APPENDIX 7-4

CRANDALL CANYON MINE
SEDIMENTATION AND DRAINAGE CONTROL PLAN

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Revised: April 2003

CRANDALL CANYON MINE
SEDIMENTATION AND DRAINAGE CONTROL PLAN

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1. Introduction

The Sedimentation and Drainage Control Plan for the Crandall Canyon Mine has been designed according to the State of Utah R645- Coal Mining Rules, November 1, 1996. All design criteria and construction will be certified by a Utah Registered Professional Engineer.

This plan has been divided into the following three sections:

1) *Design of Drainage Control Structures for the Proposed Construction*
2) *Design of Sediment Control Structures*
3) *Design of Drainage Control Structures for Reclamation*

The general surface water control plan for this project will consist of the following:

(a) *The proposed pad expansion will necessitate modifications of a number of existing hydrologic structures on the site. In an effort to clarify the new plan, the entire sedimentation and drainage control plan has been re-evaluated for the site and presented in this Appendix.*

(b) *The general plan for the pad expansion is to divert undisturbed drainage from Crandall Canyon above the minesite through a 6' diameter CMP culvert beneath the expansion area and discharge below the disturbed area. As a result of the expansion, existing culverts C-2, C-8, C-10 and Ditch DD-9 will be removed. 2 new ditches (DD-12 & DD-13) and 3 new culverts (Main Canyon, C-11 and C-11A) will be added to provide for drainage control for the expanded facility. The existing sediment pond will also be expanded to contain additional runoff from the expansion area. All other existing drainage controls will remain unchanged. All minesite drainage controls are shown on Plate 7-5 "Drainage Map".*

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(c) The main canyon culvert is sized to safely pass the runoff from a 100 year - 6 hour precipitation event. All other undisturbed diversions, disturbed ditches and culverts are sized to safely convey runoff from a 10 year - 24 hour precipitation event. The sediment pond is sized to contain runoff from a 10 year - 24 hour precipitation event, as required.

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DESIGN OF DRAINAGE CONTROL STRUCTURES

Design Parameters:

- 2.1 Precipitation
- 2.2 Flow
- 2.3 Velocity
- 2.4 Drainage Areas
- 2.5 Slopes, Lengths
- 2.6 Runoff
- 2.7 Runoff Curve Numbers
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Design Parameters:

2.1 Precipitation

The precipitation-frequency values for the area were taken from the existing plan which lists Miller, et.al. (1973) as the sources.

Frequency - Duration	*Precipitation*
10 year-6 hour	*1.55"*
10 year-24 hour	*2.50"*
25 year-6 hour	*1.90"*
100 year-6 hour	*2.40"*
100 year-24 hour	*3.70"*

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2.2 Flow

Peak flows, flow depths, areas and velocities were calculated using the computer program "Office of Surface Mining Watershed Model", Storm Version 6.21 by Gary E. McIntosh. All flow is based on the SCS - TR55 Method for Type II storms.

Time of concentration of storm events was calculated for each drainage area using the following formula:

$$t_L = \frac{L^{0.8} (S+1)^{0.7}}{1900\, Y^{0.5}}$$

where:

t_C = *Time of Concentration (hrs.)*

t_L = *Lag Time (hrs.) = 0.6 t_C*

L = *Hydraulic Length of Watershed (ft.)*

Y = *Average Land Slope (%)*

S = $\frac{1000}{CN} - 10$

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2.3 Velocity

Flow velocities for each ditch structure were calculated using the Storm computer program with Manning's Formula:

$$V = \frac{1.49}{n} R^{2/3} S^{1/3}$$

where:

V	=	*Velocity (fps)*
R	=	*Hydraulic Radius (ft.)*
S	=	*Slope (ft. per ft.)*
n	=	*Manning's n; Table 3.1, p. 159,*

"Applied Hydrology and Sedimentology for Disturbed Areas", Barfield, Warner & Haan, 1983.

Note: The following Manning's n were used in the calculations:

Structure	*Manning's n*
Culverts (cmp)	*0.020*
Unlined Disturbed Area Ditches	*0.035*

2.4 Drainage Areas

All drainage areas were planimetered directly from Plate 7-5, Drainage Map, and Plate 7-5C, Watershed Boundaries.

2.5 Slopes, Lengths

All slopes and lengths were measured directly from the topography on Plate 7-

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5, Drainage Map, and Plate 7-5C, Watershed Boundaries.

2.6 Runoff

Runoff was calculated using the SCS Formula for Type II Storms; using the Storm Version 6.21 computer program:

$$Q = \frac{(P - 0.2\,S)^2}{P + 0.8\,S}$$

where:

CN	=	*Runoff Curve Number*
Q	=	*Runoff in inches*
P	=	*Precipitation in inches*
S	=	$\frac{1000}{CN} - 10$

2.7 Runoff Curve Numbers

Two curve numbers were utilized for the undisturbed areas. Average curve numbers for the north facing and south facing slopes were determined from curves presented in Figure 7-3 (Chapter 7), using measured cover densities as reported in Chapter 3 and the northern half of lease area SL 062648, assuming a hydrologic soil group of C. Curve numbers of 60 and 69 were obtained for the north facing and south facing undisturbed areas, respectively, using Chart A for Oak-Aspen and ground cover densities of 45 and 26 for north facing and south facing areas, respectively. The above referenced Figure 7-3 (Chapter 7) is included in this Appendix as Figure 9.

Runoff curve numbers for reclaimed, disturbed and paved areas were selected based on comparison with Table 2.20 (p. 82, Barfield, et al, 1983) and

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numbers previously approved in the M.R.P. A conservative number of 75 was used for reclaimed areas within the disturbed boundary. Curve numbers of 90 and 95

were used for all disturbed areas and paved areas, respectively. See Plates 7-5 and 7-5C for referenced areas.

The following is a summary of runoff curve numbers used in these calculations:

Watershed	*Runoff CN*
Undisturbed (North Facing):	*60*
Undisturbed (South Facing):	*69*
Reclaimed:	*75*
Disturbed:	*90*
Paved:	*95*

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2.8 Culvert Sizing

Minimum culvert sizing is based on the following Manning's Equation; using the Haestad Methods, Flowmaster I, Version 3.42 computer program:

$$D = \left(\frac{2.16 \; Q \; n}{\sqrt{S}} \right)^{0.35}$$

where: D = *Required Diameter (feet)*
Q = *QP = Peak Discharge (cfs)*
n = *Roughness Factor (0.020 for cmp)*
S = *Slope (ft. Per ft.)*

Using the above formula, minimum required culvert sizes were calculated for each applicable area. Culverts were then selected above the required minimum, and these sizes were checked for adequacy against the Culvert Nomograph included as Figure 1 of this report.

2.9 Culverts

As indicated in Section 1, the proposed pad expansion will necessitate modifications of a number of existing hydrologic structures on the site, including culverts. As a result of the expansion, existing culverts C-2, C-8 and C-10 will be removed. Two new culverts (Main Canyon, C-11) were added to provide drainage control for the expanded facility during phase I of the surface expansion. One more (C-11A) will be added during the phase II south portal construction. All other existing culverts on the site will remain unchanged.

Culverts have been sized according to the calculations previously described, and are summarized on the following tables. The culverts are shown on Plate 7-5, Drainage Map.

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All undisturbed diversions are labeled with a UD number (i.e. UD-1). Two of these diversions are culverts (UD-1 and UD-3), and are clearly marked on Plate 7-5. Contributing watersheds for undisturbed diversions are labeled with a WSUD number, (i.e. WSUD-1) as shown on Plates 7-5 and 7-5C. All undisturbed diversion culverts will be fitted with trash racks to minimize plugging by rocks or other debris.

The proposed Main Canyon culvert is sized to carry runoff from a 100 year - 6 hour precipitation event for the Crandall Canyon area above the minesite. A 6' diameter C.M.P. culvert is proposed to carry the Crandall Canyon runoff beneath the expanded pad area and discharge below the minesite. Calculations in Table 10 show the proposed 6' diameter culvert to be more than adequate to carry the expected peak flow. The culvert will be equipped with an inlet headwall and trash rack and a properly sized outlet apron and energy dissipator for erosion protection. Runoff characteristics, flow and culvert design are presented in this Appendix.

The remaining undisturbed culverts on the site (UD-1 and UD-3) are existing. These culverts are adequate for a 10 year - 24 hour precipitation event, as shown on Table 10 of this Appendix.

Culverts carrying disturbed drainage are designed with a C number (i.e. C-1). Contributing watersheds for disturbed area culverts (and ditches) are designated with a WSDD number (i.e. WSDD-1) shown on Plate 7-5. All disturbed area drainage culverts have been designed to carry the runoff from a 10 year - 24 hour precipitation event. All calculations and design criteria are included in this Appendix.

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Existing culverts C-2, C-8 and C-10 will be removed during the pad extension, and therefore are not included in this Appendix. These culverts are shown on Plate 7-5C, dated 03/21/91.

All culverts will be inspected regularly, and cleaned as necessary to provide for passage of design flows. Inlets and outlets shall also be maintained to prevent plugging, undue restriction of water flow and erosion. Culvert outlets will be rip-rapped where necessary to protect from erosion.

One culvert, UD-1, is considered a permanent diversion, and will remain in place after reclamation. This culvert is sized to carry runoff in-excess of a 100 year - 6 hour storm. Justification for leaving it in place is provided in the Reclamation Hydrology Section 4.1, of this Appendix.

All other culverts are considered temporary, and will be removed upon final reclamation, with the exception of the lower 300' of the Main Canyon Culvert. This portion of the culvert will be left in place until the sediment pond is removed during Phase II Reclamation. The remaining portion of the culvert will be removed at that time.

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2.10 Ditches

The proposed pad expansion will necessitate modifications to hydrologic structures, including ditches. As a result of the expansion, existing ditch DD-9 will be eliminated. Two new ditches (DD-12 and DD-13) will be added to provide drainage control for the expanded facility. All other existing ditches on the site will remain unchanged.

Undisturbed diversions are designated with a UD number (i.e. UD-2). There is only one undisturbed diversion ditch - (UD-2). This ditch is existing. Contributing watersheds for the undisturbed diversion are labelled with a WSUD number (i.e. WSUD-2), and are shown on Plate 7-5C.

Disturbed diversions (ditches) are designated with a DD number (i.e. DD-1). Contributing watersheds for disturbed diversions are labelled with a WSDD number (i.e. WSDD-1) as shown on Plates 7-5 and 7-5C. All disturbed diversions carry runoff which ultimately goes to the sediment pond.

All ditches are designed to carry the expected runoff from respective watersheds from a 10 year - 6 hour precipitation event, with a minimum freeboard of 0.3'. Ditches were assumed to be unlined with a Manning's No. of 0.035. All ditches have been conservatively evaluated for size using the computer program "Office of Surface Mining Watershed Model," Storm, Version 6.21, by Gary E. McIntosh, to calculate peak flows, which were then routed into triangular shaped channels with 1:1 side slopes. This evaluation shows conditions which are not uncommon at minesites and which tend to maximize required flow depths. All ditches are designed with the steeper (1:1) side slopes to allow for maintenance by road grading or other equipment. Actual side slopes may vary in the field; however, as long as the ditch has the

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required depth and cross-sectional area to carry the flow with required freeboard, the ditch is adequate.

Ditches with flow velocities of 5 fps or greater will be lined with properly sized rip-rap or other controls to protect from erosion.

All ditch slopes and lengths were taken from Plate 7-5, "Drainage Map".

A typical ditch section, as well as a summary of flow depths and sizes is provided in Figure 3 of this Appendix.

All ditches will be inspected regularly, constructed and maintained to the minimum dimensions to provide adequate capacity for the design flow. All ditches are temporary and will be removed during final reclamation.

Note: Ditches are adequate to carry runoff from the 10 year - 24 hour precipitation event.

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2.11 Main Canyon Culvert

The proposed main canyon culvert will be placed to closely approximate the existing stream alignment. In an effort to protect the natural channel, the area will be covered with a filter fabric (geotextile material). An underdrain will then be installed on the fabric, consisting of an 18" perforated drain pipe surrounded by a bed of clean 2" drain drainrock. The underdrain will be covered by a second layer of fabric which in turn will be covered with a layer of marker material used to facilitate visibility during final reclamation. A layer of bedding material will then be placed over the marker material. The proposed 72" cmp culvert will then be installed on the bedding material and backfilled and compacted throughout the length of the mine site - approximately 1500'.

The culvert has been sized to safely carry the runoff from a 100 year - 6 hour precipitation event for all of Crandall Canyon above the minesite. The 100 year - 6 hour flow has been calculated at 222.79 cfs, as shown on Table 3. This flow can be carried by a 3.75' minimum diameter culvert, as calculated by the Manning's Equation and shown in Table 10; therefore, the proposed 6' diameter culvert is more than adequate.

There have been some questions raised as to previous main canyon flow calculations which showed the expected runoff from the 100 year - 6 hour storm to be as high as 431 cfs. It appears this number was generated by using a computer program called "Peak", using slightly different parameters than those used in this report.

The runoff numbers in this Appendix were calculated using the "Office of Surface Mining Watershed Model", Storm Version 6.21, by Gary E. M'Intosh. All flows were based on the SCS-TR55 Method for Type II storms. This program has been supplied to the operators by the Division, and results have been consistently accepted by the agencies.

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In an effort to make the runoff values more conservative, yet realistic, for design purposes, some parameters, such as concentration time and SCS Upland Curve numbers were placed on the conservative side in the program. Based on these numbers, a very conservative flow of 222.79 cfs was obtained. It should be noted that this flow agrees closely with a previous calculation using the equation of Thomas and Lindskov (1983), which estimates the 100 year - 6 hour flow for the main canyon at 272 cfs.

Summary: It is obvious that the final number on the main channel flow is entirely dependent upon which computer program or method is used. Since the OSM Storm program has been used throughout calculations for this plan, and since it is a widely accepted method, the more conservative figure of 222.79 cfs has been used in design calculations for this plan.

2.12 Main Canyon Culvert Inlet Structure

The culvert inlet will be protected by an inlet section and trash rack, along with a rip-rapped headwall. An additional trash rack will be installed upstream of the inlet at a location convenient for maintenance and cleanout, as shown on Figure 10. Based on the Culvert Nomograph, Figure 1, the expected flow will enter the culvert at slightly over 1 diameter of head; therefore, additional headwall protection will be provided for a minimum of 5' above and around the inlet structure. Headwall protection will be of 18" D_{50} rip-rap, as shown on Figure 10.

A small side drainage enters Crandall Creek just west of the bypass culvert inlet. As the drainage calculations took into consideration the runoff from this side canyon, the bypass culvert and inlet riprap are adequately sized to handle drainage from this side canyon. The riprap has been extended up this drainage for a short distance (see Map 5-3) in order to protect the culvert inlet area.

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2.13 Main Canyon Culvert - Outlet Structure

The outlet of the 6' diameter main canyon culvert has been designed to flow into a rip-rap apron to protect against scouring and for energy dissipation. The rip-rap apron is designed to fit the natural channel configuration as closely as possible, and will allow runoff to re-enter the natural channel at a reduced velocity which is no greater than natural flow conditions. Runoff from the 100 year - 6 hour precipitation event in the canyon above the minesite has been calculated at 222.79 cfs.

The rip-rap apron design is based on Figure 7-26, Design of Outlet Protection - Maximum Tailwater Condition, "Applied Hydrology and Sedimentology for Disturbed Areas", Barfield, Warner and Haan, 1983. Based on the figure, the apron should be a minimum of 22' in length, widening from 6' to 15', with a 0% slope. The proposed length has been increased to 30', with an 18' width, to ensure adequate time for velocity reduction. The slope is kept at 0%. Rip-rap size is conservatively placed at 30" D_{50}. Rip-rap will be placed to a depth of 1.5 D_{50} and will be embedded in a 12" layer of 2" drain rock filter. Rip-rap will also be placed on 1:1 side slopes to the height of the culvert (6') at the culvert outlet tapering to 3' at the outlet of the apron. This rip rap apron has been sized and designed to adequately dissipate energy from flow velocities of a 100 year, 24 hour precipitation event and resist dislodgement. The drain rock filter bed will also serve to secure the rip rap boulders firmly in place, to add an additional element of stability, and prevent scouring underneath the boulder bed.

The natural channel below the proposed outlet has been measured from field surveys to have a bottom width of approximately 17' at the proposed apron outlet, with side slopes approximately 1:1. When the flow is routed from the culvert across the apron to the natural channel, the velocity is reduced from 21.70 fps at the culvert outlet to 10.83 fps at the outlet of the apron. Refer to 72" Culvert Outlet Rip-Rap Apron Flow Velocity Calculations in Section 4.6. Based on actual field measurements, the

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natural channel flow velocity would be approximately 11.02 fps at this location with the same flow of 222.79 cfs. Therefore, the velocity of the stream flow exiting the rip rap apron will be less than the velocity in the naturally existing stream bed, at that location, under similar conditions.

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TABLE 1
WATERSHED SUMMARY

Watershed	Type	CN	Acres	Drains To		Final
Crandall	Undisturbed	69	3480.00	Main Culvert	-	Crandall Creek
WSUD-1	Undisturbed	69	84.88	Culvert UD-1	-	Crandall Creek
WSUD-2	Undisturbed	69	1.39	Ditch UD-2	-	Culvert UD-1
WSUD-3	Undisturbed	69	8.66	Culvert UD-3	-	Natural Drainage
WSDD-1	Undisturbed	69	0.14	Ditch DD-1	-	Sediment Pond
WSDD-1	Reclaimed	75	0.08	Ditch DD-1	-	Sediment Pond
WSDD-2	Reclaimed	75	0.15	Ditch DD-1	-	Sediment Pond
WSDD-3	Undisturbed	69	0.13	Ditch DD-3	-	Sediment Pond
WSDD-3	Reclaimed	75	0.15	Ditch DD-3	-	Sediment Pond
WSDD-3	Disturbed	90	0.26	Ditch DD-3	-	Sediment Pond
WSDD-3	Paved	95	0.33	Ditch DD-3	-	Sediment Pond
WSDD-4	Paved Road	95	0.11	Ditch DD-4	-	Sediment Pond
WSDD-4	Disturbed	90	0.08	Ditch DD-4	-	Sediment Pond
WSDD-5	Undisturbed	69	0.12	Ditch DD-5	-	Sediment Pond
WSDD-5	Reclaimed	75	0.33	Ditch DD-5	-	Sediment Pond
WSDD-5	Paved Road	95	0.33	Ditch DD-5	-	Sediment Pond
WSDD-7	Undisturbed	69	0.18	Ditch DD-7	-	Sediment Pond
WSDD-7	Disturbed	90	0.17	Ditch DD-7	-	Sediment Pond
WSDD-8	Undisturbed	69	3.59	Ditch DD-8	-	Sediment Pond
WSDD-8	Reclaimed	75	0.15	Ditch DD-8	-	Sediment Pond
WSDD-8	Disturbed	90	0.37	Ditch DD-8	-	Sediment Pond
WSDD-8	Paved Road	95	0.25	Ditch DD-8	-	Sediment Pond
WSDD-10	Undisturbed	69	0.07	Culvert C-4	-	Sediment Pond
WSDD-10	Reclaimed	75	0.12	Culvert C-4	-	Sediment Pond
WSDD-10	Disturbed	90	0.61	Culvert C-4	-	Sediment Pond
WSDD-10	Paved Road	95	0.27	Culvert C-4	-	Sediment Pond
WSDD-11	Undisturbed	69	2.09	Ditch DD-11	-	Sediment Pond
WSDD-11	Reclaimed	75	0.15	Ditch DD-11	-	Sediment Pond
WSDD-11	Disturbed	90	0.04	Ditch DD-11	-	Sediment Pond
WSDD-12	Undisturbed	60	8.82	Ditch DD-12	-	Sediment Pond
WSDD-12	Disturbed	90	2.29	Ditch DD-12	-	Sediment Pond
WSDD-13	Undisturbed	60	17.72	Ditch DD-13	-	Sediment Pond
WSDD-13	Disturbed	90	3.70	Culvert C-13	-	Sediment Pond
WSDD-13	Paved	95	0.27	Culvert C-13	-	Sediment Pond
WSDD-14	Disturbed	90	0.89	Sediment Pond	-	Sediment Pond
WSDD-14	Undisturbed	60	0.78	Sediment Pond	-	Sediment Pond
WSDD-14	Paved	95	0.02	Sediment Pond	-	Sediment Pond
WSDD-15	Paved Road	95	0.09	Ditch DD-7	-	Sediment Pond

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TABLE 2
WATERSHED PARAMETERS

Watershed	Type	CN	Acres	Hyd. Length (ft.)	Land Slope (%)	Elev. Change(ft.)
Crandall	Und.	69	3480.00	16,500	17.58	2900
WSUD-1	Und.	69	84.88	3,100	53.55	1660
WSUD-2	Und.	69	1.39	320	78.13	250
WSUD-3	Und.	69	8.66	1300	70.77	920
WSDD-1	Und.	69	0.14	100	40.00	40
WSDD-1	Recl.	75	0.08	120	25.00	30
WSDD-2	Recl.	75	0.15	200	25.00	50
WSDD-3	Und.	69	0.13	80	50.00	40
WSDD-3	Recl.	75	0.15	100	48.00	48
WSDD-3	Dist.	90	0.26	125	56.00	70
WSDD-3	Paved	95	0.33	100	3.00	3
WSDD-4	Paved	95	0.11	250	8.33	20
WSDD-4	Dist.	90	0.08	100	10.00	10
WSDD-5	Und.	69	0.12	60	50.00	30
WSDD-5	Recl.	75	0.33	80	50.00	40
WSDD-5	Paved	95	0.33	300	8.33	25
WSDD-7	Und.	69	0.18	100	78.00	78
WSDD-7	Dist.	90	0.17	120	66.67	80
WSDD-8	Und.	69	3.59	700	65.71	460
WSDD-8	Recl.	75	0.15	80	62.50	50
WSDD-8	Dist.	90	0.37	60	65.71	39
WSDD-8	Paved	95	0.25	560	5.36	30
WSDD-10	Und.	69	0.07	45	62.22	28
WSDD-10	Recl.	75	0.12	50	72.00	36
WSDD-10	Dist.	90	0.61	120	62.50	75
WSDD-10	Paved	95	0.27	335	5.37	18
WSDD-11	Und.	69	2.09	570	64.91	370
WSDD-11	Recl.	75	0.15	30	66.67	20
WSDD-11	Dist.	90	0.04	35	66.67	23
WSDD-12	Und.	60	8.82	1600	42.50	680
WSDD-12	Dist.	90	2.29	80	72.73	58
WSDD-13	Und.	60	17.72	2100	53.81	1130
WSDD-13	Dist.	90	3.70	650	9.09	59
WSDD-13	Paved	95	0.27	40	4.00	2
WSDD-14	Dist.	90	0.89	140	16.11	23
WSDD-14	Und.	60	0.78	380	64.41	245
WSDD-14	Paved	95	0.02	30	3.00	1
WSDD-15	Paved	95	0.09	150	3.33	5

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TABLE 3
RUNOFF SUMMARY
UNDISTURBED DIVERSIONS

Diversion	Main Culvert	UD-1	UD-2	UD-3
Watershed	Crandall Canyon	WSUD-1	WSUD-2	WSUD-3
Area (Acres)	3480.0	84.88	1.39	8.66
Runoff CN	69	69	69	69
10 year/6 hour Rainfall (in.)	1.55	1.55	1.55	1.55
Peak Flow 10/6 (cfs)	N/A	1.91	0.04	0.23
25 year/6 hour Rainfall (in.)	1.90	1.90	1.90	1.90
Peak Flow 25/6 (cfs)	N/A	3.68	0.08	0.43
100 year/6 hour Rainfall (in.)	2.40	2.40	2.40	2.40
Peak Flow 100/6 (cfs)	222.79	6.81	0.21	0.89
10 year/24 hour Rainfall (in.)	N/A	2.50	2.50	2.50
Runoff Volume 10/24 (ac.ft.)	N/A	2.98	0.05	0.30

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TABLE 4
RUNOFF SUMMARY
DRAINAGE TO SEDIMENT POND

Watershed	Type	10 year/24 hour Volume-ac.ft.	10 year/24 hour Peak Flow-cfs	10 year/6 hour Peak Flow-cfs	25 year/6 hour Peak Flow-cfs
WSDD-1	Undisturbed	0.02	0.10	0.04	0.06
WSDD-1	Reclaimed	0.01	0.04	0.01	0.01
WSDD-2	Reclaimed	0.01	0.06	0.01	0.03
WSDD-3	Undisturbed	0.00	0.03	0.00	0.01
WSDD-3	Reclaimed	0.01	0.05	0.01	0.02
WSDD-3	Disturbed	0.03	0.18	0.08	0.12
WSDD-3	Paved	0.05	0.32	0.17	0.22
WSDD-4	Paved	0.02	0.12	0.07	0.09
WSDD-4	Disturbed	0.01	0.08	0.04	0.05
WSDD-5	Undisturbed	0.00	0.03	0.00	0.01
WSDD-5	Reclaimed	0.02	0.10	0.02	0.04
WSDD-5	Paved	0.05	0.39	0.21	0.27
WSDD-7	Undisturbed	0.01	0.05	0.00	0.01
WSDD-7	Disturbed	0.02	0.12	0.05	0.07
WSDD-7	Paved	0.02	0.11	0.06	0.08
WSDD-8	Undisturbed	0.13	0.75	0.10	0.20
WSDD-8	Reclaimed	0.01	0.05	0.01	0.02
WSDD-8	Disturbed	0.05	0.23	0.10	0.14
WSDD-8	Paved	0.04	0.37	0.20	0.26
WSDD-10	Undisturbed	0.00	0.03	0.00	0.01
WSDD-10	Reclaimed	0.01	0.03	0.01	0.01
WSDD-10	Disturbed	0.08	0.42	0.19	0.27
WSDD-10	Paved	0.04	0.35	0.19	0.24
WSDD-11	Undisturbed	0.07	0.47	0.06	0.12
WSDD-11	Reclaimed	0.01	0.04	0.01	0.02
WSDD-11	Disturbed	0.01	0.06	0.03	0.04
WSDD-12	Undisturbed	0.13	0.25	0.04	0.16
WSDD-12	Disturbed	0.29	3.33	1.51	2.10
WSDD-13	Undisturbed	0.26	0.49	0.07	0.30
WSDD-13	Disturbed	0.47	5.39	2.44	3.39
WSDD-13	Paved	0.04	0.20	0.11	0.14
WSDD-14	Disturbed	0.11	0.78	0.35	0.49
WSDD-14	Undisturbed	0.01	0.03	0.00	0.02
WSDD-14	Paved	0.02	0.07	0.04	0.05
Totals		2.06	15.13	6.23	9.07

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TABLE 5
RUNOFF CONTROL STRUCTURE
WATERSHED SUMMARY

Structure	Type	Contributing Watersheds
Main Culvert	Culvert	Crandall Canyon Above Mine
UD-1	Culvert	WSUD-1
UD-2	Culvert	WSUD-2
UD-3	Culvert	WSUD-3
DD-1	Ditch	WSDD-1, WSDD-2
DD-3	Ditch	WSDD-1, WSDD-2, WSDD-3
DD-4	Ditch	WSDD-1, WSDD-2, WSDD-3, WSDD-4, WSDD-8, WSDD-12
DD-5	Ditch	WSDD-1, WSDD-2, WSDD-3, WSDD-4, WSDD-5, WSDD-8, WSDD-12
DD-7	Ditch	WSDD-7, WSDD-11
DD-8	Ditch	WSDD-8
DD-11	Ditch	WSDD-11
DD-12	Ditch	WSDD-12
DD-13	Ditch	WSDD-13
DD-14	Sheet Flow	WSDD-14
C-1	Culvert	WSDD-1, WSDD-2, WSDD-3, WSDD-8
C-3	Culvert	WSDD-7, WSDD-11, WSDD-15
C-4	Culvert	WSDD-10
C-5	Culvert	WSDD-11
C-6	Culvert	WSUD-2
C-7	Culvert	WSDD-1, WSDD-2, WSDD-3
C-9	Culvert	WSDD-4, WSDD-12
C-11	Culvert	WSDD-12
C-11A	Culvert	WSDD-12
C-12	Culvert	WSDD-1, 2, 3, 4, 5, 8, 12
C-13	Culvert	WSDD-13
C-14	Slot Culvert	WSDD-4
C-15	Slot Culvert	WSDD-15
C-16	Culvert	WSDD-13
C-17	Culvert	WSDD-13
Sediment Pond	Pond	WSDD-1, 2, 3, 4, 5, 7, 8, 10, 11, 12, 13, 14

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TABLE 6
RUNOFF CONTROL STRUCTURE
FLOW SUMMARY

Structure	Type	10 year/6 hour Peak Flow-cfs	10 year/24 hour Peak Flow-cfs	25 year/6 hour Peak Flow-cfs	100 year/6 hour Peak Flow-cfs
Main Culvert	Culvert	-	-	-	222.79
UD-1	Culvert	1.91	-	3.68	6.81
UD-2	Ditch	0.04	-	0.08	0.21
UD-3	Culvert	0.23	-	0.43	0.89
DD-1	Ditch	0.06	0.20	0.10	-
DD-3	Ditch	0.32	0.78	0.47	-
DD-4	Ditch	2.39	5.96	3.49	-
DD-5	Ditch	2.62	6.48	3.81	-
DD-7	Ditch	0.21	0.85	0.34	-
DD-8	Ditch	0.41	1.40	0.62	-
DD-11	Ditch	0.10	0.57	0.18	-
DD-12	Ditch	1.55	3.58	2.26	-
DD-13	Ditch	2.62	6.08	3.83	-
DD-14	Sht Flw	0.39	0.88	0.56	-
C-1	Culvert	0.73	2.18	1.09	-
C-3	Culvert	0.21	0.85	0.34	-
C-4	Culvert	3.01	6.79	4.02	-
C-5	Culvert	0.10	0.57	0.18	-
C-6	Culvert	0.04	-	0.08	-
C-7	Culvert	0.32	0.78	0.47	-
C-9	Culvert	0.11	0.20	0.14	-
C-11	Culvert	1.55	3.58	2.26	-
C-11A	Culvert	1.55	3.58	2.26	-
C-12	Culvert	2.62	5.96	3.49	-
C-13	Culvert	2.62	6.08	3.83	-
C-14	Slot Cul.	0.11	0.20	0.14	-
C-15	Slot Cul.	0.06	0.11	0.08	-
C-16	Culvert	2.62	6.08	3.83	-
C-17	Culvert	2.62	6.08	3.83	-
Sediment Pond	Pond	6.23	15.13	9.07	-

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TABLE 7
DISTURBED DITCH DESIGN SUMMARY

Ditch	DD-1	DD-3	DD-4	DD-5	DD-7	DD-8	DD-11
Slope (%)	30.77	3.00	11.91	4.50	3.33	3.59	3.00
Length (ft.)	130	75	168	628	142	557	173
Manning's No.	0.035	0.035	0.035	0.035	0.035	0.035	0.035
Side Slope (H:V)	1:1	1:1	1:1	1:1	1:1	1:1	1:1
*Bottom Width (ft.)	0	0	0	0	0	0	0
Peak Flow 10/6 (cfs)	0.06	0.32	2.39	2.62	0.21	0.41	0.10
Peak Flow 10/24 (cfs)	0.20	0.78	5.96	6.48	0.85	1.40	0.57
Flow Depth (ft.) 10/6	0.14	0.40	0.66	0.75	0.33	0.47	0.26
Flow Depth (ft.) 10/24	0.22	0.56	0.92	1.06	0.57	0.67	0.50
Flow Area (ft^2)10/6	0.02	0.16	0.43	0.57	0.11	0.18	0.07
Flow Area (ft^2)10/24	0.05	0.31	0.85	1.12	0.32	0.45	0.25
Velocity (fps)10/6	3.15	2.00	5.55	4.61	1.87	2.28	1.50
Velocity (fps) 10/24	4.26	2.50	6.97	5.78	2.66	3.10	2.31
Rip-Rap Req'd (Y/N)	N	N	Y	N	N	N	N
Rip-Rap D_{50}	-	-	6"	-	-	-	-

* All ditches are triangular.
Note: Slope/Lengths from Plate 7-5.

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TABLE 7
(Continued)
DISTURBED DITCH DESIGN SUMMARY

Ditch	DD-12	DD-13 (MIN.)	DD-13 (MAX.)
Slope (%)	3.29	1.79	50.00
Length (ft.)	50	280	80
Manning's No.	0.035	0.035	0.035
Side Slope (H:V)	1:1	1:1	2:1
Bottom Width (ft.)	0	0	2
Peak Flow 10/6 (cfs)	1.55	2.62	2.62
Peak Flow 10/24 (cfs)	3.58	6.08	6.08
Flow Depth (ft.) 10/6	0.71	0.97	0.15
Flow Depth (ft.) 10/24	0.97	1.33	0.24
Flow Area (ft^2) 10/6	0.50	0.94	0.34
Flow Area (ft^2) 10/24	0.94	1.77	0.60
Velocity (fps) 10/6	3.07	2.79	7.66
Velocity (fps) 10/24	3.79	3.44	10.12
Rip-Rap Req'd (Y/N)	N	N	Y
Rip-Rap D_{50}	-	-	9"

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* All ditches are triangular.

Note: Slope/Lengths from Plate 7-5.

Note: DD-12 is shortened due to construction of the south portal access ramp/fan pad.

TABLE 8
UNDISTURBED DITCH DESIGN SUMMARY

Ditch	UD-2
Slope (%)	12.5
Length (ft.)	400
Manning's No.	0.035
Side Slope (H:V)	1:1
Bottom Width (ft.)	0
Peak Flow-10/6 (cfs)	0.04
Flow Depth (ft.)	0.14
Flow Area (ft^2)	0.02
Velocity (fps)	2.03
Lined (Y/N)	N
Rip-Rap Req'd (Y/N)	N

Note: Slope/Lengths from Plate 7-5.

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TABLE 9
DISTURBED CULVERT DESIGN SUMMARY

Culvert	C-1	C-3	C-4	C-5	C-6	C-7	C-9	C-11	C-11A	C-12	C-13	C-14	C-15	C-16	C-17
Slope (%)	16.67	8.00	25.07	57.14	17.20	3.00	3.50	3.50	1.50	4.50	3.00	1.00	1.00	25.00	20.00
Length (ft.)	60	360	69	120	12	80	18	30	60	330	100	40	30	40	60
Manning's No.	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Peak Flow 10/6 (cfs)	0.73	0.21	3.01	0.10	0.04	0.32	0.11	1.55	1.55	2.62	2.62	0.11	0.06	2.62	2.62
Peak Flow 10/24 (cfs)	2.18	0.85	6.79	0.57	N/A	0.78	0.20	3.58	3.58	5.96	6.08	0.20	0.11	6.08	6.08
Min. Diam. Req'd (ft.) 10/6	0.41	0.28	0.60	0.14	0.13	0.39	0.25	0.68	0.80	0.79	0.85	0.32	0.25	0.57	0.60
Min. Diam. Req'd (ft.) 10/24	0.62	0.46	0.82	0.28	N/A	0.54	0.32	0.93	1.09	1.08	1.17	0.40	0.32	0.79	0.82
Diam. Installed (ft.)	1.50	2.00	2.00	1.00	1.00	1.00	1.00	1.50	1.50	2.00	2.00	1.00	1.00	1.67	1.50
Velocity (fps) 10/6	5.55	3.53	10.54	6.13	3.11	2.71	2.20	4.27	3.10	5.35	4.59	1.38	1.18	10.17	9.35
Velocity (fps) 10/24	7.30	5.01	12.91	9.47	N/A	3.39	2.56	5.26	3.83	6.56	5.67	1.60	1.38	12.55	11.54
Rip-Rap D_{50}	6"	-	12"	6"	-	-	-	-	-	6"	-	-	-	12"	12"

Note: Slope/Lengths from Plate 7-5.
Source: (Haestad Methods, Flowmaster I, Version 3.42)

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TABLE 10
UNDISTURBED CULVERT DESIGN SUMMARY

Culvert	*Main Canyon	UD-1	UD-3
Slope (%)	8.00	23.33	11.96
Length (ft.)	1500	270	460
Manning's No.	0.02	0.02	0.02
Peak Flow 100/6 (cfs)	222.79	-	-
Peak Flow 10/6 (cfs)	-	1.91	0.23
Min. Diam. Req'd (ft.)	3.75	0.52	0.26
Diam. Installed (ft.)	6.00	3.50	2.00
Velocity (fps)	20.14	9.16	4.20

* Culvert to be installed under expansion plan.
All other undisturbed culverts are existing.

Note: Slope/Lengths from Plate 7-5.
Source: (Haestad Methods, Flowmaster I, Version 3.43)

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Design Specifications:

3.1 ***Design Specification for Expanded Sedimentation Pond***
3.2 ***Sediment Yield***
3.3 ***Sediment Pond Volume***

Tables:

Table 11 ***Sediment Pond Design***
Table 12 ***Sediment Pond Stage Volume Data***
Table 13 ***Sediment Pond Stage Discharge Data***

3.4 ***Sediment Pond Summary***

Figures:

Figure 4 ***Soil Erodibility Chart - Disturbed Areas***
Figure 5 ***Soil Erodibility Chart - Undisturbed/Reclaimed Areas***
Figure 6 ***Sediment Pond Stage-Volume Curve***
Figure 7 ***Sediment Pond Stage-Discharge Curve***

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3.1 Design Specification for Expanded Sediment Pond

The sedimentation pond located in Crandall Canyon has been redesigned and reconstructed to control the additional storm runoff from the pad extension and from the undisturbed drainage areas above the pad extension. The "As-Constructed" topography and cross sections of the pond design are shown on Plate 7-3.

The pond has been sized to meet the requirements of R645-301-742.221.33 (DOGM), which stipulates that sedimentation ponds be capable of containing or treating the 10-year 24-hour precipitation event. According to Miller, et al (1973), the 10-year, 24-hour design storm for Crandall Canyon is 2.5 inches. The design storm calculations for the sedimentation pond are presented in Table 4 of this Appendix. These calculations include the proposed pad extension, the additional watersheds above the pad extension, the existing pad and reclaimed areas, and the undisturbed watersheds above the existing pad.

As required by R645-301-742.223, the 25 year-6 hour precipitation event was routed through the sedimentation pond to determine the adequacy of the spillway. Overflow from the pond is discharged to Crandall Creek. Total precipitation from the 25 year-6 hour storm is 1.9 inches (Miller, et al, 1973). The 25 year-6 hour flow is calculated at 9.07 cfs. Based on the calculations, the primary spillway is more than adequate to carry the expected runoff from a 25 year-6 hour event.

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3.2 Sediment Yield

The Universal Soil Equation (USLE) was used to estimate sediment yield from all drainage areas contributing to the pond. All soil loss from this area was assumed to be delivered to, and deposited in the sedimentation pond.

Erosion rate (A) in tons-per-acre-per-year is determined using the USLE as follows:

$$A = (R)\ (K)\ (LS)\ (CP)$$

Where the variables R, K, LS, and CP are defined as follows:

Variable "R" is the rainfall factor which can be estimated from $R = 27P^{2.2}$*; where P is the 2-year, 6-hour precipitation value. P for the Crandall Canyon area is estimated at 1.00" based on Figure 5.4, page 315, Barfield, et.al. 1983. Therefore, the estimated value of "R" for this area is 27.00.*

Variable "K" is the soil erodibility factor. For disturbed areas, the "K" value is taken as 0.06 as determined from soils samples and shown on the soil erodibility chart, Figure 4. K is estimated to be 0.15 for undisturbed and reclaimed areas, based on soils data and the soil erodibility chart, Figure 5.

Variable "LS" is the length-slope factor. This figure was determined by calculating a weighted average slope length and percentage for the undisturbed, reclaimed and disturbed areas, respectively. The slope length and percentage were then substituted into the following equation to determine the LS Factor:

$$LS = \left(\frac{\pi}{72.6}\right)^{m}\left(\frac{430\ x^2 + 30\ x + 0.43}{6.613}\right)$$

where:

π = *Field slope length in feet;*
m = *0.5 if S is 5% or greater;*
x = *sin* θ*;*
θ = *Angle of slope in degrees.*

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Variable "CP" is the control practice factor, which can be divided into a cover and practice factor. Values were determined from Appendix 5A, Barfield, et.al., 1983.

Site	CP Factor
Disturbed Areas	1.20
Reclaimed Areas	0.100
Undisturbed Areas	0.003

The sediment volume is based on a density of 100 pounds per cubic foot of sediment.

SEDIMENT YIELD CALCULATIONS - USLE

Drainage	R	K	Acres	Slope Length Feet	%	LS	CP	A*	Yield**
Undisturbed	27.00	0.15	33.59	1700	53	79.60	0.003	00.967	0.015
Reclaimed	27.00	0.15	1.22	90	52	17.81	0.10	07.213	0.004
Disturbed	27.00	0.06	8.92	350	26	11.69	1.200	22.725	0.093

Total Sediment 1 year (ac.ft.).....0.112

Total Sediment 3 years (ac. ft.) 0.336

* *A = tons/acre-year*

** *Yield = acre-ft/year*

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3.3 Sediment Pond Volume

The volumes shown in Table 11 are from the volumes calculated from the precipitation, runoff and sediment yield for a 10 year-24 hour precipitation event. The volumes were calculated based on the disturbed areas (and contributing undisturbed areas) runoff values, developed using the design parameters described in this section.

The sediment pond has been reconstructed, and the sediment pond volumes on Table 11, Table 12 and Figure 6 all represent the "As-Constructed" pond.

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Expanded Area Pond Requirement

3 Year Sediment Storage

TABLE 11
SEDIMENT POND DESIGN

1. *Use 2.50" for 10 year-24 hour event.*

2. *Runoff Volume (from Table 4, 10 yr/24 hr) =* *2.060 ac. ft.*

3. *Sediment Storage Volume*

   USLE 0.112 ac.ft./yr. x 3 yrs. = *0.336 ac. ft.*

4. *Direct Precipitation into Pond*

   0.441 acres x 2.50" / 12 in./ft. = *0.092 ac. ft.*

5. *Total Required Pond Volume*

   2.060 + 0.336 + 0.092 = *2.488 ac. ft.*

6.* *Peak Flow (25 yr. - 6 hr. event) =* *9.070 cfs*

7. *Pond Actual Volume @ Principle Spillway =*
   (See Table 12) *3.572 ac. ft.*

* *Peak Flow values from Table 4.*

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TABLE 12
SEDIMENT POND
STAGE / VOLUME DATA

Elev.	*Area*	*Volume*	*Acc. Volume (ac.ft.)*	*Remarks*
7766	*1756.67*	*.0000*	*.0000*	*Bottom of Pond*
7767	*3706.92*	*2731.80*	*0.063*	
7768	*5119.14*	*4413.03*	*0.164*	
7769	*5857.00*	*5488.07*	*0.290*	*Sediment Cleanout Level*
7770	*6949.54*	*6403.32*	*0.437*	*Maximum Sediment Level*
7771	*7806.54*	*7378.14*	*0.606*	
7772	*8894.51*	*8350.53*	*0.798*	
7773	*9905.02*	*9399.77*	*1.014*	
7774	*11055.91*	*10480.47*	*1.254*	
7775	*12153.06*	*11604.49*	*1.520*	
7776	*13120.22*	*12636.64*	*1.810*	
7777	*14084.05*	*13602.14*	*2.123*	
7778	*15043.33*	*14563.69*	*2.457*	
7779	*15984.66*	*15514.00*	*2.813*	
7780	*16934.94*	*16459.15*	*3.191*	
7780.81	*17669.26*	*14014.70*	*3.513*	*Principal Spillway*
7781	*17868.13*	*3376.05*	*3.591*	
7781.81	*18661.53*	*15028.20*	*3.936*	*Emergency Spillway*
7782	*18848.42*	*3430.08*	*4.012*	
7783	*19886.14*	*19367.28*	*4.457*	
7784	*21113.55*	*20499.85*	*4.927*	
7785	*22110.39*	*21611.97*	*5.423*	*Top of Embankment*

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TABLE 13
SEDIMENT POND
STAGE / DISCHARGE DATA

Head (ft.)	Q (cfs) Weir Controlled	Q (cfs) Orfice Controlled	Q (cfs) Pipe Flow Controlled
0.0	-	-	-
0.2	1.69	6.77	17.14
0.4	4.77	9.57	17.32
0.6	8.76	11.72	17.50
0.8	13.49	13.53	17.68
1.0	18.85	15.13	17.86

Note: 1- 25 year-6 hour flow = 9.070 cfs.

2- Flow will be weir controlled at a head of 0.62' over riser inlet.

Weir Controlled

$Q = CLH^{1.5}$; where : C = 3.0, L = Circumference of Riser = 6.2832'

Orifice Controlled

$Q = C'a\,(2gH)^{0.5}$; where : C = 0.6, a =Area of Riser = 3.1416 ft^2, g = 32.2 ft/sec^2

Pipe Flow Controlled

$$Q = \frac{a\,(2gH')0.5}{(1+Ke+Kb+KcL)^{0.5}}$$; where a = Area of Pipe = 1.77 ft^2

H' = Head = H + 9.1 (At outlet of Riser)

Ke = 1.0

Kb = 0.5

Kc = 0.043

L = 90'

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3.4 Sediment Pond Summary

a) *The sedimentation pond has been designed and constructed to contain the disturbed area (and contributing undisturbed area) runoff from a 10 year-24 hour precipitation event, along with 3 years of sediment storage capacity. Runoff to the pond will be directed by various ditches and culverts as described in the plan.*

b) *The required volume for the sediment pond is calculated at 2.488 acre feet, including 3 years of sediment storage. The existing sediment pond size is 3.572 acre feet (at the principle spillway), which is more than adequate.*

c) *The pond will meet a theoretical detention time of 24 hours. It is equipped with a culvert principle spillway and an open-channel emergency spillway. Any discharge from the pond will be in accordance with the approved UPDES Permit. The pond will be decanted as needed by a portable pump.*

d) *The pond inlets will be protected from erosion, and the spillway will discharge into the main Crandall Canyon drainage.*

e) *The pond is temporary, and will be removed upon final reclamation of the property.*

f) *The pond expansion was constructed according to the regulations and under supervision of a Registered, Professional Engineer.*

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g) The pond volume has been increased at the request of the Forest Service to provide a greater level of protection for the forest resources down stream from the mine site. The enlarged capacity (3.572 acre ft.) is over- designed to handle the following storm events :

Storm Event	*Pond Volume Required*	*Pond Capacity Provided*
10 yr./ 24 hr.	*2.06 acre ft.*	*173%*
100 yr./ 6hr.	*1.93 acre ft.*	*185%*
50 yr./24 hr.	*3.53 acre ft.*	*101%*
100 yr./ 24 hr.	*4.51 acre ft.*	*79%*

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DESIGN OF DRAINAGE CONTROL STRUCTURES FOR RECLAMATION

Reclamation Hydrology:

4.1 General (PhaseI)

4.2 General (Phase II)

4.3 Reclamation - Disturbed Drainage Control

4.4 Restored Channels

4.5 Sediment Pond

4.6 Calculations

Tables:

Table 14 Reclamation - Phase I Runoff Summary Drainage to Sediment Pond

Table 15 Reclamation - Phase I Runoff Control Structure / Watershed Summary

Table 16 Reclamation - Phase I Runoff Control Structure / Flow Summary

Table 17 Reclamation - Phase I Reclaimed Ditch Design Summary

Figures:

Figure 8 Reclamation Channel RD-1 Typical Section

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Reclamation Hydrology

4.1 General (Phase I)

During Phase I of reclamation, all disturbed area culverts and ditches will be removed except as shown on Plate 5-16. Undisturbed diversions UD-2 and UD-3 will also be removed, and the drainage from those areas will be directed to the sediment pond. Undisturbed diversion UD-1 will remain in place as a permanent structure for the following reasons:

(1) The diversion is necessary to continue to divert runoff from the reclaimed site, the U.S. Forest Service turnaround area and beneath the U.S. Forest Service Road;

(2) The 10 year-24 hour storm runoff from WSUD-1 is approximately 2.98 acre feet, which combined with runoff from the reclaimed site, exceeds the holding capacity of the sediment pond;

(3) The existing diversion is a 42" full-round C.M.P. pipe, which is well in excess of the size required to carry runoff from a 100 year-6 hour storm event for the area (See Table 10).

The main canyon 72" culvert will also be removed during Phase I reclamation, except for the lower approximately 300', which will be left in place to divert undisturbed and treated runoff beneath the sediment pond. Once the main canyon culvert is removed, Crandall Creek will be directed back to the original drainage channel through the area. Silt fences will be installed on both sides of the restored channel to treat runoff from the reclaimed pad areas, as shown on Plate 5-16.

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The U.S. Forest Service Road will be left as a permanent feature. A berm and ditch (RD-1) will be established along the road. This ditch will direct all runoff from areas above the road to the sediment pond. The sediment pond will remain in place until Phase II of reclamation.

Watersheds are shown on Plates 7-5 and 7-5C. Reclamation drainage details are shown on Plates 5-16 and 5-17.

4.2 General (Phase II)

Once the criteria for Phase II Bond Release are met, the sediment pond will be removed and, the area recontoured and reseeded according to the plan. The remaining 300' of the main canyon 72" culvert will also be removed at this time. At the discretion of the U.S. Forest Service, the berm along the road can also be removed at this time, or left in place. If the berm if left in place, reclaimed ditch RD-1 will be extended through the reclaimed pond area to the main channel.

4.3 Reclamation - Disturbed Drainage Control

Drainage from all contributing watersheds above the U.S. Forest Service Road, except WSUD-1, will be collected in a reclamation ditch (RD-1) and diverted into the sediment pond during Phase I reclamation. Drainage from the reclaimed areas and contributing watersheds below the road, will be treated through silt fences along the restored natural main channel, during Phase I reclamation.

Approximately 300' of the main canyon culvert will remain in place beneath the sediment pond area during Phase I.

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Upon Phase II reclamation, the sediment pond will be removed and the area restored. The remaining portion of the main canyon culvert will also be removed at this time. Silt fences along the previously reclaimed channel section may also be removed during Phase II; however, additional silt fences will be installed along the 300' section of culvert removal channel restoration.

Undisturbed diversion UD-1 will remain in place as a permanent diversion, as mentioned previously.

4.4 Restored Channels

Upon final reclamation, the main canyon drainage will be returned to the natural channel. During construction, this channel is to be covered by filter fabric and an underdrain system. The culvert will then be placed over the protected channel. Upon removal of the culvert, filter fabric will also be removed, exposing the natural channel. Construction in this manner will have a temporary effect on the riparian vegetation; however, this can readily be restored upon reclamation. Flow characteristics, bedding and other natural features of the natural channel will not be changed appreciably; therefore, no actual channel reconstruction or reclamation (beyond revegetation) is proposed.

No other channels are proposed to be restored within the reclaimed minesite.

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4.5 Sediment Pond

The sediment pond will remain in place during Phase I reclamation. The pond will be removed during Phase II and all drainage will be returned to the Main Crandall Canyon channel at that time.

Calculations show the sediment pond to be adequately sized to contain the runoff from contributing watersheds from a 10 year-24 hour precipitation event, along with a minimum of 3 years of sediment storage. The principle and emergency spillways are each capable of passing the runoff from a 25 year-6 hour event, as required.

4.6 Calculations

For ease of calculation and to ensure a conservative runoff requirement for sediment pond adequacy, no curve numbers for contributing watersheds were changed for reclamation purposes. Contributing watershed characteristics and flows were taken from Tables 1 through 4 of this report. Watersheds and pre-reclamation drainage control are shown on Plates 7-5 and 7-5C. Phase I and Phase II drainage control are shown on Plates 5-16 and 5-17, respectively.

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TABLE 14

RECLAMATION - PHASE I
RUNOFF SUMMARY
DRAINAGE TO SEDIMENT POND

Watershed	10 year/24 hour Volume-ac.ft.	10 year/ 6 hour Peak Flow-cfs	25 year/6 hour Peak Flow-cfs
WSUD-2	0.05	0.04	0.08
WSUD-3	0.30	0.23	0.43
WSDD-1	0.03	0.05	0.07
WSDD-2	0.01	0.01	0.03
WSDD-3	0.09	0.26	0.37
WSDD-4	0.03	0.11	0.14
WSDD-5	0.07	0.23	0.32
WSDD-7	0.05	0.11	0.16
WSDD-8	0.23	0.41	0.62
WSDD-10	0.13	0.39	0.53
WSDD-11	0.09	0.10	0.18
WSDD-14	0.13	0.39	0.56
Totals	1.21	2.33	3.49

Note: *Volumes and flows are totals from respective watersheds on Tables 3 and 4 of this report.*

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TABLE 15

RECLAMATION - PHASE I
RUNOFF CONTROL STRUCTURE
WATERSHED SUMMARY

Structure	Type	Contributing Watersheds
Main Channel	Silt Fence	WSDD-12, WSDD-13
UD-1	Culvert	WSUD-1
RD-1	Ditch	WSUD-2, WSUD-3, WSDD-1 thru WSDD-11
Sediment Pond	Pond	WSUD-2, WSUD-3, WSDD-1 thru WSDD-11 and WSDD-14

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TABLE 16

RECLAMATION - PHASE I
RUNOFF CONTROL STRUCTURE
FLOW SUMMARY

Structure	Type	10 year/6 hour Peak Flow (cfs)	25 year/6 hour Peak Flow (cfs)	100 year/6 hour Peak Flow (cfs)
Main Channel	Silt Fence	3.73	5.44	-
UD-1	Culvert	1.91	3.68	6.81
RD-1	Ditch	1.94	2.93	-
Sediment Pond	Pond	2.33	3.49	-

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TABLE 17

RECLAMATION - PHASE 1
RECLAIMED DITCH DESIGN SUMMARY

Ditch	RD-1
Slope (%)	10.10
Length (ft.)	990
Manning's No.	0.035
Side Slope (H:V)	1.5:1
Bottom Width (ft.)	0
Peak Flow 10/6 (cfs)	1.94
Flow Depth (ft.)	0.52
Flow Area (ft^2)	0.40
Velocity (fps)	4.85
Lined (Y/N)	N
Rip Rap Req'd (Y/N)	N

Note: Slope / Length from Plate 5-16

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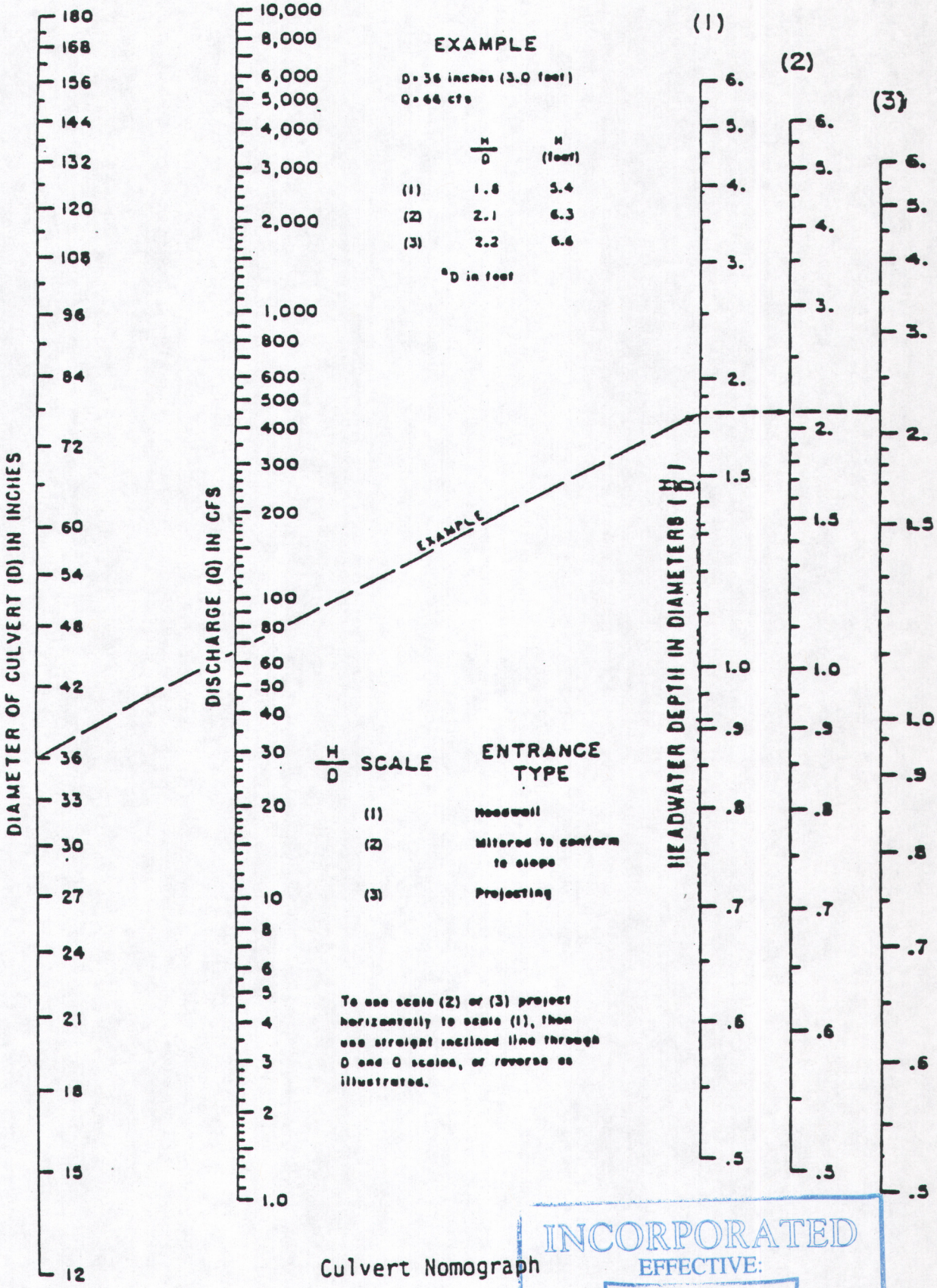

Culvert Nomograph

Headwater depth for corrugated-metal pipe culverts with entrance control. (U.S. Bureau of Public Roads.) 238—D—2909.

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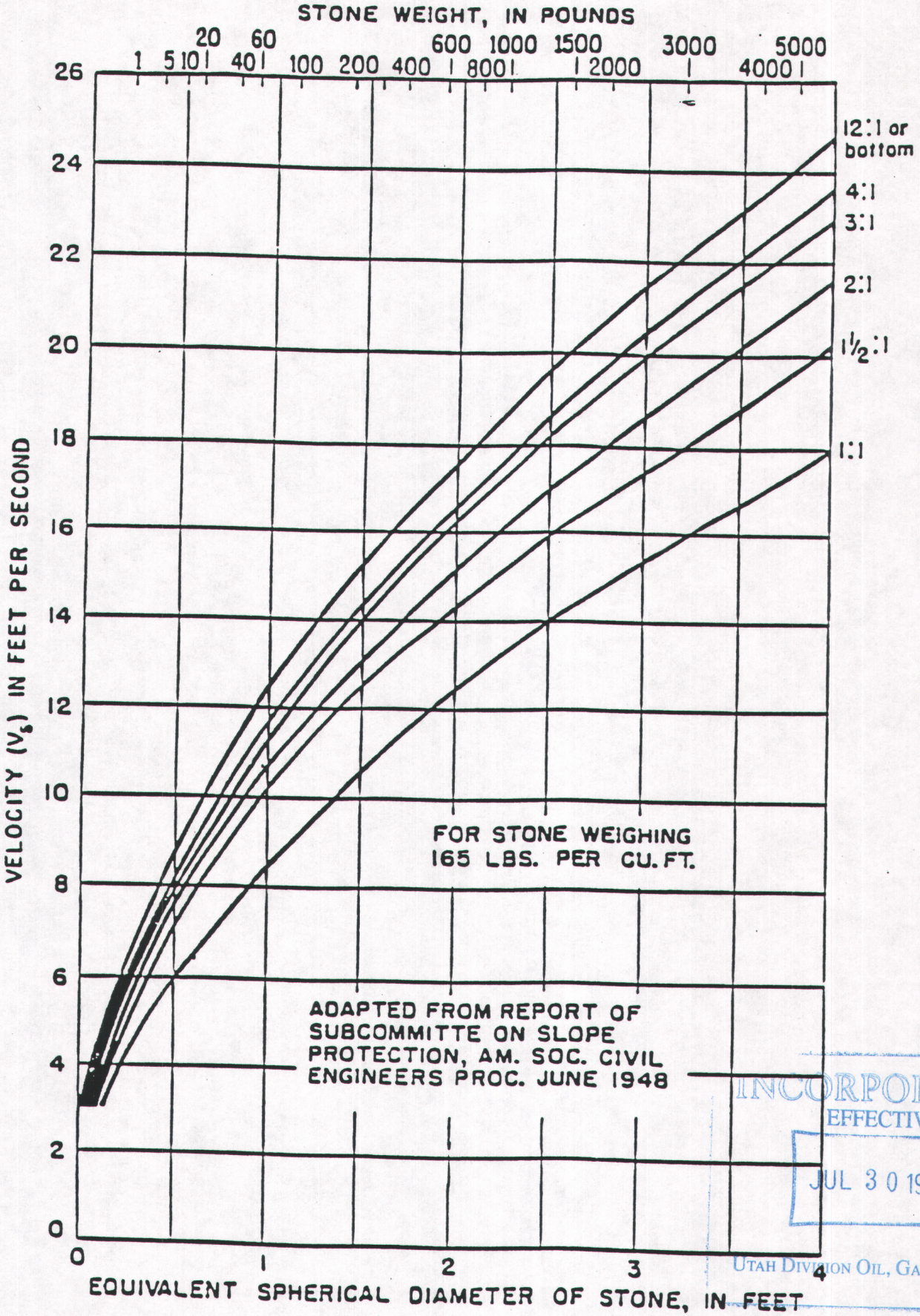
FIGURE 1

RIP-RAP CHART



SIZE OF STONE THAT WILL RESIST DISPLACEMENT FOR VARIOUS VELOCITIES AND SIDE SLOPES

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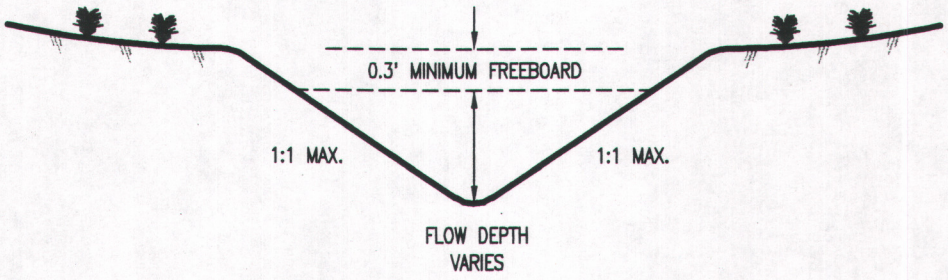
FIGURE 2

UNDISTURBED AND DISTURBED DITCH TYPICAL SECTION



DITCH SIZING					
10 YEAR 6 HOUR STORM			* 10 YEAR 24 HOUR STORM		
DITCH	FLOW DEPTH	FLOW AREA	DITCH	FLOW DEPTH	FLOW AREA
UD-2	0.14	0.02	UD-2	–	–
DD-1	0.14	0.02	DD-1	0.22	0.05
DD-3	0.40	0.16	DD-3	0.56	0.31
DD-4	0.66	0.43	DD-4	0.92	0.85
DD-5	0.75	0.57	DD-5	1.06	1.12
DD-7	0.33	0.11	DD-7	0.57	0.32
DD-8	0.47	0.18	DD-8	0.67	0.45
DD-11	0.26	0.07	DD-11	0.50	0.25
DD-12	0.71	0.50	DD-12	0.97	0.94
DD-13	0.56	0.32	DD-13	0.77	0.59

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NOTE:

DITCH CONFIGURATIONS MAY VARY IN FIELD; HOWEVER, MINIMUM FLOW DEPTHS AND AREAS WILL BE MAINTAINED.

* FOR REFERENCE ONLY.

FIGURE 3

FIGURE 4

SOIL ERODIBILITY CHART

(DISTURBED AREAS)

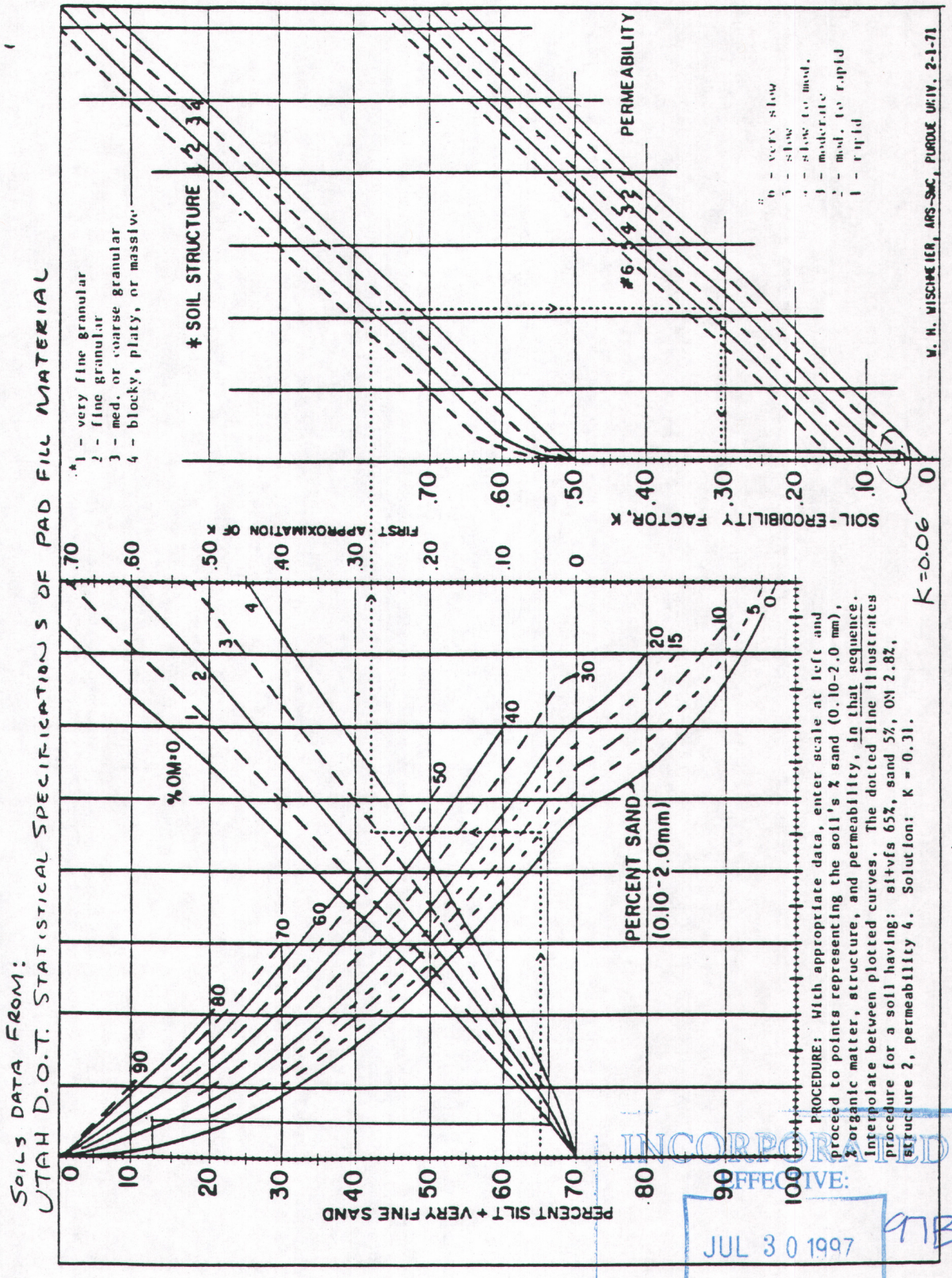

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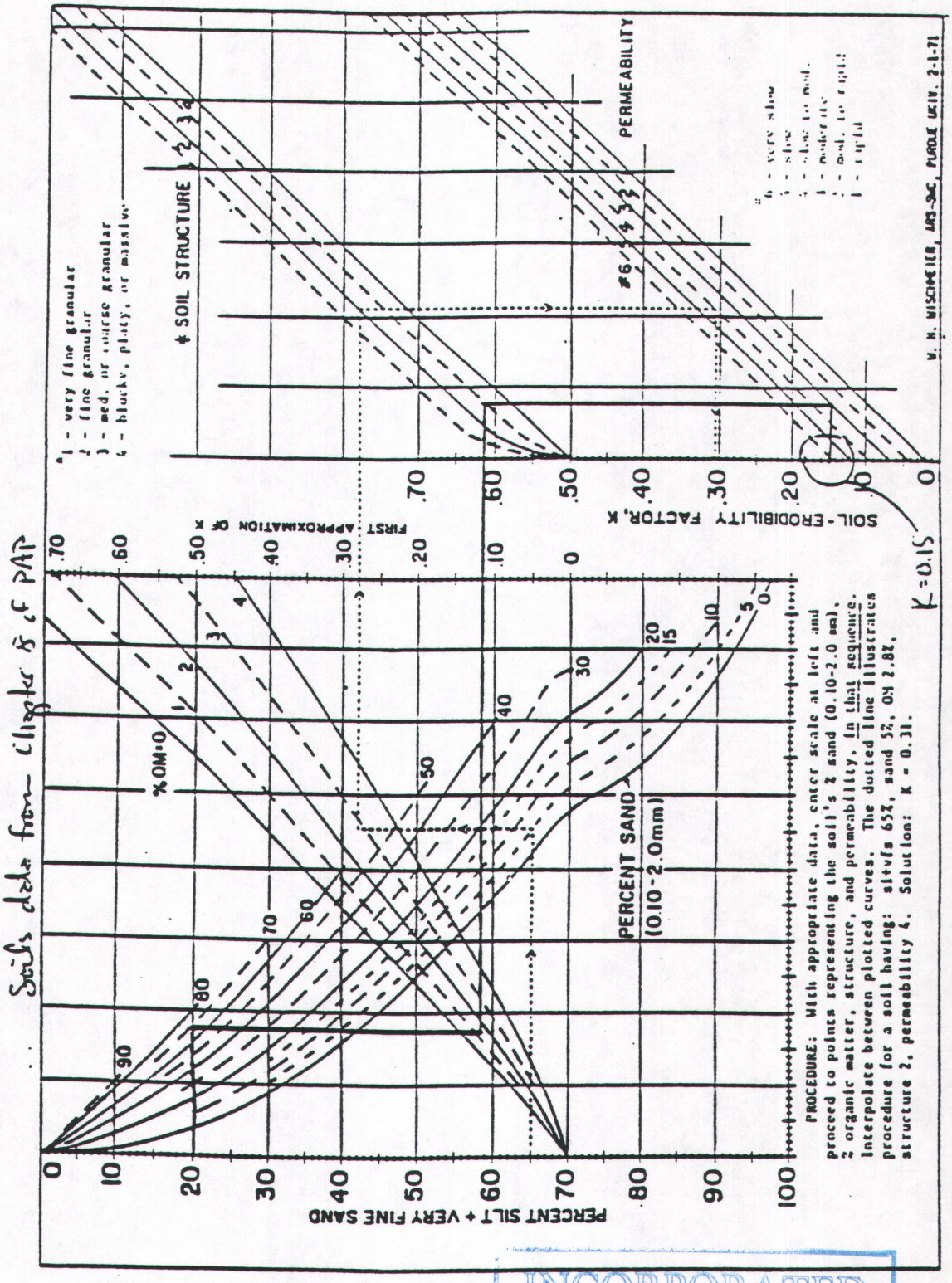
FIGURE 5

SOIL ERODIBILITY CHART (UNDISTURBED/RECLAIMED AREAS)



Soils data from chapter 5 of PAP

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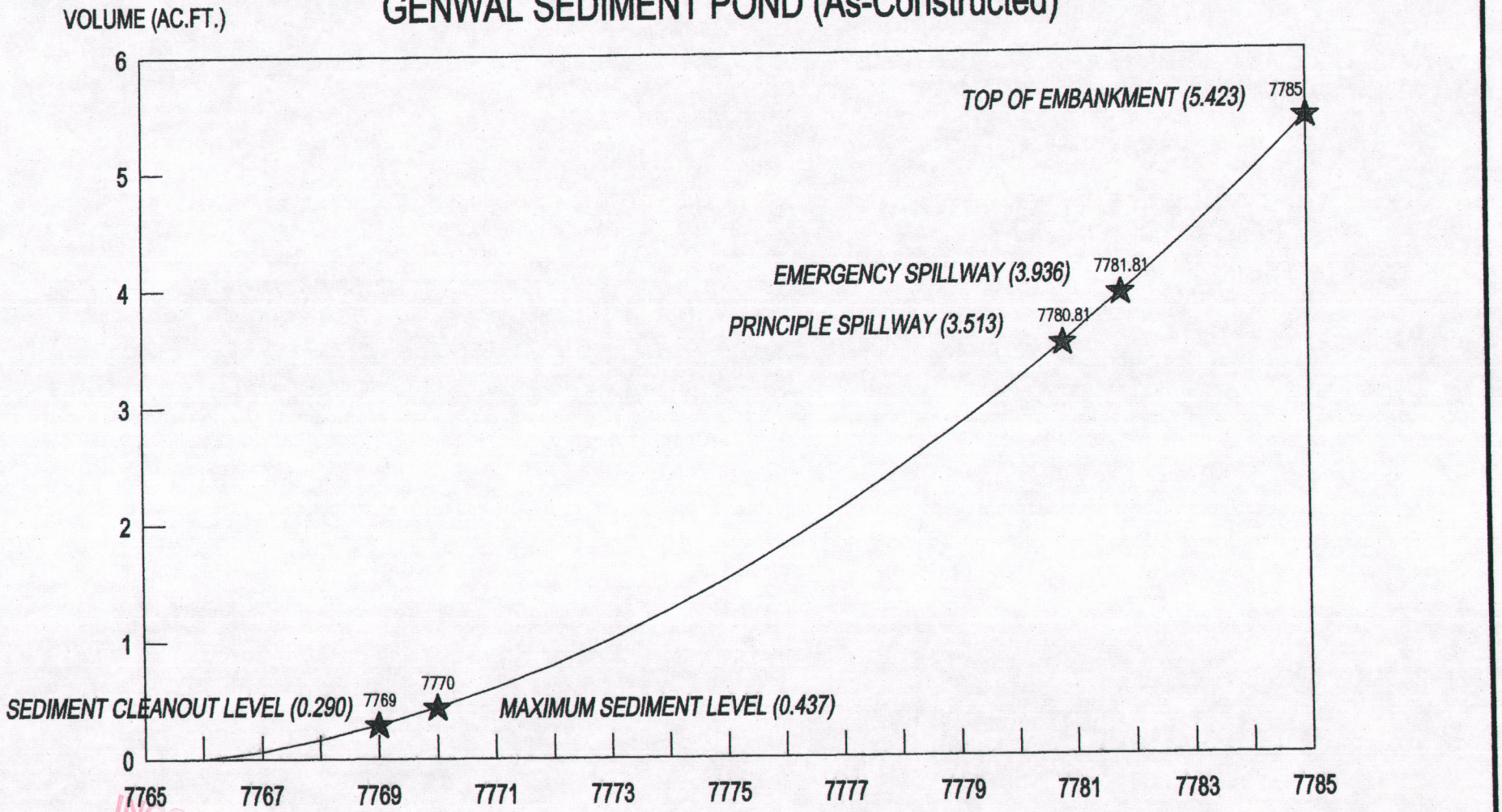
STAGE-VOLUME

GENWAL SEDIMENT POND (As-Constructed)



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PROFESSIONAL ENGINEER
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FIGURE 6

SEDIMENT POND
STAGE–DISCHARGE CURVE

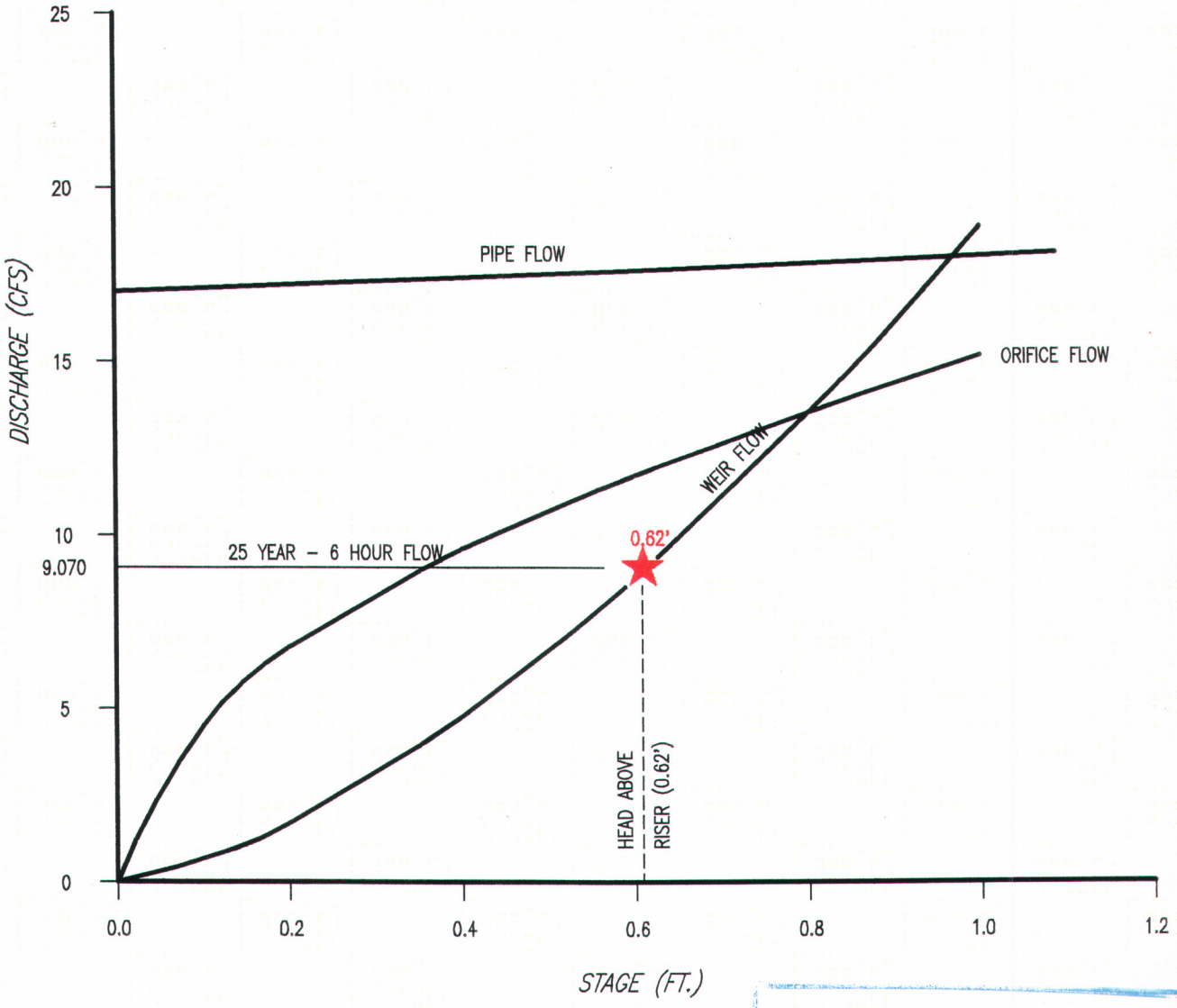

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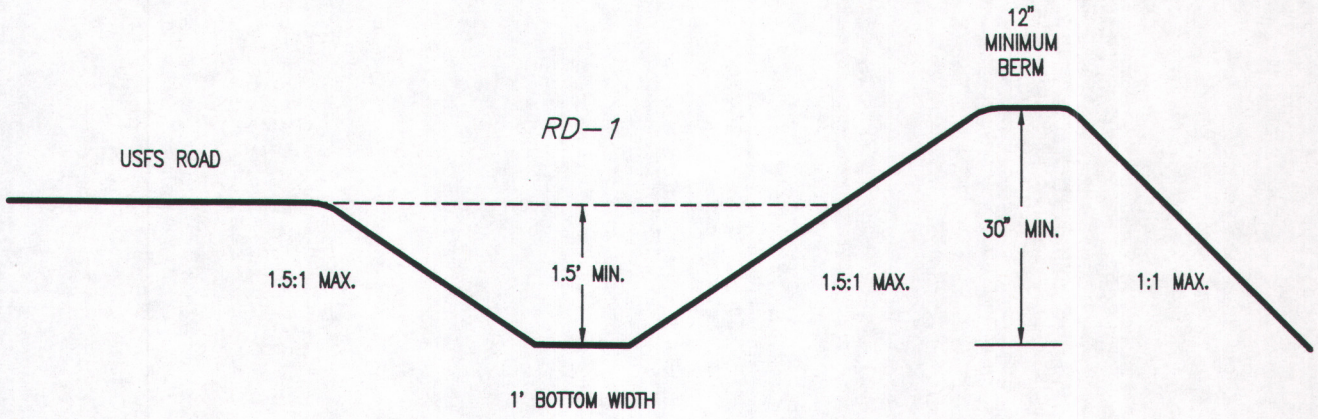
FIGURE 7

RECLAMATION DITCH RD-1
TYPICAL SECTION



DITCH SIZING		
DITCH	*FLOW DEPTH*	*FLOW AREA*
RD-1	*0.52*	*0.40*

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NOTE:

DITCH CONFIGURATIONS MAY VARY IN FIELD; HOWEVER, MINIMUM FLOW DEPTHS AND AREAS WILL BE MAINTAINED.

FIGURE 8

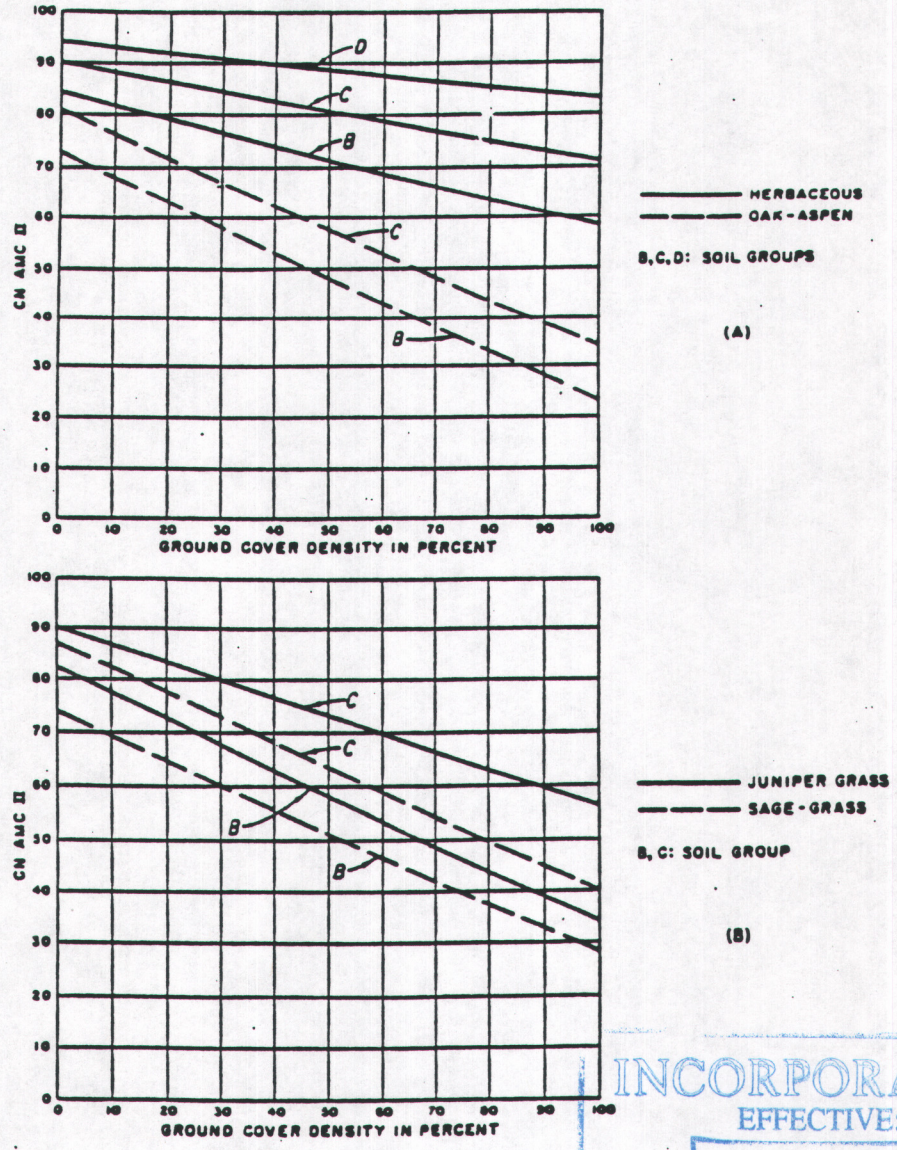

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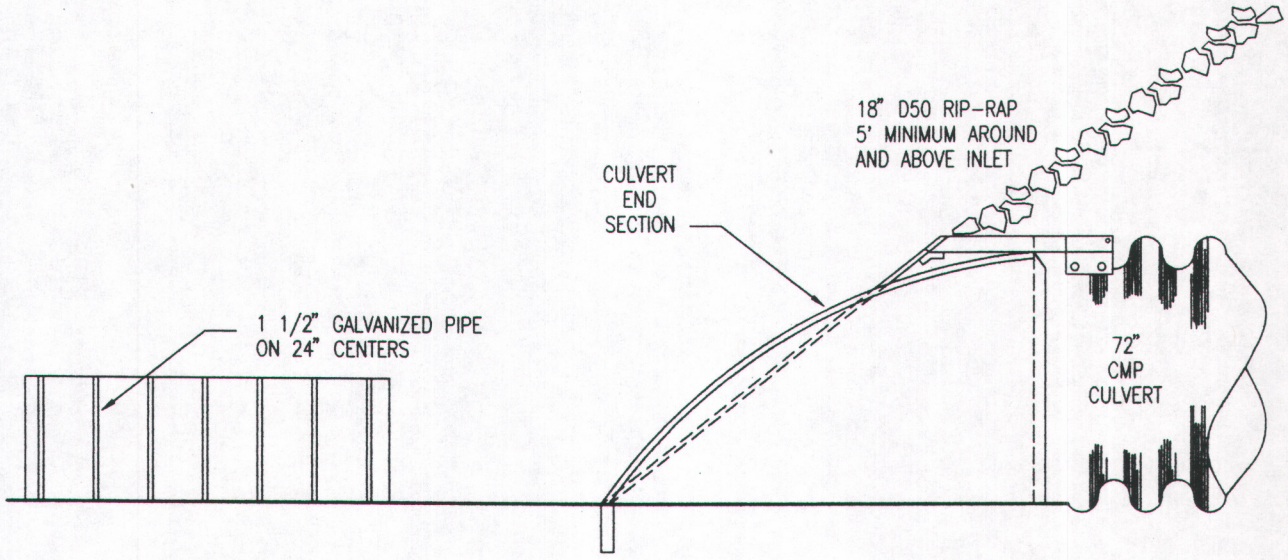
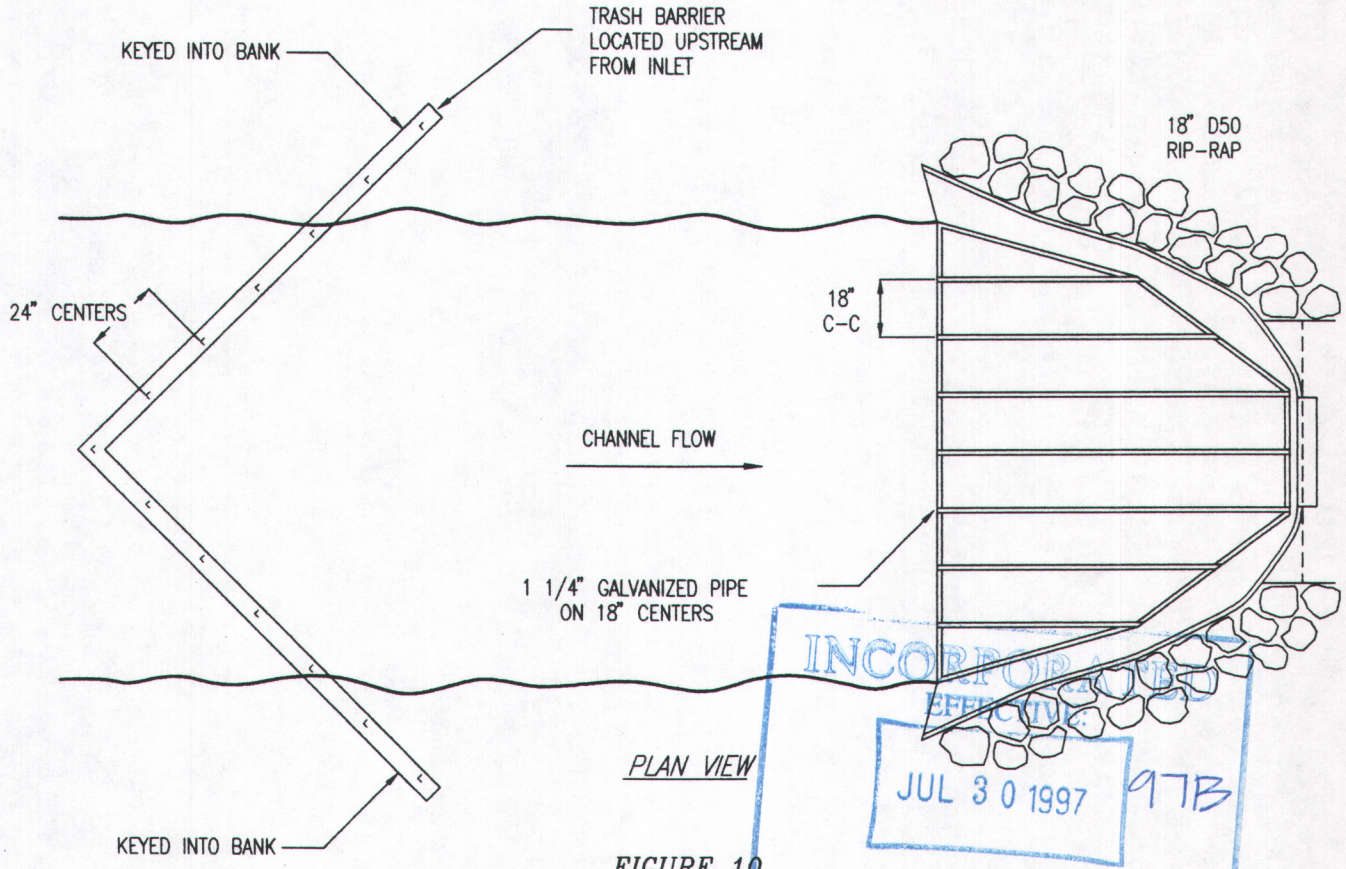
Figure 7-3. Runoff curve numbers for forest-range in the western U.S. (from U.S. Bureau of Reclamation, 1977).

FIGURE 9

MAIN CULVERT INLET AND TRASH BARRIERS



SIDE VIEW



PLAN VIEW

FIGURE 10

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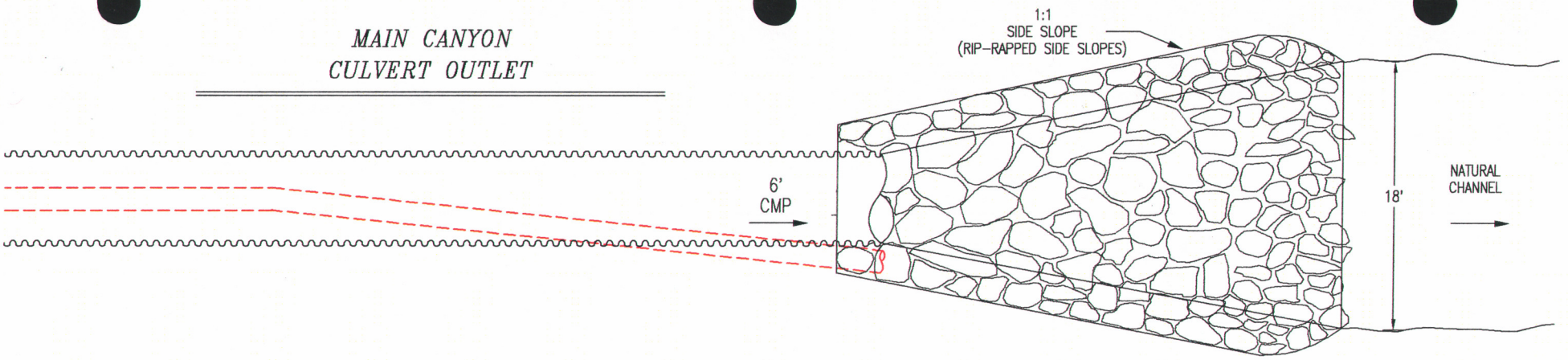
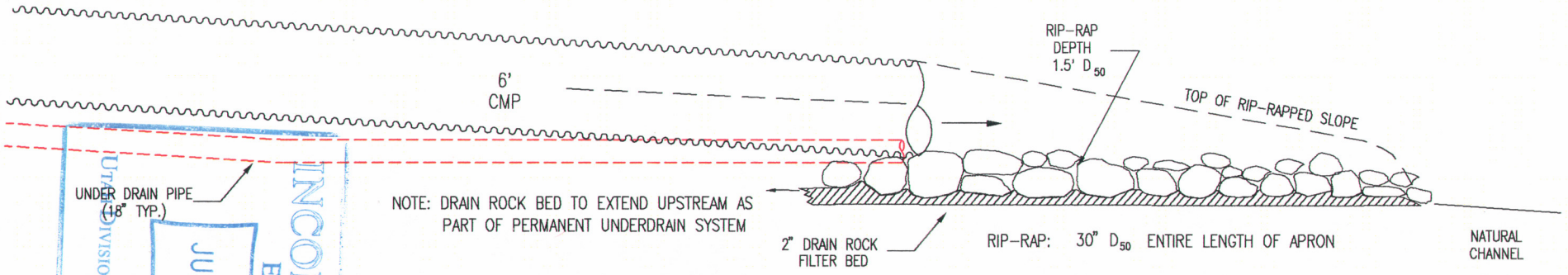
MAIN CANYON CULVERT OUTLET



TOP VIEW

RIP-RAP: 30" D_{50} ENTIRE LENGTH OF APRON

30'



SECTION VIEW

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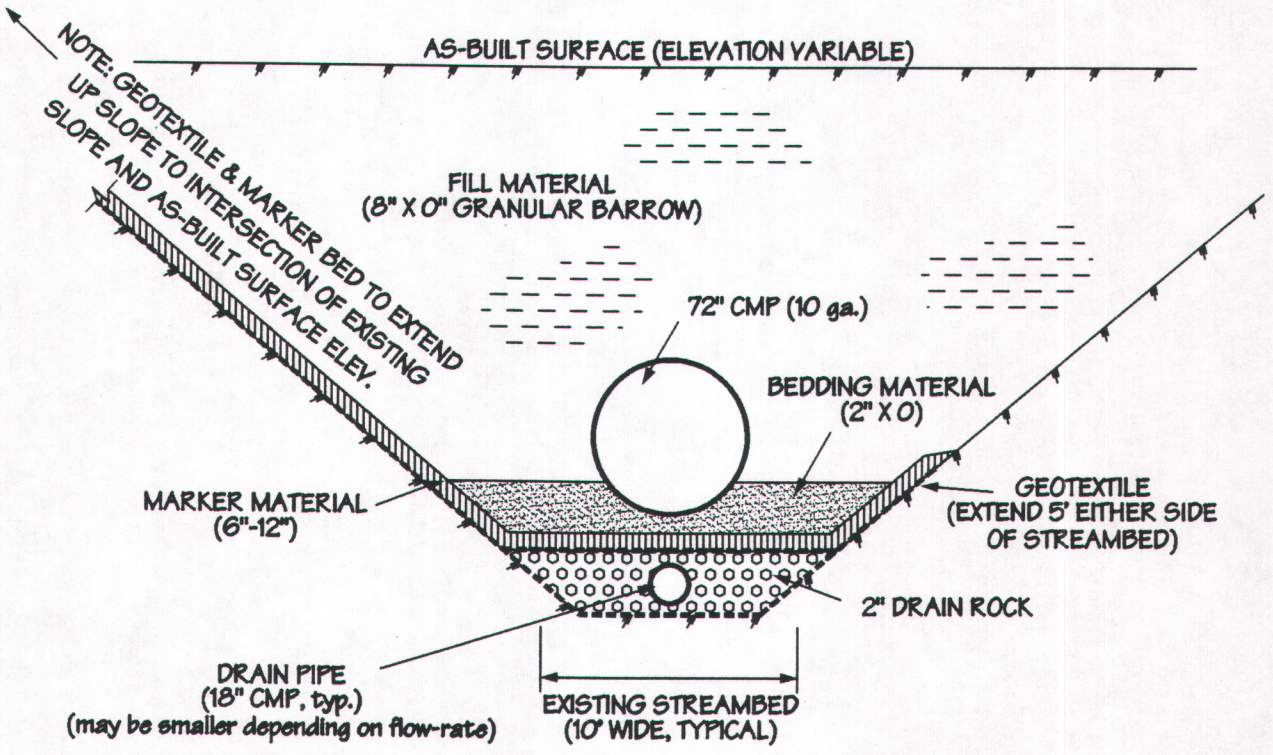
* DESIGN BASED ON FIGURE 7-26, DESIGN OF OUTLET PROTECTION - MAXIMUM TAILWATER CONDITION, "APPLIED HYDROLOGY AND SEDIMENTOLOGY FOR DISTURBED AREAS", BARFIELD, WARNER & HAAN, 1983.

FIGURE 11

SCALE: 1" = 10'

ACAD REF: FIGURE11A

TYPICAL UNDERDRAIN CONSTRUCTION



SCALE: 1" = 15'

Note: Culvert installation will generally follow the existing stream alignment, but may vary slightly to accommodate accepted engineering and installation standards.

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FIGURE 12

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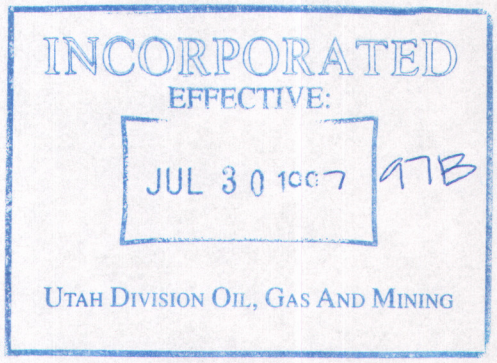
DITCH FLOW CALCULATIONS

Title of run: DD-1 (10/6)

Solving for.....= Depth Normal

Triangle

Flow depth (ft).....=	0.14
First Side slope.....=	1.0
Second Side slope.....=	1.0
Slope of diversion.....=	0.3077
Manning"s n.....=	0.035
CFS.....=	0.06
Cross section area (sqft)..=	0.02
Hydrualic radius.....=	0.05
fps.....=	3.15
Froude number.....=	2.52



Title of run: DD-1 (10/24)

Solving for.....= Depth Normal

Triangle

Flow depth (ft).....=	0.22
First Side slope.....=	1.0
Second Side slope.....=	1.0
Slope of diversion.....=	0.3077
Manning"s n.....=	0.035
CFS.....=	0.20
Cross section area (sqft)..=	0.05
Hydrualic radius.....=	0.08
fps.....=	4.26
Froude number.....=	2.71

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Title of run: DD-3 (10/6)

Solving for.....= Depth Normal

Triangle

Flow depth (ft).....=	0.40
First Side slope.....=	1.0
Second Side slope.....=	1.0
Slope of diversion.....=	0.0300
Manning"s n.....=	0.035
CFS.....=	0.32
Cross section area (sqft)..=	0.16
Hydrualic radius.....=	0.14
fps.....=	2.00
Froude number.....=	0.94

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Title of run: DD-3 (10/24)

Solving for.....= Depth Normal

Triangle

Flow depth (ft).....=	0.56
First Side slope.....=	1.0
Second Side slope.....=	1.0
Slope of diversion.....=	0.0300
Manning"s n.....=	0.035
CFS.....=	0.78
Cross section area (sqft)..=	0.31
Hydrualic radius.....=	0.20
fps.....=	2.50
Froude number.....=	0.99

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Title of run: DD-4 (10/6)

Solving for.....= Depth Normal

Triangle

Flow depth (ft).....=	0.66
First Side slope.....=	1.0
Second Side slope.....=	1.0
Slope of diversion.....=	0.1191
Manning"s n.....=	0.035
CFS.....=	2.39
Cross section area (sqft)..=	0.43
Hydrualic radius.....=	0.23
fps.....=	5.55
Froude number.....=	2.03

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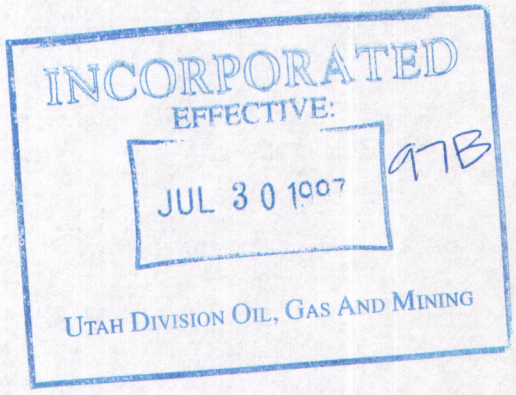
Title of run: DD-4 (10/24)

Solving for.....= Depth Normal

Triangle

Flow depth (ft).....=	0.92
First Side slope.....=	1.0
Second Side slope.....=	1.0
Slope of diversion.....=	0.1191
Manning"s n.....=	0.035
CFS.....=	5.96
Cross section area (sqft)..=	0.85
Hydrualic radius.....=	0.33
fps.....=	6.97
Froude number.....=	2.15



Title of run: DD-5 (10/6)

Solving for.....= Depth Normal

Triangle

Flow depth (ft).....=	0.75
First Side slope.....=	1.0
Second Side slope.....=	1.0
Slope of diversion.....=	0.0682
Manning"s n.....=	0.035
CFS.....=	2.62
Cross section area (sqft)..=	0.57
Hydrualic radius.....=	0.27
fps.....=	4.61
Froude number.....=	1.57

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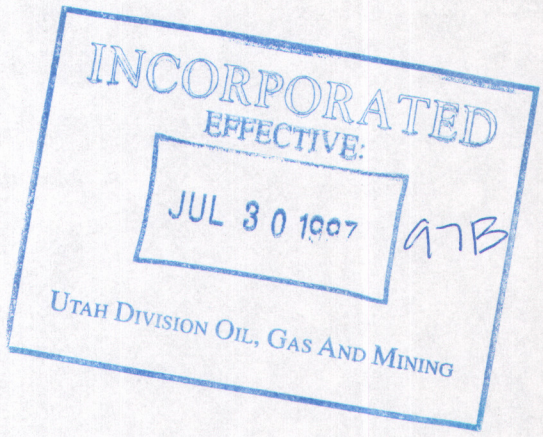
Title of run: DD-5 (10/24)

Solving for.....= Depth Normal

Triangle

Flow depth (ft).....=	1.06
First Side slope.....=	1.0
Second Side slope.....=	1.0
Slope of diversion.....=	0.0682
Manning"s n.....=	0.035
CFS.....=	6.48
Cross section area (sqft)..=	1.12
Hydrualic radius.....=	0.37
fps.....=	5.78
Froude number.....=	1.66



Title of run: DD-7 (10/6)

Solving for.....= Depth Normal

Triangle

Flow depth (ft).....=	0.33
First Side slope.....=	1.0
Second Side slope.....=	1.0
Slope of diversion.....=	0.0333
Manning"s n.....=	0.035
CFS.....=	0.21
Cross section area (sqft)..=	0.11
Hydrualic radius.....=	0.12
fps.....=	1.87
Froude number.....=	0.96

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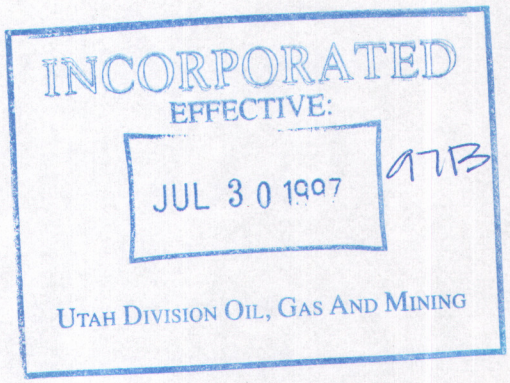
Title of run: DD-7 (10/24)

Solving for.....= Depth Normal

Triangle

Flow depth (ft).....=	0.57
First Side slope.....=	1.0
Second Side slope.....=	1.0
Slope of diversion.....=	0.0333
Manning"s n.....=	0.035
CFS.....=	0.85
Cross section area (sqft)..=	0.32
Hydrualic radius.....=	0.20
fps.....=	2.66
Froude number.....=	1.05



Title of run: DD-8 (10/6)

Solving for.....= Depth Normal

Triangle

Flow depth (ft).....=	0.42
First Side slope.....=	1.0
Second Side slope.....=	1.0
Slope of diversion.....=	0.0359
Manning"s n.....=	0.035
CFS.....=	0.41
Cross section area (sqft)..=	0.18
Hydrualic radius.....=	0.15
fps.....=	2.28
Froude number.....=	1.04

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Title of run: DD-8 (10/24)

Solving for.....= Depth Normal

Triangle

Flow depth (ft).....=	0.67
First Side slope.....=	1.0
Second Side slope.....=	1.0
Slope of diversion.....=	0.0359
Manning"s n.....=	0.035
CFS.....=	1.40
Cross section area (sqft)..=	0.45
Hydrualic radius.....=	0.24
fps.....=	3.10
Froude number.....=	1.12

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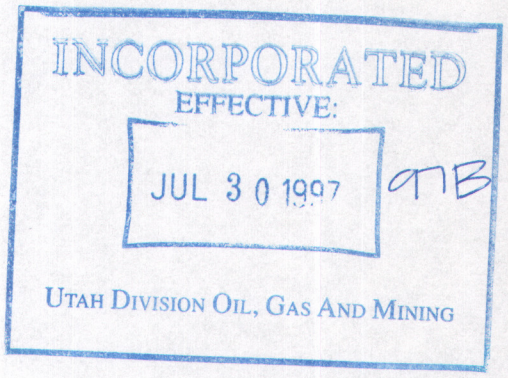
Title of run: DD-11 (10/6)

Solving for.....= Depth Normal

Triangle

Flow depth (ft).....=	0.26
First Side slope.....=	1.0
Second Side slope.....=	1.0
Slope of diversion.....=	0.0300
Manning"s n.....=	0.035
CFS.....=	0.10
Cross section area (sqft)..=	0.07
Hydrualic radius.....=	0.09
fps.....=	1.50
Froude number.....=	0.87



Title of run: DD-11 (10/24)

Solving for.....= Depth Normal

Triangle

Flow depth (ft).....=	0.50
First Side slope.....=	1.0
Second Side slope.....=	1.0
Slope of diversion.....=	0.0300
Manning"s n.....=	0.035
CFS.....=	0.57
Cross section area (sqft)..=	0.25
Hydrualic radius.....=	0.18
fps.....=	2.31
Froude number.....=	0.97

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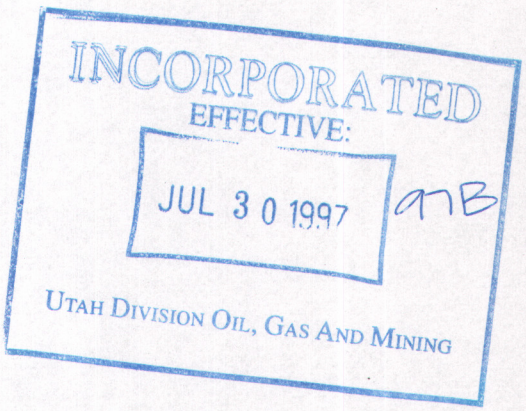
Title of run: DD-12 (10/6)

Solving for.....= Depth Normal

Triangle

Flow depth (ft).....=	0.71
First Side slope.....=	1.0
Second Side slope.....=	1.0
Slope of diversion.....=	0.0329
Manning"s n.....=	0.035
CFS.....=	1.55
Cross section area (sqft)..=	0.50
Hydrualic radius.....=	0.25
fps.....=	3.07
Froude number.....=	1.08



Title of run: DD-12 (10/24)

Solving for.....= Depth Normal

Triangle

Flow depth (ft).....=	0.97
First Side slope.....=	1.0
Second Side slope.....=	1.0
Slope of diversion.....=	0.0329
Manning"s n.....=	0.035
CFS.....=	3.58
Cross section area (sqft)..=	0.94
Hydrualic radius.....=	0.34
fps.....=	3.79
Froude number.....=	1.14

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Title of run: DD-13 (10/6)

Solving for.....= Depth Normal

Triangle

Flow depth (ft).....=	0.56
First Side slope.....=	1.0
Second Side slope.....=	1.0
Slope of diversion.....=	0.2250
Manning"s n.....=	0.035
CFS.....=	2.18
Cross section area (sqft)..=	0.32
Hydrualic radius.....=	0.20
fps.....=	6.88
Froude number.....=	2.72

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Title of run: DD-13 (10/24)

Solving for.....= Depth Normal

Triangle

Flow depth (ft).....=	0.77
First Side slope.....=	1.0
Second Side slope.....=	1.0
Slope of diversion.....=	0.2250
Manning"s n.....=	0.035
CFS.....=	5.05
Cross section area (sqft)..=	0.59
Hydrualic radius.....=	0.27
fps.....=	8.49
Froude number.....=	2.87

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Title of run: UD-2 (10/6)

Solving for.....= Depth Normal

Triangle

Flow depth (ft).....=	0.14
First Side slope.....=	1.0
Second Side slope.....=	1.0
Slope of diversion.....=	0.1250
Manning"s n.....=	0.035
CFS.....=	0.04
Cross section area (sqft)..=	0.02
Hydrualic radius.....=	0.05
fps.....=	2.03
Froude number.....=	1.61

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Title of run: UD-2 (100/6)

Solving for.....= Depth Normal

Triangle

Flow depth (ft).....=	0.26
First Side slope.....=	1.0
Second Side slope.....=	1.0
Slope of diversion.....=	0.1250
Manning"s n.....=	0.035
CFS.....=	0.21
Cross section area (sqft)..=	0.07
Hydrualic radius.....=	0.09
fps.....=	3.08
Froude number.....=	1.78

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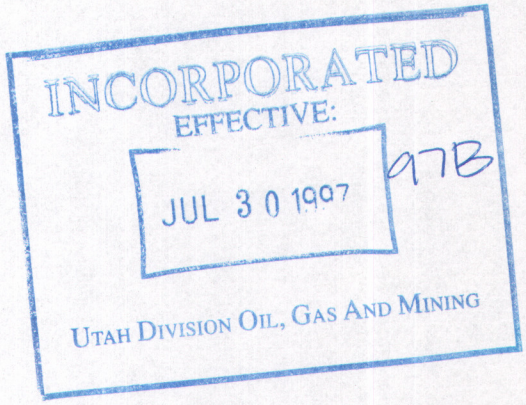
Title of run: DITCH RD-1

Solving for.....= Depth Normal

Triangle

Flow depth (ft).....=	0.52
First Side slope.....=	1.5
Second Side slope.....=	1.5
Slope of diversion.....=	0.1010
Manning"s n.....=	0.035
CFS.....=	1.94
Cross section area (sqft)..=	0.40
Hydrualic radius.....=	0.21
fps.....=	4.85
Froude number.....=	1.85



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CULVERT FLOW CALCULATIONS

Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: GENWAL CULVERT

Comment: CRANDALL - MAIN CANYON (100/6)

Solve For Full Flow Diameter

Given Input Data:

Slope.....	0.0800 ft/ft
Manning's n.....	0.020
Discharge.....	222.79 cfs

Computed Results:

Full Flow Diameter.....	3.75 ft
Full Flow Depth.....	3.75 ft
Velocity.....	20.14 fps
Flow Area.....	11.06 sf
Critical Depth....	3.70 ft
Critical Slope....	0.0728 ft/ft
Percent Full.....	100.00 %
Full Capacity.....	222.79 cfs
QMAX @.94D.....	239.66 cfs
Froude Number.....	FULL

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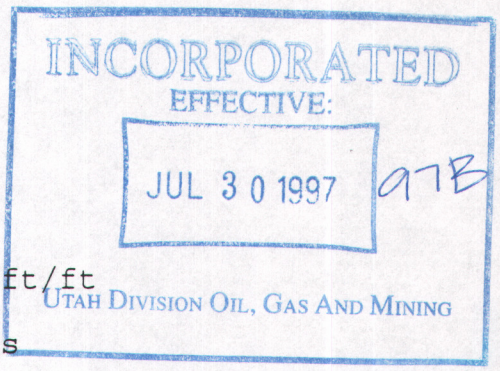
Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow



Worksheet Name: GENWAL CULVERTS

Comment: CULVERT UD-1 (100/6)

Solve For Full Flow Diameter

Given Input Data:

Slope.....	0.2333 ft/ft
Manning's n.....	0.020
Discharge.....	6.81 cfs

Computed Results:

Full Flow Diameter.....	0.83 ft
Full Flow Depth.....	0.83 ft
Velocity.....	12.58 fps
Flow Area.....	0.54 sf
Critical Depth....	0.83 ft
Critical Slope....	0.2206 ft/ft
Percent Full.....	100.00 %
Full Capacity.....	6.81 cfs
QMAX @.94D.....	7.33 cfs
Froude Number.....	FULL

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Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

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Worksheet Name: GENWAL CULVERT

Comment: CULVERT UD-1

Solve For Full Flow Diameter

Given Input Data:

Slope.....	0.2333 ft/ft
Manning's n.....	0.020
Discharge.....	1.91 cfs

Computed Results:

Full Flow Diameter.....	0.52 ft
Full Flow Depth.....	0.52 ft
Velocity.....	9.16 fps
Flow Area.....	0.21 sf
Critical Depth....	0.51 ft
Critical Slope....	0.2186 ft/ft
Percent Full.....	100.00 %
Full Capacity.....	1.91 cfs
QMAX @.94D.....	2.05 cfs
Froude Number.....	FULL

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Open Channel - Uniform flow

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Worksheet Name: GENWAL CULVERT

Comment: CULVERT UD-3

Solve For Full Flow Diameter

Given Input Data:

Slope.....	0.1196 ft/ft
Manning's n.....	0.020
Discharge.....	0.23 cfs

Computed Results:

Full Flow Diameter.....	0.26 ft
Full Flow Depth.....	0.26 ft
Velocity.....	4.20 fps
Flow Area.....	0.05 sf
Critical Depth....	0.25 ft
Critical Slope....	0.1047 ft/ft
Percent Full.....	100.00 %
Full Capacity.....	0.23 cfs
QMAX @.94D.....	0.25 cfs
Froude Number.....	FULL

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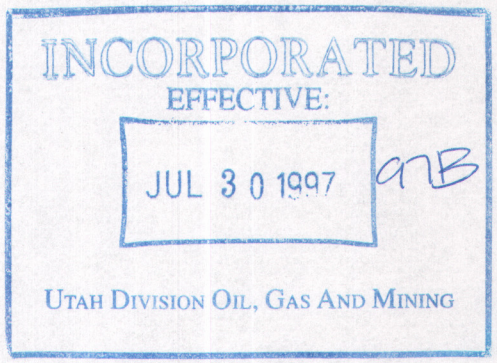

Worksheet Name: GENWAL CULVERT

Comment: CULVERT C-1 (10/6)

Solve For Full Flow Diameter

Given Input Data:

Slope.....	0.1167 ft/ft
Manning's n.....	0.020
Discharge.....	0.73 cfs

Computed Results:

Full Flow Diameter.....	0.41 ft
Full Flow Depth.....	0.41 ft
Velocity.....	5.55 fps
Flow Area.....	0.13 sf
Critical Depth....	0.40 ft
Critical Slope....	0.1031 ft/ft
Percent Full.....	100.00 %
Full Capacity.....	0.73 cfs
QMAX @.94D.....	0.79 cfs
Froude Number.....	FULL

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Circular Channel Analysis & Design
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Open Channel - Uniform flow

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Worksheet Name: GENWAL CULVERT

Comment: CULVERT C-1 (10/24)

Solve For Full Flow Diameter

Given Input Data:

Slope.....	0.1167 ft/ft
Manning's n.....	0.020
Discharge.....	2.18 cfs

Computed Results:

Full Flow Diameter.....	0.62 ft
Full Flow Depth.....	0.62 ft
Velocity.....	7.30 fps
Flow Area.....	0.30 sf
Critical Depth....	0.60 ft
Critical Slope....	0.1043 ft/ft
Percent Full.....	100.00 %
Full Capacity.....	2.18 cfs
QMAX @.94D.....	2.35 cfs
Froude Number.....	FULL

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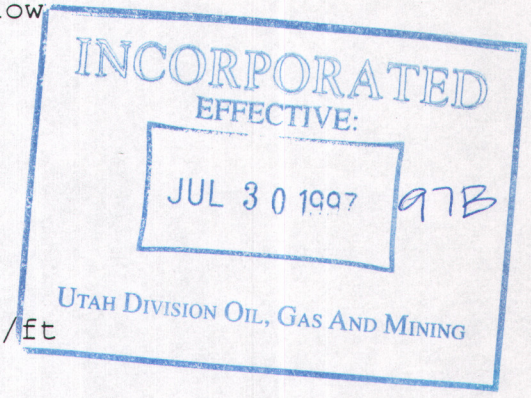

Worksheet Name: GENWAL CULVERT

Comment: CULVERT C-3 (10/6)

Solve For Full Flow Diameter

Given Input Data:

Slope.....	0.0800 ft/ft
Manning's n.....	0.020
Discharge.....	0.21 cfs

Computed Results:

Full Flow Diameter.....	0.28 ft
Full Flow Depth.....	0.28 ft
Velocity.....	3.53 fps
Flow Area.....	0.06 sf
Critical Depth....	0.26 ft
Critical Slope....	0.0692 ft/ft
Percent Full.....	100.00 %
Full Capacity.....	0.21 cfs
QMAX @.94D.....	0.23 cfs
Froude Number.....	FULL

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Worksheet Name: GENWAL CULVERT

Comment: CULVERT C-3 (10/24)

Solve For Full Flow Diameter

Given Input Data:

Slope.....	0.0800 ft/ft
Manning's n.....	0.020
Discharge.....	0.85 cfs

Computed Results:

Full Flow Diameter.....	0.46 ft
Full Flow Depth.....	0.46 ft
Velocity.....	5.01 fps
Flow Area.....	0.17 sf
Critical Depth....	0.44 ft
Critical Slope....	0.0693 ft/ft
Percent Full.....	100.00 %
Full Capacity.....	0.85 cfs
QMAX @.94D.....	0.91 cfs
Froude Number.....	FULL

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Open Channel - Uniform flow

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Worksheet Name: GENWAL CULVERT

Comment: CULVERT C-4 (10/6)

Solve For Full Flow Diameter

Given Input Data:

Slope.....	0.2507 ft/ft
Manning's n.....	0.020
Discharge.....	3.01 cfs

Computed Results:

Full Flow Diameter.....	0.60 ft
Full Flow Depth.....	0.60 ft
Velocity.....	10.54 fps
Flow Area.....	0.29 sf
Critical Depth.....	0.60 ft
Critical Slope.....	0.2366 ft/ft
Percent Full.....	100.00 %
Full Capacity.....	3.01 cfs
QMAX @.94D.....	3.24 cfs
Froude Number.....	FULL

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Worksheet Name: GENWAL CULVERT

Comment: CULVERT C-4 (10/24)

Solve For Full Flow Diameter

Given Input Data:

Slope.....	0.2507 ft/ft
Manning's n.....	0.020
Discharge.....	6.79 cfs

Computed Results:

Full Flow Diameter.....	0.82 ft
Full Flow Depth.....	0.82 ft
Velocity.....	12.91 fps
Flow Area.....	0.53 sf
Critical Depth....	0.82 ft
Critical Slope....	0.2379 ft/ft
Percent Full.....	100.00 %
Full Capacity.....	6.79 cfs
QMAX @.94D.....	7.30 cfs
Froude Number.....	FULL

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Worksheet Name: GENWAL CULVERT

Comment: CULVERT C-5 (10/6)

Solve For Full Flow Diameter

Given Input Data:

Slope.....	0.5714 ft/ft
Manning's n.....	0.020
Discharge.....	0.10 cfs

Computed Results:

Full Flow Diameter.....	0.14 ft
Full Flow Depth.....	0.14 ft
Velocity.....	6.13 fps
Flow Area.....	0.02 sf
Critical Depth....	0.14 ft
Critical Slope....	0.5483 ft/ft
Percent Full.....	100.00 %
Full Capacity.....	0.10 cfs
QMAX @.94D.....	0.11 cfs
Froude Number.....	FULL

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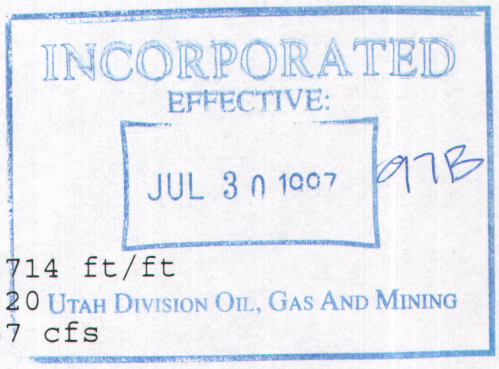
Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow



Worksheet Name: GENWAL CULVERT

Comment: CULVERT C-5 (10/24)

Solve For Full Flow Diameter

Given Input Data:

Slope	0.5714 ft/ft
Manning's n	0.020
Discharge	0.57 cfs

Computed Results:

Full Flow Diameter	0.28 ft
Full Flow Depth	0.28 ft
Velocity	9.47 fps
Flow Area	0.06 sf
Critical Depth	0.28 ft
Critical Slope	0.5527 ft/ft
Percent Full	100.00 %
Full Capacity	0.57 cfs
QMAX @.94D	0.61 cfs
Froude Number	FULL

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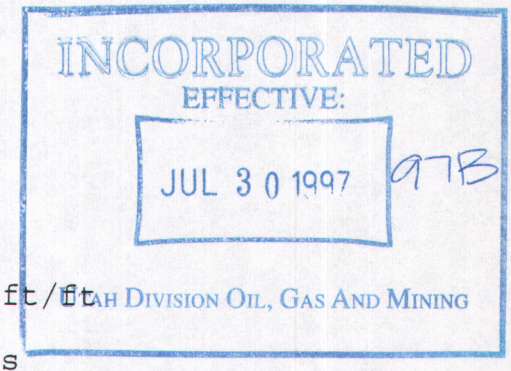
Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow



Worksheet Name: GENWAL CULVERT

Comment: CULVERT C-6 (10/6)

Solve For Full Flow Diameter

Given Input Data:

Slope.....	0.1720 ft/ft
Manning's n.....	0.020
Discharge.....	0.04 cfs

Computed Results:

Full Flow Diameter.....	0.13 ft
Full Flow Depth.....	0.13 ft
Velocity.....	3.11 fps
Flow Area.....	0.01 sf
Critical Depth....	0.12 ft
Critical Slope....	0.1520 ft/ft
Percent Full.....	100.00 %
Full Capacity.....	0.04 cfs
QMAX @.94D.....	0.04 cfs
Froude Number.....	FULL

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Worksheet Name: GENWAL CULVERT

Comment: CULVERT C-7 (10/6)

Solve For Full Flow Diameter

Given Input Data:

Slope.....	0.0300 ft/ft
Manning's n.....	0.020
Discharge.....	0.32 cfs

Computed Results:

Full Flow Diameter.....	0.39 ft
Full Flow Depth.....	0.39 ft
Velocity.....	2.71 fps
Flow Area.....	0.12 sf
Critical Depth....	0.31 ft
Critical Slope....	0.0321 ft/ft
Percent Full.....	100.00 %
Full Capacity.....	0.32 cfs
QMAX @.94D.....	0.34 cfs
Froude Number.....	FULL

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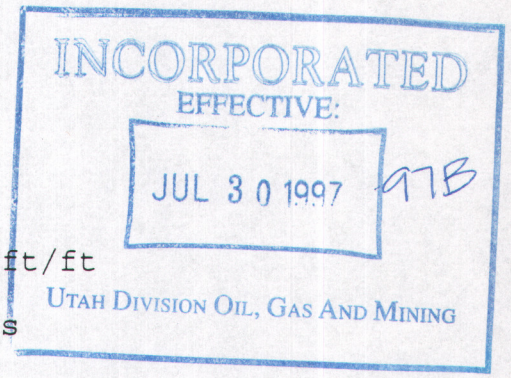
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: GENWAL CULVERT

Comment: CULVERT C-7 (10/24)

Solve For Full Flow Diameter



Given Input Data:

Slope.....	0.0300 ft/ft
Manning's n.....	0.020
Discharge.....	0.78 cfs

Computed Results:

Full Flow Diameter.....	0.54 ft
Full Flow Depth.....	0.54 ft
Velocity.....	3.39 fps
Flow Area.....	0.23 sf
Critical Depth....	0.44 ft
Critical Slope....	0.0305 ft/ft
Percent Full.....	100.00 %
Full Capacity.....	0.78 cfs
QMAX @.94D.....	0.84 cfs
Froude Number.....	FULL

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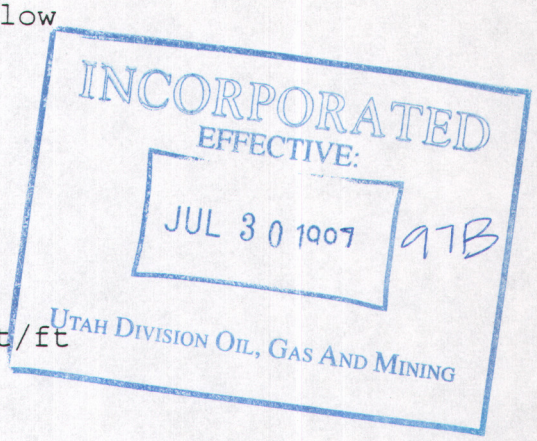
Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow



Worksheet Name: GENWAL CULVERT

Comment: CULVERT C-9 (10/6)

Solve For Full Flow Diameter

Given Input Data:

Slope.....	0.0350 ft/ft
Manning's n.....	0.020
Discharge.....	0.11 cfs

Computed Results:

Full Flow Diameter.....	0.25 ft
Full Flow Depth.....	0.25 ft
Velocity.....	2.20 fps
Flow Area.....	0.05 sf
Critical Depth....	0.20 ft
Critical Slope....	0.0372 ft/ft
Percent Full.....	100.00 %
Full Capacity.....	0.11 cfs
QMAX @.94D.....	0.12 cfs
Froude Number.....	FULL

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Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

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Worksheet Name: GENWAL CULVERT

Comment: CULVERT C-9 (10/24)

Solve For Full Flow Diameter

Given Input Data:

Slope.....	0.0350 ft/ft
Manning's n.....	0.020
Discharge.....	0.20 cfs

Computed Results:

Full Flow Diameter.....	0.32 ft
Full Flow Depth.....	0.32 ft
Velocity.....	2.56 fps
Flow Area.....	0.08 sf
Critical Depth.....	0.25 ft
Critical Slope.....	0.0360 ft/ft
Percent Full.....	100.00 %
Full Capacity.....	0.20 cfs
QMAX @.94D.....	0.22 cfs
Froude Number.....	FULL

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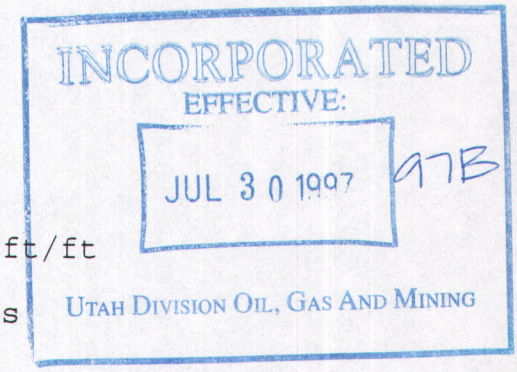
Open Channel - Uniform flow

Worksheet Name: GENWAL CULVERT

Comment: CULVERT C-11 (10/6)

Solve For Full Flow Diameter



Given Input Data:

Slope	0.0350 ft/ft
Manning's n	0.020
Discharge	1.55 cfs

Computed Results:

Full Flow Diameter	0.68 ft
Full Flow Depth	0.68 ft
Velocity	4.27 fps
Flow Area	0.36 sf
Critical Depth	0.58 ft
Critical Slope	0.0328 ft/ft
Percent Full	100.00 %
Full Capacity	1.55 cfs
QMAX @.94D	1.67 cfs
Froude Number	FULL

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Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

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Worksheet Name: GENWAL CULVERT

Comment: CULVERT C-11 (10/24)

Solve For Full Flow Diameter

Given Input Data:

Slope.....	0.0350 ft/ft
Manning's n.....	0.020
Discharge.....	3.58 cfs

Computed Results:

Full Flow Diameter.....	0.93 ft
Full Flow Depth.....	0.93 ft
Velocity.....	5.26 fps
Flow Area.....	0.68 sf
Critical Depth....	0.81 ft
Critical Slope....	0.0319 ft/ft
Percent Full.....	100.00 %
Full Capacity.....	3.58 cfs
QMAX @.94D.....	3.85 cfs
Froude Number.....	FULL

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CULVERT FLOW CALCULATIONS

(Revised October 1998)

FOR CULVERTS: C-4, C-9, C-12, C-13, C-14, C-15, C-16, C-17

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Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: GENWAL CULVERTS

Comment: CULVERT C-4 (10/6)

Solve For Full Flow Diameter

Given Input Data:

Slope.....	0.2507 ft/ft
Manning's n.....	0.020
Discharge.....	0.39 cfs

Computed Results:

Full Flow Diameter.....	0.28 ft
Full Flow Depth.....	0.28 ft
Velocity.....	6.32 fps
Flow Area.....	0.06 sf
Critical Depth....	0.28 ft
Critical Slope....	0.2329 ft/ft
Percent Full.....	100.00 %
Full Capacity.....	0.39 cfs
QMAX @.94D.....	0.42 cfs
Froude Number.....	FULL

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Open Channel - Uniform flow

Worksheet Name: GENWAL CULVERTS

Comment: CULVERT C-4 (10/24)

Solve For Full Flow Diameter

Given Input Data:

Slope.....	0.2507 ft/ft
Manning's n.....	0.020
Discharge.....	0.83 cfs

Computed Results:

Full Flow Diameter.....	0.37 ft
Full Flow Depth.....	0.37 ft
Velocity.....	7.64 fps
Flow Area.....	0.11 sf
Critical Depth....	0.37 ft
Critical Slope....	0.2344 ft/ft
Percent Full.....	100.00 %
Full Capacity.....	0.83 cfs
QMAX @.94D.....	0.89 cfs
Froude Number.....	FULL

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Open Channel - Uniform flow

Worksheet Name: GENWAL CULVERTS

Comment: CULVERT C-9 (10/6)

Solve For Full Flow Diameter

Given Input Data:

Slope.....	0.0350 ft/ft
Manning's n.....	0.020
Discharge.....	1.66 cfs

Computed Results:

Full Flow Diameter.....	0.70 ft
Full Flow Depth.....	0.70 ft
Velocity.....	4.34 fps
Flow Area.....	0.38 sf
Critical Depth....	0.60 ft
Critical Slope....	0.0327 ft/ft
Percent Full.....	100.00 %
Full Capacity.....	1.66 cfs
QMAX @.94D.....	1.79 cfs
Froude Number.....	FULL

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Open Channel - Uniform flow

Worksheet Name: GENWAL CULVERTS

Comment: CULVERT C-9 (10/24)

Solve For Full Flow Diameter

Given Input Data:

Slope.....	0.0350 ft/ft
Manning's n.....	0.020
Discharge.....	3.78 cfs

Computed Results:

Full Flow Diameter.....	0.95 ft
Full Flow Depth.....	0.95 ft
Velocity.....	5.33 fps
Flow Area.....	0.71 sf
Critical Depth....	0.83 ft
Critical Slope....	0.0318 ft/ft
Percent Full.....	100.00 %
Full Capacity.....	3.78 cfs
QMAX @.94D.....	4.07 cfs
Froude Number.....	FULL

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Open Channel - Uniform flow

Worksheet Name: GENWAL CULVERTS

Comment: CULVERT C-12 (10/6)

Solve For Full Flow Diameter

Given Input Data:

Slope.....	0.0450 ft/ft
Manning's n.....	0.020
Discharge.....	2.62 cfs

Computed Results:

Full Flow Diameter.....	0.79 ft
Full Flow Depth.....	0.79 ft
Velocity.....	5.35 fps
Flow Area.....	0.49 sf
Critical Depth....	0.71 ft
Critical Slope....	0.0396 ft/ft
Percent Full.....	100.00 %
Full Capacity.....	2.62 cfs
QMAX @.94D.....	2.82 cfs
Froude Number.....	FULL

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Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: GENWAL CULVERTS

Comment: CULVERT C-12 (10/24)

Solve For Full Flow Diameter

Given Input Data:

Slope.....	0.0450 ft/ft
Manning's n.....	0.020
Discharge.....	5.96 cfs

Computed Results:

Full Flow Diameter.....	1.08 ft
Full Flow Depth.....	1.08 ft
Velocity.....	6.56 fps
Flow Area.....	0.91 sf
Critical Depth....	0.98 ft
Critical Slope....	0.0392 ft/ft
Percent Full.....	100.00 %
Full Capacity.....	5.96 cfs
QMAX @.94D.....	6.41 cfs
Froude Number.....	FULL

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Open Channel - Uniform flow

Worksheet Name: GENWAL CULVERTS

Comment: CULVERT C-13 (10/6)

Solve For Full Flow Diameter

Given Input Data:

Slope.....	0.0300 ft/ft
Manning's n.....	0.020
Discharge.....	2.62 cfs

Computed Results:

Full Flow Diameter.....	0.85 ft
Full Flow Depth.....	0.85 ft
Velocity.....	4.59 fps
Flow Area.....	0.57 sf
Critical Depth....	0.72 ft
Critical Slope....	0.0288 ft/ft
Percent Full.....	100.00 %
Full Capacity.....	2.62 cfs
QMAX @.94D.....	2.82 cfs
Froude Number.....	FULL

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Open Channel - Uniform flow

Worksheet Name: GENWAL CULVERTS

Comment: CULVERT C-13 (10/24)

Solve For Full Flow Diameter

Given Input Data:

Slope.....	0.0300 ft/ft
Manning's n.....	0.020
Discharge.....	6.08 cfs

Computed Results:

Full Flow Diameter.....	1.17 ft
Full Flow Depth.....	1.17 ft
Velocity.....	5.67 fps
Flow Area.....	1.07 sf
Critical Depth....	1.00 ft
Critical Slope....	0.0279 ft/ft
Percent Full.....	100.00 %
Full Capacity.....	6.08 cfs
QMAX @.94D.....	6.54 cfs
Froude Number.....	FULL

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Open Channel - Uniform flow

Worksheet Name: GENWAL CULVERTS

Comment: CULVERT C-14 (10/6)

Solve For Full Flow Diameter

Given Input Data:

Slope.....	0.0100 ft/ft
Manning's n.....	0.020
Discharge.....	0.11 cfs

Computed Results:

Full Flow Diameter.....	0.32 ft
Full Flow Depth.....	0.32 ft
Velocity.....	1.38 fps
Flow Area.....	0.08 sf
Critical Depth....	0.19 ft
Critical Slope....	0.0233 ft/ft
Percent Full.....	100.00 %
Full Capacity.....	0.11 cfs
QMAX @.94D.....	0.12 cfs
Froude Number.....	FULL

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Open Channel - Uniform flow

Worksheet Name: GENWAL CULVERTS

Comment: CULVERT C-14 (10/24)

Solve For Full Flow Diameter

Given Input Data:

Slope.....	0.0100 ft/ft
Manning's n.....	0.020
Discharge.....	0.20 cfs

Computed Results:

Full Flow Diameter.....	0.40 ft
Full Flow Depth.....	0.40 ft
Velocity.....	1.60 fps
Flow Area.....	0.13 sf
Critical Depth....	0.24 ft
Critical Slope....	0.0220 ft/ft
Percent Full.....	100.00 %
Full Capacity.....	0.20 cfs
QMAX @.94D.....	0.22 cfs
Froude Number.....	FULL

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Open Channel - Uniform flow

Worksheet Name: GENWAL CULVERTS

Comment: CULVERT C-15 (10/6)

Solve For Full Flow Diameter

Given Input Data:

Slope.....	0.0100 ft/ft
Manning's n.....	0.020
Discharge.....	0.06 cfs

Computed Results:

Full Flow Diameter.....	0.25 ft
Full Flow Depth.....	0.25 ft
Velocity.....	1.18 fps
Flow Area.....	0.05 sf
Critical Depth....	0.15 ft
Critical Slope....	0.0248 ft/ft
Percent Full.....	100.00 %
Full Capacity.....	0.06 cfs
QMAX @.94D.....	0.06 cfs
Froude Number.....	FULL

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Open Channel - Uniform flow

Worksheet Name: GENWAL CULVERTS

Comment: CULVERT C-15 (10/24)

Solve For Full Flow Diameter

Given Input Data:

Slope.....	0.0100 ft/ft
Manning's n.....	0.020
Discharge.....	0.11 cfs

Computed Results:

Full Flow Diameter.....	0.32 ft
Full Flow Depth.....	0.32 ft
Velocity.....	1.38 fps
Flow Area.....	0.08 sf
Critical Depth.....	0.19 ft
Critical Slope.....	0.0233 ft/ft
Percent Full.....	100.00 %
Full Capacity.....	0.11 cfs
QMAX @.94D.....	0.12 cfs
Froude Number.....	FULL

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Open Channel - Uniform flow

Worksheet Name: GENWAL CULVERTS

Comment: CULVERT C-16 (10/6)

Solve For Full Flow Diameter

Given Input Data:

Slope.....	0.2500 ft/ft
Manning's n.....	0.020
Discharge.....	2.62 cfs

Computed Results:

Full Flow Diameter.....	0.57 ft
Full Flow Depth.....	0.57 ft
Velocity.....	10.17 fps
Flow Area.....	0.26 sf
Critical Depth.....	0.57 ft
Critical Slope.....	0.2357 ft/ft
Percent Full.....	100.00 %
Full Capacity.....	2.62 cfs
QMAX @.94D.....	2.82 cfs
Froude Number.....	FULL

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Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: GENWAL CULVERTS

Comment: CULVERT C-16 (10/24)

Solve For Full Flow Diameter

Given Input Data:

Slope.....	0.2500 ft/ft
Manning's n.....	0.020
Discharge.....	6.08 cfs

Computed Results:

Full Flow Diameter.....	0.79 ft
Full Flow Depth.....	0.79 ft
Velocity.....	12.55 fps
Flow Area.....	0.48 sf
Critical Depth....	0.78 ft
Critical Slope....	0.2370 ft/ft
Percent Full.....	100.00 %
Full Capacity.....	6.08 cfs
QMAX @.94D.....	6.54 cfs
Froude Number.....	FULL

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Open Channel - Uniform flow

Worksheet Name: GENWAL CULVERTS

Comment: CULVERT C-17 (10/6)

Solve For Full Flow Diameter

Given Input Data:

Slope.....	0.2000 ft/ft
Manning's n.....	0.020
Discharge.....	2.62 cfs

Computed Results:

Full Flow Diameter.....	0.60 ft
Full Flow Depth.....	0.60 ft
Velocity.....	9.35 fps
Flow Area.....	0.28 sf
Critical Depth....	0.59 ft
Critical Slope....	0.1861 ft/ft
Percent Full.....	100.00 %
Full Capacity.....	2.62 cfs
QMAX @.94D.....	2.82 cfs
Froude Number.....	FULL

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Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: GENWAL CULVERTS

Comment: CULVERT C-17 (10/24)

Solve For Full Flow Diameter

Given Input Data:

Slope.....	0.2000 ft/ft
Manning's n.....	0.020
Discharge.....	6.08 cfs

Computed Results:

Full Flow Diameter.....	0.82 ft
Full Flow Depth.....	0.82 ft
Velocity.....	11.54 fps
Flow Area.....	0.53 sf
Critical Depth.....	0.81 ft
Critical Slope.....	0.1874 ft/ft
Percent Full.....	100.00 %
Full Capacity.....	6.08 cfs
QMAX @.94D.....	6.54 cfs
Froude Number.....	FULL

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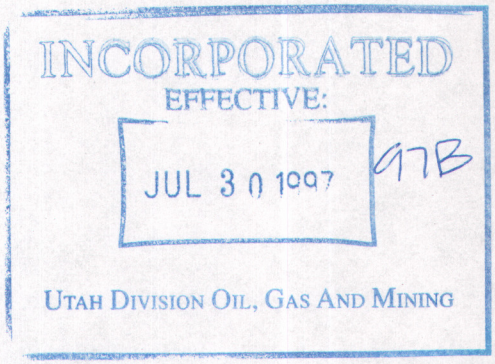
WATERSHED RUNOFF CALCULATIONS

Project Title = CRANDALL - MAIN - UNDISTURBED (100/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null



-- Watershed data for watershed # 1

Curve number	=	69.0
Area	=	3480.0 acres
Hydraulic length	=	16500.00 Feet
Elevation change	=	2900.0 feet.
Concentration time	=	1.09 hours
Concentration time type	=	SCS Upland Curves
Unit hydrograph type	=	Forested

-- Total Area = 3480.0 acres

-- Storm data

Total precipitation	=	2.4 inches
Storm type	=	SCS 6 hour design storm
Peak Discharge	=	222.79 cfs
Discharge volume	=	109.07 acre ft

Project Title = WSUD-1 (UNDISTURBED 10/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

-- Watershed data for watershed # 1

Curve number	=	69.0
Area	=	84.9 acres
Hydraulic length	=	3100.00 Feet
Elevation change	=	1660.0 feet.
Concentration time	=	0.47 hours
Concentration time type	=	SCS Upland Curves
Unit hydrograph type	=	Forested

-- Total Area = 84.9 acres

-- Storm data

Total precipitation	=	1.5 inches
Storm type	=	SCS 6 hour design storm
Peak Discharge	=	1.91 cfs
Discharge volume	=	0.58 acre ft

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Project Title = WSUD-1 (UNDISTURBED 25/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

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-- Watershed data for watershed # 1

Curve number	=	69.0
Area	=	84.9 acres
Hydraulic length	=	3100.00 Feet
Elevation change	=	1660.0 feet.
Concentration time	=	0.47 hours
Concentration time type	=	SCS Upland Curves
Unit hydrograph type	=	Forested

-- Total Area = 84.9 acres

-- Storm data

Total precipitation	=	1.9 inches
Storm type	=	SCS 6 hour design storm
Peak Discharge	=	3.68 cfs
Discharge volume	=	1.29 acre ft

Project Title = WSUD-1 (UNDISTURBED 100/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

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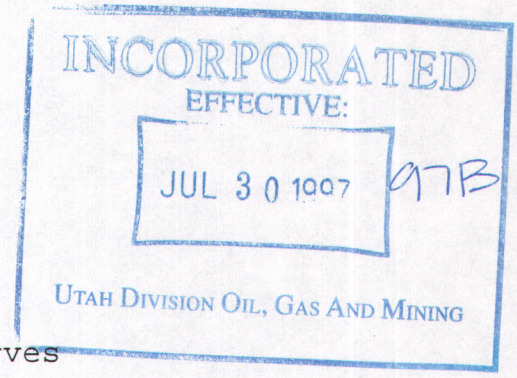
-- Watershed data for watershed # 1
Curve number = 69.0
Area = 84.9 acres
Hydraulic length = 3100.00 Feet
Elevation change = 1660.0 feet.
Concentration time = 0.47 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Forested

-- Total Area = 84.9 acres

-- Storm data
Total precipitation = 2.4 inches
Storm type = SCS 6 hour design storm
Peak Discharge = 6.81 cfs
Discharge volume = 2.66 acre ft

Project Title = WSUD-1 (UNDISTURBED 10/24)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null



-- Watershed data for watershed # 1
Curve number = 69.0
Area = 84.9 acres
Hydraulic length = 3100.00 Feet
Elevation change = 1660.0 feet.
Concentration time = 0.47 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Forested

-- Total Area = 84.9 acres

-- Storm data
Total precipitation = 2.5 inches
Storm type = SCS Type 2 storm, 24 hour storm
Peak Discharge = 8.04 cfs
Discharge volume = 2.98 acre ft

Project Title = WSUD-2 (UNDISTURBED 10/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

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-- Watershed data for watershed # 1

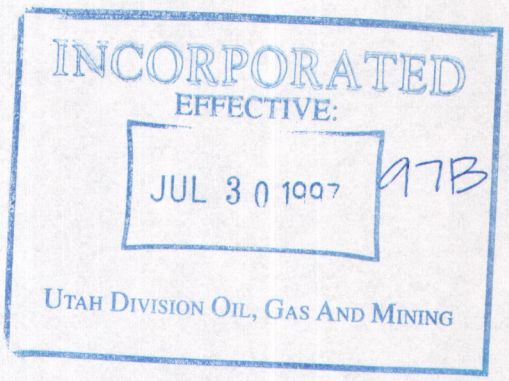
Curve number	=	69.0
Area	=	1.4 acres
Hydraulic length	=	320.00 Feet
Elevation change	=	250.0 feet.
Concentration time	=	0.04 hours
Concentration time type	=	SCS Upland Curves
Unit hydrograph type	=	Forested

-- Total Area = 1.4 acres

-- Storm data

Total precipitation	=	1.5 inches
Storm type	=	SCS 6 hour design storm
Peak Discharge	=	0.04 cfs
Discharge volume	=	0.01 acre ft

Project Title = WSUD-2 (UNDISTURBED 25/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null



-- Watershed data for watershed # 1

Curve number	=	69.0
Area	=	1.4 acres
Hydraulic length	=	320.00 Feet
Elevation change	=	250.0 feet.
Concentration time	=	0.04 hours
Concentration time type	=	SCS Upland Curves
Unit hydrograph type	=	Forested

-- Total Area = 1.4 acres

-- Storm data

Total precipitation	=	1.9 inches
Storm type	=	SCS 6 hour design storm
Peak Discharge	=	0.08 cfs
Discharge volume	=	0.02 acre ft

Project Title = WSUD-2 (UNDISTURBED 100/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

INCORPORATED
EFFECTIVE:
JUL 30 1997
97B
UTAH DIVISION OIL, GAS AND MINING

-- Watershed data for watershed # 1

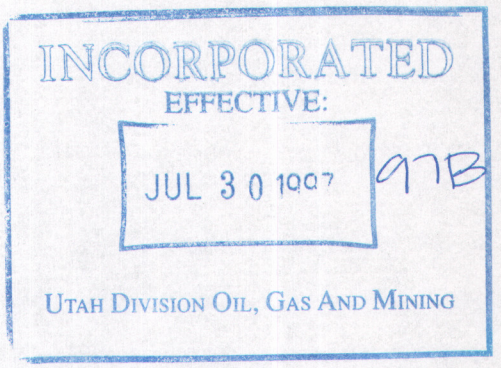
Curve number	=	69.0
Area	=	1.4 acres
Hydraulic length	=	320.00 Feet
Elevation change	=	250.0 feet.
Concentration time	=	0.04 hours
Concentration time type	=	SCS Upland Curves
Unit hydrograph type	=	Forested

-- Total Area = 1.4 acres

-- Storm data

Total precipitation	=	2.4 inches
Storm type	=	SCS 6 hour design storm
Peak Discharge	=	0.21 cfs
Discharge volume	=	0.04 acre ft

Project Title = WSUD-2 (UNDISTURBED 10/24)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null



-- Watershed data for watershed # 1

Curve number	=	69.0
Area	=	1.4 acres
Hydraulic length	=	320.00 Feet
Elevation change	=	250.0 feet.
Concentration time	=	0.04 hours
Concentration time type	=	SCS Upland Curves
Unit hydrograph type	=	Forested

-- Total Area = 1.4 acres

-- Storm data

Total precipitation	=	2.5 inches
Storm type	=	SCS Type 2 storm, 24 hour storm
Peak Discharge	=	0.34 cfs
Discharge volume	=	0.05 acre ft

Project Title = WSUD-3 (UNDISTURBED 10/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

INCORPORATED
EFFECTIVE:
JUL 30 1997
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-- Watershed data for watershed # 1
Curve number = 69.0
Area = 8.7 acres
Hydraulic length = 1300.00 Feet
Elevation change = 920.0 feet.
Concentration time = 0.17 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Forested

-- Total Area = 8.7 acres

-- Storm data
Total precipitation = 1.5 inches
Storm type = SCS 6 hour design storm
Peak Discharge = 0.23 cfs
Discharge volume = 0.06 acre ft

Project Title = WSUD-3 (UNDISTURBED 25/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

INCORPORATED
EFFECTIVE:
JUL 30 1997
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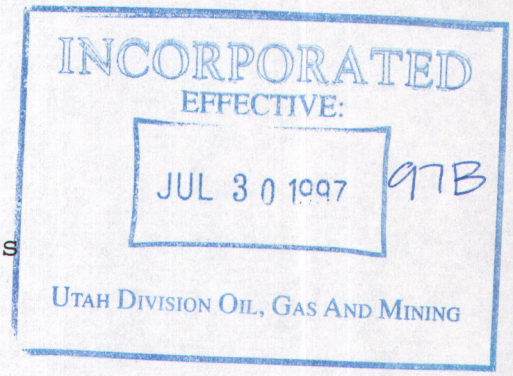
UTAH DIVISION OIL, GAS AND MINING

-- Watershed data for watershed # 1
Curve number = 69.0
Area = 8.7 acres
Hydraulic length = 1300.00 Feet
Elevation change = 920.0 feet.
Concentration time = 0.17 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Forested

-- Total Area = 8.7 acres

-- Storm data
Total precipitation = 1.9 inches
Storm type = SCS 6 hour design storm
Peak Discharge = 0.43 cfs
Discharge volume = 0.13 acre ft

Project Title = WSUD-3 (UNDISTURBED 100/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null



-- Watershed data for watershed # 1

Curve number	=	69.0
Area	=	8.7 acres
Hydraulic length	=	1300.00 Feet
Elevation change	=	920.0 feet.
Concentration time	=	0.17 hours
Concentration time type	=	SCS Upland Curves
Unit hydrograph type	=	Forested

-- Total Area = 8.7 acres

-- Storm data

Total precipitation	=	2.4 inches
Storm type	=	SCS 6 hour design storm
Peak Discharge	=	0.89 cfs
Discharge volume	=	0.27 acre ft

Project Title = WSUD-3 (UNDISTURBED 10/24)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

INCORPORATED
EFFECTIVE:
JUL 30 1997
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UTAH DIVISION OIL, GAS AND MINING

-- Watershed data for watershed # 1

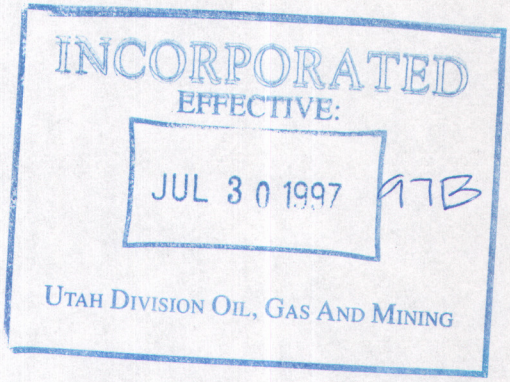
Curve number	=	69.0
Area	=	8.7 acres
Hydraulic length	=	1300.00 Feet
Elevation change	=	920.0 feet.
Concentration time	=	0.17 hours
Concentration time type	=	SCS Upland Curves
Unit hydrograph type	=	Forested

-- Total Area = 8.7 acres

-- Storm data

Total precipitation	=	2.5 inches
Storm type	=	SCS Type 2 storm, 24 hour storm
Peak Discharge	=	1.38 cfs
Discharge volume	=	0.30 acre ft

Project Title = WSDD-1 (DISTURBED - 10/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

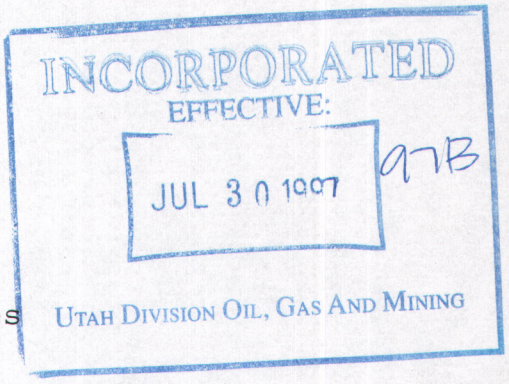


-- Watershed data for watershed # 1
Curve number = 90.0
Area = 0.1 acres
Hydraulic length = 100.00 Feet
Elevation change = 40.0 feet.
Concentration time = 0.00 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Disturbed

-- Total Area = 0.1 acres

-- Storm data
Total precipitation = 1.5 inches
Storm type = SCS 6 hour design storm
Peak Discharge = 0.04 cfs
Discharge volume = 0.01 acre ft

Project Title = WSDD-1 (DISTURBED - 25/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

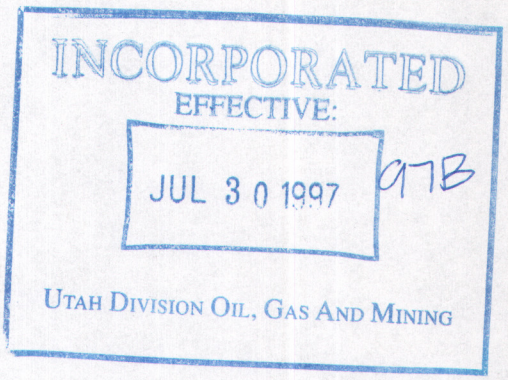


-- Watershed data for watershed # 1
Curve number = 90.0
Area = 0.1 acres
Hydraulic length = 100.00 Feet
Elevation change = 40.0 feet.
Concentration time = 0.00 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Disturbed

-- Total Area = 0.1 acres

-- Storm data
Total precipitation = 1.9 inches
Storm type = SCS 6 hour design storm
Peak Discharge = 0.06 cfs
Discharge volume = 0.01 acre ft

Project Title = WSDD-1 (DISTURBED - 10/24)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null



-- Watershed data for watershed # 1
Curve number = 90.0
Area = 0.1 acres
Hydraulic length = 100.00 Feet
Elevation change = 40.0 feet.
Concentration time = 0.00 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Disturbed

-- Total Area = 0.1 acres

-- Storm data
Total precipitation = 2.5 inches
Storm type = SCS Type 2 storm, 24 hour storm
Peak Discharge = 0.10 cfs
Discharge volume = 0.02 acre ft

Project Title = WSDD-1 (RECLAIMED - 10/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

-- Watershed data for watershed # 1

Curve number	=	75.0
Area	=	0.1 acres
Hydraulic length	=	120.00 Feet
Elevation change	=	30.0 feet.
Concentration time	=	0.01 hours
Concentration time type	=	SCS Upland Curves
Unit hydrograph type	=	Disturbed

-- Total Area = 0.1 acres

-- Storm data

Total precipitation	=	1.5 inches
Storm type	=	SCS 6 hour design storm
Peak Discharge	=	0.01 cfs
Discharge volume	=	0.00 acre ft

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Project Title = WSDD-1 (RECLAIMED - 25/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

INCORPORATED
EFFECTIVE:
JUL 30 1997
97B
UTAH DIVISION OIL, GAS AND MINING

-- Watershed data for watershed # 1
Curve number = 75.0
Area = 0.1 acres
Hydraulic length = 120.00 Feet
Elevation change = 30.0 feet.
Concentration time = 0.01 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Disturbed

-- Total Area = 0.1 acres

-- Storm data
Total precipitation = 1.9 inches
Storm type = SCS 6 hour design storm
Peak Discharge = 0.01 cfs
Discharge volume = 0.00 acre ft

Project Title = WSDD-1 (RECLAIMED - 10/24)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

INCORPORATED
EFFECTIVE:
JUL 30 1997
97B
UTAH DIVISION OIL, GAS AND MINING

-- Watershed data for watershed # 1
Curve number = 75.0
Area = 0.1 acres
Hydraulic length = 120.00 Feet
Elevation change = 30.0 feet.
Concentration time = 0.01 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Disturbed

-- Total Area = 0.1 acres

-- Storm data
Total precipitation = 2.5 inches
Storm type = SCS Type 2 storm, 24 hour storm
Peak Discharge = 0.04 cfs
Discharge volume = 0.01 acre ft

Project Title = WSDD-2 (RECLAIMED - 10/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

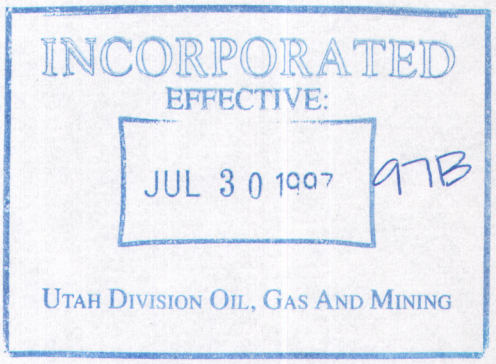
-- Watershed data for watershed # 1
Curve number = 75.0
Area = 0.2 acres
Hydraulic length = 200.00 Feet
Elevation change = 50.0 feet.
Concentration time = 0.01 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Disturbed

-- Total Area = 0.2 acres

-- Storm data
Total precipitation = 1.5 inches
Storm type = SCS 6 hour design storm
Peak Discharge = 0.01 cfs
Discharge volume = 0.00 acre ft

INCORPORATED
EFFECTIVE:
JUL 30 1997
97B
UTAH DIVISION OIL, GAS AND MINING

Project Title = WSDD-2 (RECLAIMED - 25/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null



-- Watershed data for watershed # 1

Curve number	=	75.0
Area	=	0.2 acres
Hydraulic length	=	200.00 Feet
Elevation change	=	50.0 feet.
Concentration time	=	0.01 hours
Concentration time type	=	SCS Upland Curves
Unit hydrograph type	=	Disturbed

-- Total Area = 0.2 acres

-- Storm data

Total precipitation	=	1.9 inches
Storm type	=	SCS 6 hour design storm
Peak Discharge	=	0.03 cfs
Discharge volume	=	0.00 acre ft

Project Title = WSDD-2 (RECLAIMED - 10/24)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

INCORPORATED
EFFECTIVE:
JUL 30 1997
UTAH DIVISION OIL, GAS AND MINING

-- Watershed data for watershed # 1
Curve number = 75.0
Area = 0.2 acres
Hydraulic length = 200.00 Feet
Elevation change = 50.0 feet.
Concentration time = 0.01 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Disturbed

-- Total Area = 0.2 acres

-- Storm data
Total precipitation = 2.5 inches
Storm type = SCS Type 2 storm, 24 hour storm
Peak Discharge = 0.06 cfs
Discharge volume = 0.01 acre ft

Project Title = WSUD-3 (UNDISTURBED - 10/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

INCORPORATED
EFFECTIVE:
JUL 30 1997
97B
UTAH DIVISION OIL, GAS AND MINING

-- Watershed data for watershed # 1

Curve number	=	69.0
Area	=	8.8 acres
Hydraulic length	=	1300.00 Feet
Elevation change	=	920.0 feet.
Concentration time	=	0.17 hours
Concentration time type	=	SCS Upland Curves
Unit hydrograph type	=	Forested

-- Total Area = 8.8 acres

-- Storm data

Total precipitation	=	1.5 inches
Storm type	=	SCS 6 hour design storm
Peak Discharge	=	0.23 cfs
Discharge volume	=	0.06 acre ft

Project Title = WSUD-3 (UNDISTURBED - 25/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

INCORPORATED
EFFECTIVE:
JUL 30 1997
UTAH DIVISION OIL, GAS AND MINING

-- Watershed data for watershed # 1
Curve number = 69.0
Area = 8.8 acres
Hydraulic length = 1300.00 Feet
Elevation change = 920.0 feet.
Concentration time = 0.17 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Forested

-- Total Area = 8.8 acres

-- Storm data
Total precipitation = 1.9 inches
Storm type = SCS 6 hour design storm
Peak Discharge = 0.43 cfs
Discharge volume = 0.13 acre ft

Project Title = WSUD-3 (UNDISTURBED - 100/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

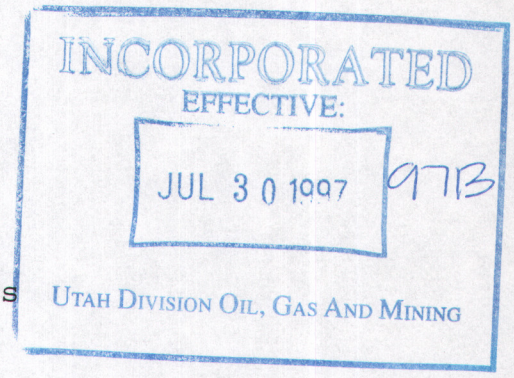
INCORPORATED
EFFECTIVE:
JUL 30 1997
97B
UTAH DIVISION OIL, GAS AND MINING

-- Watershed data for watershed # 1
Curve number = 69.0
Area = 8.8 acres
Hydraulic length = 1300.00 Feet
Elevation change = 920.0 feet.
Concentration time = 0.17 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Forested

-- Total Area = 8.8 acres

-- Storm data
Total precipitation = 2.4 inches
Storm type = SCS 6 hour design storm
Peak Discharge = 0.90 cfs
Discharge volume = 0.27 acre ft

Project Title = WSUD-3 (UNDISTURBED - 10/24)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

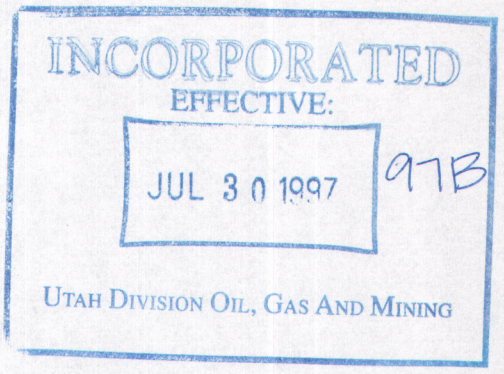


-- Watershed data for watershed # 1
Curve number = 69.0
Area = 8.8 acres
Hydraulic length = 1300.00 Feet
Elevation change = 920.0 feet.
Concentration time = 0.17 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Forested

-- Total Area = 8.8 acres

-- Storm data
Total precipitation = 2.5 inches
Storm type = SCS Type 2 storm, 24 hour storm
Peak Discharge = 1.40 cfs
Discharge volume = 0.31 acre ft

Project Title = WSDD-3 (UNDISTURBED - 10/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null



-- Watershed data for watershed # 1
Curve number = 69.0
Area = 0.1 acres
Hydraulic length = 80.00 Feet
Elevation change = 40.0 feet.
Concentration time = 0.01 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Forested

-- Total Area = 0.1 acres

-- Storm data
Total precipitation = 1.5 inches
Storm type = SCS 6 hour design storm
Peak Discharge = 0.00 cfs
Discharge volume = 0.00 acre ft

Project Title = WSDD-3 (UNDISTURBED - 25/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

INCORPORATED
EFFECTIVE:
JUL 30 1997
UTAH DIVISION OIL, GAS AND MINING

-- Watershed data for watershed # 1
Curve number = 69.0
Area = 0.1 acres
Hydraulic length = 80.00 Feet
Elevation change = 40.0 feet.
Concentration time = 0.01 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Forested

-- Total Area = 0.1 acres

-- Storm data
Total precipitation = 1.9 inches
Storm type = SCS 6 hour design storm
Peak Discharge = 0.01 cfs
Discharge volume = 0.00 acre ft

Project Title = WSDD-3 (UNDISTURBED - 10/24)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

INCORPORATED
EFFECTIVE:
JUL 30 1997
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-- Watershed data for watershed # 1
Curve number = 69.0
Area = 0.1 acres
Hydraulic length = 80.00 Feet
Elevation change = 40.0 feet.
Concentration time = 0.01 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Forested

-- Total Area = 0.1 acres

-- Storm data
Total precipitation = 2.5 inches
Storm type = SCS Type 2 storm, 24 hour storm
Peak Discharge = 0.03 cfs
Discharge volume = 0.00 acre ft

Project Title = WSDD-3 (RECLAIMED - 10/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

INCORPORATED
EFFECTIVE:
JUL 30 1997
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UTAH DIVISION OIL, GAS AND MINING

-- Watershed data for watershed # 1
Curve number = 75.0
Area = 0.2 acres
Hydraulic length = 100.00 Feet
Elevation change = 48.0 feet.
Concentration time = 0.00 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Disturbed

-- Total Area = 0.2 acres

-- Storm data
Total precipitation = 1.5 inches
Storm type = SCS 6 hour design storm
Peak Discharge = 0.01 cfs
Discharge volume = 0.00 acre ft

Project Title = WSDD-3 (RECLAIMED - 25/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

INCORPORATED
EFFECTIVE:
JUL 30 1997
97B
UTAH DIVISION OIL, GAS AND MINING

-- Watershed data for watershed # 1

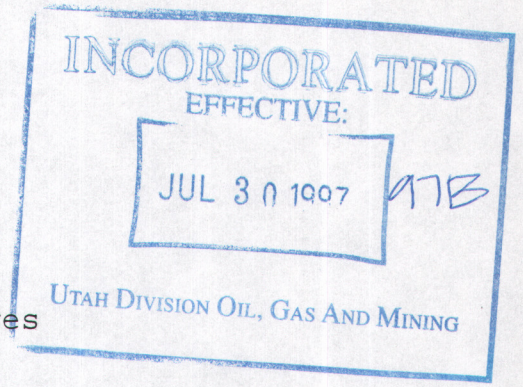
Curve number	=	75.0
Area	=	0.2 acres
Hydraulic length	=	100.00 Feet
Elevation change	=	48.0 feet.
Concentration time	=	0.00 hours
Concentration time type	=	SCS Upland Curves
Unit hydrograph type	=	Disturbed

-- Total Area = 0.2 acres

-- Storm data

Total precipitation	=	1.9 inches
Storm type	=	SCS 6 hour design storm
Peak Discharge	=	0.02 cfs
Discharge volume	=	0.00 acre ft

Project Title = WSDD-3 (RECLAIMED - 10/24)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null



-- Watershed data for watershed # 1

Curve number	=	75.0
Area	=	0.2 acres
Hydraulic length	=	100.00 Feet
Elevation change	=	48.0 feet.
Concentration time	=	0.00 hours
Concentration time type	=	SCS Upland Curves
Unit hydrograph type	=	Disturbed

-- Total Area = 0.2 acres

-- Storm data

Total precipitation	=	2.5 inches
Storm type	=	SCS Type 2 storm, 24 hour storm
Peak Discharge	=	0.05 cfs
Discharge volume	=	0.01 acre ft

Project Title = WSDD-3 (DISTURBED 10/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

INCORPORATED
EFFECTIVE:
JUL 30 1997
97B
UTAH DIVISION OIL, GAS AND MINING

-- Watershed data for watershed # 1

Curve number	=	90.0
Area	=	0.3 acres
Hydraulic length	=	125.00 Feet
Elevation change	=	70.0 feet.
Concentration time	=	0.00 hours
Concentration time type	=	SCS Upland Curves
Unit hydrograph type	=	Disturbed

-- Total Area = 0.3 acres

-- Storm data

Total precipitation	=	1.5 inches
Storm type	=	SCS 6 hour design storm
Peak Discharge	=	0.08 cfs
Discharge volume	=	0.02 acre ft

Project Title = WSDD-3 (DISTURBED 25/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

INCORPORATED
EFFECTIVE:
JUL 30 1997
97B
UTAH DIVISION OIL, GAS AND MINING

-- Watershed data for watershed # 1

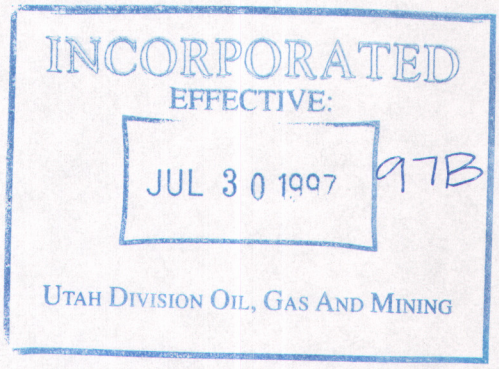
Curve number	=	90.0
Area	=	0.3 acres
Hydraulic length	=	125.00 Feet
Elevation change	=	70.0 feet.
Concentration time	=	0.00 hours
Concentration time type	=	SCS Upland Curves
Unit hydrograph type	=	Disturbed

-- Total Area = 0.3 acres

-- Storm data

Total precipitation	=	1.9 inches
Storm type	=	SCS 6 hour design storm
Peak Discharge	=	0.12 cfs
Discharge volume	=	0.02 acre ft

Project Title = WSDD-3 (DISTURBED 10/24)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null



-- Watershed data for watershed # 1
Curve number = 90.0
Area = 0.3 acres
Hydraulic length = 125.00 Feet
Elevation change = 70.0 feet.
Concentration time = 0.00 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Disturbed

-- Total Area = 0.3 acres

-- Storm data
Total precipitation = 2.5 inches
Storm type = SCS Type 2 storm, 24 hour storm
Peak Discharge = 0.18 cfs
Discharge volume = 0.03 acre ft

Project Title = WSDD-3 (PAVED 10/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

INCORPORATED
EFFECTIVE:
JUL 30 1007
97B
UTAH DIVISION OIL, GAS AND MINING

-- Watershed data for watershed # 1

Curve number	=	95.0
Area	=	0.3 acres
Hydraulic length	=	100.00 Feet
Elevation change	=	3.0 feet.
Concentration time	=	0.01 hours
Concentration time type	=	SCS Upland Curves
Unit hydrograph type	=	Disturbed

-- Total Area = 0.3 acres

-- Storm data

Total precipitation	=	1.5 inches
Storm type	=	SCS 6 hour design storm
Peak Discharge	=	0.17 cfs
Discharge volume	=	0.03 acre ft

Project Title = WSDD-3 (PAVED 25/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

INCORPORATED
EFFECTIVE:
JUL 30 1997
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-- Watershed data for watershed # 1

Curve number	=	95.0
Area	=	0.3 acres
Hydraulic length	=	100.00 Feet
Elevation change	=	3.0 feet.
Concentration time	=	0.01 hours
Concentration time type	=	SCS Upland Curves
Unit hydrograph type	=	Disturbed

-- Total Area = 0.3 acres

-- Storm data

Total precipitation	=	1.9 inches
Storm type	=	SCS 6 hour design storm
Peak Discharge	=	0.22 cfs
Discharge volume	=	0.04 acre ft

Project Title = WSDD-3 (PAVED 10/24)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

INCORPORATED
EFFECTIVE:
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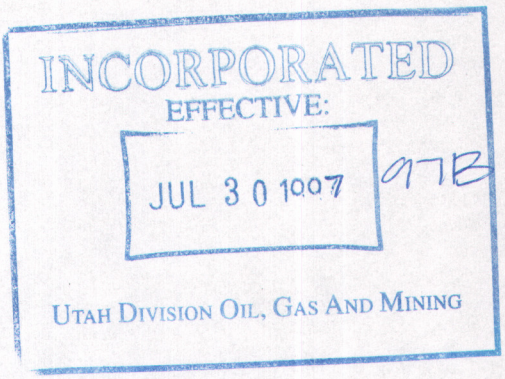
-- Watershed data for watershed # 1
Curve number = 95.0
Area = 0.3 acres
Hydraulic length = 100.00 Feet
Elevation change = 3.0 feet.
Concentration time = 0.01 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Disturbed

-- Total Area = 0.3 acres

-- Storm data
Total precipitation = 2.5 inches
Storm type = SCS Type 2 storm, 24 hour storm
Peak Discharge = 0.32 cfs
Discharge volume = 0.05 acre ft

Project Title = WSDD-4 (PAVED 10/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null



-- Watershed data for watershed # 1

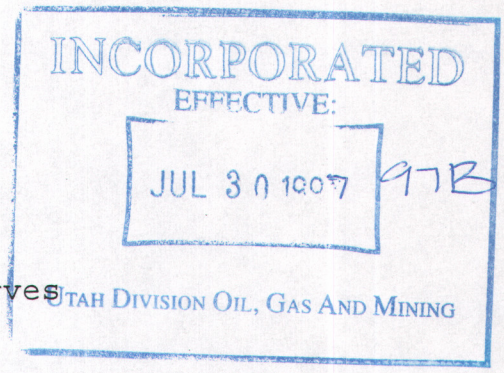
Curve number	=	95.0
Area	=	0.1 acres
Hydraulic length	=	250.00 Feet
Elevation change	=	20.0 feet.
Concentration time	=	0.01 hours
Concentration time type	=	SCS Upland Curves
Unit hydrograph type	=	Disturbed

-- Total Area = 0.1 acres

-- Storm data

Total precipitation	=	1.5 inches
Storm type	=	SCS 6 hour design storm
Peak Discharge	=	0.07 cfs
Discharge volume	=	0.01 acre ft

Project Title = WSDD-4 (PAVED 25/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null



-- Watershed data for watershed # 1

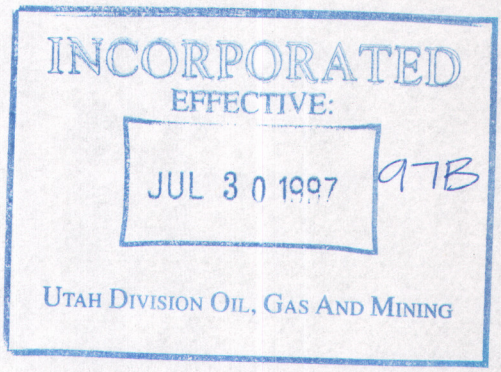
Curve number	=	95.0
Area	=	0.1 acres
Hydraulic length	=	250.00 Feet
Elevation change	=	20.0 feet.
Concentration time	=	0.01 hours
Concentration time type	=	SCS Upland Curves
Unit hydrograph type	=	Disturbed

-- Total Area = 0.1 acres

-- Storm data

Total precipitation	=	1.9 inches
Storm type	=	SCS 6 hour design storm
Peak Discharge	=	0.09 cfs
Discharge volume	=	0.01 acre ft

Project Title = WSDD-4 (PAVED 10/24)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null



-- Watershed data for watershed # 1

Curve number	=	95.0
Area	=	0.1 acres
Hydraulic length	=	250.00 Feet
Elevation change	=	20.0 feet.
Concentration time	=	0.01 hours
Concentration time type	=	SCS Upland Curves
Unit hydrograph type	=	Disturbed

-- Total Area = 0.1 acres

-- Storm data

Total precipitation	=	2.5 inches
Storm type	=	SCS Type 2 storm, 24 hour storm
Peak Discharge	=	0.12 cfs
Discharge volume	=	0.02 acre ft

Project Title = WSDD-4 (DISTURBED 10/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

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-- Watershed data for watershed # 1

Curve number	=	90.0
Area	=	0.1 acres
Hydraulic length	=	100.00 Feet
Elevation change	=	10.0 feet.
Concentration time	=	0.01 hours
Concentration time type	=	SCS Upland Curves
Unit hydrograph type	=	Disturbed

-- Total Area = 0.1 acres

-- Storm data

Total precipitation	=	1.5 inches
Storm type	=	SCS 6 hour design storm
Peak Discharge	=	0.04 cfs
Discharge volume	=	0.01 acre ft

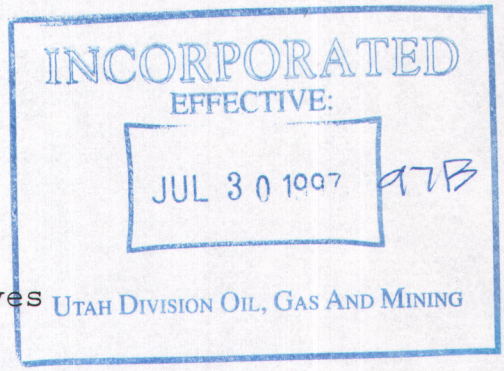
Project Title = WSDD-4 (DISTURBED 25/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

-- Watershed data for watershed # 1
Curve number = 90.0
Area = 0.1 acres
Hydraulic length = 100.00 Feet
Elevation change = 10.0 feet.
Concentration time = 0.01 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Disturbed

-- Total Area = 0.1 acres

-- Storm data
Total precipitation = 1.9 inches
Storm type = SCS 6 hour design storm
Peak Discharge = 0.05 cfs
Discharge volume = 0.01 acre ft

Project Title = WSDD-4 (DISTURBED 10/24)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null



-- Watershed data for watershed # 1
Curve number = 90.0
Area = 0.1 acres
Hydraulic length = 100.00 Feet
Elevation change = 10.0 feet.
Concentration time = 0.01 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Disturbed

-- Total Area = 0.1 acres

-- Storm data
Total precipitation = 2.5 inches
Storm type = SCS Type 2 storm, 24 hour storm
Peak Discharge = 0.08 cfs
Discharge volume = 0.01 acre ft

Project Title = WSDD-5 (UNDISTURBED - 10/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

INCORPORATED
EFFECTIVE:
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-- Watershed data for watershed # 1
Curve number = 69.0
Area = 0.1 acres
Hydraulic length = 60.00 Feet
Elevation change = 30.0 feet.
Concentration time = 0.01 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Forested

-- Total Area = 0.1 acres

-- Storm data
Total precipitation = 1.5 inches
Storm type = SCS 6 hour design storm
Peak Discharge = 0.00 cfs
Discharge volume = 0.00 acre ft

Project Title = WSDD-5 (UNDISTURBED - 25/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

INCORPORATED
EFFECTIVE:
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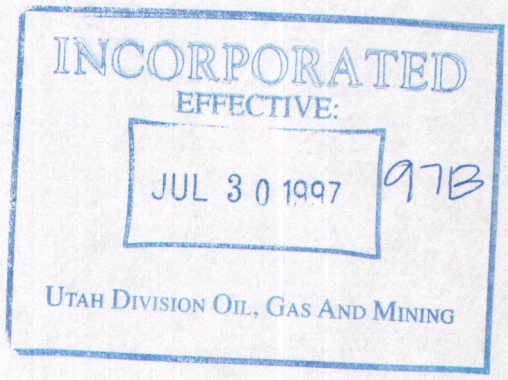
-- Watershed data for watershed # 1
Curve number = 69.0
Area = 0.1 acres
Hydraulic length = 60.00 Feet
Elevation change = 30.0 feet.
Concentration time = 0.01 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Forested

-- Total Area = 0.1 acres

-- Storm data
Total precipitation = 1.9 inches
Storm type = SCS 6 hour design storm
Peak Discharge = 0.01 cfs
Discharge volume = 0.00 acre ft

Project Title = WSDD-5 (UNDISTURBED - 10/24)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null



-- Watershed data for watershed # 1

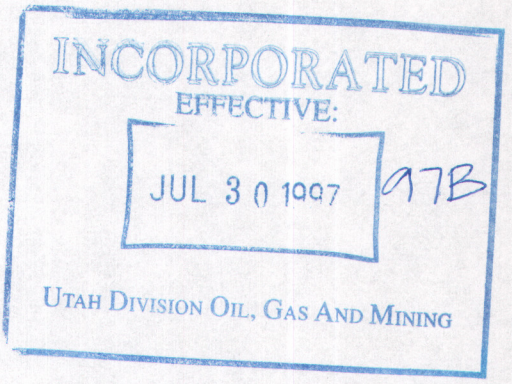
Curve number	=	69.0
Area	=	0.1 acres
Hydraulic length	=	60.00 Feet
Elevation change	=	30.0 feet.
Concentration time	=	0.01 hours
Concentration time type	=	SCS Upland Curves
Unit hydrograph type	=	Forested

-- Total Area = 0.1 acres

-- Storm data

Total precipitation	=	2.5 inches
Storm type	=	SCS Type 2 storm, 24 hour storm
Peak Discharge	=	0.03 cfs
Discharge volume	=	0.00 acre ft

Project Title = WSDD-5 (RECLAIMED - 10/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null



-- Watershed data for watershed # 1

Curve number	=	75.0
Area	=	0.3 acres
Hydraulic length	=	80.00 Feet
Elevation change	=	40.0 feet.
Concentration time	=	0.00 hours
Concentration time type	=	SCS Upland Curves
Unit hydrograph type	=	Disturbed

-- Total Area = 0.3 acres

-- Storm data

Total precipitation	=	1.5 inches
Storm type	=	SCS 6 hour design storm
Peak Discharge	=	0.02 cfs
Discharge volume	=	0.01 acre ft

Project Title = WSDD-5 (RECLAIMED - 25/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

-- Watershed data for watershed # 1

Curve number	=	75.0
Area	=	0.3 acres
Hydraulic length	=	80.00 Feet
Elevation change	=	40.0 feet.
Concentration time	=	0.00 hours
Concentration time type	=	SCS Upland Curves
Unit hydrograph type	=	Disturbed

-- Total Area = 0.3 acres

-- Storm data

Total precipitation	=	1.9 inches
Storm type	=	SCS 6 hour design storm
Peak Discharge	=	0.04 cfs
Discharge volume	=	0.01 acre ft

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Project Title = WSDD-5 (RECLAIMED - 10/24)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

-- Watershed data for watershed # 1
Curve number = 75.0
Area = 0.3 acres
Hydraulic length = 80.00 Feet
Elevation change = 40.0 feet.
Concentration time = 0.00 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Disturbed

-- Total Area = 0.3 acres

-- Storm data
Total precipitation = 2.5 inches
Storm type = SCS Type 2 storm, 24 hour storm
Peak Discharge = 0.10 cfs
Discharge volume = 0.02 acre ft

INCORPORATED
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Project Title = WSDD-5 (PAVED - 10/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

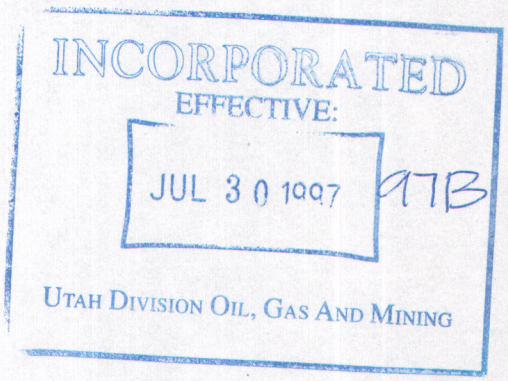
-- Watershed data for watershed # 1

Curve number	=	95.0
Area	=	0.3 acres
Hydraulic length	=	300.00 Feet
Elevation change	=	25.0 feet.
Concentration time	=	0.01 hours
Concentration time type	=	SCS Upland Curves
Unit hydrograph type	=	Disturbed

-- Total Area = 0.3 acres

-- Storm data

Total precipitation	=	1.5 inches
Storm type	=	SCS 6 hour design storm
Peak Discharge	=	0.21 cfs
Discharge volume	=	0.03 acre ft



```
Project Title          = WSDD-5 (PAVED - 25/6)
WATERSHED HYDROGRAPH
     Inflow into structure #  1
     Structure type:          Null


-- Watershed data for watershed # 1
     Curve number              =    95.0
     Area                      =     0.3 acres
     Hydraulic length          =  300.00 Feet
     Elevation change          =    25.0 feet.
     Concentration time        =    0.01 hours
     Concentration time type   = SCS Upland Curves
     Unit hydrograph type      = Disturbed

-- Total Area             =     0.3 acres

-- Storm data
     Total precipitation  =     1.9 inches
     Storm type           = SCS 6 hour design storm
     Peak Discharge       =    0.27 cfs
     Discharge volume     =    0.04 acre ft
```

INCORPORATED
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Project Title = WSDD-5 (PAVED - 10/24)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

-- Watershed data for watershed # 1
Curve number = 95.0
Area = 0.3 acres
Hydraulic length = 300.00 Feet
Elevation change = 25.0 feet.
Concentration time = 0.01 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Disturbed

-- Total Area = 0.3 acres

-- Storm data
Total precipitation = 2.5 inches
Storm type = SCS Type 2 storm, 24 hour storm
Peak Discharge = 0.39 cfs
Discharge volume = 0.05 acre ft

INCORPORATED
EFFECTIVE:
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UTAH DIVISION OIL, GAS AND MINING

Project Title = WSDD-7 (UNDISTURBED 10/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

-- Watershed data for watershed # 1

Curve number	=	69.0
Area	=	0.2 acres
Hydraulic length	=	100.00 Feet
Elevation change	=	78.0 feet.
Concentration time	=	0.01 hours
Concentration time type	=	SCS Upland Curves
Unit hydrograph type	=	Forested

-- Total Area = 0.2 acres

-- Storm data

Total precipitation	=	1.5 inches
Storm type	=	SCS 6 hour design storm
Peak Discharge	=	0.00 cfs
Discharge volume	=	0.00 acre ft

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Project Title = WSDD-7 (UNDISTURBED 25/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

-- Watershed data for watershed # 1

Curve number	=	69.0
Area	=	0.2 acres
Hydraulic length	=	100.00 Feet
Elevation change	=	78.0 feet.
Concentration time	=	0.01 hours
Concentration time type	=	SCS Upland Curves
Unit hydrograph type	=	Forested

-- Total Area = 0.2 acres

-- Storm data

Total precipitation	=	1.9 inches
Storm type	=	SCS 6 hour design storm
Peak Discharge	=	0.01 cfs
Discharge volume	=	0.00 acre ft

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Project Title = WSDD-7 (UNDISTURBED 10/24)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

-- Watershed data for watershed # 1

Curve number	=	69.0
Area	=	0.2 acres
Hydraulic length	=	100.00 Feet
Elevation change	=	78.0 feet.
Concentration time	=	0.01 hours
Concentration time type	=	SCS Upland Curves
Unit hydrograph type	=	Forested

-- Total Area = 0.2 acres

-- Storm data

Total precipitation	=	2.5 inches
Storm type	=	SCS Type 2 storm, 24 hour storm
Peak Discharge	=	0.05 cfs
Discharge volume	=	0.01 acre ft

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Project Title = WSDD-7 (DISTURBED 10/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

-- Watershed data for watershed # 1

Curve number	=	90.0
Area	=	0.2 acres
Hydraulic length	=	120.00 Feet
Elevation change	=	80.0 feet.
Concentration time	=	0.00 hours
Concentration time type	=	SCS Upland Curves
Unit hydrograph type	=	Disturbed

-- Total Area = 0.2 acres

-- Storm data

Total precipitation	=	1.5 inches
Storm type	=	SCS 6 hour design storm
Peak Discharge	=	0.05 cfs
Discharge volume	=	0.01 acre ft

INCORPORATED
EFFECTIVE:
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```
Project Title          = WSDD-7 (DISTURBED 25/6)
WATERSHED HYDROGRAPH
     Inflow into structure #  1
     Structure type:          Null


-- Watershed data for watershed # 1
     Curve number              =    90.0
     Area                      =     0.2 acres
     Hydraulic length          =  120.00 Feet
     Elevation change          =    80.0 feet.
     Concentration time        =    0.00 hours
     Concentration time type   = SCS Upland Curves
     Unit hydrograph type      = Disturbed

-- Total Area            =     0.2 acres

-- Storm data
     Total precipitation  =     1.9 inches
     Storm type           = SCS 6 hour design storm
     Peak Discharge       =    0.07 cfs
     Discharge volume     =    0.01 acre ft
```

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Project Title = WSDD-7 (DISTURBED 10/24)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

-- Watershed data for watershed # 1

Curve number	=	90.0
Area	=	0.2 acres
Hydraulic length	=	120.00 Feet
Elevation change	=	80.0 feet.
Concentration time	=	0.00 hours
Concentration time type	=	SCS Upland Curves
Unit hydrograph type	=	Disturbed

-- Total Area = 0.2 acres

-- Storm data

Total precipitation	=	2.5 inches
Storm type	=	SCS Type 2 storm, 24 hour storm
Peak Discharge	=	0.12 cfs
Discharge volume	=	0.02 acre ft

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Project Title = WSDD-7 (PAVED 10/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

-- Watershed data for watershed # 1

Curve number	=	95.0
Area	=	0.1 acres
Hydraulic length	=	150.00 Feet
Elevation change	=	5.0 feet.
Concentration time	=	0.01 hours
Concentration time type	=	SCS Upland Curves
Unit hydrograph type	=	Disturbed

-- Total Area = 0.1 acres

-- Storm data

Total precipitation	=	1.5 inches
Storm type	=	SCS 6 hour design storm
Peak Discharge	=	0.06 cfs
Discharge volume	=	0.01 acre ft

INCORPORATED
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```
Project Title          = WSDD-7 (PAVED 25/6)
WATERSHED HYDROGRAPH
     Inflow into structure #  1
     Structure type:          Null


-- Watershed data for watershed # 1
     Curve number              =    95.0
     Area                      =     0.1 acres
     Hydraulic length          =  150.00 Feet
     Elevation change          =     5.0 feet.
     Concentration time        =    0.01 hours
     Concentration time type   = SCS Upland Curves
     Unit hydrograph type      = Disturbed

-- Total Area            =     0.1 acres

-- Storm data
     Total precipitation  =     1.9 inches
     Storm type           = SCS 6 hour design storm
     Peak Discharge       =    0.08 cfs
     Discharge volume     =    0.01 acre ft
```

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```
Project Title          = WSDD-7 (PAVED 10/24)
WATERSHED HYDROGRAPH
     Inflow into structure #  1
     Structure type:          Null


-- Watershed data for watershed # 1
     Curve number              =    95.0
     Area                      =     0.1 acres
     Hydraulic length          =  150.00 Feet
     Elevation change          =     5.0 feet.
     Concentration time        =    0.01 hours
     Concentration time type   = SCS Upland Curves
     Unit hydrograph type      = Disturbed

-- Total Area            =     0.1 acres

-- Storm data
     Total precipitation  =     2.5 inches
     Storm type           = SCS Type 2 storm, 24 hour storm
     Peak Discharge       =    0.11 cfs
     Discharge volume     =    0.02 acre ft
```

INCORPORATED
EFFECTIVE:
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Project Title = WSDD-8 (UNDISTURBED 10/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

-- Watershed data for watershed # 1
Curve number = 69.0
Area = 3.6 acres
Hydraulic length = 700.00 Feet
Elevation change = 460.0 feet.
Concentration time = 0.09 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Forested

-- Total Area = 3.6 acres

-- Storm data
Total precipitation = 1.5 inches
Storm type = SCS 6 hour design storm
Peak Discharge = 0.10 cfs
Discharge volume = 0.02 acre ft

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Project Title = WSDD-8 (UNDISTURBED 25/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

-- Watershed data for watershed # 1

Curve number	=	69.0
Area	=	3.6 acres
Hydraulic length	=	700.00 Feet
Elevation change	=	460.0 feet.
Concentration time	=	0.09 hours
Concentration time type	=	SCS Upland Curves
Unit hydrograph type	=	Forested

-- Total Area = 3.6 acres

-- Storm data

Total precipitation	=	1.9 inches
Storm type	=	SCS 6 hour design storm
Peak Discharge	=	0.20 cfs
Discharge volume	=	0.05 acre ft

INCORPORATED
EFFECTIVE:
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Project Title = WSDD-8 (UNDISTURBED 10/24)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

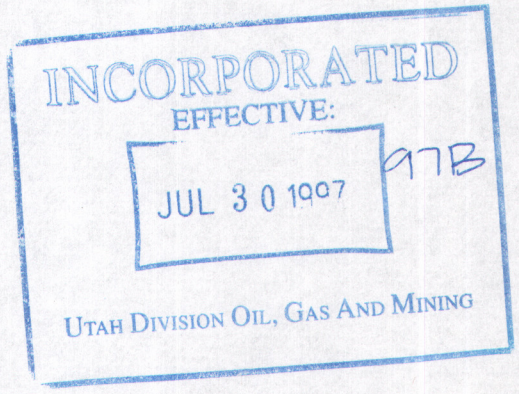
-- Watershed data for watershed # 1

Curve number	=	69.0
Area	=	3.6 acres
Hydraulic length	=	700.00 Feet
Elevation change	=	460.0 feet.
Concentration time	=	0.09 hours
Concentration time type	=	SCS Upland Curves
Unit hydrograph type	=	Forested

-- Total Area = 3.6 acres

-- Storm data

Total precipitation	=	2.5 inches
Storm type	=	SCS Type 2 storm, 24 hour storm
Peak Discharge	=	0.75 cfs
Discharge volume	=	0.13 acre ft



Project Title = WSDD-8 (RECLAIMED 10/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

-- Watershed data for watershed # 1
Curve number = 75.0
Area = 0.2 acres
Hydraulic length = 80.00 Feet
Elevation change = 50.0 feet.
Concentration time = 0.00 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Disturbed

-- Total Area = 0.2 acres

-- Storm data
Total precipitation = 1.5 inches
Storm type = SCS 6 hour design storm
Peak Discharge = 0.01 cfs
Discharge volume = 0.00 acre ft

INCORPORATED
EFFECTIVE:
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Project Title = WSDD-8 (RECLAIMED 25/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

INCORPORATED
EFFECTIVE:
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-- Watershed data for watershed # 1
Curve number = 75.0
Area = 0.2 acres
Hydraulic length = 80.00 Feet
Elevation change = 50.0 feet.
Concentration time = 0.00 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Disturbed

-- Total Area = 0.2 acres

-- Storm data
Total precipitation = 1.9 inches
Storm type = SCS 6 hour design storm
Peak Discharge = 0.02 cfs
Discharge volume = 0.00 acre ft

Project Title = WSDD-8 (RECLAIMED 10/24)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

-- Watershed data for watershed # 1
Curve number = 75.0
Area = 0.2 acres
Hydraulic length = 80.00 Feet
Elevation change = 50.0 feet.
Concentration time = 0.00 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Disturbed

-- Total Area = 0.2 acres

-- Storm data
Total precipitation = 2.5 inches
Storm type = SCS Type 2 storm, 24 hour storm
Peak Discharge = 0.05 cfs
Discharge volume = 0.01 acre ft

INCORPORATED
EFFECTIVE:
JUL 30 1997
UTAH DIVISION OIL, GAS AND MINING

Project Title = WSDD-8 (DISTURBED 10/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

-- Watershed data for watershed # 1
Curve number = 90.0
Area = 0.4 acres
Hydraulic length = 60.00 Feet
Elevation change = 39.0 feet.
Concentration time = 0.00 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Disturbed

-- Total Area = 0.4 acres

-- Storm data
Total precipitation = 1.5 inches
Storm type = SCS 6 hour design storm
Peak Discharge = 0.10 cfs
Discharge volume = 0.02 acre ft

INCORPORATED
EFFECTIVE:
JUL 30 1997
97B
UTAH DIVISION OIL, GAS AND MINING

Project Title = WSDD-8 (DISTURBED 25/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

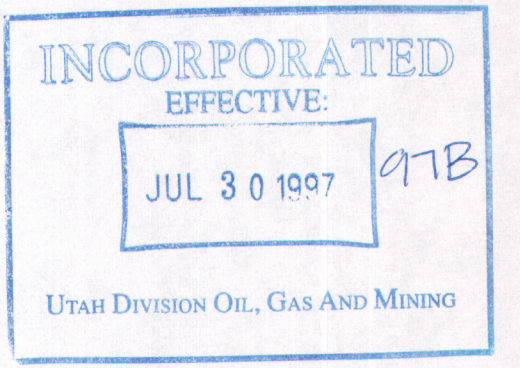
-- Watershed data for watershed # 1

Curve number	=	90.0
Area	=	0.4 acres
Hydraulic length	=	60.00 Feet
Elevation change	=	39.0 feet.
Concentration time	=	0.00 hours
Concentration time type	=	SCS Upland Curves
Unit hydrograph type	=	Disturbed

-- Total Area = 0.4 acres

-- Storm data

Total precipitation	=	1.9 inches
Storm type	=	SCS 6 hour design storm
Peak Discharge	=	0.14 cfs
Discharge volume	=	0.03 acre ft



Project Title = WSDD-8 (DISTURBED 10/24)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

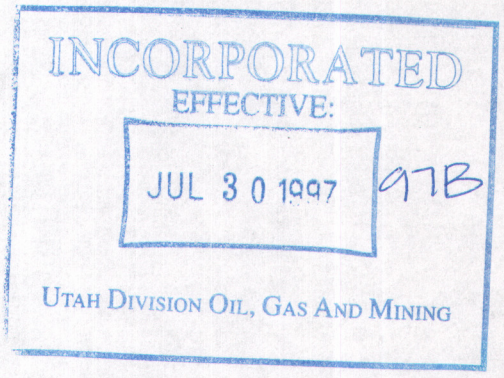
-- Watershed data for watershed # 1

Curve number	=	90.0
Area	=	0.4 acres
Hydraulic length	=	60.00 Feet
Elevation change	=	39.0 feet.
Concentration time	=	0.00 hours
Concentration time type	=	SCS Upland Curves
Unit hydrograph type	=	Disturbed

-- Total Area = 0.4 acres

-- Storm data

Total precipitation	=	2.5 inches
Storm type	=	SCS Type 2 storm, 24 hour storm
Peak Discharge	=	0.23 cfs
Discharge volume	=	0.05 acre ft



Project Title = WSDD-8 (PAVED 10/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

-- Watershed data for watershed # 1

Curve number	=	95.0
Area	=	0.3 acres
Hydraulic length	=	560.00 Feet
Elevation change	=	30.0 feet.
Concentration time	=	0.03 hours
Concentration time type	=	SCS Upland Curves
Unit hydrograph type	=	Disturbed

-- Total Area = 0.3 acres

-- Storm data

Total precipitation	=	1.5 inches
Storm type	=	SCS 6 hour design storm
Peak Discharge	=	0.20 cfs
Discharge volume	=	0.02 acre ft

INCORPORATED
EFFECTIVE:
JUL 30 1997
97B
UTAH DIVISION OIL, GAS AND MINING

Project Title = WSDD-8 (PAVED 25/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

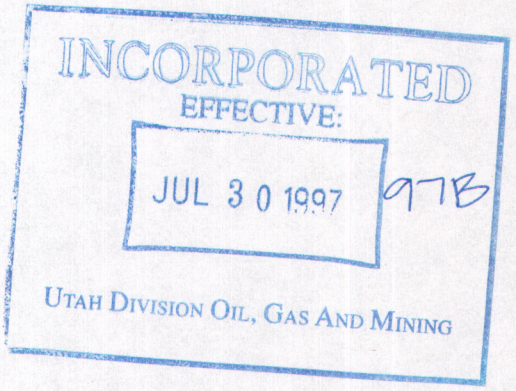
-- Watershed data for watershed # 1

Curve number	=	95.0
Area	=	0.3 acres
Hydraulic length	=	560.00 Feet
Elevation change	=	30.0 feet.
Concentration time	=	0.03 hours
Concentration time type	=	SCS Upland Curves
Unit hydrograph type	=	Disturbed

-- Total Area = 0.3 acres

-- Storm data

Total precipitation	=	1.9 inches
Storm type	=	SCS 6 hour design storm
Peak Discharge	=	0.26 cfs
Discharge volume	=	0.03 acre ft



Project Title = WSDD-8 (PAVED 10/24)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

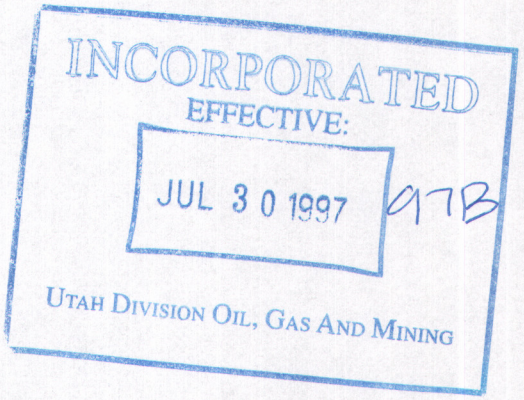
-- Watershed data for watershed # 1

Curve number	=	95.0
Area	=	0.3 acres
Hydraulic length	=	560.00 Feet
Elevation change	=	30.0 feet.
Concentration time	=	0.03 hours
Concentration time type	=	SCS Upland Curves
Unit hydrograph type	=	Disturbed

-- Total Area = 0.3 acres

-- Storm data

Total precipitation	=	2.5 inches
Storm type	=	SCS Type 2 storm, 24 hour storm
Peak Discharge	=	0.37 cfs
Discharge volume	=	0.04 acre ft



Project Title = WSDD-10 (UNDISTURBED - 10/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

-- Watershed data for watershed # 1

Curve number	=	69.0
Area	=	0.1 acres
Hydraulic length	=	45.00 Feet
Elevation change	=	28.0 feet.
Concentration time	=	0.01 hours
Concentration time type	=	SCS Upland Curves
Unit hydrograph type	=	Forested

-- Total Area = 0.1 acres

-- Storm data

Total precipitation	=	1.5 inches
Storm type	=	SCS 6 hour design storm
Peak Discharge	=	0.00 cfs
Discharge volume	=	0.00 acre ft

INCORPORATED
EFFECTIVE:
JUL 30 1997
97B
UTAH DIVISION OIL, GAS AND MINING

Project Title = WSDD-10 (UNDISTURBED - 25/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

-- Watershed data for watershed # 1
Curve number = 69.0
Area = 0.1 acres
Hydraulic length = 45.00 Feet
Elevation change = 28.0 feet.
Concentration time = 0.01 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Forested

-- Total Area = 0.1 acres

-- Storm data
Total precipitation = 1.9 inches
Storm type = SCS 6 hour design storm
Peak Discharge = 0.01 cfs
Discharge volume = 0.00 acre ft

INCORPORATED
EFFECTIVE:
JUL 30 1997
97B
UTAH DIVISION OIL, GAS AND MINING

Project Title = WSDD-10 (UNDISTURBED - 10/24)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

-- Watershed data for watershed # 1
Curve number = 69.0
Area = 0.1 acres
Hydraulic length = 45.00 Feet
Elevation change = 28.0 feet.
Concentration time = 0.01 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Forested

-- Total Area = 0.1 acres

-- Storm data
Total precipitation = 2.5 inches
Storm type = SCS Type 2 storm, 24 hour storm
Peak Discharge = 0.03 cfs
Discharge volume = 0.00 acre ft

INCORPORATED
EFFECTIVE:
JUL 3 0 1997
UTAH DIVISION OIL, GAS AND MINING

Project Title = WSDD-10 (RECLAIMED - 10/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

-- Watershed data for watershed # 1
Curve number = 75.0
Area = 0.1 acres
Hydraulic length = 50.00 Feet
Elevation change = 36.0 feet.
Concentration time = 0.00 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Disturbed

-- Total Area = 0.1 acres

-- Storm data
Total precipitation = 1.5 inches
Storm type = SCS 6 hour design storm
Peak Discharge = 0.01 cfs
Discharge volume = 0.00 acre ft

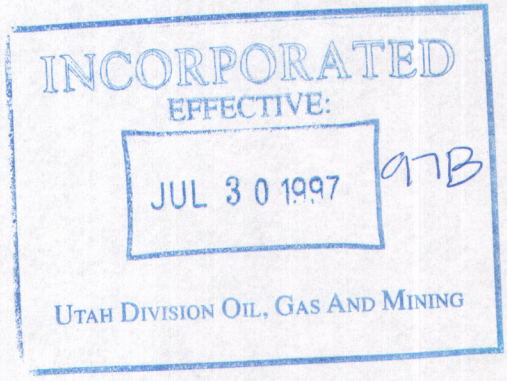
INCORPORATED
EFFECTIVE:
JUL 30 1997
97B
UTAH DIVISION OIL, GAS AND MINING

Project Title = WSDD-10 (RECLAIMED - 25/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

-- Watershed data for watershed # 1
Curve number = 75.0
Area = 0.1 acres
Hydraulic length = 50.00 Feet
Elevation change = 36.0 feet.
Concentration time = 0.00 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Disturbed

-- Total Area = 0.1 acres

-- Storm data
Total precipitation = 1.9 inches
Storm type = SCS 6 hour design storm
Peak Discharge = 0.01 cfs
Discharge volume = 0.00 acre ft



Project Title = WSDD-10 (RECLAIMED - 10/24)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

-- Watershed data for watershed # 1
Curve number = 75.0
Area = 0.1 acres
Hydraulic length = 50.00 Feet
Elevation change = 36.0 feet.
Concentration time = 0.00 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Disturbed

-- Total Area = 0.1 acres

-- Storm data
Total precipitation = 2.5 inches
Storm type = SCS Type 2 storm, 24 hour storm
Peak Discharge = 0.03 cfs
Discharge volume = 0.01 acre ft

INCORPORATED
EFFECTIVE:
JUL 30 1997
97B
UTAH DIVISION OIL, GAS AND MINING

Project Title = WSDD-10 (DISTURBED 10/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

-- Watershed data for watershed # 1
Curve number = 90.0
Area = 0.6 acres
Hydraulic length = 120.00 Feet
Elevation change = 75.0 feet.
Concentration time = 0.00 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Disturbed

-- Total Area = 0.6 acres

-- Storm data
Total precipitation = 1.5 inches
Storm type = SCS 6 hour design storm
Peak Discharge = 0.19 cfs
Discharge volume = 0.04 acre ft

INCORPORATED
EFFECTIVE:
JUL 30 1997
97B
UTAH DIVISION OIL, GAS AND MINING

Project Title = WSDD-10 (DISTURBED 25/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

-- Watershed data for watershed # 1

Curve number	=	90.0
Area	=	0.6 acres
Hydraulic length	=	120.00 Feet
Elevation change	=	75.0 feet.
Concentration time	=	0.00 hours
Concentration time type	=	SCS Upland Curves
Unit hydrograph type	=	Disturbed

-- Total Area = 0.6 acres

-- Storm data

Total precipitation	=	1.9 inches
Storm type	=	SCS 6 hour design storm
Peak Discharge	=	0.27 cfs
Discharge volume	=	0.05 acre ft

INCORPORATED
EFFECTIVE:
JUL 30 1997
97B
UTAH DIVISION OIL, GAS AND MINING

Project Title = WSDD-10 (DISTURBED 10/24)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

-- Watershed data for watershed # 1

Curve number	=	90.0
Area	=	0.6 acres
Hydraulic length	=	120.00 Feet
Elevation change	=	75.0 feet.
Concentration time	=	0.00 hours
Concentration time type	=	SCS Upland Curves
Unit hydrograph type	=	Disturbed

-- Total Area = 0.6 acres

-- Storm data

Total precipitation	=	2.5 inches
Storm type	=	SCS Type 2 storm, 24 hour storm
Peak Discharge	=	0.42 cfs
Discharge volume	=	0.08 acre ft

INCORPORATED
EFFECTIVE:
JUL 30 1997
97B
UTAH DIVISION OIL, GAS AND MINING

Project Title = WSDD-10 (PAVED 10/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

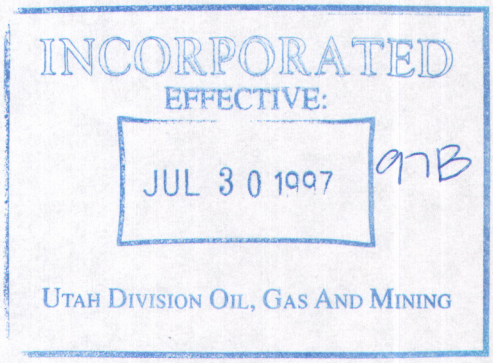
-- Watershed data for watershed # 1

Curve number	=	95.0
Area	=	0.3 acres
Hydraulic length	=	335.00 Feet
Elevation change	=	18.0 feet.
Concentration time	=	0.02 hours
Concentration time type	=	SCS Upland Curves
Unit hydrograph type	=	Disturbed

-- Total Area = 0.3 acres

-- Storm data

Total precipitation	=	1.5 inches
Storm type	=	SCS 6 hour design storm
Peak Discharge	=	0.19 cfs
Discharge volume	=	0.02 acre ft



Project Title = WSDD-10 (PAVED 25/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

-- Watershed data for watershed # 1
Curve number = 95.0
Area = 0.3 acres
Hydraulic length = 335.00 Feet
Elevation change = 18.0 feet.
Concentration time = 0.02 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Disturbed

-- Total Area = 0.3 acres

-- Storm data
Total precipitation = 1.9 inches
Storm type = SCS 6 hour design storm
Peak Discharge = 0.24 cfs
Discharge volume = 0.03 acre ft

INCORPORATED
EFFECTIVE:
JUL 30 1997
UTAH DIVISION OIL, GAS AND MINING

Project Title = WSDD-10 (PAVED 10/24)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

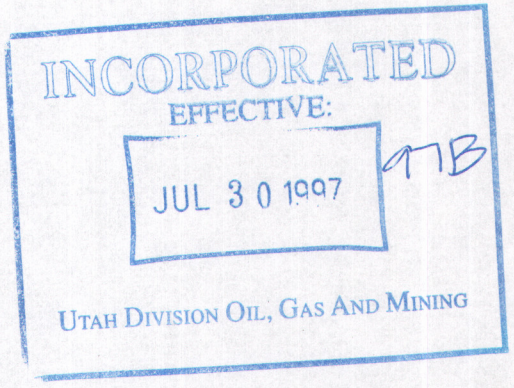
-- Watershed data for watershed # 1

Curve number	=	95.0
Area	=	0.3 acres
Hydraulic length	=	335.00 Feet
Elevation change	=	18.0 feet.
Concentration time	=	0.02 hours
Concentration time type	=	SCS Upland Curves
Unit hydrograph type	=	Disturbed

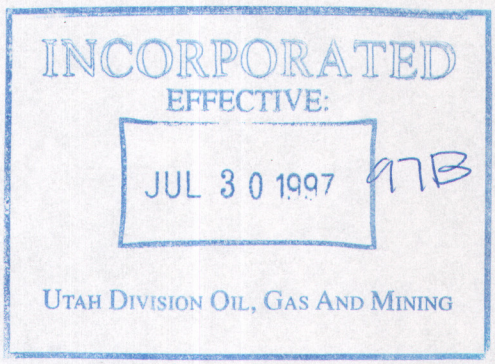
-- Total Area = 0.3 acres

-- Storm data

Total precipitation	=	2.5 inches
Storm type	=	SCS Type 2 storm, 24 hour storm
Peak Discharge	=	0.35 cfs
Discharge volume	=	0.04 acre ft



Project Title = WSDD-11 (UNDISTURBED 10/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null



-- Watershed data for watershed # 1

Curve number	=	69.0
Area	=	2.1 acres
Hydraulic length	=	570.00 Feet
Elevation change	=	370.0 feet.
Concentration time	=	0.08 hours
Concentration time type	=	SCS Upland Curves
Unit hydrograph type	=	Forested

-- Total Area = 2.1 acres

-- Storm data

Total precipitation	=	1.5 inches
Storm type	=	SCS 6 hour design storm
Peak Discharge	=	0.06 cfs
Discharge volume	=	0.01 acre ft

Project Title = WSDD-11 (UNDISTURBED 25/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

-- Watershed data for watershed # 1

Curve number	=	69.0
Area	=	2.1 acres
Hydraulic length	=	570.00 Feet
Elevation change	=	370.0 feet.
Concentration time	=	0.08 hours
Concentration time type	=	SCS Upland Curves
Unit hydrograph type	=	Forested

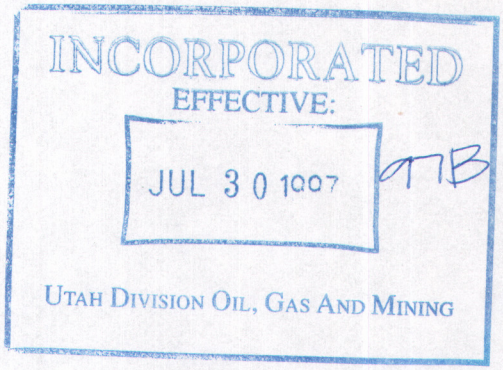
-- Total Area = 2.1 acres

-- Storm data

Total precipitation	=	1.9 inches
Storm type	=	SCS 6 hour design storm
Peak Discharge	=	0.12 cfs
Discharge volume	=	0.03 acre ft

INCORPORATED
EFFECTIVE:
JUL 30 1997
97B
UTAH DIVISION OIL, GAS AND MINING

Project Title = WSDD-11 (UNDISTURBED 10/24)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null



-- Watershed data for watershed # 1

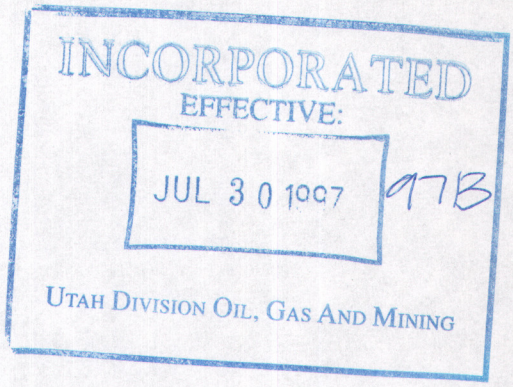
Curve number	=	69.0
Area	=	2.1 acres
Hydraulic length	=	570.00 Feet
Elevation change	=	370.0 feet.
Concentration time	=	0.08 hours
Concentration time type	=	SCS Upland Curves
Unit hydrograph type	=	Forested

-- Total Area = 2.1 acres

-- Storm data

Total precipitation	=	2.5 inches
Storm type	=	SCS Type 2 storm, 24 hour storm
Peak Discharge	=	0.47 cfs
Discharge volume	=	0.07 acre ft

Project Title = WSDD-11 (RECLAIMED 10/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null



-- Watershed data for watershed # 1
Curve number = 75.0
Area = 0.2 acres
Hydraulic length = 30.00 Feet
Elevation change = 20.0 feet.
Concentration time = 0.00 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Disturbed

-- Total Area = 0.2 acres

-- Storm data
Total precipitation = 1.5 inches
Storm type = SCS 6 hour design storm
Peak Discharge = 0.01 cfs
Discharge volume = 0.00 acre ft

Project Title = WSDD-11 (RECLAIMED 25/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

INCORPORATED
EFFECTIVE:
JUL 30 1997
97B
UTAH DIVISION OIL, GAS AND MINING

-- Watershed data for watershed # 1
Curve number = 75.0
Area = 0.2 acres
Hydraulic length = 30.00 Feet
Elevation change = 20.0 feet.
Concentration time = 0.00 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Disturbed

-- Total Area = 0.2 acres

-- Storm data
Total precipitation = 1.9 inches
Storm type = SCS 6 hour design storm
Peak Discharge = 0.02 cfs
Discharge volume = 0.00 acre ft

Project Title = WSDD-11 (RECLAIMED 10/24)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

INCORPORATED
EFFECTIVE:
JUL 30 1007
97B
UTAH DIVISION OIL, GAS AND MINING

-- Watershed data for watershed # 1

Curve number	=	75.0
Area	=	0.2 acres
Hydraulic length	=	30.00 Feet
Elevation change	=	20.0 feet.
Concentration time	=	0.00 hours
Concentration time type	=	SCS Upland Curves
Unit hydrograph type	=	Disturbed

-- Total Area = 0.2 acres

-- Storm data

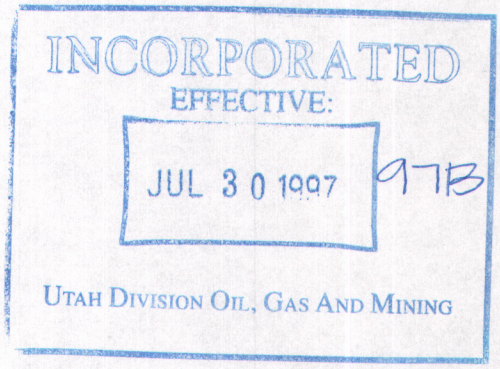
Total precipitation	=	2.5 inches
Storm type	=	SCS Type 2 storm, 24 hour storm
Peak Discharge	=	0.04 cfs
Discharge volume	=	0.01 acre ft

Project Title = WSDD-11 (DISTURBED 10/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

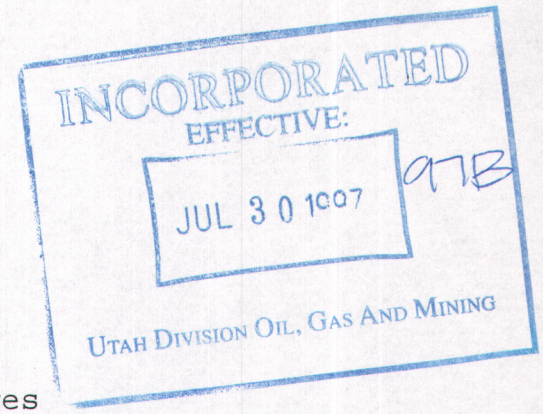
-- Watershed data for watershed # 1
Curve number = 90.0
Area = 0.1 acres
Hydraulic length = 35.00 Feet
Elevation change = 23.0 feet.
Concentration time = 0.00 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Disturbed

-- Total Area = 0.1 acres

-- Storm data
Total precipitation = 1.5 inches
Storm type = SCS 6 hour design storm
Peak Discharge = 0.03 cfs
Discharge volume = 0.01 acre ft



Project Title = WSDD-11 (DISTURBED 25/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null



-- Watershed data for watershed # 1
Curve number = 90.0
Area = 0.1 acres
Hydraulic length = 35.00 Feet
Elevation change = 23.0 feet.
Concentration time = 0.00 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Disturbed

-- Total Area = 0.1 acres

-- Storm data
Total precipitation = 1.9 inches
Storm type = SCS 6 hour design storm
Peak Discharge = 0.04 cfs
Discharge volume = 0.01 acre ft

Project Title = WSDD-11 (DISTURBED 10/24)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

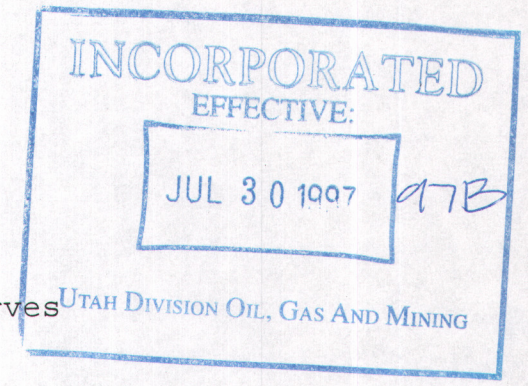
INCORPORATED
EFFECTIVE:
JUL 30 1007
97B
UTAH DIVISION OIL, GAS AND MINING

-- Watershed data for watershed # 1
Curve number = 90.0
Area = 0.1 acres
Hydraulic length = 35.00 Feet
Elevation change = 23.0 feet.
Concentration time = 0.00 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Disturbed

-- Total Area = 0.1 acres

-- Storm data
Total precipitation = 2.5 inches
Storm type = SCS Type 2 storm, 24 hour storm
Peak Discharge = 0.06 cfs
Discharge volume = 0.01 acre ft

Project Title = WSDD-12 (UNDISTURBED 10/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null



-- Watershed data for watershed # 1

Curve number	=	60.0
Area	=	8.8 acres
Hydraulic length	=	1600.00 Feet
Elevation change	=	680.0 feet.
Concentration time	=	0.27 hours
Concentration time type	=	SCS Upland Curves
Unit hydrograph type	=	Forested

-- Total Area = 8.8 acres

-- Storm data

Total precipitation	=	1.5 inches
Storm type	=	SCS 6 hour design storm
Peak Discharge	=	0.04 cfs
Discharge volume	=	0.01 acre ft

Project Title = WSDD-12 (UNDISTURBED 25/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

INCORPORATED
EFFECTIVE:
JUL 30 1997
UTAH DIVISION OIL, GAS AND MINING

-- Watershed data for watershed # 1

Curve number	=	60.0
Area	=	8.8 acres
Hydraulic length	=	1600.00 Feet
Elevation change	=	680.0 feet.
Concentration time	=	0.27 hours
Concentration time type	=	SCS Upland Curves
Unit hydrograph type	=	Forested

-- Total Area = 8.8 acres

-- Storm data

Total precipitation	=	1.9 inches
Storm type	=	SCS 6 hour design storm
Peak Discharge	=	0.16 cfs
Discharge volume	=	0.03 acre ft

Project Title = WSDD-12 (UNDISTURBED 10/24)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

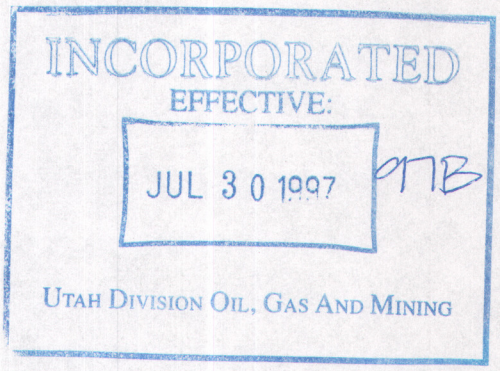
INCORPORATED
EFFECTIVE:
JUL 3 0 1997
97B
UTAH DIVISION OIL, GAS AND MINING

-- Watershed data for watershed # 1
Curve number = 60.0
Area = 8.8 acres
Hydraulic length = 1600.00 Feet
Elevation change = 680.0 feet.
Concentration time = 0.27 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Forested

-- Total Area = 8.8 acres

-- Storm data
Total precipitation = 2.5 inches
Storm type = SCS Type 2 storm, 24 hour storm
Peak Discharge = 0.25 cfs
Discharge volume = 0.13 acre ft

Project Title = WSDD-12 (DISTURBED 10/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null



-- Watershed data for watershed # 1
Curve number = 90.0
Area = 2.3 acres
Hydraulic length = 450.00 Feet
Elevation change = 20.0 feet.
Concentration time = 0.06 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Disturbed

-- Total Area = 2.3 acres

-- Storm data
Total precipitation = 1.5 inches
Storm type = SCS 6 hour design storm
Peak Discharge = 1.51 cfs
Discharge volume = 0.14 acre ft

Project Title = WSDD-12 (DISTURBED 25/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

-- Watershed data for watershed # 1
Curve number = 90.0
Area = 2.3 acres
Hydraulic length = 450.00 Feet
Elevation change = 20.0 feet.
Concentration time = 0.06 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Disturbed

-- Total Area = 2.3 acres

-- Storm data
Total precipitation = 1.9 inches
Storm type = SCS 6 hour design storm
Peak Discharge = 2.10 cfs
Discharge volume = 0.19 acre ft

INCORPORATED
EFFECTIVE:
JUL 30 1997
97B
UTAH DIVISION OIL, GAS AND MINING

Project Title = WSDD-12 (DISTURBED 10/24)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

-- Watershed data for watershed # 1

Curve number	=	90.0
Area	=	2.3 acres
Hydraulic length	=	450.00 Feet
Elevation change	=	20.0 feet.
Concentration time	=	0.06 hours
Concentration time type	=	SCS Upland Curves
Unit hydrograph type	=	Disturbed

-- Total Area = 2.3 acres

-- Storm data

Total precipitation	=	2.5 inches
Storm type	=	SCS Type 2 storm, 24 hour storm
Peak Discharge	=	3.33 cfs
Discharge volume	=	0.29 acre ft

INCORPORATED
EFFECTIVE:
JUL 30 1997
97B
UTAH DIVISION OIL, GAS AND MINING

Project Title = WSDD-13 (UNDISTURBED - 10/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

-- Watershed data for watershed # 1
Curve number = 60.0
Area = 17.7 acres
Hydraulic length = 2100.00 Feet
Elevation change = 1130.0 feet.
Concentration time = 0.31 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Forested

-- Total Area = 17.7 acres

-- Storm data
Total precipitation = 1.5 inches
Storm type = SCS 6 hour design storm
Peak Discharge = 0.07 cfs
Discharge volume = 0.01 acre ft

INCORPORATED
EFFECTIVE:
JUL 3 0 1997
97B
UTAH DIVISION OIL, GAS AND MINING

Project Title = WSDD-13 (UNDISTURBED - 25/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

-- Watershed data for watershed # 1
Curve number = 60.0
Area = 17.7 acres
Hydraulic length = 2100.00 Feet
Elevation change = 1130.0 feet.
Concentration time = 0.31 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Forested

-- Total Area = 17.7 acres

-- Storm data
Total precipitation = 1.9 inches
Storm type = SCS 6 hour design storm
Peak Discharge = 0.30 cfs
Discharge volume = 0.07 acre ft

INCORPORATED
EFFECTIVE:
JUL 30 1997
97B
UTAH DIVISION OIL, GAS AND MINING

Project Title = WSDD-13 (UNDISTURBED - 10/24)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

-- Watershed data for watershed # 1
Curve number = 60.0
Area = 17.7 acres
Hydraulic length = 2100.00 Feet
Elevation change = 1130.0 feet.
Concentration time = 0.31 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Forested

-- Total Area = 17.7 acres

-- Storm data
Total precipitation = 2.5 inches
Storm type = SCS Type 2 storm, 24 hour storm
Peak Discharge = 0.49 cfs
Discharge volume = 0.26 acre ft

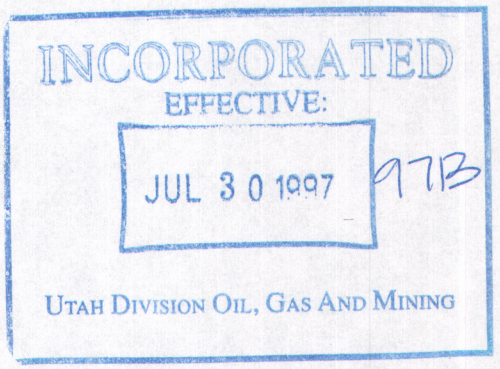
INCORPORATED
EFFECTIVE:
JUL 30 1997
GTB
UTAH DIVISION OIL, GAS AND MINING

Project Title = WSDD-13 (DISTURBED - 10/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

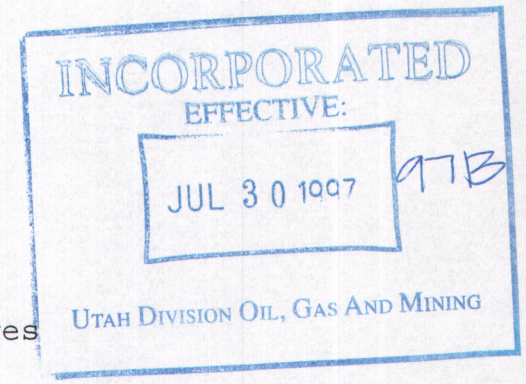
-- Watershed data for watershed # 1
Curve number = 90.0
Area = 3.7 acres
Hydraulic length = 650.00 Feet
Elevation change = 59.0 feet.
Concentration time = 0.06 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Disturbed

-- Total Area = 3.7 acres

-- Storm data
Total precipitation = 1.5 inches
Storm type = SCS 6 hour design storm
Peak Discharge = 2.44 cfs
Discharge volume = 0.22 acre ft



Project Title = WSDD-13 (DISTURBED - 25/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null



-- Watershed data for watershed # 1

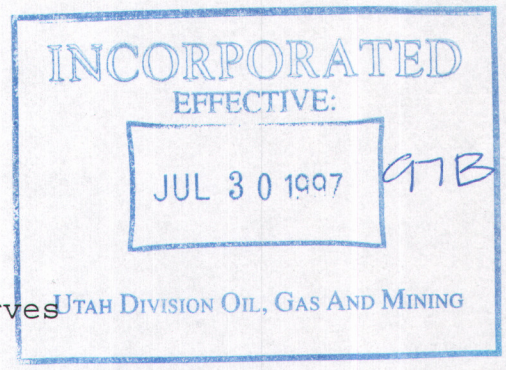
Curve number	=	90.0
Area	=	3.7 acres
Hydraulic length	=	650.00 Feet
Elevation change	=	59.0 feet.
Concentration time	=	0.06 hours
Concentration time type	=	SCS Upland Curves
Unit hydrograph type	=	Disturbed

-- Total Area = 3.7 acres

-- Storm data

Total precipitation	=	1.9 inches
Storm type	=	SCS 6 hour design storm
Peak Discharge	=	3.39 cfs
Discharge volume	=	0.31 acre ft

Project Title = WSDD-13 (DISTURBED - 10/24)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

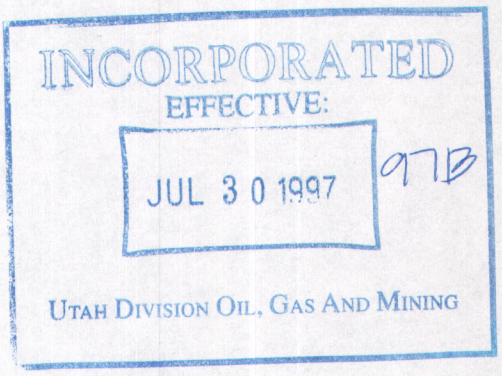


-- Watershed data for watershed # 1
Curve number = 90.0
Area = 3.7 acres
Hydraulic length = 650.00 Feet
Elevation change = 59.0 feet.
Concentration time = 0.06 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Disturbed

-- Total Area = 3.7 acres

-- Storm data
Total precipitation = 2.5 inches
Storm type = SCS Type 2 storm, 24 hour storm
Peak Discharge = 5.39 cfs
Discharge volume = 0.47 acre ft

Project Title = WSDD-13 (PAVED - 10/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null



-- Watershed data for watershed # 1
Curve number = 95.0
Area = 0.3 acres
Hydraulic length = 40.00 Feet
Elevation change = 2.0 feet.
Concentration time = 0.00 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Disturbed

-- Total Area = 0.3 acres

-- Storm data
Total precipitation = 1.5 inches
Storm type = SCS 6 hour design storm
Peak Discharge = 0.11 cfs
Discharge volume = 0.02 acre ft

Project Title = WSDD-13 (PAVED - 25/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

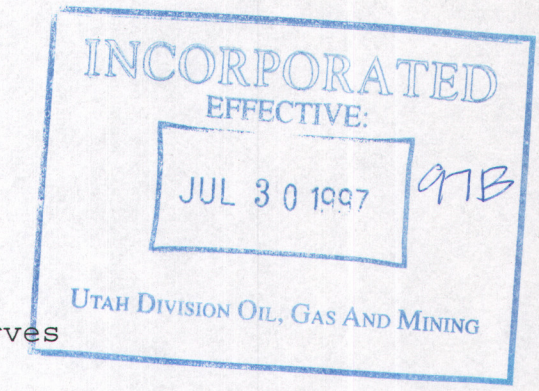
INCORPORATED
EFFECTIVE:
JUL 3 0 1007
97B
UTAH DIVISION OIL, GAS AND MINING

-- Watershed data for watershed # 1
Curve number = 95.0
Area = 0.3 acres
Hydraulic length = 40.00 Feet
Elevation change = 2.0 feet.
Concentration time = 0.00 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Disturbed

-- Total Area = 0.3 acres

-- Storm data
Total precipitation = 1.9 inches
Storm type = SCS 6 hour design storm
Peak Discharge = 0.14 cfs
Discharge volume = 0.03 acre ft

Project Title = WSDD-13 (PAVED - 10/24)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null



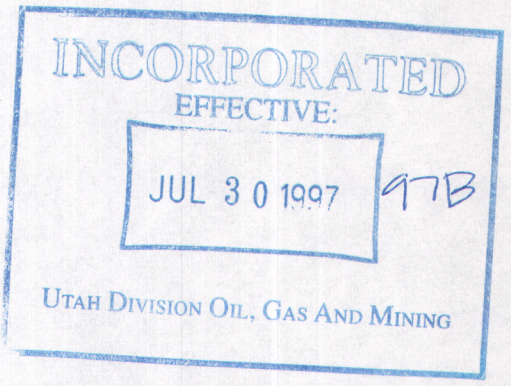
97B

-- Watershed data for watershed # 1
Curve number = 95.0
Area = 0.3 acres
Hydraulic length = 40.00 Feet
Elevation change = 2.0 feet.
Concentration time = 0.00 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Disturbed

-- Total Area = 0.3 acres

-- Storm data
Total precipitation = 2.5 inches
Storm type = SCS Type 2 storm, 24 hour storm
Peak Discharge = 0.20 cfs
Discharge volume = 0.04 acre ft

Project Title = WSDD-14 (DISTURBED 10/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null



-- Watershed data for watershed # 1

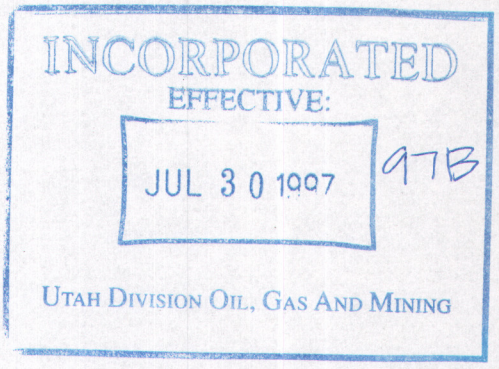
Curve number	=	90.0
Area	=	0.9 acres
Hydraulic length	=	140.00 Feet
Elevation change	=	23.0 feet.
Concentration time	=	0.01 hours
Concentration time type	=	SCS Upland Curves
Unit hydrograph type	=	Disturbed

-- Total Area = 0.9 acres

-- Storm data

Total precipitation	=	1.5 inches
Storm type	=	SCS 6 hour design storm
Peak Discharge	=	0.35 cfs
Discharge volume	=	0.05 acre ft

Project Title = WSDD-14 (DISTURBED 25/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null



-- Watershed data for watershed # 1

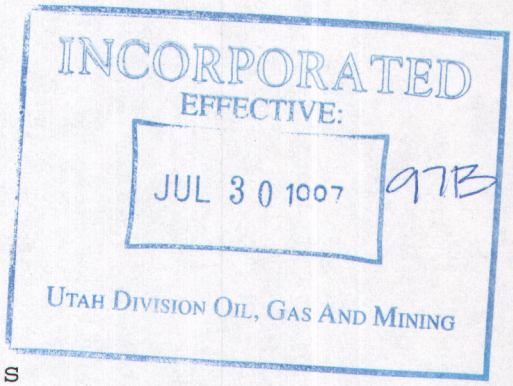
Curve number	=	90.0
Area	=	0.9 acres
Hydraulic length	=	140.00 Feet
Elevation change	=	23.0 feet.
Concentration time	=	0.01 hours
Concentration time type	=	SCS Upland Curves
Unit hydrograph type	=	Disturbed

-- Total Area = 0.9 acres

-- Storm data

Total precipitation	=	1.9 inches
Storm type	=	SCS 6 hour design storm
Peak Discharge	=	0.49 cfs
Discharge volume	=	0.07 acre ft

Project Title = WSDD-14 (DISTURBED 10/24)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null



-- Watershed data for watershed # 1
Curve number = 90.0
Area = 0.9 acres
Hydraulic length = 140.00 Feet
Elevation change = 23.0 feet.
Concentration time = 0.01 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Disturbed

-- Total Area = 0.9 acres

-- Storm data
Total precipitation = 2.5 inches
Storm type = SCS Type 2 storm, 24 hour storm
Peak Discharge = 0.78 cfs
Discharge volume = 0.11 acre ft

Project Title = WSDD-14 (UNDISTURBED 10/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

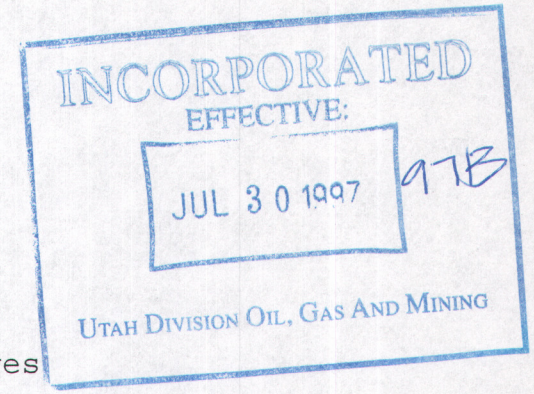
INCORPORATED
EFFECTIVE:
JUL 30 1007
97B
UTAH DIVISION OIL, GAS AND MINING

-- Watershed data for watershed # 1
Curve number = 60.0
Area = 0.8 acres
Hydraulic length = 380.00 Feet
Elevation change = 245.0 feet.
Concentration time = 0.05 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Forested

-- Total Area = 0.8 acres

-- Storm data
Total precipitation = 1.5 inches
Storm type = SCS 6 hour design storm
Peak Discharge = 0.00 cfs
Discharge volume = 0.00 acre ft

Project Title = WSDD-14 (UNDISTURBED 25/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null



-- Watershed data for watershed # 1
Curve number = 60.0
Area = 0.8 acres
Hydraulic length = 380.00 Feet
Elevation change = 245.0 feet.
Concentration time = 0.05 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Forested

-- Total Area = 0.8 acres

-- Storm data
Total precipitation = 1.9 inches
Storm type = SCS 6 hour design storm
Peak Discharge = 0.02 cfs
Discharge volume = 0.00 acre ft

Project Title = WSDD-14 (UNDISTURBED 10/24)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

INCORPORATED
EFFECTIVE:
JUL 30 1997
97B
UTAH DIVISION OIL, GAS AND MINING

-- Watershed data for watershed # 1
Curve number = 60.0
Area = 0.8 acres
Hydraulic length = 380.00 Feet
Elevation change = 245.0 feet.
Concentration time = 0.05 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Forested

-- Total Area = 0.8 acres

-- Storm data
Total precipitation = 2.5 inches
Storm type = SCS Type 2 storm, 24 hour storm
Peak Discharge = 0.03 cfs
Discharge volume = 0.01 acre ft

Project Title = WSDD-14 (PAVED - 10/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

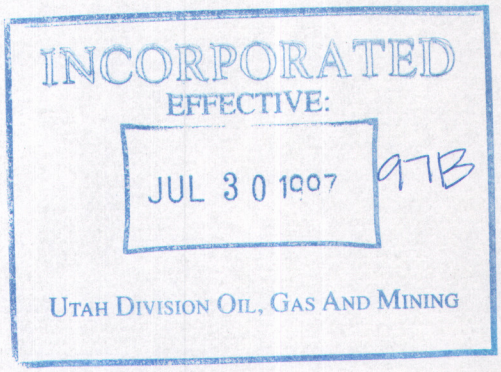
INCORPORATED
EFFECTIVE:
JUL 3 0 1997
UTAH DIVISION OIL, GAS AND MINING

-- Watershed data for watershed # 1
Curve number = 95.0
Area = 0.1 acres
Hydraulic length = 30.00 Feet
Elevation change = 1.0 feet.
Concentration time = 0.00 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Disturbed

-- Total Area = 0.1 acres

-- Storm data
Total precipitation = 1.5 inches
Storm type = SCS 6 hour design storm
Peak Discharge = 0.04 cfs
Discharge volume = 0.01 acre ft

Project Title = WSDD-14 (PAVED - 25/6)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null

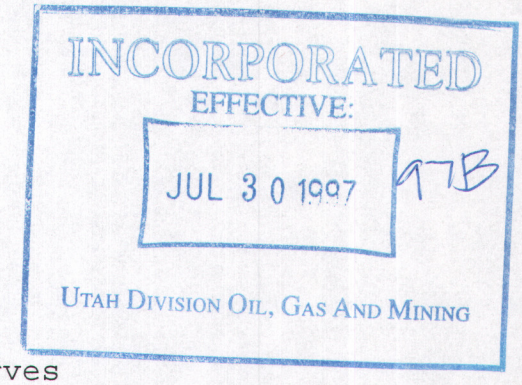


-- Watershed data for watershed # 1
Curve number = 95.0
Area = 0.1 acres
Hydraulic length = 30.00 Feet
Elevation change = 1.0 feet.
Concentration time = 0.00 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Disturbed

-- Total Area = 0.1 acres

-- Storm data
Total precipitation = 1.9 inches
Storm type = SCS 6 hour design storm
Peak Discharge = 0.05 cfs
Discharge volume = 0.01 acre ft

Project Title = WSDD-14 (PAVED - 10/24)
WATERSHED HYDROGRAPH
Inflow into structure # 1
Structure type: Null



-- Watershed data for watershed # 1
Curve number = 95.0
Area = 0.1 acres
Hydraulic length = 30.00 Feet
Elevation change = 1.0 feet.
Concentration time = 0.00 hours
Concentration time type = SCS Upland Curves
Unit hydrograph type = Disturbed

-- Total Area = 0.1 acres

-- Storm data
Total precipitation = 2.5 inches
Storm type = SCS Type 2 storm, 24 hour storm
Peak Discharge = 0.07 cfs
Discharge volume = 0.02 acre ft

INCORPORATED
EFFECTIVE:
JUL 30 1997
97B
UTAH DIVISION OIL, GAS AND MINING

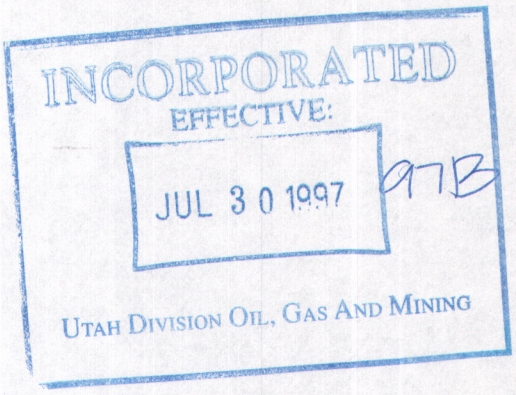
DITCH FLOW CALCULATIONS

Title of run: DD-13 (MIN. 10/6)

Solving for	Depth Normal

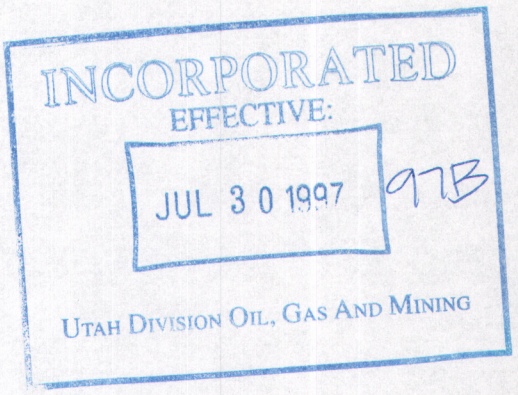
Triangle

Flow depth (ft)	0.97
First Side slope	1.0
Second Side slope	1.0
Slope of diversion	0.0179
Manning"s n	0.035
CFS	2.62
Cross section area (sqft)	0.94
Hydrualic radius	0.34
fps	2.79
Froude number	0.84



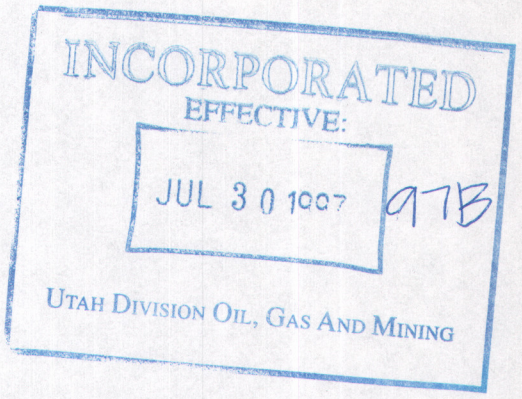
Title of run: DD-13 (MIN. 10/24)

Solving for	Depth Normal
iangle	
Flow depth (ft)	1.33
First Side slope	1.0
Second Side slope	1.0
Slope of diversion	0.0179
Manning"s n	0.035
CFS	6.08
Cross section area (sqft)	1.77
Hydrualic radius	0.47
fps	3.44
Froude number	0.89



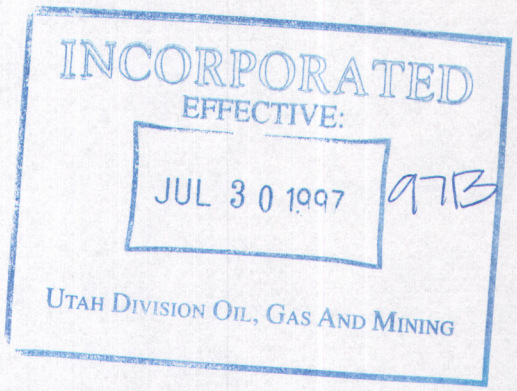
Title of run: DD-13 (MAX. 10/6)

Solving for	=	Depth Normal
Trapedeziod		
Flow depth (ft)	=	0.15
First Side slope	=	2.0
Second Side slope	=	2.0
Bottom width (ft)	=	2.00
Slope of diversion	=	0.5000
Manning"s n	=	0.035
CFS	=	2.62
Cross section area (sqft)	=	0.34
Hydrualic radius	=	0.13
fps	=	7.66
Froude number	=	3.77



Title of run: DD-13 (MAX. 10/24)

Solving for	=	Depth Normal
Trapedeziod		
Flow depth (ft)	=	0.24
First Side slope	=	2.0
Second Side slope	=	2.0
Bottom width (ft)	=	2.00
Slope of diversion	=	0.5000
Manning"s n	=	0.035
CFS	=	6.08
Cross section area (sqft)	=	0.60
Hydrualic radius	=	0.19
fps	=	10.12
Froude number	=	4.04



INCORPORATED
EFFECTIVE:
JUL 3 0 1997
97B
UTAH DIVISION OIL, GAS AND MINING

72" CULVERT OUTLET

RIP-RAP APRON

FLOW VELOCITY CALCULATIONS

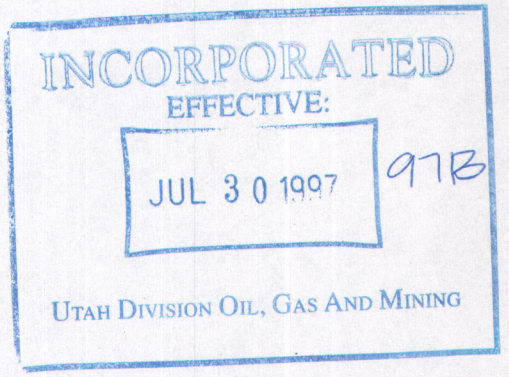
Title of run: BEGIN APRON **(ZONE A)**

Solving for.....=	Depth Normal
Trapedeziod	
Flow depth (ft).....=	2.03
First Side slope.....=	1.0
Second Side slope.....=	1.0
Bottom width (ft).....=	6.00
Slope of diversion.....=	0.0667
Manning"s n.....=	0.035
CFS.....=	222.79
Cross section area (sqft)..=	16.29
Hydrualic radius.....=	1.39
fps.....=	13.68
Froude number.....=	2.05

INCORPORATED
EFFECTIVE:
JUL 3 0 1997
97B
UTAH DIVISION OIL, GAS AND MINING

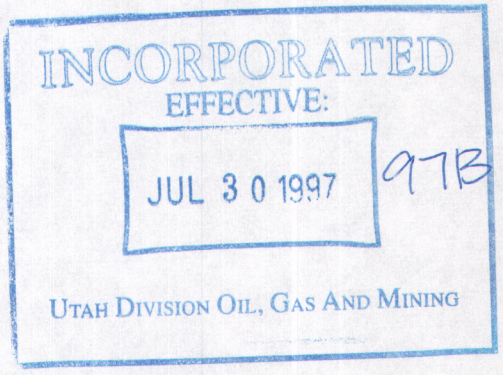
Title of run: MIDDLE APRON (15') **(ZONE B)**

Solving for	Depth Normal
Trapedeziod	
Flow depth (ft)	1.37
First Side slope	1.0
Second Side slope	1.0
Bottom width (ft)	12.00
Slope of diversion	0.0667
Manning"s n	0.035
CFS	222.79
Cross section area (sqft)	18.38
Hydrualic radius	1.16
fps	12.12
Froude number	1.99



Title of run: END APRON (30') **(ZONE C)**

Solving for	=	Depth Normal
Trapedeziod		
Flow depth (ft)	=	1.08
First Side slope	=	1.0
Second Side slope	=	1.0
Bottom width (ft)	=	18.00
Slope of diversion	=	0.0667
Manning"s n	=	0.035
CFS	=	222.79
Cross section area (sqft)	=	20.57
Hydrualic radius	=	0.98
fps	=	10.83
Froude number	=	1.93



Title of run: NATURAL CHANNEL

Solving for	Depth Normal
Trapedeziod	
Flow depth (ft)	1.12
First Side slope	1.0
Second Side slope	1.0
Bottom width (ft)	17.00
Slope of diversion	0.0667
Manning"s n	0.035
CFS	222.79
Cross section area (sqft)	20.22
Hydrualic radius	1.00
fps	11.02
Froude number	1.94