0030

NATOMAS
TRAIL
MOUNTAIN
COAL
COMPANY

ACT/015/009
#7

April 11, 1983

State of Utah
Division of Oil, Gas and Mining
4241 State Office Building
Salt Lake City, Utah 84114

Re: Inhouse Maintenance of Surface Drainage

Dear Sirs:

I am writing this letter as an introduction of myself to the Division and other State concerns.

My name is Robert Downard. I am a member of the newly realigned Natomas Trail Mountain Coal Company management team. My title is Surface and Maintenance Supervisor and my responsibilities include the supervision and coordination of maintenance activities, specifically surface functions, such as care and maintenance of surface facilities (shop, yard, tipple, storage areas, etc.).

I have been employed at Trail Moutain for two years and have been witness to changes in the commitment of management personnel. With these changes has come a steady trend toward a more professional and responsible operation.

With my background of over 25 years of top management and supervisory experience, and hands-on experience working with the various Federal, State and Local governing agencies, I feel I will be of great assistance to Trail Mountain in maintaining our facility in compliance.

In my conversations with Allen Childs and Joe Fielder, there has been great emphasis placed on the importance of conducting our operation within the guidelines of Federal, State and Local agencies.

P.O. Box 551 Orangeville Utah 84537 a Natomas Coal Company subsidiary

It is my commitment as a management member of Natomas Trail Mountain Coal and as a professional that we will implement a plan to maintain the surface drainage system to the best of our ability and in a state of compliance.

Sincerely,

NATOMAS TRAIL MOUNTAIN COAL

Robert Downard
Surface and Maintenance Supervisor

RD/ja

SUMMARY

1. Extend the 66" culvert in Cotton Creek north, adjacent to the mine offices. (See drawings).

    A. Install culvert in the same approved manner as the first culvert project.

    B. Construct a concrete inlet.

2. Install half-round culvert from mine offices to sedimentation pond.

    A. Install with best management practices.

    B. Provide a protection barrier on perimeter parallel to culvert.

    C. Provide metal grading covers at all crossings that will facilitate removal to allow for cleaning of half-round culvert.

3. Continue with newly implemented maintenance and protection program.

    A. Inhouse program.

    B. Maintenance consultant.

4. Education.

    A. Ongoing.

1. Implementation of surface drainage plan;
2. Needed construction;
3. Daily monitoring and inspection;
4. Routine maintenance; and
5. Education and training of mine personnel.

The following recommendation is being made in light of Natomas Trail Mountain's recently revised sedimentation control plan (tentatively approved), and newly implemented compliance and surface maintenance program.

Natomas proposes that, in the best interest of the Division of Oil, Gas and Mining, its Board, and Natomas Trail Mountain Coal Company, abatement of the Show Cause Order relating to a pattern of violations concerning hydrologic balance should consist of:

1. Natomas Trail Mountain to obtain final approval on sediment control plan;
2. Natomas Trail Mountain to construct and install culvert in Cottonwood Creek;
3. Natomas Trail Mountain to install half-round culvert drainage ditch and protective barrier on perimeter; and
4. Items 1, 2 and 3 must be completed within 90 days of the Board's acceptance.

(Upon completion of items 1, 2, 3 and 4 (UMC 843.13(b), the Board will vacate the Show Cause Order. Failure to complete items 1, 2, 3 and 4 will lead to a possible suspended mining permit.)

Please consider these recommendations as you review a summary of our drainage, sedimentation control and protection plan.

Natomas Trail Mountain Coal Company feels it has illustrated, implemented, and recommended all of the actions for the abatement of the current Show Cause Order and by continued use of this program, Natomas Trail Mountain can prevent future patterns of violations.

Sincerely,

Allen Childs
Mine Engineer

AC/ja

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I. HISTORY

The Trail Mountain Coal Mine has been a small family mine since the early thirties. The location, design and layout of the mine find their origins from these days and reflect, for the most part, reflect decisions made long before the Surface Mining Control and Reclamation Act.

In 1979, the Fetterholf group purchased the Trail Mountain Mine from the Bell family, but made few, if any, improvements to the mine.

In March of 1981, Natomas acquired the Trial Mountain Mine from the Fetterholf group and is the present operator. At the time Natomas acquired the mine, no permit existed. Natomas recognized many of the long-standing deficiencies related to surface control and implemented a plan to correct these deficiencies. In may of 1981, long before receipt of its first notice of violation, Natomas designed and installed a 48 inch culvert across a portion of its permitted area to eliminate a potential sedimentation problem. Construction was commenced in late May and was completed in July of that year. Next, in August of 1981, bids were solicited for expansion of the sedimentation pond and installation of a 66 inch culvert along the major portion of the permit area. Bids were received and a contractor selected in November of 1981, too late in the year for construction to commence.

The first and second violations in the pattern were received at this point. In the Spring of 1982, construction was delayed due to a renegotiation of this contract, delays in approval of funding and the general lack of availability of construction personnel during the peak construction months. During this period of delay, two additional violations occurred. Construction began in late August of 1982 and was completed in November of that year. The final two violations in the pattern were incurred during the construction of this phase of the sedimentation control plan.

The fruits of the Natomas ownership have been many, such as increased coal production, revenue, professionalism, the desire to be a long term operation, the ability to plan, foresee, access and implement needed underground and surface needs. As Natomas track record shows they will take the necessary steps to achieve those goals as they observe and correct these long-standing problems.

VIOLATIONS RECEIVED AND PORTION OF OPERATIONS TO WHICH NOTICE APPLIES (See Drawing)

* N81-1-9-2	Berm between Cottonwood Creek and stockpile/ scalehouse area.
** C82-1-1-1	Cottonwood Creek (opposite stockpile).
** N82-2-4-1	Berm along parking area. Parking at upper and lower crossings.
* C82-7-1-1	Sediment pond (original).
* N82-7-5-1	Berm between Cottonwood Creek and stockpile/ scalehouse area.
* N82-7-8-2	Sediment pond (original).

These violations can be condensed into the following problem areas:

1. Foreign material in Cottonwood Creek;
2. Failure to maintain adequate drainage and sediment control, inadequately sized and constructed sediment pond and debilitated burms around Cottonwood Creek; and
3. An inadequate understanding of the educational and maintenance requirements associated with sediment control.

Solutions to the problem areas:

1. Extent 66" culvert north through mine property (see drawings);
2. Extend 66" culvert, implement approved sedimentation control plan. (Adequately sized and constructed sedimentation pond and 850' of 66" culvert have been installed.) (See drawings.); and

3. Natomas Trail Mountain Coal Company has formed a new management team, implemented an education program and have combined an inhouse/consultant firm maintenance protection program. (See enclosed letter.)

* This area of concern has been addressed by the installation of 850' of 66" culvert and the construction of a new adequately designed and sized sedimentation pond.

** This area of concern will be addressed by the 450' extension of 66" culvert.

MAINTENANCE AND PROTECTION PLAN

In retrospect, the underlying statement is: lack of proper maintenance of drainage control and control structures.

Natomas Trail Mountain Coal Company, with new leadership, has drawn-up and implemented an aggressive two part maintenance and protection program.

1. Natomas Trail Moutain has contracted with an independent engineering and consulting company during the transition of new mine management to:

   A. Twice monthly visit and physically inspect mine property;
   B. To work with Trail Mountain to correct, alleviate and/or foresee any compliance deficiencies.

2. Natomas Trail Mountain has empowered, educated and made responsible, several management personnel to protect and maintain:

   A. Drainage control and control structures;
   B. Roads;
   C. Signs and markers;
   D. Top soil;
   E. Permits;
   F. Hydrologic balance; and
   G. Etc.

NATOMAS
TRAIL
MOUNTAIN
COAL
COMPANY

April 11, 1983

State of Utah
Division of Oil, Gas and Mining
4241 State Office Building
Salt Lake City, Utah 84114

Dear Sirs:

Recently I have been put in full charge of all operations at Natomas Trial Mountain Coal Company of Orangeville, Utah. I am fully aware of the problems that have existed with DOGM in compliance areas and intend to deal with these problems.

Allen Childs, Mine Engineer, has been empowered to address any problems promptly. I believe you will be well satisfied with the future performance of Natomas Trail Mountain Coal. We are very concerned and will do everything possible to comply and establish a cooperative relationship with DOGM.

Sincerely,

NATOMAS TRAIL MOUNTAIN COAL

Joseph R. Fielder
Superintendent

JRF/ja

P.O. Box 551 Orangeville Utah 84537 a Natomas Coal Company subsidiary

NATOMAS
TRAIL
MOUNTAIN
COAL
COMPANY

April 11, 1983

Mr. Ronald W. Daniels, Deputy Directory
Division of Oil, Gas, and Mining
4242 State Office Building
Salt Lake City, Utah 84114

Dear Mr. Daniels:

In response to the "Pattern of Violations" for which the Division recommended that the Board issue a Show Cause Order, Natomas Trail Mountain Coal would like to express great concern and regret over its past performance. This concern prompted Natomas Trail Mountain to take serious and aggressive action to correct these problem areas even prior to the Division's notice. Monies were appropriated and 800 feet of 66 inch culvert and a new sediment pond were constructed by November of 1982. The result of this and other actions was total abatement of all violations received from December 1, 1981 through December 1, 1982.

The violations received by Natomas Trail Mountain that established a pattern concern themselves with drainage and sediment control in relationship with the Cottonwood Creek and the adjacent sedimentation pond. Drainage and sedimentation control problems have developed at the mine site due to the following reasons:

1. Restricted and limited surface area;
2. Past practices established prior to enforcement of the Act and before Natomas acquired the mine; and
3. Poor maintenance.

Currently Natomas Trail Mountain is under new leadership. A leadership who has committed to the following to eliminate future violations through:

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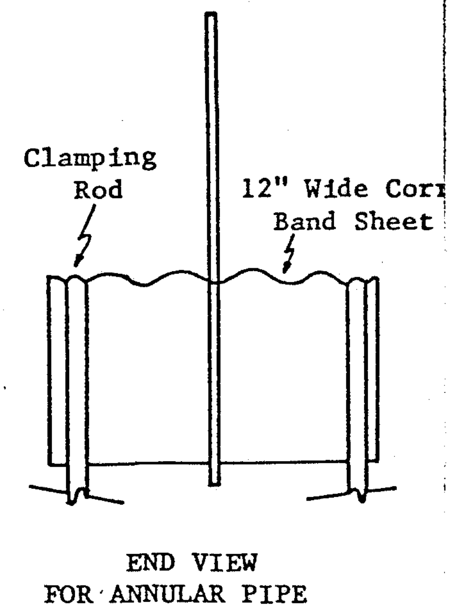
pond embankment of each pond to a width of five feet on both sides of the spillway and dewatering device up the full height of the embankment to protect the embankment from erosion.

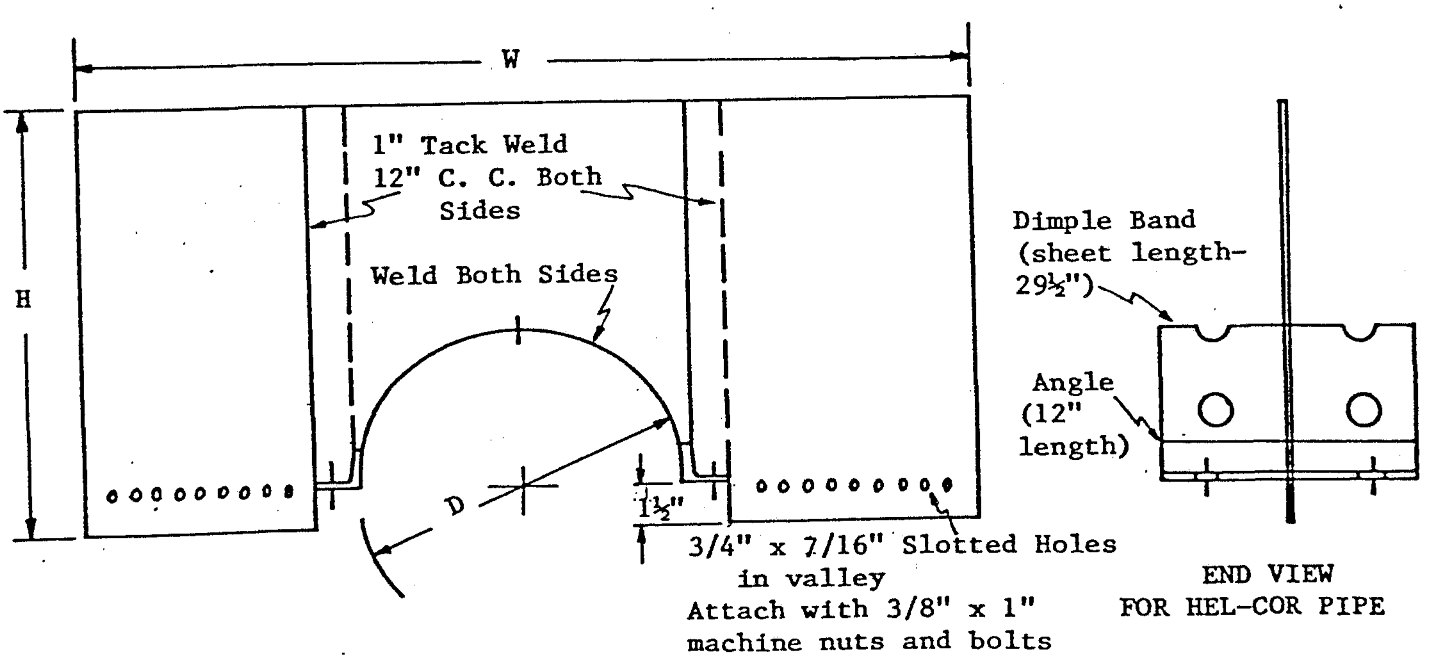
<u>Sediment Disposal Plans.</u> Federal and State regulations require that sediment, which has accumulated in the pond, be removed when 60 percent of the design sediment storage volume has been filled. The point at which cleanout becomes necessary can be marked with paint on the spillway riser following the construction of the pond. Sediment removed from the pond will be disposed within the drainage basin to the pond.

<u>Pond Reclamation.</u> Federal and State regulations require that areas disturbed by pond construction be stablized with an effective vegetative cover as soon as possible after disturbance. This cover should be composed of native and other plants which are adaptable to the site and provide soil stability. All disturbed areas should be seeded with the exception of the interior of the pond below the dewatering device level. Shallow rooting species should be used to preserve the integrity of the structure.

Size of Anti-Seep Collars

	Spillway	Dewatering Device
Metal Gauge	14	14
Width, inches	72	36
Height, inches	38	20





ONE HALF SHOWN - OTHER HALF IDENTICAL

Figure 7-17. Armco Corrugated Metal Anti-Seep Collar.

7.2 SURFACE WATER HYDROLOGY

As was explained under Section 7.1, OSM and DOGM regulations require that water monitoring programs be established in areas of underground coal mining to monitor the effects of mining activities and protect the hydrologic balance of such areas. This section of this chapter outlines the surface water hydrologic investigation conducted on the mine plan area owned by the Natomas Trail Mountain Coal Company.

7.2.1 Scope. The scope of this surface water section of this report is to describe the existing hydrologic conditions of the mine plan and adjacent areas and to describe the methods that have been and will be used to predict, monitor, and mitigate the impacts of mining. Sections within this surface water section of this report will cover the following major topics: methodology, existing surface water resources, surface water development, control and diversions, effects of mining on the surface water hydrologic balance, mitigation and control plans, and surface water monitoring plans.

7.2.2 Methodology. Information used in preparing the surface water hydrologic section of this report has been gathered by field investigations. Pertinent literature has been examined. Numerous water quality samples have been and will continue to be analyzed by a certified laboratory. Attachment 7A lists the laboratory methods used for sample analysis. Water rights have been determined by examining current records of the Utah Division of Water Rights.

The mean annual water yield from the Trail Mountain mine plan area was calculated by two separate methods and compared with an estimate of the mean annual water yield given in Jeppson et al. (1968) to increase the level of confidence. The first method of calculation, referred to as "Grunsky's Rule", was originally developed by Grunsky (1908) and later adapted by Sellars (1965). In accordance with this method, the average annual water yield can be determined from

$$Q = \alpha P^2 \ [\text{for } P \leq 1/(2\alpha)] \qquad (7\text{-}1)$$

or

$$Q = P - 1/(4\alpha) \quad [\text{for } P \geq 1/(2\alpha)] \qquad (7\text{-}2)$$

where Q is the mean annual water yield, in inches; P is the normal annual precipitation, in inches; and α is the runoff coefficient, in inches^{-1}. Alpha (α) was determined from guidelines set forth by Hawkins (1976). The second method of calculation is known as Ol'deKop's formula (Sellars, 1965). According to this method, the mean annual water yield is determined from:

$$Q = P - E_o \tanh \frac{P}{E_o}$$

where Q and P are as previously defined and E_o is the annual potential evapotranspiration, in inches.

Estimates of peak flow recurrence intervals for ephemeral streams in the mine plan area were determined from techniques presented by Fields (1975). According to Fields (1975), the 25- and 50-year recurrence interval flood discharge of Utah streams are related to channel geometry characteristics. Specifically, for the mine plan area, the following relationships were found to apply:

$$q_{25} = 3.7W^{1.57} \qquad (7\text{-}4)$$

28% error

and

$$q_{50} = 3.9W^{1.58} \qquad (7\text{-}5)$$

30% error

where W is the width of the channel bar cross-section in feet and q_{25} and q_{50} are the 25- and 50-year recurrence interval flood discharges in cfs, respectively. The respective standard errors associated with Equations 7-4 and 7-5 are 28 and 33 percent.

The runoff volume resulting from a particular rainfall depth was determined using the runoff curve number technique, as defined by the U.S. Soil Conservation Service (1972). According to the curve number methodology, the algebraic and hydrologic relationship between storm rainfall, soil moisture storage, and runoff can be expressed by the equations

$$Q = \frac{(P - 0.2S)^2}{P + 0.8S} \qquad (7\text{-}6)$$

and

$$CN = \frac{1000}{10 + S} \quad (7\text{-}7)$$

where Q is the direct runoff volume in inches, P is the storm rainfall depth in inches; S is a watershed storage factor in inches (defined as the maximum possible difference between P and Q), and CN is a dimensionless expression of S referred to as the curve number. Curve number values were chosen using information supplied by the U.S. Soil Conservation Service (1972), Hawkins (1973), and personal hydrologic judgement following field observations. Weighted curve numbers were used for hetrogeneous areas. Values of P were obtained for selected durations and return periods from Miller et al. (1973). A 24-hour storm was used for design purposes.

Equation 7-6 is based upon the assumption that $I_a = 0.2S$, where I_a is the initial abstraction from storm rainfall, defined as the rainfall which must fall before runoff begins (i.e. to satisfy interception, evaporation, and soil-water storage). Therefore, determination of runoff from Equation 7-6 is valid only when $P > I_a$ or $P > 0.2S$. Below this point, no runoff can occur.

Estimates of the peak discharge to be expected from various precipitation events were made using the unit hydrograph procedure developed by the U.S. Soil Conservation Service (1972). Figure 7-3 shows a runoff hydrograph and the associated terminology.

A hyetograph of a single block of rainfall excess with duration D is shown in the upper portion of the figure. The lower portion of the figure contains the resultant runoff hydrograph. For runoff from excess rainfall, the area under the hydrograph curve and the area enclosed by the rainfall hyetograph represent the same volume of water (Q). The peak flow rate for the hydrograph is represented by Q_p, while t_p represents the time to peak, flow from the start of the hydrograph to Q_p. The base time (t^b) is the duration of the hydrograph. The time from the center of mass of rainfall excess to the peak of the runoff hydrograph is the lag time (t_L).

The time of concentation (t_c), (not shown on Figure 7-3) is defined as the time for flow from the hydraulically most remote point in a basin to reach the basin outlet.

Time to peak, t_p, is assumed to be a function of watershed lag (t_L) which is determined according to the equation:

$$t_L = \frac{(\ell^{0.8})\ (S + 1)^{0.7}}{1900\ Y^{0.5}} \qquad (7\text{-}8)$$

where t_L is the watershed lagtime in hours, ℓ is the hydraulic length or the length of the mainstream to the farthest divide in feet, S is as previously defined, and Y is the average watershed slope in percent. Values of Y were obtained by using methods outlined by Craig and Rankl (1977). The hydraulic length was taken from an appropriate topographic map while S was determined from Equation 7-7 once the runoff curve number was estimated.

According to the U.S. Soil Conservation Service (1972), the watershed lag time is equal to $0.6t_C$ and the time of concentration (t_C) is equal to $1.5t_p$. Combining these two expressions, it can be seen that:

$$t_p = 1.11\ t_L \qquad (7\text{-}9)$$

where both variables are as previously defined.

The peak discharge constant used in the dimensionless unit hydrograph method is determined according to the equation:

$$q_p = \frac{484\ A\ Q}{t_p} \qquad (7\text{-}10)$$

where q_p is the unit hydrograph peak flow rate in cubic feet per second, A is the drainage area in square miles, Q is the runoff volume in inches (as determined by Equation 7-6), t_p is as previously defined in hours, and 484 is a conversion factor. The rainfall distribution for the 24 hour storm duration were generated from the theoretical NOAA Type II storm distribution shown in Figure 7-4.

Dimensionless unit hydrographs are developed by simulating many natural unit hydrographs using the time to peak and the peak discharge constant. Haan (1970) proposed a dimensionless unit

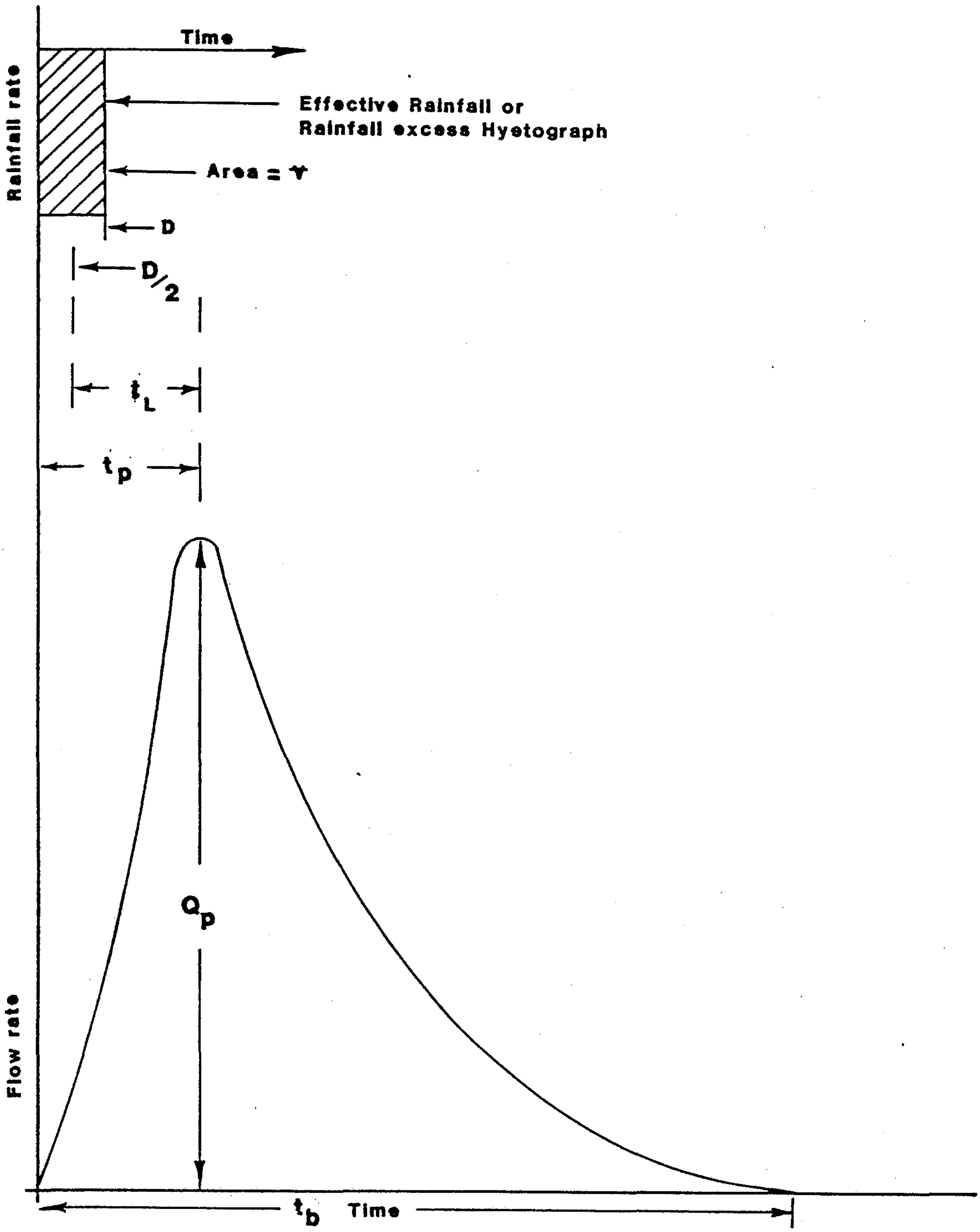


FIGURE 7-3 Hydrograph Terminology

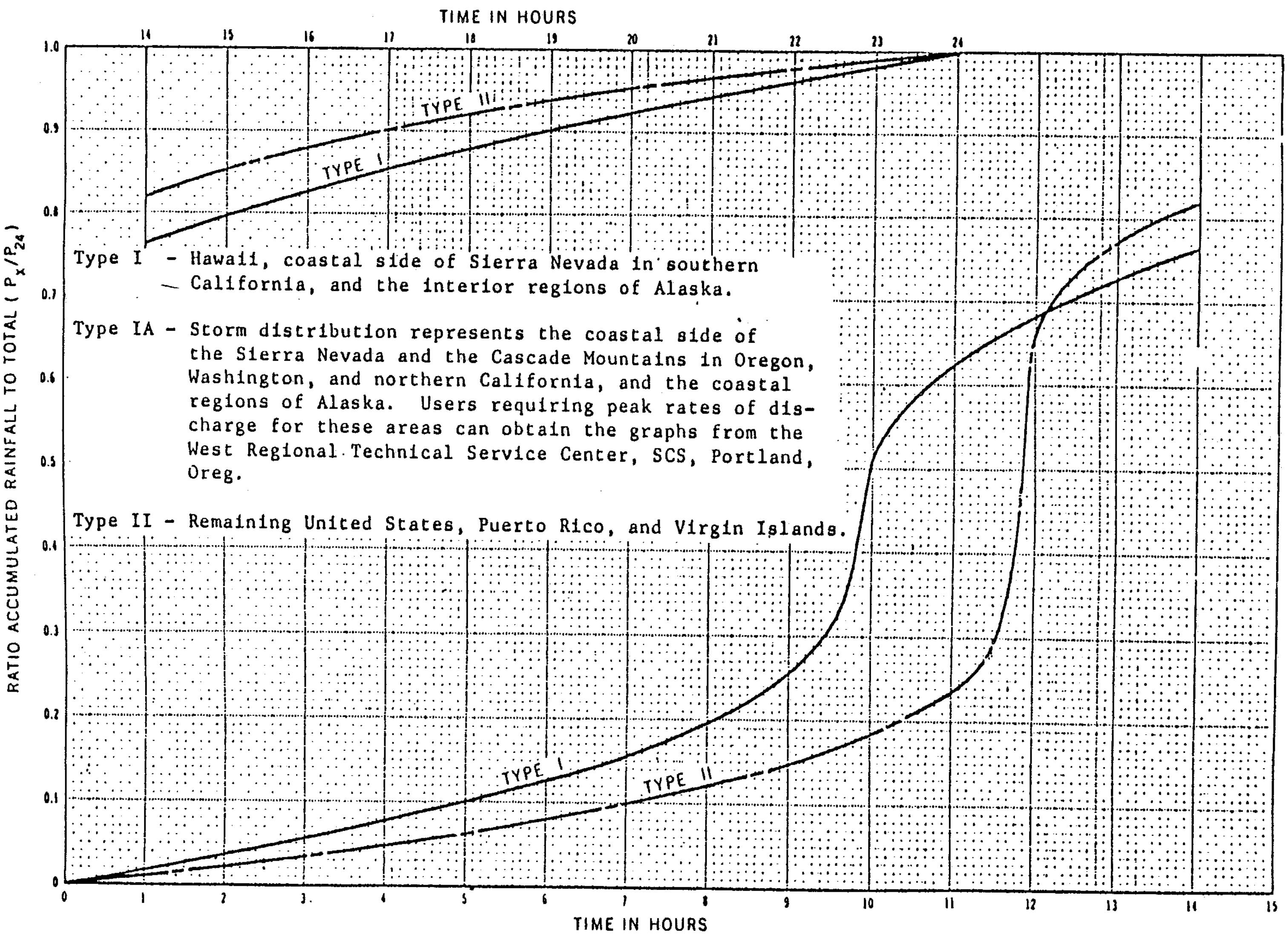


Figure 7-4. Twenty-four-hour rainfall distributions (from Kent, 1973).

hydrograph based on the gamma function:

$$\frac{q(t)}{q_p} = \left[\frac{t}{t_p} * e^{1-t/t_p} \right]^{(C_3 t_p)} \qquad (7\text{-}11)$$

where q(t) is the hydrograph ordinate at time t, q_p and t_p are as previously defined, and C_3 is a parameter defined by:

$$Q = q_p \; t_p \left[\frac{e}{C_3 \; t_p} \right]^{C_3 \; t_p} \Gamma \, (C_3 \; t_p) \qquad (7\text{-}12)$$

where Q is the runoff volume (one inch for a unit hydrograph) and represents the gamma function.

Figure 7-5 shows how shape of the hydrograph defined by equation 7-11 changes as $C_3 \; t_p$ changes. The higher the value of $C_3 \; t_p$ the sharper the peak of the hydrograph.

The dimensionless unit hydrograph method involves the development of a runoff hydrograph from a complex rainstorm. The storm is divided into blocks of uniform intensity of duration D. Values of D must be less than or equal to t_p. Practically the selection of D as a multiple of t_p will ensure that the peak will be encountered.

Rainfall excess is generated from the rainfall depths of duration D and the rainfall-runoff relationship expressed in equation 7-6. The rainfall excess from each increment D is then multiplied by the unit hydrograph ordinates to produce a component hydrograph. Each of the component hydrographs are then lagged by a time

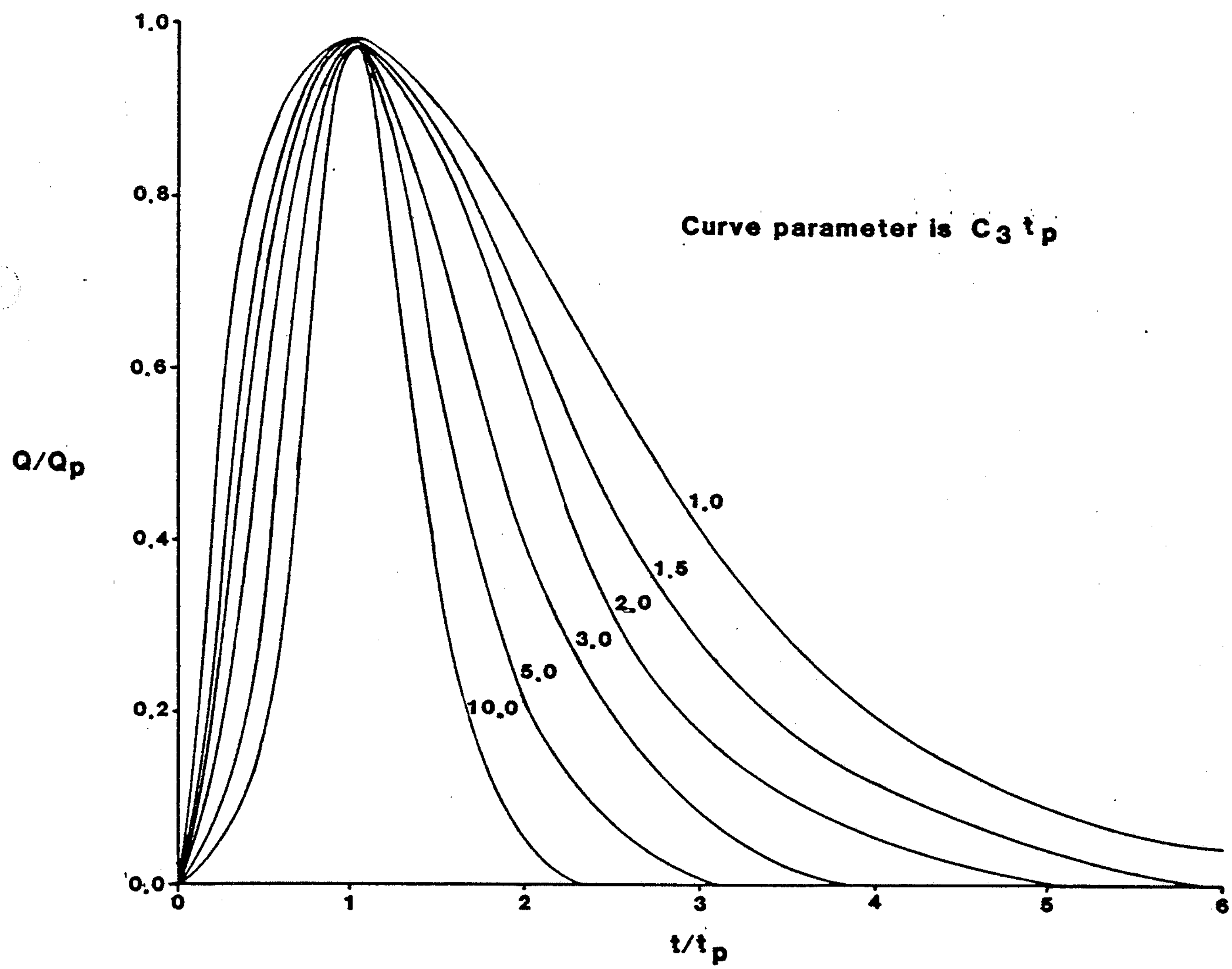


FIGURE 7-5 Variation of hydrograph shape with $C_3\ t_p$

increment D and are concurrently summed to produce the synthetic runoff hydrograph.

A more complete discussion of the unit hydrograph method can be found in Chow (1964) or Haan and Barfield (1977).

Following the determination of a given peak discharge, design sizes for culverts used for runoff diversions and conveyance were determined using methods derived by the U.S. Soil conservation Service (1972) and illustrated in Figure 7-6.

Sedimentation storage requirements were determined using a disturbed acreage factor of 0.05 ac-ft. of sediment per acre disturbed.

Open channel flow capacities were determined using the Manning equation. According to this method:

$$V = \frac{1.486}{n} R^{0.67} S^{0.50} \tag{7-13}$$

where V is the velocity in feet per second, n is the Manning roughness coefficient, R is the hydraulic radius in feet, (defined as the area divided by the wetted perimeter), and S is the hydraulic slope, in feet per feet. Estimates of the roughness coefficient were determined from tabular information presented by the U.S. Department of Transportation (1979). The velocity obtained by equation 7-14 was converted to a flow rate using the

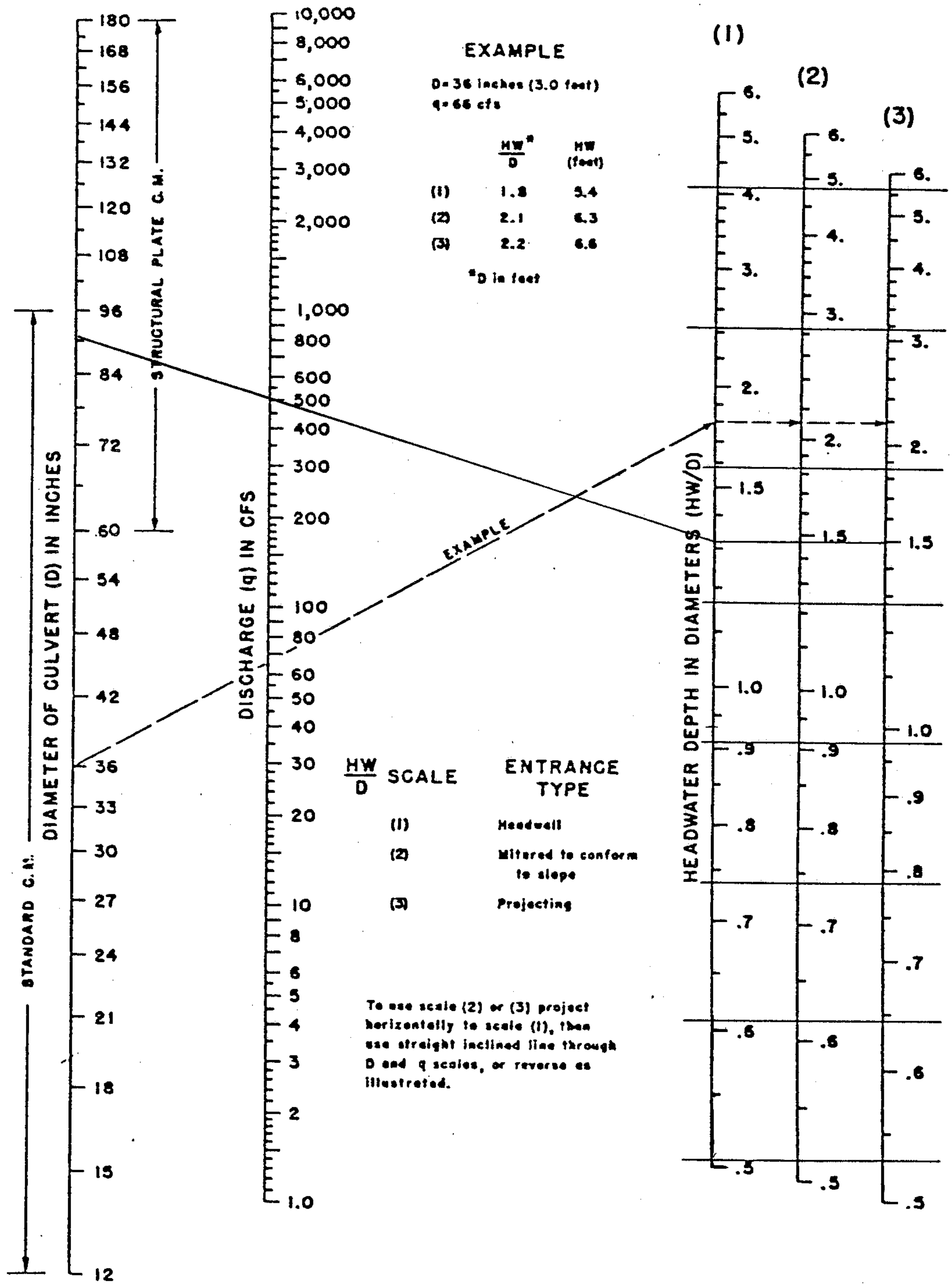


Figure 7-5. Headwater depth for corrugated metal pipe culverts with inlet control (U.S. Soil Conservation Service, 1972).

continuity equation which states that:

$$q = AV \tag{7-14}$$

where q is the discharge, in cubic feet per second; A is the cross-sectional area of flow in square feet, and V is the velocity in feet per second. A maximum permissible velocity of 5 feet per second for unlined channels was assumed.

Those sections of diversion channels having velocities in excess of 5 feet per second were designed with rock riprap linings in accordance with methodologies presented by the U.S. Department of Transportation (1975). In accordance with this methodology, the maximum permissible depth of flow for a channel lined with rock riprap is determined by:

$$d_{max} = \frac{5\ (D_{50})}{S_o} \tag{7-15}$$

where d_{max} is the maximum permissible depth of flow, in feet; D_{50} is the mean rock diameter (or the particle size gradation for which 50 percent of the mixture is finer by weight) in feet, is the unit weight of water in pounds per cubic feet, and S_o is the channel slope, in feet per foot. The mean rock diameter (D_{50}) in each case was assumed from which the maximum permissible depth was determined. The channel configuration was then determined such that the maximum permissible depth at the design flow would not be exceeded.

7.2.4.2 Sedimentation Control Structures and Diversions. One sedimentation pond with corresponding runoff control facilities will be required to provide sediment control for the Trail Mountain Mine. The layout of the sedimentation control plan, including pond location, pond drainage area boundary, ditches and berms are illustrated in Figure 7-11.

A sedimentation pond exists on site presently, however, it is inadequate due to instability and sizing. Reconstruction and enlargement of the pond is necessary to comply with DOGM's regulations. Specific design details for the sedimentation pond reconstruction and channels conveying runoff to the pond are described in this section. Some conveyance facilties associated with the runoff control plan have already been constructed. These facilities will be utilized, where feasible.

Conveyance Facilities Design The sedimentation pond will be sized to contain runoff from the undisturbed areas draining onto the mine site. As shown in Figure 7-11, no diversion ditches for undisturbed area runoff are proposed. Only runoff from the side-canyon above the operation will be bypassed through a culvert. The side canyon culvert was designed to pass runoff from the 10-year, 24-hour storm (2.4 inches).

A diversion ditch conveys runoff from the disturbed area to the sedimentation pond. The ditch was designed to pass runoff from the 10-year, 24-hour storm (2.4 inches). The diversion culverts for Cottonwood Creek were designed and sized by the U.S. Forest Service and the Division of Oil, Gas, and Mining to pass runoff from the 50 year, 24-hour storm (3.2 inches).

The diversion ditch has been designed assuming the trapezoidal cross section illustrated in Figure 7-12. A maximum permissible velocity of 5.0 feet per second was assumed in all cases for diversion ditches without a riprap lining. A Mannings roughness coefficient (n) of 0.03 was assumed to be representative of natural conditions in the area of the surface facilities. Diversions with riprap have a higher roughness coefficient. Peak flows and peak flow design related information for the diversion ditch and culverts are contained in Table 7-7.

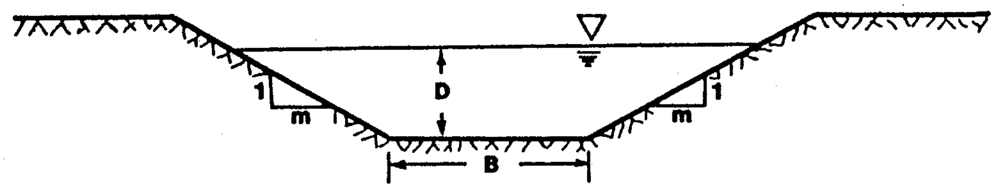


Figure 7-12. Trapeziodal diversion cross-section to be used in runoff control for the Trail Mountain Mine.

Table 7-7. Peak flows and peak flow design related information for diversion ditches and culverts.

Structure	Disturbed Area ac	Undisturbed Area ac	Total Area mi^2	Weighted Cn	Design Storm in	S in	Runoff (Q) in	Hydraulic Length ft	Average Watershed Slope %	Watershed Lag hr	t_p hr	ΔD hr	$\frac{484AQ}{t_p}$	C t 3 P	Peak Flow (q) cfs
Cottonwood Canyon Culvert	---	11,969	18.7	57	3.2	7.54	0.31	40,000	36.5	1.74	2.09	1.0	~~1341.5~~	3.70	510.0
Side Canyon Culver	---	366	0.57	80	2.4	2.5	0.82	6,375	49.12	0.199	0.22	0.04	1032	.83	80.1
Sediment Pond Diversion I	5.0	18.0	0.04	78.5	2.4	2.74	0.75	1,900	52.7	0.08	0.09	0.08	144.4	3.91	20.1

The exact relationship between runoff curve numbers and precipitation depth is undetermined. Therefore, based on vegetative types, hydrologic soil grouping, and ground cover density (as outlined by the U.S. Soil Conservation Service, 1972) a curve numver of 90 was assumed for disturbed areas and 75 for undisturbed areas.

Design criteria and calculation results for sizing the diversion ditch are presented in Table 7-8. Also contained in Table 7-8 are the required mean rock diameter (D_{50}) for those channels (with velocities in excess of five feet per second) requiring a rock riprap lining.

Sedimentation Pond Design. As mentioned previously, one sedimentation pond will be required to provide sediment control for the surface facilities of the Trail Mountain Mine. The sedimentation pond was designed to contain sediment storage volume from 0.05 acre-feet of sediment per acre of disturbed area. Sediment will be cleaned out at 60 percent of the sediment storage level. Sediment yield for the 5.5 acre disturbed area will be 0.28 acre-feet.

Spillway capacity requirements for the sedimentation pond was based on runoff from the 25-year, 24-hour storm (2.9 inches). Table 7-9 contains the volume and spillway capacity requirements for the pond as well as additional design related information not

Table 7-8. Design criteria and calculation results for the diversion ditches.

Diversion Ditch No.	1a*	1b*
Manning's, n	0.038	0.03
Maximum Channel Slope (Smax) ft/ft	0.093	0.082
Channel Side Slope (m)	1.5	4.0
Bottom Width (B), ft	0.0	20.0
Flow Depth (D) at Smax, ft	1.30	0.203
Flow Area at Smax, ft^2	2.53	4.22
Wetted Perimeter at Smax, ft	4.69	21.67
Hydraulic Radius at Smax, ft	0.54	0.19
Velocity at Smax, fps	7.94	4.76
Discharge, cfs	20.1	20.1
Minimum Channel Slope (Smin), ft/ft	0.083	0.0465
Flow Depth (D) at Smin, ft	1.16	0.24
Freeboard, ft	0.5	0.25
Total Required Channel Depth, ft	2.04	0.50
Mean Rock Diameter (D_{50}) for Channels requiring riprap, ft	0.75	----

*Note: Diversion No. 1 will consist of two different sections. The lower section will be constructed below the scale house. The upper section will be constructed upper stream from the scale house.

Table 7-9. Sedimentation pond storage and spillway capacity requirements.

Variable	
Disturbed Area, in acres	5.5
Undisturbed Area, in acres	18.0
Total Area (A), in mi^2	0.037
Weighted Curve Number	78.5
S, in inches	2.74
Time Increment of Excess Rainfall	0.08 hrs.
25-year, 24-hour Runoff (Q), in inches	2.9
Hydraulic Length (ℓ), in feet	1900 feet
Average Watershed Slope (Y), in percent	52.7%
Time of Concentration (T_c), in hours	0.13
T_p, in hours	0.09
Peak flow constant	208.79
25-year, 24-hour Peak Inflow, in cfs	27.5
10-year, 24-hour Runoff, in inches	0.75
10-year, 24-hour Runoff, in ac-ft.	1.49
Storage Requirement, in ac-ft.	0.28
Pond Storage Requirement, in ac-ft.	1.77

illustrated on Figure 7-11. Runoff storage volume requirements were based on the 10-year, 24-hour design storm.

The pond design details for the sedimentation pond are illustrated in Figure 7-13 with the stage-capacity curve for the pond given in Figure 7-14. The sedimentation pond will consist of a sediment storage pool, a dead pool, and a runoff control pool equal to the inflow volume from a 10-year, 24-hour storm (2.4 inches). The Utah Division of Oil, Gas, and Mining requests that a dewatering device be placed in the pond to draw the pond level down to the bottom of the runoff control pool in anticipation of a future runoff event. This dewatering device must be placed above the top of the sediment storage pool. However, the Utah Division of Health requires that no dewatering device be placed within three feet of the top of the sediment cleanout level (60 percent). Thus, a dead storage pool has been created in order to meet the requirements of both agencies.

The proposed principal and emergency spillway system consists of a corregated metal riser and conduit, with an anti-vortex device, trash rack, and anti-seep collars. Utilizing Equation 7-16, which defines orifice flow, the discharge capacity of the riser-conduit combination with a diameter of 48 inches was found adequate in passing the peak inflow resulting from the 25-year, 24-hour storm (see Figure 7-15).

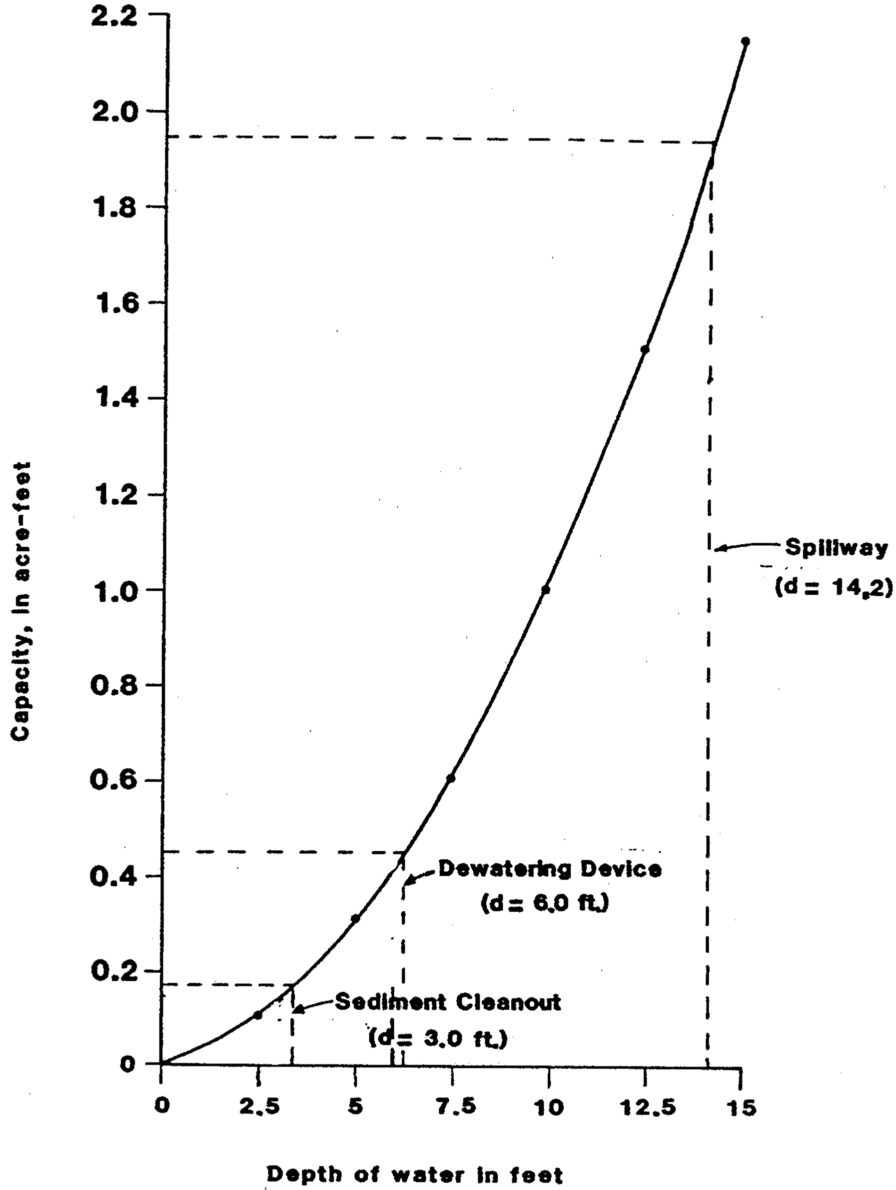


Figure 7-14. Stage-capacity curve for Sedimentation Pond.

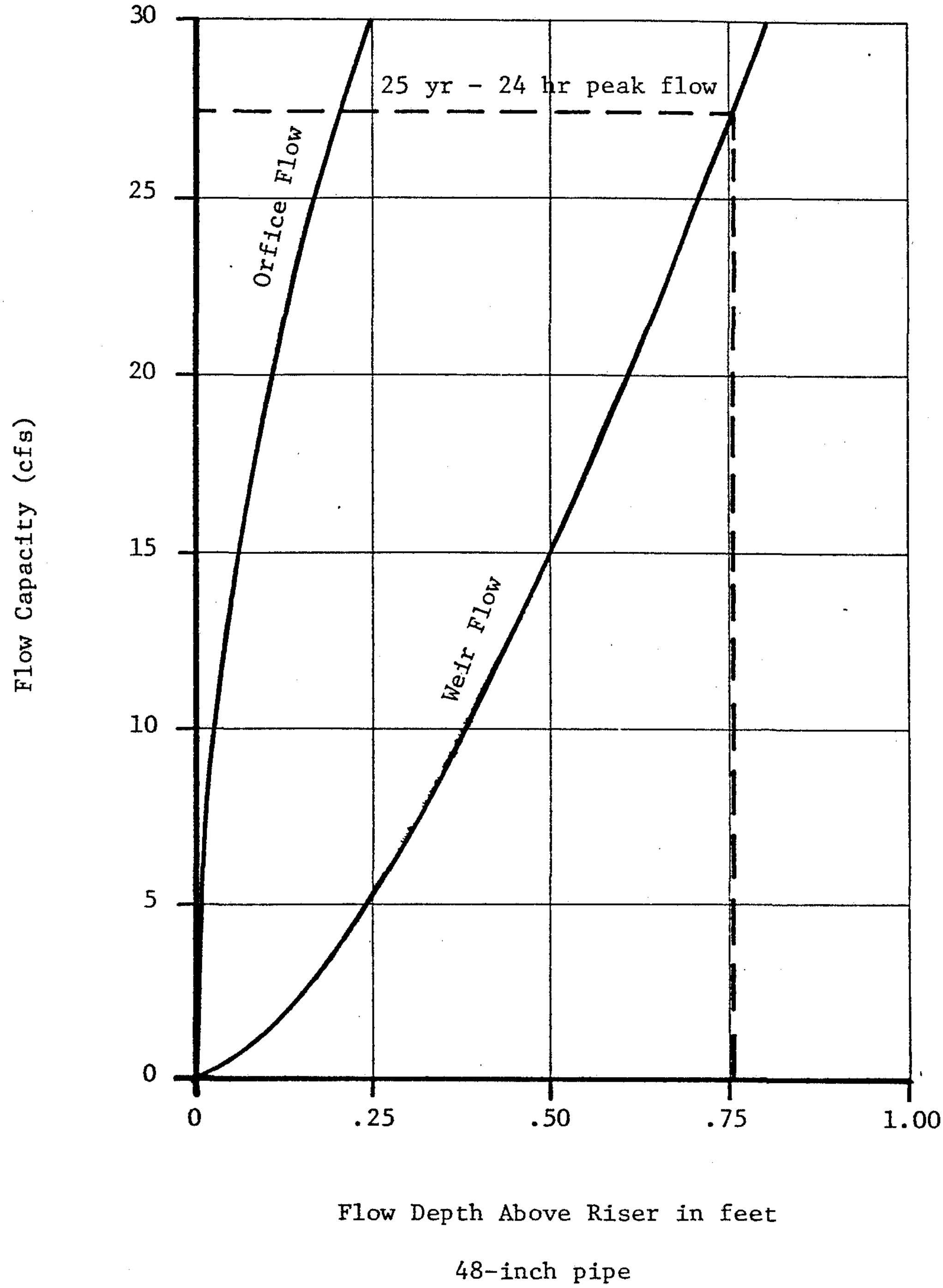


Figure 7-15. Stage-discharge curves for the 48-inch spillway riser and conduit.

Orifice flow occurs when the flow is restricted by the opening and can be determined as

$$q = CA\ (2gH)^{1/2} \qquad (7\text{-}16)$$

where q is as previously defined; C is a coefficient dependent upon the orifice geometry (0.6 in this case); A is the cross sectional area of the opening, in square feet; g is the gravitational constant (32.2 feet per second squared); and H is the head above the orifice inlet, in feet. The orifices considered are the riser inlet and the inlet of the conduit leading from the riser through the pond embankment.

The total embankment height was obtained by adding the stage at full storage capacity, the head of water over the spillway under design flow conditions, the required freeboard height (1.0 foot), and a five percent settlement allowance. The embankment top width will not be less than (H + 35)/5 where H is the height of the embankment, in feet. Table 7-10 summarizes the design specifications for the sedimentation pond.

The sedimentation pond is to be constructed between the excavated slope of the old pond and a new embankment to be constructed over the proposed 66 inch culvert. The excavated slope of the old pond is approximately equal to 1.06H:1V. To obtain the necessary pond storage capacity, the remaining inside slopes of the pond were designed at 2h:1V.

Table 7-10. Design values of the sedimentation pond.

	Design	Constructed
Sediment Storage Volume (ac-ft.)	0.28	
Dead Pool Storage Volume (ac-ft.)	0.28	
Runoff Storage Volume (ac-ft.)	1.49	
Total Storage Volume (ac-ft.) (Design Volume)	1.95	
Embankment Height at Design Volume * (ft.)	14.2	15.3
Spillway Capacity (cfs)	27.5	
Spillway Diameter (inches)	48	
Head Above Spillway Crest at Design Discharge (ft.)	0.76	
Required Freeboard (ft.)	1.0	
Required Total Embankment Height* (ft.)	15.96	
Required Total Embankment Height* Including 5% Settlement Allowance (ft.)	17.46	14.8
Actual Embankment Height of Existing Ponds (ft.)	17.5	
Total Width (ft.)	11-13	

* As measured from the upstream toe of the embankment.

The pond will be lined to prevent seepage and piping with 18 inches of an 10:1 mixture of the embankment material and bentonite, respectively.

Both the spillway and dewatering device should be constructed of similar materials, with the dewatering device consisting of a 12-inch corrugated metal riser and an 8-inch conduit drainline, anti-vortex device, trash rack, and anti-seep collars. The anti-vortex will also act as a skimming device by not allowing water to be pulled directly from the surface of the pond. A water control gate valve will be located at the end of the 8-inch diameter corrugated metal conduit within the 48-inch spillway within the pond embankment to allow efficient water release. This is necessitated by the facts that:

1) The water control gate valve must be installed in the manhole/spillway to allow access to the valve;
2) The location of the riser does not allow access to the gate if placed at the extreme inlet;
3) Gates are apparently not available which can be attached between two culverts in a watertight manner; and
4) It is desirable to allow access to the control gate for maintenance purposes.

The control gate operator mechanism will be located above the spillway cover. The operating device will be locked and the key kept in the possession of one individual in order to satisfy the desires of the Utah Division of Health. Access to the gate for maintenance can be made via a ladder or rebar rungs which have been welded to the spillway side.

Sufficient space must be available in the pond to completely detain the runoff resulting from the 10-year, 24-hour storm. At the same time, sufficient settling time must be allowed in order to meet applicable effluent standards in the discharged water. It is therefore, suggested that water in the pond be released through the dewatering device after 14 days, unless there is a good probability of occurrence of a runoff producing storm prior to that time, under which condition the water should be released before the storm occurrence. This will allow sufficient time for all but the fine clay and colloidal particles to settle (U.S. Environmental Protection Agency, 1976).

Anti-seep collars have been proposed based on methods outlined by the U.S. Environmental Protection Agency (1976). Figure 7-17 outlines details of the proposed anti-seep collars with spacing requirements shown in Figure 7-13. The corrugations should be installed vertically with a continuous weld. It must be specified whether annularly or helically corrugated pipe is used for the conduit when ordering the collars.

Riprap shall be placed in the inlet channels and below the outlet conduit of the pond to dissipate energy and reduce erosion potential. Riprap shall also be placed on the inside slope of the

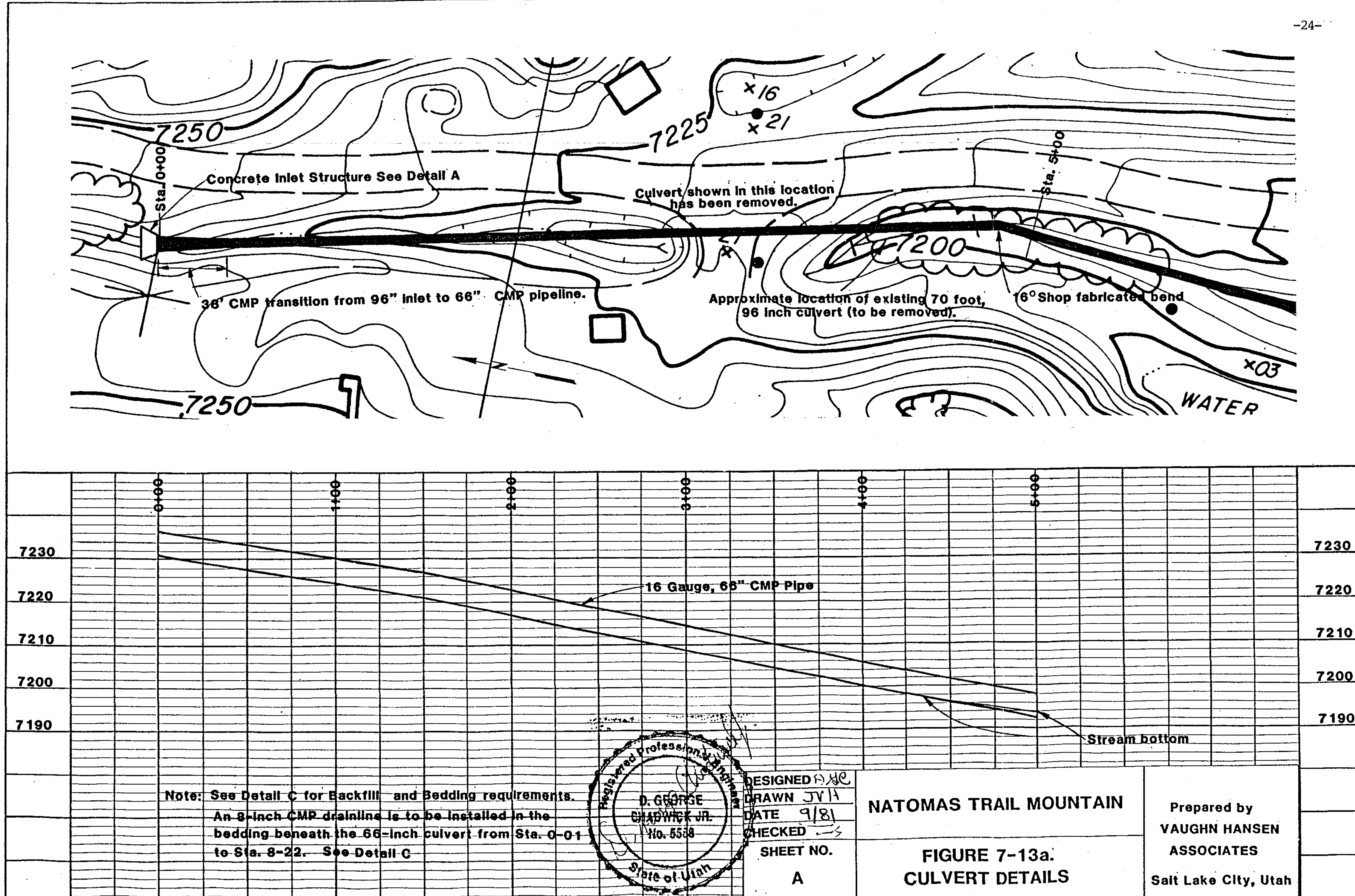
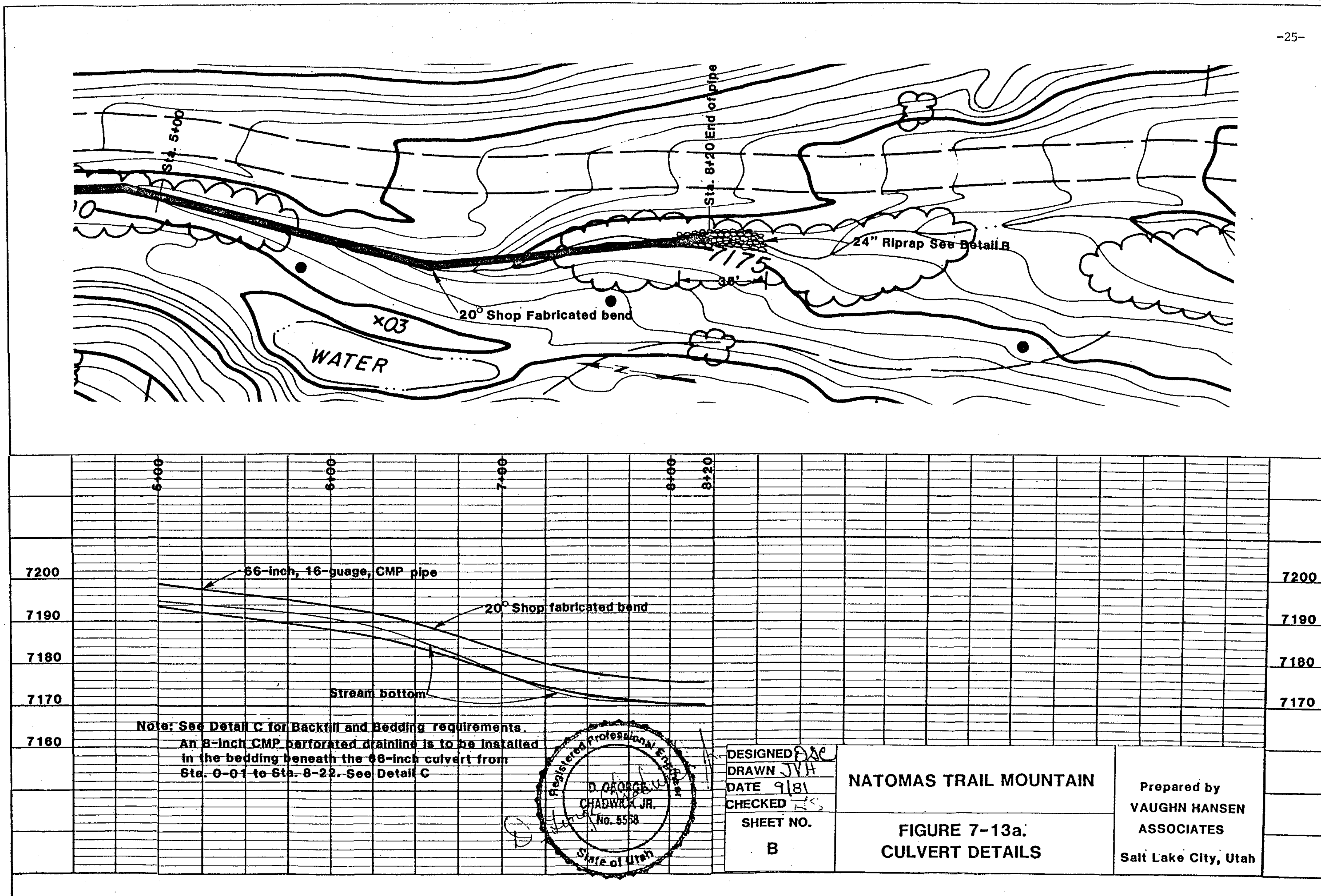


FIGURE 7-13a.
CULVERT DETAILS


Sta. 5+00
Sta. 8+20 End of pipe
24" Riprap See Detail B
7175
38'
20° Shop Fabricated bend
×03
WATER
5+00
6+00
7+00
8+00
8+20
7200
7190
7180
7170
7160
66-inch, 16-guage, CMP pipe
20° Shop fabricated bend
Stream bottom
Note: See Detail C for Backfill and Bedding requirements.
An 8-inch CMP perforated drainline is to be installed
in the bedding beneath the 66-inch culvert from
Sta. 0-01 to Sta. 8-22. See Detail C
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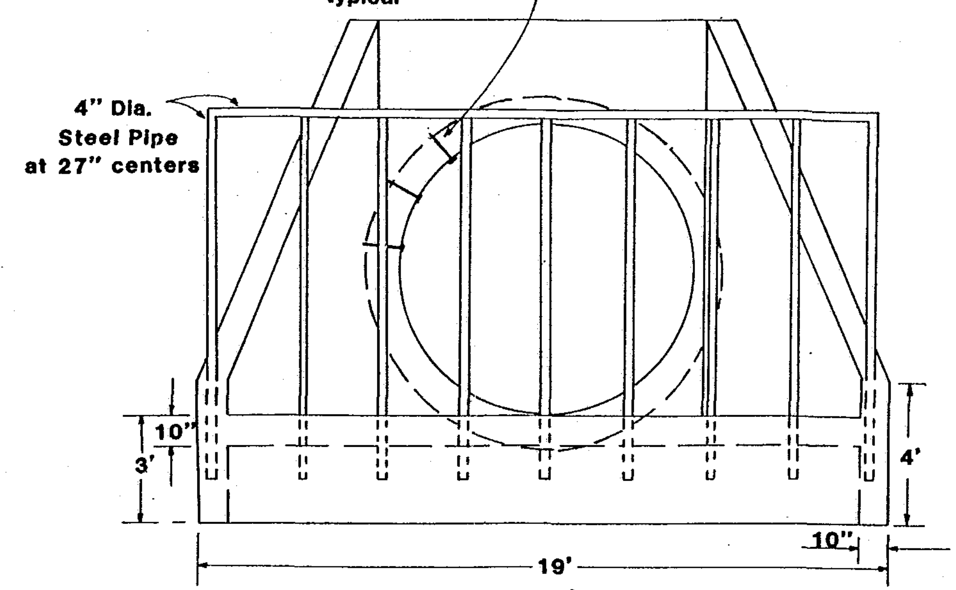
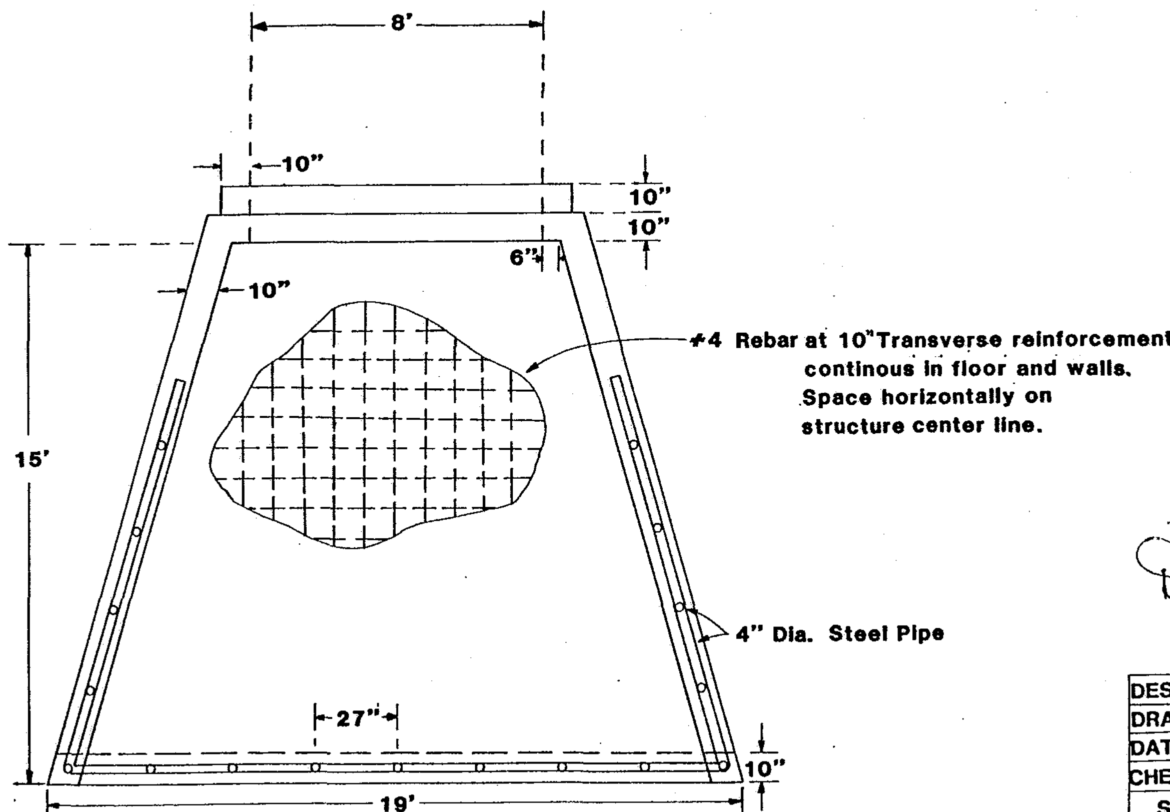
No. 5568
State of Utah
DESIGNED
DRAWN JVH
DATE 9/81
CHECKED
SHEET NO.
B
NATOMAS TRAIL MOUNTAIN
FIGURE 7-13a.
CULVERT DETAILS
Prepared by
VAUGHN HANSEN
ASSOCIATES
Salt Lake City, Utah

DETAIL A Inlet Structure

Note: For Trash Racks on sidewall
See side view



Front View



Top View

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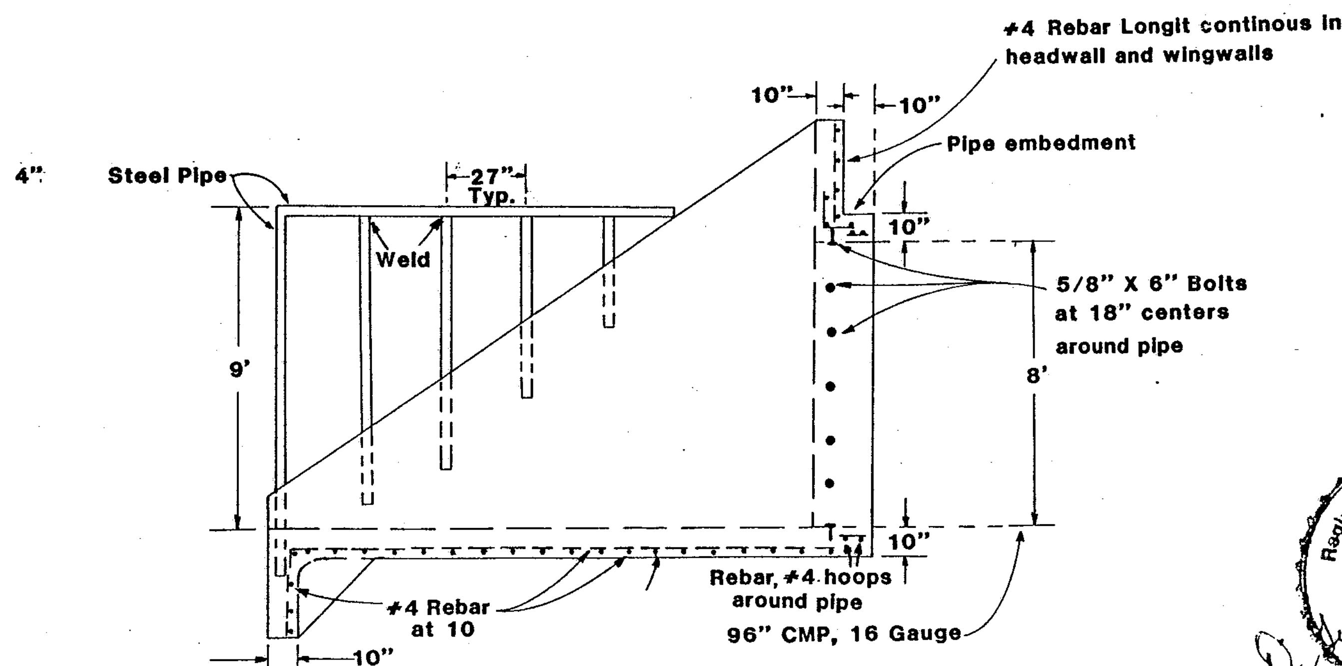
DESIGNED DGC DRAWN JVH DATE 9/81 CHECKED TS	NATOMAS TRAIL MOUNTAIN	Prepared by VAUGHN HANSEN ASSOCIATES Salt Lake City, Utah
SHEET NO. C	FIGURE 7-13a. CULVERT DETAILS	

DETAIL A (continued) Inlet Structure



Side View

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DESIGNED DGC	NATOMAS TRAIL MOUNTAIN	Prepared by VAUGHN HANSEN ASSOCIATES Salt Lake City, Utah
DRAWN JVH		
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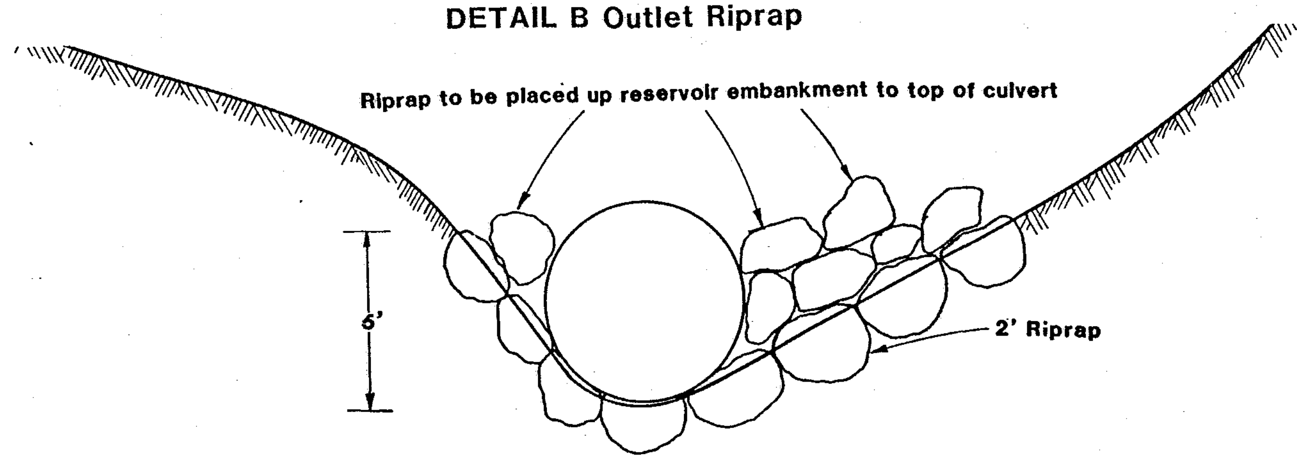
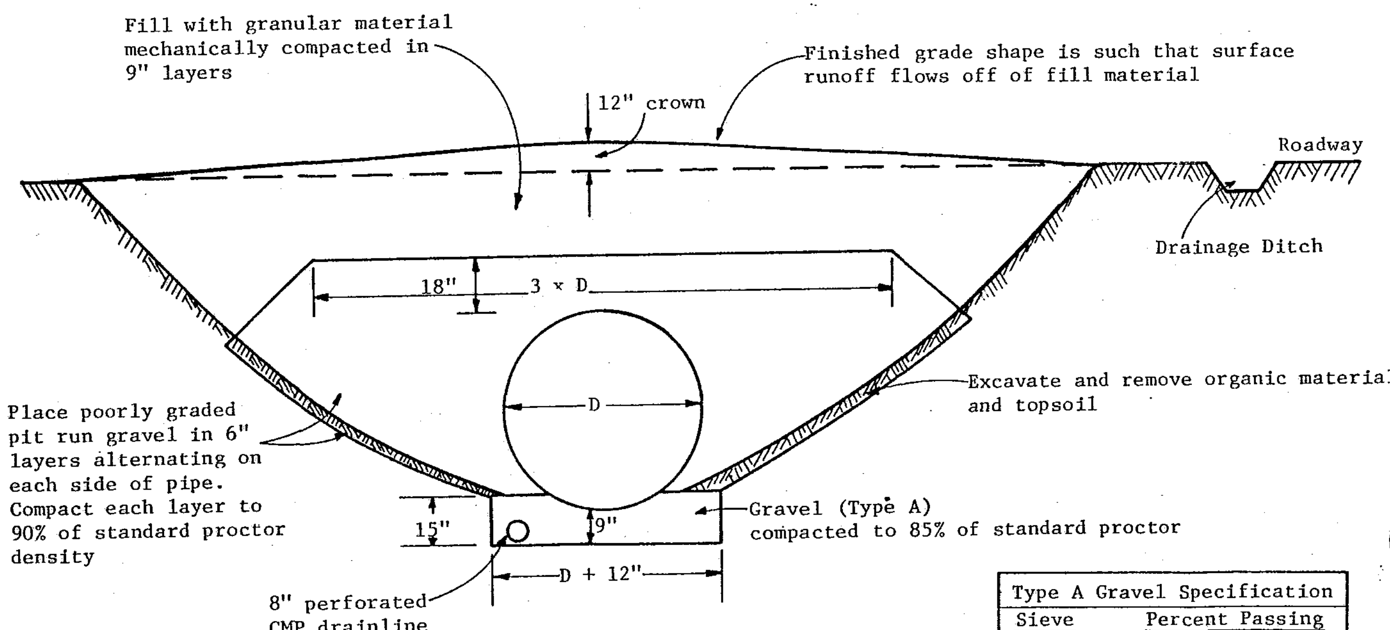
SHEET NO. D	FIGURE 7-13a. CULVERT DETAILS	

DETAIL B Outlet Riprap



DETAIL C Typical Bedding Details



Typical Bedding Details

Type A Gravel Specification	
Sieve	Percent Passing
1½" sieve	100
1" sieve	90-100
3/8" sieve	25-100
No. 4 sieve	10-100
No. 16 sieve	5-80
No. 50 sieve	0-30
No. 100 sieve	0-10

$Cu = \frac{D60}{D10}$ greater than 4

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DESIGNED DGC DRAWN JVH DATE 9/81 CHECKED ??	NATOMAS TRAIL MOUNTAIN	Prepared by VAUGHN HANSEN ASSOCIATES Salt Lake City, Utah
SHEET NO. E	FIGURE 7-13a. CULVERT DETAILS	