FILE ACT/007/007 #2

0005

KAISER STEEL

KAISER STEEL CORPORATION
SUNNYSIDE COAL MINES
SUNNYSIDE, UTAH 84539
TELEPHONE 801-888-4421

RECEIVED
SEP 14 1984
DIVISION OF OIL GAS & MINING

To Mary
JIM
SEP 17 1984

September 12, 1984

Mr. James W. Smith, Jr.
Administrator MRD&RP
Division of Oil, Gas, & Mining
4241 State Office Building
Salt Lake City, Utah 84114

Dear Mr. Smith:

Re: Additional Technical Deficiencies
Sunnyside Mines, ACT/007/007
Carbon County, Utah

Enclosed are responses to UMC 805.11, 817.43, 817.45, 817.46, and 817.47. Response to UMC 817.101 which involves the stability of highwalls is still in the hands of an engineering consultant.

Sincerely yours,

Douglas C. Pearce

Douglas C. Pearce
Mine Engineer

DCP:th

Enclosures

- only 1 copy of response received
- made additional copies for circulation to review team
- will contact Doug Pearce for total 14 copy response to all deficiencies. MB 9/18/84

UMC 805.11 Amount and Duration of Performance Bond

The applicant has detailed the costs. However, there are areas which were omitted that must be addressed.

Deficiencies

1. The applicant must resolve the road discrepancies and revise the bond as needed.

2. The applicant must provide additional backfilling and grading information and revise the bond estimate as needed. This information must include a regrading plan for the borrow area and a specific plan for covering of coal seams exposed in the facilities area. The bond estimate must reflect the additional costs.

3. The coal waste disposal plan must be approved and the bond estimate adjusted accordingly.

4. The bond estimate needs a summary page for the entire estimate.

5. Will the rail lines be removed and reclaimed? If so, this must be included in the bond estimate.

---

1. Roads that are marked on Plate III-1 as not permanent are included in the acreage in Table III-24 for reclamation (see first paragraph on page 49 of Chapter III).

2. Back filling and grading of the borrow area will not be needed. Three feet of material will be removed from the borrow areas. The top sides and bottom ends of the excavation will be tapered into the existing slope. The area will then be part of the area to be reclaimed. On page 58, the paragraph under "Quantity of borrow material to be redistributed and scraper hours" will be changed as follows:

Near the tailings pond are two borrow pits which cover approximately 22 acres (Plate III-1). About 3.0 feet of borrow material will be removed from each pit to cover the refuse pile, slurry roads, and adjacent areas that have been disturbed by refuse. The borrow material will be in layers parallel with the existing surface configuration and tapering at the ends and sides to blend in with existing slope. Removing the soil is this manner will eliminate the need for regrading and leave an area ready for revegetation efforts. This borrow material will cover 81 acres one foot deep.

Covering of coal seams with 4 feet of non-toxic material has been committed to (see Section 3.5.4). On page 55 of Chapter III is an estimate of regrading cost for all disturbed areas including covering coal seams.

3. The coal waste disposal plan has been submitted for approval. The bond estimate was made to match this plan.

4. Table III-36 is a summary of the bond estimate.

5. The rail lines will not be removed (see response to UMC 817.180).

UMC 817.47 Discharge Structures

Deficiencies

1. Calculations and design details for protection measures at each discharge point must be included in the MRP. Please see the discussion under UMC 817.43 for details.

See response to UMC 817.43.

UMC 817.46 Sediment Ponds

Deficiencies

1. Several deficiencies in the Sunnyside Surface Facilities Pond design information must be corrected. These are enumerated as follows:

A. The peak flow calculation (25-year, 24-hour storm) must be corrected (see discussion in UMC 817.43 under lag time calculations), and the emergency spillway designs sized accordingly.

B. The volume of the proposed pond does not appear to be able to contain the 10-year, 24-hour storm. Use of a weighted curve number approach is not advisable in this situation. The two areas denoted should be calculated separately then summed to obtain the total storm runoff volume. The dimensions on the pond should be clearly denoted as to length and width in order to accurately calculate pond volumes. The size of the pond must be increased to accommodate the 10-year, 24-hour runoff volume.

See response to UMC 817.43.

UMC 817.45 Sediment Control Measures

Deficiencies

1. The use of straw bales for permanent sediment control on small areas is mentioned in the MRP. The installation methodology and maintenance of straw bales is not covered in the MRP. The location of straw bales and the installation and maintenance procedures must be included in the MRP. The effectiveness of straw bales for permanent sediment control is not documented.

The use of straw bales will be discontinued. All bales will be replaced with silt fences. Locations of the straw bales and future silt fences are on Plate III-1 and other drawings for individual areas. The silt fences will be checked on a monthly basis or after each rain storm of 0.25 inches or more. If the fences are damaged or at capacity, they will be replaced.

UMC 817.43 Diversions

Deficiencies

1. Supporting calculations and dimensions of disturbed and undisturbed diversion ditches associated with the Manshaft Sediment Pond are not included in the MRP. This information must be supplied.

2. Supporting calculations for riprap protection measures to be implemented in diversion ditches (where velocities exceed five feet per second) at spillway outlet points and at culvert inlets and outlets are not included in the MRP. Velocity calculations for all diversion ditches (disturbed and undisturbed), all spillway outlets, and at all culvert outlet points must be included in the MRP. Based on the predicted velocities, detailed erosion protection measures must be specified (e.g., for each ditch, spillway point, etc.). Where rock gabion-type structures are proposed to reduce velocities in diversion ditches, supporting calculations to show that velocities are reduced below five feet per second must be included in the MRP. Calculations and installation details must be provided for a filter blanket under the riprap. If a filter blanket is not deemed necessary, adequate justification demonstrating this must be included in the MRP.

3. The hydrologic calculations to determine peak discharges for culverts and diversion ditches in the Sunnyside Surface Facilities area are in error. The calculation of basin lag time is excessive by a factor of 10, resulting in computed peak discharges which are too low. These calculations must be corrected and then used for design of culverts and ditches in this area.

---

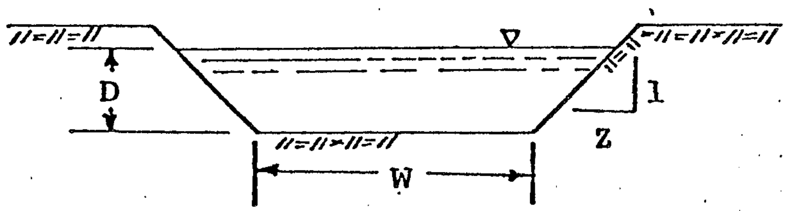
1. Calculations of ditches associated with the Manshaft Sediment Pond are found at the end of the document for inclusion in Appendix III-1.

2. Supporting calculations for riprap protection measures are found at the end of this document for inclusion in Appendix III-1.

3. Revised hydrologic calculations for the Sunnyside Surface Facilities are found at the end of this document for replacement in Appendix III-1.

PROJECT	Manshart	PAGE ____ OF ____	
	D1	CALCULATION & DESIGN BY	D. C. Pearce
	See Plate III-1	DATE	09-04-84

DITCH DESIGN AND SIZING



For an earth ditch,
ASSUME: $n = 0.030$

FLOW THROUGH OPEN CHANNEL IS DERIVED FROM CHEZY-MANNING EQUATION:

(1) $Q = \frac{1.486}{n} A (R_h)^{2/3} S^{1/2}$

$Q = q_p$ from previous design calcs.

WHERE:
- Q = quantity in cfs
- n = coefficient of roughness
- A = area of channel in ft^2
- R_h = hydraulic radius in ft
- S = avg. slope of channel in dec.%

DERIVATION FOR SOLUTION OF CHANNEL DEPTH FROM EQ. (1) GIVES:

$$\frac{Q(n)}{1.486 S^{1/2}} = \left[\frac{WD + ZD^2}{W + 2D\sqrt{Z^2 + 1}}\right]^{2/3} (WD + ZD^2)$$

WHERE:
- W = width of channel
- D = depth of channel

EQUATION (2) IS SOLVED BY TRIAL USING A KNOWN (W) AND TRIAL (D) VALUES

RESULTS:

PEAK FLOW IN DITCH 0.5916 CFS (FROM q_p CALCULATION)

AVG. PERCENT SLOPE .083 DECIMAL%

WIDTH OF CHANNEL 1 FT

DEPTH OF CHANNEL Flow 0.146 FT

COMMENTS: V = 3.53 ft/sec

Z = 1

PAGE ____ OF ____

PROJECT Manshart

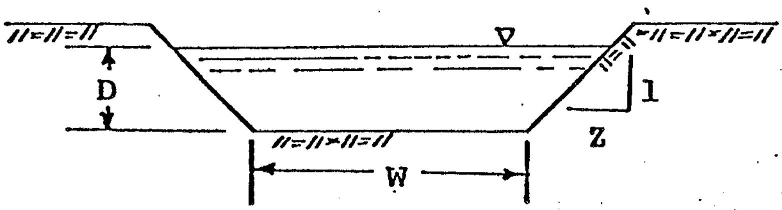
D2

1/3 Flow from Area III

CALCULATION & DESIGN BY D. C. Pearce

DATE 09-04-84

DITCH DESIGN AND SIZING



For an earth ditch,
ASSUME: $n = 0.030$

FLOW THROUGH OPEN CHANNEL IS DERIVED FROM CHEZY-MANNING EQUATION:

(1) $Q = \frac{1.486}{n} A(R_h)^{2/3} S^{1/2}$

WHERE:
Q = quantity in cfs
n = coefficient of roughness
A = area of channel in ft^2
R_h = hydraulic radius in ft
S = avg. slope of channel in dec.%

$Q = q_p$ from previous design calcs.

DERIVATION FOR SOLUTION OF CHANNEL DEPTH FROM EQ. (1) GIVES:

$$\frac{Q(n)}{1.486 S^{1/2}} = \left[\frac{WD + ZD^2}{W + 2D\sqrt{Z^2 + 1}}\right]^{2/3} (WD+ZD^2)$$

WHERE: W = width of channel
D = depth of channel

EQUATION (2) IS SOLVED BY TRIAL USING A KNOWN (W) AND TRIAL (D) VALUES

RESULTS:

PEAK FLOW IN DITCH 0.5628/3 = 0.1876 CFS (FROM q_p CALCULATION)

AVG. PERCENT SLOPE 0.01 DECIMAL%

WIDTH OF CHANNEL 1 FT

DEPTH OF CHANNEL Flow 0.13 FT

COMMENTS: V = 1.2 ft/sec

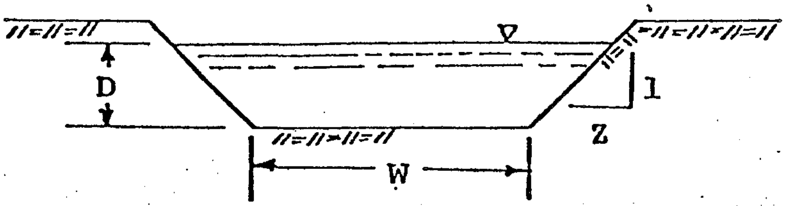
Z = 1

PROJECT: Manshaft
D3
Area 2 + Area 3

CALCULATION & DESIGN BY: D. C. Pearce

DATE: 09-04-84

DITCH DESIGN AND SIZING



For an earth ditch,
ASSUME: $n = 0.030$

FLOW THROUGH OPEN CHANNEL IS DERIVED FROM CHEZY-MANNING EQUATION:

(1) $Q = \frac{1.486}{n} A(R_h)^{2/3} S^{1/2}$

$Q = q_p$ from previous design calcs.

WHERE:
Q = quantity in cfs
n = coefficient of roughness
A = area of channel in ft^2
R_h = hydraulic radius in ft
S = avg. slope of channel in dec.%

DERIVATION FOR SOLUTION OF CHANNEL DEPTH FROM EQ. (1) GIVES:

$$\frac{Q(n)}{1.486 S^{1/2}} = \left[\frac{WD + ZD^2}{W + 2D\sqrt{Z^2 + 1}}\right]^{2/3} (WD+ZD^2)$$

WHERE:
W = width of channel
D = depth of channel

EQUATION (2) IS SOLVED BY TRIAL USING A KNOWN (W) AND TRIAL (D) VALUES

RESULTS:

PEAK FLOW IN DITCH 0.192 + 0.563 = 0.755 CFS (FROM q_p CALCULATION)

AVG. PERCENT SLOPE .01 DECIMAL%

WIDTH OF CHANNEL 2 FT

DEPTH OF CHANNEL Flow 0.21 FT

COMMENTS: V = 1.59 ft/sec
Z = 1

Ditches - RipRap Protection

All ditches or sections of ditches with expected velocities of 5.0 feet per second will be protected with RipRap and a filter blanket if needed. The following method was used to determine RipRap and filter blanket size:

1. From peak flow calculations using an assumed n value for Manning's n, calculate the normal depth, hydraulic radius, and wetted perimeter.

2. Calculate D_{50} riprap size from the following equation (figure 1-19 in "Erosion and Sediment Control" EPA 1976):

   $$D_{50} = (118Q(S_b)^{13/16}(R/P))^{2/5}$$

   where

   Q = discharge ft^3/sec
   S_b = channel slope (decimal)
   R = hydraulic radius (ft)
   P = wetted perimeter (ft)
   D_{50} = diameter of riprap for which 50% is finer

3. Check assumed Na value with n calculated (N_c) where

   $$N_c = .04\ (D_{50})^{1/6}$$

   if $N_c \approx= N_a$, proceed

   if $N_c \not\approx$ to N_a, then use N_c to calculate new values in Step 2

4. Determine riprap gradation (see Table 5.1 OSM TR-82/2)

   $D_{max} = 1.25\ D_{50}$

   $D_{85} = 1.1\ D_{50}$

   $D_{50} = D_{50}$

   $D_{15} = 0.15\ D_{50}$

5. Determine filter blank gradation by the following relationship (figure 5.2, OSM/TR-82/2):

   $$\frac{D_{15}\ (\text{RipRap})}{D_{85}\ (\text{Base Material})}\quad 5;\ 5\quad \frac{D_{15}\ (\text{RipRap})}{D_{15}\ (\text{Base Material})}\quad 40$$

Calculate a D_{50} size for the base material which meets the above relationship. If the D_{50} size is greater than that of the base material, then a filter blanket is needed. The above relationship is then used to see if the filter blanket and the base material are compatible. Filter blanket size should be from 3/16 (0.0156 ft) inches to an upper limit depending on the gradation of the riprap (5.2.7.1, OSM/TR-82/2). Thickness of the filter should not be less than 6 to 9 inches (5.2.7.1, OSM/TR-82/2).

The following ditches have velocities in excess of 5 feet per second:

Ditch	Q	S	W	Z	N	D	V	RipRap D_{50}	Filter Blanket: Fine Gravel F1 D_{50}	Filter Blanket: Medium Sand F2 D_{50}
CR Toe	8.55	.2	1	4	.0416	.45	6.68	1.24'	.034'	$.001 < .0156$
Rail Cut D1	16.33	.045	1	1	.037	1.20	6.122	1.19'	.033'	$9.1 \times 10^{-4} <$
D3	16.43	.094	0	1	.041	1.53	7.3	1.158'	.032'	$9.1 \times 10^{-4} <$
D4	16.43	.061	0	1	.039	1.59	6.43	.796'	.022'	$6 \times 10^{-4} <$
Refuse Rd I	7.12	.15	2	2	.039	.393	6.49	1.03'	.028'	$8 \times 10^{-4} <$
Div I	1.8	.49	3	2	.04	.102	5.5	1.09'	.030'	$9 \times 10^{-4} <$
WSC 1	40.6	.042	1	1	.038	1.956	7.02	.85'	.024'	$7 \times 10^{-4} <$

RipRap will be placed in thickness that ranges from 1.3 to 2.0 times the D_{50} size. Calculated D50 sizes are found above.

SEDIMENT POND DISCHARGE PROTECTION

Coarse Refuse Toe Discharge Protection (Drop Spillway)

Q = 11.72 CFS

S = .50

W = 4'

Z = 1

N = .048

V = 10 ft/sec (See Ditch Methodology)

D_{50} (RipRap) = 3.00' (See RipRap Methodology)

D_{50} (Filter 1) = .081'

D_{50} (Filter 2) = .0022' .0156' (3/16") OK

Use 4' of 3.1' D_{50}

6" of .081' D_{50} (Filter)

Rail Cut Pond Discharge Protection

Q = 71.69 CFS

S = .097

W = 6

Z = 2

N = .043

V = 8.98 ft/sec

D_{50} (RipRap) = 1.73'

D_{50} (Filter 1) = .047'

Use 2'3" of RipRap

6" of Filter Blanket

Pasture Pond Discharge Protection

Q = 3.58 CFS

S = .025

W = 1

Z = 1

N = .03

V = 3.88'/sec

D_{50} (RipRap) = .20'

D_{50} (Filter) = .006   .0156 (3/16)

RipRap is to be limited to the first six feet of the channel.

Use 3" of RipRap

3" of Filter Blanket

Refuse Rd. I

Q = 7.12 CFS

S = .02

W = 2

Z = 1

N = .031

V = 4.11 ft/sec

No continuous riprap is needed; use size feet of riprap in the apron area.

D_{50} (RipRap) = .211"

D_{50} (Fib) = .006   .0156 (3/16)

Use 3" of RipRap

3" of Filter Blanket

Hoisthouse Pond Discharge Protection
Drop Outlet

Q = 2.73 CFS

S = .667

W = 6

Z = 1

N = .04

V = 5.61 ft/sec

D_{50} (RipRap) = 1.23'

D_{50} (Filter 1) = .034'

D_{50} (Filter 2) = .001 .0156' (3/16") so this layer is not needed.

Use 1.6' of RipRap and 6" of 7/16" Gravel

Upper No. 2 Canyon Discharge Protection

Q = 2.53 CFS

S = .01

W = 2

Z = 1

N = .025

V = 2.36 ft/sec

No RipRap is needed.

Lower No. 2 Canyon Discharge Protection

Q = 4.63 CFS

S = .50

W = 4'

Z = 1

N = .043

V = 8.68 ft/sec

D_{50} (RipRap) = 1.63'

D_{50} (Filter Blanket 1) = .045' (1/2")

D_{50} (Filter Blanket 2) = .0013 .0156' (3/16) OK

Second layer is not needed.

Use 2' of RipRap

6" of Filter Blanket

001 Mine Water Discharge Protection

Q = 600 GPM = 1.33 CFS

S = .11

W = 2

Z = 1

N = .03

V = 4.25

Immediate discharge area should be riprapped for 6 feet.

D_{50} (RipRap) = .346'

D_{50} (Filter Blanket) = .010'   .0156 (3/16) OK

Use 0.5' of RipRap
6" of 1/8" Gravel

SSSF Discharge Protection

Q = 18.93 CFS

S = .065

W = 4

Z = 2

N = .0375

V = 6.07 ft/sec

D_{50} = .689'

D_{50} (Fib) = .019'   .0156 (3/16")   OK

Use 1' of 8" RipRap

6" of 3/16" RipRap

Manshaft Discharge Protection

Q = 2.28 CFS

S = .65

W = 2

Z = 1

N = .045

V = 7.58 ft/sec

D_{50} (RipRap) = 1.98'

D_{50} (Filter Blanket 1) = .054'

D_{50} (Filter Blanket 2) = .0015 .0156' (3/16") OK

Use 2.5' of 2' RipRap

6" of 3/16" Gravel

CULVERT OUTLET RIPRAP CALCULATIONS

Railcut Pond

Culvert C1

2' dia = 3.14 ft^2 cross sectional area

Q = 16.3 CFS

V = 16.3 CFS/3.14 ft^2 = 5.19 ft/sec

N = .0328

D_{50} (RipRap) = .306'

D_{50} (Filter 1) = .009'   .0156' (3/16")

Use 5" of 4" RipRap

4" of 3/16" Filter Blanket

Pasture Pond

Haul Road Culvert

12" diameter = .785 ft^2 cross sectional area

Q = 2.5 CFS

V = 2.5 CFS/.785 ft^2 = 3.18 CFS   OK

No RipRap is needed

Refuse Road I

CMP Under Old Haul Road

D = 18" = 2.54 ft^2 cross sectional area

V = 5 CFS/2.54 ft^2 = 1.96 CFS   OK

No RipRap is needed

CMP Under Road for Diversion Areas I and II

D = 12" = .785 ft^2 cross sectional area

V = 3 CFS/.785 ft^2 = 3.82 ft/sec

No RipRap is needed

No. 3 Hoisthouse

1C

D = 1.0' = 0.785 ft^2

Q = .27 CFS

V = 0.27 CFS/.785 ft^2 = 0.34 ft/sec   OK

No RipRap is needed

2C

D = 1.0' = 0.785 ft^2

Q = 2.2 CFS

V = 2.2 CFS/0.785 ft^2 = 2.80 ft/sec   OK

No RipRap is needed

3C

2 - 18" CMP

D = 1.5' = 2.54 ft^2 2 X 2.54 = 5.08 ft^2

Q = 1.1 CFS

V = 1.1 CFS/5.08 ft^2 = 0.216 ft/sec   OK

No RipRap is needed

4C

D = 1.0 = 0.785'

Q = 0.14 CFS

V = 0.14 CFS/0.785 ft^2 = 0.178 ft/sec   OK

No RipRap is needed

5C

D = 1.0' = 0.785 ft^2

Q = 0.14 CFS

V = 0.14 CFS/0.785 ft^2 = 0.178 ft/sec OK

No RipRap is needed

6C

Same as Above

7C

D = 2.5' = 4.9 ft^2

Q = 10.89 CFS

V = 10.89 CFS/4.9 ft^2 = 2.22 ft/sec OK

No RipRap is needed

No. 2 Canyon

C1

D = 1.5'

A = 2.54 ft^2

Q = 3.87 CFS

V = 3.87 CFS/2.54 ft^2 = 1.52 ft/sec OK

No RipRap is needed

C2

D = 1.0'

A = .785 ft^2

Q = 1.19 CFS

V = 1.19 CFS/2.54 ft^2 = 0.468 ft/sec OK

No RipRap is needed

C3

D = 2.0'

A = 3.14 ft^2

Q = 5.95 CFS

V = 5.95 CFS/3.14 ft^2 = 1.89 ft/sec OK

No RipRap is needed

C4

D = 18"

A = 2.54 ft^2

Q = 2.03 CFS

V = 2.03 CFS/2.54 ft^2 = 0.799 ft/sec   OK

No RipRap is needed

C5

D = 1.0'

A = .0785

Q = 1.85 CFS

V = 1.85 CFS/.785 ft^2 = 2.35 ft/sec   OK

No RipRap is needed

SSSF

Overlooking Hillside

D = 2.0'

A = 3.14 ft^2

Q = 5.64 CFS

V = 5.64 CFS/3.14 ft^2 = 1.79 ft/sec OK

No RipRap is needed

No. 2 Canyon Hillside

D = 1.0'

A = 0.785 ft^2

Q = 2 CFS

V = 2 CFS/0.785 ft^2 = 2.5 ft/sec OK

No RipRap is needed

Upper Hillside

D = 36"

A = 7.06 ft^2

Q = 7.34 CFS

V = 7.34 CFS/7.06 ft^2 = 1.04 ft/sec OK

No RipRap is needed

Surface Facilities Interior Culverts

SF1

D = 1.0'

A = 0.785 ft^2

Q = 3.8 CFS

V = 3.8 CFS/0.785 ft^2 = 4.8 ft/sec   OK

No RipRap is needed

SF2

D = 1.5'

A = 2.54 ft^2

Q = 2.23 CFS

V = 2.23 CFS/2.54 ft^2 = 0.878 ft/sec   OK

No RipRap is needed

SF3

D = 2.0'

A = 3.4 ft^2

Q = 2.59 CFS

V = 2.59 CFS/3.14 ft^2 = 0.823 ft/sec   OK

No RipRap is needed

SF4

D = 2.0 ft

A = 2.54 ft^2

Q = 2.33 CFS

V = 2.33 CFS/2.54 ft^2 = 0.92 ft/sec   OK

No RipRap is needed

SF5

D = 3.0 ft

A = 7.06 ft^2

Q = 3.49 CFS

V = 3.49 CFS/7.06 ft^2 = 0.49 ft/sec

Slurry Ditch and Surrounding Areas

West Facing Hillside

D = 3.0'

A = 7.06 ft^2

Q = 7.33 CFS

V = 7.33 CFS/7.06 ft^2 = 1.03 ft/sec OK

No RipRap is needed

UL2

D = 1.0'

A = 0.785 ft^2

Q = 0.05 CFS

V = 0.05 CFS/0.785 ft^2 = 0.064 ft/sec OK

No RipRap is needed

SUR

D = 2.0

A = 3.14 ft^2

Q = 1.5 CFS

V = 1.5 CFS/3.14 ft^2 = 0.478 ft/sec OK

No RipRap is needed

SMR

D = 3.0'

A = 7.06 ft^2

Q = 1.56 CFS

V = 1.56 CFS/7.06 ft^2 = 0.22 ft/sec   OK

No RipRap is needed

SLR

D = 3.0'

A = 7.06 ft^2

Q = 1.8 CFS

V = 1.8 CFS/7.06 ft^2 = 0.255 ft/sec   OK

No RipRap is needed

Slurry Ponds and Coarse Refuse Dump

Coarse Refuse Crest

D = 1.5'

A = 2.54 ft^2

Q = 8.87 CFS

V = 8.87 CFS/2.54 ft^2 = 3.49 ft/sec   OK

No RipRap is needed

Permanent Road Culverts

RC-1

D = 1.33'

A = 1.38 ft^2

Q = 0.648 CFS

V = 0.648 CFS/1.38 ft^2 = 0.46 ft/sec OK

No RipRap is needed

RC1-3

D = 3.0 ft

A = 7.06 ft^2

Q = 7.33 CFS

V = 7.33 CFS/7.06 ft^2 = 1.04 ft/sec OK

No RipRap is needed

RC1-4

D = 1.0'

A = 0.785 ft^2

Q = 0.05 CFS

V = 0.05 CFS/0.785 ft^2 = 0.06 ft/sec OK

No RipRap is needed

RC2-1

D = 2'

A = 3.14 ft^2

Q = 2.65 CFS

V = 2.65 CFS/3.14 ft^2 = 0.84 ft/sec   OK

No RipRap is needed

RC2-2 and RC2-3

D = 2'

A = 3.14 ft^2

Q = 4.73 CFS

V = 4.73 CFS/3.14 ft^2 = 1.5 ft/sec   OK

No RipRap is needed

RC-4

D = 3.0'

A = 7.06 ft^2

Q = 4.57 CFS

V = 4.57 CFS/7.06 ft^2 = 0.647 ft/sec   OK

No RipRap is needed

RC3-1

D = 3.0'

A = 7.06 ft^2

Q = 5.03 CFS

V = 5.03 CFS/7.06 ft^2 = 0.712 ft/sec

No RipRap is needed

RC3-2

D = 3.0'

A = 7.06 ft^2

Q = 1.63 CFS

V = 1.63 CFS/7.06 ft^2 = 0.23 ft/sec OK

No RipRap is needed

RC3-3

D = 3.0'

A = 7.06 ft^2

Q = 1.53 CFS

V = 1.53 CFS/7.06 ft^2 = 0.22 ft/sec OK

No RipRap is needed

RC3-4

D = 3.0'

A = 7.06 ft^2

Q = 1.48 CFS

V = 1.48 CFS/7.06 ft^2 = 0.21 ft/sec OK

No RipRap is needed

RC3-5

D = 3.0'

A = 7.06 ft^2

Q = 1.33 CFS

V = 1.33 CFS/7.06 ft^2 = 0.188 ft/sec OK

No RipRap is needed

RC3-6

D = 3.0'

A = 7.06 ft^2

Q = 1.07 CFS

V = 1.07 CFS/7.06 ft^2 = 0.15 ft/sec OK

No RipRap is needed

RC7-2

D = 4.0'

A = 12.56 ft^2

Q = 4.58 CFS

V = 4.58 CFS/12.56 ft^2 = 0.36 ft/sec OK

No RipRap is needed

RC7-3

D = 4.0'

A = 12.56 ft^2

Q = 25.69 CFS

V = 25.69 CFS/12.56 ft^2 = 2.04 ft/sec OK

No RipRap is needed

RC-1

D = 5.1'

A = 20.43 ft^2

Q = 100.022 CFS

V = 100.022 CFS/20.43 ft^2 = 4.89 ft/sec OK

No RipRap is needed

RC10-4

D = 12.0'

A = 113 ft^2

Q = 30 CFS

V = 30 CFS/113 ft^2 = 0.26 ft/sec   OK

No RipRap is needed

M-CV

D = 6'

A = 28.27 ft^2

Q = 111.5 CFS

V = 111.5 CFS/28.27 ft^2 = 3.94 CFS   OK

No RipRap is needed

Sediment Structure Worksheet

Sediment Structure: REVISED SSSF SEDIMENT POND UNPAVED BOTTOM AREAS

Conditions:

Soil Type: HBC

Hydrologic Group: B

Land Use: Pasture or Range Land

Land Condition: Poor

Curve Number CN: 79

10 Year 24 Hour Storm Event: 1.84"

25 Year 24 Hour Storm Event: 2.20"

Contributing Area: 34.7 Acres

Slope of Area: 5% Average

Length of Slope: 2,000 Ft. Average

Calculations of Runoff and Sediment Volume

$S=\frac{1,000}{CN}-10=$ 2.658

$Q=\frac{(P-.2(S))^2}{P+.8(S)}=$ 0.432 $Q_v 10/24=$ 54,415 FT^3

$Q=\frac{(P-.2(S))^2}{P+.8(S)}=$ 0.643 $Q_v 25/24=$ 80,993 FT^3

A=R K LS CP = 13.21 T/A

R---Figure 5.3 Page 314 (16)
K---Page 331 (.43)
LS--Figure 5.15 Page 334 (2.4)
C---Table 5.A.1 Page 390 (0.8)

See attached copies of the mentioned pages.

$S_v=\frac{A(Area)(2000)}{(140)}=$ 6,548 FT^3

Area---Area in Acres
2000---2000 lbs/ton
140----140 lbs/cu. ft.

Peak Runoff Worksheet

Sediment Structure: REVISED SSSF SEDIMENT POND UNPAVED AREAS

Conditions:

Length of Drainage: 2,000 Feet

Average Slope: 5%

Curve Number: 79

Calculations of Peak Runoff:

$$T_1 = \frac{1^{.8}(S+1)^{.7}}{1900(y)^{.5}} \quad ; \quad S = \frac{1000}{CN} - 10 \quad \text{and } y = \text{Slope}.$$

$= \underline{0.255}$

$$T_c = T_1 / .6$$

$= \underline{0.425}$

$$q_p' = 10^{(2.50963 - 0.6995 \log T_c - 0.14808 (\log T_c)^2 + 0.07074 (\log T_c)^3}$$

$= \underline{556.3}$

$q_p = q_p' \, A \, Q$; A = Area in Sq. Mi. and Q = Storm runoff in inches

= 13.03 CFS 10/24 Storm

= 19.39 CFS 25/24 Storm

Sediment Structure Worksheet

Sediment Structure: REVISED SSSF SEDIMENT POND PAVED AREAS

Conditions:

Soil Type: Pavement

Hydrologic Group: D

Land Use: Parking Lot

Land Condition: Poor

Curve Number CN: 98

10 Year 24 Hour Storm Event: 1.84"

25 Year 24 Hour Storm Event: 2.20"

Contributing Area: 6.8 Acres

Slope of Area: 5% Average

Length of Slope: 100 Feet

Calculations of Runoff and Sediment Volume

$$S=\frac{1,000}{CN} - 10 = 0.204$$

$$Q=\frac{(P-.2(S))^2}{P+.8(S)} = 1.616 \qquad Q_v 10/24 = 39,889 \text{ FT}^3$$

$$Q=\frac{(P-.2(S))^2}{P+.8(S)} = 1.973 \qquad Q_v 25/24 = 48,702 \text{ FT}^3$$

$$A=R\ K\ LS\ CP = 0$$

R---Figure 5.3 Page 314
K---Page 331
LS--Figure 5.15 Page 334
C---Table 5.A.1 Page 390

See attached copies of the mentioned pages.

$$S_v=\frac{A(\text{Area})(2000)}{(140)} = 0$$

Area---Area in Acres
2000---2000 lbs/ton
140----140 lbs/cu. ft.

Peak Runoff Worksheet

Sediment Structure: REVISED SSSF SEDIMENT POND PAVED AREAS

Conditions:

Length of Drainage: 100 Feet

Average Slope: 5%

Curve Number: 98

Calculations of Peak Runoff:

$$T_l = \frac{l^{.8}(S+1)^{.7}}{1900(y)^{.5}} \quad ; \quad S = \frac{1000}{CN} - 10 \text{ and } y = \text{Slope.}$$

= 0.107

$$T_c = T_l/.6$$

= 0.178

$$q_p' = 10^{(2.50963-0.6995 \log T_c - 0.14808 (\log T_c)^2 + 0.07074 (\log T_c)^3}$$

= 796.5

$q_p = q_p' \, A \, Q$; A = Area in Sq. Mi. and Q = Storm runoff in inches

= 13.68 CFS 10/24 Storm

= 16.70 CFS 25/24 Storm

Determination of Average Slope for SSF Sediment Pond Drainage Areas:

SSSF Bottom Area	- 39.5 Acres
Vertical Drop	- 135 Ft.
Slope Distance	- 4,500 Ft.
Slope	- 3.0%
SSSF Hillside Areas	- 2.0 Acres
Vertical Drop	- 100 Ft.
Slope Distance	- 300 Ft.
Slope	- 33.0%

Weighting by Areas:

Average Slope is 5.0%

Calculation of Peak Runoff Amount for Overall SSSF Sediment Control Area:

Unpaved Areas	34.7 Acres	(83.6%)
Paved Areas	6.8 Acres	(16.3%)
Total Area	41.5 Acres	(100.0%)

Unpaved Area Runoff Contribution:

13.03 CFS X 0.836 = 10.89 CFS

Paved Area Runoff Contribution:

13.68 CFS X 0.163 = 2.23 CFS

Total Contribution = 13.12 CFS (10 Yr/24 Hr)

= 18.93 CFS (25 Yr/24 Hr)

Total Runoff Volume 10 Yr/24 Hr

Unpaved Areas	54,415 FT^3
Paved Areas	39,889
TOTAL VOLUME	94,304 FT^3

VOLUME CAPACITY - SSSF SEDIMENT POND

6615 Elev. or 0

Area = 40 X 160 = 6400 FT^2

6620 Elev. or 5'

Area = 60 X 180 = 10,800 FT^2

6625 Elev. or 10'

Area = 80 X 200 = 16,000 FT^2

$A = AX^2 + BX + 6400$ X = Depth

$A = 30X^2 + 730X + 6400$

<u>Integrating</u>:

$\int A = 30X^2 + 730X + 6400$

$V = 10X^3 + 365X^2 + 6400X$

<u>Sediment Load</u>

$V = 10X^3 + 365X^2 + 6400X$ = Sediment Volume

V = 6548 FT^3/YR = 19,644 FT^3/3 YRS

@ X = 2.65 FT V = 19,709 FT^3 OK USE 2.65'

<u>10 YR/24 HR Volume</u>

V = 94,304 FT^3

V = 94,304 + 19,644 = 113,948 FT^3

@ X = 10.21 FT V = 113,950 FT^3 OK USE 10.2'

Spillway Design

$$H' = Q^2 \frac{(1 + K_e + K_b + K_c L)}{A^2 (2G)}$$

$L = 80.0'$

$Q_{24/24} = 18.93$ CFS

$K_e = 0.5$

$K_b = 1.0$

	30"	36"
K_c =	.0314	.0246
A =	4.91	7.07
H' =	1.2'	0.5'

Use A 36" CMP

Total Depth of Pond

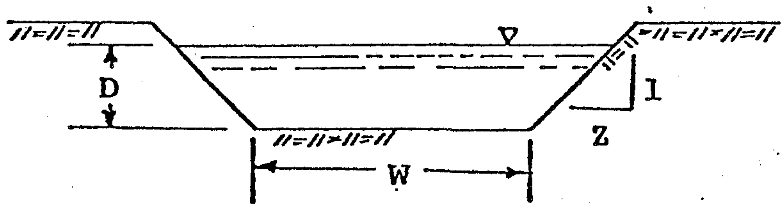
Sediment and Runoff Volume	-	10.21'
Head to Pass 25 Yr/24 Hr	-	0.50'
Freeboard	-	1.00'
TOTAL DEPTH		11.71'

PROJECT SSSF SEDIMENT POND
FINAL COLLECTION DITCH

CALCULATION & DESIGN BY

DATE

DITCH DESIGN AND SIZING



For an earth ditch,
ASSUME: $n = 0.030$

FLOW THROUGH OPEN CHANNEL IS DERIVED FROM CHEZY-MANNING EQUATION:

(1) $Q = \frac{1.486}{n} A (R_h)^{2/3} S^{1/2}$

$Q = q_p$ from previous design calcs.

WHERE:
Q = quantity in cfs
n = coefficient of roughness
A = area of channel in ft^2
R_h = hydraulic radius in ft
S = avg. slope of channel in dec.%

DERIVATION FOR SOLUTION OF CHANNEL DEPTH FROM EQ. (1) GIVES:

$$\frac{Q(n)}{1.486 S^{1/2}} = \left[\frac{WD + ZD^2}{W + 2D\sqrt{Z^2 + 1}}\right]^{2/3} (WD + ZD^2)$$

WHERE: W = width of channel
D = depth of channel

EQUATION (2) IS SOLVED BY TRIAL USING A KNOWN (W) AND TRIAL (D) VALUES

RESULTS:

PEAK FLOW IN DITCH 13.12 CFS (FROM q_p CALCULATION)

AVG. PERCENT SLOPE 0.05 DECIMAL%

WIDTH OF CHANNEL 2 FT

DEPTH OF CHANNEL 0.78 FT

COMMENTS: Freeboard @ 2' Deep = 1.22'
Velocity = 4.70 FPS