ALTERNATE # 1

DRAINAGE FACILITIES

AND

SEDIMENT CONTROL PLAN

SOUTHERN UTAH FUEL COMPANY

MINE NO. 1

June 11, 1980

Prepared For

SOUTHERN UTAH FUEL COMPANY

P.O. Box P

Salina, Utah 84654

REGISTERED PROFESSIONAL ENGINEER
No. 4622
M. Gregory Cloward
State of Utah

Prepared By

Richfield, Utah 84701

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Division of
Coastal States
Energy Company

June 24, 1980

Mr. Jim Smith
Division of Oil, Gas, and Mining
1588 West North Temple
Salt Lake City, Utah 84611

Dear Mr. Smith:

Please find the enclosed four copies of our revised sedimentation pond plan. It is submitted in response to a request from Mr. Don Crane's office that we investigate reducing the pond's impact relative to the plan submitted last fall. That plan, which was designed by Merrick and Company of Denver, Colorado, was included in the October, 1979 SUFCo mine plan addendum. It incorporated a pipeline system down East Spring Canyon to Convulsion Canyon where the pond could be located outside of a stream channel.

Considerable additional long term surface disturbance would result from implementation of the Merrick Plan even though it satisfied the requirements of the OSM regulations. The revised plan, submitted herewith, was developed by Valley Engineering, Inc. It places the pond adjacent to the mine site in the bottom of East Spring Canyon. Although it is located in the original stream channel, the placement of the dam and its associated features (slope, spillway, etc.) is compatible with final reclamation plans for the mine site. It incorporates a two stage sedimentation process with a primary concrete sediment basin on the presently disturbed area to reduce the area of additional disturbance while achieving the same degree of efficiency.

Please initiate the review and approval process for the plan at your earliest convence. We are committed to building either the Merrick plan pond or the Valley Engineering plan pond this summer pursuant an agreement with the Forest Service. Due to the length of our construction season, work must begin August 1, 1980 on either one plan or the other. If approval of the alternative plan is not acquired by then, we will begin construction of the previously approved Merrick Plan at that time.

(next page)

In the interest of expediting the approval process, we are sending seven copies of the plan to OSM and two copies to the Fishlake National Forest under separate cover today.

Responsible employees of the three agencies involved who have had input into this alternative plan are:

Darryl Hintze
Fishlake National Forest
55 S. 100 E.
Richfield, Utah 84701
Phone 801/896-6429

Tom Suchoski
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1588 West North Temple
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Please telephone me if I can help during the review and approval process for this alternative plan.

Yours very truly,

Kerry A. Frame
Chief Engineer

KAF:ble

Enclosure

xc: Tom Suchoski (without enclosure)

Valley Engineering, Inc.

850 North Main Street
Richfield, Utah 84701
Phone (801) 896-5434

June 11, 1980

Kerry Frame
Chief Engineer
Southern Utah Fuel Company
P.O. Box P
Salina, Utah 84654

Dear Kerry:

Submitted herewith is the report, concept plans, calculations, and drawings for Alternate # 1 to the present Drainage Plan which was submitted to you by Merrick and Company, Engineers and Architects of Denver, Colorado.

The proposed Alternate deals with a relocation of the sedimentation pond to the area immediately below the fill on which existing mine facilities are constructed. This plan also includes a new concrete sedimentation basin which will remove in excess of 65% of all solids before runoff from the disturbed area enters the sediment pond. This allowed us to reduce the size of the sediment pond as outlined in the regulations and to decrease the amount of overall disturbance. We feel that this alternate is more efficient in removing and controling sedimentation and controling drainage, as well as being more economical and fitting in more readily with the overall reclamation plan for Mine # 1.

Much of the original hydrologic and hydraulic information has been taken from the report by Merrick and Company dated September 17, 1979, where applicable. Notations for drainage basins, such as ATOF and SOF are described in Merrick's Report. We have not attempted to reiterate calculations and information that are detailed in their report, and some familiarity with Merrick's Report is necessary to adequately understand the information given here.

Sincerely,

M. Gregory Cloward, P.E.

DESCRIPTION OF PROPOSED ALTERNATES

Alternate # 1, to the drainage and sedimentation plan prepared by Merrick and Associates, primarily involves relocation of the sedimentation pond, and enlargement and redesign of the existing concrete sedimentation basin on top of fill slope near the existing crushing operation.

The primary drainage plan as outlined by Merrick will be used with this alternate. The 72" CMP which collects water from East Spring Canyon and Mud Spring Hollow will be reduced to a 48" pipe on the steep fill slope below the mine facility area. This 48" pipe will run underneath the proposed dam and empty water from above the disturbed area into the existing drainage. The water from the existing sedimentation tank, which currently connects and empties into the 72" pipe, will be diverted to a newly constructed 24" pipe and run down into the new sediment pond. The sediment pond will be located immediately below the toe of the existing fill, as shown on Sheet 2 of the enclosed drawings. The sedimentation pond in conjunction with the concrete sediment basin located on top of the fill are adequately sized to handle all runoff and sediment volume for a 10-year 24-hour storm event.

The spillway has been designed to handle a 100-year 24-hour event. The primary outlet has been designed to drain the 10-year 24-hour storm in 24 hours, and has been equipped with a grease and oil skimmer. Concrete cutoff collars have been designed and placed on the 48" pipe that passes underneath the dam and on the 12" primary outlet pipe. An energy dissipater has been designed to be placed at the toe of the spillway for erosion and channel protection.

A riprap and gravel filter slope drain has been designed to protect the toe of the existing fill from erosion or movement as a result of having a saturated toe caused by water in the sediment pond. The slope drain allows for free movement of water from the existing fill material for good drainage without permitting a migration of soil material. The slope drain also acts as ballast to further insure slope stability.

The dam will be keyed into competent rock with abutments in the fine grain massive sand stone, known as the Star Point Formation.

Material for construction of the dam will conform to U.S. Bureau of Reclamation standards for design of small dams, and will be obtained locally from previously disturbed areas. Riprap for the project will be collected on the dam site location. Gravel and filter material will be imported from the Salina area.

As can be seen on Sheet # 1 of the drawings, the dam will be located in a drainage which has very little impact, should the structure fail, on any downstream facilities. The Quitchupah Creek drainage runs under Utah Highway 10, and continues eastward into the Colorado River Basin Drainage. There are no houses, buildings, or structures which can be affected should the dam fail. All significant hydraulic structures and earthwork structures have been designed with a minimum 1.5 to 1 safety factor.

The concrete sedimentation basin on top of the hill has been designed to remove a minimum of 65% of the total sediment volume which is created from the basin designated by Merrick as ATOF, which is primarily the disturbed area around the mine portal facilities and crusher area. The structure will remove more than 65% of the sediment material as low flows expected under normal runoff conditions, and storms smaller than the 10-year 24-hour event.

As mentioned in the attached cover letter, sedimentation volumes and runoff volumes were taken from the report by Merrick. The design of these facilities has been based on that work. One distinct advantage of locating a sediment pond at the location described in this alternate, is that it is compatible with the overall final reclamation plan. The downstream 2 to 1 slope will be continued upstream towards the portal facilities during final reclamation, and the spillway will also be continued up this 2 to 1 slope to become the permanent stream channel upon final reclamation. This means that facilities that are now constructed are compatible and will be compatible with final reclamation and will not need to be removed, but rather a small amount of additional grading and contouring to blend with the final grading plan is all that will be necessary. This enhances and creates a minimal amount of disturbance as opposed to locating the structure farther downstream.

An access road will be constructed down to the pond as shown on Sheet # 2, and will have a maximum 15% slope. This will allow for cleaning and maintenance of the pond.

The complete plan set showing details and design of all structures associated with this alternate has been included. These plans are in final form for approval with exception that some information necessary to the selected contractor and for his benefit such as structural detailing and contract documents will be prepared upon approval by the reviewing agencies of this concept plan. Hydrologic and hydraulic calculations are included in this report and follow here:

CALCULATIONS

POND SIZING

Total Runoff Area

ATOF = Area top of fill = 12.0 acres

SOF = Area slope of fill = 95,000 sq. ft. = 2.2 acres

Use 2.5 acres " from Merrick Report

Runoff volume .10 acre @ 1.9 cfs

Sediment volume = .25 ac. ft.
CBW = Contributing Basin west = .51 acre feet

Runoff Volume =	.49 ac. ft.	ATOF
	.25 ac. ft.	SOF
	.51 ac. ft.	CBW
	1.25	Total Runoff Volume

Sediment Volume
(Reduce volume from ATOF by 65% due to concrete settling basin. See page 10).

	.25	SOF
.35 x 1.2	=.42	ATOF (From Merrick)
	.67	Total Sediment Volume

Pond Volume = 1.25 + .67 = 1.92 ac. ft.

It is proposed to:
Reduce sediment volume by 50% by cleaning when sediment volume reaches 60% of total volume.
Reduce sediment volume to .34 ac. ft.
Total 10 year pond volume = 1.25 + .34 = 1.59 ac. ft.

Elev.	Area (Sq. Ft.)	Volume (Ac. Ft.)
7718	9720	
		.22
7417	8577	
		.35
7415	6813	
		.61
7410	3807	
		.32
7405	1728	
		.12
7400	369	

Total Volume Available = 1.62 Ac. Ft.

Spillway Design

Design @ 100 years 24 peak = 62.4 cfs x 1.5 S.F. = 94 cfs

$Q = CLH^{3/2}$ C = 3.0 H = 2.0 feet L = 11.08 feet

Check Manning

$Q = \frac{1.49}{n} AR^{2/3} S^{1/2}$ n = .045

$Q = \frac{1.49}{.045} (22.16) (\frac{22.16}{15.08})^{2/3} (1/2)^{1/2}$

Q = 670 cfs OK

Pipe Sizing

Mud Spring Hollow = 147 cfs

East Spring Canyon = 247 cfs

Mine Flow = 5 cfs

Total 399 cfs Say 400 cfs

$S = \frac{120}{175}$ on steep slope

Try 48" on steep slope

$Q = \frac{1.49}{n} AR^{2/3} S^{1/2}$

n = .027 A = 12.57 S.F. R = 1 S = .69

$Q = \frac{1.49}{.027} 12.57 (1)^{2/3} (.69)^{1/2} = 576$ cfs OK

Try 42" on steep slope A = 9.62 R - .875

$Q = \frac{1.49}{.027} (9.62)(.875)^{2/3} (.69)^{1/2} = 403$ cfs OK

Try 48" for overall length = 495

$Q = \frac{1.49}{n} AR^{2/3} S^{1/2}$

$= \frac{1.49}{.027} (12.57)(1)^{2/3} (.35)^{1/2}$

= 410 cfs - Good - Use 48" pipe velocity = 32.63

Use heavy gauge for scour protection

Check Entrance loss from 72" to 48"

$h_e = k_e \frac{V2}{29}$ Assume $k_e = .5$

$$h_e = \frac{.5 \left(\frac{410}{12.57}\right)^2}{64.4} = 8.26 \text{ feet}$$

Try 10' of 72" at S = .54

L = 18.51' say 20'

$$410 = \frac{1.49}{.027} (36) (1.5)^{2/3} \left(\frac{hL}{20}\right)^{1/2}$$

h_L = .50'

h_{L_t} = .5 + 8.26 = 8.76 feet

Use 20 of 72" down slope with tentle transition

Pond Outlet Q 10 = 20.6 $Q_{p\ 25}$ = 36.3 cfs

Q_{25} = .72 + .15 + .85 + .07 = 1.79 ac. ft./24 hrs. = .90 cfs

Use 1.5 SF Q = 1.35 cfs

Try 12" pipe L = π D = 3.14'

Q/ft. = .43 cfs/ft.

from table 20-17 Seelye

H = .24' 12" acceptable

Top of Slope Inlet (After Merrick)

Existing inlet HW = 18"
Q = 23.2 cfs, Not enough head available

Try new 24" Dia CMP

Orifice Control
HW req = 1.14 ft. = 14", Good
Inlet Control (at bend)
HW req = 2.8 ft. = 34", Good

Pipe Sizing Along Slope

Shallowest slope 0.05
Use unpaved CMP 2-2/3 x 1/2 Corrugations
n = .024
Q = 23.2 cfs

$$Q = \frac{1.49}{n} AR^{2/3}S^{1/2}$$

Size	A	R	Q		
18	1.77	0.375	15.5	No Good	
24	3.14	0.50	27.5	Good	V = 8.75 fps
21	2.41	0.44	19.3	No Good	
Q/Q Full = .84		V = 9.8 fps		D = 1.23 ft.	

S	Q Cap	V Cap	Q/Q Cap	V	d
0.215	52.3	16.6	0.44	9.4	0.92
0.135	41.4	13.2	0.56	13.5	1.06
0.120	39.1	12.4	0.59	12.9	1.10

Cutoff Collars

L = 289'
S = .24
Y = 4'
Z = 3'

L_{rt} L_5 = 1.25 L = 361.25

collar length - 72.25' $L = L_5$

Use 8 collars @ 4' x 1' above pipe

Riprap Sizing in East Spring Canyon (After Merrick)

V_b = 9.81 (based on velocity and depth in natural stream)

D_{50} req = 15" Class II riprap

Filter Sizing

Existing Soil

d_{85} = 0.47 mm

d_{50} = 0.135 mm

3_{15} = 0.017 mm

Filter Layer 1

$DF_{1\ 15}$	$5d_{85}$	$DF_{1\ 15}$	1.85 mm	$DF_{1\ 15}$	= 0.55 mm
$DF_{1\ 15}$	$5d_{15}$	$DF_{1\ 15}$	0.085 mm	$DF_{1\ 50}$	1.50 mm
$DF_{1\ 50}$	$25d_{50}$	$DF_{1\ 50}$	3.38 mm	$DF_{1\ 85}$	3.50 mm
$DF_{1\ 15}$	$40d_{15}$	$DF_{1\ 15}$	0.68 mm		

Filter Layer 2

$DF_{2\ 15}$	17.50 mm	$DF_{2\ 15}$	= 7.0 mm
$DF_{2\ 15}$	2.50 mm	$DF_{2\ 50}$	= 23.0 mm
$DF_{2\ 50}$	37.50 mm	$DF_{2\ 85}$	= 55.0 mm
$DF_{2\ 15}$	20.00 mm		

Riprap Limits

RR_{15}	275 mm
RR_{15}	35 mm
RR_{50}	575 mm
RR_{15}	280 mm

Energy Dissapater for 24" Pipe

Q = 23.2 cfs in 24" Dia CMP
S = 51% Down Face of Slope
S - 15% Final 30' into stilling basin

$$Q\ Cap = \frac{1.49}{n}\ AR^{2/3}\ S^{1/2}$$ n = 0.027 A = 3.14 SF R = 0.5 feet S = 0.15

Q Cap = 42.3 cfs V Cap = 13.5 fps
Q/Q Cap = .55 V = 13.9 fps y = 1.1 ft.

Froude number = V/ gd
where V = 2gh
g = acceleration of gravity
h = head loss required
d = A
V = 2g (4.1) = 16.2
gd = g(1.77) = 7.6

F = 2.15
W/d = 4.4
W = 7.8 ft = use W = 8 ft.

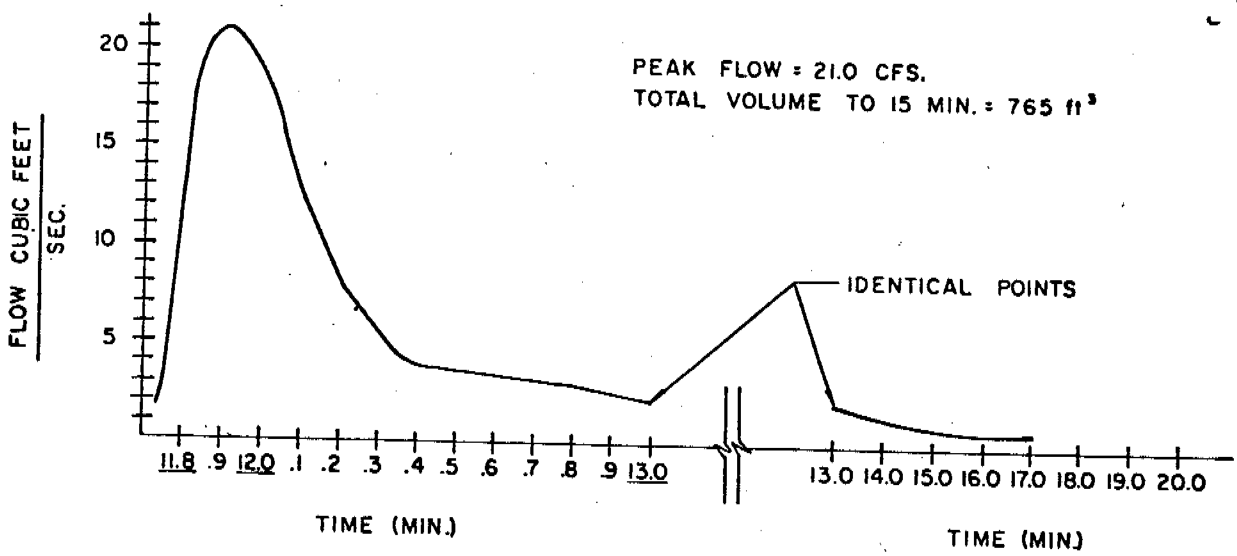
CONCRETE SEDIMENTATION BASIN

SOUTHERN UTAH FUEL COMPANY
SALINA UTAH

DESIGN STORM VOLUMES:

For a 10-year 24-hour storm the water reaching the sedimentation basin prior to 15 min. after the storm beginning, based on the Hydrograph computed by Merrick and Companies 765 ft^3.

If a basin of 1900 ft^3 of volume is used and assumed to be nearly empty when the storm began, the average over flow from the basin will be about 0.57 c.f.s. during a 10-year 24-hour storm.



HYDROGRAPH AT SEDIMENTATION BASIN FOR 10 YEAR 24 HOUR STORM

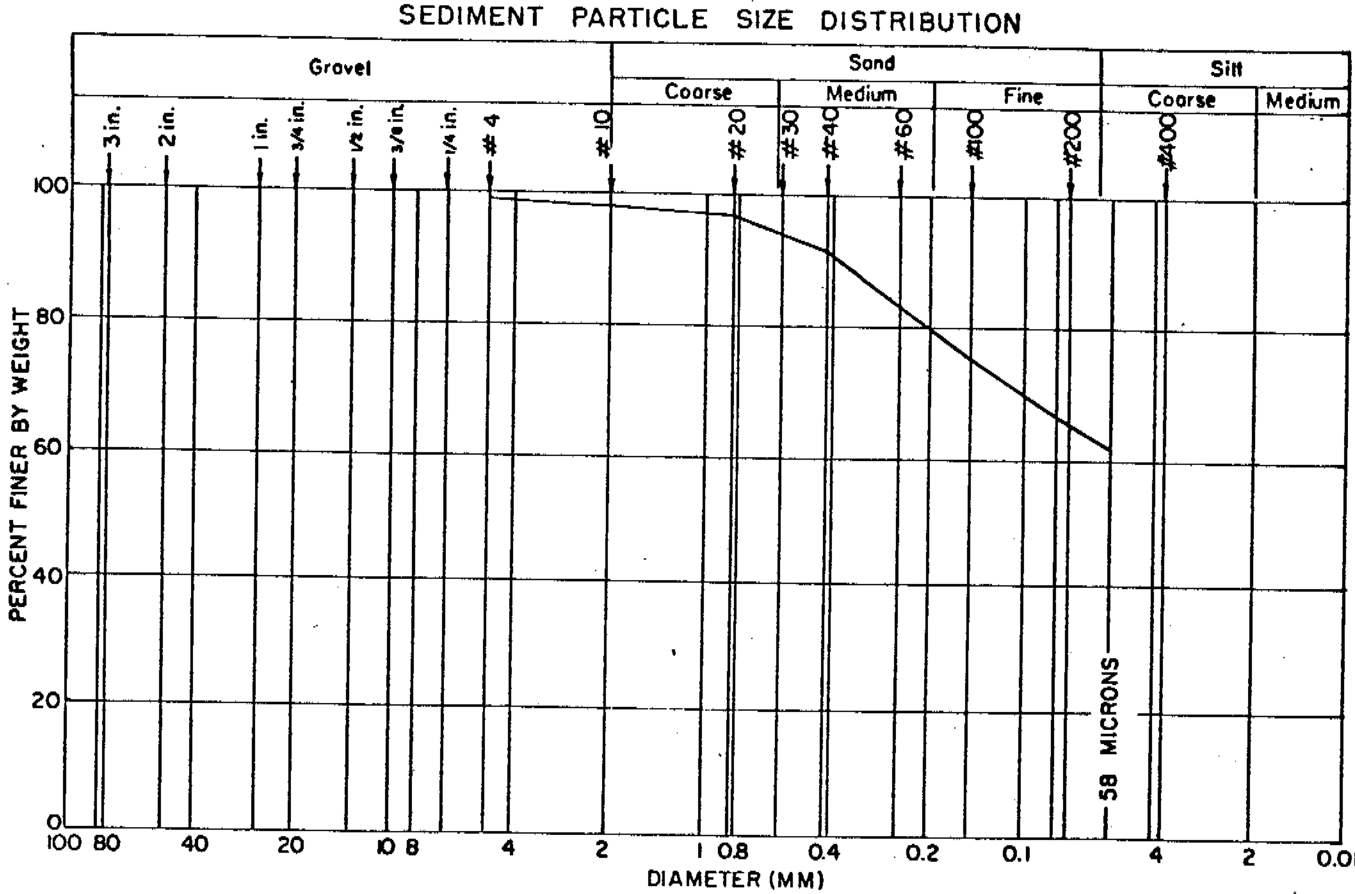
At this flow rate of 0.57 cfs, which will be the average loading rate for the design storm, an effective detention time of 1053 seconds will exist when the tank is all but 1 foot full of settleable solids. This will remove all particules larger than .58 microns according to Stokes Law.

$$Vs = \frac{g}{18} \frac{(Ss - Sw)}{K} d^2$$

Where Vs = Settling velocity of solid.
g = 32.2 ft/sec^2
Ss = specific gravity of solid = 2.48 for coal
Sw = specific gravity of water 1.94
d = diameter of solids
K = dynamic visocity

The following table shows graphic results of a sieve analyses of typical sediment collected from the existing sedimentation basin.

SEDIMENT PARTICLE SIZE DISTRIBUTION



As can be noted from the sieve analysis this amount to 39% removal of the material entering the tank.

Because some settling in the concrete basin will be Class 2 sedimentation, which occurs when small particles attach themselves to large particles by surface tension, the actual volume to be settled out will be considerably higher than that indicated by Stokes Law.

To determine the amount of actual removal a laboratory test was run. 75 ml of sample sediment was placed into a settlemeter then diluted and suspended in cold water. Following the prescribed time period of 1053 seconds, the water was decanted from the settlemeter and about 50 ml of soil mass was recovered. This indicates a 66% removal rate based on volume.

It should be pointed out that this is based on the detention times for the design storms and in actual use the removal rate from the concrete basin would be larger because of the longer detention times that will exist with smaller magnitude storms which occur most frequently.

Larger removal rates into the concrete sedimentation basin can be accomplished by the addition of alum to the water flowing into the sedimentation basin or placing it directly into the basin. Further laboratory testing showed that 95% of the sediment volume could be removed during the 1053 second detention time if alum is used to floculate the smaller solids. It is recommended that this procedure be used for smaller storms and to settle the solids from the liquid within the tank prior to decanting the tank following any storm.

In the laboratory test 1.5 grams per liter or about 180 # for the tank volume produced good settling rates. To determine the best dosage for field conditions other dosages should be tried.

The sedimentation tank is designed to handle a peak hydraulic flow of 21 cfs throughout the tank and draining the entire flow into the 24 inch diameter outlet pipe.