Project No. RM78-669
Mar. 79

D'APPOLONIA
CONSULTING ENGINEERS, INC.

Guideline Specifications

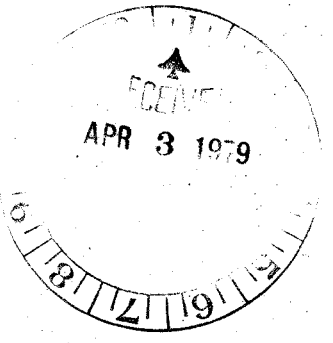
Emery Mine – Sedimentation Pond Designs

Emery Mine Site
Emery, Utah

Prepared For:
Consolidation Coal Company
Englewood, Colorado

Guideline Specifications

Emery Mine – Sedimentation Pond Designs



GUIDELINE SPECIFICATIONS

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GUIDELINE SPECIFICATIONS

SECTION 1
CLEARING AND GRUBBING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work

1. The Work covered by this Section consists of furnishing all plant, labor and equipment and performing all operations in connection with clearing and grubbing in accordance with the Drawings and these Specifications.

B. Limits of Clearing and Grubbing

1. The limits for clearing and grubbing shall be five (5) feet outside of the limit of work for the dike constructions as indicated on the Plans.

PART 2 - PRODUCTS

Not required

PART 3 - EXECUTION

3.01 CLEARING

A. Clearing shall consist of the removal and disposition of boulders, brush, down timber, logs, trash and other growth and objects on or above the ground surface. Within the limits of excavation, brush may be removed during the excavation operations. Brush at the top of cut slopes, the roots or parts of which are exposed by the excavation operations, shall be removed completely.

B. Brush, stumps, down timber, and partially buried logs and snags shall be removed completely from all areas to be occupied by fill and these areas shall be stripped. On areas outside of and contiguous to the top of the cut slopes and the toe lines of fill sections, brush shall be cut off and the areas shall be grubbed as specified for

areas to be occupied by fill. Cleared material shall be disposed of as specified hereafter. Cleared materials shall not be placed in the fill sections or left on the Work area.

3.02 GRUBBING

A. Grubbing shall be done in all areas to be occupied by fill. Grubbing shall consist of the removal and deposition of stumps, roots, buried logs, boulders, and other objectionable material below the ground surface. Stumps, roots over 1-1/2 inches in diameter, buried logs and boulders shall be removed completely. Roots 1-1/2 inches and under in diameter shall be removed to a depth of 2 feet below the surface of the ground in the area. Excavations made for removal of stumps, roots, and buried material shall be backfilled to the ground surface with suitable material, and the areas shall be graded to present a neat and pleasing appearance. Within the limits of excavations, grubbing may be done during excavation operations.

3.03 WASTE MATERIAL DISPOSAL

A. All brush, logs, roots, trash and other combustible debris from the clearing, and grubbing operations shall be disposed of by burning (with an approved permit) and/or hauling to an approved disposal site. No such material shall be placed in the fill sections. All durable stone and boulders from clearing and grubbing may be salvaged for use in construction.

SECTION 2
EARTHWORK

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work

1. The Work covered under this section includes the furnishing of labor, materials, required equipment and performing all operations for the following items of work:

   a. Removal of plants and stripping and stockpiling topsoil, where appropriate.

   b. All excavation, filling and rough grading for site work required by the Drawings and Specifications.

   c. Placing and compacting fill as required.

   d. All dewatering and/or diversion required by the Work.

B. Project Survey Layout

1. The project work shall be staked out by a qualified surveyor, including establishing elevations and all other layout work required. He shall also establish a datum point from which all grades are to be taken.

C. Safety Precautions

1. All barricades, fences, red lights, torches and enclosures necessary to protect construction and mine personnel from injury due to the Work set forth herein shall be erected, maintained as required and removed when the need for them no longer exists.

PART 2 - PRODUCTS

Not required

PART 3 - EXECUTION

3.01 STRIPPING AND SITE PREPARATION

A. All topsoil in the area of new Work shall be stripped to its full depth where appropriate and stockpiled on the site or placed where directed, where it will not interfere with the Work. A portion of topsoil shall be reused in finished grading work.

B. Topsoil is defined as that material having a significant organic content which will readily support vegetation.

3.02 WORK AREA DRAINAGE

A. To protect the surface of the fill, the top of all fill areas shall be crowned and sealed at the end of each working day to minimize the infiltration of water in the event of rainfall.

1. All fill saturated due to precipitation shall be dried or removed prior to placement of additional fill.

2. All impervious fills which become dried and/or cracked due to exposure, shall be wetted and reworked prior to application of additional fill.

B. As interim protection of the cut and fill slopes, adequate surface drains shall be provided at both the top and bottom of slopes to intercept and conduct runoff from the developed areas and to reduce saturation and erosion of the slopes.

3.03 EXCAVATION

A. GENERAL

1. All open-cut excavations shall be performed to the lines, grades, and dimensions shown on the Drawings or established by the Engineer. All necessary precautions shall be taken to preserve the material below and beyond the lines of all excavations in the soundest possible condition. Where required to complete the

Work, all excess excavation and overexcavation shall be refilled with suitable materials acceptable to the Engineer as specified herein. No excavation shall be made in frozen materials.

2. All materials removed from all types of excavations embraced in the Specification, which are suitable, shall be used in the formation of fills, also for refilling or other uses as indicated on the Plans or as directed. Excavated material which will be suitable when dry shall be taken from the excavation and then placed in the fill area, if so required. All materials removed from all excavations embraced in the Specifications, which are considered unsuitable shall be disposed of in a suitable manner as discussed in these Specifications.

B. Unsuitable Material

1. Materials found unsuitable due to the expansive properties, clay content or other objectionable reasons, may have to be blended with suitable materials or wasted. Where practicable, suitable materials shall be excavated separately from the materials to be wasted.

3.04 PREPARATION OF SITE BEFORE FILLING

A. The areas to be filled should be stripped of all topsoil, frozen soil, and organic material prior to filling. All materials to be used in the backfill shall be as specified below.

B. Large stones, clods, refuse, expansive materials, topsoil frozen soil or other debris should not be included in the fill.

C. Prior to the placement of any fill the areas should be checked for soft spots and adequately compacted with a sheepsfoot roller in accordance with the specifications herein below.

3.05 FILLS

A. General

1. The fills shall be constructed to the lines, grades and cross-sections indicated on the Plans.

2. The distribution of materials throughout the compacted earthfill shall be such that it will be free from lenses, pockets, streaks, and layers of material differing substantially in texture or gradation from surrounding fill material.

3. All required fills shall be compacted and built of materials selected from general excavation. Use of large rocks or frozen material will not be permitted.

4. Where fill is to be placed on natural slopes steeper than one vertical to seven horizontal, the existing slope shall be benched prior to placing fill. The width of any bench should not be greater than 25 feet or less than 5 feet. The width of each bench should be maintained within the specified limits, and the height of face cut varied in accordance with the slope of the natural ground surface. The height of cut at the face should not exceed five (5) feet. The slope of the temporary cut face should be no steeper than one vertical to one horizontal. All benches should be sloped at a minimum of one (1) percent away from the face cut to maintain proper drainage.

5. After specified benches have been cut, the fill should proceed. The lowest elevations shall be filled first, in horizontal layers with a thickness no greater than specified limits and sloped to the outer edge of the fill. As each layer is spread it shall be thoroughly compacted with proper rollers. The top and bottom of all fills shall be rounded or eased to form a pleasing transition in change of grade.

6. Particles larger than five (5) inches, but less than ten (10) inches in maximum dimensions shall be worked into the fill in such a manner as will disintegrate friable material and orient and distribute resistant particles to effect a compact well-knit mass with spaces between larger particles thoroughly choked with compact finer materials. To aid in accomplishing this, material containing more than 20 percent (by volume) of particles exceeding five (5) inches in maximum dimensions, shall be spread in lifts not exceeding eight (8) inches in thickness (loose measure), and tracked with at least four passes of the treads of a crawler type tractor trips

which, by means of sufficient overlap, will assure complete coverage of an entire layer by the tractor treads. Second and subsequent passes of the treads shall not be made until each pass, as defined above, is completed. If the size and content of resistant particles in the fill material precludes proper compaction, the material shall be mixed with finer materials before placement and/or shall be disposed of.

3.06 COMPACTION SPECIFICATION - GRANULAR MATERIAL

A. All granular fill placed at the site should be spread in one-foot lifts (loose material) and each lift compacted to 75 percent relative density (ASTM-D2049) as defined by:

$$D_D = \frac{E_1 - E_N}{E_1 - E_D} \text{ (percent)}$$

where:

D_D = relative density in percent

E_1 = void ratio of the granular soil in its loosest state (minimum dry density)

E_D = void ratio of the granular soil in its densest state (maximum dry density)

E_N = void ratio of the soil in its natural state

B. All granular fill should be clean, nonexpansive, free of trash, rubble, debris, frozen, and other foreign materials.

C. For uniformity, a minimum of five passes of a 10-ton vibratory roller or its equivalent shall be required on each lift of fill.

3.07 COMPACTION SPECIFICATION - COHESIVE MATERIALS

A. All cohesive fill placed at the site should be spread uniformly in six- to eight-inch lifts (loose material) and compacted to approximately 90 percent of the modified Proctor density (ASTM-D1557). Upon

placement and compaction of a lift of cohesive material, the surface should be scarified to a depth of two (2) inches prior to the placement of the next lift. Cohesive earth embankment material should be compacted at a water content of between one (1) and two (2) percent above optimum water content as determined by the modified Proctor method (ASTM-D1557).

B. All cohesive fill should be free of trash, rubble, debris, roots, organic, frozen, and other foreign material. Fill should not be placed on any subgrade that is under water, muddy, frozen, or contains frost.

C. For uniformity, a minimum of four passes of a sheepsfoot or segmented wheel roller in the 20- to 30-ton class shall be required on each lift.

3.08 ACCURACY OF COMPLETED GRADING

A. The grades as shown on the Plans or as specified shall be met within three (3) inches at the completion of the site grading.

3.09 ZONES OF SOFT SILTS OR CLAYS

A. Small local zones or pockets of soft silts or clays or other unsuitable materials that were not defined during the course of the exploration program, may be encountered in the excavation. They will require overexcavation and replacement with suitable backfill compacted in accordance with the Specifications. The determination to overexcavate and replace with backfill should be made by an Engineer.

SECTION 3
APPURTENANT FACILITIES CONSTRUCTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work

1. The Work covered under this section includes the furnishing of all labor and materials to install the decant system for the sedimentation pond and improve site drainage control in accordance with the following Work items:

   a. Installing new culverts to the limits as shown on the Drawings.

   b. Installing standard slide gates on decant pipes to the elevations indicated on the Drawings.

   c. Providing erosion protection at the outlet of the proposed decant system.

   d. Providing drainage control throughout the site particularly in the portal area by installing diversion ditches and pipe where required.

PART 2 - PRODUCTS

2.01 DECANT SYSTEMS

A. Culverts and Decant Pipes

1. The culverts and decant pipes shall be standard diameter corrugated metal pipe with a gauge thickness designation of 16 and 2-2/3 x 1/2 inch corrugations.

B. Gates

1. The slide gates shall be standard Armco Model No. 20-10C gates or equivalent for the respective pipe diameters as indicated on the Drawings.

2. The slide gate stem shall extend to the top of the outlet structure. A chain and lock system shall be installed on the gate wheel with operation of such gate under the supervision of the mine superintendent.

D. Cutoff Collars

1. Cutoff collars shall be fabricated standard metal sheets with a minimum width of 2 feet plus the pipe diameter as measured from the pipe centerline.

E. Secondary Pond Outlet Box

1. The secondary pond outlet box shall consist of welded 16 gage metal sheets constructed to the dimensions shown on the Drawing. The welds shall be made such that leakage through the joints is not apparent.

F. Secondary Pond Outlet Pipe and Valves

1. The secondary pond outlet box will be installed with two inlets consisting of 6" diameter valves or slide gates. These valves or gates will be installed at the locations indicated on the Drawing and will be operated from the top of the pond. The outlet pipe shall consist of Schedule 40, 6" diameter PVC pipe installed as indicated on the Drawings with eventual outlet to the main sedimentation pond.

2. The secondary pond outlet pipe shall contain a clean out valve located as shown on the drawings. This clean out valve shall consist of a standard tee section at the clean out location with a vertical riser extending to the ground surface. A screw cap shall be placed on this pipe for easy access.

G. Staff Gauge

1. A calibrated staff gauge shall be located in the main sedimentation pond as shown on the drawings delineating the design sediment clean out level and water level. This staff gauge shall consist of a 4 x 4 wooden post soundly embedded in the pond bottom and containing clearly visible painted lines indicating the appropriate design levels.

2.02 CONCRETE AND REINFORCING STEEL

A. General

Concrete, reinforcing steel, forming, pouring, finishing, and curing for the concrete support blocks shall conform to the requirements set forth herein.

B. Materials

The Portland Cement shall conform to specifications for Portland Cement, ASTM Standards, Designation C-150-67, Type I. The actual mixed proportion of cement, aggregates and water shall be determined by the contractor and/or the supervisory personnel provided by the owner.

C. Forming

Forms shall be provided that are true, rigid and thoroughly braced. The forms shall be sufficiently strong to carry the dead weight of the concrete without excessive deflection and tight enough to prevent leakage of mortar through cracks and joints.

D. Reinforcement steel shall consist of No. 4 bars conforming to ASTM specifications. All reinforcement shall be free from heavy rust, grease, dirt, oil or other debris that will interfere with the concrete to steel bond.

The reinforcement shall not have less than three (3) inches between it and the outside concrete surface.

2.03 RIPRAP

A. General

Riprap should be used for erosion control at the decant system outlet as shown on the Drawings and in other ditches where required.

B. Materials

Riprap should be maximum 12-inch diameter hard, durable cobbles and boulders in size designations such that the materials can be placed in a tight matrix to avoid the presence of large voids.

PART 3 - CONSTRUCTION REQUIREMENTS

3.01 CONSTRUCTION REQUIREMENTS FOR DECANT PIPES AND CULVERTS

A. General

1. The trench and bed for the new decant pipes and culvert shall have a width equal to the outside diameter of the pipe at the bell or band, plus 2.0 feet.

2. The trench shall be excavated through natural ground or where pipe structures are to be placed within fill, the fill should be constructed to a minimum of four (4) feet, where practicable, above the top of the pipe before placing the pipe, or as indicated on the Plans. Shallow installations, with less than four (4) feet of cover over the top of the pipe, shall be constructed after all heavy hauling is completed over the pipe location.

3. When the material encountered is unstable, it shall be entirely removed for the full width of the trench or as otherwise required for the particular condition, replaced with approved material, compacted to a satisfactory density and the bed shaped as specified.

B. Culvert and Decant Pipe Bedding

1. The pipe shall be bedded with care in a soil foundation shaped to fit the pipe exterior to a minimum depth of 15 percent of the outside diameter, or as shown on the drawings.

C. Backfilling

1. General - All backfill shall be thoroughly compacted with mechanical tampers or other approved methods to a density consistent with the surrounding fill. The backfilling of trenches shall be done in horizontal layers, not exceeding six (6) inches in thickness, each layer thoroughly consolidated and compressed. The compaction of each layer to be continued until the six (6) inches are thoroughly consolidated and compressed, after which the next layer of six (6) inches shall be spread and treated in like manner. Degree of compaction shall be in accordance with Section 2, Part 3, Paragraph 3.06 and 3.07.

2. Backfill shall be brought up on each side of the pipe simultaneously. The layers shall be compacted on both sides of the pipe before the next layer is placed to avoid shifting of the pipe during backfilling.

D. Placement

The manufacturers recommendation shall be followed regarding the pipe handling, placement, joint sealing and methods to close the joints. A 10-1/2 inch dimpled band connector in conjunction with TC-40 sealant will be used for pipe connections to achieve leak resistent joints.

3.02 MISCELLANEOUS CONSTRUCTION ITEMS

A. Reinforced Concrete Headwall Construction

1. Placing

Prior to the placement of concrete, the subgrade shall be thoroughly dampened to prevent the escape of moisture from the concrete into the subbase. The concrete shall be deposited in the forms as near to its final position as possible. Under no circumstances shall the agitation from the vibrator be used to move concrete laterally in the form.

Concrete shall be placed in layers not more than 24-inches in thickness. Each layer shall be thoroughly agitated by a vibrator. The vibrator, when used, shall be raised and lowered, always in a vertical position, and the vibrating head shall be allowed to penetrade and vibrate the concrete in the upper portion of the underlying layer. At no time shall the vibrator be permitted to lay in a horizontal position. Layers of concrete shall not be placed until the layers previously placed have been worked thoroughly as specified.

Concrete shall be protected against adverse weather conditions in accordance with "Recommended Practice for Cold Weather Concreting," ACI 306 and "Recommended Practice for Hot Weather Concreting," ACI 605. Accelerators, such as calcium chloride, shall not be used unless specifically approved.

2. Curing

After finishing, curing shall be done by keeping the concrete moist and at a temperature above 50 degrees and below 100 degrees for one week. Liquid, membrane-forming, curing compounds may be used in lieu of moist curing when approved or directed, and shall be applied to exposed surfaces of formed concrete and to finished surfaces at conclusion of finishing.

3. Finishing

Any small surface voids which may occur upon removal of the forms, and holes due to form ties shall be thoroughly cleaned of all loose or defective material, flushed with water, and immediately filled with a nonshrink cement mortar.

Any fins or projections which may occur shall be removed and the area rubbed smooth and finished with a wooden float in a neat and workmanlike manner. Plastering of the surface with cement grout shall not be permitted.

4. Joints

Construction joints shall be located only at points shown on the Plans or as directed or approved by the Engineer. They shall be so located as not to impair the strength of the structure, and so as to least impair its appearance. All construction joints shall be keyed.

5. Placement of Reinforcing Steel

Fabrication shall be accurate and to the dimensions indicated on the Plans. Stirrups and ties shall be bent around a pin having a diameter at least twice the bar diameter. All other bars shall be bent around a pin having a diameter of at least six times the diameter of the bar. All bars shall be bent cold.

The reinforcement shall not have less than 3-inches of concrete between it and the outside concrete surface.

All reinforcing shall be free from heavy rust, grease, dirt, oil or other debris that will interfere with the concrete to steel bond.

Reinforcing steel shall be installed in accordance with ACI-318-71 Specifications. All bars shall be lapped a minimum of 24 diameters.

B. Oil Skimming Device

1. An oil skimming device shall be installed over the decant structure of the main sedimentation pond as indicated on the drawings. This skimming device shall consist of a baffle system over discharge standpipe type as indicated on sheet 4 of 4. The skimming device will be installed at the plan location and to the lines and grades indicated on the drawings.

C. Riprap Installation

1. The subgrade under riprap should be well compacted before riprap is placed.

2. The riprap should be spread in a single lift. After placement, the riprapped surface should appear well graded with the voids choked with smaller cobbles and stones. The smaller size riprap should be placed against the slope to avoid migration of fines through the riprap.

3.03 EXISTING DIKE COSMETICS

All existing berms and dikes shall be inspected for continuity and structural integrity. All voids that exist shall be filled with competent fill material compacted to prevent erosion and/or sloughing. Any large boulders which facilitate leakage of surface water runoff through the berm or dike shall be removed and replaced with competent fill material, or the boulders shall be adequately encased in fill to prevent drainage around the boulders. Periodic inspection of these dikes shall be conducted and the appropriate upgrading or cosmetic work performed where required.

3.04 CLEAN-UP

After the construction specified herein is complete, the work area shall be cleaned up and any excess construction materials removed from the site or stored as designated by the owner. Disturbance to the work area shall be minimized by removing any excess fill or spreading it to maintain a uniform contoured surface. Final surface preparation of the fill areas shall be in accordance with Section 4 of these Specifications.

3.05 SEDIMENT CLEAN OUT AND DISPOSAL

When the sediment level in the sedimentation ponds reaches the design sediment level, removal of the sediment below the design level shall occur. Disposal of sediment from the sedimentation pond shall be within the limits designated "Sediment Disposal Area" on the drawings. Erosion protection discussed in Section 4 of these specifications shall be applied to exposed sediment surfaces in this area.

3.06 WATER MONITORING PROGRAM

A water monitoring program should be established consisting of procurement of water quality samples during any discharge from the main sedimentation pond. In addition to collection of water quality samples, average flow depths will be recorded by manually measuring the depth at various time intervals for the period of discharge.

SECTION 4
REVEGETATION OF COMPLETED DIKE SURFACES

PART 1 - GENERAL

1.01 DESCRIPTION

The establishment of vegetation on all exposed areas of the embankment is necessary to control erosion, reduce infiltration of water into the embankment, and to provide an environment compatible with the surrounding area. Establishment of an effective stand of vegetation requires a growth medium both physically and chemically capable of supporting plant growth as well as proper selection and planting of compatible grass and legume species.

PART 2 - TOPSOIL AND SEED MATERIALS

2.01 GENERAL

Topsoil material obtained from the construction operations and/or mine stripping operations should be placed on the completed downstream portion of the main sedimentation pond on fill sections of the dike surface and of the improved dike area. This soil should have physical and chemical characteristics conducive to establishment of vegetation and should be free of wood fragments, large rocks, and other debris. Soil cover shall be compacted with a bulldozer or appropriate soil compactor in such a manner as to minimize soil erosion and maximize surface slope stability. However, compaction of the soil cover should not result in a dense surface which could be detrimental to the establishment of vegetation. Final grading or backblading shall be accomplished to assure free drainage with no depressions or drainage courses.

2.02 SEEDBED PREPARATION

Prior to seeding, a seedbed should be prepared on all soil covered surfaces in such a manner as to enhance seed germination, optimize plant root penetration, increase infiltration, minimize soil erosion, and optimize available water within the rooting zone. Seedbed preparation may be accomplished by dragging a heavy chain or other suitable implement over the area in order to loosen the upper three inches of cover. Fertilizer and other soil amendments may be incorporated into the soil during this operation.

2.03 SEED MIXTURE AND FERTILIZER

A seed mixture and fertilizer shall be selected which is consistent with the local growing conditions. Advice from the local SCS should be sought concerning the selection of the appropriate mixture and application rates. Proper protection such as storm or erosion control mats should be applied after seed mixture to prevent loss of seed on newly planted dike slopes.

PART 3 - MAINTENANCE

3.01 DESCRIPTION

Revegetated embankment surfaces should be maintained in order to minimize erosion and maximize aesthetics. Liming, fertilization, and/or reseeding should be completed as required. Large gullies formed by erosion should be filled and reseeded to minimize downstream sediment loads.

Project No. RM78-669
Nov. 1978

ACT/015/015

D'APPOLONIA
CONSULTING ENGINEERS, INC.

Calculation Brief

Emery Mine - Sedimentation Pond Designs

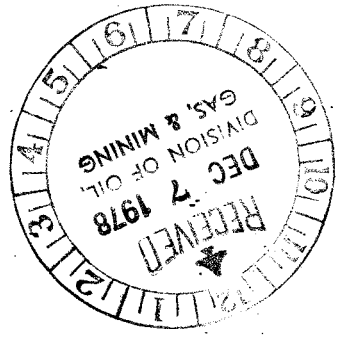
Emery Mine Site
Emery, Utah

Prepared For:
Consolidation Coal Company
Englewood, Colorado

Act 015/003

Calculation Brief

Emery Mine - Sedimentation Pond Designs



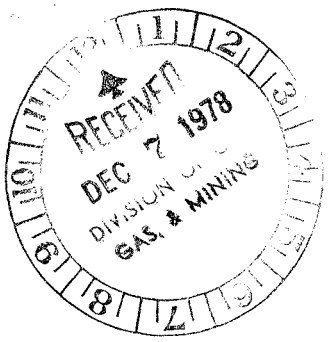
Note:

Sed. pond

plats are in

map roll stand.

2/22/79



Consolidation Coal Company
Western Region
2 Inverness Drive East
Englewood, Colorado 80110
303-770-1600

December 5, 1978

Mr. Cleon B. Feight, Director
Utah Division of Oil, Gas, & Mining
1588 West North Temple
Salt Lake City, Utah 84116

Dear Mr. Feight:

In accordance with the Surface Mining Reclamation and Enforcement Act of 1977, enclosed for your approval are Consolidation Coal Company's surface drainage and sedimentation control plans for the Emery Mine located five miles south of Emery, Utah. If further information is required, please feel free to contact either of the undersigned. Your diligence in these matters in appreciated.

Sincerely,

CONSOLIDATION COAL COMPANY

James R. Murray
Senior Engineer

Timothy J. O'Connor
Staff Mining Engineer

JRM:TOC:bf

enclosures

cc: (w/o encl.)

Fuller, L.
Hanks, T.
Harvel, G.

ROUGH DRAFT
PAGE 1
FEB 16 1979
SRM/laf

Timothy J. O'Connor

Staff Mining Engineer

Consolidation Coal Company

2 Inverness Drive East

Englewood, CO. 80110

RE: Emery Coal Mine Sedimentation Control

Dear Mr. O'Connor:

We have reviewed the plans and information for the proposed Consolidation Coal Emery Mine sedimentation ponds submitted December 5, 1978. As discussed Febraury 6, 1979 the invert elevation of the outlet pipe for the main pond must not be less than seven feet above the bottom of the pond and the sediment level must remain at least three feet below the outlet level. We also need further details of the following:

Take out lower pipe lock other

1. An appropriate baffle or other suitable device at the outlet to retain floating debris and other floating pollutants.
2. Details of the 6" pipeline from the secondary to primary pond showing any necessary manholes or cleanouts. gravity feed inlet & outlet design
3. Final ~~deposit~~ disposal of the sediment such that it will not pollute waters of the State.
4. The improved dike ~~should be rip rapped~~ should be riprapped or seeded on the stream side to and elevation above the maximum ~~a~~anticipated flood level. 10yr

nat. gd. not incl.

We understand that there will be no discharge from these ponds during the runoff of storms not exceeding the maximum 10-year 24-hour storm. To accomplish this, the outlet will be locked to prevent unauthorized discharge. ~~We suggest that~~ An additional inlet on the side farthest from the outlet ~~might~~ should be considered to improve the settling basin design.

Rec. 2/20/79
Div. St. Health

February 19, 1979

Project No. RM78-669

Operating Instructions
for Sedimentation Pond System
Emery Mine, Emery, Utah

Two sedimentation ponds are proposed at the Emery Mine site to control sedimentation in the facilities area vicinity. These ponds are located as shown on Sheet 3 of 4 "Sedimentation Ponds, Plans, and Sections," included in the construction drawings for sedimentation pond designs at the Emery Mine site.

The main pond discharge system consists of an emergency spillway plus an outlet structure consisting of a headwall with two 12" diameter corrugated metal pipes with slide gates. The slide gates should remain closed except when evacuating stored water after a storm event, or when stored water is to be evacuated for pond clean out. Opening the gates will allow water evacuation of the pond between storm events to allow adequate capacity to store and hold subsequent runoff volumes. Sediment removal may also occur during these periods of no water storage. At all other times these pipes will remain closed so that adequate sedimentation will occur in the pond. Discharge through the spillway will occur naturally but only during storm events larger than the 25-year frequency recurrence interval storm. Prior to that time all water should be stored in a closed pond.

The secondary pond outlet works consists of a pond outlet box constructed of a 16 gage galvanized sheet metal. This box has two 6" diameter valves or slide gates that should be opened only to allow water evacuation of this pond between storm events and provide adequate capacity to store and hold subsequent runoff volumes. Sediment removal may also occur during these periods of no water storage. Again these gates or valves will remain closed at other times so that adequage sedimentation will occur in the pond. The secondary pond is completely incised and

flow from this pond will be routed to the main pond as shown on the drawing from the buried 6" diameter PVC pipe. The gates should be opened to evacuate this pond only when the main pond is empty or adequate storage below the spillway elevation exists to store the released water.

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INTRODUCTION The following calculations will be performed to provide required sedimentation control for the Emery Mine site. The calculations will include the following items:

- Determination of runoff volumes for a 10 year design storm, based on rainfall and runoff characteristics pertinent to the Emery site

- Determination of sediment load and volume expected from the site based on the Universal Soil Loss Equation utilizing pertinent SCS soil data

- Determination of sedimentation pond volume based on the above data

- Design of the embankment and spillway system using standard engineering practices.

- Evaluation of condition of embankment under hydrologic events, resulting in potential flooding of the major stream that passes through the site.

I DEVELOPMENT OF RAINFALL AND RUNOFF DATA

A. WATERSHED AREA DETERMINATION

THE CONTRIBUTING WATERSHED AREA AT THE MINE SITE IS LINE ON THE ATTACHED 1" = 200' MAP OF THE EMERY MINE SITE.

THE AREAS HAVE BEEN BROKEN DOWN BY SOIL CLASS AND ARE INDICATED IN NUMERICAL SEQUENCE WITH THE CORRESPONDING PLANIMETERED AREAS AS FOLLOWS: $\left[in^2 \times \frac{40000\ ft^2}{in^2} \times \frac{1\ Acre}{43,560\ ft^2} \right.$

AREA DESIGNATION	PLAN. READINGS	PLAN. AREA (ACRES)
(1)	24.32 / 24.16 → 24.24	22.26
(1A)	1.68 / 1.63 → 1.66	1.52
(1B)	0.78 / 0.84 → 0.81	0.74
(2)	4.39 / 4.31 → 4.35	3.99
(2A)	3.24 / 3.20 → 3.22	2.96
(3)	0.75 / 0.79 → 0.77	0.71
(3A)	4.84 / 4.80 → 4.82	4.43
(4)	0.38 / 0.37 → 0.38	0.35
(5)	0.72 / 0.70 → 0.71	0.65
(5A)	1.80 / 1.80 → 1.85	1.70
		TOTAL 39.31

I DEVELOPMENT OF RAINFALL AND RUNOFF WITH (CONT'D

B. RAINFALL DATA: (1)

ARROX MINE LOCATION: CENTRAL UTAH
LAT - 39°
LONG - 111°

STORM DURATION (HOURS)	10 YEAR RAINFALL (INCHES) (PG.) (1)	25 YEAR RAINFALL (INCHES) (PG.) (1)	100 YEAR RAINFALL (INCHES) (PG.) (1)
0.5	0.65 (#11)	0.8 (#12)	1.00 (#14)
1	0.85 (#18)	0.95 (#19)	1.35 (#21)
2	1.00 (#25)	1.25 (#26)	1.60 (#28)
3	1.15 (#32)	1.50 (#33)	1.70 (#35)
6	1.50 (#39)	1.50 (#40)	2.00 (#42)
12	1.50 (#46)	2.00 (#47)	2.50 (#49)
24	1.50 (#53)	1.9 (#54)	2.4 (#56)

OK KMP

C. RUNOFF CHARACTERISTICS:

CN NUMBERS FOR THE RESPECTIVE SOIL TYPES AT THE SITE ARE ESTIMATED AS FOLLOWS:

SOIL ASSOCIATIONS (ATTACHED MAP)	SOIL (2) GROUP	COMPLEX NUMBERS (CN)
A (SALTAIR LIBBINGS)	D	90
B (RAVOLA, BILLINGS, REMOTE)	C	70
C Castle Valley, Kenilworth	D	80
D COAL	C	85
B & C	C/D/2	75

(1) TECHNICAL PAPER 40 (TP-40) "RAINFALL FREQUENCY ATLAS OF THE UNITED STATES - U.S. DEPT OF COMMERCE
(2) DESIGN OF SMALL DAMS BUREAU OF RECLAMATION

I DEVELOPMENT OF RAINFALL AND RUNOFF DATA (CONT'D)

C. RUNOFF CHARACTERISTICS:

1. DETERMINE WEIGHTED CN FOR AREAS 1, 5A, 4, 5 3, 2, 1A ABOVE PROPOSED POND LOCATION - 1 - MAIN POND

AREA # (SOIL ASSOCIATION)	① ACRES	② CN	① x ②
1 (B & C)	22.26	75	1669.5
5A (A)	1.70	90	153.0
4 (B)	0.35	70	24.5
5 (A)	0.65	90	58.5
3 (C)	0.71	80	56.8
2 (D)	3.99	85	339.2
1A (B & C)	1.52	75	114.0
TOTALS	31.18	-	2415.5
WEIGHTED CN	77.47 OK xmp		

2. DETERMINE ADDITIONAL CHARACTERISTICS OF WATERSHED AREA FOR DEVELOPMENT OF RUNOFF HYDROGRAPH

MAXIMUM EL DIFFERENCE = 6066 - 5900 = 166
LONGEST WATERCOURSE PATH = 1800 FT

I. DEVELOPMENT OF RAINFALL AND RUNOFF DATA (CONT'D)

C RUNOFF CHARACTERISTICS

3. DETERMINE WEIGHTED CN FOR AREAS 3A, 2A, 1B FOR POND SOUTH OF STREAM - SECONDARY POND

AREA # SOIL ASSOCIATION	① ACRES	② CN	① x ②
3A (C)	4.43	80	354.4
2A (D)	2.96	85	251.6
1B (B & C)	0.74	75	55.5

TOTALS	8.13	-	661.5
WEIGHTED CN	81.37 OK if CN & Area correct JCM		

4. DETERMINE ADDITIONAL CHARACTERISTICS OF WATERSHED AREA FOR DEVELOPMENT OF RUNOFF HYDROGRAPH

MAXIMUM EL. DIFFERENCE = 6063 - 5913 = 150
LONGEST DRAINAGE PATH = 1300 FT.

RMT 1/29/99

Kirpitch Tc [Main Pond]

0.77

$$Tc = 0.00013 \frac{1300}{\left(\frac{147}{1300}\right)^{0.385}} = 0.075 \text{ hrs.}$$

Storage required

P = 1.5in, 10yr-24hr

CN = 77.47 ; S = (1000/CN) - 10 = 2.91

$$Q = \frac{(P-0.2S)^2}{P+0.8S} = 0.22 \text{ in} = 0.0184 \text{ ft}$$

Area = $0.05 mi^2$ = 32 Ac

32 AC * 0.0184 ft = 0.59 AF RO storage

\+ 3.2 AF Sed Sto. (note: They use USLE)

3.79 AF Total

I. DEVELOPMENT OF RAINFALL AND RUNOFF DATA (CON'T)

D. HYDROGRAPH DEVELOPMENT

1. MAIN POND DATA	2. SECONDARY POND DATA
10YR 1 HR RAINFALL = 0.85 " 6 HR RAINFALL = 1.50 " 24 HR RAINFALL = 1.50 MAX. EL. DIFF. = 166 FT. LONGEST DRAINAGE PATH = 1800 FT (0.34 MI) AREA = 0.05 MI^2 CN = 76.7 ⇒ 77	10YR 1 HR RAINFALL = 0.85 " 6 HR RAINFALL = 1.50 " 24 HR RAINFALL = 1.85 MAX. EL. DIFF = 147 FT. LONGEST DRAINAGE PATH = 1300 FT (0.25 MI.) AREA = 0.013 MI^2 CN = 81.3 ⇒ 81

1. MAIN POND

COMPUTER RUN #1 SCS TRIANGULAR HYDROGRAPH METHOD

```
                PROGRAM THYD - REVISED 10-20-78

     EMERY MINE RM78-669
     THOMAS A. DONOVAN
     10 YEAR 24 HR STORM -LARGE POND
AREA=          .05SQ.MI.      LENGTH OF LONGEST WATERCOURSE=    1800.00FT.

ELEVATION DIFFERENCE=     166.00FT.      CURVE NO.=      77.00
CUMMULATIVE RAINFALL

        .67 AFTER 1/2 HOUR
        .85 AFTER ONE HOUR
       1.50 AFTER SIX HOURS
       1.50  AFTER TWENTY-FOUR HOURS
TIME OF CONCENTRATION=          .10(HRS.)
FLOOD HYDROGRAPH
```

? Kirpitch 0.075 hrs

TIME (HRS.)	WATER FLOW (SECOND-FEET)	TOTAL FLOW (ACRE-FT)
.25	.11	.002
.50	.09	.004
.75	1.13	.027
1.00	.89	.046
1.25	1.92	.086
1.50	1.36	.114
1.75	1.93	.154
2.00	1.27	.180
2.25	1.75	.216
2.50	1.14	.240
2.75	1.57	.272
3.00	1.03	.293
3.25	1.42	.323
3.50	.93	.342
3.75	1.30	.369
4.00	.85	.387
4.25	1.19	.411
4.50	.79	.427
4.75	1.11	.450
5.00	.73	.465
5.25	1.03	.487
5.50	.68	.501
5.75	.96	.521
6.00	.64	.534
7.00	0.00	.537
8.00	0.00	.537
9.00	0.00	.537
10.00	0.00	.537
11.00	0.00	.537
12.00	0.00	.537
13.00	0.00	.537
14.00	0.00	.537
15.00	0.00	.537
16.00	0.00	.537
17.00	0.00	.537
18.00	0.00	.537
19.00	0.00	.537
20.00	0.00	.537
21.00	0.00	.537
22.00	0.00	.537
23.00	0.00	.537
24.00	0.00	.537

PEAK DISCHARGE= 1.93 TOTAL DISCHARGE= .54 OK 10yr-24 hr. Runoff in AF

AREA= .05 SQ.MI. LENGTH OF LONGEST WATERCOURSE= .34 FT.

ELEVATION DIFFERENCE= 166.00 FT. CURVE NO.= 77.00

END-OF-FILE ENCOUNTERED, FILENAME - TOPO

PROGRAM THYD - REVISED 10-20-78

EMERY MINE RM78-669
THOMAS A. DONOVAN
25 YEAR 24 HOUR STORM LARGE POND

AREA= .0550.MI. LENGTH OF LONGEST WATERCOURSE= 1800.00FT.

ELEVATION DIFFERENCE= 166.00FT. CURVE NO.= 77.00
CUMMULATIVE RAINFALL

.75 AFTER 1/2 HOUR
.95 AFTER ONE HOUR
1.50 AFTER SIX HOURS
1.90 AFTER TWENTY-FOUR HOURS

TIME OF CONCENTRATION= .10(HRS.)
FLOOD HYDROGRAPH

TIME

(HRS.)	WATER FLOW (SECOND-FEET)	TOTAL FLOW (ACRE-FT)
.25	.46	.010
.50	.37	.017
.75	1.93	.057
1.00	1.48	.088
1.25	2.14	.132
1.50	1.41	.161
1.75	1.86	.199
2.00	1.21	.224
2.25	1.60	.258
2.50	1.04	.279
2.75	1.41	.308
3.00	.92	.327
3.25	1.25	.353
3.50	.82	.370
3.75	1.13	.393
4.00	.74	.408
4.25	1.03	.430
4.50	.68	.444
4.75	.95	.463
5.00	.62	.476
5.25	.88	.494
5.50	.58	.506
5.75	.82	.523
6.00	.54	.534
7.00	.45	.582
8.00	.40	.625
9.00	.36	.663
10.00	.33	.698
11.00	.31	.731
12.00	.28	.761
13.00	.26	.789
14.00	.25	.815
15.00	.23	.839
16.00	.22	.863
17.00	.21	.885
18.00	.20	.905
19.00	.19	.925
20.00	.18	.945
21.00	.17	.963
22.00	.17	.980
23.00	.16	.997
24.00	.16	1.013

PEAK DISCHARGE= 2.14 TOTAL DISCHARGE= 1.01 OK

AREA= .05 SQ.MI. LENGTH OF LONGEST WATERCOURSE= .34 FT. ?

SMALL POND

RMI
1/29

$$TC_{Kirpitch} = 0.00013 \frac{1300^{0.77}}{\left(\frac{150}{1300}\right)^{0.385}} = 0.075 \text{ hrs}$$

RO storage

$P = 1.5$ in, 10yr-24hr

$CN = 81$, $S = \frac{1000}{CN} - 10 = 2.346$

$$Q = \frac{(P-0.2S)^2}{P+0.8S} = 0.315 \text{ in.} = 0.026 \text{ ft.}$$

$Area = 0.01 mi^2 = 6.4$ Ac

$Ac 6.4 * 0.026 ft = 0.17 AF$ Runoff

PROGRAM THYD - REVISED 10-20-78

EMERY MINE RM78-669
THOMAS A. DONOVAN
10 YR 24 HR STORM SMALL POND

AREA= .01SQ.MI. LENGTH OF LONGEST WATERCOURSE= 1300.00FT.

ELEVATION DIFFERENCE= 150.00FT. CURVE NO.= 81.00
CUMMULATIVE RAINFALL

.67 AFTER 1/2 HOUR
.85 AFTER ONE HOUR
1.50 AFTER SIX HOURS
1.50 AFTER TWENTY-FOUR HOURS

TIME OF CONCENTRATION= .07(HRS.) ok
FLOOD HYDROGRAPH

TIME (HRS.)	WATER FLOW (SECOND-FEET)	TOTAL FLOW (ACRE-FT)
.25	.29	.006
.50	.20	.010
.75	.70	.025
1.00	.46	.034
1.25	.85	.052
1.50	.55	.063
1.75	.74	.078
2.00	.46	.088
2.25	.64	.101
2.50	.40	.109
2.75	.56	.121
3.00	.35	.128
3.25	.50	.138
3.50	.31	.145
3.75	.45	.154
4.00	.28	.160
4.25	.41	.168
4.50	.25	.174
4.75	.37	.181
5.00	.23	.186
5.25	.35	.193
5.50	.22	.198
5.75	.32	.204
6.00	.20	.209
7.00	0.00	.209
8.00	0.00	.209
9.00	0.00	.209
10.00	0.00	.209
11.00	0.00	.209
12.00	0.00	.209
13.00	0.00	.209
14.00	0.00	.209
15.00	0.00	.209
16.00	0.00	.209
17.00	0.00	.209
18.00	0.00	.209
19.00	0.00	.209
20.00	0.00	.209
21.00	0.00	.209
22.00	0.00	.209
23.00	0.00	.209
24.00	0.00	.209

PEAK DISCHARGE= .85TOTAL DISCHARGE= .21 OK

.043 CP SECONDS EXECUTION TIME

)BYE
JOB PROCESSING CCUS 15.279
BYE 78/11/14. 10.05.40.
6?)

PROGRAM THYD - REVISED 10-20-78

EMERY MINE RM78-669
THOMAS A. DONAVAN
25 YEAR 24 HR STORM - SECONDARY POND

AREA= .0150.MI. LENGTH OF LONGEST WATERCOURSE= 1300.00FT.

ELEVATION DIFFERENCE= 150.00FT. CURVE NO.= 81.00
CUMMULATIVE RAINFALL

.75 AFTER 1/2 HOUR
.95 AFTER ONE HOUR
1.50 AFTER SIX HOURS
1.90 AFTER TWENTY-FOUR HOURS

TIME OF CONCENTRATION= .07(HRS.)

FLOOD HYDROGRAPH

TIME (HRS.)	WATER FLOW (SECOND-FEET)	TOTAL FLOW (ACRE-FT)
.25	.55	.011
.50	.38	.019
.75	.98	.039
1.00	.64	.053
1.25	.85	.070
1.50	.53	.081
1.75	.69	.095
2.00	.42	.104
2.25	.57	.116
2.50	.36	.123
2.75	.49	.133
3.00	.31	.140
3.25	.43	.149
3.50	.27	.154
3.75	.39	.162
4.00	.24	.167
4.25	.35	.174
4.50	.22	.179
4.75	.32	.186
5.00	.20	.190
5.25	.29	.196
5.50	.18	.199
5.75	.27	.205
6.00	.17	.209
7.00	.14	.224
8.00	.12	.238
9.00	.11	.250
10.00	.10	.261
11.00	.09	.272
12.00	.09	.281
13.00	.08	.290
14.00	.08	.298
15.00	.07	.306
16.00	.07	.313
17.00	.06	.320
18.00	.06	.327
19.00	.06	.333
20.00	.05	.339
21.00	.05	.344
22.00	.05	.350
23.00	.05	.355
24.00	.05	.360

PEAK DISCHARGE= .98TOTAL DISCHARGE= .36

OK 25 yr 24 hr

.044 CP SECONDS EXECUTION TIME

$$LS = \left[\frac{(0.43 + 0.35 + 0.0435^2)}{6.613}\right]\left[\frac{10{,}000}{10{,}000 + S^2}\right]\left[\frac{\lambda}{72.6}\right]^m$$

λ = Slope Length ft = 1800

m = 0.5 when $S \geq 8\%$

S = Slope % = 5

$$LS = [0.4544][0.9975][4.7773] = 2.026$$

Donavan used published tables

DAMPPOLONIA
CONSULTING ENGINEERS, INC.

(15)

By TAD Date 11/12/78 Subject EMERY MINE Sheet No. 1 of 5
Chkd. By SEP Date 11/21/78 CONSOL Proj. No. EM 78-66

II. DEVELOPMENT OF SEDIMENT VOLUME FOR SEDIMENTATION POND DESIGN

A. METHODOLOGY - UNIVERSAL SOIL LOSS EQUATION

$$A = RKLSCP$$

WHERE:

R = RAINFALL FACTOR
K = SOIL ERODIBILITY FACTOR
LS = SOIL LOSS RATIO (L = SLOPE LENGTH, S = % SLOPE)
C = CROPPING MANAGEMENT FACTOR
P = CONSERVATION PRACTICE FACTOR
A = SOIL LOSS IN TONS/ACRE/YR

FOR EMERY SITE : LARGE POND

Fm. map OK R = 20 C_w = 0.39 (EST) 0.3 NATIVE VEG. OK 1.0 COAL OK

0.45? Could be higher → K = 0.35* OK P = 1.0 (NOT CONTOURED)

OK L = 1800 FT

OK S ≈ 6000-5900/1300 = 7.7% say (8% OVERAGE)

FROM TABLE 1 - "PRELIMINARY GUIDANCE FOR ESTIMATING EROSION ON DISTURBED AREAS BY SURFACE MINING ACTIVITIES IN THE INTERIOR WESTERN STATES" EPA, SCS - EPA-908/4-77-003 JULY 1977

FOR S = 8%, L = 1800 FT, LS = 4.17

$$A = (20)(0.35)(4.17)(0.39)1.0 = 11.38 \text{ TONS/ACRE/YEAR}$$

R: 20 (0.45 ?) K: 0.35 (2.26) LS: 4.17 (≈ 8) C: 0.39 P: 1.0

Possibly overestimate OK

* FROM APPENDIX A REF GIVEN ABOVE AND DISCUSSIONS AFB CASTLE SERIES K = 0.37 RAVOLA = 0.49

II. DEVELOPMENT OF SEDIMENT VOLUME FOR SEDIMENTATION POND DESIGN (CONT'D)

B. SEDIMENT YIELD - LARGE POND

1. TO DETERMINE SEDIMENT LOAD - DETERMINE WEIGHTED AVERAGE OF SOIL & COAL FINES BY AREA

AREA COAL = 3.99 ACRES
AREA SOIL = 31.18 - 3.99 = 27.19 ACRES

- ASSUME SAT. UNIT WEIGHT COAL = 90 #/ft3 52 #/ft3
- ASSUME SAT. UNIT WEIGHT SOIL = 105 #/ft3 104 #/ft3 OK
- ASSUME BUOYANT WEIGHT ≥ 40 #/ft3

convert #/ft3 to vol.

$$\gamma_b = \gamma_T - \gamma_w$$

$$e = \frac{G_s(\gamma_w) - \gamma_{SAT}}{\gamma_{SAT} - S(\gamma_w)}$$ (REF. LAMBE & WHITMAN Whitman p. 30)

ASSUME G_s = 2.65 SOIL, 1.9 COAL (Specific gravity)

$S = 1.0$

γ_w = 62.4 #/ft3 H_2O

$$e_{SOIL} = \frac{(2.65)(62.4) - 105}{105 - (62.4)(1)} = 1.416$$

$$e_{COAL} = \frac{1.9(62.4) - (90)}{90 - 62.4} = 1.03$$

$$\gamma_d = \frac{G}{1+e}\gamma_w$$

$$\gamma_{d\ SOIL} = \frac{(2.65)}{(1+1.42)}(62.4) = 68 \text{ #/ft3}$$

$$\gamma_{d\ COAL} = \frac{(1.9)}{(1+1.03)}(62.4) = 58.4 \text{ #/ft3}$$

Sed. yield Large Pond

KMT
2/2

Given: 11.38 Tons/ac/yr sed.

1410 lb/yd^3 = 0.705 ton/yd^3 Loose stacked Coal

$$11.38\ T/Ac/yr * \frac{1}{0.705}\ yd^3/ton * 31.18\ AC * 27\ ft^3/yd^3 * 1/43560\ AF/ft^3$$

= 0.31 AF/yr sediment produced

Donavan's est. should be OK as coal sed settled in pond should take less vol./unit weight than Loose stacked coal. In addition, he uses 5yrs. sed. accumulation equal to 1.2 AF; 3yrs of this estimate is 0.93 AF.

II DEVELOPMENT OF SEDIMENT VOLUME FOR SEDIMENTATION POND DESIGNS (CONT'D)

B. SEDIMENT YIELD - LARGE POND

WEIGHTED SEDIMENT DRY WEIGHT FOR AREA:

$$\frac{3.99(58.4) + 27.19(68)}{31.18} = 66.8 \ \#/ft^3$$

$$\text{SEDIMENT YIELD} = \left[11.38 \text{ TONS/ACRE/YEAR} \times \frac{2000 \ \#/\text{TON}}{66.8 \ \#/ft^3} \times \frac{1 \text{ AC-FT}}{43560 \ ft^3}\right]$$

$$\text{SEDIMENT YIELD} = 0.0078 \text{ ACRE/FT/ACRE/YEAR}$$

OR

$$[0.0078] \ 31.18 \text{ ACRES} = 0.243 \text{ ACRE FT/YEAR}$$

C. SEDIMENT YIELD SMALL POND - SOIL AREA

USING SAME PARAMETERS AS GIVEN IN PREVIOUS POND DESIGN

$C_W = 0.30$ $C_{NAT.\ MAT} = 0.30$

OK $R = 20$ $P = 1.0$

$K = 0.35$ LS - TABLE 1 PREVIOUS REF = 22.6

$L = 1300'$

$S_{AVG} = 22\%$ FOR SOIL AREA

$$\therefore A_s = (20)(0.30)(0.35)(22.6)(1.0) = 47.46 \text{ TONS/ACRE/YEAR}$$

Small pond - Soil

Soil Lb/yd³ = 2800 , = 1.4 Ton/yd³

47.46 T/Ac/yr * 1/1.4 yd³/Ton * 5.71 Ac. * 27 ft³/yd³ * 1/43560 AF/ft³ =

= 0.12 AF/yr

Small pond - Coal

Lb/yd³ Coal = 1410 = 0.705 ton/yd³ Loose stacked coal

7 T/Ac/yr x 1/0.705 yd³/Ton * 2.96 Ac * 27 ft³/yd³ * 1/43560 AF/ft³ =

0.018 AF/yr * Note 7 T/A/yr Assumes TAD correct

Total

0.12 + 0.018 = 0.138 AF/yr x 3 = 0.41 AF

II C - CONTD

- ASSUMING $\gamma_d = 68\ \#/ft^3$

SEDIMENT YIELD =

$$\left[47.46\ \frac{TONS/ACRE/YEAR}{TON/ACRE} \times 2000\ \frac{\#}{TON} \times \frac{1\ AC\text{-}FT}{43560\ FT^3} \times \frac{1\ ft^3}{68\ \#}\right]$$

S.Y. = 0.031 ACRE-FT/ACRE/YEAR OR

$$(5.17)(0.031) = 0.16\ ACRE\text{-}FT/YEAR$$

D SEDIMENT YIELD SMALL POND (COAL AREA)

- ASSUME $S = 1\%$ ALLOWS FOR DIFFERENCE IN ELEVATION AS SHOWN ON DWG

$L = 700$ FT [TABLE 1 (REF ON SOIL EROSION) $LS = 0.23$]
$S = 1\%$
$P = 1.0$
$C = 1.0$
$K = 0.35$
$\gamma_d = 58\ \#/ft^3$
$R = 20$

Left out LS factor overestimates

$$A = (20)^{0.6}(1.0)^{P}(1.0)^{C}(0.35)^{K} = 7\ TONS/ACRE/YEAR$$

$$S.Y. = 7\ \frac{TONS/ACRE}{YEAR} \times 2000\ \frac{\#}{TON} \times \frac{1\ ft^3}{43560\ ACRE\ FT} \times \frac{1\ ft^3}{58\ \#}$$

$$= .0055\ TONS/ACRE/YEAR$$

$$TOTAL = 2.96(0.0055) = 0.016\ ACRE\text{-}FT/YEAR$$

TOTAL SEDIMENT YIELD SMALL POND =

$$0.016 + 0.16 = 0.176\ ACRE\text{-}FT/YEAR$$ OK

0.138

Table 1. Values of the Topographic Factor "LS"

Length of Slope (L) Ft.	Percent Slope (S)																				
	0.2	0.3	0.4	0.5	1.0	2.0	3.0	4.0	5.0	6.0	8.0	10.0	12.0	14.0	16.0	18.0	20.0	25.0	30.0	40.0	50.0
20	.05	.05	.06	.06	.08	.12	.18	.21	.24	.30	.44	.61	.81	1.0	1.3	1.6	1.8	2.6	4	6	8
40	.06	.07	.07	.08	.10	.15	.22	.28	.34	.43	.63	.87	1.2	1.4	1.8	2.2	2.6	3.5	5	8	11
60	.07	.08	.08	.08	.11	.17	.25	.33	.41	.52	.77	1.0	1.4	1.8	2.2	2.6	3.0	4.5	6	10	14
80	.08	.08	.09	.09	.12	.19	.27	.37	.48	.60	.89	1.2	1.6	2.1	2.6	3.0	3.6	5.5	7	11	16
100	.08	.09	.09	.10	.13	.20	.29	.40	.54	.67	.99	1.4	1.8	2.4	2.9	3.5	4.2	6.0	8	13	18
110	.08	.09	.10	.10	.13	.21	.30	.42	.56	.71	1.0	1.5	2.0	2.5	3.0	3.7	4.5	6	9	14	19
120	.09	.09	.10	.10	.14	.21	.30	.43	.59	.74	1.0	1.6	2.1	2.6	3.3	4.0	4.6	7	9	14	20
130	.09	.09	.10	.11	.14	.22	.31	.44	.61	.77	1.2	1.6	2.2	2.8	3.4	4.1	4.9	7	9	15	20
140	.09	.10	.10	.11	.14	.22	.32	.46	.63	.80	1.2	1.7	2.3	2.9	3.6	4.3	5.1	7	10	15	21
150	.09	.10	.11	.11	.15	.23	.32	.47	.66	.82	1.2	1.8	2.4	3.0	3.7	4.5	5.3	8	10	16	23
160	.09	.10	.11	.11	.15	.23	.33	.48	.68	.85	1.2	1.9	2.5	3.1	3.9	4.7	5.5	8	10	17	24
180	.10	.10	.11	.12	.15	.24	.34	.51	.72	.90	1.4	1.9	2.6	3.3	4.1	5.0	6.0	9	12	18	26
200	.10	.11	.11	.12	.16	.25	.35	.53	.76	.95	1.4	2.1	2.8	3.6	4.4	5.3	6.3	9	12	18	27
300	.11	.12	.13	.14	.18	.28	.40	.62	.93	1.2	1.8	2.7	3.6	4.5	5.6	6.8	8	12	16	25	35
400	.12	.13	.14	.15	.20	.31	.44	.70	1.0	1.4	2.0	3.2	4.2	5.4	6.7	8.0	10	14	19	30	42
500	.13	.14	.15	.16	.21	.33	.47	.76	1.2	1.6	2.2	3.7	4.9	6.2	7.6	9.2	11	16	21	34	47
600	.14	.15	.16	.17	.22	.34	.49	.82	1.4	1.6	2.4	4.1	5.4	6.9	8.5	10.3	12	16	24	38	53
700	.15	.16	.17	.18	.23	.36	.52	.87	1.4	1.8	2.6	4.5	6.0	7.5	9.3	11.3	13	18	26	41	58
800	.15	.16	.17	.18	.24	.38	.54	.92	1.6	2.0	2.8	4.9	6.4	8.2	10.1	12.2	14	20	28	45	58
900	.16	.17	.18	.19	.25	.39	.56	.96	1.6	2.0	3.0	5.2	6.9	8.8	10.8	13.1	16	22	30	48	67
1000	.16	.18	.19	.20	.26	.40	.57	1.0	1.6	2.2	3.0	5.6	7.4	9.3	11.6	14.0	17	24	32	51	72
1100	.17	.18	.19	.20	.27	.41	.59	1.0	1.8	2.2	3.5	5.9	7.8	9.9	12.2	14.8	18	25	34	54	76
1200	.17	.18	.20	.21	.27	.42	.81	.10	.18	2.4	3.5	6.2	8.2	10.4	13.0	15.6	18	27	36	57	80
1300	.18	.19	.20	.21	.28	.43	.82	1.2	2.0	2.4	3.5	6.5	8.6	11.0	13.5	16.4	19	28	38	60	84
1400	.18	.19	.21	.22	.29	.44	.63	1.2	2.0	2.6	3.5	6.8	9.0	11.4	14.1	17.1	20	30	40	63	88
1500	.19	.20	.21	.22	.29	.45	.65	1.2	2.0	2.6	4.0	7.1	9.4	12.0	14.7	17.8	21	31	41	65	92
1600	.19	.20	.21	.23	.30	.46	.66	1.2	2.2	2.6	4.0	7.4	9.8	12.4	14.8	18.5	22	32	43	68	95
1700	.19	.21	.22	.23	.30	.47	.67	1.2	2.2	2.8	4.0	7.6	10.1	12.9	15.9	19.2	23	33	44	70	97
2000	.20	.22	.23	.24	.32	.49	.71	1.4	2.4	3.0	4.5	8.4	11.1	14.1	17.5	21	25	36	49	77	108

Contour limits - 2 percent 400 feet, 8 percent 200 feet, 10 percent 100 feet, 14 - 24 percent 60 feet. The effectiveness of contouring beyond these limits is speculative.

When the length of slope exceeds 400 feet and (or) percent of slope exceeds 24 percent, soil loss estimates are speculative as these values are beyond the range of research data.

II. CHECK ON DETENTION TIME FOR SETTLING OF COAL PARTICLES

$$\frac{V}{S} = \frac{g(\rho_s - \rho)d^2}{18\mu}$$

(REF. WATER SUPPLY AND POLLUTION CONTROL, CLARK, VIESSMAN AND HAMMER, 1971)

where: V_s = settling velocity cm/sec.
ρ_s = density solid material
ρ = density liquid "
d = particle diameter
μ = dynamic viscosity

assume: $\rho_s = 80\ \#/ft^3 = 1.295\ g/cc$
$\rho = 1\ g/cc$
$\mu = 1.31 \times 10^{-2}$
$d = .001\ cm$

$$V_s = \left[\frac{981(1.295 - 1.00)(.001)^2}{18 \times 1.31 \times 10^{-2}}\right] = 1.227 \times 10^{-3}\ cm/sec$$

$V_s = 3.47\ FT/DAY$

$$A = \frac{Q}{V_s}$$

$Q = 15,110\ FT^3/DAY$
WILL SETTLE

AREA PONDS: MAIN = 13,000 FT²
SECONDARY = 13,000 FT²

PEAK INFLOW 10YR 24 HR = .54 AC-FT OR 23,522 O.K

III POND VOLUME SUMMARY

POND	1 10 YEAR 24 HR RUNOFF (AC-FT)	2 25 YR 24 HR RUNOFF (AC-FT)	3 SEDIMENT * STORAGE (AC FT)	VOLUME 1 1 + 3 (AC-FT	VOLUME 2 2 + 3 (AC-FT)
MAIN POND	0.54 OK	1.01 OK	1.22 OK	1.76 OK	2.23 OK
SECONDARY POND	0.21 OK	0.36 OK	0.88 OK	1.09 OK	1.24 OK

* ASSUMES 5 YRS SEDIMENT STORAGE

IV. DECANT SYSTEM REQUIREMENTS

POND	10 YEAR - 24 HR PEAK DISCHARGE (CFS)	25 YR - 24 HR PEAK DISCHARGE (CFS)
MAIN POND	1.93 ✓	2.14 ✓
SECONDARY POND	0.85 ✓	0.98 ✓

III. POND CONFIGURATIONS

REQUIRED STORAGE VOLUME - MAIN POND → 2.2 ACRE-FT
uses 25yr 24hr + 5yr add.t. Sed vol.

- SEE ATTACHED DIKE CONFIGURATION - (SHEET 2 OF

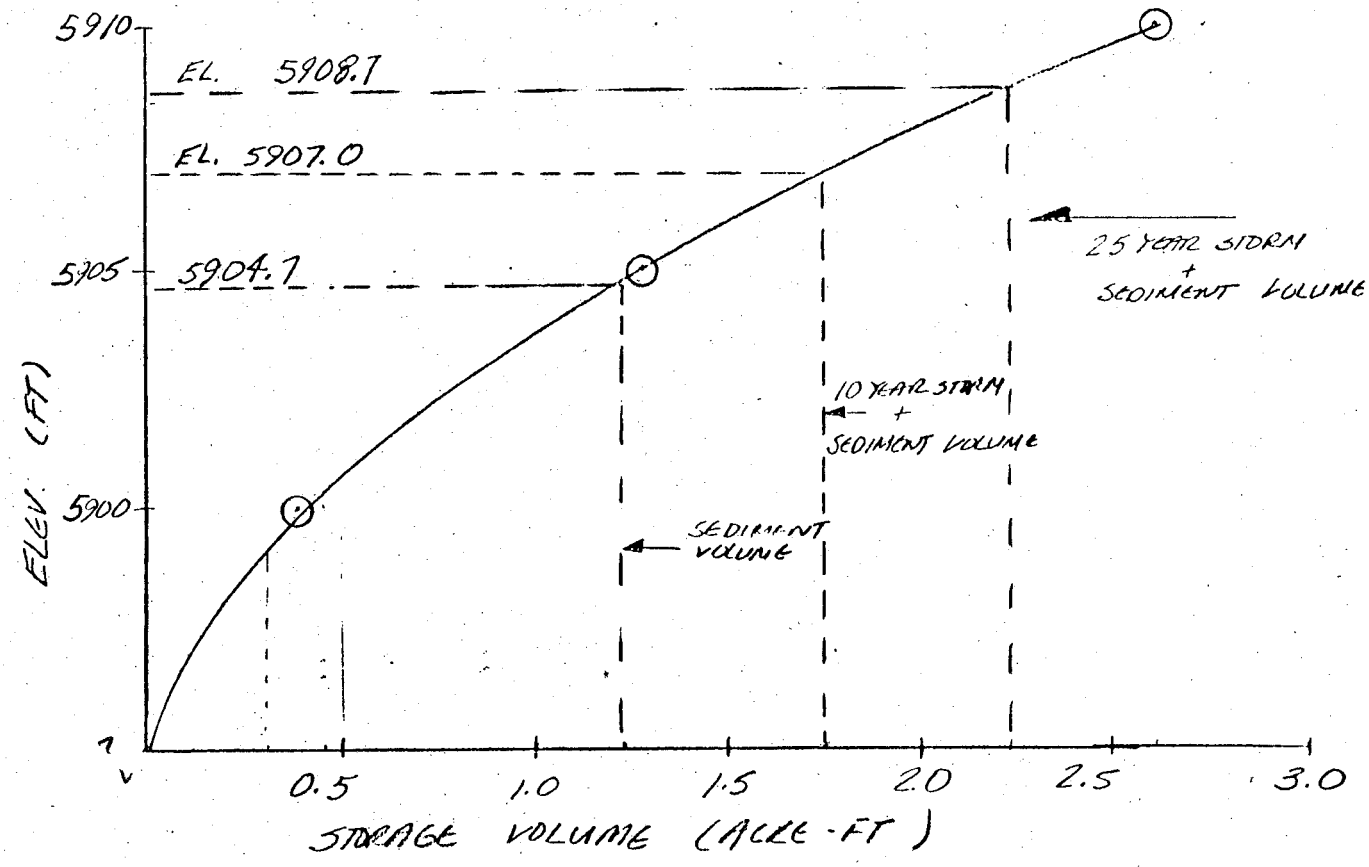
- ASSUME CREST EL. = 5910

- STORAGE CAPACITY DETERMINED AS FOLLOWS:

MAP SCALE 1" = 50'

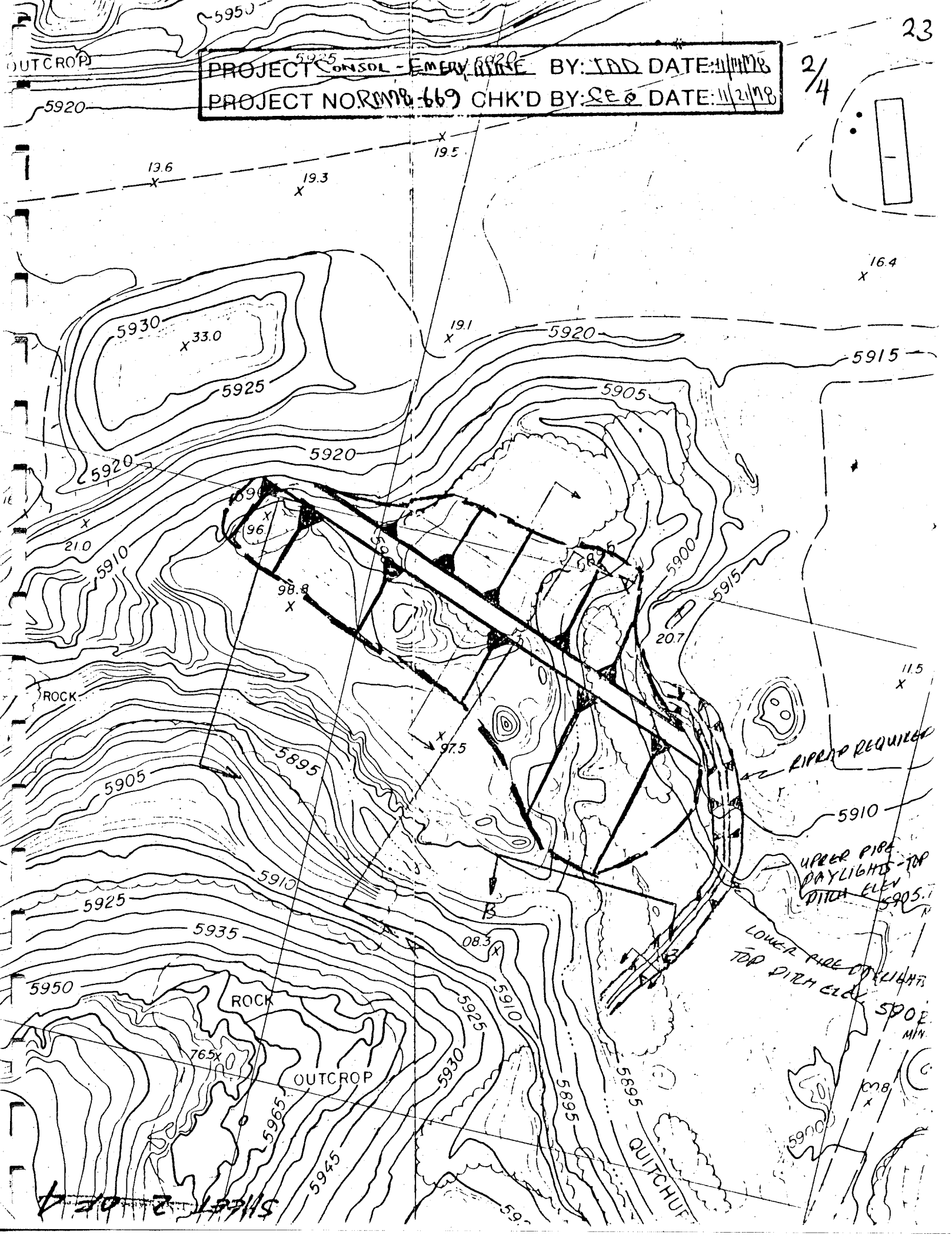
ELEV.	PLAN AREA in²	ACTUAL AREA (FT²)	ΔH (FT)	Δ VOLUME ACRE-FT
5895	0.46	1150		
			5	0.39
5900	2.25	5625		
			5	0.90
5905	4.00	10,000		
			5	1.32
5910	5.20	13,000		
				2.61

STO OK



PROJECT CONSOL - EMERY MINE BY: JDD DATE: 11/19/18
PROJECT NO. RM18-669 CHK'D BY: CE DATE: 11/21/18

2/4



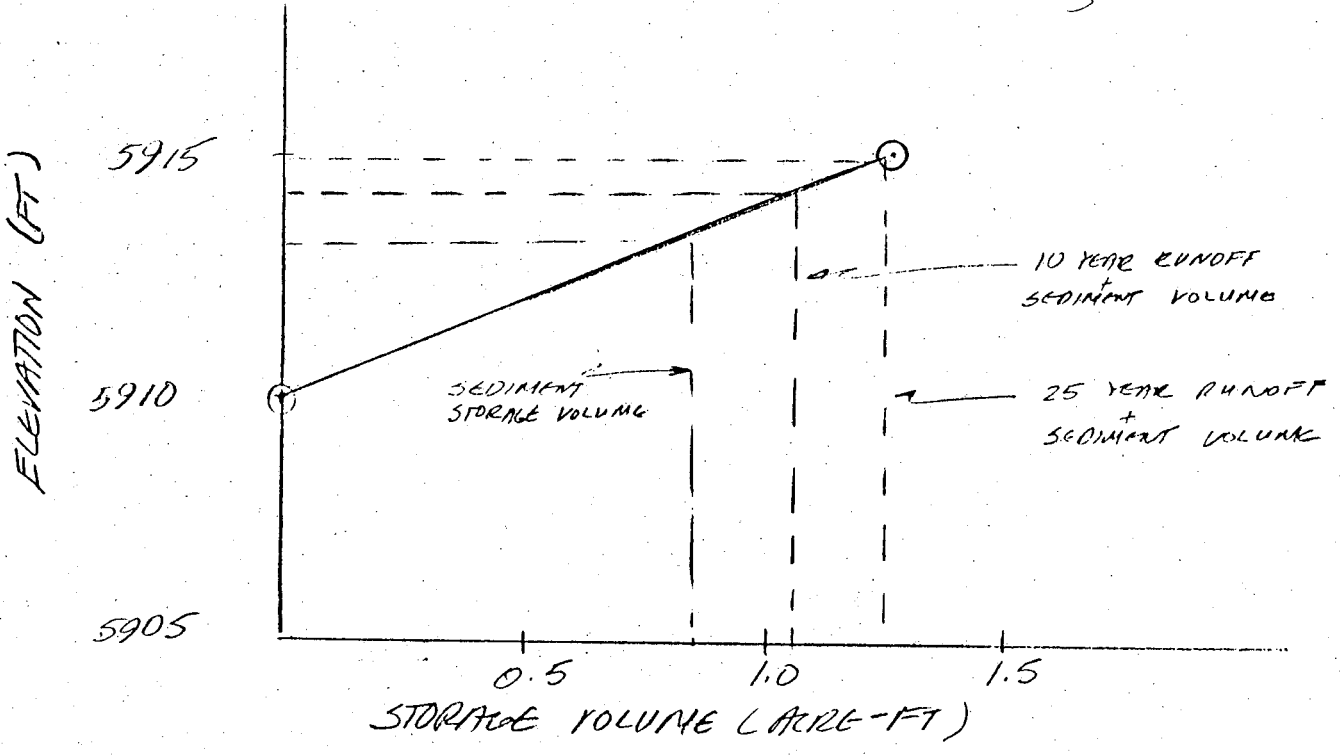
SHEET 2 OF 4

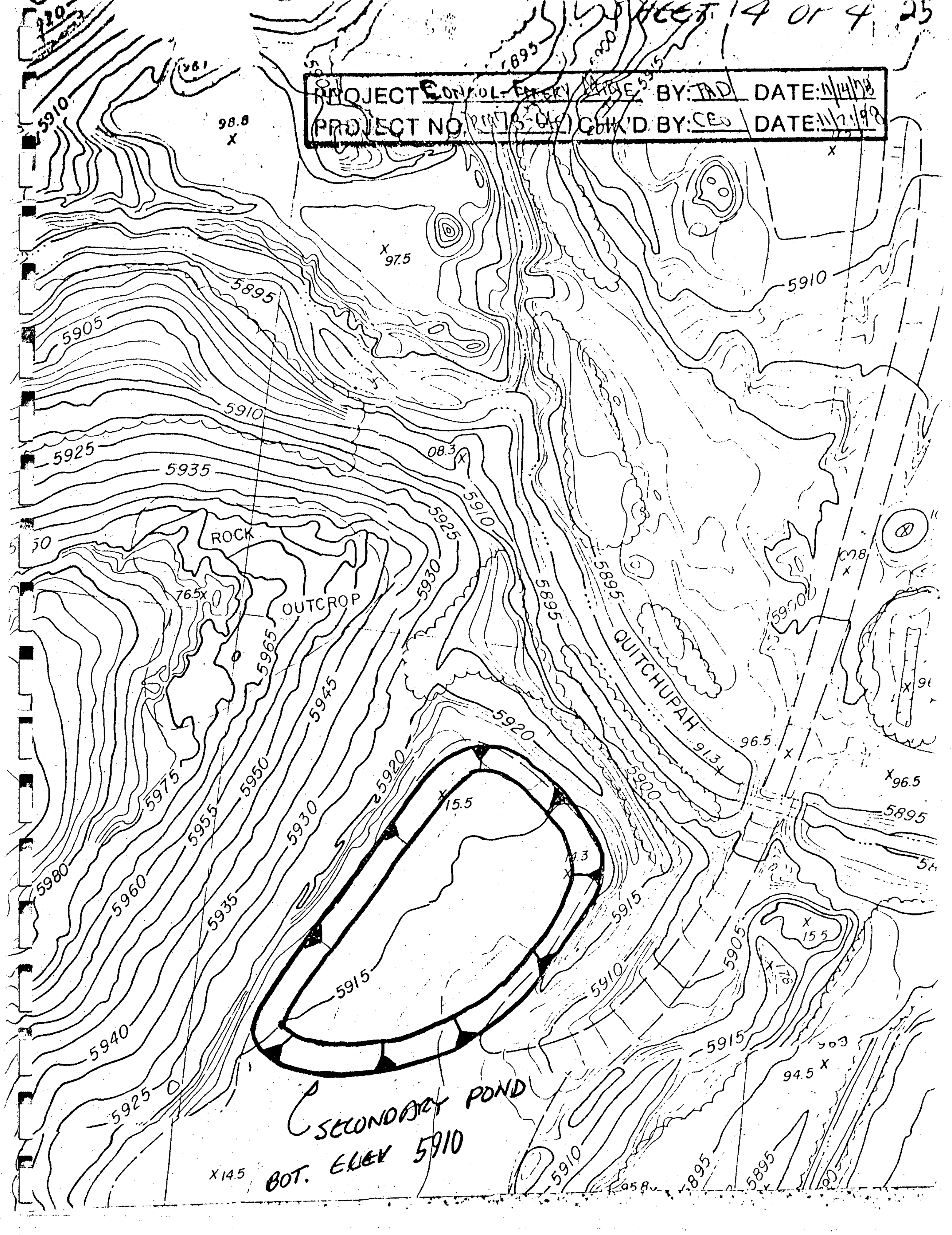
DIKE SIZE REQUIREMENTS
INCISED SECONDARY POND
STORAGE VOLUME REQUIRED 1.24 ACRE-FT
SEE ATTACHED SHEET

ELEV.	PLAN. AREA	AVER AREA	ΔH	VOLUME (AC-FT)
5910	3.65	9125	5	1.27
5915	5.20	13,000		

1.27 ≥ 1.24 SAY O.K.

STO. OK




PROJECT
BY:
DATE:
PROJECT NO.
CHK'D BY:
DATE:
98.8
97.5
5910
5895
5905
5910
5925
5935
ROCK
OUTCROP
76.5
08.3
5910
5925
5930
5965
5895
5895
QUITCHUPAH
5945
5920
5920
91.3
5900
96.5
96.5
5895
5975
5955
5950
5930
15.5
5980
5960
5935
5915
5915
5905
5910
15.5
5940
5915
94.5
5925
5925
SECONDARY POND
BOT. ELEV 5910
14.5
5910
5895
5895

IV DECANT SYSTEM DESIGN

MAIN POND

FROM THYDGPH - AS INDICATED IN THE PREVIOUS CALCULATIONS THE PEAK DISCHARGE FOR THE TWO PONDS IS AS FOLLOWS:

	10 YR	25 YR
MAIN POND	1.93 CFS	2.14 CFS
SMALL POND	0.85 CFS	0.98 CFS

REQUIRE THAT EACH POND BE DRAWN DOWN IN A MAXIMUM OF 10 DAYS - CHECK 12" PIPE ADEQUACY

POND	RETURN PERIOD (YRS)	VOLUME STORAGE (ACRE-FT)	Q REQ'D (CFS)
MAIN	25	1.01	0.05 OK
SECONDARY	25	0.36	0.02 OK

$1.01 AF \times 43560 \frac{ft^3}{AF} = 43996 ft^3$

$17280 ft^3$ drained

*** FROM THE HEADWATER VS DISCHARGE CURVE FOR A 12" Ø CMP, IT IS READILY APPARENT THAT THIS PIPE IS SUFFICIENT FOR USE IN BOTH PONDS

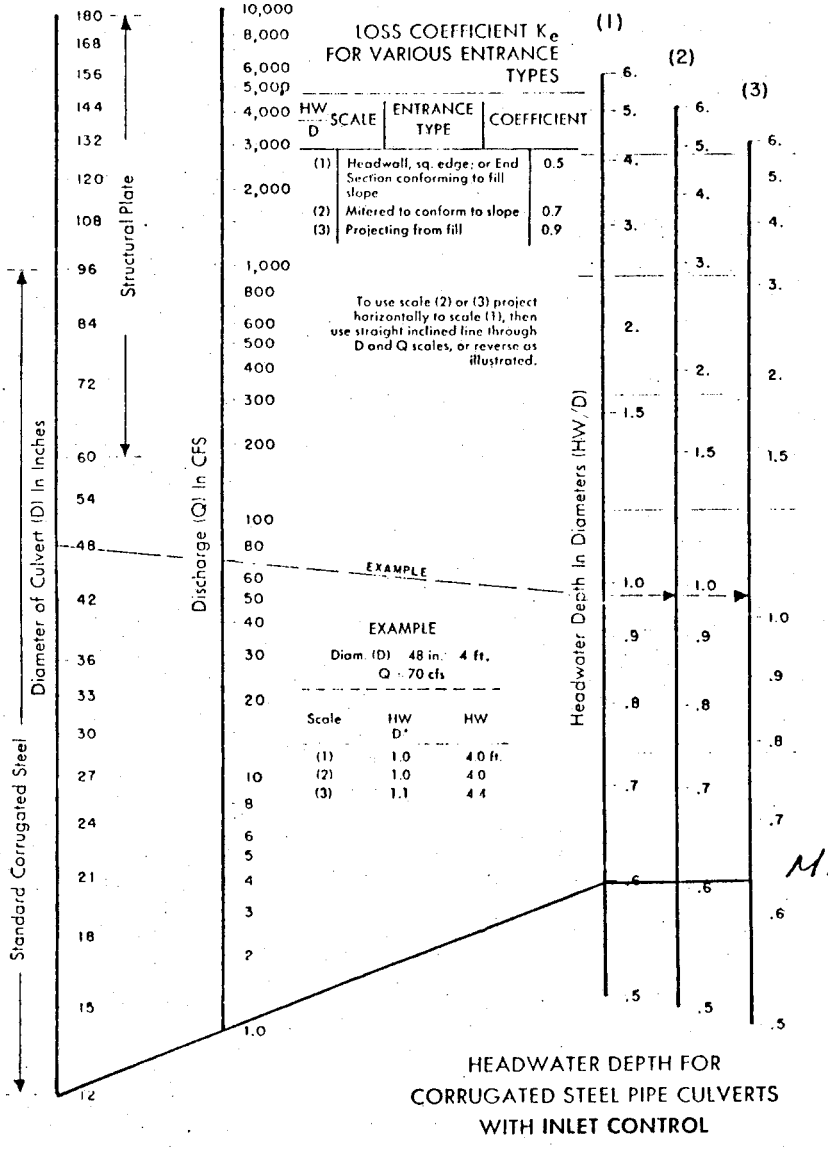
SECONDARY POND

$$\text{Available HEAD LOSS} = \frac{5915 - 5905}{500} = 0.02$$

FOR $N = .012$ (PLASTIC PIPE)
$Q \geq 1.0$ CFS O.K.
6" DIAM

SHEET 2 OF 2 27

PROJECT CONSOL - EMERY MINE BY: IAD DATE: 11/14/17
PROJECT NO. RMN8-669 CHK'D BY: CLO 161 DATE: 11/21/17



HEADWATER DEPTH FOR CORRUGATED STEEL PIPE CULVERTS WITH INLET CONTROL

MIN $\frac{H}{D} = 0.6$ OK

Fig. 4-18. *Inlet control* nomograph for corrugated steel *pipe* culverts. The manufacturers recommend keeping *HW/D* to a maximum of 1.5 and preferably to no more than 1.0.

VII DETERMINATION OF FLOOD LEVEL FOR QUITCHUPAH CREEK

- TRY 10 YEAR 24HRS FLOOD LEVEL APPROXIMATION USING THYD78 COMPUTER PROGRAM

1. QUITCHUPAH CREEK BASIN AREA = 61,900 ACRES*
   = 96.7 MI²

   ELEVATION DIFFERENCE = 4000 FT
   LENGTH = 70,000 FT
   10 YEAR RAINFALL = 1.5 INCHES
   ASSUME CURVE NO 75

PROGRAM THYD - REVISED 10-20-78

EMERY MINE SITE
THOMAS A. DONOVAN
→ 10 YR. 24 HR. STORM QUITCHINPAH BASIN
AREA= 96.70SQ.MI. LENGTH OF LONGEST WATERCOURSE= 70000.00FT.

ELEVATION DIFFERENCE= 4000.00FT. CURVE NO.= 75.00 ok
CUMMULATIVE RAINFALL

.67 AFTER 1/2 HOUR
.85 AFTER ONE HOUR
1.50 AFTER SIX HOURS
1.50 AFTER TWENTY-FOUR HOURS
TIME OF CONCENTRATION= 2.11(HRS.)
FLOOD HYDROGRAPH

AS INDICATED ON CONSOL DWG-D'APPOLONIA CHECK INCLUDED AFTER HYDROGRAPH ANALYSIS

TIME (HRS.)	WATER FLOW (SECOND-FEET)	TOTAL FLOW (ACRE-FT)
.25	.04	.001
.50	.07	.002
.75	48.83	1.011
1.00	97.59	3.028
1.25	249.63	8.185
1.50	401.66	16.484
1.75	657.56	30.070
2.00	913.45	48.943
2.25	1192.53	73.582
2.50	1467.12	103.894
2.75	1674.77	138.497
3.00	1872.89	177.193
3.25	1995.87	218.430
3.50	2109.27	262.010
3.75	2152.23	306.478
4.00	2186.29	351.649
4.25	2156.47	396.204
4.50	2118.48	439.974
4.75	2046.86	482.265
5.00	1972.81	523.025
5.25	1897.49	562.230
5.50	1826.01	599.957
5.75	1758.17	636.283
6.00	1694.73	671.298
7.00	1161.14	785.532
8.00	455.18	843.151
9.00	80.78	859.669
10.00	0.00	860.623
11.00	0.00	860.623
12.00	0.00	860.623
13.00	0.00	860.623
14.00	0.00	860.623
15.00	0.00	860.623
16.00	0.00	860.623
17.00	0.00	860.623
18.00	0.00	860.623
19.00	0.00	860.623
20.00	0.00	860.623
21.00	0.00	860.623
22.00	0.00	860.623
23.00	0.00	860.623
24.00	0.00	860.623

1 PEAK DISCHARGE= 2186.29TOTAL DISCHARGE= 860.62

.046 CP SECONDS EXECUTION TIME
C>OLD,TADJB
C>EDIT

PROGRAM THYD - REVISED 10-20-78

EMERY MINE RM78-669
THOMAS A DONOVAN
25 YR 24 HR STORM QUITCHINPAH BASIN WATERSHED
AREA= 96.7080.MI. LENGTH OF LONGEST WATERCOURSE= 70000.00FT.

ELEVATION DIFFERENCE= 4000.00FT. CURVE NO.= 75.00
CUMMULATIVE RAINFALL

.75 AFTER 1/2 HOUR
.95 AFTER ONE HOUR
1.50 AFTER SIX HOURS
1.90 AFTER TWENTY-FOUR HOURS
TIME OF CONCENTRATION= 2.11(HRS.)

FLOOD HYDROGRAPH

TIME (HRS.)	WATER FLOW (SECOND-FEET)	TOTAL FLOW (ACRE-FT)
.25	10.49	.217
.50	20.99	.650
.75	134.23	3.424
1.00	247.47	8.537
1.25	474.25	18.335
1.50	701.03	32.819
1.75	1013.11	53.751
2.00	1324.23	81.111
2.25	1569.87	113.547
2.50	1806.04	150.862
2.75	1950.83	191.168
3.00	2085.16	234.250
3.25	2139.01	278.444
3.50	2183.54	323.559
3.75	2158.93	368.165
4.00	2126.09	412.092
4.25	2038.54	454.211
4.50	1944.72	494.391
4.75	1849.11	532.596
5.00	1757.58	568.909
5.25	1675.40	603.525
5.50	1599.01	636.563
5.75	1530.53	668.185
6.00	1467.04	698.496
7.00	1245.36	807.978
8.00	1064.97	901.229
9.00	934.03	982.209
10.00	840.74	1054.372
11.00	768.07	1120.000
12.00	707.64	1180.278
13.00	656.53	1236.058
14.00	612.70	1288.002
15.00	574.66	1336.630
16.00	541.31	1382.364
17.00	511.81	1425.546
18.00	485.53	1466.461
19.00	461.95	1505.346
20.00	440.67	1542.404
21.00	421.36	1577.807
22.00	403.75	1611.703
23.00	387.63	1644.224
24.00	372.81	1675.480

1 PEAK DISCHARGE= 2183.54 TOTAL DISCHARGE= 1675.48 25 yr, 24 hr

AREA= 96.7080.MI. LENGTH OF LONGEST WATERCOURSE= 13.26FT.

ELEVATION DIFFERENCE= 4000.00FT. CURVE NO.= 75.00

DETERMINATION OF 10 YEAR FLOOD LEVEL QUITCHUPAH CREEK

TO FIND THE 100 YEAR FLOOD LEVEL, MANNINGS EQUATION:

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

WILL BE USED: THE FOLLOWING ASSUMPTIONS WILL BE MADE

$n = 0.05$ (DESIGN OF SMALL DAMS - BUREAU REC.)
$S = 0.02$ FT/FT (2% AVERAGE SLOPE)

THE CROSS SECTION ON THE ATTACHED SHEET IS USED FOR AREA COMPUTATIONS

$A = 1373 \text{ FT}^2$
$R = 9.15$

$$Q = \frac{1.49(1373)(9.15)^{0.66}(.02)^{0.5}}{0.05}$$

$Q_{MAX} = 24942$ CFS capacity of channel?

$$Q_{ELEV\ 5900} = \frac{(1.49)(234)(2.73)^{0.66}(0.02)^{.5}}{0.05} = 2077 \text{ CFS}$$

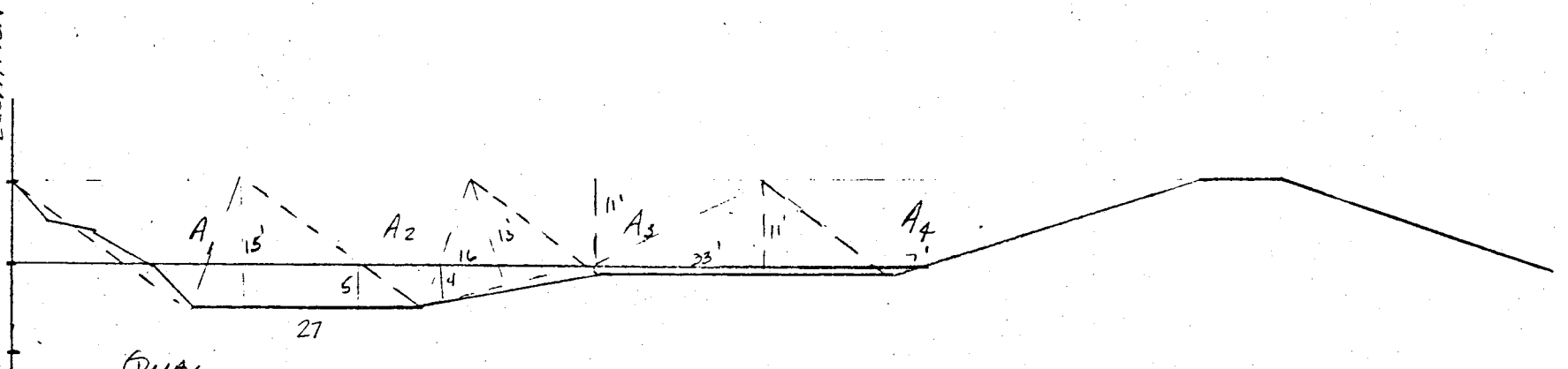
∴ RIPRAP TOE OF DAM REQUIRED - EST ELEV. ~ 5902 OR 5903

DANIEL, (DON) MAY
CONSULTING ENGINEERS, INC.

By TAD Date 11-14-78 Subject Gilmer Mine Sheet No. 2 of 12
Chkd. By CED Date 11/21/78 Proj. No. 4478-668

CROSS-SECTION A-A

SCALE 1" = 20'



DMA

$A_1 = 2(1/2 \cdot 15 \cdot 27) = 405\ FT^2$ $A_T = 1373\ FT^2$

$A_2 = \left[(26.14)/2 + (21.13)/2\right] = 319\ FT^2$ WETTED PERIMETER = 150 FT

$A_3 = 11 \times 34 = 374\ FT^2$ $R = 9.15$

$A_4 = 1/2(50 \times 11) = 275\ FT^2$

Q 1900

$A_1 = 5 \times 27 = 135\ FT^2$ $A_3 = 2 \times 33 = 66\ FT^2$ $A_T = 254\ FT^2$

$A_2 = \frac{1}{2}(4.16) + \frac{1}{2}(21.2) = 53\ FT^2$ WETTED PERIMETER = 93 FT $R = 2.73'$

AT SECTION B-B

$$Q = \frac{1.49(129)(2.22)^{0.66}(0.02)^{0.5}}{0.05} = 920 \text{ CFS} \leq 2200$$

∴ RIPRAP PROTECTION REQUIRED ON DOWNSTREAM FACE OF DIKE

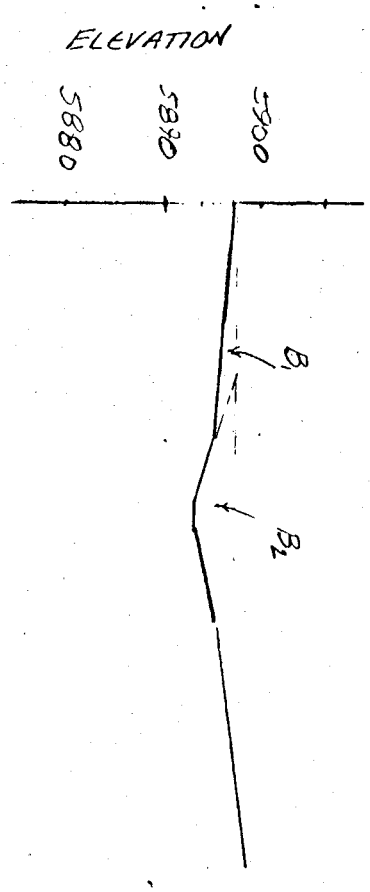
AT SECTION C-C

$$Q = \frac{(1.49)(123)(3.84)^{0.66}(0.02)}{0.05} = 1260 \text{ CFS} \leq 2200$$

∴ AGAIN RIPRAP PROTECTION IS REQUIRED ON THE DOWNSTREAM FACE

CROSS-SECTION B-B

SCALE 1" = 20'



$B_1 = \frac{1}{2}(2 \times 24) = 24 FT^2$

$B_2 = \left(\frac{39+4}{2}\right) \times 5 = 105 FT^2$

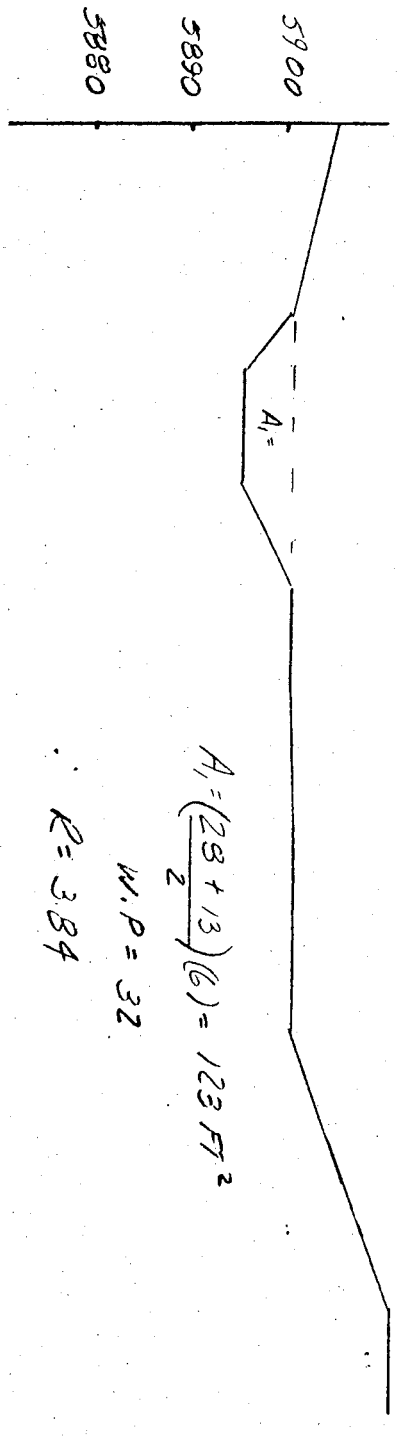
$\Sigma = 129 FT^2$

W.P. = 58 FT

$\therefore R = 2.22$

CROSS-SECTION C-C

SCALE 1" = 20'



$A_1 = \left(\frac{23+13}{2}\right)(6) = 123 FT^2$

W.P. = 32

$R = 3.84$

CHECK ON QUITCHIPAH CREEK BASIN WATERSHED

ATTACHED FIGURE SHOWS APPROXIMATE WATERSHED AREA OF 60,000 ACRES WHICH IN AGREEMENT WITH REPORTED WATERSHED AREA OF 61,900 ACRES BY CONSOL

WATERSHED AREA DETERMINATION:

PLANIMETERED AREA = $6.0\ in^2$

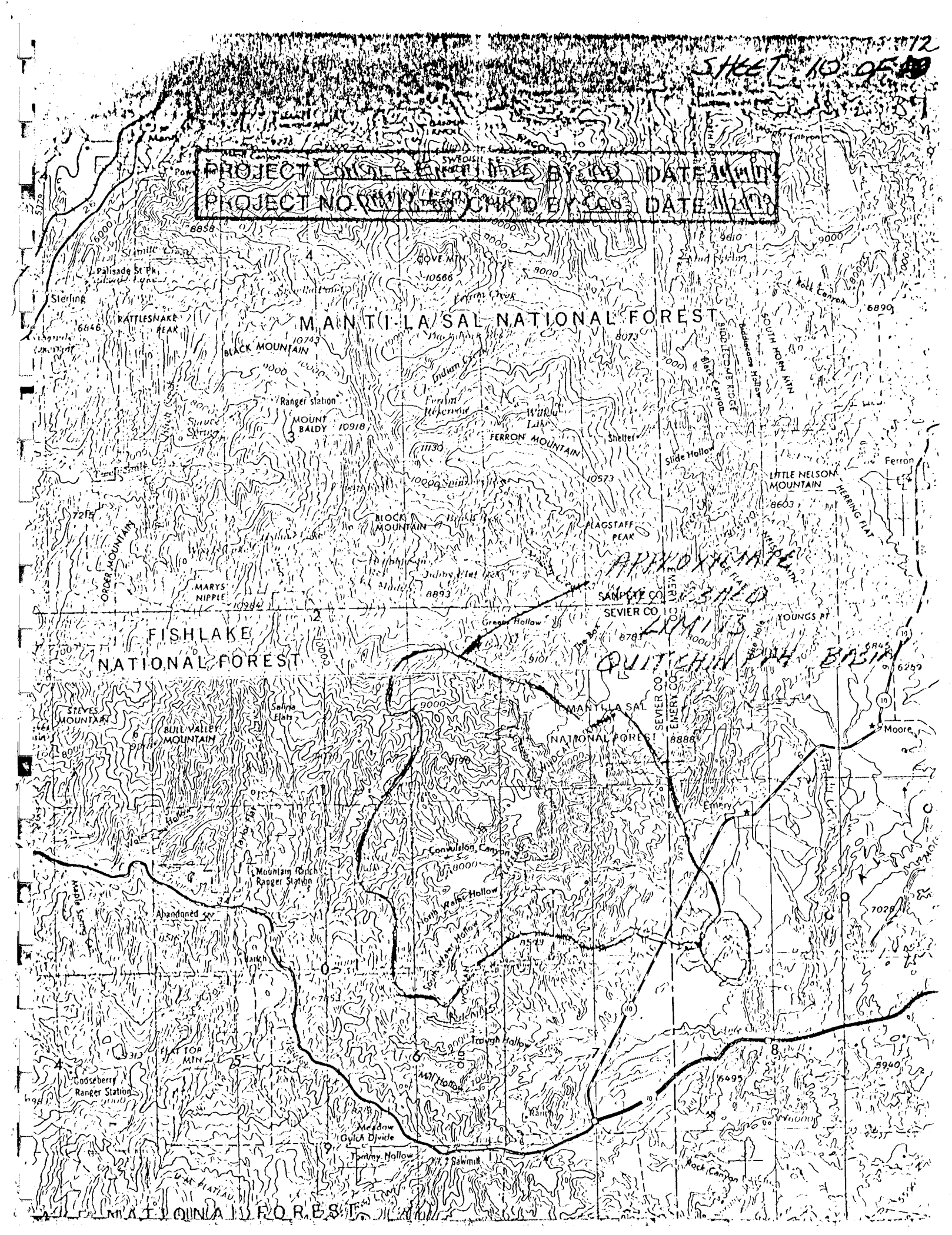
MAP SCALE = 1:250,000

= 1" = 20,833FT.

= $1''^2 = 4.34 \times 10^8\ FT^2$

$$\therefore\ 6.0\ in^2 \times 4.34 \times 10^8 \frac{FT^2}{in^2} \times \frac{1\ ACRE}{43560\ FT^2}$$

$\cong$ 59,800 ACRES


PROJECT
BY
DATE
PROJECT NO.
CHK'D BY
DATE
MANTI-LA/SAL NATIONAL FOREST
FISHLAKE NATIONAL FOREST
MANTI-LA SAL NATIONAL FOREST
APPROXIMATE
QUITCHUPAH BASIN
SANPETE CO.
SEVIER CO.
EMERY CO.
Sterling
RATTLESNAKE PEAK
BLACK MOUNTAIN
Ranger station
MOUNT BALDY
FERRON MOUNTAIN
Shelter
Ferron
LITTLE NELSON MOUNTAIN
HERRING FLAT
SOUTH HORN MTN
Slide Hollow
BLOCK MOUNTAIN
FLAGSTAFF PEAK
ORDER MOUNTAIN
MARYS NIPPLE
Gregor Hollow
YOUNGS PT
STEVES MOUNTAIN
BULL VALLEY MOUNTAIN
Salina Flats
Moore
Emery
Convulsion Canyon
Mountain Ranch Ranger Station
North Wafer Hollow
Abandoned
Ranch
FLAT TOP MTN
Gooseberry Ranger Station
Meadow Gylch Divide
Tommy Hollow
Salina
Trough Hollow
Rock Canyon

DETERMINE 10 YEAR FLOOD LEVEL FOR IMPROVED DIKE USING MANNINGS EQUATION

DETERMINE DISCHARGE CAPACITY AT DIKE ELEV. 5914.9

$$Q = \frac{1.49 A R^{0.66} S^{1/2}}{n}$$

ASSUME AS IN PREVIOUS CALCS

$S = 0.02$ ft/ft
$n = 0.05$

$$Q = \frac{1.49(404)(6.22)^{0.66}(.02)^{1/2}}{.05} = 5688.7 \text{ CFS} > 2200$$

O.K.

Q AT ELEV 5910 =

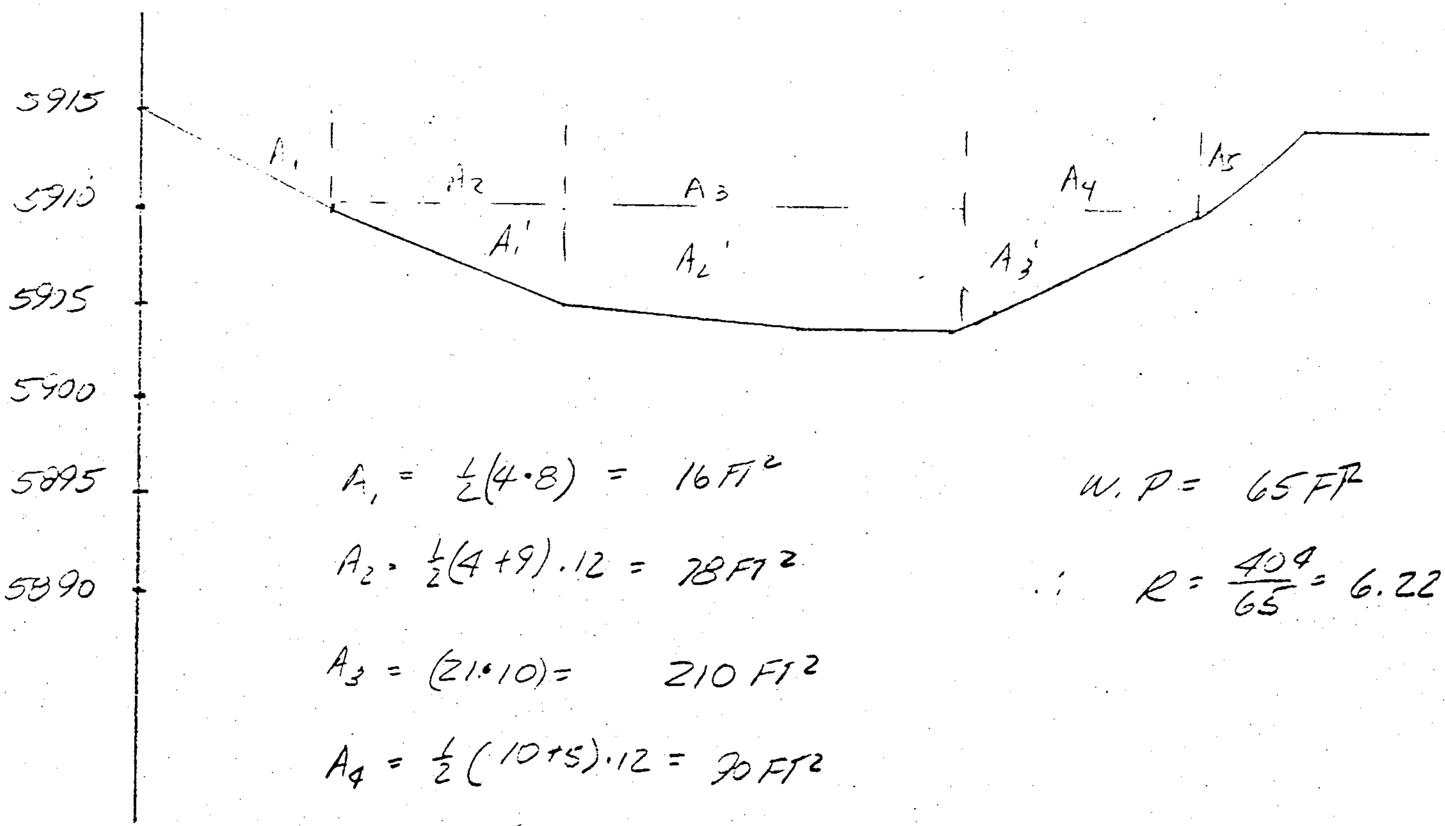
$$Q = \frac{1.49(192)(4.09)^{0.66}(0.02)^{.5}}{0.05}$$

$= 2050$ CFS

SAY 10YR FLOOD LEVEL ELEVATION 5911

CONSULTING ENGINEERS, INC.

By TAD Date 11/18/78 Subject EMILY MINE
Chkd. By CEJ Date 11/21/78 CONSOL
Sheet No. 13 of 12
Proj. No. [illegible]



$A_1 = \frac{1}{2}(4 \cdot 8) = 16\ FT^2$

$A_2 = \frac{1}{2}(4+9) \cdot 12 = 78\ FT^2$

$A_3 = (21 \cdot 10) = 210\ FT^2$

$A_4 = \frac{1}{2}(10+5) \cdot 12 = 90\ FT^2$

$A_5 = \frac{1}{2}(4 \cdot 5) = 10\ FT^2$

$404\ FT^2$

W.P = 65 FT

$\therefore\ R = \frac{404}{65} = 6.22\ FT$

W.P = 47 ∴ R = 4.09

AT ELEV 5910

$A_1' = \frac{1}{2}(12 \cdot 5) = 30\ FT^2$

$A_2 = 21 \cdot 6 \quad 126\ FT^2$

$A_3' = \frac{1}{2}(6)(12) = 36\ F^2$

$A = 192\ FT^2$

DESIGN OF PIPE SYSTEM TO CONVEY RUNOFF BY PORTAL AREA:

A. WATERSHED AREA ABOVE PORTAL AREA (200' SCALE MAP)

$4.26\ in^2 = 3.91$ ACRES

10 YR 24 HR RAINFALL = 1.5 INCHES ✓
25 YR 24 HR RAINFALL = 1.9 INCHES ✓

USING RATIONAL FORMULA: (DESIGN OF ROADSIDE CHANNELS BUREAU OF PUBLIC ROADS 1965)

$Q = CIA$

DETERMINE $T_c = \left[\frac{11.9L^3}{H}\right]^{0.385}$ OK

$L = 1000$ FT
$H = 6066 - 5915 = 151$ FT

FROM FIG 5 REF (1)

$T_c = 3.5$ MIN. (SHEET DURATION)

10 YR 30 MIN RAINFALL = 0.67 IN. SAY $I = 1.34$ INCHES/HR
ASSUMED $C = 0.75$ (CONSERVATIVELY)

$Q = (0.75)(1.34)(3.91) = 3.93$ CFS SAY 4 CFS

5 MIN 10 YR $= 0.21$ IN
$= 2.52$ IN/HR

$(.6)(2.52)(3.91) = 5.91$ CFS
$(.7)(2.52)(3.91) = 6.9$ CFS

B. SIZE CULVERT FOR 4 CFS BY THE PORTAL AREA

150 FT OF CULVERT
ELEV DIFF = 5920.5 − 5915 = 4.5'
∴ AVERAGE PIPE SLOPE = 3.0 %

UTILIZE DESIGN CHART "HANDBOOK OF STEEL DRAINAGE & HIGHWAY CONSTRUCTION PRODUCTS" ARMCO STEEL PG 197 (attached)

FOR $n = 0.19 - 0.21$
$Q_{REQ} = 4$ CFS $\Longrightarrow$ PIPE DIAMETER = 12"

$S = 0.03$

∴ USE 150 FT OF 12" CMP

CHECK FLOW VELOCITY

$A = \frac{\pi D^2}{4} = 0.79\ FT^2$

$V = \frac{Q}{A} = \frac{4}{0.79} =$ 5.06 FT/SEC SAY O.K. (close enough to 5.9)

LIMIT OF EROSIVE SOIL VELOCITIES ≈ 5 FT/SEC

C. SIZE DITCH TO MAIN SEDIMENTATION POND AND AROUND PORTAL AREA

1. AROUND PORTAL AREA

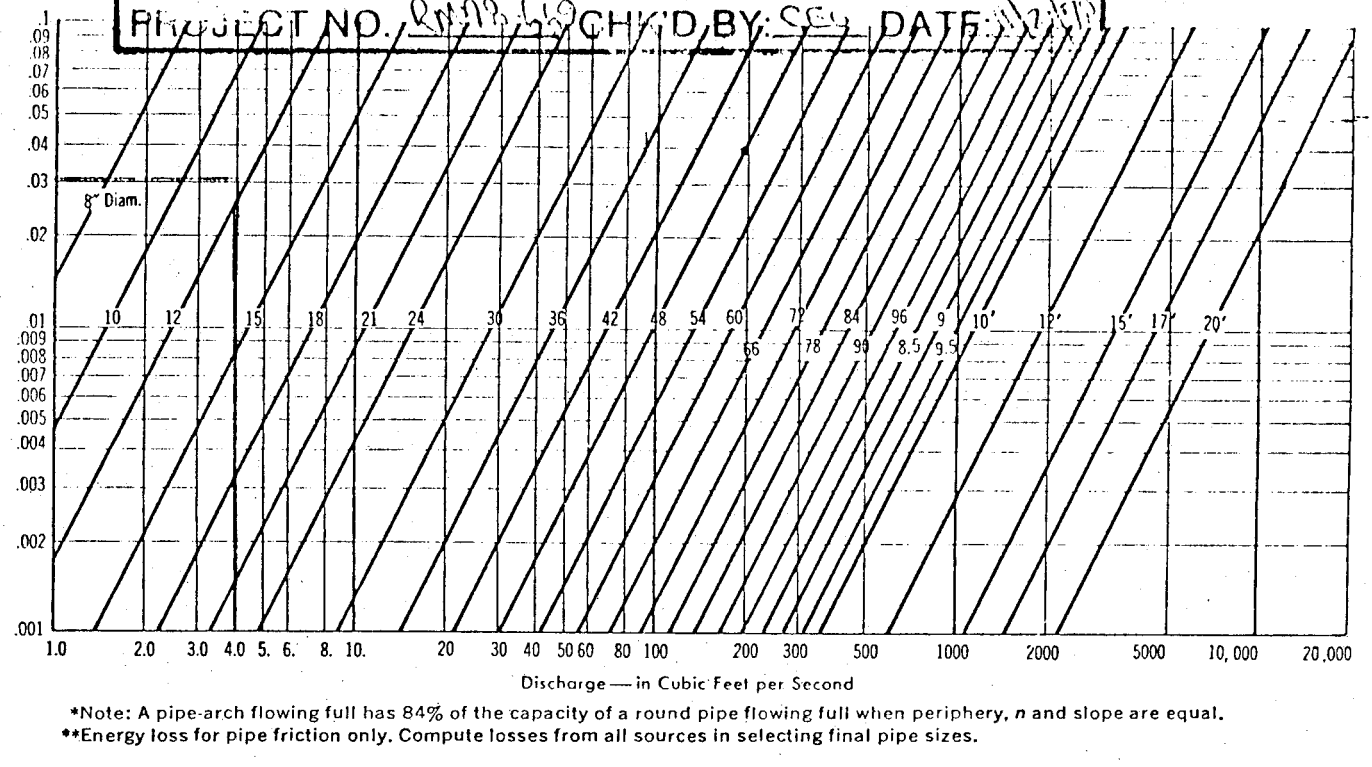


Fig. 4-46. Energy Head Loss Based on Manning's Formula. Pipe Flowing Full $n = .019$**

*Note: A pipe-arch flowing full has 84% of the capacity of a round pipe flowing full when periphery, *n* and slope are equal.
**Energy loss for pipe friction only. Compute losses from all sources in selecting final pipe sizes.

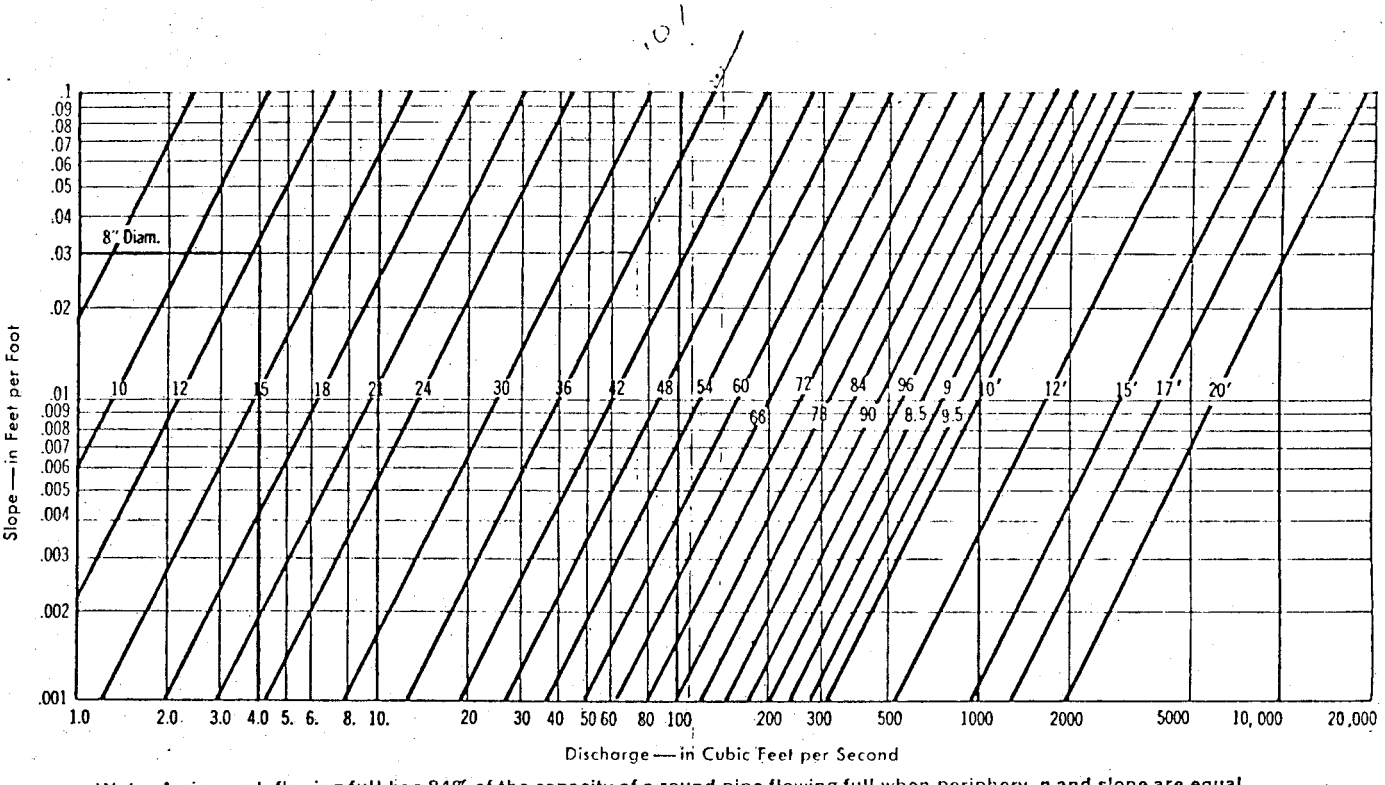


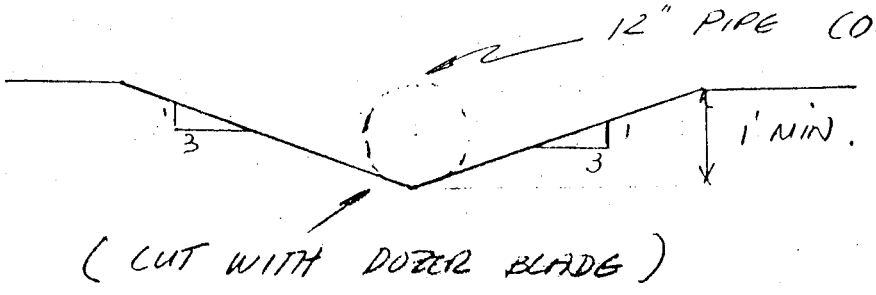
Fig. 4-47. Energy Head Loss Based on Manning's Formula. Pipe Flowing Full $n = .021$**

*Note: A pipe-arch flowing full has 84% of the capacity of a round pipe flowing full when periphery, *n* and slope are equal.
**Energy loss for pipe friction only. Compute losses from all sources in selecting final pipe sizes.

AVERAGE SLOPE ~ 5' in 50 FT SAY 10%
Q = 4CFS

FROM SEELY " DESIGN DATA BOOK FOR CIVIL ENGINEERS PG 12-06 ATTACHED

SECTION IS FOLLOWS: CUT IN ROCK OR RIPRAPPED



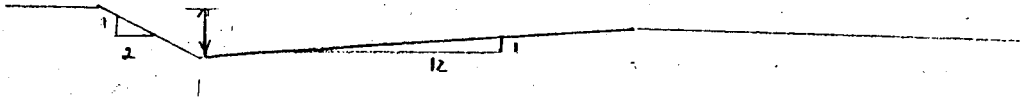
PEAK DISCHARGE CAPACITY - MORE THAN ADEQUATE ~ 3CFS

2. DITCH TO MAIN SEDIMENTATION POND

MIN SLOPE = 3 FT IN 400 FT = 0.8% SLOPE (.008 FT/FT)

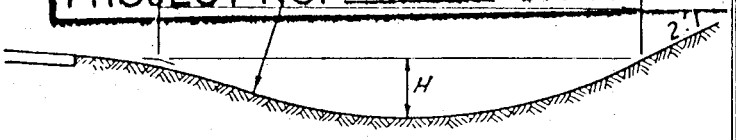
(1) FROM DESIGN CHART ON FOLLOWING PAGE - TYPICAL SECTION 6B AS SHOWN ABOVE WILL CARRY THE FLOW WITH A VELOCITY OF ABOUT 2.8 F/SEC NO RIPRAP REQUIRED

(2) ALTERNATIVE DESIGN - USE EXISTING BERM - DESIGNATE MINIMUM HEIGHT OF 2' SPECIFY H = .75' AS FOLLOWS

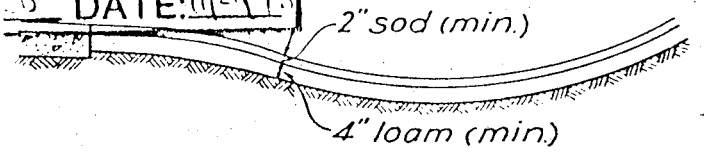


DRAINAGE - DITCHES - COMMON SECTIONS - I

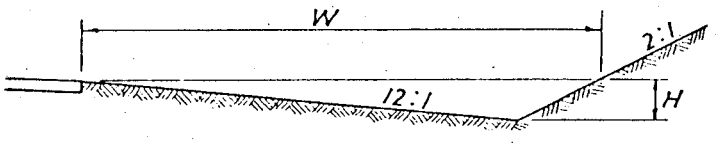
PROJECT CONSOL - EMERY MINE BY: JAD DATE: 11/6/73 SHEET 5 OF 9
PROJECT NO. RMW2-653 CHK'D BY: [illegible] DATE: 11/21/73



D-1 SEGMENTAL

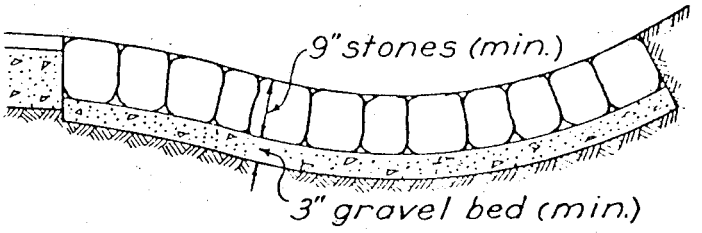


SODDED GUTTER

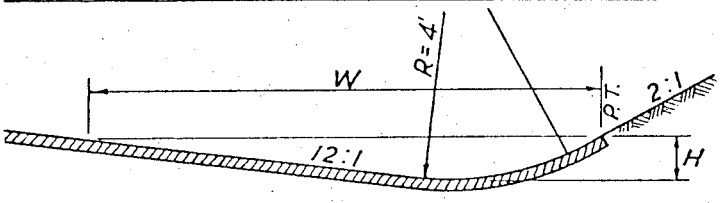


D-1A TRIANGULAR

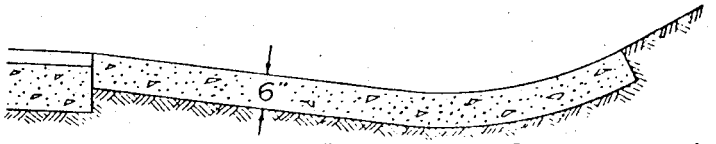
Unequal side slopes



COBBLED GUTTER

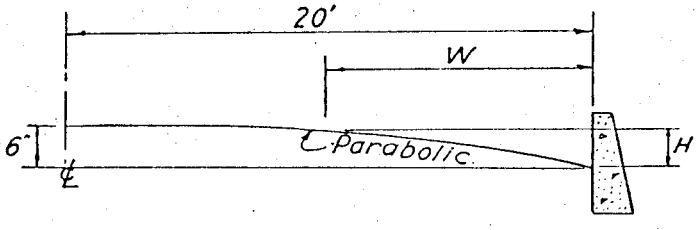


D-1B BITUMINOUS GUTTER

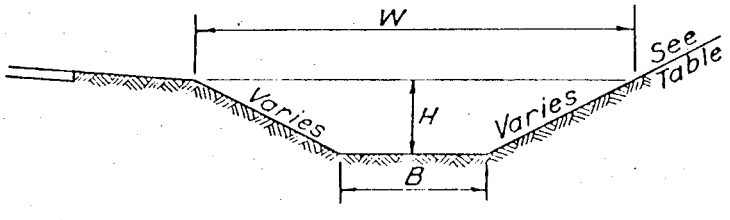


Base required same as for concrete pavement.

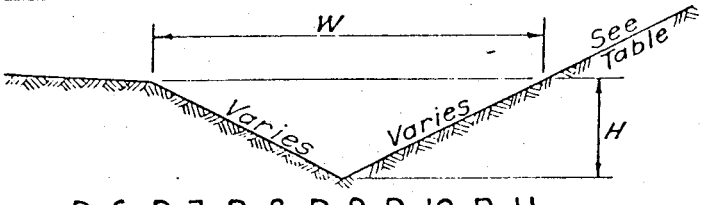
CONCRETE GUTTER



D-1C CURBED CROWNED STREET



D-2, D-3, D-4, D-5 TRAPEZOIDAL



D-6, D-7, D-8, D-9, D-10, D-11 ISOSCELES TRIANGULAR

D-9, D-10 and D-11 - Airport ditches

TABLE A — PROPERTIES OF DITCHES

NO.	DIMENSIONS				HYDRAULICS			
	SIDE SLOPES	B	H	W	a	p	R	$R^{2/3}$
D-1	—	—	6½"	5'-0"	1.84	5.16	0.356	0.502
D-1A	12:1 & 2:1	—	6"	7'-0"	1.75	7.14	0.245	0.392
D-1B	12:1 & 2:1	—	5"±	7'-0"	1.64	7.08	0.232	0.377
D-1C	½" to 1'-0"	—	4.5"	10'-0"	1.68	10.38	0.162	0.297
D-2A	1½:1'	2'-0"	1'-0"	5'-0"	3.50	5.61	0.624	0.730
B	2:1	2'-0"	1'-0"	6'-0"	4.00	6.47	0.618	0.726
C	3:1	2'-0"	1'-0"	8'-0"	5.00	8.32	0.601	0.712
D-3A	1½:1	3'-0"	1'-6"	7'-6"	7.88	8.41	0.937	0.958
B	2:1	3'-0"	1'-6"	9'-0"	9.00	9.71	0.927	0.951
C	3:1	3'-0"	1'-6"	12'-0"	11.25	12.49	0.901	0.933
D-4A	1½:1	3'-0"	2'-0"	9'-0"	12.00	10.21	1.175	1.114
B	2:1	3'-0"	2'-0"	11'-0"	14.00	11.94	1.173	1.112
C	3:1	3'-0"	2'-0"	15'-0"	18.00	15.65	1.150	1.091
D-5A	1½:1	4'-0"	3'-0"	13'-0"	25.50	14.82	1.721	1.436
B	2:1	4'-0"	3'-0"	16'-0"	30.00	17.42	1.722	1.437
C	3:1	4'-0"	3'-0"	22'-0"	39.00	22.97	1.698	1.423
D-6A	2:1	—	1'-0"	4'-0"	2.00	4.47	0.447	0.584
B	3:1	—	1'-0"	6'-0"	3.00	6.32	0.475	0.609
D-7A	2:1	—	2'-0"	8'-0"	8.00	8.94	0.895	0.929
B	3:1	—	2'-0"	12'-0"	12.00	12.65	0.949	0.965
D-8A	2:1	—	3'-0"	12'-0"	18.00	13.42	1.341	1.216
B	3:1	—	3'-0"	18'-0"	27.00	18.97	1.423	1.265
D-9	7:1	—	1'-0"	14'-0"	7.00	14.14	0.495	0.626
D-10	7:1	—	2'-0"	28'-0"	28.00	28.28	0.990	0.993
D-11	7:1	—	3'-0"	42'-0"	63.00	42.43	1.485	1.302

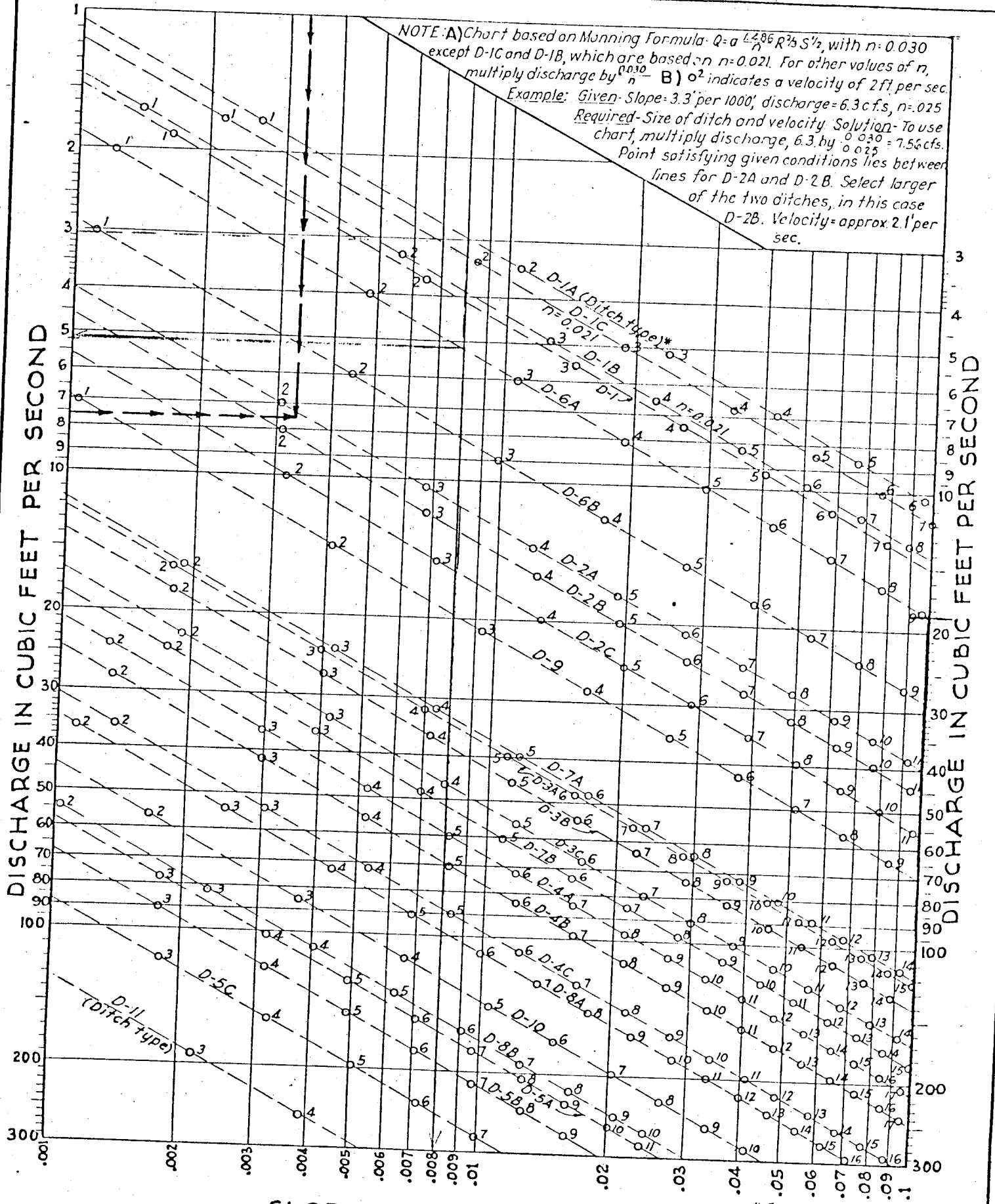
PROJECT Sonora - Grand Ave. BY: JAD DATE: 11/2/98

PROJECT NO. [illegible] CHKD BY: CCo DATE: 11/2/98

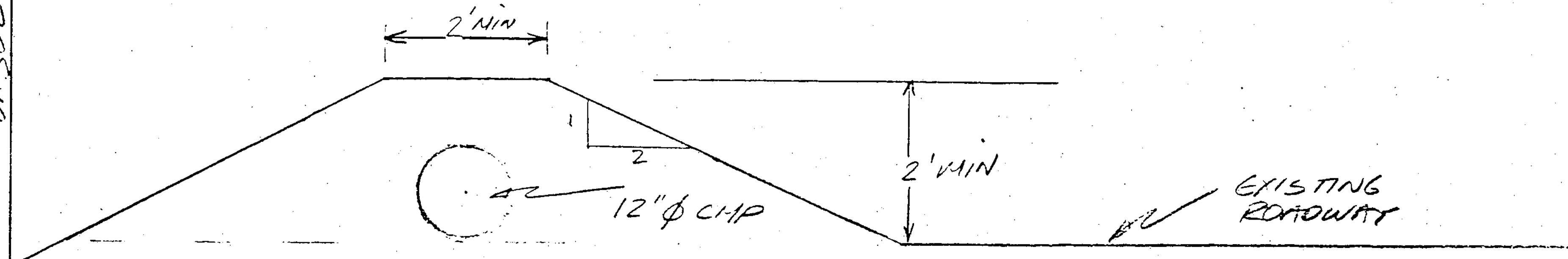
DRAINAGE—DITCHES—COMMON SECTIONS—2

NOTE: A) Chart based on Manning Formula- $Q = a \frac{1.486}{n} R^{2/3} S^{1/2}$, with $n = 0.030$ except D-1C and D-1B, which are based on $n = 0.021$. For other values of n, multiply discharge by $\frac{0.030}{n}$ — B) o^2 indicates a velocity of 2 ft per sec.

Example: Given- Slope = 3.3' per 1000', discharge = 6.3 c.f.s, n = .025 Required- Size of ditch and velocity. Solution- To use chart, multiply discharge, 6.3 by $\frac{0.030}{0.025}$ = 7.56 cfs. Point satisfying given conditions lies between lines for D-2A and D-2B. Select larger of the two ditches, in this case D-2B. Velocity = approx. 2.1' per sec.



*See page 18-05



CULVERT INSTALLATION DETAIL - PORTHOLE VICINITY

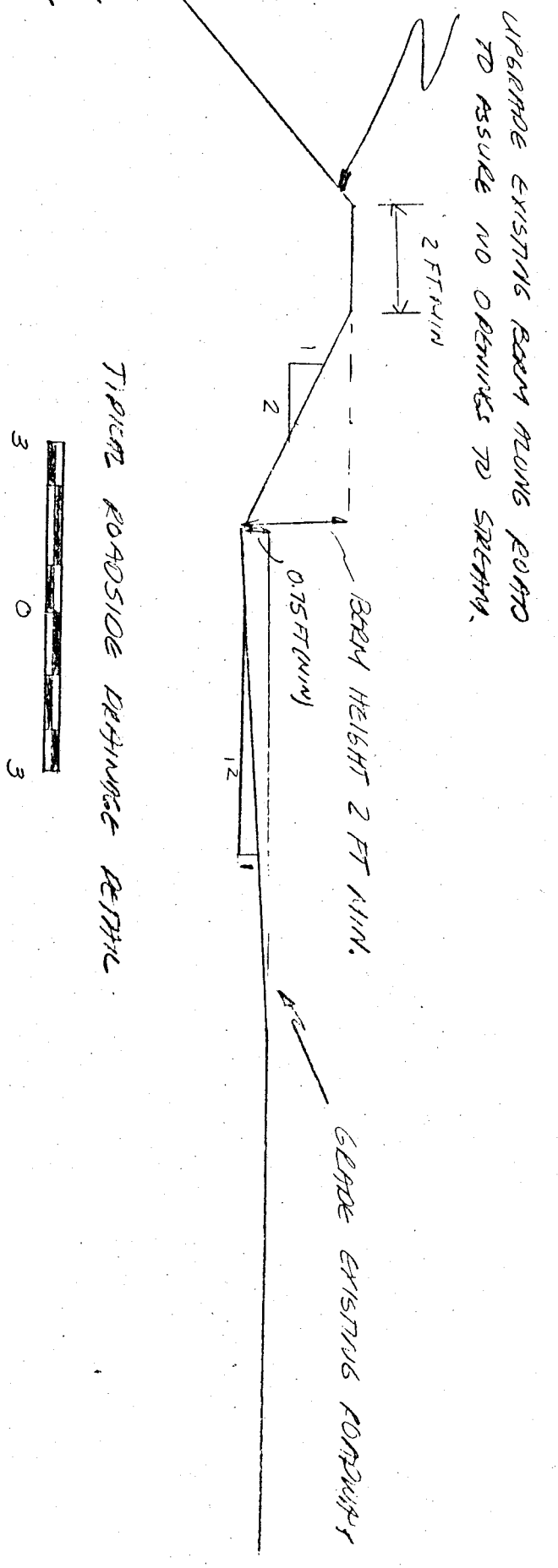
2 0 2

NOTES:

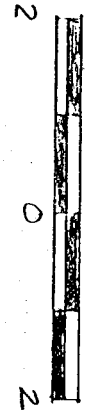
(1) CULVERT INSTALLED TO FOLLOW ROAD AT EXISTING ROAD GRADE
(2) RIPRAP SHOULD BE PLACED AT THE INLET AND OUTLET OF THE PIPE

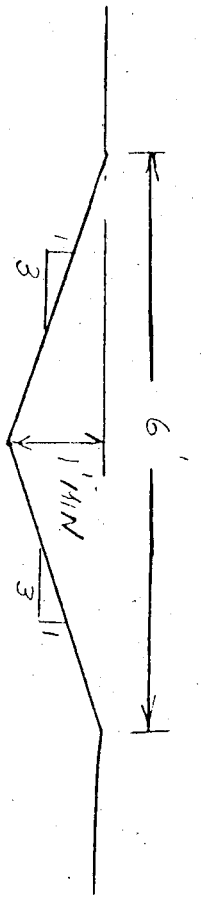
DAPPRODONIA
CONSULTING ENGINEERS, INC.

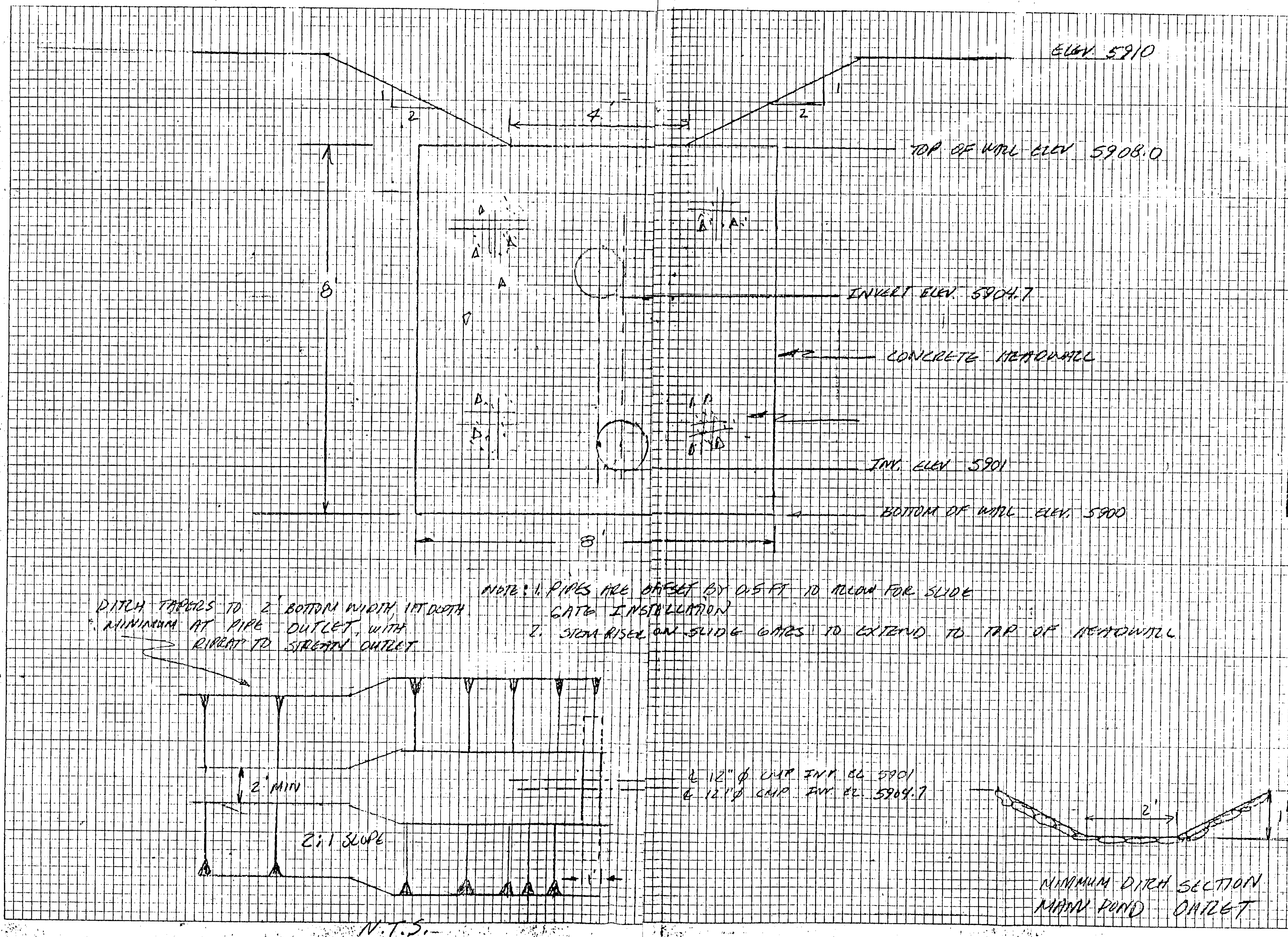
By TMD Date 11/16/78 Subject EMERY MINE Sheet No. 8 of 9
Chkd. By SEV Date 11/21/78 Proj. No. K117-1-68



TRIAL DITCH DETAIL - PORTAL VICINITY







PROJECT CONDL-EMERY(?) BY: TAD DATE: 11/1/79
PROJECT NO. 0078-160 CHK'D BY: CED DATE: 11/2/79

47 0702
K&E 10 X 10 TO THE INCH • 10 X 15 INCHES KEUFFEL & ESSER CO. MADE IN U.S.A.

Project No. RM78-669
Nov. 1978

D'APPOLONIA
CONSULTING ENGINEERS, INC.

Guideline Specifications

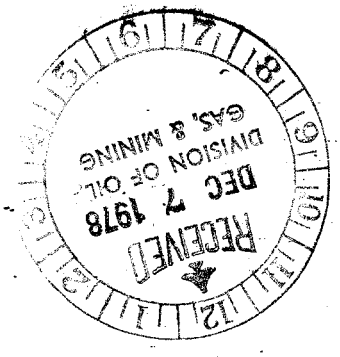
Emery Mine - Sedimentation Pond Designs

Emery Mine Site
Emery, Utah

Prepared For:
Consolidation Coal Company
Englewood, Colorado

Guideline Specifications

Emery Mine - Sedimentation Pond Designs



For Reference

STATE OF UTAH
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF OIL, GAS, AND MINING
1588 West North Temple
Salt Lake City, Utah 84116
(801) 533-5771

March 19, 1979

Mr. Tim O'Conner
Staff Mining Engineer
Consolidation Coal Company
Western Region
2 Inverness Drive East
Englewood, Colorado 80110

RE: Emery Deep Mine
ACT/015/015

Dear Mr. O'Conner:

The Division has received the plans for the arch bridge over Quitch Creek at the Emery Deep Mine and it has been determined that the bridge plans are in compliance with the applicable regulations presently in force.

Enclosed is a copy of a letter sent to Mr. James R. Murray concerning items needed for final Division approval of Consolidation's proposed sediment control plan. Before Division approval of the sediment control plan can be issued, the items listed in the letter are needed.

If you have any questions please feel free to call.

Sincerely,

K. Michael Thompson

K. MICHAEL THOMPSON
ENGINEERING GEOLOGIST

KMT/te

Enclosure: Letter to Mr. Murray

STATE OF UTAH
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF OIL, GAS, AND MINING
1588 West North Temple
Salt Lake City, Utah 84116
(801) 533-5771

February 22, 1979

Mr. James R. Murray
Senior Engineer
Consolidation Coal Company
2 Inverness Drive East
Englewood, Colorado 80110

Re: Sediment Pond Design
Emery Deep Mine
ACT/015/015

Dear Mr. Murray:

The Division has reviewed the sediment pond design prepared by D'Appolonia and submitted on December 5, 1978. The Division has also met with Mr. Steve McNeal fo the Division of State Health, Mr. Tim O'Connor of Consol and Mr. Tom Donovan of D'Appolonia.

Before approval for the pond can be issued the following items are needed:

1. A sediment disposal plan. Sediment cleaned from the pond must be placed within the area draining back into a sediment pond. Sediment should be stabilized with vegetation to prevent excess wind and water erosion.

2. A revegetation plan for the pond and diversion structures. In order to stabilize and control erosion from the outside slopes of the pond structure and the outside slopes of the bermed pad, these slopes must be revegetated. Final reclamation and revegetation plans upon termination of operations are also needed.

3. A staff gauge must be included in the design that delineates the designed sediment clean-out level and water depth.

4. Please forward a copy of the N.P.D.E.S. discharge permit.

5. A water monitoring program is needed for the pond discharge. The Division suggests sampling all discharges.

6. At the request of the Division of State Health, the following items are also requested:

   a. The design of a skimming device for the discharge structure.

   b. the design of cleanout facilities for the 6 inch pipeline between the two ponds.

   c. A commitment to place rip-rap or to revegetate the dike.

   d. A commitment to lock, with chain and lock, the discharge structures and designate a responsible individual to be in charge of control of the discharge and maintenance.

Thank you for your continuing cooperation.

Sincerely,

K. MICHAEL THOMPSON
ENGINEERING GEOLOGIST

KMT/sp
cc: Steve McNeal, Division of State Health
O.S.M., Denver

For Reference

Consolidation Coal Company
Western Region
2 Inverness Drive East
Englewood, Colorado 80110
303-770-1600

April 2, 1979

Rec.
Apr. 3, 79

Mr. Cleon B. Feight
Director
Division of Oil, Gas & Mining
1588 West North Temple
Salt Lake City, Utah 84116

Mr. Steve McNeal
Division of State Health
150 West North Temple
Salt Lake City, Utah 84110

RE: Emery Deep Mine Sedimentation Pond Design

Dear Messrs. Feight and McNeal:

Enclosed for your review are Consol's revised plans for sedimentation ponds to be constructed to comply with OSM regulations. The drawings that are part of this plan are being sent under separate cover.

In addition to the enclosed guideline specifications, the following information should be considered part of Consol's submittal.

1. FINAL RECLAMATION AND REVEGETATION

At the conclusion of all underground mining activity, existing haulage belts, and ventilation portals will be sealed using concrete block walls, backfilled with dirt, recontoured and seeded.

All buildings, power facilities, and ventilation systems will be removed from the mine site, (see table for list of surface structures), and their component parts moved to other locations for sale, salvage, or reuse. Once this is accomplished, surface grading will be performed as necessary.

All areas graded after abandonment will have positive drainage to Quitchupah Creek or Christiansen Wash. Also, graded slopes will not exceed 3:1.

Soils which are intended to support vegetation will be tested by standard methods to determine nutrient deficiencies prior to the revegetation effort. Any additional soil treatment employed as an aid to revegetation will be based on the results of soil testing. As an area is prepared for revegetation the surface will be graded, disked, mulched and seeded as necessary.

The revegetation objective at Emery Mine is the establishment of a diverse permanent ground cover meeting the needs of the proposed land use by utilizing as many species native to the area as possible. Based on the above revegetation objective, the seed mixture will include both introduced and native species. Based on greenhouse studies conducted on soils located near the Emery Mine, practical experience in revegetation areas under semi-arid conditions, and recommendations of the USDA Soil Conservation Service, District Conservationists for Emery County, Utah, the following grasses and shrubs are being considered for inclusion in the seed mixture:

1. Streambank Wheatgrass
2. Crested Wheatgrass
3. Russian Wildrye
4. Indian Ricegrass
5. Alkali Sacaton
6. Fourwing Saltbrush
7. Siberian Wheatgrass
8. Nuttal Saltbrush
9. Mat Saltbrush
10. Scarlet Globemallow
11. Shadscale
12. Galetta

After seeding, straw or hay (approximately 1500-2000 pounds per acre) mulch will be added, when necessary, to promote moisture retention and minimize the erosion of loose surface materials.

Due to the high slopes around Christiansen Wash, and the rocky nature of the land, grazing prior to vegetation establishment should not be a problem.

Vegetation establishment and growth will be monitored and corrective actions taken if necessary.

Upon approval of the reclamation of the surface facilities, the three settling ponds that are proposed in this plan will be reclaimed and revegetated in a manner similar to that noted above.

2. CONTROL OF DISCHARGE

The main settling pond is the only pond which will dicharge into a creek. The slide gate which controls this discharge will be locked by means of a chain and lock. The Emery Mine Superintendent or his designated representative will be in charge of control of the discharge and maintenance of the ponds and dikes.

Enclosed with this letter is a copy of our application for a NPDES discharge permit. As you know a discharge permit cannot be issued until the Division of Health approves construction of the ponds.

Our contractor plans on beginning construction of the multiplate arch bridge sometime around April 16. If it is at all possible, and if we

have the proper approvals, he would like to begin work on the sediment structures at that time. Your consideration is appreciated.

Sincerely,

Timothy J. O'Connor
Staff Mining Engineer

TOC:bf

cc: Badovinak, J.
Borell, S.
Fuller, L.
Hanks, T.
Hughes, R.
Murray, J.

EMERY DEEP MINE SURFACE FACILITIES

STRUCTURE	NUMBER
Main Office Building	1
Support Office Building	3
Warehouse Building	4
Shop	1
Bathhouse	3
Reverse Osmosis Water Treatment Building	1
Truck Scales	1
Mine Substation	1
100,000 Gallon Water Tank	1
Mine Dewatering Pump	1
Mine Water Settling Pond	1
Coal Crushing, Screening & Loadout Facilities	1

CONSOL

Consolidation Coal Company
Western Region
2 Inverness Drive East
Englewood, Colorado 80110
303-770-1600

July 24, 1978

Mr. Robert Burm
Enforcement Division - Permits
U.S. Environmental Protection Agency
Suite 900, 1860 Lincoln Street
Denver, Colorado 80203

RE: Request for Modification of NPDES Permit No. UT-0022616

Dear Mr. Burm:

Consolidation Coal Company (Consol) herein requests permission to incorporate two (2) additional discharge points into the Emery underground mine NPDES permit (No. UT-0022616).

One discharge point will be located at 38°51'15" latitude and 111°15'30" longitude adjacent to Quitchupah Creek about four (4) miles south of Emery, Utah. The purpose of this discharge will be to operate a sedimentation pond which must be designed and constructed in accordance with the initial federal surface mining regulations.

The second discharge point will be located at 38°51'20" latitude and 111°15'20" longitude about 800 feet northeast of the first new discharge point. The second discharge will be an intermittent overflow from a water storage tank which supplies water for drinking, bathing, fugitive dust suppression, and operation of mine equipment. A water sample taken from a water line leading to the tank on June 30, 1978 yielded the following analytical results:

pH	7.7
suspended solids	6.0 mg/l
total iron	0.04 mg/l
total manganese	0.01 mg/l

We believe that this data indicates that the second discharge should easily meet the NPDES permit conditions.

Both proposed discharge points are identified on the attached topographic map.

If you need any additional information to process this request, please advise me. Your prompt action on this request will be greatly appreciated.

Sincerely,

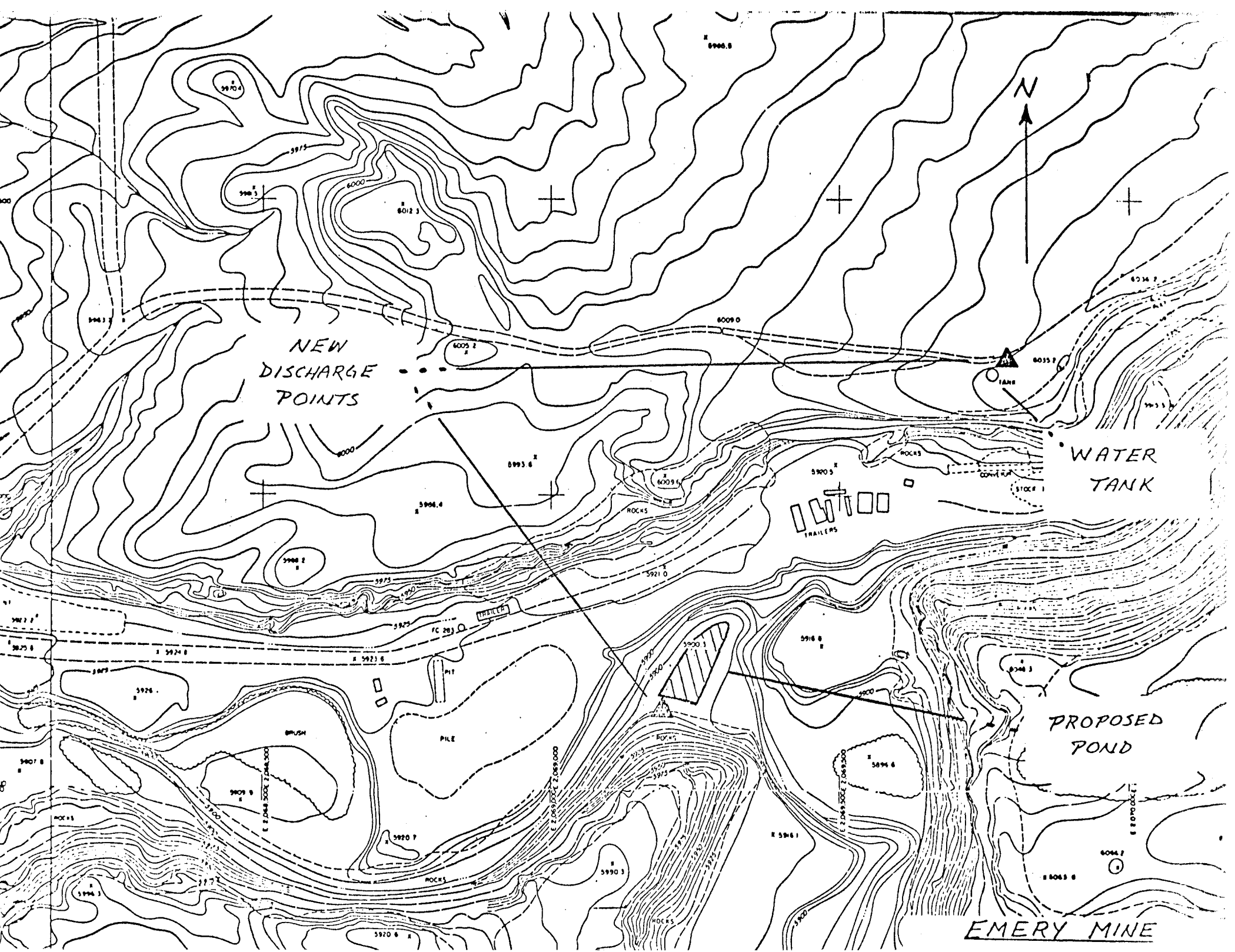
John M. Kaufman

John M. Kaufman
Regional Supervisor
Environmental Quality Control

JK:bf

cc: Utah Division of Health
Mr. Cleon B. Feight, Director
Utah Division of Oil, Gas, and Mining

bcc: Barthauer, G.
Borell, S.
Harvel, G.
Hughes, R.
Karkaria, N.
Silbernagel, D.
Slagel, G.


NEW
DISCHARGE
POINTS
WATER
TANK
PROPOSED
POND
EMERY MINE
N
TRAILERS
PIT
PILE
BRUSH
ROCKS
TRAILER
TANK

GUIDELINE SPECIFICATIONS

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GUIDELINE SPECIFICATIONS

SECTION 1
CLEARING AND GRUBBING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work

1. The Work covered by this Section consists of furnishing all plant, labor and equipment and performing all operations in connection with clearing and grubbing in accordance with the Drawings and these Specifications.

B. Limits of Clearing and Grubbing

1. The limits for clearing and grubbing shall be five (5) feet outside of the limit of work for the dike constructions as indicated on the Plans.

PART 2 - PRODUCTS

Not required

PART 3 - EXECUTION

3.01 CLEARING

A. Clearing shall consist of the removal and disposition of boulders, brush, down timber, logs, trash and other growth and objects on or above the ground surface. Within the limits of excavation, brush may be removed during the excavation operations. Brush at the top of cut slopes, the roots or parts of which are exposed by the excavation operations, shall be removed completely.

B. Brush, stumps, down timber, and partially buried logs and snags shall be removed completely from all areas to be occupied by fill and these areas shall be stripped. On areas outside of and contiguous to the top of the cut slopes and the toe lines of fill sections, brush shall be cut off and the areas shall be grubbed as specified for

areas to be occupied by fill. Cleared material shall be disposed of as specified hereafter. Cleared materials shall not be placed in the fill sections or left on the Work area.

3.02 GRUBBING

A. Grubbing shall be done in all areas to be occupied by fill. Grubbing shall consist of the removal and deposition of stumps, roots, buried logs, boulders, and other objectionable material below the ground surface. Stumps, roots over 1-1/2 inches in diameter, buried logs and boulders shall be removed completely. Roots 1-1/2 inches and under in diameter shall be removed to a depth of 2 feet below the surface of the ground in the area. Excavations made for removal of stumps, roots, and buried material shall be backfilled to the ground surface with suitable material, and the areas shall be graded to present a neat and pleasing appearance. Within the limits of excavations, grubbing may be done during excavation operations.

3.03 WASTE MATERIAL DISPOSAL

A. All brush, logs, roots, trash and other combustible debris from the clearing, and grubbing operations shall be disposed of by burning (with an approved permit) and/or hauling to an approved disposal site. No such material shall be placed in the fill sections. All durable stone and boulders from clearing and grubbing may be salvaged for use in construction.

SECTION 2
EARTHWORK

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work

1. The Work covered under this section includes the furnishing of labor, materials, required equipment and performing all operations for the following items of work:

   a. Removal of plants and stripping and stockpiling topsoil, where appropriate.

   b. All excavation, filling and rough grading for site work required by the Drawings and Specifications.

   c. Placing and compacting fill as required.

   d. All dewatering and/or diversion required by the Work.

B. Project Survey Layout

1. The project work shall be staked out by a qualified surveyor, including establishing elevations and all other layout work required. He shall also establish a datum point from which all grades are to be taken.

C. Safety Precautions

1. All barricades, fences, red lights, torches and enclosures necessary to protect construction and mine personnel from injury due to the Work set forth herein shall be erected, maintained as required and removed when the need for them no longer exists.

PART 2 - PRODUCTS

Not required

PART 3 - EXECUTION

3.01 STRIPPING AND SITE PREPARATION

A. All topsoil in the area of new Work shall be stripped to its full depth where appropriate and stockpiled on the site or placed where directed, where it will not interfere with the Work. A portion of topsoil shall be reused in finished grading work.

B. Topsoil is defined as that material having a significant organic content which will readily support vegetation.

3.02 WORK AREA DRAINAGE

A. To protect the surface of the fill, the top of all fill areas shall be crowned and sealed at the end of each working day to minimize the infiltration of water in the event of rainfall.

1. All fill saturated due to precipitation shall be dried or removed prior to placement of additional fill.

2. All impervious fills which become dried and/or cracked due to exposure, shall be wetted and reworked prior to application of additional fill.

B. As interim protection of the cut and fill slopes, adequate surface drains shall be provided at both the top and bottom of slopes to intercept and conduct runoff from the developed areas and to reduce saturation and erosion of the slopes.

3.03 EXCAVATION

A. GENERAL

1. All open-cut excavations shall be performed to the lines, grades, and dimensions shown on the Drawings or established by the Engineer. All necessary precautions shall be taken to preserve the material below and beyond the lines of all excavations in the soundest possible condition. Where required to complete the

Work, all excess excavation and overexcavation shall be refilled with suitable materials acceptable to the Engineer as specified herein. No excavation shall be made in frozen materials.

2. All materials removed from all types of excavations embraced in the Specification, which are suitable, shall be used in the formation of fills, also for refilling or other uses as indicated on the Plans or as directed. Excavated material which will be suitable when dry shall be taken from the excavation and then placed in the fill area, if so required. All materials removed from all excavations embraced in the Specifications, which are considered unsuitable shall be disposed of in a suitable manner as discussed in these Specifications.

B. Unsuitable Material

1. Materials found unsuitable due to the expansive properties, clay content or other objectionable reasons, may have to be blended with suitable materials or wasted. Where practicable, suitable materials shall be excavated separately from the materials to be wasted.

3.04 PREPARATION OF SITE BEFORE FILLING

A. The areas to be filled should be stripped of all topsoil, frozen soil, and organic material prior to filling. All materials to be used in the backfill shall be as specified below.

B. Large stones, clods, refuse, expansive materials, topsoil frozen soil or other debris should not be included in the fill.

C. Prior to the placement of any fill the areas should be checked for soft spots and adequately compacted with a sheepsfoot roller in accordance with the specifications herein below.

3.05 FILLS

A. General

1. The fills shall be constructed to the lines, grades and cross-sections indicated on the Plans.

2. The distribution of materials throughout the compacted earthfill shall be such that it will be free from lenses, pockets, streaks, and layers of material differing substantially in texture or gradation from surrounding fill material.

3. All required fills shall be compacted and built of materials selected from general excavation. Use of large rocks or frozen material will not be permitted.

4. Where fill is to be placed on natural slopes steeper than one vertical to seven horizontal, the existing slope shall be benched prior to placing fill. The width of any bench should not be greater than 25 feet or less than 5 feet. The width of each bench should be maintained within the specified limits, and the height of face cut varied in accordance with the slope of the natural ground surface. The height of cut at the face should not exceed five (5) feet. The slope of the temporary cut face should be no steeper than one vertical to one horizontal. All benches should be sloped at a minimum of one (1) percent away from the face cut to maintain proper drainage.

5. After specified benches have been cut, the fill should proceed. The lowest elevations shall be filled first, in horizontal layers with a thickness no greater than specified limits and sloped to the outer edge of the fill. As each layer is spread it shall be thoroughly compacted with proper rollers. The top and bottom of all fills shall be rounded or eased to form a pleasing transition in change of grade.

6. Particles larger than five (5) inches, but less than ten (10) inches in maximum dimensions shall be worked into the fill in such a manner as will disintegrate friable material and orient and distribute resistant particles to effect a compact well-knit mass with spaces between larger particles thoroughly choked with compact finer materials. To aid in accomplishing this, material containing more than 20 percent (by volume) of particles exceeding five (5) inches in maximum dimensions, shall be spread in lifts not exceeding eight (8) inches in thickness (loose measure), and tracked with at least four passes of the treads of a crawler type tractor trips

which, by means of sufficient overlap, will assure complete coverage of an entire layer by the tractor treads. Second and subsequent passes of the treads shall not be made until each pass, as defined above, is completed. If the size and content of resistant particles in the fill material precludes proper compaction, the material shall be mixed with finer materials before placement and/or shall be disposed of.

3.06 COMPACTION SPECIFICATION - GRANULAR MATERIAL

A. All granular fill placed at the site should be spread in one-foot lifts (loose material) and each lift compacted to 75 percent relative density (ASTM-D2049) as defined by:

$$D_D = \frac{E_1 - E_N}{E_1 - E_D} \text{ (percent)}$$

where:

D_D = relative density in percent

E_1 = void ratio of the granular soil in its loosest state (minimum dry density)

E_D = void ratio of the granular soil in its densest state (maximum dry density)

E_N = void ratio of the soil in its natural state

B. All granular fill should be clean, nonexpansive, free of trash, rubble, debris, frozen, and other foreign materials.

C. For uniformity, a minimum of five passes of a 10-ton vibratory roller or its equivalent shall be required on each lift of fill.

3.07 COMPACTION SPECIFICATION - COHESIVE MATERIALS

A. All cohesive fill placed at the site should be spread uniformly in six- to eight-inch lifts (loose material) and compacted to approximately 90 percent of the modified Proctor density (ASTM-D1557). Upon

placement and compaction of a lift of cohesive material, the surface should be scarified to a depth of two (2) inches prior to the placement of the next lift. Cohesive earth embankment material should be compacted at a water content of between one (1) and two (2) percent above optimum water content as determined by the modified Proctor method (ASTM-D1557).

B. All cohesive fill should be free of trash, rubble, debris, roots, organic, frozen, and other foreign material. Fill should not be placed on any subgrade that is under water, muddy, frozen, or contains frost.

C. For uniformity, a minimum of four passes of a sheepsfoot or segmented wheel roller in the 20- to 30-ton class shall be required on each lift.

3.08 ACCURACY OF COMPLETED GRADING

A. The grades as shown on the Plans or as specified shall be met within three (3) inches at the completion of the site grading.

3.09 ZONES OF SOFT SILTS OR CLAYS

A. Small local zones or pockets of soft silts or clays or other unsuitable materials that were not defined during the course of the exploration program, may be encountered in the excavation. They will require overexcavation and replacement with suitable backfill compacted in accordance with the Specifications. The determination to overexcavate and replace with backfill should be made by an Engineer.

SECTION 3
APPURTENANT FACILITIES CONSTRUCTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work

1. The Work covered under this section includes the furnishing of all labor and materials to install the decant system for the sedimentation pond and improve site drainage control in accordance with the following Work items:

   a. Installing new culverts to the limits as shown on the Drawings.

   b. Installing standard slide gates on decant pipes to the elevations indicated on the Drawings.

   c. Providing erosion protection at the outlet of the proposed decant system.

   d. Providing drainage control throughout the site particularly in the portal area by installing diversion ditches and pipe where required.

PART 2 - PRODUCTS

2.01 DECANT SYSTEMS

A. Culverts and Decant Pipes

1. The culverts and decant pipes shall be standard diameter corrugated metal pipe with a gauge thickness designation of 16 and 2-2/3 x 1/2 inch corrugations.

B. Gates

1. The slide gates shall be standard Armco Model No. 20-10C gates or equivalent for the respective pipe diameters as indicated on the Drawings.

D. Cutoff Collars

1. Cutoff collars shall be fabricated standard metal sheets with a minimum width of 2 feet plus the pipe diameter as measured from the pipe centerline.

E. Secondary Pond Outlet Box

1. The secondary pond outlet box shall consist of welded 16 gage metal sheets constructed to the dimensions shown on the Drawing. The welds shall be made such that leakage through the joints is not apparent.

F. Secondary Pond Outlet Pipe and Valves

1. The secondary pond outlet box will be installed with two inlets consisting of 6" diameter valves or slide gates. These valves or gates will be installed at the locations indicated on the Drawing and will be operated from the top of the pond. The outlet pipe shall consist of Schedule 40, 6" diameter PVC pipe installed as indicated on the Drawings with eventual outlet to the main sedimentation pond.

2.02 CONCRETE AND REINFORCING STEEL

A. General

Concrete, reinforcing steel, forming, pouring, finishing, and curing for the concrete support blocks shall conform to the requirements set forth herein.

B. Materials

The Portland Cement shall conform to specifications for Portland Cement, ASTM Standards, Designation C-150-67, Type I. The actual mixed proportion of cement, aggregates and water shall be determined by the contractor and/or the supervisory personnel provided by the owner.

C. Forming

Forms shall be provided that are true, rigid and thoroughly braced. The forms shall be sufficiently strong to carry the dead weight of the concrete without excessive deflection and tight enough to prevent leakage of mortar through cracks and joints.

D. Reinforcement steel shall consist of No. 4 bars conforming to ASTM specifications. All reinforcement shall be free from heavy rust, grease, dirt, oil or other debris that will interfere with the concrete to steel bond.

The reinforcement shall not have less than three (3) inches between it and the outside concrete surface.

2.03 RIPRAP

A. General

Riprap should be used for erosion control at the decant system outlet as shown on the Drawings and in other ditches where required.

B. Materials

Riprap should be maximum 12-inch diameter hard, durable cobbles and boulders in size designations such that the materials can be placed in a tight matrix to avoid the presence of large voids.

PART 3 - CONSTRUCTION REQUIREMENTS

3.01 CONSTRUCTION REQUIREMENTS FOR DECANT PIPES AND CULVERTS

A. General

1. The trench and bed for the new decant pipes and culvert shall have a width equal to the outside diameter of the pipe at the bell or band, plus 2.0 feet.

2. The trench shall be excavated through natural ground or where pipe structures are to be placed within fill, the fill should be constructed to a minimum of four (4) feet, where practicable, above the top of the pipe before placing the pipe, or as indicated on the Plans. Shallow installations, with less than four (4) feet of cover over the top of the pipe, shall be constructed after all heavy hauling is completed over the pipe location.

3. When the material encountered is unstable, it shall be entirely removed for the full width of the trench or as otherwise required for the particular condition, replaced with approved material, compacted to a satisfactory density and the bed shaped as specified.

B. Culvert and Decant Pipe Bedding

1. The pipe shall be bedded with care in a soil foundation shaped to fit the pipe exterior to a minimum depth of 15 percent of the outside diameter, or as shown on the drawings.

C. Backfilling

1. General - All backfill shall be thoroughly compacted with mechanical tampers or other approved methods to a density consistent with the surrounding fill. The backfilling of trenches shall be done in horizontal layers, not exceeding six (6) inches in thickness, each layer thoroughly consolidated and compressed. The compaction of each layer to be continued until the six (6) inches are thoroughly consolidated and compressed, after which the next layer of six (6) inches shall be spread and treated in like manner. Degree of compaction shall be in accordance with Section 2, Part 3, Paragraph 3.06 and 3.07.

2. Backfill shall be brought up on each side of the pipe simultaneously. The layers shall be compacted on both sides of the pipe before the next layer is placed to avoid shifting of the pipe during backfilling.

D. Placement

The manufacturers recommendation shall be followed regarding the pipe handling, placement, joint sealing and methods to close the joints. A 10-1/2 inch dimpled band connector in conjunction with TC-40 sealant will be used for pipe connections to achieve leak resistent joints.

3.02 MISCELLANEOUS CONSTRUCTION ITEMS

A. Reinforced Concrete Headwall Construction

1. Placing

Prior to the placement of concrete, the subgrade shall be thoroughly dampened to prevent the escape of moisture from the concrete into the subbase. The concrete shall be deposited in the forms as near to its final position as possible. Under no circumstances shall the agitation from the vibrator be used to move concrete laterally in the form.

Concrete shall be placed in layers not more than 24-inches in thickness. Each layer shall be thoroughly agitated by a vibrator. The vibrator, when used, shall be raised and lowered, always in a vertical position, and the vibrating head shall be allowed to penetrade and vibrate the concrete in the upper portion of the underlying layer. At no time shall the vibrator be permitted to lay in a horizontal position. Layers of concrete shall not be placed until the layers previously placed have been worked thoroughly as specified.

Concrete shall be protected against adverse weather conditions in accordance with "Recommended Practice for Cold Weather Concreting," ACI 306 and "Recommended Practice for Hot Weather Concreting," ACI 605. Accelerators, such as calcium chloride, shall not be used unless specifically approved.

2. Curing

After finishing, curing shall be done by keeping the concrete moist and at a temperature above 50 degrees and below 100 degrees for one week. Liquid, membrane-forming, curing compounds may be used in lieu of moist curing when approved or directed, and shall be applied to exposed surfaces of formed concrete and to finished surfaces at conclusion of finishing.

3. Finishing

Any small surface voids which may occur upon removal of the forms, and holes due to form ties shall be thoroughly cleaned of all loose or defective material, flushed with water, and immediately filled with a nonshrink cement mortar.

Any fins or projections which may occur shall be removed and the area rubbed smooth and finished with a wooden float in a neat and workmanlike manner. Plastering of the surface with cement grout shall not be permitted.

4. Joints

Construction joints shall be located only at points shown on the Plans or as directed or approved by the Engineer. They shall be so located as not to impair the strength of the structure, and so as to least impair its appearance. All construction joints shall be keyed.

5. Placement of Reinforcing Steel

Fabrication shall be accurate and to the dimensions indicated on the Plans. Stirrups and ties shall be bent around a pin having a diameter at least twice the bar diameter. All other bars shall be bent around a pin having a diameter of at least six times the diameter of the bar. All bars shall be bent cold.

The reinforcement shall not have less than 3-inches of concrete between it and the outside concrete surface.

All reinforcing shall be free from heavy rust, grease, dirt, oil or other debris that will interfere with the concrete to steel bond.

Reinforcing steel shall be installed in accordance with ACI-318-71 Specifications. All bars shall be lapped a minimum of 24 diameters.

B. Riprap Installation

1. The subgrade under riprap should be well compacted before riprap is placed.

2. The riprap should be spread in a single lift. After placement, the riprapped surface should appear well graded with the voids choked with smaller cobbles and stones. The smaller size riprap should be placed against the slope to avoid migration of fines through the riprap.

3.03 EXISTING DIKE COSMETICS

All existing berms and dikes shall be inspected for continuity and structural integrity. All voids that exist shall be filled with competent fill material compacted to prevent erosion and/or sloughing. Any large boulders which facilitate leakage of surface water runoff through the berm or dike shall be removed and replaced with competent fill material, or the boulders shall be adequately encased in fill to prevent drainage around the boulders. Periodic inspection of these dikes shall be conducted and the appropriate upgrading or cosmetic work performed where required.

3.04 CLEAN-UP

After the construction specified herein is complete, the work area shall be cleaned up and any excess construction materials removed from the site or stored as designated by the owner. Disturbance to the work area shall be minimized by removing any excess fill or spreading it to maintain a uniform contoured surface. Final surface preparation of the fill areas shall be in accordance with Section 4 of these Specifications.

SECTION 4
STABILIZATION OF COMPLETED DIKE SURFACES

Outslopes should be re vegetated!!!

PART 1 - GENERAL

1.01 DESCRIPTION

The stabilization of all exposed nonriprapped areas of the embankment is necessary to control wind and water erosion, reduce infiltration of water into the embankment and to provide an environment compatible with the surrounding area. Establishment of effective stabilization requires a soil additive or agent physically and chemically capable of preventing erosion.

PART 2 PRODUCTS

2.01 GENERAL

The stabilizing agent shall consist of soil cement or available soil binder additives such as Aerospray 70. The manufacturers' recommendation on the relative mixture of the stabilizing agent shall be followed to achieve a properly stabilized embankment surface.

2.02 APPLICATION

Stabliizing agents are typically applied by spraying in a diluted water solution. This method has been successful and should be considered, however, application of the stabilizing agent should be in accordance with the manufacturers' recommendation.

PART 3 - MAINTENANCE

3.01 GENERAL

Stabilized embankment surfaces should be maintained in order to minimize erosion and maximize aesthetics. Additional application of the stabilizing agent should be completed as required. Large gullies formed by erosion should be filled and restabilized to minimize downstream sediment loads.