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August 15, 1975

Fuel Cycle Licensing Branch i
Division of Materials and Fuel
Cycle Licensing
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Attention : Mr. Leroy Person

Gentlemen:

Submittal of a second supplement to the Environmental Report for the Uranium Mill of Atlas Minerals at Moab, Utah, Under Source Material License SUA-917, dealing with slope stabilazation of the tailings retention system.

On behalf of Mr. William P. Badger, General Superintendent of the Atlas Minerals Division of the Atlas Corporation, we herewith submit 10 copies of a second supplement to the Environmental Report for the Uranium Mill of Atlas Minerals Division of the Atlas Corporation at Moab, Utah. This submittal supports Atlas' application and supplement for license renewal and major modifications of Source Material License No. SUA-917.

This second supplement deals with slope stabilization of the tailings retention system. Alternative stabilization methods and costs are presented together with the projected stabilization procedure.

Very truly yours,

DAMES & MOORE

Richard Chojnacki
Associate

encl.
cc; Mr. William P. Badger

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PLATES

SUPPLEMENT TO THE ENVIRONMENTAL REPORT FOR THE

URANIUM MILL OF ATLAS MINERALS DIVISION,

ATLAS CORPORATION AT MOAB, UTAH

SECTION 1

INTRODUCTION

This document has been prepared as a supplement to the Environmental Report to assist The Atlas Minerals Division of Atlas Corporation at Moab, Utah in complying with the U. S. Nuclear Regulatory Commission (NRC) guide 3.23 entitled "Stabilization of Uranium-Thorium Milling Waste Retention Systems Criteria," dated January 15, 1975. These guides are pursuant to Section 3.9 of American National Standard ANSI N 313-1974 entitled "Stabilization of Uranium-Thorium Milling Wastes Retention System," as accepted and promulgated by the Atomic Energy Commission as part of their Regulatory Guide.

The purpose of this report is to present a stabilization plan for the uranium tailings area at the Atlas Minerals facilities located near Moab, Utah, and costs involved to accomplish stabilization. After a tour of the existing site a Dames & Moore ecologist obtained soil samples on the tailings area and berms to ascertain existing conditions and provide a basis for the design of stabilization methods. Using state-of-the-art technology obtained from literature, communications with knowledgeable researchers, and site visits where stabilization of uranium tailings have been conducted, we present several options selected for the Atlas Mineral Tailings.

Objectives for stabilization will be directed at limiting exposures from the tailings to "as low as practicable levels," keeping in mind the long-term restoration of the surface compatible with safe future use of surrounding lands.

Five alternatives were considered in developing the proposed stabilization program. Alternative I was selected which consists of minor shaping of the tailings area and addition of cover material.

SECTION 2

TAILINGS RETENTION SYSTEM

2.1 INTRODUCTION

The Atias Minerals Uranium Mill at Moab, Utah went into operation in 1956. The tailings retention system was put into operation at the same time. The tailings retention system has been used to store solid wastes from the mining process and is now utilized in the evaporation or "zero discharge" mode of operation. It is anticipated that the system will be utilized for another 15 years. Detailed information concerning the plant, mill operations, and tailings retention system can be found in the Environmental Report (ER) submitted in 1973, the Safety Analysis Report (SAR) submitted in 1974 and the Amendment to the ER submitted in 1974.

2.2 PHYSICAL CHARACTERISTICS

The tailings retention system is southwest of the mill (Plate 1). The slope of the original ground surface at the site trends to the ESE and ranges from about three degrees on the north side to about one degree near the Colorado River. The pond and solids are contained by embankments, up to 75 feet high, on all sides except the west, covering at the present time, an area of 115 acres and storing approximately seven million tons of tailing. The original starter dikes were built using dense silty fine sand typical of the subsurface material in the area. The starter dikes were later expanded using the same material, but with less compaction. As solid storage increased, the dikes were built up with coarse tailing. The exposed embankments are covered with about one foot of local siltstone material (which will hereafter be referred to as cover material) to retard

erosion of tailing and enhance appearance of the tailing pond. The slope of the embankments vary from 1.06 horizontal to 1 vertical to as flat as 3.28 horizontal to 1 vertical (Dames & Moore, 1973).

The propcsed operation (Dames & Moore, 1973) will add 4.5 to 5 million tons of tailing to the pond. A starter dike will be built on the west side where there is no embankment at the present time, and the existing embankments will be raised using coarse tailings fractions. The tailing pile will increase in height approximately five feet for each million tons of dry solids deposited (Dames & Moore, 1974a).

2.2.1 Tailings Properties

Samples of tailings material and cover material used on the berms were collected at Atlas Mineral's Moab, Utah facilities in August 1975 to evaluate chemical and physical parameters to determine the agronomic characteristics of these materials.

2.2.1.1 Sampling and Analysis

Samples were collected at seven locations on the berms and within the tailings (Plate 1). The samples were placed in glass containers and shipped to the Dames & Moore Environmental Laboratory, Cincinnati, Ohio. Analyses conducted on the soil samples included; soil texture, conductivity, total Kjeldahl nitrogen, nitrate nitrogen, pH, organic matter, available phosphorus, available potassium, and exchangeable sodium. Physical and chemical determinations were conducted according to procedures outlined in "Methods of Soil Analysis" (1965).

2.2.1.2 Results

Analyses for the samples collected are presented in Table 2.1. Milling processes leave the materials as separated fines. Consequently, these have no physical structure or organic matter which are essential to retain water for plant growth. Organic matter also supplies essential nutrients required by plants. Of the three essential macronutrients required for plant growth (nitrogen, phosphorous, and potassium) only potassium is in sufficient quantity for plant growth. Supplemental nitrogen and phosphorus would be required.

These materials would be classified as highly alkaline based on conductivity and pH. The conductivity is controlled, in part, by the exchangeable sodium. Exchangeable sodium concentration does not correlate with the high conductivity obtained on the slime area sample (S-13). However, exchangeable calcium and magnesium salts were not analyzed which could account for the variation.

These materials would require considerable treatment before they would support vegetative growth. Treatments would include: addition of organic matter; addition of gypsum to lower pH; and leaching to remove exchangeable salts.

SECTION 3

ALTERNATIVE CONSIDERATIONS FOR THE STABILIZATION PROGRAM

Fine-sized mineral wastes stored in the tailings pond require stabilization to minimize erosion by air and water and resulting releases to the environment. Reclamation plans are presented to project procedures and alternatives of the tailing area at the anticipated termination of operation 15 years hence. The purpose of reclamation is to stabilize the tailings area against wind and water erosion.

Four principal methods are currently used by the uranium mining industry for stabilization of mineral waste (Dean et al, 1974). These include:

1. Physical - covering tailings with soil or other restraining materials;
2. Vegetative - the growth of plants in the tailings;
3. Chemical - use of a material to interact with fine-sized minerals to form a crust; and
4. Chemical - vegetative - utilizing a combination of chemicals and vegetation.

Each method has its merits and drawbacks and should be evaluated in light of the characteristics of the area to be stabilized.

Five alternatives developed from the aforementioned methods were evaluated within this study. The alternative programs were developed after consideration of the methods presently available for tailings stabilization and a review of chemical and physical data collected on the Atlas Minerals tailings.

The five alternatives include:

- Alternative I: Apply one foot of cover material to exposed tailings
- Alternative II: Shape to 3:1 slope and apply one foot of cover material
- Alternative III: Shape to 3:1 slope, apply one foot of cover material and seed
- Alternative IV: Smooth tailings and apply chemical sealant to form stable crust
- Alternative V: Shape to 3:1 slopes apply one foot of cover material, seed and chemical sealant

Concrete and asphalt were considered as possible alternatives but were rejected on the basis of cost effectiveness. Both provide an effective seal against wind and water erosion. These also provide an effective seal against Radon gas and fugitive dust release. However, if the integrity of the seal is broken the gas becomes a major problem. This integrity would be difficult to maintain over the 50 year maintenance period. Consequently we did not believe the high cost of application made asphalt or concrete viable alternatives.

3.1 PROCEDURES FOR STABILIZATION

The tailings pond will contain the soft, wet, very fine fraction of the tailings (slimes) and will, upon termination of operations, require burial of these fines with coarse to medium sand tailings from the beach. The beach refers to the dried tailings between the tailings pond and the embankments. This burial would be required prior to initiation of any stabilization.

3.1.1 Alternative I

3.1.1.1 Earthwork Requirements

All exposed embankments of the Atlas Minerals tailings area have been covered with approximately one-foot-thick layer of weathered bedrock or slope wash deposits from adjacent hillsides. The in-place cover material consists of reddish-brown fine to coarse sand and gravel with some cobbles and boulders.

Alternative I would consist of allowing the surface and beaches of the tailings pond to dry. The fines would then be buried with the coarser beach tailings. The top of the embankment would then be leveled to the height of the tailings material.

A vertical one-foot-thick layer of cover material would be applied to the exposed surface area of the tailings pond. The configuration would be designed to leave a crown on top. Some minor shaping of the existing berms will be done for cosmetic purposes.

This method is considered satisfactory from a standpoint of slope stability in that the present design slopes are already stable and lowering of water levels in the pond after decommissioning will increase stability even more. Inclusive of "benches" in the present tailings embankments, typical toe to crown slopes range from 1 on 2.5 to 1 on 3 with limited sections being 1 on 2.

This method also has the added advantage of promoting water to run off the slopes rather than to percolate into the underlying tailings pile. This would reduce leaching of materials from the tailings pile.

3.1.1.2 Cost Estimate

The cost estimates presented for Alternative I and the other alternatives are based on constant 1975 dollars with no provision for inflation. The costs for Alternative I are estimated below.

The area of the tailings retention system is about 115 acres, of which approximately 18 acres already have been covered. About 45 acres are occupied by the evaporation pond and underlain by fines which will require burial with from 4 to 5 feet of coarse beach material. The volume of this material to be moved by dozer is estimated as:

$$(45A)(43{,}560\ ft^2/A)(4.5\ ft\ av\ depth)/(27\ ft^3/yd^3) = 326{,}700\ yd^3$$

It is estimated that a D-8 type tractor with dozer can move 800 cubic yards per hour over short distances at a cost of about $50 per hour. The burial of fines would, therefore, require:

$$326{,}700\ yd^3/800\ yd^3\ per\ hr = 408\ or\ about\ 400\ hours$$

(400 hours)($50 per hour) = $20,000

($20,000)/ (45 acres) = $444 per acre for covering fines

A possible source for already broken and stockpiled material for use as cover has been identified approximately 7 miles from the mill. At this haul distance, it is estimated that 5 twenty-ton bottom dump trucks would be required to complement a single Caterpiller 988 loader. A D-8 tractor with dozer and a motor patrol would be required at the site to spread the cover materials. Based on current estimates of hauling at $0.10 per ton mile, a loader cost of $35 per hour, a D-8 cost of $50 per hour, a hauling cycle time of 45 minutes at an average 30 miles per hour, and a motor patrol cost of $25 per hour, the cost of cover emplacement is estimated as follows:

Cover material

$$\text{Volume} = \frac{(97A)(43{,}560\ ft^2/A)(1\ ft\ depth)}{27\ ft^3/yd^3} = 156{,}493 \text{ or } 157{,}000\ yd^3$$

$$\text{Tonnage} = (97)(43{,}560)(1)(125\ lb/ft^3)/2000\ lb/ton = 264{,}082 \text{ or } 264{,}000 \text{ tons}$$

Truck loads = 264,000 tons/20 tons = 13,200 trips

Cycle time = 10m load +(14mi)(60 minph)/(30mph) + 7m dump = 45 min

Total haul hours = (13,200)(45/60) = 9900 hours

Time for 5 trucks = (9900)/(5) = 1980 or 2000 hours

Loader cost = (2000 hr)($35/hr) = $70,000

Bulldozer time = $(157{,}000\ yd^3)/(800\ yd^3/hr)$ = 196 or 200 hours

Bulldozer cost = (200 hr)($50/hr) = $10,000

Motor patrol cost = (200 hr)($25/hr) = $5,000

Hauling Cost = (264,000 tons)($0.10/ton-mi)(7 mi) = $184,800 or $185,000

Material cost @ $0.50 = (264,000 tons)($0.50) = $132,000

Total cover cost = $70,000 + $10,000 + $5,000 + $185,000 + $132,000

= $402,000 or $402,000/97A = $4,144 per acre

The total cost for burying fines and placing cover material is $422,000

3.1.2 Alternative II

3.1.2.1 Earthwork requirements

Burial of fine material would follow the same procedures as presented in Section 3.1.1.1. Alternative II would consist of removing the existing benches in the tailing embankments so that the finished embankments would have unbroken uniform slopes of at least 1 on 3. Following reshaping, the entire pond and embankment area would be covered with a

one-foot-thick layer of cover material. This method would require additional construction effort and would cover additional area. Configuration of slopes before and after reshaping are illustrated in Plates 2 through 6.

3.1.2.2 Cost Estimates

Cost estimates for fines burial would be $444 per acre as presented in Section 3.1.1.2. It is expected that reshaping of the tailings embankments to a uniform outside slope no steeper than 1 on 3 could be accomplished with conventional bulldozer equipment. Such reshaping would primarily consist of blading the in-place tailings from the crown of the slopes downward. It was estimated that approximately 100,000 cubic yards of cut (mainly in benches) with a compaction factor on the order of 10 percent, given a fill figure of about 110,000 cubic yards, would be required to establish the recommended 1 on 3 slopes. In order to maintain an earthwork balance, the reshaped embankments would, in places, extend beyond the present toe locations.

Reshaping would therefore require:

$$\frac{100,000}{800} \text{ cubic yards} = 125 \text{ hours}$$

125 hours x $50 per hour = $6,250 or approximately $190 per acre

It was estimated that approximately 210,000 cubic yards of cover material would be required to cover the tailings pond and embankments with a one-foot-thick layer.

Cost estimates for covering the reshaped slopes were estimated using $4144 per acre (Section 3.1.1.2). Reshaping would result in an expansion of the 115 acre area to approximately 130 acres. Thus, the total

estimate to reshape and cover the tailings material would be $563,420 plus $20,000 for fines burial for a total of $583,420 or about $584,000.

3.1.3 Alternative III

3.1.3.1 Earthwork and Seeding Requirements

Local climatic conditions and chemical properties of the tailings material dictate the necessity of covering the tailings material with cover material. Considerable reshaping of the cover material would be required to accomplish this task. Reshaping procedures and costs have been presented in Section 3.1.2.1 and 3.1.2.2.

Vegetative stabilization procedures were prepared with the assistance of Mr. Richard Baird of the Soil Conservation Service office at Monticello, Utah (personal communication). Once the slopes have been shaped to a 3 to 1 contour a 12 inch layer or cover material would be applied (Section 3.1.2.1). Due to the absence of organic matter in the cover material, the addition of municipal sludge is recommended. The sludge should be amended to the upper three inches of cover material at the rate of 15 tons per acre (Dean et al., 1974).

The sludge would improve the soil structure, increase the water retention capacity, and supply nutrients required for plant growth. Four grass species were recommended for the Moab area (Baird, personal communication); crested wheatgrass (Agropyron destorum), Siberian wheatgrass (Agropyron sibericum), Indian ricegrass (Oryzopsis hymenoides), and sand

dropseed (Sporobolus ryptandrus). A mixture of Siberian wheatgrass and sand dropseed planted at eight pounds per acre and two pounds per acre, respectively was recommended. Siberian was recommended over crested wheatgrass because it is more drought resistant. Sand dropseed is a warm season grass and does well on sandy soils.

Seeding should be accomplished in late fall (late October - early November) for the wheatgrass. It should be sowed at a depth of three-quarter inches on twelve inch spacings. Sand dropseed should be broadcast seeded the following July.

Fertilizer should be applied after seeding at the rate of 25 pounds per acre of available nitrogen and 20 pounds per acre of available phosphorus.

Dames & Moore ecologists do not recommend continued irrigation of the tailings area to establish vegetation. Stabilization of the McGill, Nevada site was initiated in 1967. A half-inch of water was applied prior to seeding and a suitable vegetative cover has been established (Dean, personal communication). The McGill site receives approximately the same precipitation as Moab. Observation of the New Rifle, Colorado tailings area indicated irrigation has resulted in leaching of salts and/or toxic metals to the base of the waste retention system (Smith, personal observation; Haldane, personal communication). This leaching has killed the vegetation at the base of the retention system.

No recommendations are made at present to alter the pH of trilings materials. The materials are very basic due to the current milling process. However, an acid circuit is being built and the

waste from this circuit will have some influence on the pH. The addition of municipal sludge should ameliorate the high basic conditions of the cover material.

3.1.3.2 Revegetation Costs of Tailings Area

Revegetation costs for the Atlas Mineral's tailings area are based on 1975 costs and are broken down into four general categories:

Fertilizer and Application (Cost from Utah Supplier)	$ 12.00
Seedbed Preparation Including Sludge Application (Based on Literature Estimates)	$ 25.00
Seeding (Including Seed) (Cost Obtained from Seed Supplier)	$ 11.00
Irrigation	$200.00
Total Revegetation Costs	$248.00/acre

The irrigation cost would be for limited irrigation prior to planting. The cost was derived from spray and drip irrigation systems using electric pumps which average about $200.00 per acre on small plots.

3.1.4 Alternative IV

3.1.4.1 Earthwork Requirement and Chemical Application

Chemical stabilization involves the application of a reagent to the tailings surface to form a crust which would stop dusts from blowing and inhibit water erosion. Chemicals have been used to stabilize uranium tailings in arid regions where precipitation is too low to make vegetative stabilization. It also has been used to stabilize tailing material which was not homogeneous enough for vegetative stabilization (Dean et al, 1974; Dean and Haven, 1971).

Chemical stabilization has not proved as durable as soil covering or vegetation. Dean et al. (1974) reported that once the integrity of the chemical seal is breached the materials beneath the seal are susceptible to wind and water erosion.

Theoretically, earthwork shaping should not be required to accomplish chemical stabilization. However, results of the field trials on the Tuba City, Arizona tailing pile indicate all projections should be leveled prior to application (Dean et al., 1974).

Based on the Tuba City, Arizona tests it would be recommended that the top surface of the tailings pile be leveled prior to application of the chemical sealant. This would be accomplished when the fines are buried (Section 3.1.1.1).

The chemical sealant would be applied after the surface has been leveled. Application would be accomplished using a lightweight sprinkling device called a Rain Train. A yearly maintenance program would have to be established after chemical application.

3.1.4.2 <u>Chemical Stabilization Cost</u>

Cost estimates for chemical stabilization are based on equipment time and application of chemicals. The price associated with chemical application is dependent on the type of chemical used and rate of application.

Equipment time costs are estimated for the cost required to bury fines in the tailings pond (Section 3.1.1.2) chemical application costs are based on Bureau of Mines estimates (Dean et al., 1974).

Earth Moving Costs	\$444 per acre
Chemicals and Application	335 per acre
TOTAL	\$779 per acre or \$76,000 for 97A

3.1.5 Alternative V

The U. S. Bureau of Mines, Salt Lake City Metallurgy Research Center has developed a combination for chemical-vegetative stabilization (Dean et al.,1974). This procedure follows normal seeding procedures followed by a light chemical application over the seeded area. Several advantages are claimed for the use of a chemical in combination with vegetation. These advantages include: a reduction in sand blasting of vegetation created by blowing sand as well as a greatly reduced risk of sand drifting over established vegetation; moisture is retained in the tailings because the chemical application reduces evaporation; and reflected solar radiation is reduced because the chemical application is dark and absorbs heat rather than reflecting it.

3.1.5.1 Earthwork Requirements for Chemical-Vegetative Stabilization

The combination of chemical-vegetative stabilization will require the same reshaping and addition of topsoil to the tailing wastes. Procedures for shaping, preparation of seedbed, seeding, and applying chemicals are described in previous sections (Sections 3.1.2.1; 3.1.3.1, and 3.1.4.1). It is not thought that these procedures be modified for application at the Moab plant site.

3.1.5.2 Cost Estimates

Costs associated with stabilization by a chemical-vegetative combination are related to reshaping, establishing vegetation, and application of chemicals. Estimates are the same as those presented in Sections 3.1.1.2, 3.1.2.2, 3.1.3.2 and 3.1.4.2.

These are summarized as follows:

Reshape slopes	$ 190 per acre	
Apply cover material	4,144	
Apply seed	248	
Chemical application	335	
Total 130 acres	$ 4,917 per acre	= $639,210
Add fines burial		20,000
Total		$659,210 or $660,000

3.2 MAINTENANCE PROGRAM

Although the proposed stabilization plan will require low maintenance, it is anticipated that in some years of high precipitation, erosion may be expected. In order to provide inspection and maintenance for this contingency, a provision is made in the budget at the rate of $10,000 per year for a total budget of $500,000.

The work would include:

1. Periodic inspection of stabilized materials for evidence of wind and water erosion; and
2. Addition of cover material to areas exhibiting erosion.

It is not expected that the allotted amount will be used each year. Therefore, funds will accrue which can be used in the event some years have unusually high erosion.

3.3 COST SUMMARY

Five alternatives have been scoped and estimated to determine costs for stabilization of The Atlas Minerals waste retention system. The waste retention system will be in operation for another 15 years. The costs are presented in Table 3.2.

3.4 RANKING OF ALTERNATIVES

Five alternatives were evaluated for cost effectiveness and their stabilization program.

It is considered herein that alternative I is the most suitable to develop for long-term stabilization. This alternative would require minimal maintenance once the cover material is in place and is best suited for the climatic conditions. Alternatives II, III and V require considerable cover material due to the additional area to be covered. Chemical stabilization (Alternative IV) does not appear to be very effective at present. Vegetative stabilization would probably require considerable maintenance. Vegetative stabilization also would require periodic irrigation which will probably result in leaching of salts and toxic metals.

SECTION 4

PROPOSED STABILIZATION PROGRAM

4.1 STABILIZATION PROGRAM

It is proposed that a physical stabilization program be developed to reduce potential wind and water erosion. This program would follow the following procedures once the mill is decommissioned:

1. Allow sufficient time for surface water to evaporate from tailings pond;
2. Bury fines of tail pond area with coarse beach material;
3. Add a one-foot layer of cover material to the top surface of the tailings material;
4. Shape top surface to form crown which will facilitate water runoff to the sides;
5. Maintain the stability of the waste retention system by adding cover material as needed when erosion channels start to form.

Construction of a protective dike along the Colorado River was given consideration as a part of the stabilization program; however, data presented in Section 2.3 of the Safety Analysis Report indicate flooding would not be a hazard to the waste retention system.

TABLE 2.1

PHYSICAL AND CHEMICAL PROPERTIES OF SOILS COLLECTED FROM TAILINGS PILE AND BERMS, ATLAS MINERALS, MOAB, UTAH FACILITY

Parameter / Sample[a]	S-6[b]	S-7[b]	S-8[b]	S-10[c]	S-11[c]	S-12[c]	S-13[d]
Texture	Sandy	Loamy Sand	Sandy Loam	Loam	Sandy Loam	Sandy Loam	Silt Loam
Conductivity (µmhos/cm)	2.4×10^2	1.3×10^3	6.4×10^2	1.4×10^3	5.6×10^3	4.7×10^3	2.2×10^4
Total K-N (ppm)	127	147	210	62	54	20	57
Nitrate (ppm)	<0.2	<0.2	2.2	1.1	1.6	1.3	0.2
pH (units)	8.7	8.3	8.5	9.8	10.2	9.8	9.6
Organic Matter	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Available Phosphorus (ppm)	12.0	6.4	2.2	4.5	2.5	2.2	2.5
Available Potassium (ppm)	23,000	32,500	14,000	8,120	5,000	6,620	9,700
Exchangeable Na (ppm)	4,000	3,800	4,700	7,450	11,250	34,000	5,000

[a] Sample Locations Identified on Plate 1

[b] Cover Material from Berms

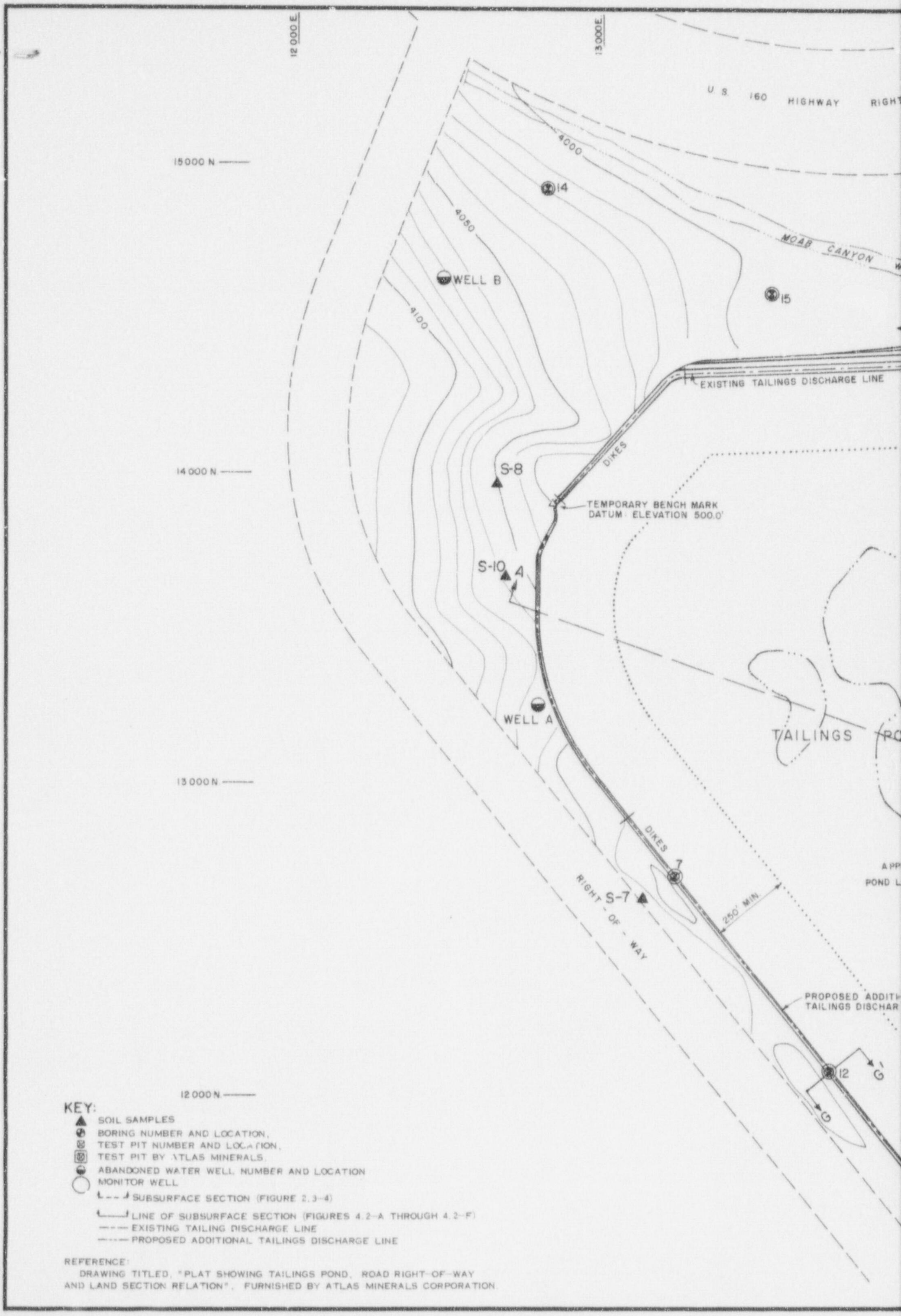
[c] Tailings from Beach

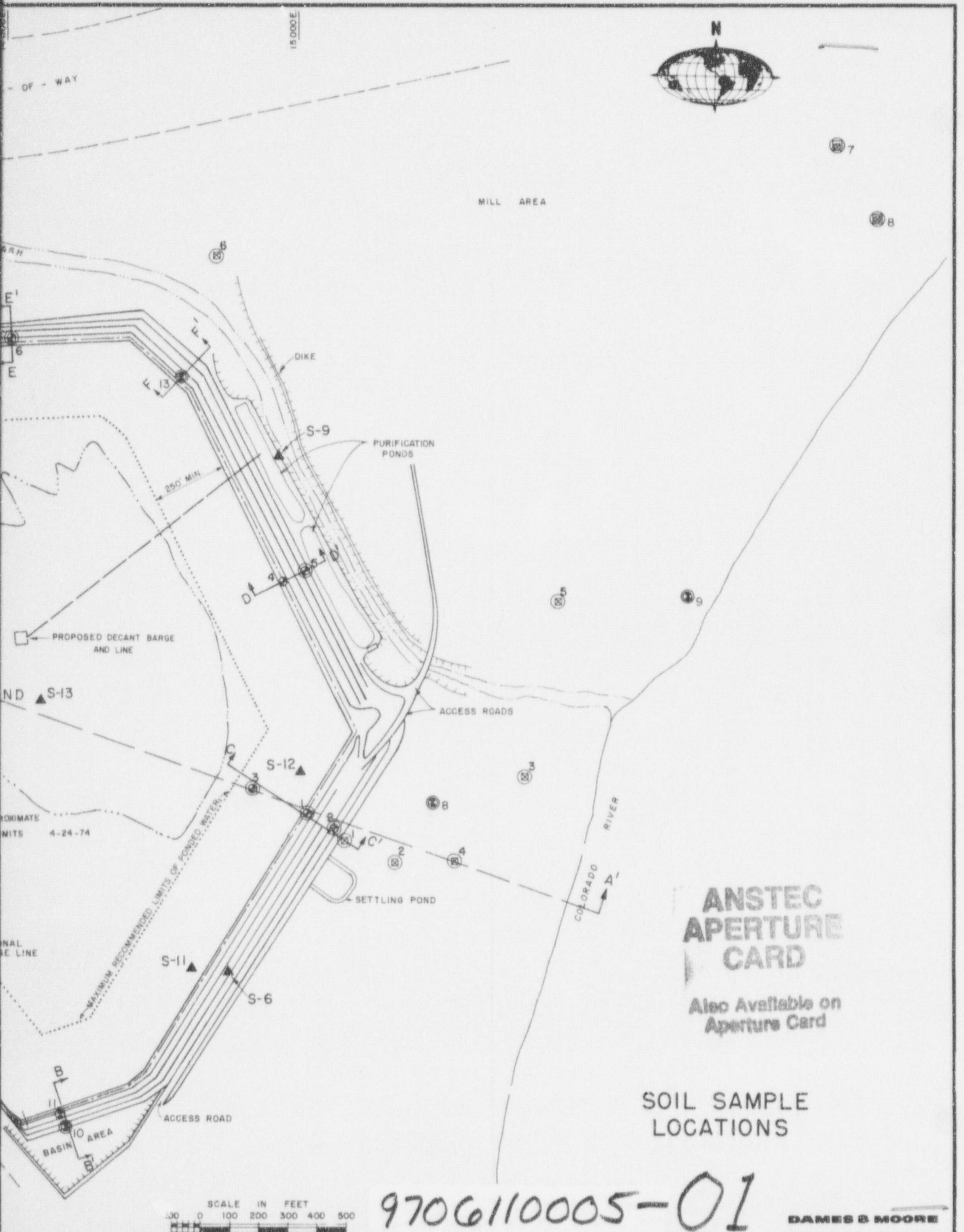
[d] Tailings from Slime Area

TABLE 3.1

COST ESTIMATES FOR FIVE ALTERNATIVES EVALUATED FOR STABILIZING THE ATLAS MINERALS, MOAB, UTAH WASTE RETENTION SYSTEM

TASK	ALTERNATIVE I	II	III	IV	V
Reshaping slopes		$ 190/A	$ 190/A		$ 190/A
Applying cover material	$ 4,144/A	$ 4,144/A	$ 4,144/A		$ 4,144/A
Vegetation			248/A		248/A
Chemical application				$ 335/A	$ 335/A
Subtotal per acre cost	$ 4,144/A	$ 4,334/A	$ 4,582/A	$ 335/A	$ 4,917/A
Number of acres	97	130	130	97	130
Subtotal cost extended	$ 401,968	$ 563,420	$ 595,660	$ 32,495	$ 639,210
Rounded to $1,000's	$ 402,000	$ 564,000	$ 596,000	$ 33,000	$ 640,000
Add fines burial (45 A)	$ 20,000	$ 20,000	$ 20,000	$ 20,000	$ 20,000
Add 50 yr maintenance	$ 500,000	$ 500,000	$ 500,000	$ 500,000	$ 500,000
Total cost	$ 922,000	$1,084,000	$1,116,000	$ 553,000	$1,160,000


12 000 E
13 000 E
U.S. 160 HIGHWAY RIGHT
15000 N
14000 N
13000 N
12000 N
4000
4050
4100
14
15
WELL B
WELL A
MOAB CANYON
EXISTING TAILINGS DISCHARGE LINE
DIKES
TEMPORARY BENCH MARK
DATUM ELEVATION 500.0'
S-8
S-10
A
S-7
7
12
G
G'
RIGHT OF WAY
250' MIN.
TAILINGS PO
APP
POND L
PROPOSED ADDITI
TAILINGS DISCHAR
KEY:
SOIL SAMPLES
BORING NUMBER AND LOCATION.
TEST PIT NUMBER AND LOCATION.
TEST PIT BY ATLAS MINERALS.
ABANDONED WATER WELL NUMBER AND LOCATION
MONITOR WELL
SUBSURFACE SECTION (FIGURE 2.3-4)
LINE OF SUBSURFACE SECTION (FIGURES 4.2-A THROUGH 4.2-F)
EXISTING TAILING DISCHARGE LINE
PROPOSED ADDITIONAL TAILINGS DISCHARGE LINE
REFERENCE:
DRAWING TITLED, "PLAT SHOWING TAILINGS POND, ROAD RIGHT-OF-WAY AND LAND SECTION RELATION", FURNISHED BY ATLAS MINERALS CORPORATION.



SOIL SAMPLE LOCATIONS

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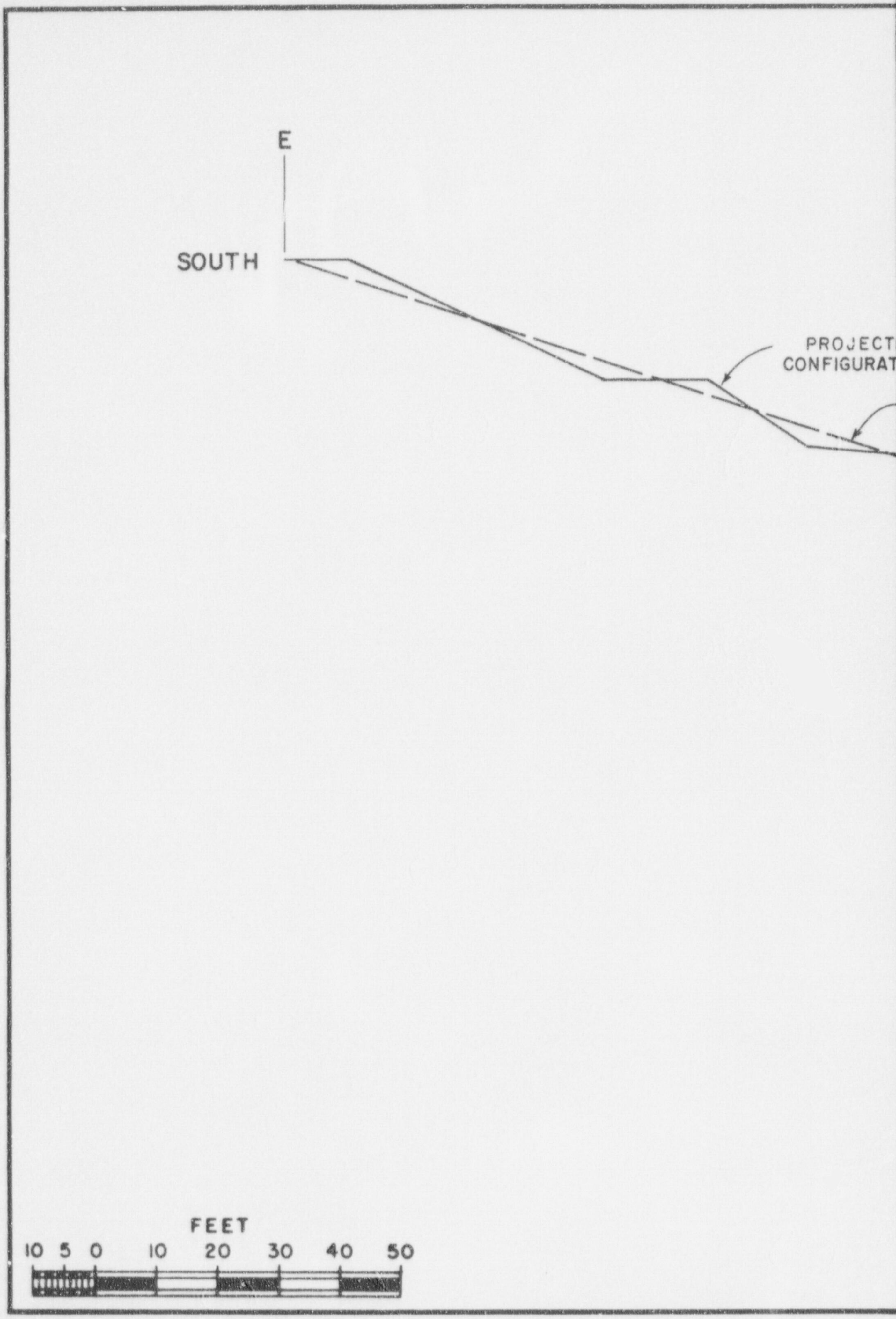
PLATE 1



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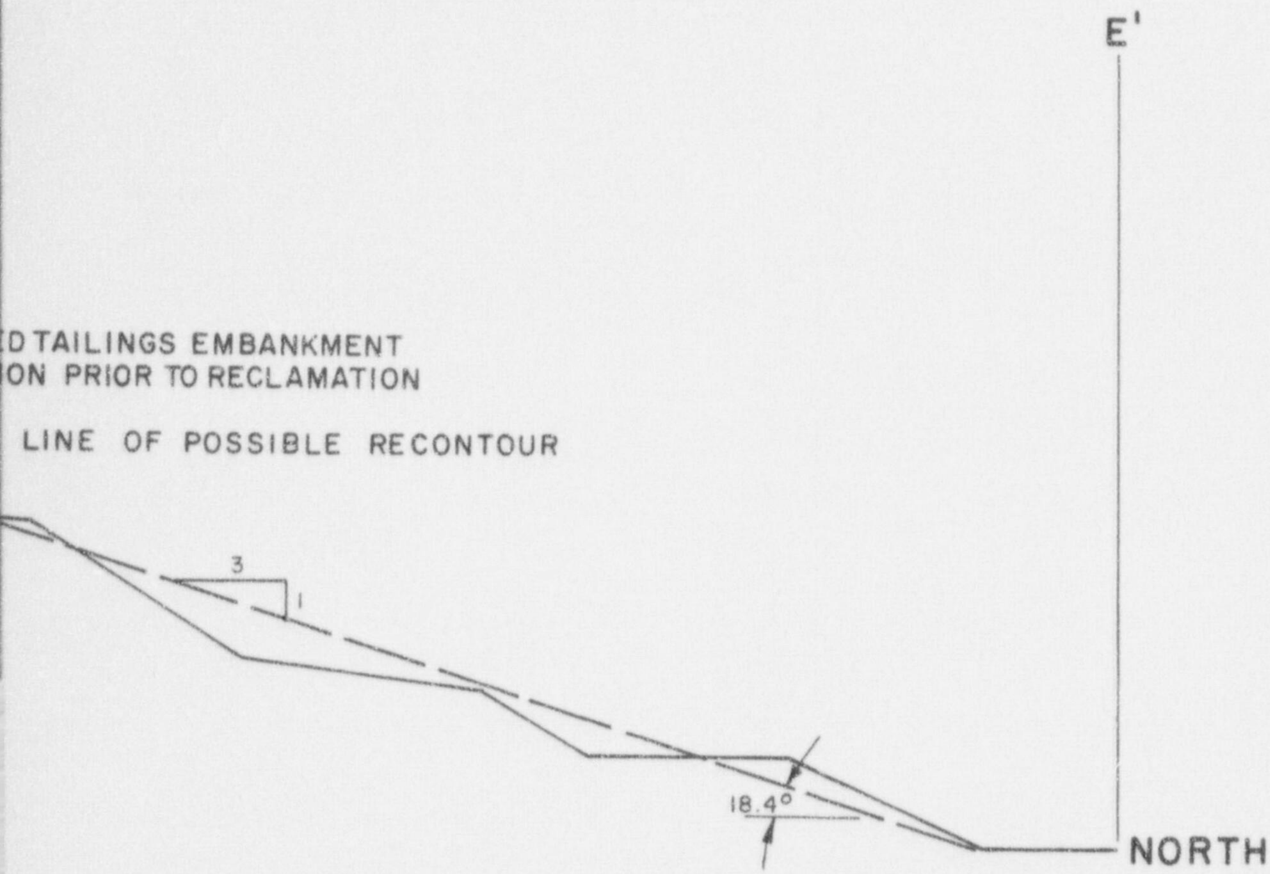
ATLAS
BY A.B.D. DATE 8-13-75
CHECKED BY [illegible] DATE 8/15/75

REVISIONS
BY ___ DATE ___
BY ___ DATE ___
PLATE ___ OF ___

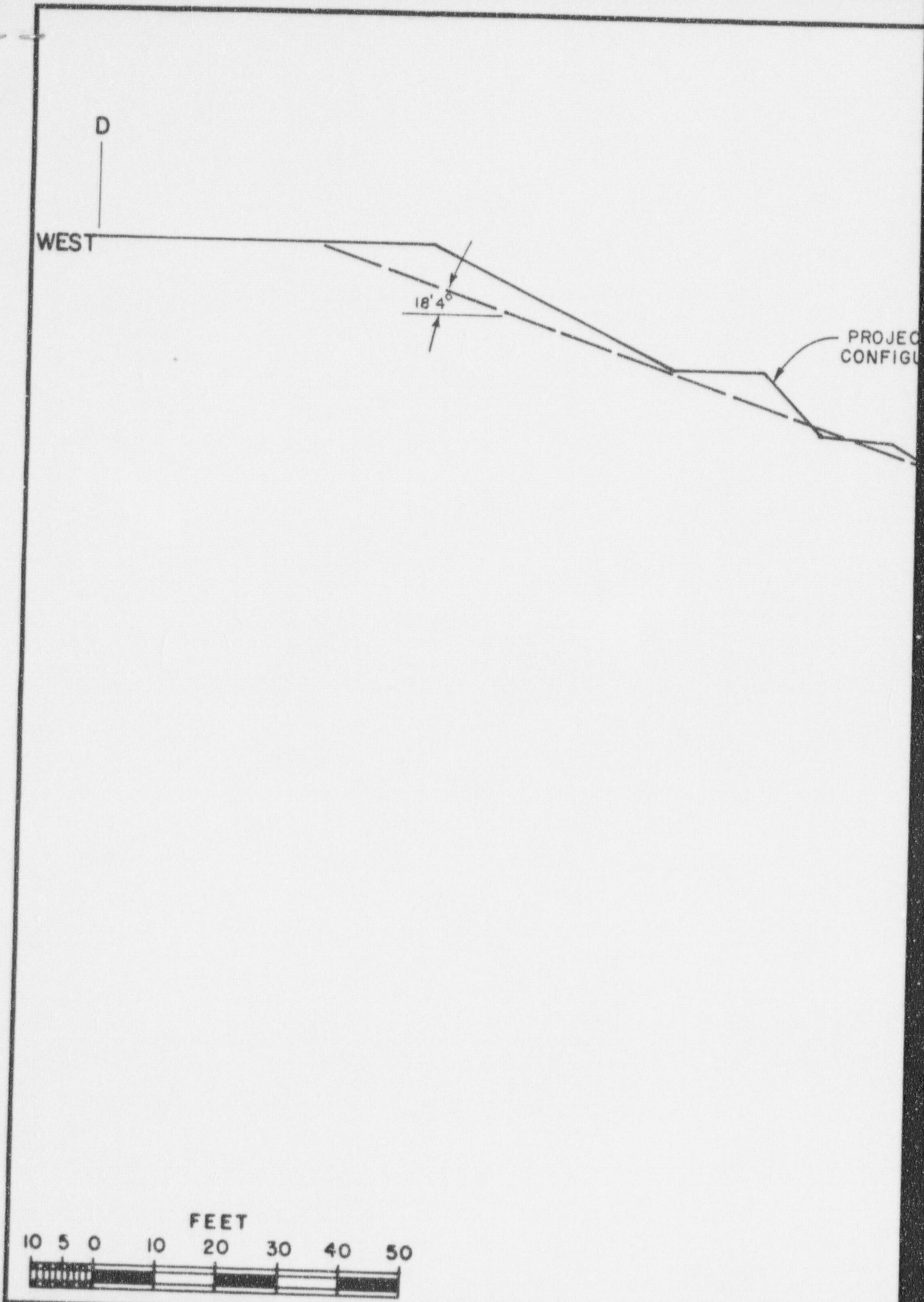
666.12 (4-64)



TYPICAL NORTHERN TAILINGS EMBANKMENT SECTION USED FOR ESTIMATING EARTHWORK RESHAPING COSTS

9706110005-02

DAMES & MOORE



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REVISIONS
BY DATE
BY DATE
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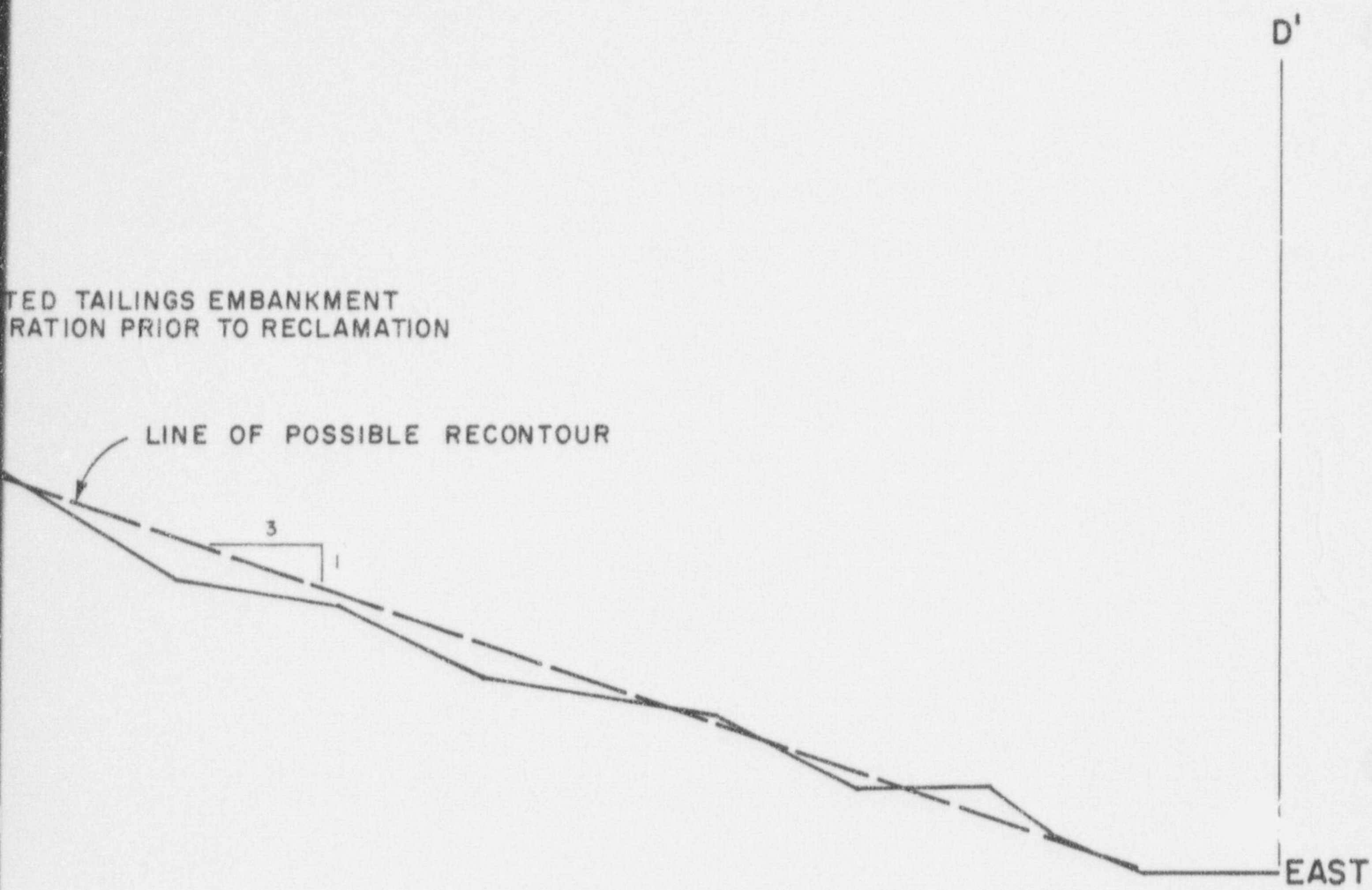
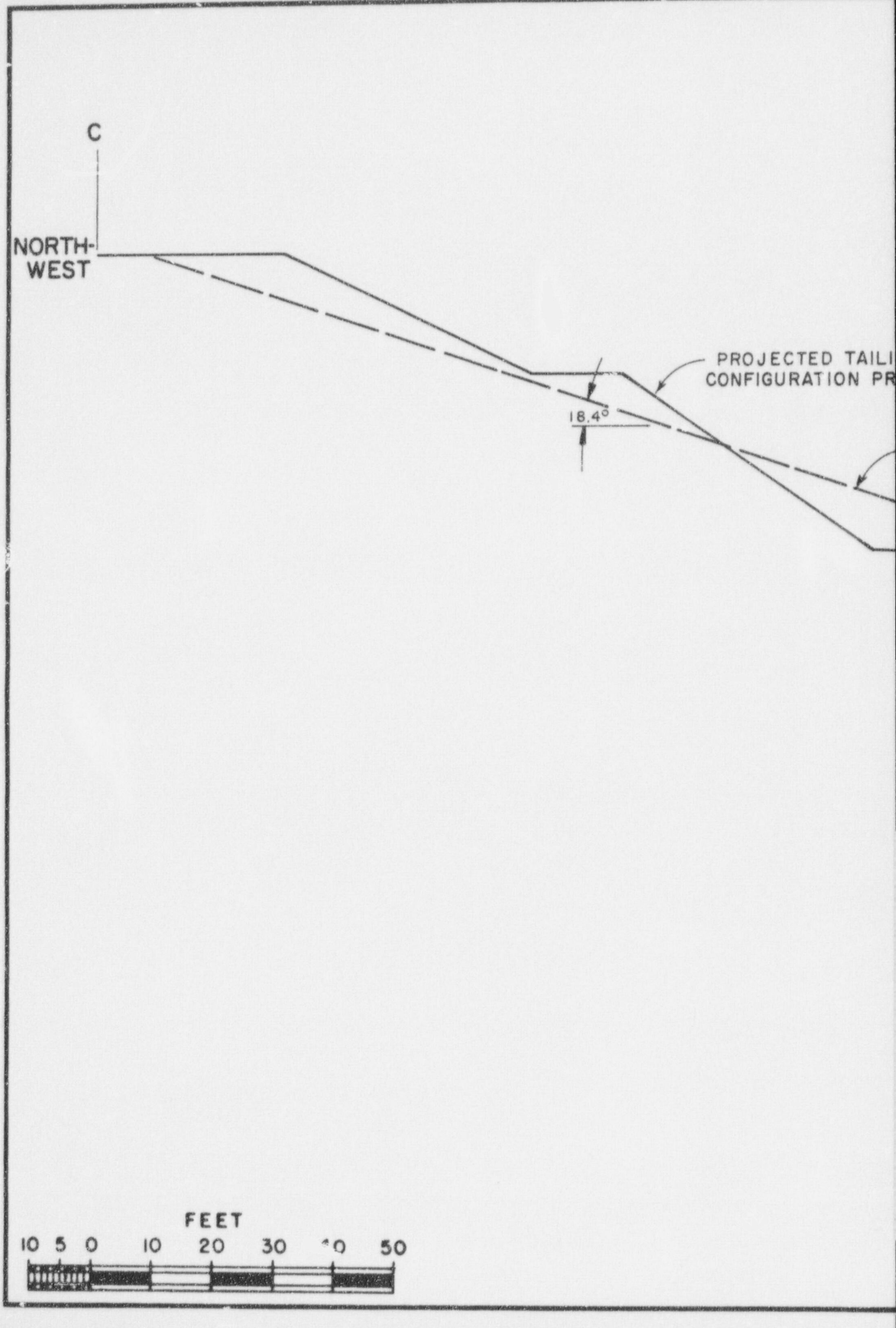


TYPICAL EASTERN TAILINGS
EMBANKMENT SECTION USED
FOR ESTIMATING EARTHWORK
RESHAPING COSTS

9706110005- 03

DAMES & MOORE

PLATE 3



5467-012
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BY A.B.D. DATE 8-13-75
CHECKED BY DATE

REVISIONS
BY DATE
BY DATE
PLATE OF

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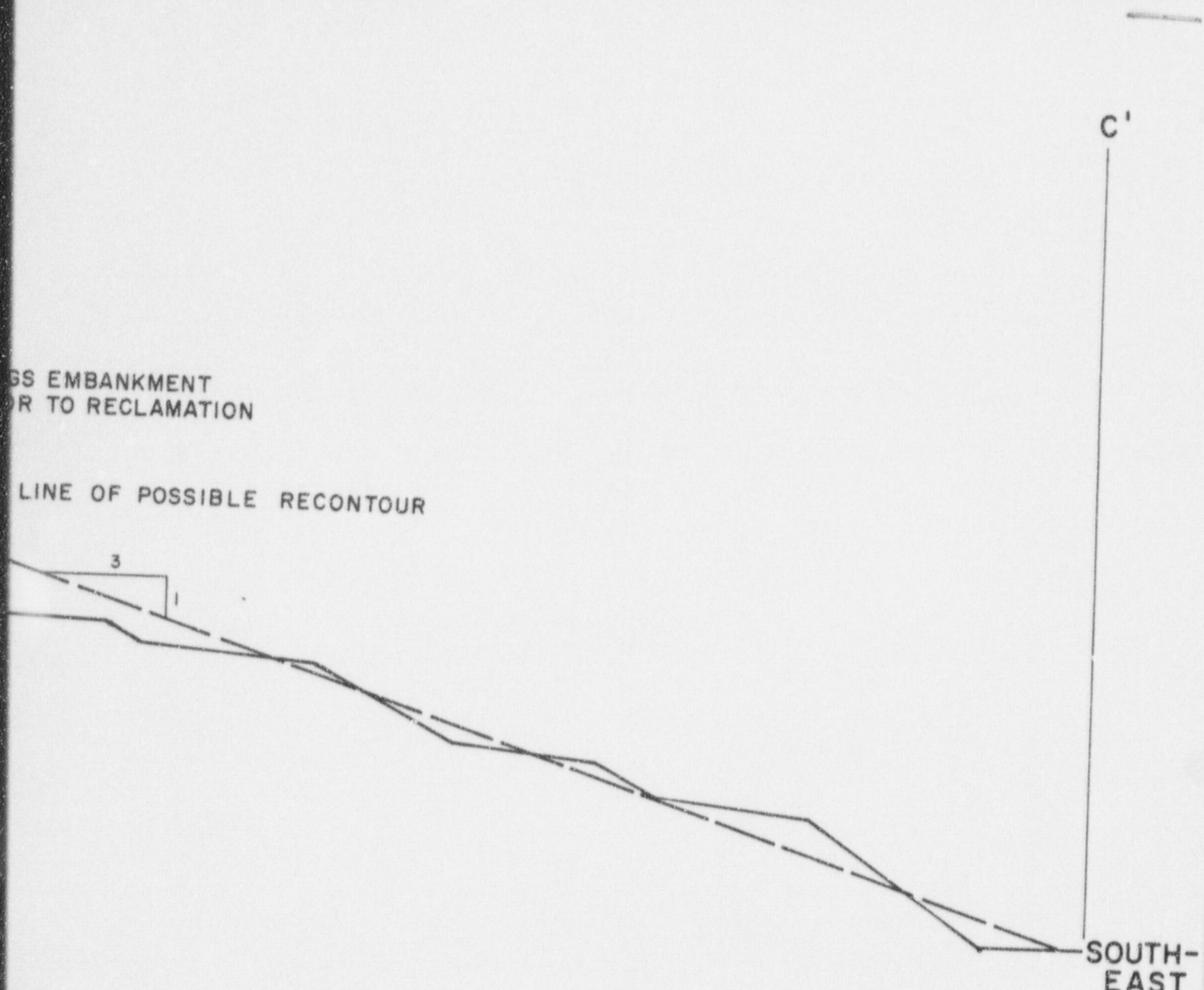

TYPICAL SOUTHERN TAILINGS
EMBANKMENT SECTION USED
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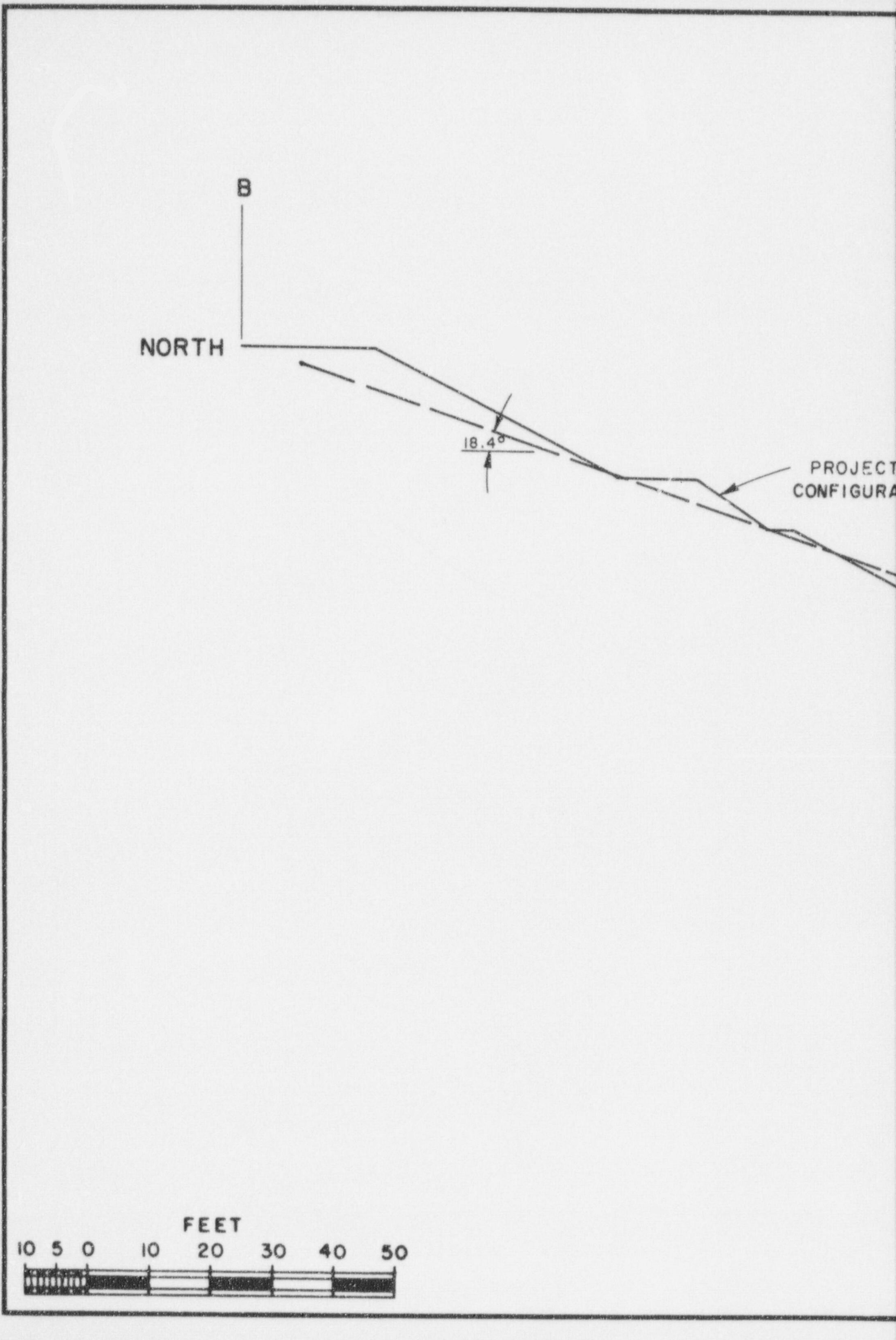
RESHAPING COSTS

9706110005 —04

DAMES & MOORE



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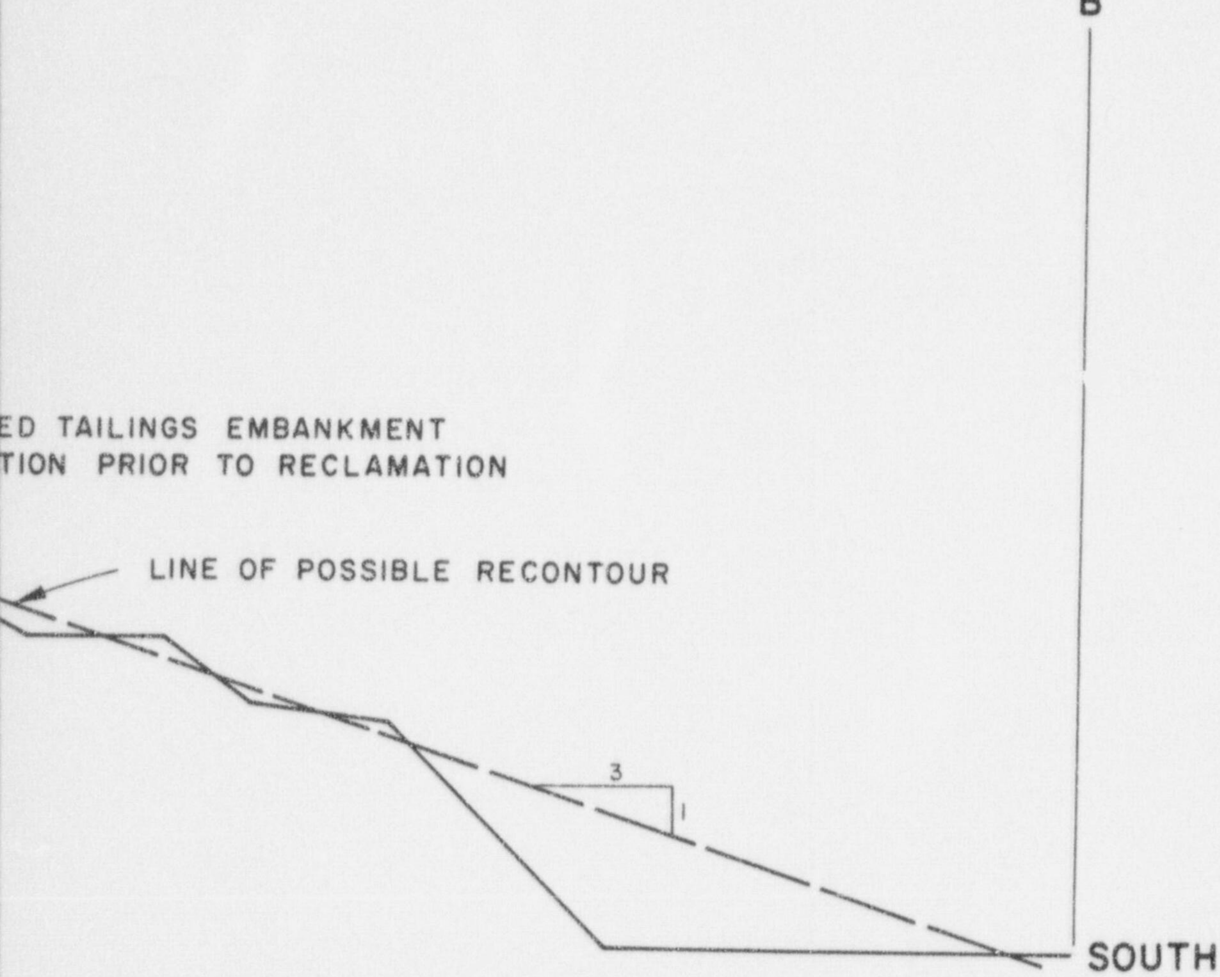
BY SWMD DATE 8-13-75
CHECKED BY DATE 8/?/75

466.12 (4-64)

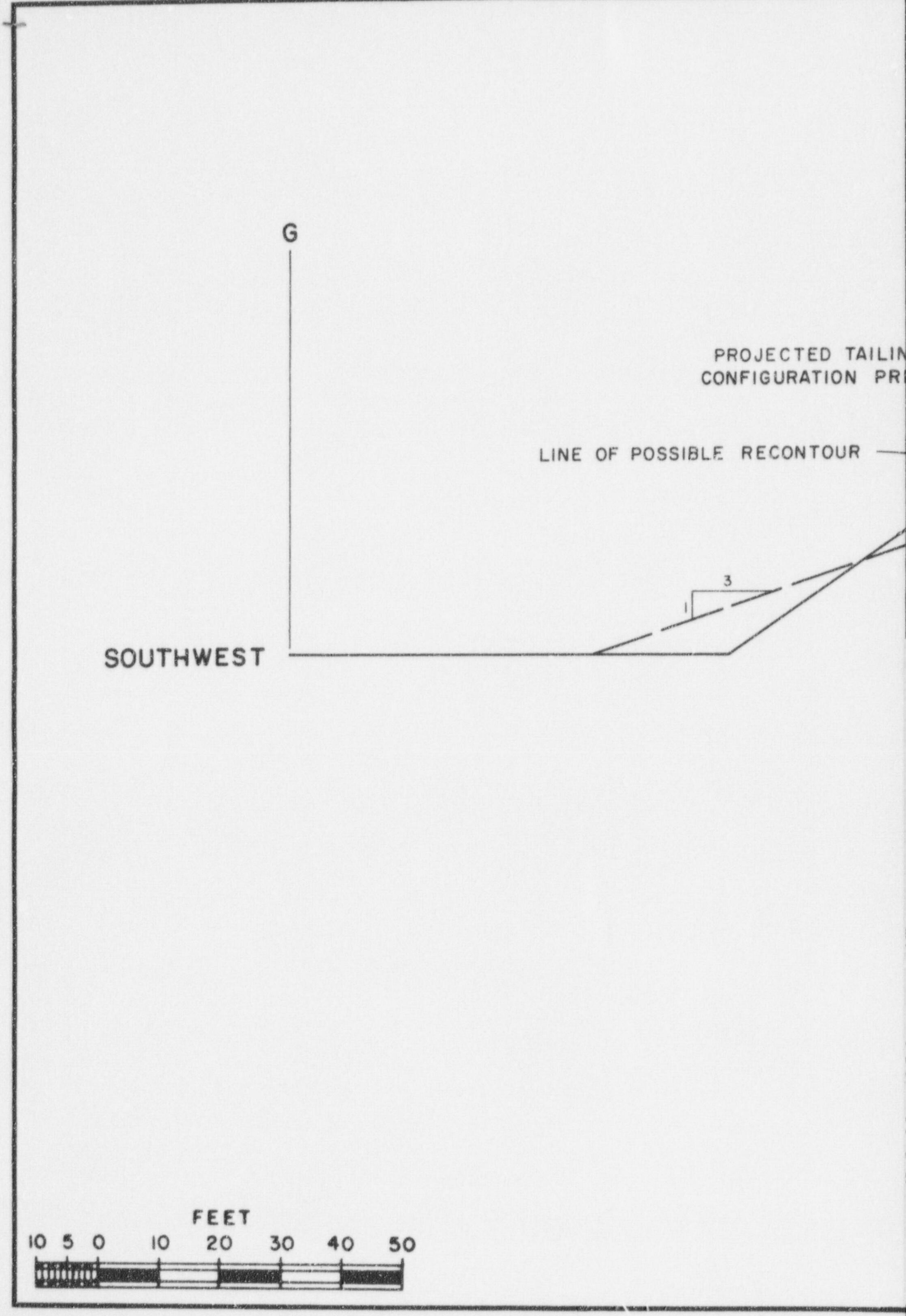


TYPICAL BASIN AREA TAILING
EMBANKMENT USED FOR
ESTIMATING EARTHWORK
RESHAPING COSTS

9706110005 -05

DAMES & MOORE

PLATE 5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PROJECTED TAILIN
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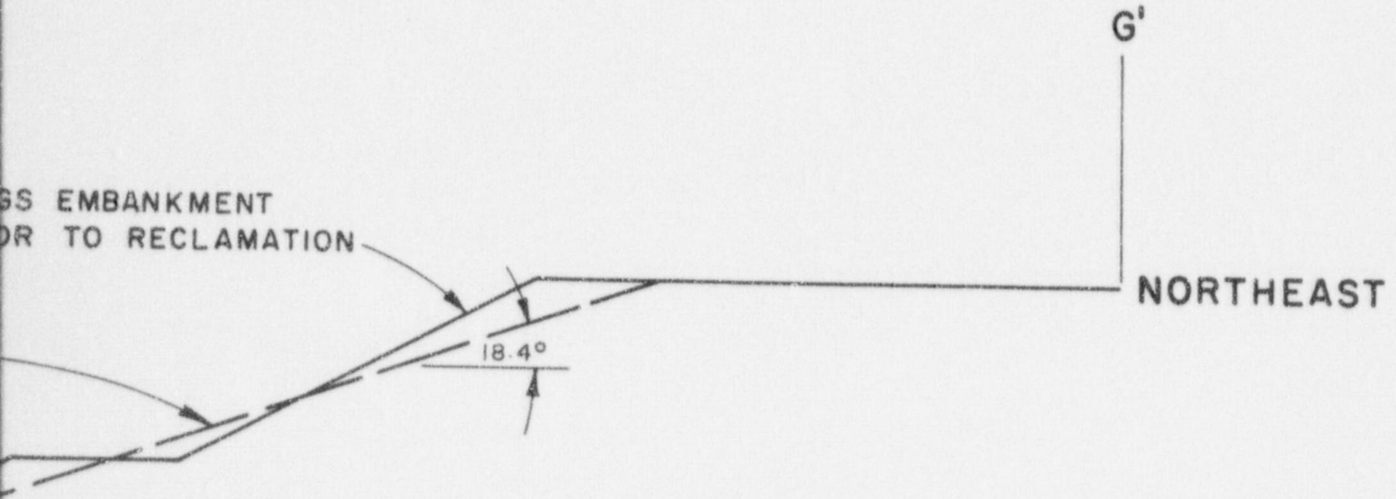
466.12 (4-64)



TYPICAL WESTERN TAILINGS EMBANKMENT SECTION USED FOR ESTIMATING EARTHWORK RESHAPING COSTS

9706110005 -06