City of Albuquerque

P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

May 20, 1994

Paul Brasher
Brasher Engineering Inc.
4425 Juan Tabo NE Suite 202
Albuquerque, NM 87111

RE: REVISED ENGINEER CERTIFICATION FOR FINANCIAL GUARANTEE RELEASE FOR NOR-ESTE MANOR BLOCK F (C19-D6B1) ENGINEER CERTIFICATION STATEMENT DATED 5/5/94.

Dear Mr. Brasher:

Based on the information provided on your May 6, 1994 resubmittal, the above referenced site is acceptable for Financial Guarantee Release (3355.91).

If I can be of further assistance, please feel free to contact me at 768-2667.

Sincerely,

Bernie J. Montoya

Bernie J. Montoya, CE
Engineering Associate

BJM/dl/WPHYD/1652

c: Andrew Garcia
File

City of Albuquerque

P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

February 15, 1994

Paul Brasher, P.E.
Brasher Engineering
Suite 113
11930 Menaul Boulevard NE
Albuquerque, NM 87112

RE REVISED GRADING PLAN FOR LOWERING PADS ON LOTS 4, 5, 6, 7, AND 8, NOR ESTE MANOR, TRACT B, (C19/D6B1), ENGINEER'S STAMP DATED FEBRUARY 3, 1994.

Dear Mr. Brasher:

Based on the information provided that the floodwall provides 1.6 feet of freeboard above the energy grade, this office and AMAFCA have no objection to lowering the above referenced pads per your plan.

If you have any questions concerning my comments, please do not hesitate to call me at 768-2650.

Cordially,

Gilbert Aldaz, P.E. & L.S.
City/County Floodplain Adm.

xc: Clifford E. Anderson, AMAFCA
File

wp+1652

EROSION STUDY

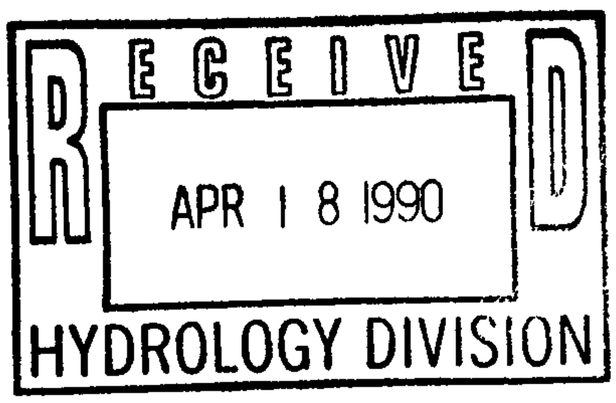
NORTH DOMINGO BACA ARROYO

AT

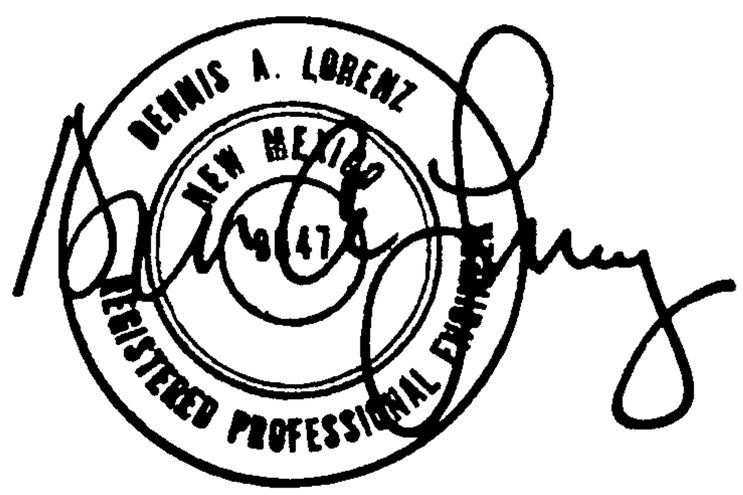
NOR ESTE MANOR, BLOCK F AND TRACT "B"

Prepared for:

PRESLEY COMPANY OF NEW MEXICO
1909 CARLISLE BOULEVARD NE
ALBUQUERQUE, NEW MEXICO 87106



JANUARY 1990
REVISED APRIL 1990



4-16-90

PURPOSE AND SCOPE

The purpose of this study is to analyze a 1500 foot reach of the North Domingo Baca Arroyo adjacent to Nor Este Manor Subdivision, located between Wyoming Boulevard and Barstow Street NE.

This analysis studies the North Domingo Baca Arroyo under various flow conditions in order to estimate the erosion potential of the arroyo within the study reach. The scope of this analysis is to provide design criteria for construction of a structural cut-off wall to be placed along the arroyo's north bank, and to provide general maintenance criteria for the cut-off wall to mitigate damage by major storm events.

Criteria for development of this study has three sources: 1) a predesign conference (see Exhibit "A") with AMAFCA and the City of Albuquerque; 2) comments on the first submittal of this analysis by Resource Consultants, Inc. dated March 13, 1990 (see Exhibit "B"); and 3) subsequent meetings with AMAFCA and City of Albuquerque representatives. It has been agreed that a structural cut-off wall will be constructed along the length of study reach adjacent to the Nor Este Manor project. The wall will provide adequate protection from erosion (degradation) resulting from consecutive 10-year and 100-year 6-hour storm events.

NORTH DOMINGO BACA ARROYO

The North Domingo Baca Arroyo drains approximately 1420 acres (2.2 square miles) of partially developed land. Scattered homesites are located within the drainage basin. These homesites were developed on existing 1.0 acre North Albuquerque Acres platting. The arroyo meanders through the drainage area in a relatively unrestricted manner. Mapped flow widths range from less than 100 feet to more than 500 feet (see Figure 1). AMAFCA has constructed a dam at Hamilton Street (approximately 1.5 miles from the study reach), and several trainer dikes to prohibit pirating of flows from the main channel. Flow widths fan out west of the study reach to widths of 1000 feet or more prior to crossing I-25. West of I-25, flows pass through a mobile home park prior to merging with the South Domingo Baca Arroyo. Within the study reach, flow widths vary from 250 feet to 600 feet. Vegetation is typical for the North Albuquerque Acres area.

Within the study reach, the arroyo has a braided flowpath with well defined main channel beds. Flow is typically unrestricted until the arroyo crosses Wyoming, where a temporary crossing facility has been constructed to provide all weather access to La Cueva High School. Some trash can be found, which unfortunately is also typical in the area. A fill area is located along the south bank of the arroyo, just west of Barstow. This fill is loose and has been placed in piles; however, no recent erosion is evident.

SOILS AND GROUND COVER

Soils within the drainage area consist mainly of Embudo type soils (see Figure 2). Embudo Tijeras Complex (Etc) is found on ridges and steep slopes. This unit includes areas of Tesajo, Millett and Wink Soils which make up about 15 percent of the unit. Embudo gravelly fine sandy loam (EMB) is found on level to slightly sloping ground. This unit has areas of Tesajo, Millett and Tijeras soils. Both soils are gravelly fine sandy loams, which contain almost no clays or silts. The hazard of water erosion is typically moderate. Both soils are classified by the USDA Soil Conservation Service as hydrologic soil Group "B" soils.

Vegetation consists of grasses mixed with some shrubs and annual plants. Vegetation typically covers about 15 percent of the surface. Grasses (typically Black Gramma) and annual plants are found on ridges and gently sloping areas. Wooded shrubs (typically) Apache Plume) is dominant in drainage ways.

DATA COLLECTION

Data used to prepare this study was collected from various sources. Topography for the study reach was obtained from aerial base mapping prepared by Tom R. Mann and Associates, Job No. 86-114 (dated 1986). Soils samples were taken and analyzed by Western Technologies, Inc. Design flowrates and hydrographs were taken from the "Review and Refinement to the Northeast Heights Drainage Management Plan", prepared by Espey, Huston and Associates, Inc. 1980.

General knowledge about the arroyo was obtained by field trips. The arroyo system was walked to determine the nature of the watershed and note areas where erosion was occurring. Soil sample sites were also determined as well as visually obtaining a feel for representative roughness values.

HYDROLOGY

Hydrology for use by this analysis was obtained from the "Review and Refinement to the Northeast Heights Drainage Management Plan" (RRNEHDMP). The report determined flowrates for the North Domingo Baca Arroyo at various analysis points between the Sandia Mountains and the North Diversion Channel under nine (9) different landuse scenarios. This analysis utilizes Hydrologic Condition VI, which is defined as:

"Maintained existing channels and fully developed watershed land use without AMAFCA Drainage Resolution 1972-2 and without proposed floodwater detention reservoirs."

This hydrologic condition anticipated low to mixed density residential development within the North Domingo Baca

Basin. These assumptions appear to be fairly realistic, particularly in light of the development of the Nor Este and Vineyard projects. As shown by the project hydrographs (see Appendix), this condition yields the highest peak flowrates.

Project hydrographs were developed from the RRNEHDMP Hydrographs taken at Barstow Street. Unit hydrographs were used to obtain hydrographs for smaller frequency storms.

SEDIMENT TRANSPORT AND EROSION POTENTIAL METHODOLOGY

This analysis utilizes the HEC-6 program for Scour and Deposition in Rivers and Reservoirs. The program calculates water surface profiles and applies incoming sediment load, bed load grain size distribution, channel geometry and channel conveyance parameters to determine sediment transport capabilities and changes in channel bed geometry.

Incoming sediment loads were determined by using Toffaleti's method for computation of sand discharge. This method utilizes channel geometry, velocity, water temperature, energy slope and grain size distribution to determine bed load and suspended load sediment values. Toffaleti's method was selected because HEC-6 also uses Toffaleti's method in its sediment transport analysis. Per comments issued by Resource Consultants, Inc. on the first copy of this analysis, incoming sediment loads were reduced by approximately one-third. This adjustment resulted in a slightly greater degradation of the arroyo bed.

HEC-2 runs were made at various flowrates to provide data for sediment transport calculations and determine exact water surface profiles and conveyance parameters.

In accordance with the design criteria, the study reach was analyzed for erosion potential resulting from consecutive 10-year and 100-year/6-hour storms. The project hydrographs were converted into histograms with flow duration of 20 minutes for each strip (see Appendix). The HEC-6 program uses the histograms along with water temperature to calculate sediment loading and bed change.

For purposes of developing cut-off wall design and maintenance criteria, the study reach was divided into three segments (see Plates I, II & III). Within each segment the arroyo cross section and interface with the Nor Este Manor project are consistent. Typical sections within each study segment were analyzed to determine erosion potential adjacent to the proposed cut-off wall under worst case conditions. The erosion potential was used to determine cut-off wall footing depths and maintenance criteria. Typical study cross sections and cut-off wall design is detailed in Section 4 of this document.

CONCLUSIONS

As shown by the HEC-6 runs, the arroyo is typically degradational within the study reach. The output does, however, show pockets of aggredation. This is most likely due to oscillations in the model and not the ability of the channel to vary from degradation to aggredation from section to section. This is a reflection of the limitation of the state of the art for sediment transport methods at this time. Overall, the arroyo has a trap efficiency of 0.31 for the high frequency (10 year) and 0.41 for the low frequency (100 year) storms.

As detailed in Section 4, a structural cut-off wall will be constructed along the north arroyo bank adjacent to Nor Este Manor. This interface is to be monitored at least annually by AMAFCA. AMAFCA will utilize the maintenance criteria outlined in Section 4 and make improvements to the north arroyo bank subsequent to a major storm event (i.e. one 10-year or 100-year storm) or several minor low level storms. The Grading and Drainage Plan for Nor Este Manor Block F and Tract B (Plates II & III) is provided in the back pocket of this document. The plan shows the proposed interface with the floodway, and the location of the proposed cut-off walls.

FUTURE CONDITIONS

Future upstream improvements will likely have an impact on the North Domingo Baca Arroyo within the limits of this study. It is anticipated that development will continue in North Albuquerque Acres which will result in the discharge of developed runoff into the arroyo system. This study utilizes projected developed flowrates without AMAFCA Drainage Resolution 1972-2 and without floodwater detention reservoirs, per the "Review and Refinement to the Northeast Heights Drainage Management Plan". It will, however, be necessary for any upstream development to prepare a downstream erosion study to determine the impact of discharging developed runoff into the system.

Other public infrastructure improvements are certain to impact the study reach and Nor Este Manor. Future Barstow Street improvements, which will include crossing structures at the North Domingo Baca, could significantly effect the study reach and require supplemental improvements and/or increased maintenance efforts. Since the arroyo floodplain is approximately 400 feet wide at Barstow, with at least 3 well defined main channels, it is difficult to anticipate where, and what type of crossing structures are to be built. Planned development and land acquisitions may play a major part in selection of drainage corridors. This study makes no attempt to estimate the impacts of future crossing structures or road improvements. It will be the ultimate responsibility of the developer/engineer to design and construct these improvements with the safety of Nor Este Manor in mind.

RECOMMENDATIONS

The following recommendations are made for development of Nor Este Manor Block F, Tract B adjacent to the North Domingo Baca Arroyo.

1. A structural cut-off wall shall be constructed along the North Arroyo bank adjacent to the development, as detailed in Section 4.

2. The arroyo and cut-off wall shall be monitored and maintained by AMAFCA as outlined in Section 4.

3. No improvements shall be placed within the platted floodway.

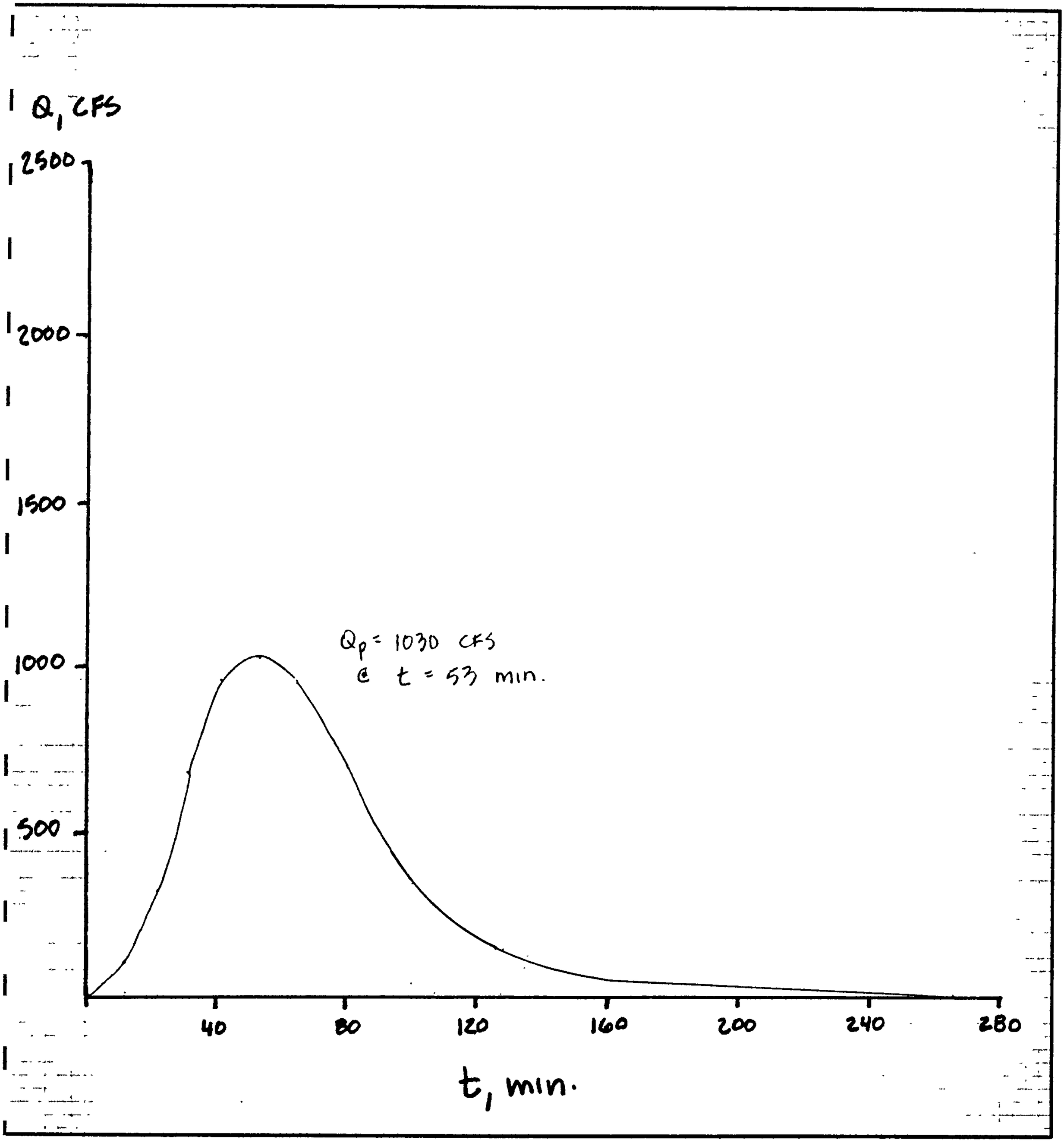
4. The 100-year flood hazard zone easement shall be documented by proper graphics and notes on the subdivision plat for Nor Este Manor Block F, Tract B. Additionally, the plat shall grant an easement between the 100-year flood fringe and the cut-off wall to allow AMAFCA the right of ingress/egress and to perform maintenance.

5. Freeboard shall be provided for the cutoff walls per DPM Vol. II, Section 22.3.4.b.1., and for the building pads, minimum 1 foot higher and in accordance with DPM, Vol. II, 22.3.4.b.2.

PROJECT NAME EROSION STUDY FOR NDB ARROYO JOB NO. 11567-12

SUBJECT 2 YEAR 6 HOUR HYDROGRAPH

BY DL CK. BY _____ APPROVED BY _____ DATE 12-11-89 PAGE ____ OF ____



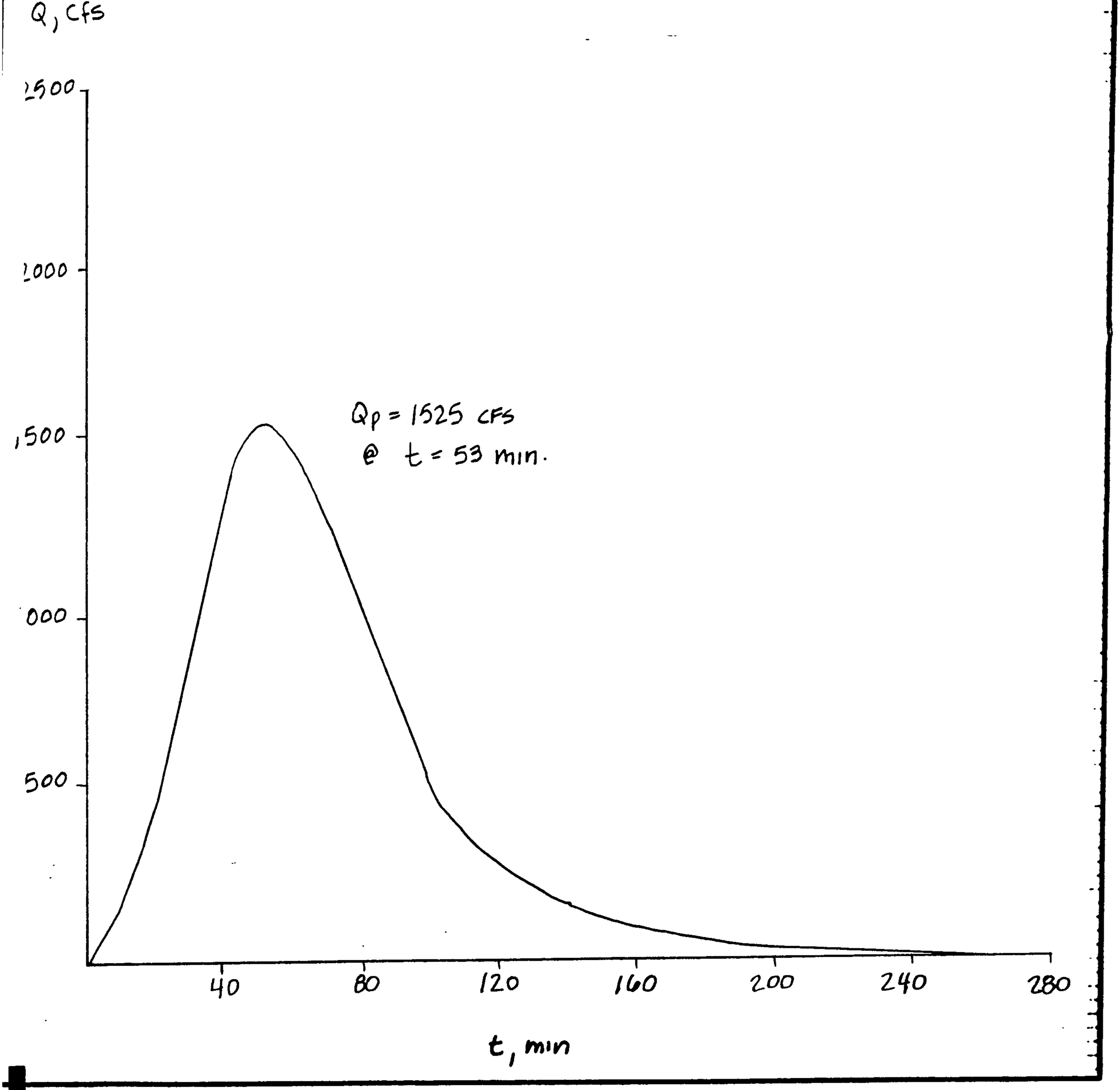
NOTES:

e_h

PROJECT NAME EROSION STUDY FOR NIDB ARROYO JOB NO. 11567-12

SUBJECT 10 YEAR 6HOUR HYDROGRAPH

BY DL CK. BY _____ APPROVED BY _____ DATE 3-29-90 PAGE ____ OF ____



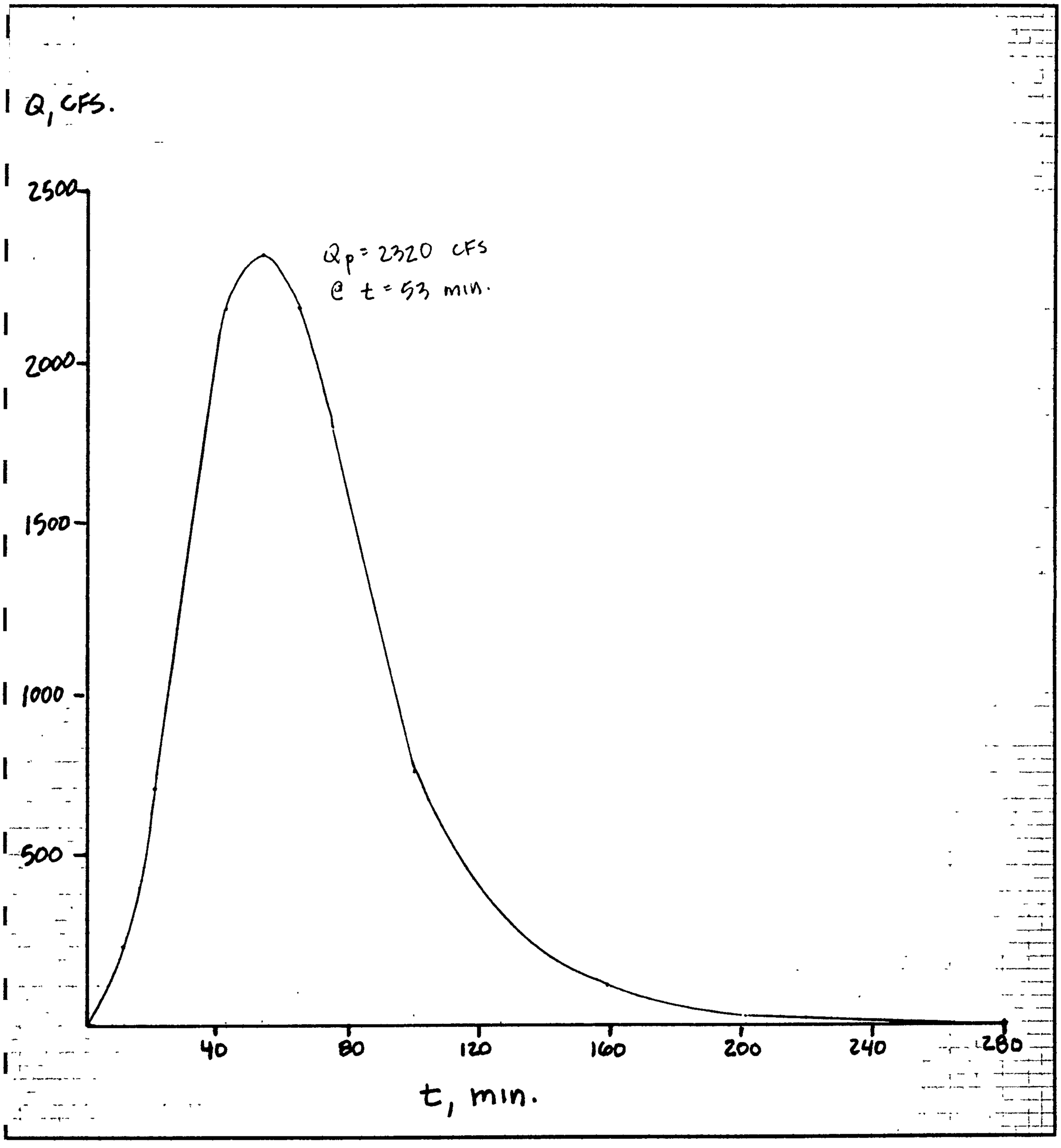
NOTES:

ESPEY, HUSTON & ASSOCIATES, INC.

PROJECT NAME EROSION STUDY FOR NDB JOB NO. 11567.12

SUBJECT 100 YEAR 6 HOUR HYDROGRAPH

BY DL CK. BY _____ APPROVED BY _____ DATE 12-11-89 PAGE ____ OF ____



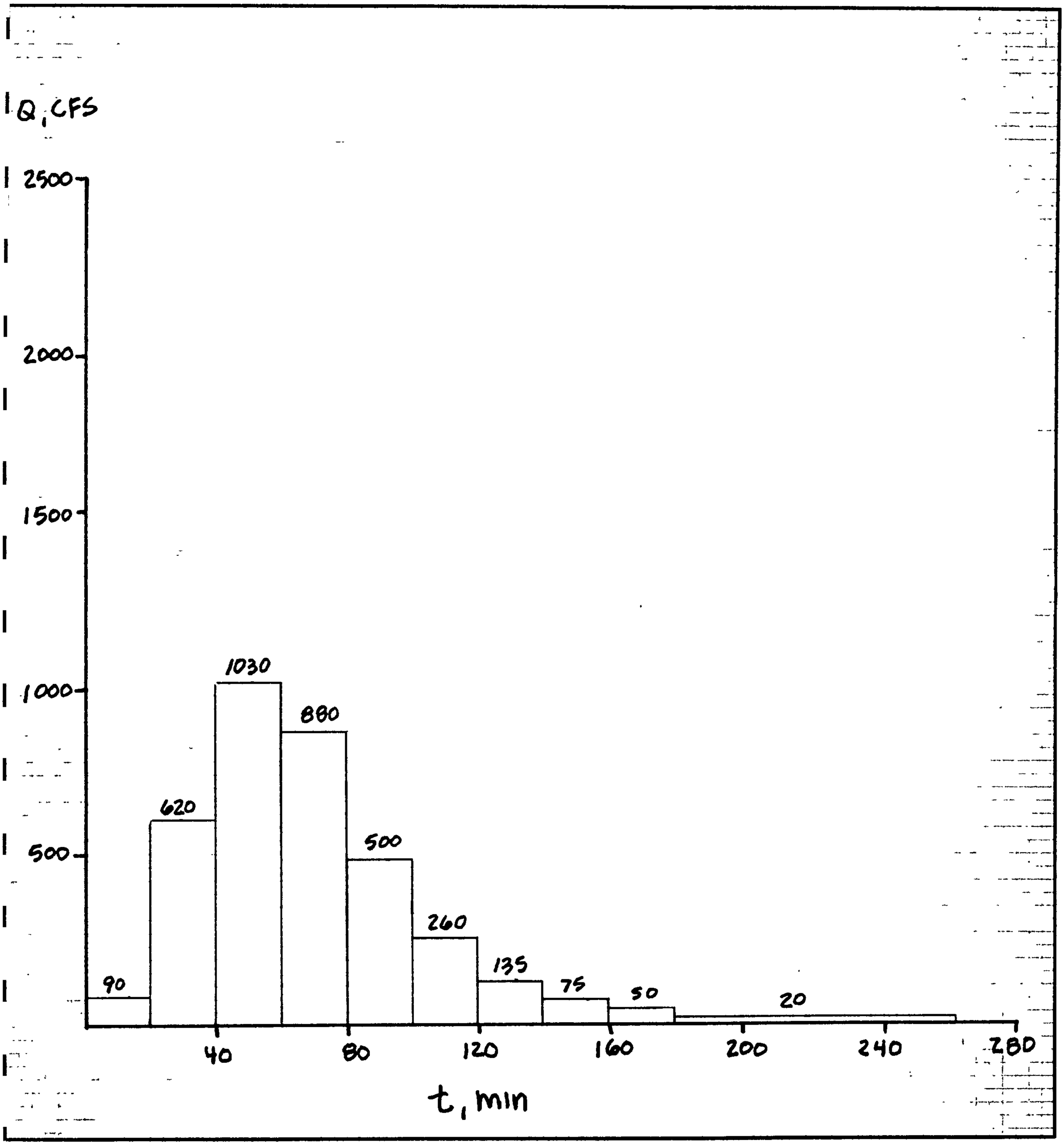
NOTES:

e_h

PROJECT NAME EROSION STUDY FOR NDB JOB NO. 11567-12

SUBJECT 2 YEAR 6 HOUR HISTOGRAM

BY DV CK. BY _____ APPROVED BY _____ DATE 12-11-89 PAGE ____ OF ____

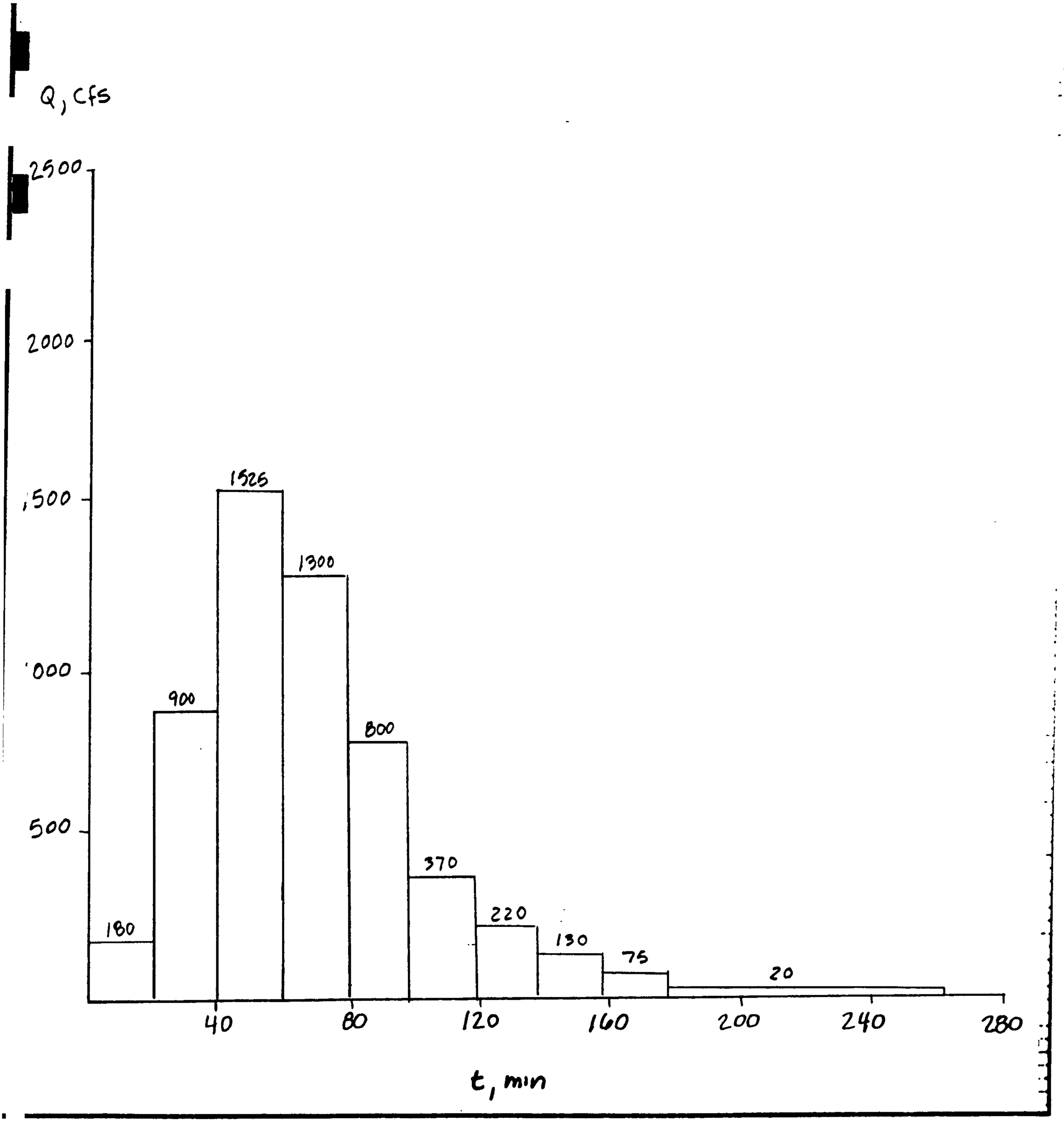


NOTES:

PROJECT NAME EROSION STUDY FOR NDB ARROYO JOB NO. 11567.12

SUBJECT 10 YEAR 6HOUR HISTOGRAM

BY DL CK. BY _____ APPROVED BY _____ DATE 3-29-90 PAGE ____ OF ____



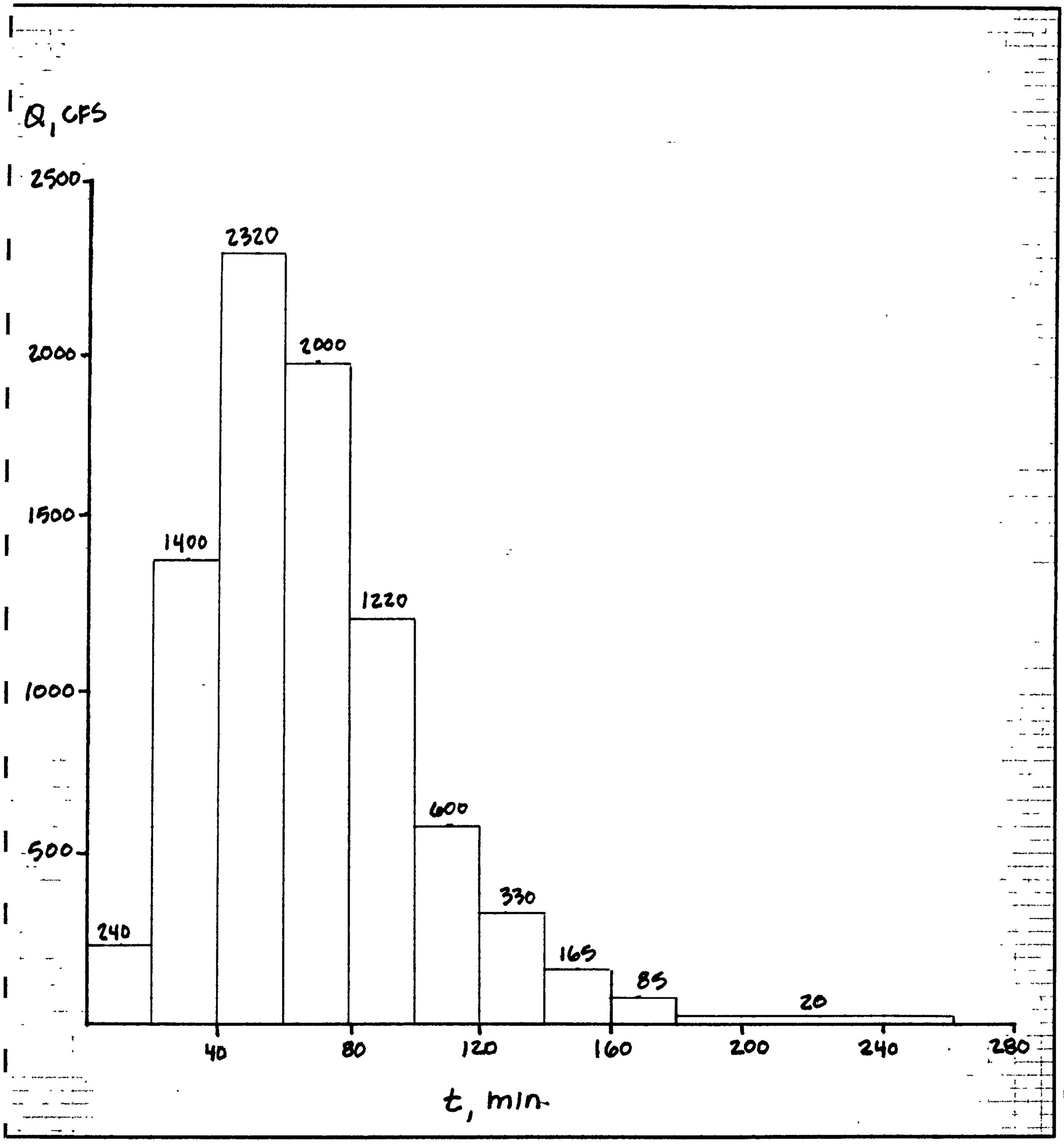
NOTES:

ESPEY, HUSTON & ASSOCIATES, INC.

PROJECT NAME EROSION STUDY FOR NDB JOB NO. 11567-12

SUBJECT 100 YEAR 6 HOUR HISTOGRAM

BY DL CK. BY _____ APPROVED BY _____ DATE 12-11-89 PAGE ____ OF ____



NOTES:

WESTERN TECHNOLOGIES INC.

8305 Washington Place, N.E.
Albuquerque, New Mexico 87113
(505) 823-4488

PHYSICAL PROPERTIES OF SOILS

Client: Espey-Huston & Associates, Inc.
317 Commercial Street, NE
Albuquerque, NM 87102

Job No. _____
Lab/Invoice No. 32490850
Date of Report 11-15-89
Reviewed By _____

Project: Nor Este Manor

Location: Albuquerque, NM — Sampled By: Jason Collard/WT — Date: 11-7-89

Type of Material: Silty Sand — Submitted By: Jason Collard/WT — Date: 11-7-89

Source of Material: #1 (see site plan) — Authorized By: Dennis Lorenz/Client — Date: 11-7-89

Sieve Analysis, ASTM D422-

Sieve Size	% Passing Accumulative	Specification
3"		
2½"		
2"		
1½"		
1"		
¾"		
½"	100	
⅜"	100	
¼"	--	
No. 4	92	
8	77	
10	74	
16	64	
30	57	
40	54	
50	51	
100	45	
200	38.8	
Finer than 200 ASTM D1140-		

Soil Classification

Liquid Limit and Plasticity of Soils
ASTM D4318- — LL = _____ PI = _____

Moisture - Density Relations
☐ ASTM D698- ; ☐ ASTM D1557- ; Method _____
Maximum Dry Density, pcf _____ Optimum Moisture, % _____

Specific Gravity of Soils (minus No. 4 material)
ASTM D854- — Specific Gravity _____

Resistance 'R' Value of Compacted Soils
ASTM D2844- — 'R' Value _____

Other:

Copies to: 3-Client

WESTERN TECHNOLOGIES INC.

8305 Washington Place, N.E.
Albuquerque, New Mexico 87113
(505) 823-4488

LABORATORY REPORT

PHYSICAL PROPERTIES OF SOILS

Client: Espey-Huston & Associates, Inc.
317 Commercial Street, NE
Albuquerque, NM 87102

Job No. _____
Lab/Invoice No. 32490850
Date of Report 11-15-89
Reviewed By _____

Project: Nor Este Manor

Location: Albuquerque, NM — Sampled By: Jason Collard/WT — Date: 11-7-89

Type of Material: Silty Sand — Submitted By: Jason Collard/WT — Date: 11-7-89

Source of Material: #2 (see site plan) — Authorized By: Dennis Lorenz/Client — Date: 11-7-89

Sieve Analysis, ASTM D422-

Sieve Size	% Passing Accumulative	Specification
3"		
2½"		
2"		
1½"		
1"		
¾"		
½"		
⅜"		
¼"	100	
No. 4	95	
8	80	
10	76	
16	61	
30	49	
40	44	
50	41	
100	34	
200	25	
Finer than 200 ASTM D1140-		

Soil Classification

Liquid Limit and Plasticity of Soils
ASTM D4318- LL = _____ PI = _____

Moisture - Density Relations
☐ ASTM D698- ; ☐ ASTM D1557- ; Method _____
Maximum Dry Density, pcf _____
Optimum Moisture, % _____

Specific Gravity of Soils (minus No. 4 material)
ASTM D854- Specific Gravity _____

Resistance 'R' Value of Compacted Soils
ASTM D2844- 'R' Value _____

Other:

Copies to: 3-Client

WESTERN TECHNOLOGIES INC.

8305 Washington Place, N.E.
Albuquerque, New Mexico 87113
(505) 823-4488

LABORATORY REPORT

PHYSICAL PROPERTIES OF SOILS

Client: Espey-Huston & Associates, Inc.
317 Commercial Street, NE
Albuquerque, NM 87102

Job No. _____
Lab/Invoice No. 32490850
Date of Report 11-15-89
Reviewed By _____

Project: Nor Este Manor

Location: Albuquerque, NM — Sampled By: Jason Collard/WT — Date: 11-7-89

Type of Material: Silty Sand — Submitted By: Jason Collard/WT — Date: 11-7-89

Source of Material: #3 (see site plan) — Authorized By: Dennis Lorenz/Client — Date: 11-7-89

Sieve Analysis, ASTM D422-

Sieve Size	% Passing Accumulative	Specification
3"		
2½"		
2"		
1½"		
1"		
¾"		
½"	100	
⅜"	100	
¼"	--	
No. 4	93	
8	79	
10	76	
16	64	
30	53	
40	49	
50	45	
100	39	
200	31.0	
Finer than 200 ASTM D1140-		

Soil Classification

Liquid Limit and Plasticity of Soils
ASTM D4318- — LL = _____ PI = _____

Moisture - Density Relations
☐ ASTM D698- ; ☐ ASTM D1557- ; Method _____ — Maximum Dry Density, pcf _____ Optimum Moisture, % _____

Specific Gravity of Soils (minus No. 4 material)
ASTM D854- — Specific Gravity _____

Resistance 'R' Value of Compacted Soils
ASTM D2844- — 'R' Value _____

Other:

Copies to: 3-Client

WESTERN TECHNOLOGIES INC.

8305 Washington Place, N.E.
Albuquerque, New Mexico 87113
(505) 823-4488

LABORATORY REPORT

PHYSICAL PROPERTIES OF SOILS

Client: Espey-Huston & Associates, Inc.
317 Commercial Street, NE
Albuquerque, NM 87102

Job No. _____
Lab/Invoice No. 32490850
Date of Report 11-15-89
Reviewed By _____

Project: Nor Este Manor

Location: Albuquerque, NM — Sampled By: Jason Collard/WT — Date: 11-7-89

Type of Material: Silty Sand — Submitted By: Jason Collard/WT — Date: 11-7-89

Source of Material: #4 (see site plan) — Authorized By: Dennis Lorenz/Client — Date: 11-7-89

Sieve Analysis, ASTM D422-

Sieve Size	% Passing Accumulative	Specification
3"		
2½"		
2"		
1½"		
1"		
¾"		
½"		
⅜"		
¼"	100	
No. 4	96	
8	86	
10	84	
16	74	
30	65	
40	61	
50	58	
100	51	
200	39	
Finer than 200 ASTM D1140-		

Soil Classification

Liquid Limit and Plasticity of Soils
ASTM D4318-
LL = _____
PI = _____

Moisture - Density Relations
☐ ASTM D698- ; ☐ ASTM D1557- ; Method _____
Maximum Dry Density, pcf _____
Optimum Moisture, % _____

Specific Gravity of Soils (minus No. 4 material)
ASTM D854-
Specific Gravity _____

Resistance 'R' Value of Compacted Soils
ASTM D2844-
'R' Value _____

Other:

Copies to: 3-Client

WESTERN TECHNOLOGIES INC.

8305 Washington Place, N.E.
Albuquerque, New Mexico 87113
(505) 823-4488

LABORATORY REPORT

PHYSICAL PROPERTIES OF SOILS

Client: Espey-Huston & Associates, Inc.
317 Commercial Street, NE
Albuquerque, NM 87102

Job No. _____
Lab/Invoice No. 32490850
Date of Report 11-15-89
Reviewed By _____

Project: Nor Este Manor

Location: Albuquerque, NM — Sampled By: Jason Collard/WT — Date: 11-7-89

Type of Material: Silty Sand — Submitted By: Jason Collard/WT — Date: 11-7-89

Source of Material: #5 (see site plan) — Authorized By: Dennis Lorenz/Client — Date: 11-7-89

Sieve Analysis, ASTM D422-

Sieve Size	% Passing Accumulative	Specification
3"		
2½"		
2"		
1½"		
1"		
¾"		
½"	100	
⅜"	99	
¼"	--	
No. 4	95	
8	80	
10	75	
16	59	
30	45	
40	40	
50	36	
100	30	
200	23	
Finer than 200 ASTM D1140-		

Soil Classification

Liquid Limit and Plasticity of Soils
ASTM D4318-
LL = _____
PI = _____

Moisture - Density Relations
☐ ASTM D698- ; ☐ ASTM D1557- ; Method _____
Maximum Dry Density, pcf _____
Optimum Moisture, % _____

Specific Gravity of Soils (minus No. 4 material)
ASTM D854-
Specific Gravity _____

Resistance 'R' Value of Compacted Soils
ASTM D2844-
'R' Value _____

Other:

Copies to: 3-Client

WESTERN TECHNOLOGIES INC.

8305 Washington Place, N.E.
Albuquerque, New Mexico 87113
(505) 823-4488

LABORATORY REPORT

PHYSICAL PROPERTIES OF SOILS

Client: Espey-Huston & Associates, Inc.
317 Commercial Street, NE
Albuquerque, NM 87102

Job No. _____
Lab/Invoice No. 32490850
Date of Report 11-15-89
Reviewed By _____

Project: Nor Este Manor

Location: Albuquerque, NM — Sampled By: Jason Collard/WT — Date: 11-7-89

Type of Material: Silty Sand — Submitted By: Jason Collard/WT — Date: 11-7-89

Source of Material: #6 (see site plan) — Authorized By: Dennis Lorenz/Client — Date: 11-7-89

Sieve Analysis, ASTM D422-

Sieve Size	% Passing Accumulative	Specification
3"		
2½"		
2"		
1½"		
1"		
¾"		
½"	100	
⅜"	99	
¼"	--	
No. 4	93	
8	79	
10	76	
16	65	
30	56	
40	53	
50	50	
100	44	
200	35	
Finer than 200 ASTM D1140-		

Soil Classification

Liquid Limit and Plasticity of Soils
ASTM D4318- — LL = _____ PI = _____

Moisture - Density Relations
☐ ASTM D698- ; ☐ ASTM D1557- ; Method _____ — Maximum Dry Density, pcf _____ Optimum Moisture, % _____

Specific Gravity of Soils (minus No. 4 material)
ASTM D854- — Specific Gravity _____

Resistance 'R' Value of Compacted Soils
ASTM D2844- — 'R' Value _____

Other:

Copies to: 3-Client

WESTERN TECHNOLOGIES INC.

8305 Washington Place, N.E.
Albuquerque, New Mexico 87113
(505) 823-4488

LABORATORY REPORT

PHYSICAL PROPERTIES OF SOILS

Client: Espey-Huston & Associates, Inc.
317 Commercial Street, NE
Albuquerque, NM 87102

Job No. _____
Lab/Invoice No. 32490850
Date of Report 11-15-89
Reviewed By _____

Project: Nor Este Manor

Location: Albuquerque, NM — Sampled By: Jason Collard/WT — Date: 11-7-89

Type of Material: Silty Sand — Submitted By: Jason Collard/WT — Date: 11-7-89

Source of Material: #7 (see site plan) — Authorized By: Dennis Lorenz/Client — Date: 11-7-89

Sieve Analysis, ASTM D422-

Sieve Size	% Passing Accumulative	Specification
3"		
2½"		
2"		
1½"		
1"		
¾"		
½"	100	
⅜"	99	
¼"	--	
No. 4	93	
8	82	
10	79	
16	67	
30	57	
40	52	
50	47	
100	36	
200	26	
Finer than 200 ASTM D1140-		

Soil Classification

Liquid Limit and Plasticity of Soils
ASTM D4318- LL = _____ PI = _____

Moisture - Density Relations
☐ ASTM D698- ; ☐ ASTM D1557- ; Method _____
Maximum Dry Density, pcf _____ Optimum Moisture, % _____

Specific Gravity of Soils (minus No. 4 material)
ASTM D854- Specific Gravity _____

Resistance 'R' Value of Compacted Soils
ASTM D2844- 'R' Value _____

Other:

Copies to: 3-Client

WESTERN TECHNOLOGIES INC.

8305 Washington Place, N.E.
Albuquerque, New Mexico 87113
(505) 823-4488

LABORATORY REPORT

PHYSICAL PROPERTIES OF SOILS

Client: Espey-Huston & Associates, Inc.
317 Commercial Street, NE
Albuquerque, NM 87102

Job No. _____
Lab/Invoice No. 32490850
Date of Report 11-15-89
Reviewed By _____

Project: Nor Este Manor

Location: Albuquerque, NM — Sampled By: Jason Collard/WT — Date: 11-7-89

Type of Material: Silty Sand — Submitted By: Jason Collard/WT — Date: 11-7-89

Source of Material: #8 (see site plan) — Authorized By: Dennis Lorenz/Client — Date: 11-7-89

Sieve Analysis, ASTM D422-

Sieve Size	% Passing Accumulative	Specification
3"		
2½"		
2"		
1½"		
1"	100	
¾"	97	
½"	97	
⅜"	96	
¼"	--	
No. 4	79	
8	54	
10	49	
16	35	
30	25	
40	22	
50	19	
100	15	
200	11	
Finer than 200 ASTM D1140-		

Soil Classification

Liquid Limit and Plasticity of Soils
ASTM D4318- LL = _____ PI = _____

Moisture - Density Relations
☐ ASTM D698- ; ☐ ASTM D1557- ; Method _____
Maximum Dry Density, pcf _____
Optimum Moisture, % _____

Specific Gravity of Soils (minus No. 4 material)
ASTM D854- Specific Gravity _____

Resistance 'R' Value of Compacted Soils
ASTM D2844- 'R' Value _____

Other:

Copies to: 3-Client

WESTERN TECHNOLOGIES INC.

8305 Washington Place, N.E.
Albuquerque, New Mexico 87113
(505) 823-4488

LABORATORY REPORT

PHYSICAL PROPERTIES OF SOILS

Client: Espey-Huston & Associates, Inc.
317 Commercial Street, NE
Albuquerque, NM 87102

Job No. _____
Lab/Invoice No. 32490850
Date of Report 11-15-89
Reviewed By _____

Project: Nor Este Manor

Location: Albuquerque, NM — Sampled By: Jason Collard/WT — Date: 11-7-89

Type of Material: Poorly Graded Sand — Submitted By: Jason Collard/WT — Date: 11-7-89

Source of Material: #9 (see site plan) — Authorized By: Dennis Lorenz/Client — Date: 11-7-89

Sieve Analysis, ASTM D422-

Sieve Size	% Passing Accumulative	Specification
3"		
2½"		
2"		
1½"		
1"		
¾"		
½"	100	
⅜"	100	
¼"	--	
No. 4	90	
8	64	
10	46	
16	34	
30	19	
40	15	
50	13	
100	9	
200	6.2	
Finer than 200 ASTM D1140-		

Soil Classification

Liquid Limit and Plasticity of Soils
ASTM D4318- LL = _____ PI = _____

Moisture - Density Relations
☐ ASTM D698- ; ☐ ASTM D1557- ; Method _____
Maximum Dry Density, pcf _____
Optimum Moisture, % _____

Specific Gravity of Soils (minus No. 4 material)
ASTM D854- Specific Gravity _____

Resistance 'R' Value of Compacted Soils
ASTM D2844- 'R' Value _____

Other:

Copies to: 3-Client

WESTERN TECHNOLOGIES INC.

8305 Washington Place, N.E.
Albuquerque, New Mexico 87113
(505) 823-4488

LABORATORY REPORT

PHYSICAL PROPERTIES OF SOILS

Client: Espey-Huston & Associates, Inc.
317 Commercial Street, NE
Albuquerque, NM 87102

Job No. _____
Lab/Invoice No. 32490850
Date of Report 11-15-89
Reviewed By _____

Project: Nor Este Manor

Location: Albuquerque, NM — Sampled By: Jason Collard/WT — Date: 11-7-89

Type of Material: Poorly Graded Sand — Submitted By: Jason Collard/WT — Date: 11-7-89

Source of Material: #10 (see site plan) — Authorized By: Dennis Lorenz/Client — Date: 11-7-89

Sieve Analysis, ASTM D422-

Sieve Size	% Passing Accumulative	Specification
3"		
2½"		
2"		
1½"		
1"		
¾"		
½"	100	
⅜"	99	
¼"	--	
No. 4	93	
8	73	
10	68	
16	46	
30	24	
40	18	
50	13	
100	8	
200	4.1	
Finer than 200 ASTM D1140-		

Soil Classification

Liquid Limit and Plasticity of Soils
ASTM D4318- LL = _____ PI = _____

Moisture - Density Relations
☐ ASTM D698- ; ☐ ASTM D1557- ; Method _____
Maximum Dry Density, pcf _____
Optimum Moisture, % _____

Specific Gravity of Soils (minus No. 4 material)
ASTM D854- Specific Gravity _____

Resistance 'R' Value of Compacted Soils
ASTM D2844- 'R' Value _____

Other:

Copies to: 3-Client

WESTERN TECHNOLOGIES INC.

8305 Washington Place, N.E.
Albuquerque, New Mexico 87113
(505) 823-4488

LABORATORY REPORT

PHYSICAL PROPERTIES OF SOILS

Client: Espey-Huston & Associates, Inc.
317 Commercial Street, NE
Albuquerque, NM 87102

Job No. _____
Lab/Invoice No. 32490850
Date of Report 11-15-89
Reviewed By _____

Project: Nor Este Manor

Location: Albuquerque, NM — Sampled By: Jason Collard/WT — Date: 11-7-89
Type of Material: Poorly Graded Sand — Submitted By: Jason Collard/WT — Date: 11-7-89
Source of Material: #11 (see site plan) — Authorized By: Dennis Lorenz/Client — Date: 11-7-89

Sieve Analysis, ASTM D422-

Sieve Size	% Passing Accumulative	Specification
3"		
2½"		
2"		
1½"		
1"		
¾"		
½"		
⅜"		
¼"		
No. 4	100	
8	84	
10	79	
16	54	
30	29	
40	21	
50	15	
100	7	
200	4.1	
Finer than 200 ASTM D1140-		

Soil Classification

Liquid Limit and Plasticity of Soils
ASTM D4318- LL = _____ PI = _____

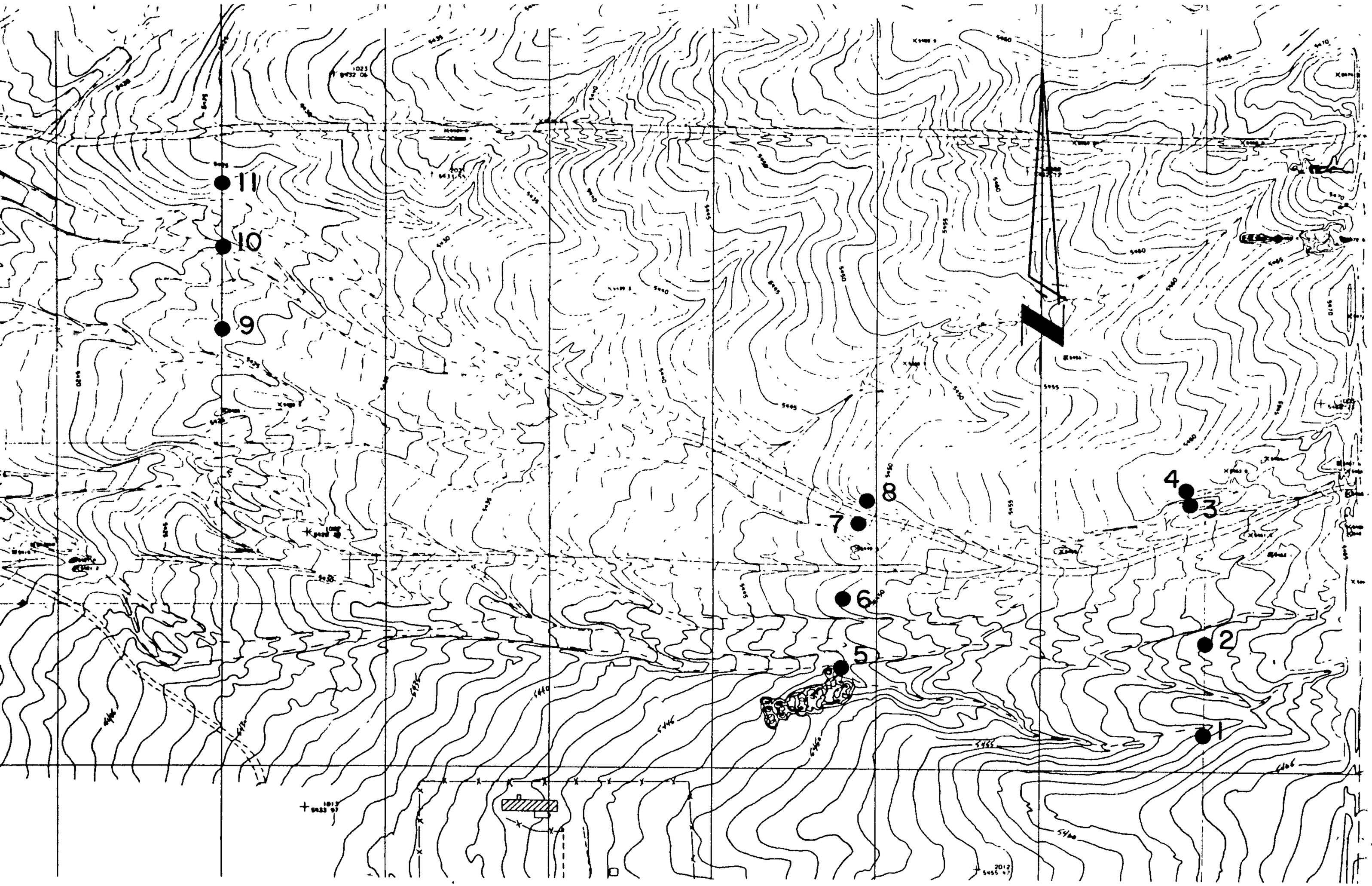
Moisture - Density Relations
☐ ASTM D698- ; ☐ ASTM D1557- ; Method _____
Maximum Dry Density, pcf _____ Optimum Moisture, % _____

Specific Gravity of Soils (minus No. 4 material)
ASTM D854- Specific Gravity _____

Resistance 'R' Value of Compacted Soils
ASTM D2844- 'R' Value _____

Other:

Copies to: 3-Client



SOIL SAMPLE SITES

COMPUTATION OF SAND dISCHARGE
By TOFFALETIS METhOD

Q = 100 CFS

MEAN vELOCITY	=	3.30 FT/SEC
HYDRAuLIC DEPTH	=	1.00 FT
WATER SURFACE WIDTH	=	63.00 FT
WATER TEMPERATURE	=	70.00 DEG F
D65	=	1.00 MM
ENERGY SLOPE	=	0.014000 FT.FT
KINEMATIC VISCOSITY	=	0.105E-04 FT**2/SEC

PUSH RETURN TO CONTINUE

PUSH RETURN TO CONTINUE

SEDIMeNT SIZE (MM	FRACTION	BED LOAD (TONS/DAY)	SUSPENDED LOAD (TONS/DAY)	TOTAL LOAD (TONS/DAY
0.1250	0.29	10.4	9944.2	9954.6
0.2000	0.10	2.6	1575.1	1577.7
0.500	0.18	2.6	629.1	631.7
1.000	0.14	1.5	123.2	124.7
2.000	0.5	0.4	11.1	11.5
4.000	0.7	1.1	10.1	11.1
8.000	0.7	0.4	1.5	1.9

TOTAL BED LOAD	=	19. TONS/DAY
SUSPENDED LOAD		12294. TONS/DAY
TOTAL BED-MATERIAL LOaD	=	12313. TONS/DAY

COMPuTATION OF SAND dISCHARGE
BY TOFFALETIS METhOD

Q = 1030 CFS

MEAN vELOCITY	=	5.50 FT/SEC
HYDRAULIC DEPTH	=	1.00 FT
WATER SURFACE WIDTH	=	207.00 FT
WATER TEMPERATURE	=	70.00 DEG F
D65	=	1.00 MM
ENERGY SLOPE	=	0.014000 FT.FT
KINEMATIC VISCOSITY	=	0.105E-04 FT**2/SEC

PUSH RETURN TO CONTINUE

PUSH RETURN TO COnTINUE

SEDIMeNT SIZE (MM)	FRACTION	BED LOAD (TONS/DAY	SUSPENDED LOAD (TONS/DAY)	TOTAL LOAD (TONS/DAY
0.1250	0.9	139.3	*******	*******
0.2000	0.10	35.0	21100.3	21135.3
0.5000	0.18	44.8	6155.7	6200.6
1.0000	0.14	27.9	1048.1	1076.0
2.0000	0.05	7.4	64.5	91.8
4.000	0.7	18.1	72.0	90.1
8.000	0.07	6.5	10.2	16.7

TOTAL BED LOAD	279.	TONS/DAY
SUSPENDED LOAD	161684.	TONS/DAY
TOTAL BED-MATERIAL LOaD	161963.	TONS/DAY

COMPUTATION OF SAND DISCHARGE
BY TOFFALETIS METHOD

Q = 2320 CFS

MEAN VELOCITY	=	5.90 FT/SEC
HYDRAULIC DEPTH	=	1.00 FT
WATER SURFACE WIDTH	=	370.00 FT
WATER TEMPERATURE	=	70.00 DEG F
D65	=	1.00 MM
ENERGY SLOPE	=	0.014000 FT.FT
KINEMATIC VISCOSITY	=	0.105E-04 FT**2/SEC

PUSH RETURN TO CONTINUE

PUSH RETURN TO CONTINUE

SEDIMENT SIZE (MM	FRACTION	BED LOAD (TONS/DAY	SUSPENDED LOAD (TONS/DAY)	TOTAL LOAD (TONS/DAY)
0.150	0.29	249.6	*******	*******
0.2000	0.10	62.7	37791.9	37854.6
0.5000	0.18	84.3	10420.8	10505.1
1.000	0.4	52.7	1739.5	1792.2
2.000	0.05	13.9	138.5	152.4
4.0000	0.7	33.8	118.0	151.8
8.000	0.7	11.9	16.8	28.7

TOTAL BED LOAD	=	509. TONS/DAY
SUSPENDED LOAD	=	288818. TONS/DAY
TOTAL BED-MATERIAL LOAD	=	289327. TONS/DAY

CUT-OFF WALL DESIGN

A structural cut-off wall is to be constructed north of the north bank of the North Domingo Baca Arroyo to provide protection to the Nor Este Manor development. Criteria for design and construction of the wall are as follows:

1. The wall shall be located 15 feet north of the Flood Hazard Zone.

2. The wall shall be designed as a structural retaining wall, capable of standing after degradation of the arroyo north bank resulting from consecutive 10-year and 100-year 6-hour storms.

3. Top of footing shall be located at least 18 inches below the maximum degradation elevation caused by the design storms.

4. The top of wall elevation shall include free board per DPM Vol. II, Section 22.3.4.b.1.

5. The wall shall be monitored by AMAFCA, at least annually, and after major storm events, to check for degradation and scour along the face of the wall.

6. AMAFCA shall restore the arroyo bank adjacent to the wall once significant erosion is apparent.

The study reach has been divided into three segments. Within each segment the arroyo cross-section and interface with the Nor Este Manor project are somewhat consistent. Typical cross-sections within each segment were evaluated to determine the erosion potential along the face of the cut-off wall under worst case conditions. These typical cross-sections follow the text in this section and serve to illustrate the schematic cut-off wall design, channel geometry, erosion potential adjacent to the wall, and probable maintenance effort required to restore the arroyo bank after major storm events. The following narrative describes each segment in detail and outlines anticipated maintenance measures.

SEGMENT 1

Segment 1 represents a rather straight reach of the arroyo where a retaining wall is proposed by the Nor Este Manor development. Degradation resulting from the 10-year storm is estimated to expose approximately 6 inches of the cut-off wall. The following 100-year storm is estimated to expose approximately 5.5 feet of the wall. The wall footing will be located 2.0 feet below the existing arroyo bottom which will provide adequate bury for protection from consecutive 10-year and 100-year storms.

AMAFCA's maintenance effort is likely to occur when 6 to 12 inches of the cut-off wall is exposed. Since a retaining wall is to be extended above the cut-off wall, the existing top of bank elevation should be painted on the cut-off wall to assist AMAFCA

in determining the degree of erosion adjacent to the wall. It is likely that AMAFCA will simply place imported fill on the eroded bank to restore the arroyo cross-section.

SECTION 2

Segment 2 is located on the inside of the arroyo curvature in a section where large building setbacks occur.? In this segment the arroyo cross-section can withstand degredation by the 10-year storm without exposing the cut-off wall. The following 100-year storm is estimated to expose approximately 2.5 feet of the cut-off wall. The footing will be located 2.1 feet below the existing arroyo bottom which will provide adequate bury for protection from consecutive 10-year and 100-year storms. How

Maintenance should occur when either the cut-off wall is exposed or when noticeable bank erosion is apparent. Placement of imported fill on the eroded arroyo bank is the likely method of restoring the cross-section.

SEGMENT 3

Segment 3 is located directly west of Barstow Street on the outside of the arroyo's curvature. Building setbacks are small and channel velocities are somewhat greater than average. It is estimated that the 10-year storm will expose approximately 2 feet of the wall. The following 100-year storm will expose another 0.5 feet. The wall footing will be located 2.1 feet below the existing arroyo bottom to provide adequate bury for protection from consecutive 10-year and 100-year storms.

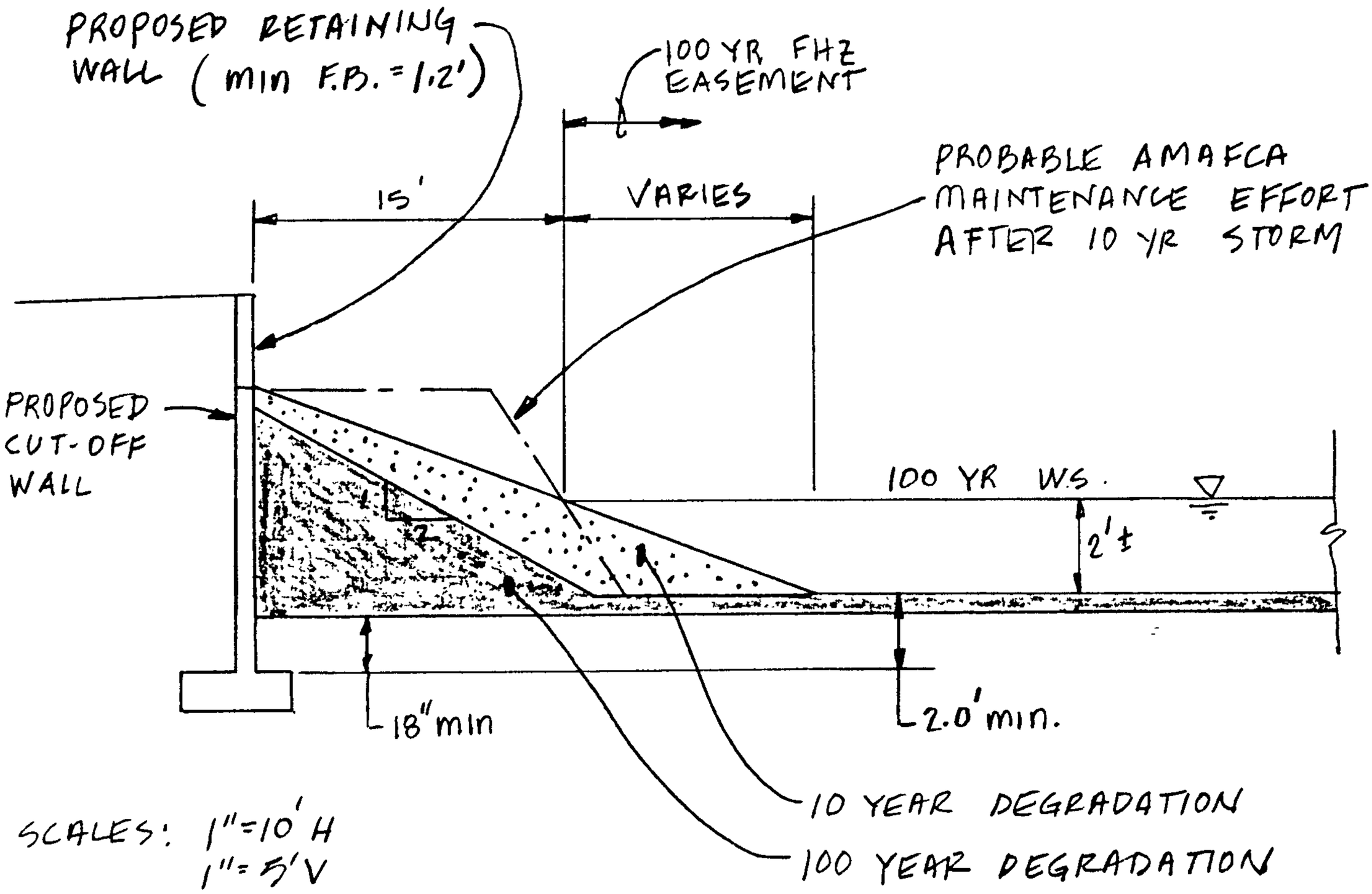
Maintenance should occur when the wall face is exposed. Placement of imported fill is a likely method of restoring the arroyo cross-section. However, since this segment is expected to be maintenance intensive, AMAFCA may wish to place rip rap rock adjacent to the wall. This would reduce the maintenance effort and still provide adequate protection to the wall.

It will be necessary to wrap the cut-off wall around Lot 4 along the Barstow frontage to provide protection from flows topping Barstow. The wall design will be consistent with Segment 3 criteria. However, it is not ancicipated to be as maintenance intensive.

PROJECT NAME NORTH DOMINGO BACA ARROYO JOB NO. 11567

SUBJECT CUT-OFF WALL AT NE MANOR

BY DL CK. BY _____ APPROVED BY _____ DATE 4-11-90 PAGE ____ OF ____



TYPICAL SECTION - SEGMENT 1

TYPICAL DEGRADATION VALUES - TAKEN AT SECTION 16 (WORST CASE)

10 YEAR : $d = -0.15'$, $BW = 311'$ $VOL_{SED} = 47$ CF How

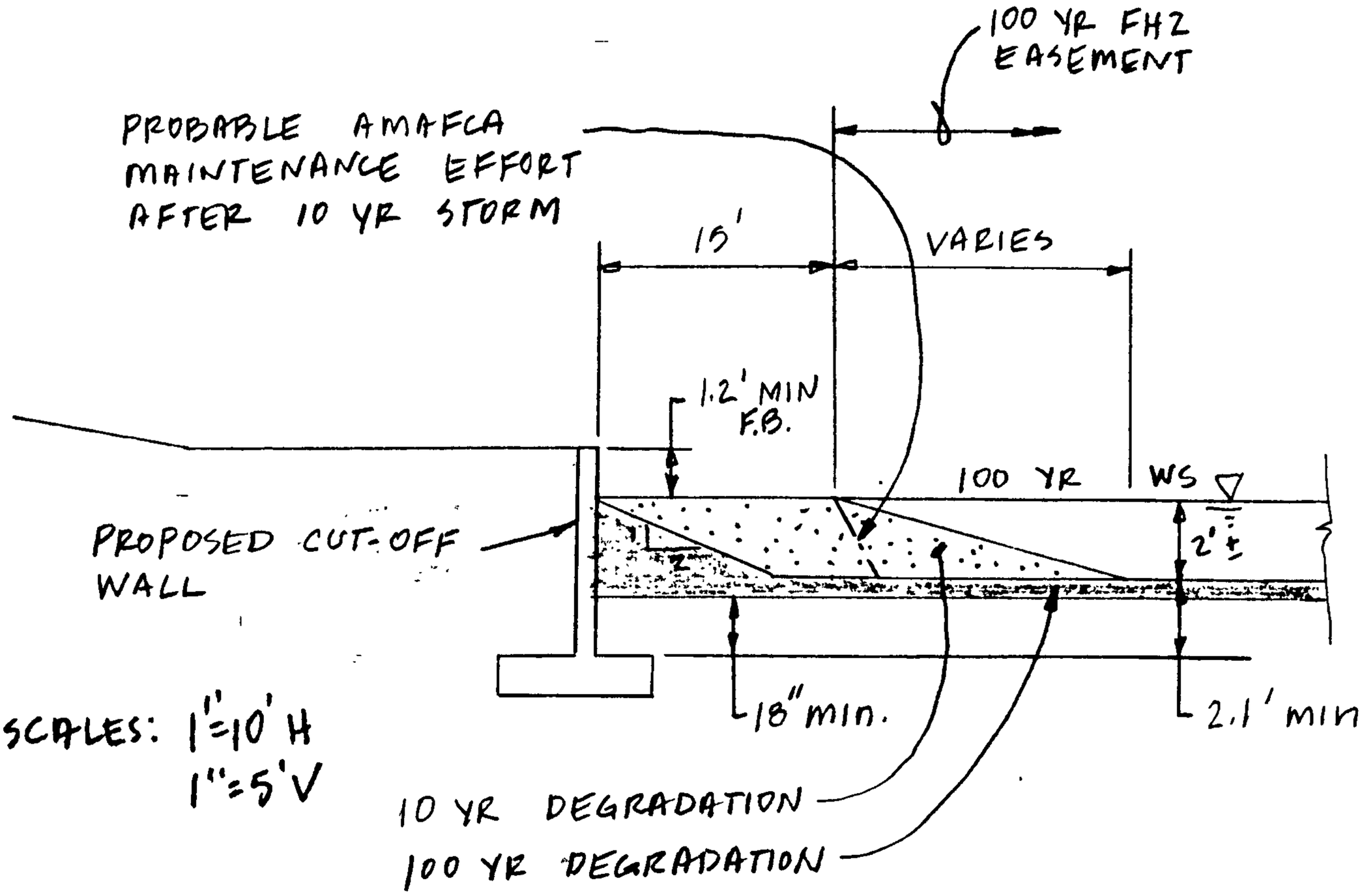
100 YEAR : $d = -0.48'$, $BW = 311'$ $VOL_{SED} = 149$ CF

NOTES:

PROJECT NAME NORTH DOMINGO BACA ARROYO JOB NO. 11567

SUBJECT CUT OFF WALL AT N.E. MANOR

BY DL CK. BY _____ APPROVED BY _____ DATE 4-11-90 PAGE _____ OF _____



TYPICAL SECTION - SEGMENT 2

TYPICAL DEGRADATION VALUES - TAKEN AT SECTION 20 (WORST CASE)

10 YEAR: d = -0.12' BW = 262' VOL_{SED} = 31 CF

100 YEAR: d = -0.59' BW = 262' VOL_{SED} = 155 CF

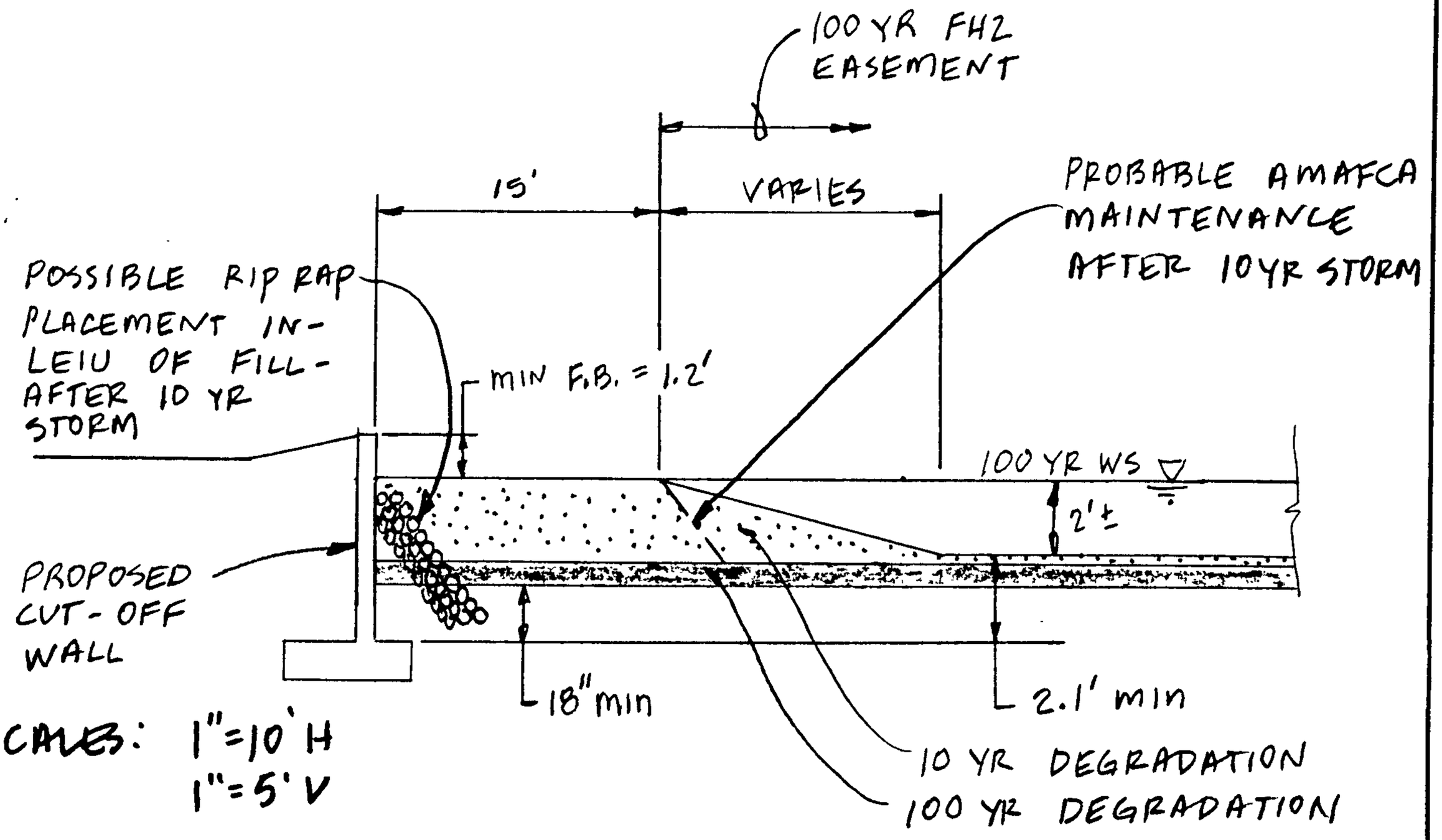
NOTES:

ESPEY, HUSTON & ASSOCIATES, INC.
Engineering & Environmental Consultants

PROJECT NAME NORTH DOMINGO BACA ARROYO JOB NO. 11567

SUBJECT CUT-OFF WALL AT N.E. MANOR

BY DL CK. BY _____ APPROVED BY _____ DATE 4-11-90 PAGE _____ OF _____



TYPICAL SECTION - SEGMENT 3

TYPICAL DEGRADATION VALUES - TAKEN AT SECTION 26 (WORST CASE)

10 YEAR : d = -0.24'
BW = 360'
VOL SED = 86 CF

100 YEAR : d = -0.49'
BW = 360'
VOL SED = 176 CF

NOTES:

BY DL DATE 4-12-90 SUBJECT N. DOMINGO BACA SHEET NO. ..... OF .....

CHKD. BY ..... DATE ..... FREEBOARD DETERMINATION JOB NO. 11567

CRITERIA ESTABLISHED AT PRE-DESIGN MEETING REQUIRES FREE BOARD FOR BUILDING PAD AND CUT-OFF WALL AS FOLLOWS:

1. FOR CUT-OFF WALL USE DPM EQN:

$$FB = 1.0 + 0.025 V d^{1/3}$$ (VOL II, CHP 22, PG 61.1)

2. FOR BUILDING PAD USE DPM EQN:

$$FB = 2.0 + 0.7(0.025 V d^{1/3})$$ (VOL II, CHP 22, PG 61.1)

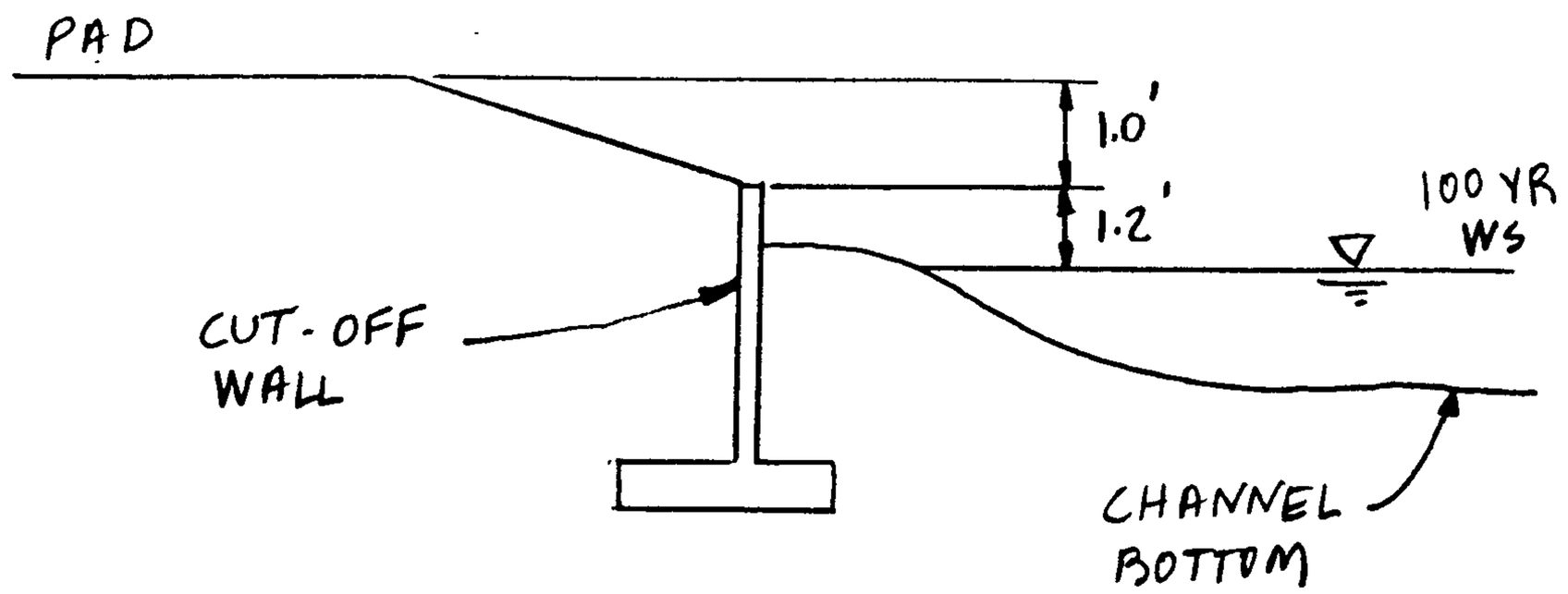
WHERE: V = AVE VELOCITY, FPS = 6.2

d = AVE DEPTH, FT = 2.35

$\Rightarrow$ FOR WALL $FB = 1.0 + 0.025(6.2)(2.35)^{1/3} \cong 1.2$ FT

FOR PAD $FB = 2.0 + 0.7\left[0.025(6.2)(2.35)^{1/3}\right] = 1.54$ FT

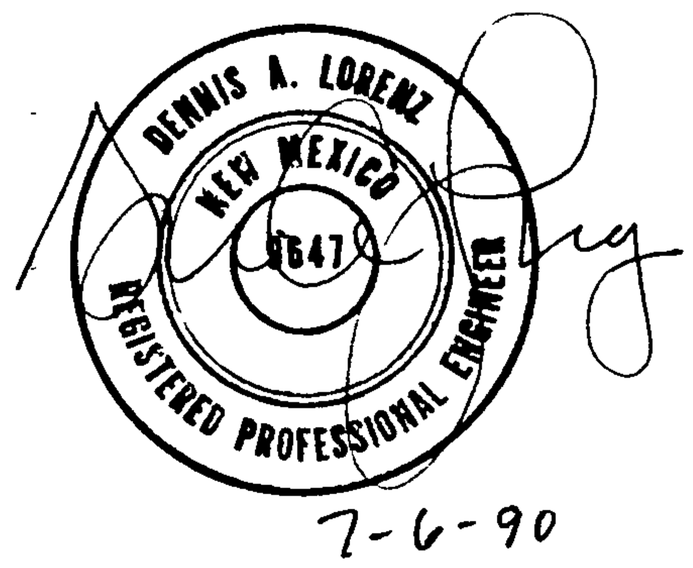
$\Rightarrow$ FOR PAD USE 2.2 FT (1' MIN ABOVE TOP OF WALL PER PRE-DESIGN CRITERIA)



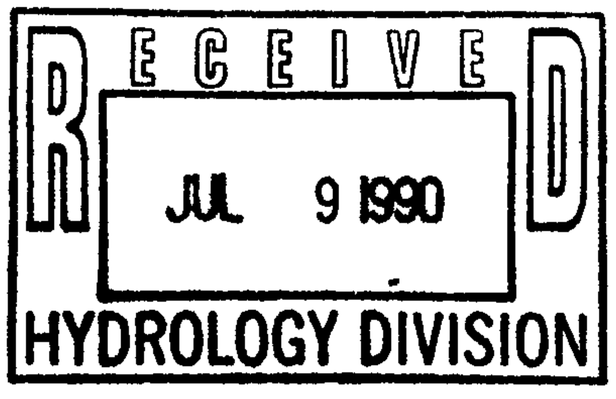
ADDENDUM NO. 1
TO THE
EROSION STUDY
NORTH DOMINGO BACA ARROYO
AT
NOR ESTE MANOR, BLOCK F AND TRACT "B"

Prepared for:

PRESLEY COMPANY OF NEW MEXICO
1909 CARLISLE BOULEVARD NE
ALBUQUERQUE, NEW MEXICO 87106



JUNE 1, 1990
Revised July 6, 1990



INTRODUCTION

The purpose of this addendum is to finalize the criteria for development of Nor Este Manor, Block "F" and Tract "B" adjacent to the North Domingo Baca Arroyo. Pursuant to the April 16, 1990 submittal, AMAFCA and it's consultant, Resource Consultants, Inc. have issued comment letters (see Appendix) which will be addressed by this addendum. Subsequent meetings with AMAFCA, City of Albuquerque and developer representatives resulted in the establishment of acceptable design criteria for the construction and maintenance of a buried cut-off wall along the interface between the Nor Este development and the North Domingo Baca Arroyo. This criteria is discussed in the following section.

FINAL DESIGN CRITERIA

As agreed at the previously mentioned meetings, a structural cut-off wall is to be constructed along the interface between the Nor Este Manor development and the North Domingo Baca Arroyo. As shown by the attached sections, the south face of the wall is to be placed 15 feet north of the 100-year Flood Hazard Zone easement. The depth of footing is established by determining the depth of degradation resulting from consecutive 10-year and 100-year 6-hour storms plus local scour resulting from a single 100-year 6-hour storm. Our calculations (see Appendix) show a required footing depth of 4.0 feet below the existing arroyo bed elevation. The cut-off wall design must consider the complete removal of all material adjacent to the south face of the wall due to occurrence of the design storms. This requires the wall to be designed as a retaining wall capable of holding backfill material until maintenance operations replace the soils removed from the arroyo by erosion. Since the cut-off wall will be constructed along approximately 1800 lineal feet of frontage with overall depths varying from 6.5 to 8.5 feet, construction costs are a concern. It was decided that a monolithic retaining wall would be most economical while satisfying the design criteria. The proposed

wall is to be essentially a monolithic gravity wall poured within a neatly trimmed open trench. Width of the wall is to be 48 inches. Calculations for the retaining wall design are provided in the Appendix for review.

MAINTENANCE

AMAFCA has agreed to assume maintenance responsibility for the cut-off wall. As such, the developer will grant a maintenance easement for the lands between the flood plain and wall including the wall. The intent of the cut-off wall design is to leave the arroyo in a natural condition while providing erosion protection to the Nor Este Manor development. The wall is to be positioned 15 feet north of the 100-year Flood Hazard Zone which preserves the existing north arroyo bank. By preserving the arroyo bank, considerable scour and degradation must occur before maintenance operations will be required.

Future maintenance will depend on the ultimate condition of the arroyo. Two improvement types are possible: 1) a natural arroyo section where the cut-off wall is accepted as a permanent improvement; and 2) a concrete lined arroyo channel. Which alternative will be chosen is not known at this time, but maintenance efforts for each can be estimated. Maintenance to the cut-off wall approach will consist mainly of earthwork to replace the eroded arroyo bank adjacent to the cut-off wall. One concern is a local source of fill material required to restore the arroyo bank. We feel that deposit areas will exist along the east side off roadways (i.e. Barstow, Wyoming) which can be removed and filled along the cut-off wall. Visual evidence of these deposit areas presently exists along Wyoming Boulevard, just west of the study reach.

Maintenance efforts for concrete channels are more straight forward and typically consist of sediment and debris removal, and concrete lining repair. In the event a concrete

channel is constructed, maintenance along the proposed wall will not be required.

Costs for the maintenance of the natural earthen arroyo section, with cut-off wall, can be estimated by determining the average annual material removed from the arroyo within the study reach. The analysis provided in the Appendix estimates that approximately 2132 cubic yards of material will be removed from the study reach in an average year. For simplicity, it can be assumed that one-half, or 1066 cubic yards, will be removed from the north arroyo bank. Depending on the source of borrow material (either local or imported), the cost for replacement of the eroded material can vary substantially. We estimate that unit costs can vary from $2.00 to $4.00 per cubic yard, in place. This translates to an estimated average annual maintenance cost of $2,132.00 to $4,264.00. Per AMAFCA records, maintenance costs for concrete lined channels run approximately $3,000 to $4,000 per mile. For comparison, if the study reach were concrete lined, maintenance costs would vary from $1,023 to $1,364. It must be kept in mind that our analysis assumes uniform erosion from the arroyo through the study reach, when in reality it is likely that some areas will require little maintenance. Also, per AMAFCA's recommendation, flow diverters will be placed at critical locations along the cut-off wall to prohibit flows from creating areas of local scour adjacent to the wall. The result should be reduced maintenance.

PROJECT NAME NORTH DOMINGO BACA ARROYO JOB NO. 11567

SUBJECT LOCAL SCOUR CALCULATION

BY PL CK. BY _____ APPROVED BY _____ DATE 6-1-90 PAGE 1 OF _____

LOCAL SCOUR AROUND EMBANKMENTS

PER " DESIGN GUIDELINES AND CRITERIA FOR CHANNELS AND HYDRAULIC STRUCTURES ON SANDY SOILS", SIMONS, LI & ASSOC, INC, JUNE 1981, PGS 47-9

$$\frac{Y_S}{Y_1} = 1.1 \left(\frac{a}{Y_1} \right)^{0.40} F_R^{0.33}$$

WHERE:

Y_S = SCOUR DEPTH, FT

Y_1 = UPSTREAM FLOW DEPTH, FT

a = EMBANKMENT LENGTH NORMAL TO BANK, FT

F_R = FROUDE NUMBER

$$= \frac{V}{\sqrt{gL}}$$ WHERE:

V = MEAN VELOCITY, FPS

g = 32.2 F/s^2

L = a, FT

NOTES:

PROJECT NAME NORTH DOMINGO BACA ARROYO JOB NO. 11567

SUBJECT LOCAL SCOUR CALCULATION

BY DL CK BY _____ APPROVED BY _____ DATE 6-1-90 PAGE 2 OF _____

ASSUMING WORST CASE, WHERE DEPTH AND VELOCITY ARE HIGH:

AT SECTION 22

$V = 6.8$ FPS

$Y_1 = 2.2$ FT

$a = 3.5$ FT

$$\Rightarrow F_R = \frac{6.8}{\sqrt{g(2.2)}} = 0.81$$

$$\Rightarrow \frac{Y_s}{Y_1} = 1.1\left(\frac{3.5}{2.2}\right)^{0.40}(.81)^{.33} = 1.24$$

$$\boxed{Y_s = 2.73' \text{ SAY } 3'}$$

TOTAL SCOUR

TOTAL SCOUR = LOCAL SCOUR + DEGRADATION

WORST CASE (SEGMENT 3) TOTAL SCOUR = $3.0' + 1.0'\pm$

$\Rightarrow$ LOCATE BOTTOM OF CUT-OFF WALL A MINIMUM OF 4.0 FT BELOW ARROYO BED ELEVATION.

NOTES:

ESPEY, HUSTON & ASSOCIATES, INC.
Engineering & Environmental Consultants

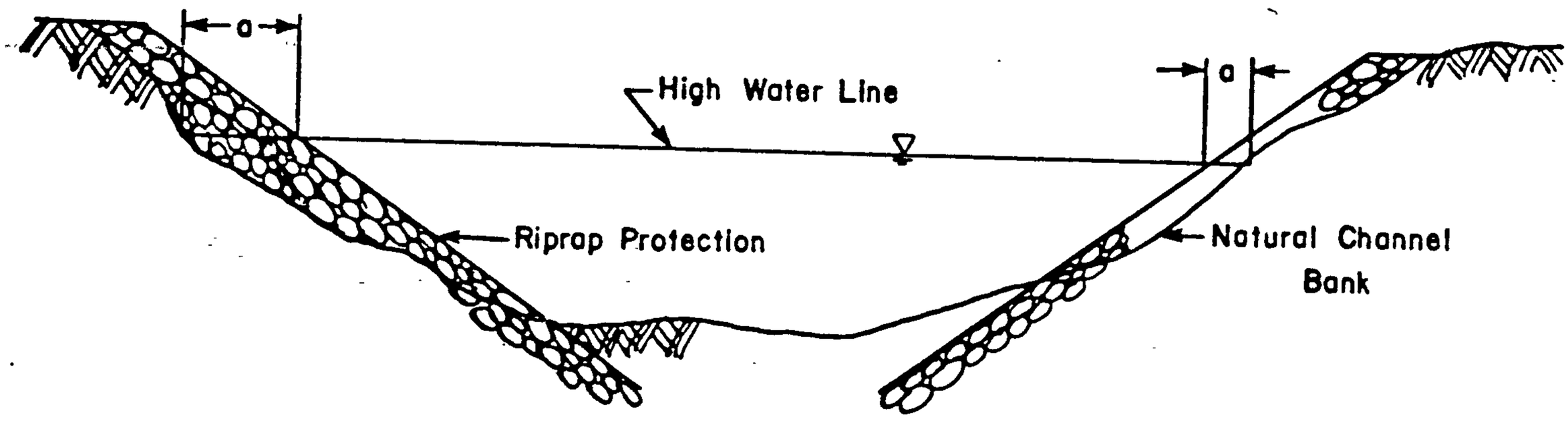
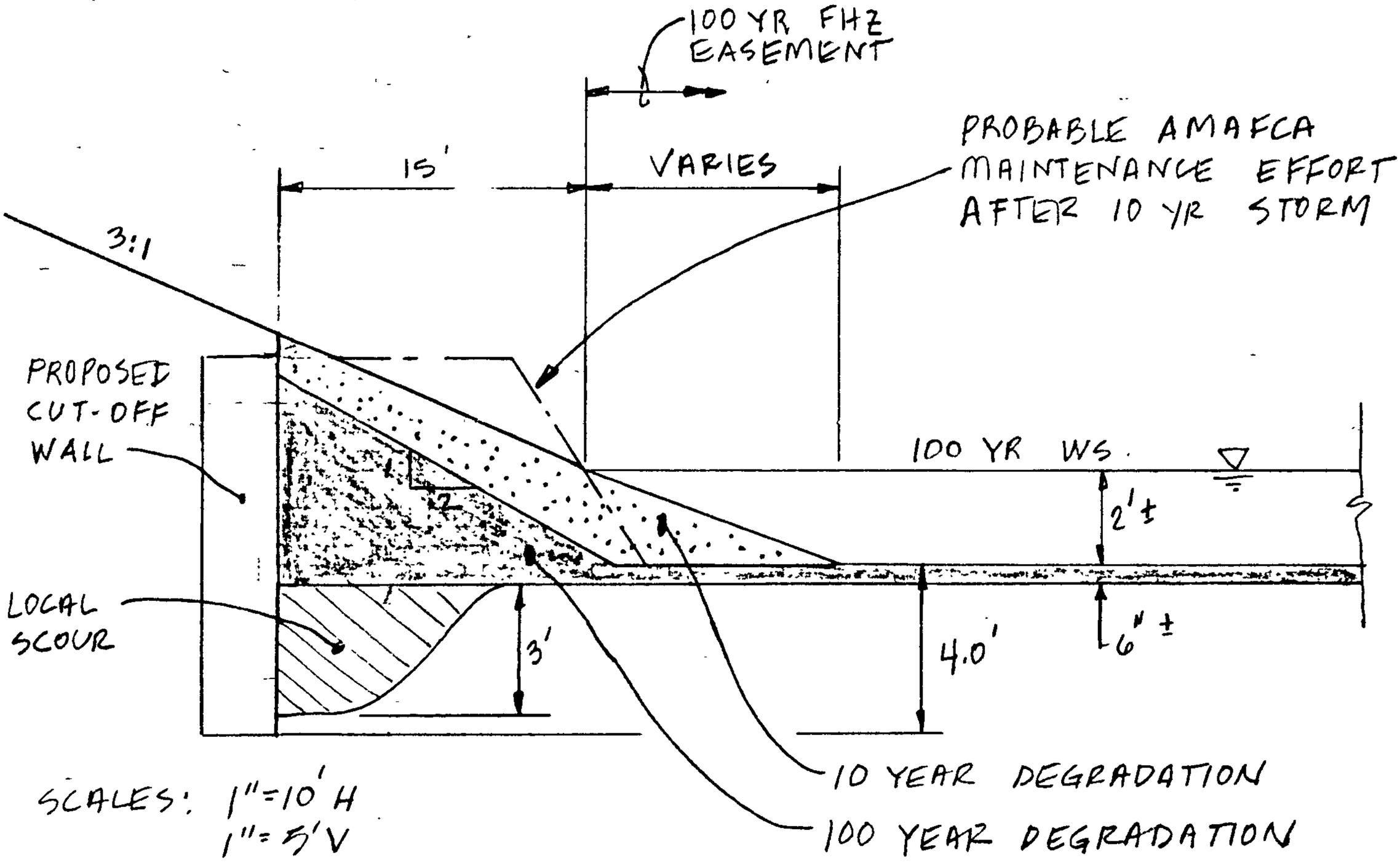


Figure 3-2. The embankment length measured normal to the flow.

PROJECT NAME NORTH DOMINGO BACA ARROYO JOB NO. 11567

SUBJECT CUT-OFF WALL AT NE MANOR

BY DL CK. BY _____ APPROVED BY _____ DATE 6-1-90 PAGE 4 OF _____



TYPICAL SECTION - SEGMENT 1

TYPICAL DEGRADATION VALUES - TAKEN AT SECTION 16 (WORST CASE)

10 YEAR : $d = -0.15'$, $BW = 311'$ $\quad VOL_{SED} = 47$ CF

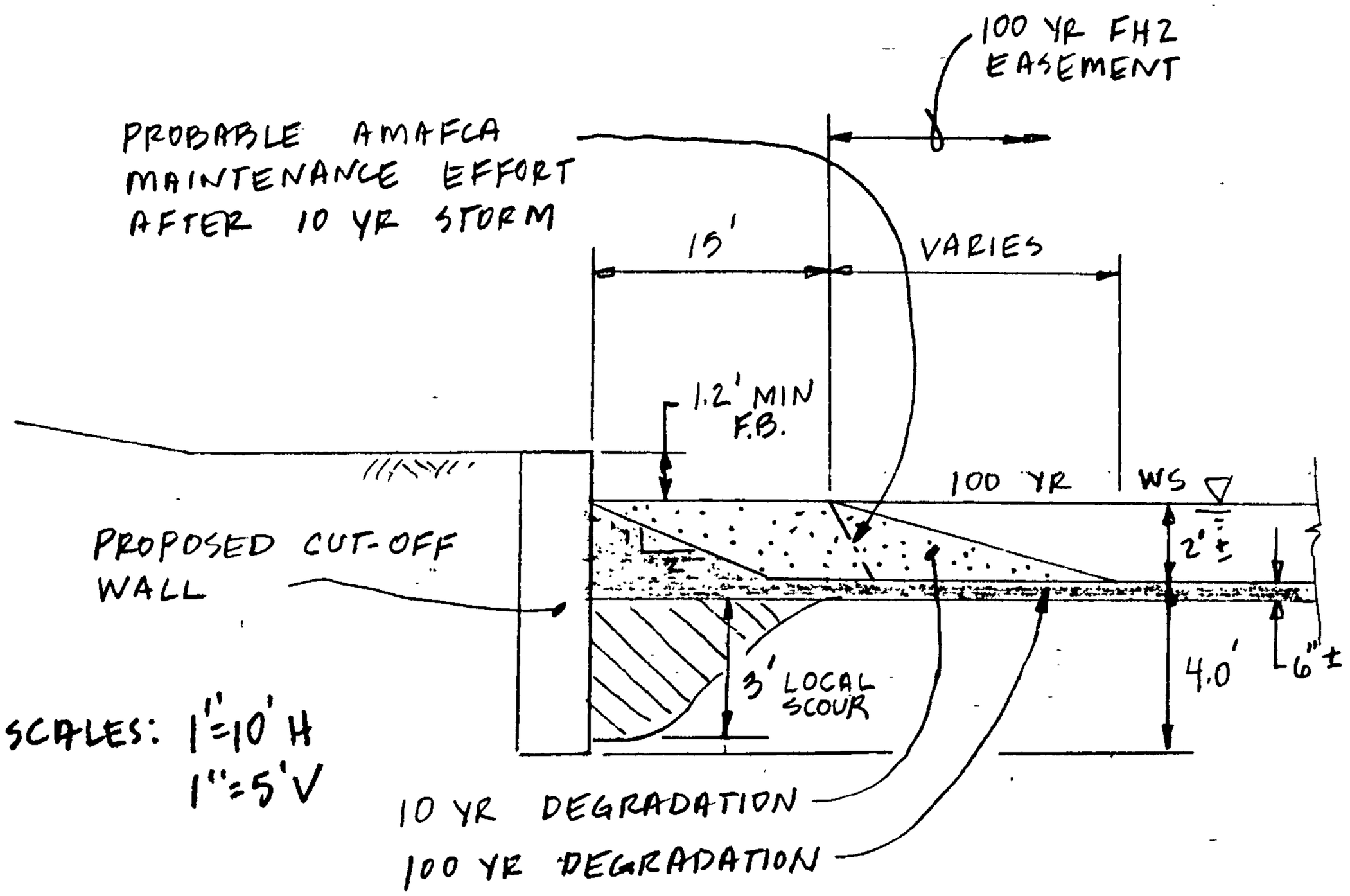
100 YEAR : $d = -0.48'$, $BW = 311'$ $\quad VOL_{SED} = 149$ CF

NOTES:

PROJECT NAME NORTH DOMINGO BACA ARROYO JOB NO. 11567

SUBJECT CUT OFF WALL AT N.E. MANOR

BY DL CK BY _____ APPROVED BY _____ DATE 6-1-90 PAGE 5 OF _____



TYPICAL SECTION - SEGMENT 2

TYPICAL DEGRADATION VALUES - TAKEN AT SECTION 20 (WORST CASE)

10 YEAR : $d = -0.12'$, $BW = 262'$, $VOL_{SED} = 31$ CF

100 YEAR : $d = -0.59'$, $BW = 262'$, $VOL_{SED} = 155$ CF

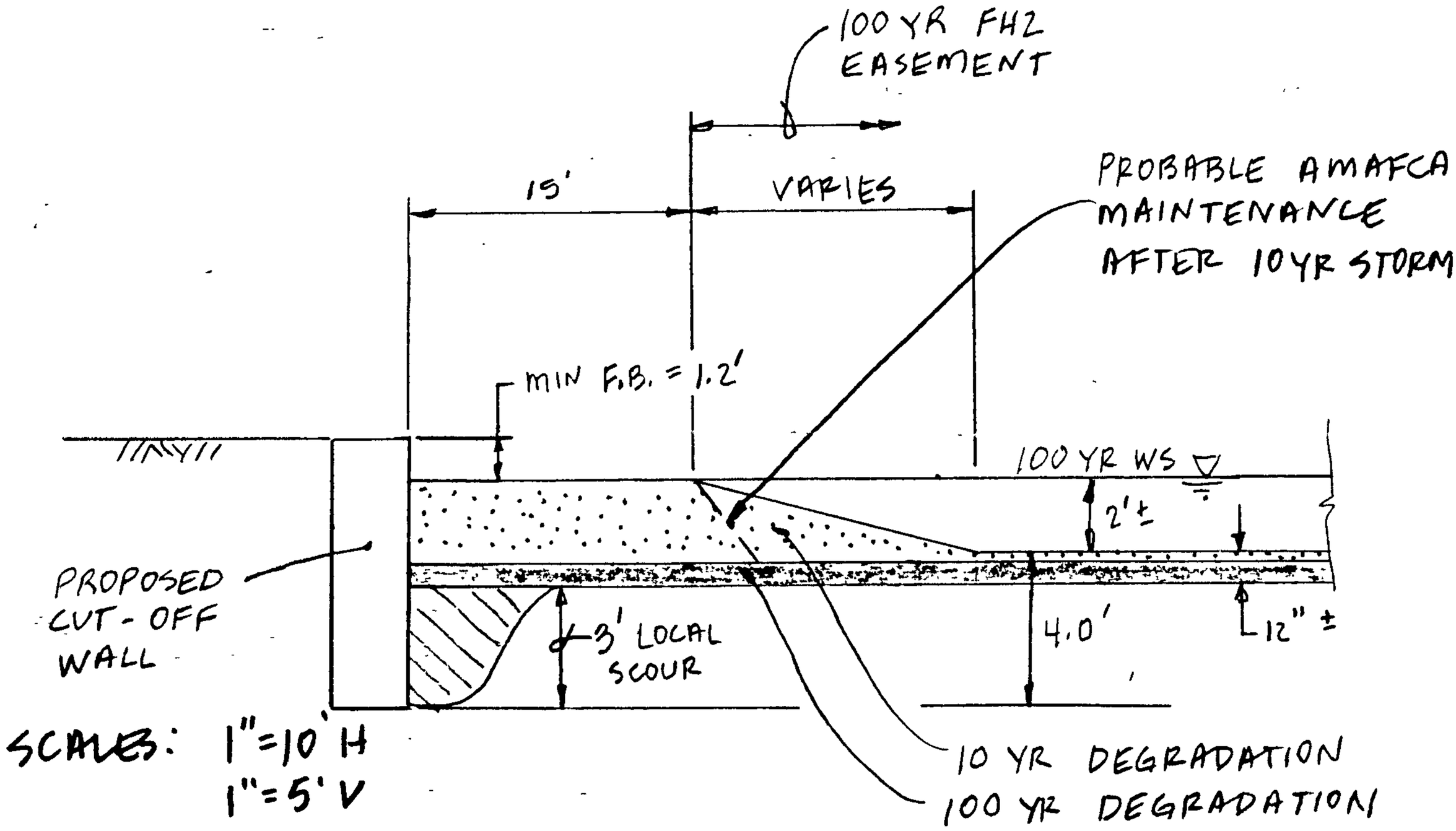
NOTES:

ESPEY, HUSTON & ASSOCIATES, INC.
Engineering & Environmental Consultants

PROJECT NAME NORTH DOMINGO BACA ARROYO JOB NO. 11567

SUBJECT CUT-OFF WALL AT N.E. MANOR

BY DL CK. BY _____ APPROVED BY _____ DATE 6-1-90 PAGE 6 OF _____



TYPICAL SECTION - SEGMENT 3

TYPICAL DEGRADATION VALUES - TAKEN AT SECTION 26 (WORST CASE)

10 YEAR : d = -0.24', BW = 360', VOL SED = 86 CF

100 YEAR : d = -0.49', BW = 360', VOL SED = 176 CF

NOTES:

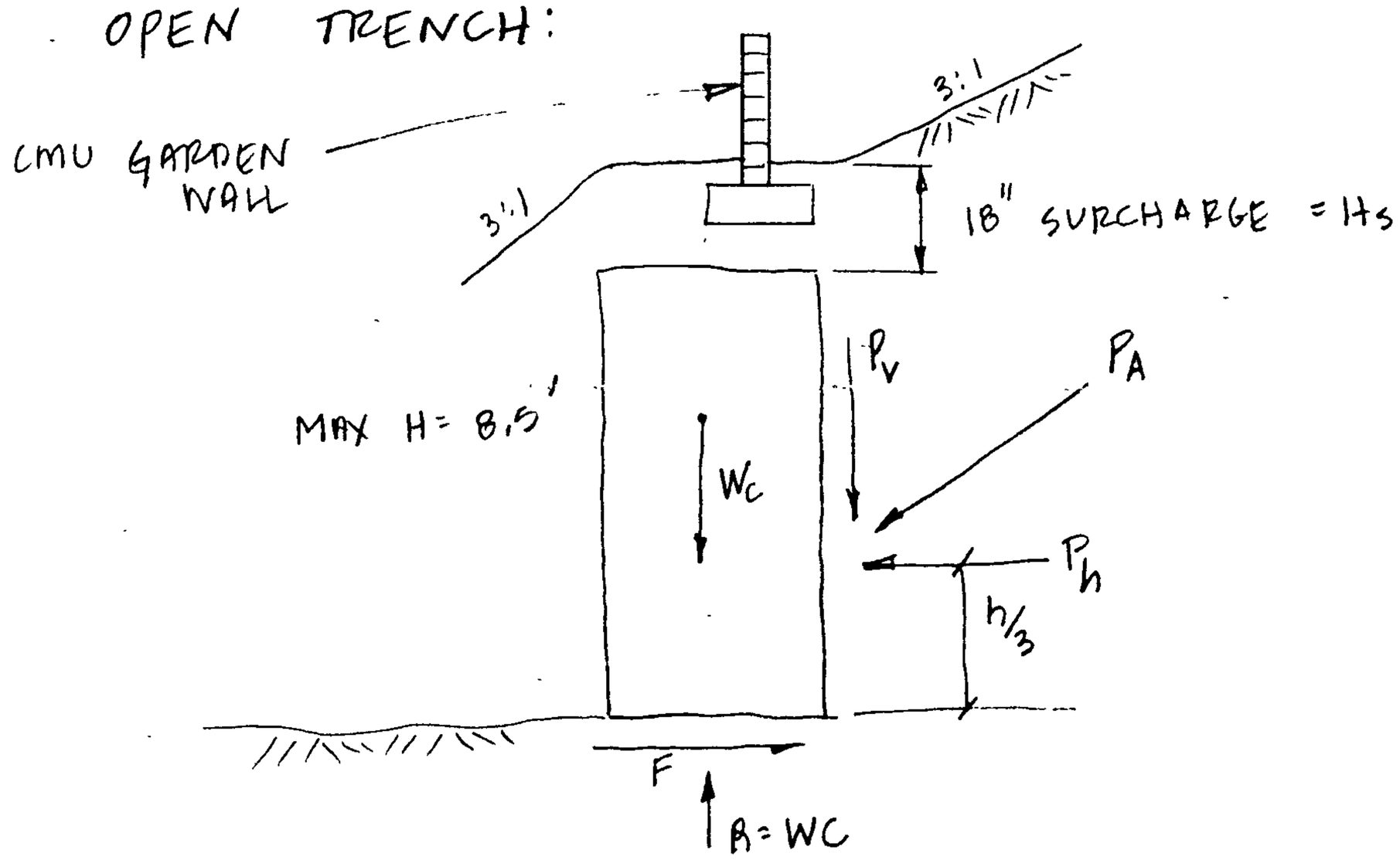
PROJECT NAME NORTH DOMINGO BACA ARROYO JOB NO. 11567

SUBJECT CUT-OFF WALL DESIGN CALCULATIONS

BY DL CK. BY _____ APPROVED BY _____ DATE 6-1-90 PAGE 7 OF _____

CUT-OFF WALL DESIGN

DESIGN WALL AS GRAVITY TYPE RETAINING WALL TO BE MONOLITHICALLY POURED IN AN OPEN TRENCH:



γ_c = 150 PCF

γ_s = 130 PCF

WANT F.S. OVERTURN = 2.0

F.S. SLIDE = 1.5

$P_h = \frac{1}{2}(51)(8.5)^2 = 1842.4$ lb.

$P_v = \frac{1}{2}(15)(8.5)^2 = 541.9$ lb

$W_c = 8.5(4)(150) + 1.5(4)(130) + \left[2(1) + 4(.5)\right](150) = 6630$

$P_{hs} = K_h H_s h = 47(1.5)\,8.5 = 599.3$ lb

NOTES:

ESPEY, HUSTON & ASSOCIATES, INC.
Engineering & Environmental Consultants

PROJECT NAME NORTH DOMINGO BACA ARROYO JOB NO. 11567

SUBJECT CUT-OFF WALL DESIGN CALCULATIONS

BY DL CK BY _____ APPROVED BY _____ DATE 6-1-90 PAGE 8 OF _____

(1) CHECK FOR OVERTURNING

$$F.S.\ OT = \frac{2.0 W_C + 4.0 P_V}{2.83 P_H + 4.25 P_{HS}} = \underline{\underline{2.0}}\ OK$$

(2) CHECK FOR SLIDING

$$F.S.\ SLIDE = \frac{F}{P_H}$$

$F = \mu R \qquad R = W_C$

μ = COEF FRICT = 0.40 ⟨PER SOILS REPT⟩

$F = 0.40 (6630) = 2652$ lb

$$F.S.\ SLIDE = \frac{2652}{1156.0} = \underline{\underline{2.3}}\ OK$$

(3) CHECK BEARING PRESSURE

$W_C = 5100$ lb $\qquad A_{BASE} = 4$ SF

$P_B = 5100/4 = 1275$ PSF $\underline{\underline{OK}}$

P_B (ALLOW) = 2500 PSF

NOTES:

ESPEY, HUSTON & ASSOCIATES, INC.
Engineering & Environmental Consultants

PROJECT NAME NORTH DOMINGO BACA ARROYO JOB NO. 11567

SUBJECT

BY ____ CK BY ____ APPROVED BY ____ DATE 7-5-90 PAGE 10 OF ____

THE FOLLOWING ANALYSIS IS PROVIDED TO DETERMINE THE AMOUNT OF MATERIAL ANTICIPATED TO BE REMOVED (ETCHED) FROM THE STUDY REACH DURING A TYPICAL YEAR (AVERAGE ANNUAL MATERIAL REMOVED).

THE ANALYSIS UTILIZES THE METHOD OUTLINED IN "EROSION RISK ANALYSIS FOR A SOUTHWESTERN ARROYO", BY PETER F. LAGASSE, M. ASCE, JAMES D. SCHALL, AND MARK PETERSEN, ASSOCIATE MEMBERS ASCE, PAGES 10-24.

NOTES:

ESPEY, HUSTON & ASSOCIATES, INC.
Engineering & Environmental Consultants

PROJECT NAME NORTH DOMINGO BACA ARROYO JOB NO. 11567

SUBJECT

BY _____ CK. BY _____ APPROVED BY _____ DATE 7-2-90 PAGE 11 OF _____

BED CHANGE & SEDIMENT YIELD DATA

A. 2 YR, 10 YR & 100 YR DATA FROM HEC-6:

REACH	BED CHANGE FT.	SECTION	W FT.	ℓ FT.	Y_{si} C.F.	TOTAL Y_s C.F.
2 YEAR:						
1	-0.20	14	403	280	81	22,680
2	-0.11	20	262	730	29	21,170
3	-0.32	26	360	280	115	32,200
10 YEAR						
1	-0.15	16	311	280	47	13,160
2	-0.12	20	262	730	31	22,630
3	-0.24	26	360	280	86	24,080
100 YEAR						
1	-0.48	16	311	280	149	41,720
2	-0.59	20	262	730	155	113,150
3	-0.49	26	360	280	176	49,280

NOTES:

PROJECT NAME NORTH DOMINGO BACA ARROYO JOB NO. 11567

SUBJECT

BY _____ CK BY _____ APPROVED BY _____ DATE 7-2-90 PAGE 12 OF _____

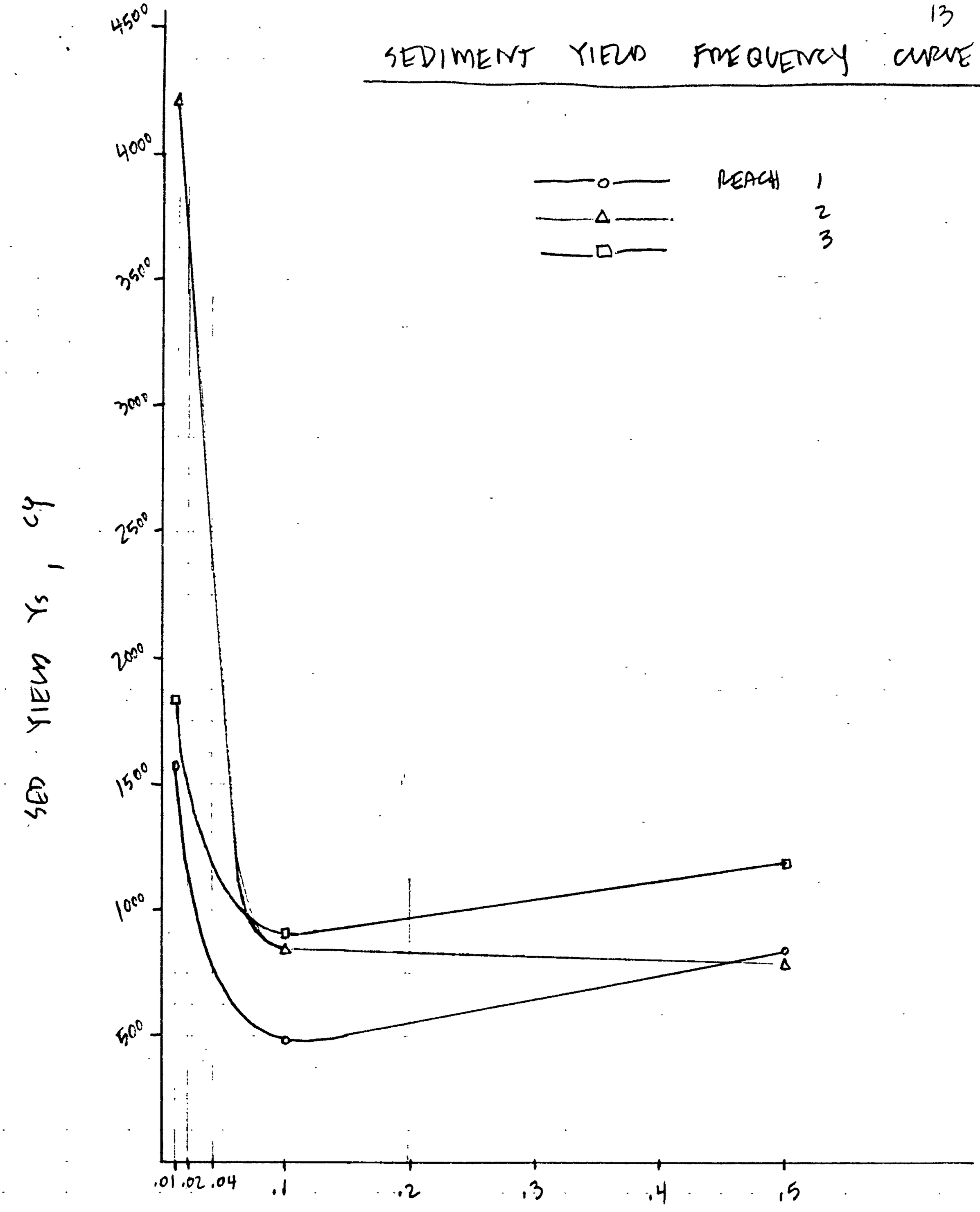
B. FROM THE SEDIMENT YIELD FREQUENCY CURVE AFE SEDIMENT VOLUMES FROM THE 5 YR, 25 YR & 50 YR EVENTS

REACH	$Y_s(5)$	$Y_s(25)$	$Y_s(50)$
1	550 CY	750 CY	1125 CY
2	825	2375	3625
3	975	1200	1500

NOTES:

ESPEY, HUSTON & ASSOCIATES, INC.
Engineering & Environmental Consultants

SEDIMENT YIELD FREQUENCY CURVE



DETERMINE TOTAL SEDIMENT YIELD BY INTEGRATION OF SEDIMENT YIELD FREQUENCY CURVE, OR BY NUMERICAL PROCEDURE:

$$Y_{s_m} = 0.01\, Y_{s,100} + 0.01\left[\frac{Y_{s100} + Y_{s50}}{2}\right] + 0.02\left[\frac{Y_{s50} + Y_{s25}}{2}\right] + 0.06\left[\frac{Y_{s25} + Y_{s10}}{2}\right] + 0.1\left[\frac{Y_{s10} + Y_{s5}}{2}\right] + 0.3\left[\frac{Y_{s5} + Y_{s2}}{2}\right] + 0.5\left[\frac{Y_{s2} + 0}{2}\right]$$

REACH ①:

$$Y_{sm} = 0.01(1545) + 0.01\left[\frac{1545 + 1125}{2}\right] + 0.02\left[\frac{1125 + 750}{2}\right] + 0.06\left[\frac{750 + 487}{2}\right] + 0.1\left[\frac{487 + 550}{2}\right] + 0.3\left[\frac{550 + 840}{2}\right] + 0.5\left[\frac{840}{2}\right] = 555 \text{ CY}$$

REACH ②:

$$Y_{sm} = 0.01(4190) + 0.01\left[\frac{4190 + 3625}{2}\right] + 0.02\left[\frac{3625 + 2375}{2}\right] + 0.06\left[\frac{2375 + 838}{2}\right] + 0.1\left[\frac{838 + 825}{2}\right] + 0.3\left[\frac{825 + 784}{2}\right] + 0.5\left(\frac{784}{2}\right) = 736 \text{ CY}$$

REACH ③ :

$$Y_{SM} = 0.01(1825) + 0.01\left[\frac{1825+1500}{2}\right] + 0.02\left[\frac{1500+1200}{2}\right]$$
$$+ 0.06\left[\frac{1200+892}{2}\right] + 0.1\left[\frac{892+975}{2}\right]$$
$$+ 0.3\left[\frac{975+1193}{2}\right] + 0.5\left(\frac{1193}{2}\right) = 841 \text{ CY}$$

TOTAL ESTIMATED ANNUAL SEDIMENT YIELD

$= 555 + 736 + 841 = 2132$ CY

PER AGREEMENT LET 1/2 COME FROM NORTH SIDE = 1066 CY

11567

Albuquerque
Metropolitan
Arroyo
Flood
Control
Authority

2600 PROSPECT N E - ALBUQUERQUE N M 87107
TELEPHONE (505) 884-2215

May 17, 1990

Dennis A. Lorenz, P.E.
Espey, Huston & Associates, Inc.
317 Commercial St. N.E.
Albuquerque, New Mexico 87102

Re: Erosion Study North Domingo Baca Arroyo at Nor Este Manor, Block F, and Tract "B" (Revised April, 1990)

Dear Dennis:

AMAFCA and Resource Consultants, Inc. have reviewed the revised Erosion Study as referenced above. A copy of the letter from Resource Consultants, Inc. is enclosed for your consideration. AMAFCA agrees that the issue of lateral distribution procedure needs to be clarified, particularly for the 100-year storm. The computation of low flow incisement depth and local scour needs to be incorporated into the wall analysis. It appears that the cutoff wall depth should be at least 3.0 feet and that additional riprap protection to a depth of 4 to 6 feet should be provided at the wall too.

The study indicates that segment 3 will have a higher maintenance cost than the other segments and that riprap protection is necessary to reduce maintenance costs. The riprap protection proposed for segment 3 must be included with the construction of the erosion protection wall.

The issue of Federal Embergency Management Agency (FEMA) levee protection requirements as discussed in our March 16th letter should be addressed in the study. Revision of flood hazard areas in this area is extremely complex due to new FEMA requirements. An application for conditional approval from FEMA should be submitted as soon as possible.

The erosion study proposes maintenance by AMAFCA following construction. Since the proposed maintenance will be extraordinary to the maintenance normally performed by AMAFCA on permanent projects, AMAFCA's Board of Directors will need to review the project and concur that the maintenance is an appropriate responsibility. A comparison of maintenance costs with this project and maintenance costs for a prudent line and concrete lined channel would assist in this evaluation. Mr. John Kelly, AMAFCA's Field Engineer, can assist you in establishing maintenance costs for concrete lined channels. If AMAFCA's Board is unwilling to assume extraordinary maintenance responsibilities, how might the project be modified to reduce maintenance costs?

Please let us know if you have any questions regarding our comments. We anticipate that the City of Albuquerque, Public Works Department will have further comments and questions.

Sincerely,

Clifford E. Anderson, PE & LS
Drainage Engineer

CEA/JM

Rick Semones, Presley Company
Fred Aguirre, Hydrologist, City of Albuq. Public Works
Gilbert Aldaz, City-County Floodplain Administrator
James D. Schall, Resource Consultants Inc.
Peter F. Lagasse, Resource Consultants Inc.

RESOURCE CONSULTANTS INC

Peter F. Lagasse, PE
George Pilos
David M. Frick, PE
Paul R. Barker, PE
Everett V. Richardson, PE

May 4, 1990 Ref: 1528

Mr. Cliff Anderson, PE & LS
Albuquerque Metropolitan Arroyo
Flood Control Authority
2600 Prospect N.E.
Albuquerque, New Mexico 87107

RE: Review of the Espey, Huston report "Erosion Study, North Domingo Baca Arroyo at Nor Este Manor, Block F and Tract B"

Dear Cliff:

Per your letter dated May 1, 1990, we have reviewed a revised version of the above referenced report. The revised version, dated April 1990, updates the original report dated January 1990. Our comments on the original version of the report were transmitted to you by our letter dated March 13, 1990.

It is our understanding that the engineer (Espey, Huston), AMAFCA, and the City have agreed in concept to the use of a structural cutoff wall along the arroyo adjacent to the proposed project. The purpose of the revised report was to define general design criteria for such a wall and maintenance criteria. Consequently, some of the comments in our original response are no longer relevant, as the objective of the original study was to define the "prudent line." However, as discussed below, some of these comments remain valid and relevant to the proposed cutoff wall and are largely unanswered by the revised report.

HEC-6 RESULTS

The engineer has reduced the sediment supply by about one-third (page 5, revised report) in response to comments in our March 13 letter. However, we feel that the engineer may have misinterpreted our original concerns, as detailed in Section II of our March 13 letter. Our two primary observations were that: A) Both the assumed sediment supply and HEC-6 calculated transport capacity might be somewhat high, and B) there was no discussion of the impact of the upstream AMAFCA detention dam on sediment supply. By reducing the sediment supply by one-third the engineer has only partially addressed both concerns; however, be that as it may, the revision has made the HEC-6 degradation analysis more conservative.

402 West Mountain Avenue • Post Office Box Q • Fort Collins, Colorado 80522
(303) 482-8471 • Denver Metro (303) 572-1806
FAX (303) 484-3311

LATERAL DISTRIBUTION PROCEDURE

In the original report we commented that it was not possible to document or verify the procedure utilized for distributing the calculated HEC-6 erosion volumes. Similarly, the lateral distribution procedure in the revised report is not clearly stated or defined. In the calculation sheets in Section 4 it appears that the 10-year erosion is taken entirely from the channel bank, but that the 100-year is taken in part from the bed and in part from the bank. The engineer should explain the assumptions utilized.

DESIGN OF CUTOFF WALL

As in the original report, the cutoff walls have been designed considering only degradation. In Section V of our March 13 letter we discuss the need to account for other components of scour, such as low flow incisement and local scour, in designing cutoff walls. These concerns and recommendations remain unaddressed and limit the integrity of the proposed design.

Additionally, it is not entirely clear from the calculation sheets how the scour depth was computed, which relates directly to the above comment on the lateral distribution assumptions. Regardless of the method, we are concerned that the proposed cutoff walls will only be about 2.0 feet below the existing arroyo bottom. With such a minor amount of toe-down, it will not take much erosion to undermine the wall. Such erosion could easily occur in localized reaches, possibly resulting in wall failure over longer reaches. Considering the dynamic nature of arroyo channels, as an absolute minimum, we would recommend a toe-down of 3 feet, which we still feel to be somewhat risky with little or no safety factor. In similar situations, design of toe-down for riprap bank protection often results in a recommended burial depth of 4 to 6 feet.

If you have any questions or comments on any of the above discussion, do not hesitate to contact us.

Sincerely,

RESOURCE CONSULTANTS, INC.

Peter F. Lagasse

Peter F. Lagasse, Ph.D., P.E.
President

Jim

James D. Schall, Ph.D., P.E.
Water Resource Engineer

PFL/JDS/gz