HYDROLOGY J11/D10 1 of 2 5 PLANS

J11/D10

5 Plans

CONTRACTORS

ENGINEERS

UNIVERSAL CONSTRUCTORS Inc.

STATION B, BOX 6008 PHONE 884-0400
ALBUQUERQUE, NEW MEXICO 87197

RECEIVED AUG 20 1981 THE BANES CO. ALBUQUERQUE, NM

August 19, 1981

The Banes Company
4322 Second Street, N.W.
Albuquerque, New Mexico 87107

Attention: Joe White

Re: Merchant's Truck Terminal, ~~6300~~ 6101 Hanover, N.W.

Gentlemen:

Please accept this letter as confirmation that we did not alter the grade of the lot immediately east of the referenced project.

Very truly yours,

Universal Constructors, Inc.

Gilbert A. Luna

Gilbert A. Luna
Vice President

GAL/cb

cc: file

N.M. LIC. 17512

HEAVY CONSTRUCTION – HIGHWAYS – BUILDINGS – UTILITIES

OFFICE OF THE CITY ENGINEER
BUILDING PLANS
DRAINAGE REVIEW

6101 Hanover Rd N.W

DATE ISSUED 4-13-81

Gentlemen:

In order to expedite the passage of building construction plans through the drainage review we have compiled this list of requirements. With a few exceptions, these requirements are complete.

(1) Any building site 1.00 acres or larger will require a formal drainage report prepared by a New Mexico Registered Professional Engineer competent in surface hydrology. This report must be submitted to the office of the Principal Assistant City Engineer (Hydrology) for review and acceptance prior to submission of construction plans for review. Please be advised, a pre-conference meeting will be required before the drainage report is submitted.

(2) Before attempting to submit a set of plans for a building located in a flood hazard area, contact the Hydrology Section. Failure to do this will often result in much lost time.

(3) When construction plans are submitted, the following items must be included:

(A) A GRADING PLAN SHOWING:

✓ (1) Vicinity map with the zone atlas page and legal description.

✓ (2) Existing contours extending approximately 10 feet beyond the property line. If it is not feasible to provide contours beyond the property line, spot elevations, at the property line, designated as existing and proposed may be substituted.

(3) Proposed contours at one foot intervals and proposed spot elevations at key points.

(4) Finish building floor elevation (s).

(5) Notes defining asphalt, sidewalks, planting areas, ponding areas, property line, and any other areas whose definition would increase clarity.

(6) Proposed alley grades, if property abuts a dedicated unpaved alley. These grades are available, at no charge, from the City Engineer's office. An advance request will expedite your project.

✓ (7) A description of the bench mark. (T.B.M)

(8) Ground Elevation on the site based on mean sea level datum as established by the U.S. Coast and Geodetic Survey (North American Datum 1929).

(B) A DRAINAGE PLAN SHOWING:

✓ (1) Direction of roof drainage including canales, gutters, and downspouts.

(2) Outlined contributory drainage areas, including roof areas.

(3) Swales with top and bottom spot elevations.

✓ (4) Curb ~~and sidewalk~~ spot elevations. (C.Fy)

(5) Flow lines with arrows and spot elevations for confirmation.

(C) IF PONDING IS REQUIRED THE DRAINAGE PLAN MUST ALSO SHOW:

(1) Calculations showing developed and undeveloped volumetric flow rate.

(2) Pond volume calculations.

(3) That pond volumes balance with area contributing to the pond.

(4) The pond overflow point with a spot elevation and slope protection if necessary.

(5) Positive discharge of ponds with required rate calculations and orifice calculations, if applicable.

NOTE: Close proximity ponding to any structure requires the concurrence of a soils investigation report.

(D) A discussion of offsite flows must be included. If the contour maps disagree with the designers opinion of offsite flows, further information will be required.

(E) A discussion of any other local conditions that effect site drainage should be included.

(F) Details of ponds, curbcuts, water blocks, and any other significant drainage structures must be included.

✓ (G) The professional who designs the drainage scheme must affix his/her stamp to the drainage plan.

✓ (H) A copy of the drainage plan must also be included with the construction plans for our drainage files.

✓ (I) Construction in the public right of way requires approval, prior to construction, from the City Engineers office. SUBMIT COPY OF THE APPROVED CONNECTION DETAIL.

(J) Indicate all easements on site or adjacent to the site with the following information: Location, width, and purpose.

(1) PROVIDE A NON-ERODIBLE SWALE BETWEEN THE RUNDOWS AND THE STORM DRAIN INLET. ALSO, PROVIDE AN ADEQUATE GRADE BETWEEN THE RUNDOWS AND THE INLET TO DRAIN THE POND.

(2) COMPLY WITH THE REQUIRED ELEVATIONS FOR THE STD. DRIVEPAD.

(3) INDICATE HOW THE GRADE CHANGE ALONG THE PROPERTY LINE WILL BE ABSORBED.
NOTE: DEVELOPMENT CAN NOT BLOCK OFFSITE FLOWS.

DRAINAGE REPORT
FOR
MERCHANTS, INC.
FREIGHT TERMINAL
with
Supplement No. 1
March ~~16~~ 26, 1981

THE BANES COMPANY
Albuquerque, New Mexico

DRAINAGE REPORT

FOR

MERCHANTS, INC.
FREIGHT TERMINAL

with

Supplement No. 1

March 26, 1981

Prepared by
Andrews, Asbury & Robert, Inc.
Consulting Engineers
401 San Pedro NE
Albuquerque, New Mexico
505-265-6631

Drainage Report

For

MERCHANTS INC.
FREIGHT TERMINAL

Table of Contents

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	Location Map	Map No. 1
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	Existing Conditions - OnSite	Map No. 3
	Developed Conditions - OnSite	Map No. 4

I

INTRODUCTION

The Banes Company propose to improve a southerly portion (approximately 4.3 acres) of a 10 acre tract of land located within the northwest quadrant of Albuquerque, New Mexico, and being situate in the Nortwest Quarter (NW¼) of Section 14 and the Southwest Quarter (SW¼) of Section 15, Township 10 North, Range 2 East, N.M.P.M. (See enclosed Location Map No. 1 - Zone Atlas Maps H-11 and J-11). The subject property is presently not incorporated within the city limits of the City of Albuquerque.

The type of development proposed for this tract is heavy commercial and consists of an office and freight terminal for Merchants Incorporated, a nationwide trucking company.

It is the intent of this report to provide an acceptable method of developing the subject property without appreciably effecting the present storm drainage patterns.

Guidelines for the analysis are based on the Albuquerque Metropolitan Arroyo Flood Control Authority's Drainage Resolution 1980-15 and the City of Albuquerque Drainage Ordinances and Interim Drainage Guidelines.

II

EXISTING CONDITIONS

A. GENERAL

The subject property is presently undeveloped with a slope from west to east of approximately 0.7 percent. The tract is bounded on the north by Iliff Road NW and bounded on the south by Hanover Road NW. Iliff Road NW is presently an unimproved dirt roadway whereas Hanover Road NW is semi-improved with a strip of temporary paving approximately twenty-five feet wide.

The area directly to the west and to the east of the subject property is presently undeveloped.

An analysis of the proposed site and surrounding areas by field visits and studies of the 1" = 200' scale orthophoto topographic map indicates that the subject tract lies within the southwestern limits of a large ponding area that would be created by a 10 year frequency storm. This large ponding area is formed by natural depressions, the raised roadbed of Coors Boulevard NW, and the Interstate 40 - Coors Boulevard Interchange off ramp. (See Location Map No. 1 for proximity of Coors Boulevard and Interstate 40 off ramp to subject property.)

B. OFFSITE DRAINAGE

A delineation of drainage areas external to the property indicates that there are about 0.73 square miles of drainage area north of Interstate 40 and approximately 0.19 square miles of drainage area south of Interstate 40 which contribute to the storm water runoff flowing to the large ponding area previously mentioned.

The area north of Interstate 40 is essentially divided equally into three separate drainage areas (See Offsite Drainage Areas, Map No. 2 enclosed). The offsite areas are undeveloped, partially covered with natural grasses and shrubs and are characterized by non-distinct drainage patterns. The soil is sandy and has a relatively high infiltration rate.

The drainage areas north of Interstate 40 have an upper terminus at the Ladera Storm Drainage Diversion and Detention Facility and discharge to the area south of Interstate 40 by a series of drainage structures. An inspection of the Interstate 40 drainage structures indicate that, although some have inlets that are partially covered with sand and weeds, these structures are capable of operating as designed.

The area south of Interstate 40 that contributes runoff to the ponding area is designated as Drainage Area 4 (See Map No. 2 for offsite drainage area designations) and includes the site of the proposed freight terminal.

Due to a large ponding area formed by the abandoned West Mesa Airport, the storm water runoff generated by offsite areas to

the west and south of the subject tract will be contained within this ponding area and will not discharge into Drainage Area 4. (See Drainage Analysis, Sheet 1 for Pond Volumes.) Therefore, the external drainage areas contributing storm runoff to the subject area are limited to those shown on Map No. 2.

The large ponding area in which the subject tract is located will contain all runoff from the four drainage areas until the water surface reaches elevation 5093.8, at which time storm water will commence flowing over the Interstate 40 - Coors Boulevard Interchange off ramp.

Hydrologic and hydraulic analysis of the offsite drainage areas were performed to determine the maximum pool elevation of the ponding area in the event of the 100-year frequency design storm.

C. DESIGN RAINFALL AND RAINFALL LOSSES

The 100-year design rainfall was obtained from the NOAA Atlas 2, Precipitation-Frequency Atlas of Western United States, Volume IV-New Mexico. This document is generally regarded as the best source of rainfall frequency data for this area.

The rainfall loss rates used are from U.S. Army Corps of Engineers studies of areas within New Mexico which have been used recently by the Corps for studies within the Middle Rio Grande Valley. These losses are 0.50 inch initial loss and 0.25 inch per hour uniform loss for mountainous or hilly area and 0.80 inch

initial loss and 0.40 inch per hour uni; rm loss for flat areas. For this study, the uniform rate for flat areas of 0.40 inches per hour was used; but it was assumed that antecedent conditions eliminate the inital loss.

D. UNIT HYDROGRAPH

Unit hydrographs were calculated with the Snyder method where basin characteristics determine the basic unit hydrograph values. A curve of equivalent slope, S_{st}, versus unit hydrograph coefficient, C_t, that was developed by and is used by the Albuquerque District of the Corps of Engineers was used to determine C_t. A value of 604 C_p was assumed to be equal to 540. Since the drainage areas are quite small, a five minute unit hydrograph time interval was selected.

E. RUNOFF HYDROGRAPH

The excess rainfall was multiplied times the three basins' unit hydrographs to calculate the runoff hydrographs. It was assumed that the three runoff hydrographs could be added directly to obtain one hydrograph for the area north of Interstate 40. Because of the lack of straight forward drainage patterns south of Interstate 40, no unit or runoff hydrographs were computed for that area. It was assumed that the volume of runoff from this area of 0.19 square mile would be proportional to the volume of runoff from the area north of Interstate 40.

F. CALCULATION OF PONDING ELEVATION

An elevation-capacity table of the ponding area was determined by planimetering the 1" = 200' map contour lines. The initial 12 acre-feet of storage available was assumed to be eliminated by storage of the runoff from the area south of Interstate 40. The total hydrograph from the areas north of Interstate 40 was then routed through the ponding area with an S + Q/2 routing technique. A weir equation was used to rate the discharge over the off ramp. A maximum ponding elevation of 5094.51 was obtained.

G. ONSITE DRAINAGE

The existing drainage patterns for the onsite - undeveloped conditions are presented on Map No. 3 enclosed.

This portion of the analysis is confined to the boundary limits of the subject tract and is presented in order to determine the storage volume required under the developed conditions.

III

DEVELOPED CONDITIONS

In the developed state, storm water runoff generated from upland drainage areas in the event of a 100-year frequency storm will, as previously stated, pond storm water on the subject property. The maximum pool elevation will be 5094.51. In order for the freight terminal building not to be subjected to flooding the finished floor must be set above elevation 50.94.51. To provide for easy loading and unloading of transports at the terminal, the finished floor of the entire terminal building will be 4'-3" above the adjacent finished grade and surrounding pavement. The proposed finished floor of the terminal building will be set at elevation 5099.25, well above the maximum pool elevation of the pond and will therefore not be subject to flooding in the design event.

In the developed state, it is proposed to control excess storm runoff due to development of the tract by means of onsite ponding with a controlled outlet. (See Map No. 4 enclosed for Drainage Area Designations.)

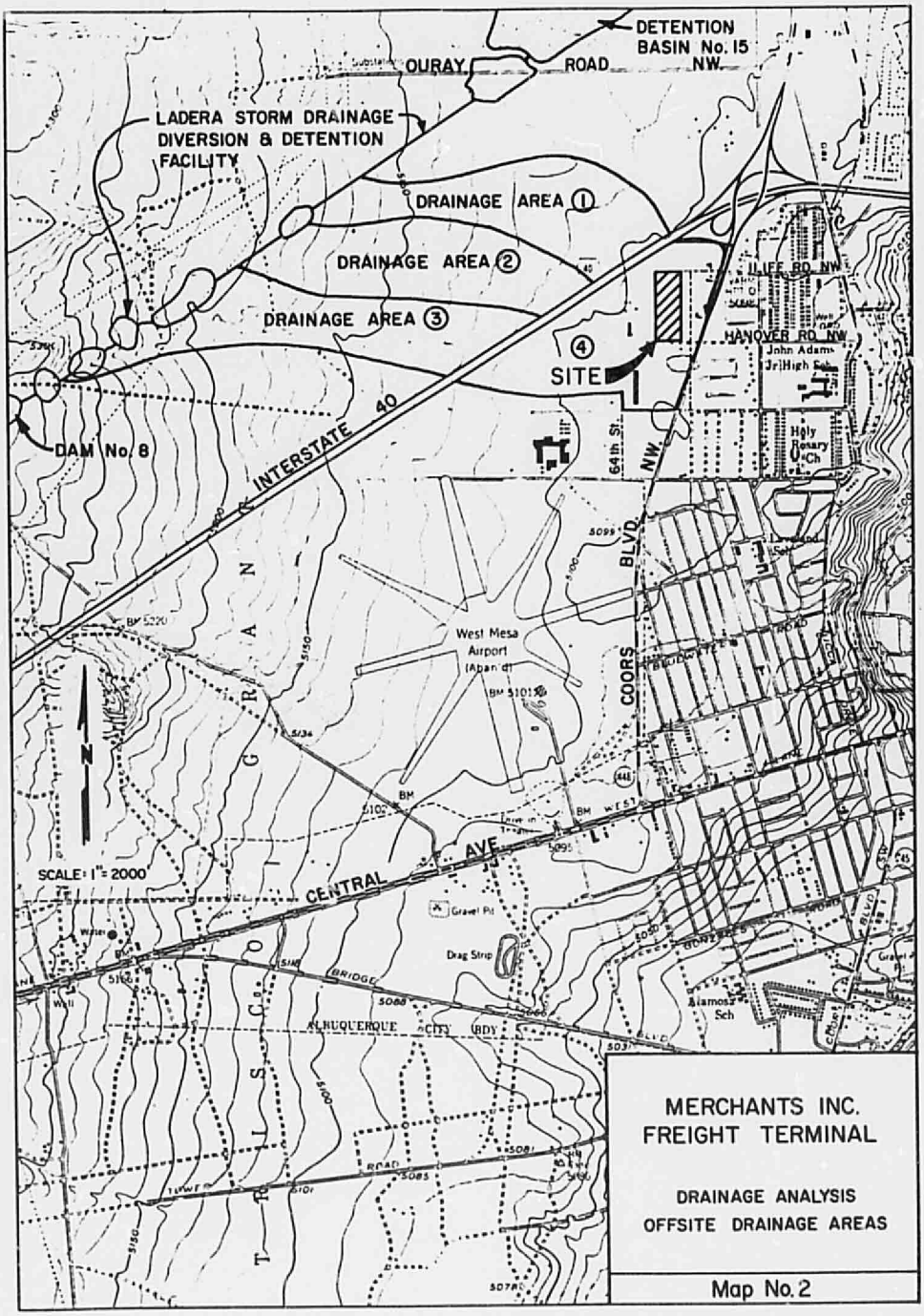
NOTE THIS MAP WAS PREPARED FROM ZONE ATLAS SHEETS H-11 & J-11.

MERCHANTS INC.
FREIGHT TERMINAL

DRAINAGE ANALYSIS

LOCATION MAP

Map No. I



MERCHANTS INC.
FREIGHT TERMINAL

DRAINAGE ANALYSIS
OFFSITE DRAINAGE AREAS

Map No. 2

DRAINAGE ANALYSIS

Following is the Drainage Analysis (computations) for the subject property, for both Existing Conditions and Developed Conditions for a 100-year storm.

ANDREWS, ASBURY & ROBERT, INC.
CONSULTING ENGINEERS
401 San Pedro, NE., Albuquerque, N.M. 87108
Telephone (505) 265-6631

OFF SITE PONDING AREAS

1. Area south of West Mesa High School

Elevation	Area (acres)	ΔCap (ac.ft.)	Σ Cap (ac.ft.)
5096.9	0	-	-
5097.0	0.79	0.04	0.04
5098.0	2.98	1.89	1.93
5099.0	5.65	4.32	6.25
5100.0	9.81	7.73	13.98

2. Area from Interstate 40 and Coors Boulevard south to south of Hanover and west of Coors

Elevation	Area (acres(	Δ Cap (ac.ft.)	Σ Cap (ac.ft.)
5091.7	0	-	-
5092.0	5.46	0.82	0.82
5093.0	18.32	11.89	12.71
5094.0	30.20	24.26	36.97
5095.0	38.02	34.11	71.08

3. Area West of Coors Boulevard, north and south of Fortuna

Elevation	Area (acres)	Δ Cap (ac.ft.)	Σ Cap (ac.ft.)
5096.0	0	-	-
5097.0	5.11	5.11	5.11
5098.0	15.01	10.06	15.17

NOTE: Volumes of ponds were determined by planimetering the areas of the existing contours on 1" = 200' scale orthophoto topographic maps.

100-YEAR RAINFALL - ALBUQUERQUE WEST MESA

Latitude 35°06', Longitude 106°43'

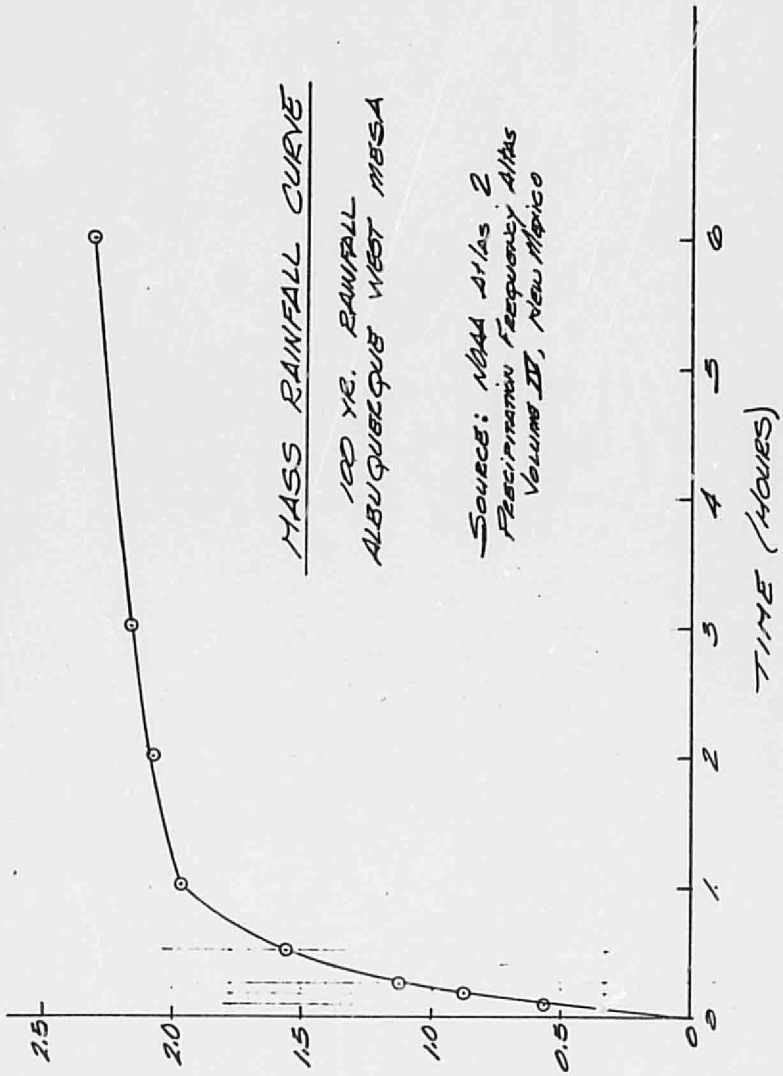
Source: NOAA Atlas 2, Precipitation-Frequency Atlas of Western United States, Volume IV - New Mexico

From Figure 24

100-year	6-hour	= 2.3"
100-year	24-hour	= 2.7"
100-year	1-hour	= 0.494 + 0.755 (2.3(2.3/2.7)) = 1.97"
100-year	2-hour	= 0.341(2.3) + 0.659(1.97) = 2.08"
100-year	3-hour	= 0.569(2.3) + 0.431(1.97) = 2.16"
100-year	30-min.	= 0.79(1.97) = 1.56"
100-year	15-min.	= 0.57(1.97) = 1.12"
100-year	10-min.	= 0.45(1.97) = 0.88"
100-year	5-min.	= 0.29(1.97) = 0.57"

ANDREWS, ASBURY & ROBERT, INC.
CONSULTING ENGINEERS
401 San Pedro, NE., Albuquerque, N.M. 87108
Telephone (505) 265-6631

Project MERCHANTS INC. Sheet 3 of 22
DRAINAGE ANALYSIS Job No. 2416
By RSF Chk'd JA Date 2/3/81



DETERMINATION OF 5-MIN. INTERVALS OF 100-YEAR RAINFALL

Time Period (5-min)	(1) ΣR_f (in)	ΔR_f (in)	(2) Arranged Critically	(3) Rainfall Losses (.40"/hr)	Excess R_f (in)
1	0.57	0.57	0.31	.04	0.27
2	0.88	0.31	0.57	.04	0.53
3	1.12	0.24	0.24	.04	0.20
4	1.28	0.16	0.16	.04	0.12
5	1.44	0.16	0.16	.03	0.13
6	1.56	0.12	0.12	.03	0.09
7	1.66	0.10	0.10	.03	0.07
8	1.73	0.07	0.07	.03	0.04
9	1.80	0.07	0.07	.03	0.04
10	1.87	0.07	0.07	.03	0.04
11	1.92	0.05	0.05	.03	0.02
12	1.97	0.05	0.05	.03	0.02
13	1.98	0.01	0.01	.04	0
14	1.99	0.01	0.01	.04	0
15	2.00	0.01	0.01	.04	0

(Beyond time period No. 15, rainfall loss rate exceeds total rainfall rate)

NOTES:

1. Accumulated rainfall read from mass rainfall curve.

2. Critical arrangment based on having most intense rainfall increment occur in 2nd time period. Assumed to represent local conditions.

3. Rainfall loss rates based on U.S. Army Corps of Engineers studies of watersheds with characteristics similar to Albuquerque area. These losses were 0.50 inch initial loss and 0.25 inch per hour uniform loss for mountainous or hilly areas; 0.80 inch initial loss and 0.40 inch per hour uniform loss for flat areas. For this study, use rates for flat areas and assume antecedent conditions eliminate initial loss.

UNIT HYDROGRAPH SUMMARY - OFFSITE

(See Map No. 2 for Drainage Area Designations)

Drainage Area 1

Area = 0.22 mi^2

L = 1.093 mi

L_{ca} = 0.430 mi

S_{st} = 0.01363

C_t = 0.63

$640C_p$ = 540

$t_p = C_t(LL_{ca})^{.3} = 0.5022$ hr

$t_r = t_p/5.5 = 0.0913$ hr

$t_R = 0.0833$ hr

$t_{pR} = t_p + 0.25(t_R - t_r) = 0.50$ hr

$q_{pR} = 640C_p/t_{pR} = 1080$ cfs/mi^2

$Q_{pF} = 238$ cfs

DRAINAGE AREA 2

Area = 0.22 mi^2

L = 1.036 mi

L_{ca} = 0.400 mi

S_{st} = 0.0171

C_t = 0.58

$640C_p$ = 540

$t_p = C_t(LL_{ca})^{.3} = 0.445$ hr

$t_r = t_r/5.5 = 0.0809$ hr

$t_R = 0.0833$ hr

$t_{pR} = t_p + 0.25(t_R - t_r) = 0.445$ hr

$q_{pR} = 640C_p/t_{pR} = 1213$ cfs/mi^2

$Q_{pR} = 267$ cfs

DRAINAGE AREA 3

Area = 0.29 mi^2

L = 1.516 mi

L_{ca} = 0.562 mi

S_{st} = 0.0187

C_t = 0.57

$640C_p$ = 540

$t_p = C_t(LL_{ca})^{.3} = 0.549$ hr

$t_r = t_p/5.5 = 0.100$ hr

$t_R = 0.0833$ hr

$t_{pR} = t_p + .25(t_R - t_r) = 0.544$ hr

$q_{pR} = 640C_p/t_{pR} = 991$ cfs/mi^2

$Q_{pR} = 287$ cfs

Where: $S_{st} = \dfrac{\text{elev at .85 L} - \text{elev at .10 L}}{.75\ L}$

C_t from curve developed by U.S. Army Corps of Engineers

ANDREWS, ASBURY & ROBERT, INC.
CONSULTING ENGINEERS
401 San Pedro, NE., Albuquerque, N.M. 87108
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DRAINAGE AREA NO. 1

UNIT HYDROGRAPH BASED ON LOG-NORMAL DISTRIBUTION

AREA IN SQUARE MILES =	0.22
MAXIMUM ORDINATE IN CFS =	238
LAG TIME IN HOURS =	0.5
UNIT RAIN DURATION IN HOURS =	0.0833
TIME TO HALF VOLUME =	0.638091776
SIGMA =	0.175801894

TIME IN HOURS	INST ORDINATES
0.167	3
0.250	38
0.333	116
0.417	193
0.500	233
0.583	234
0.666	209
0.750	172
0.833	135
0.916	102
1.000	76
1.083	55
1.166	40
1.250	28
1.333	20
1.416	14
1.499	10
1.583	7
1.666	5
1.749	4
1.833	3
1.916	2
1.999	1
SUM	1704.130
VOLUME	12 ACRE-FEET

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DRAINAGE AREA NO. 3

UNIT HYDROGRAPH BASED ON LOG-NORMAL DISTRIBUTION

AREA IN SQUARE MILES =	0.22
MAXIMUM ORDINATE IN CFS =	267
LAG TIME IN HOURS =	0.445
UNIT RAIN DURATION IN HOURS =	0.0833
TIME TO HALF VOLUME =	0.572031927
SIGMA =	0.174611026

TIME IN HOURS	INST ORDINATES
0.167	8
0.250	68
0.333	171
0.417	248
0.500	266
0.583	241
0.666	197
0.750	150
0.833	109
0.916	77
1.000	54
1.083	37
1.166	25
1.250	17
1.333	12
1.416	8
1.499	5
1.583	4
1.666	2
1.749	2
1.833	1
SUM	1704.110
VOLUME	12 ACRE-FEET

DRAINAGE AREA NO. 3

UNIT HYDROGRAPH BASED ON LOG-NORMAL DISTRIBUTION

AREA IN SQUARE MILES =	0.29
MAXIMUM ORDINATE IN CFS =	287
LAG TIME IN HOURS =	0.544
UNIT RAIN DURATION IN HOURS =	0.0833
TIME TO HALF VOLUME =	0.692071873
SIGMA =	0.177459906

TIME IN HOURS	INST ORDINATES
	3
0.167	33
0.250	111
0.333	203
0.417	266
0.500	287
0.583	273
0.666	239
0.750	198
0.833	158
0.916	122
1.000	93
1.083	69
1.166	51
1.250	38
1.333	28
1.416	20
1.499	15
1.583	11
1.666	8
1.749	6
1.833	4
1.916	3
1.999	2
2.083	2
2.166	1
2.249	
SUM	2246.327
VOLUME	15 ACRE-FEET

ANDREWS, ASBURY & ROBERT, INC.
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401 San Pedro, NE., Albuquerque, N.M. 87108
Telephone (505) 265-6631

DRAINAGE AREA NO. 1

RUNOFF HYDROGRAPH COMPUTATION

TIME PERIOD IN HOURS 0.0833

TIME PERIOD	EXCESS	UNITGRAPH	R.O. HYDROGRAPH
1	0.27	3	1
2	0.53	38	12
3	0.20	116	52
4	0.12	193	122
5	0.13	233	193
6	0.09	234	244
7	0.07	209	269
8	0.04	172	270
9	0.04	135	255
10	0.04	102	230
11	0.04	76	201
12	0.02	55	173
13	0.02	40	147
14		28	124
15		20	103
16		14	84
17		10	67
18		7	52
19		5	39
20		4	29
21		3	21
22		2	16
23		1	11
24			8
25			5
26			3
27			2
28			1
29			1

SUMMATION HYDROGRAPH = 2737.00

VOLUME (ACRE-FEET) = 18.84

ANDREWS, ASBURY & ROBERT, INC.
CONSULTING ENGINEERS
401 San Pedro, NE., Albuquerque, N.M. 87108
Telephone (505) 265-6631

DRAINAGE AREA NO. 2

RUNOFF HYDROGRAPH COMPUTATION

TIME PERIOD IN HOURS 0.0833

TIME PERIOD	EXCESS	UNITGRAPH	R.O. HYDROGRAPH
1	0.27	8	2
2	0.53	68	23
3	0.20	171	84
4	0.12	248	172
5	0.13	266	247
6	0.09	241	286
7	0.07	197	293
8	0.04	150	278
9	0.04	109	249
10	0.04	77	215
11	0.02	54	181
12	0.02	37	150
13		25	123
14		17	99
15		12	77
16		12	59
17		8	46
18		5	33
19		4	24
20		2	17
21		2	12
22		1	8
23			6
24			4
25			2
26			2
27			1
28			1

SUMMATION HYDROGRAPH = 2690.98

VOLUME (ACRE-FEET) = 18.53

ANDREWS, ASBURY & ROBERT, INC.
CONSULTING ENGINEERS
401 San Pedro, NE., Albuquerque, N.M. 87108
Telephone (505) 265-6631

DRAINAGE AREA NO. 3

RUNOFF HYDROGRAPH COMPUTATION

TIME PERIOD IN HOURS 0.0833

TIME PERIOD	EXCESS	UNITGRAPH	R.O. HYDROGRAPH
1	0.27	3	1
2	0.53	33	11
3	0.20	111	48
4	0.12	203	121
5	0.13	266	206
6	0.09	287	277
7	0.07	273	321
8	0.04	239	337
9	0.04	198	331
10	0.04	158	310
11	0.02	122	279
12	0.02	93	245
13		69	211
14		51	178
15		38	148
16		28	120
17		20	95
18		15	74
19		11	56
20		8	43
21		6	32
22		4	24
23		3	17
24		2	13
25		2	9
26		1	7
27			5
28			3
29			2
30			1
31			1

SUMMATION HYDROGRAPH = 3523.08

VOLUME (ACRE-FEET) = 24.25

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Project: Merchants, Inc. Sheet 12 of 22
Drainage Analysis Job No. 246
By RSF Chk'd JA Date 2/3/81

SUMMATION OF RUNOFF HYDROGRAPHS - OFFSITE

Time Period (5 min)	Hydrograph from Area: (1)	(2)	(3)	Σ (1)+(2)+(3)
	1cfs	2cfs	3cfs	
1				4
2	12	23	11	46
3	52	84	48	184
4	122	172	121	415
5	193	247	206	646
6	244	286	277	807
7	269	293	321	883
8	270	278	337	885
9	255	249	331	835
10	230	215	310	755
11	201	181	279	661
12	173	150	245	568
13	147	123	211	481
14	124	99	178	401
15	103	77	148	328
16	84	59	120	263
17	67	46	95	208
18	52	33	74	159
19	39	24	56	119
20	29	17	43	89
21	21	12	32	65
22	16	8	24	48
23	11	6	17	34
24	8	4	13	25
25	5	2	9	16
26	3	2	7	12
27	2	1	5	8
28	1	1	3	5
29	1		2	3
30			1	1
31			1	1

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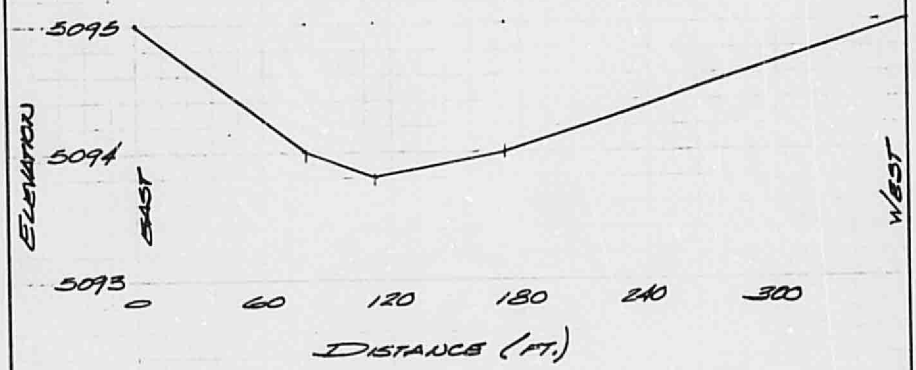
DISCHARGE FOR I-40 OFFRAMP

I-40 OFFRAMP PROFILE



FOR DISCHARGE RATING, USE $Q = CLH^{3/2}$, $C = 2.65$

AREA BETWEEN 5093.8 & 5094 = 9.5 FT^2

AREA BETWEEN 5094 & 5095 = 222 FT^2

$H = 5095 - 5093.8 = 1.2$ FT

ASSUME L = AVERAGE WIDTH = 192 FT.

$Q = CLH^{3/2}$

$Q = 2.65 \times 192 \times 1.2^{3/2} = 668$ CFS

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STORAGE INDICATION CURVE

ELEVATION	CONTENTS	DISCHARGE	S+O/2
5093.000	0.000	0.000	0.000
5093.800	20.000	0.000	2881.150
5094.000	24.000	9.300	3462.030
5095.000	59.000	668.000	8833.390
5096.000	100.000	2000.000	15405.700

RESERVOIR ROUTING

TIME IN HOURS	AVERAGE INFLOW PERIOD	OUTFLOW END OF PERIOD	ELEVATION END OF PERIOD	CONTENTS END OF PERIOD
0.083	4	0	5093.00	0
0.167	46	0	5093.01	0
0.250	184	0	5093.06	2
0.333	415	0	5093.18	5
0.417	646	0	5093.36	9
0.500	807	0	5093.58	15
0.583	883	2	5093.84	21
0.666	885	59	5094.08	27
0.750	835	154	5094.22	32
0.833	755	228	5094.33	36
0.916	661	281	5094.41	38
1.000	568	316	5094.47	40
1.083	481	336	5094.50	41
1.166	401	344	5094.51	42
1.250	328	342	5094.51	42
1.333	263	333	5094.49	41
1.416	208	317	5094.47	40
1.499	159	298	5094.44	39
1.583	119	276	5094.40	38
1.666	89	253	5094.37	37
1.749	65	230	5094.34	36
1.833	48	208	5094.30	35
1.916	34	186	5094.27	33
1.999	25	167	5094.24	32
2.083	16	148	5094.21	31
2.166	12	131	5094.19	30
2.249	8	116	5094.16	30
2.332	5	103	5094.14	29
2.416	3	90	5094.12	28
2.499	1	79	5094.11	28
2.582	1	70	5094.09	27

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EXISTING CONDITIONS - ONSITE

PEAK FLOWS & VOLUMES
(REFER TO MAP NO. 3 FOR DRAINAGE AREA DESIGNATION)

DRAINAGE AREA A

A = AREA = 5.039 AC.
H = ELEV. DIFFERENCE = 5.5 FT
L = LENGTH OF DRAINAGE AREA = 530 FT
C = COEFFICIENT OF RUNOFF = 0.40
TC = TIME OF CONCENTRATION = 5.5 MIN < 10 USE 10
I = INTENSITY = 5.4 IN/HR

$Q_{100} = CIA = 0.4 \times 5.4 \times 5.039 = \underline{10.88 \text{ CFS}}$

$V = 0.4 \times 2.3 \times 1/12 \times 5.039 = \underline{0.386 \text{ AC-FT}}$

DRAINAGE AREA B

A = 4.960 AC
H = 4 FT
L = 442 FT
C = 0.40
TC = 4.8 MINS < 10 USE 10 MINS
I = 5.4 IN/HR.

$Q_{100} = CIA = 0.40 \times 5.4 \times 4.960 = \underline{10.71 \text{ CFS}}$

$V = 0.4 \times 2.3 \times 1/12 \times 4.960 = \underline{0.380 \text{ AC-FT}}$

SUMMARY - EXISTING CONDITIONS

DRAINAGE AREA	Q_{100} (CFS)	VOL (AC-FT)
A	10.88	0.386
B	10.71	0.380
TOTAL	21.59	0.766

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DEVELOPED CONDITIONS - ONSITE

PEAK FLOWS & VOLUMES
(REFER TO MAP NO. 4 FOR DRAINAGE AREA DESIGNATION)

DRAINAGE AREA A-1

TOTAL AREA = 4.339 ACRES

ROOF AREA = 0.558 AC.
PAVED AREA = 3.491 AC.
OPEN AREA = 0.290 AC.

$$C_{combined} = \frac{0.558 \times .875 + 3.491 \times 0.92 + 0.290 \times 0.40}{4.339}$$

$$= 0.879$$

$H = 3.27$ FT

$L = 825$ FT

$TC = 2.5$ mins < 10 USE 10 mins

$I = 5.4$ in/hr

$Q_{100} = CIA = 0.879 \times 5.4 \times 4.339 = \underline{20.60 \text{ CFS}}$

$V = 0.879 \times 2.3 \times 1/12 \times 4.339 = \underline{0.731 \text{ AC-FT}}$

DRAINAGE AREA A-2

A = 0.700 ACRES
H = 3 FT
L = 430 FT
C = 0.40
TC = 5.2 MINS < 10 USE 10 MINS.
I = 5.4 IN/HR

Q_{100} = C I A = 0.4 × 5.4 × 0.700 = 1.51 CFS
V = 0.4 × 2.3 × 1/12 × 0.700 = 0.054 AC-FT

DRAINAGE AREA B

SAME AS EXISTING CONDITIONS
SEE SHEET —

SUMMARY DEVELOPED CONDITIONS

DRAINAGE AREA	Q_{100} (CFS)	V (AC-FT)
A-1	20.60	0.731
A-2	1.51	0.054
B	10.71	0.380
TOTAL	32.82	1.165

REQUIRED POND VOLUME = 1.165 - 0.766 = 0.399 AC-FT
= 17,380 FT³

DETERMINATION OF POND VOLUME

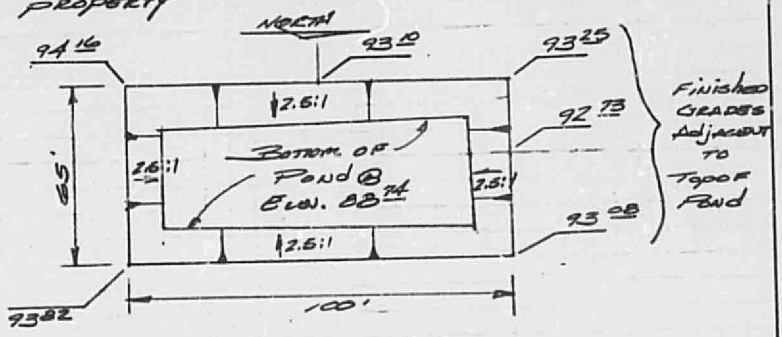
THE VOLUME OF THE POND WAS DETERMINED by the PRISMOIDAL FORMULA:

$$V = \frac{h}{6}(A_1 + 4A_m + A_2)$$

WHERE h = depth of POND
A_1 = TOP AREA OF POND
A_2 = bottom AREA OF POND
A_m = middle AREA OF POND

POND A-1

POND A-1 is LOCATED within DRAINAGE AREA A-1, in the SOUTHEAST CORNER OF THE SUBJECT PROPERTY



PLAN - POND A-1

AREA @ ELEV 92.73 = A_1 = 95.76 × 60.76 = 5818.38 FT²

AREA @ ELEV 88.74 = A_2 = 75.81 × 40.81 = 3094.10 FT²

AREA @ ELEV 90.74 = A_m = 85.81 × 50.91 = 4368.59 FT²

$h = 92.73 - 88.74 = 3.99$ FT

Volume of Pond A-1 $= \frac{3.99}{6}(5818.38 + 4 \times 4368.59 + 3074.10)$

$= \underline{\underline{17,547.24 \text{ FT}^3}}$

TOTAL REQUIRED POND VOLUME = 17380 FT³ (see sh –) OK

IN the developed condition, the onsite DRAINAGE AREA A-1 will generate RUNOFF THAT will detained by Pond A-1. THEREFORE in the event of a 100 year storm THE TOTAL VOLUME OF ONSITE RUNOFF DIRECTED TO Pond A-1 is 0.731 AC·FT (31,842 FT³).

THEREFORE Pond A-1 will be built with AN OVERFLOW spillway. The OVERFLOW spillway will be designed to DISCHARGE THE PEAK RATE OF RUNOFF GENERATED FROM DRAINAGE AREA A-1

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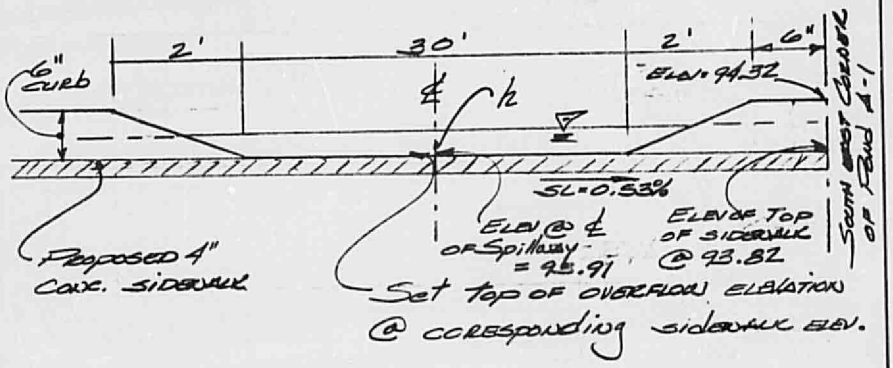
FOR A 100 YEAR STORM, which is 20.60 cfs (see sheet —)

DETERMINATION OF DEPTH OF FLOW OVER OVERFLOW



$Q = cLh^{3/2}$ where $Q = 20.6$ cfs

$L = 30'$

$c = 3.087$

$$h^{3/2} = \frac{Q}{cL}$$

$$= \frac{20.6}{3.087 \times 30} = 0.222$$

$h = 0.365$ ft OK

Maximum Pool Elev. in Pond A-1 = 95.91 + .365
= 94.275 OK

REVISED 3/26/81

ANDREWS, ASBURY & ROBERT, INC. CONSULTING ENGINEERS 401 San Pedro, NE., Albuquerque, N.M. 87108 Telephone (505) 265-6631	Project MERCHANTS, INC. Sheet 21 of 22 DRAINAGE ANALYSIS Job No. 246 By RSF Chk'd JA Date 2/5/81

The pond shall be built with a positive discharge equal to the peak rate generated from Drainage Area A-1 in the undeveloped state for a 5-year storm:

$Q_5 = C I_5 A$ $A = 4.339$ ac (see sk.)

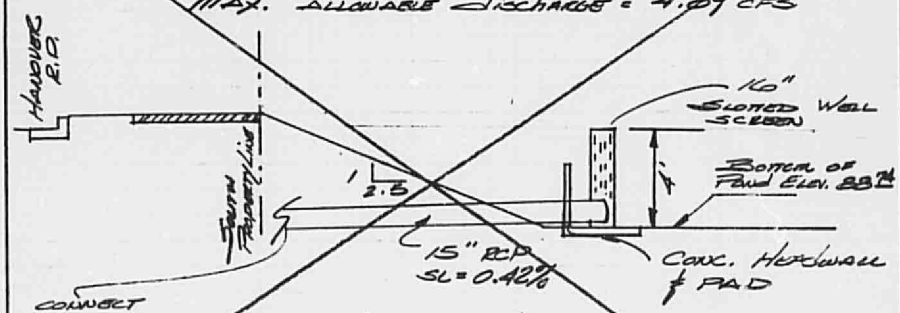
$C = 0.40$

$I_5 = 2.82$ in/hr

$Q_5 = .4 \times 2.82 \times 4.339 = \underline{4.89 \text{ cfs}}$

Discharge thru Drain Pipe

Max. allowable discharge = 4.89 cfs



Connect 15" RCP to New Storm Sewer System in Handover

See Map No 4 for Section

$Q = C a \sqrt{2gh}$ where: $Q = 4.89$ cfs

$C = 0.60$

$h = 4/2 = 2$ ft

REVISED FINAL ATTACHMENT #1

REVISED 3/26/81

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Project MERCHANTS, INC Sheet 22 of 22
DRAINAGE ANALYSIS Job No. 246
By RSF Chk'd JA Date 2/3/81

$$a = \frac{Q}{c\sqrt{2gh}}$$

$$= \frac{4.89}{0.6\sqrt{2g \times 2}} = 0.718 \text{ FT}^2$$

$$= 103.4 \text{ in}^2$$

THEREFORE NET OPEN AREA OF SLOTTED WELL SCREEN = 103.4 in²

PROVIDE WELL SCREEN WITH 25.8 in² OF OPEN AREA PER FOOT.

REVISED 1/91

CAPACITY OF 15" RCP FLOWING FULL.

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

$n = 0.013$
$A = 1.227 \text{ FT}^2$
$p = 3.927 \text{ FT}$
$R = 0.3125 \text{ FT}$
$S = 0.0042 \text{ FT/FT}$

$$Q = \frac{1.486}{.013}(0.3125)^{2/3}(0.0042)^{1/2} \times 1.227$$

$$= 4.17 \text{ CFS} < 4.89 \text{ CFS max.}$$

(See sh —)

OK

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MERCHANTS INC.

DRAINAGE REPORT

SUPPLEMENT #1

It is required to drain pond A-1 in 24 hr. Therefore, assume riser pipe in pond has a net open area of 32 in², space so as to provide a linear relationship between open area and height. Also assume that the volume of Pond A-1 varies linearly with the depth. The orifice equation ($Q = CA\sqrt{2gh}$) is utilized to determine the discharge for each one-half foot increment of pond depth. The table on the following sheet represents the calculations preform to determine the release time of the ponded storm water.

($C = 0.60$ for orifice equation)

INTERVAL	A_o (FT²)	h_o (FT)	Q (CFS)	VOL. (FT³)	Time (MIN.)
4.0' to 3.5'	0.208	1.875	1.374	2789.34	33.84
3.5' to 3.0'	0.181	1.625	1.108	2619.08	39.39
3.0' to 2.5'	0.153	1.375	0.863	2448.81	47.31
2.5' to 2.0'	0.125	1.125	0.638	2278.54	59.49
2.0' to 1.5'	0.097	0.875	0.438	2108.27	80.24
1.5' to 1.0'	0.069	0.625	0.264	1938.00	122.19
1.0' to 0.5'	0.042	0.375	0.123	1767.73	239.81
0.5' to 0'	0.014	0.250	0.033	1597.46	796.24

TOTAL = 1418.51 MINS
= 23.64 hr.

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Project: MERCHANTS INC. SUPPLEMENT #1
Sheet 3 of 25
By: ZF
Chk'd: JSC
Job No. 2460
Date 3/23/81

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∴ PROVIDE 16" CORRUGATED METAL PIPE FOR RISER to drain POND A-1. CUT 32 SLOTS IN RISER PIPE, EACH SLOT 1/4" wide x 4" long uniformly SPACED THROUGH OUT LENGTH OF RISER.

The following 14 sheets REPRESENT CROSS SECTIONS for THAT PORTION OF THE PROJECT THAT WILL BE IMPROVED. STA 0+00 is LOCATED ON THE SOUTH PROPERTY LINE of the project AND PROCEEDS NORTH.

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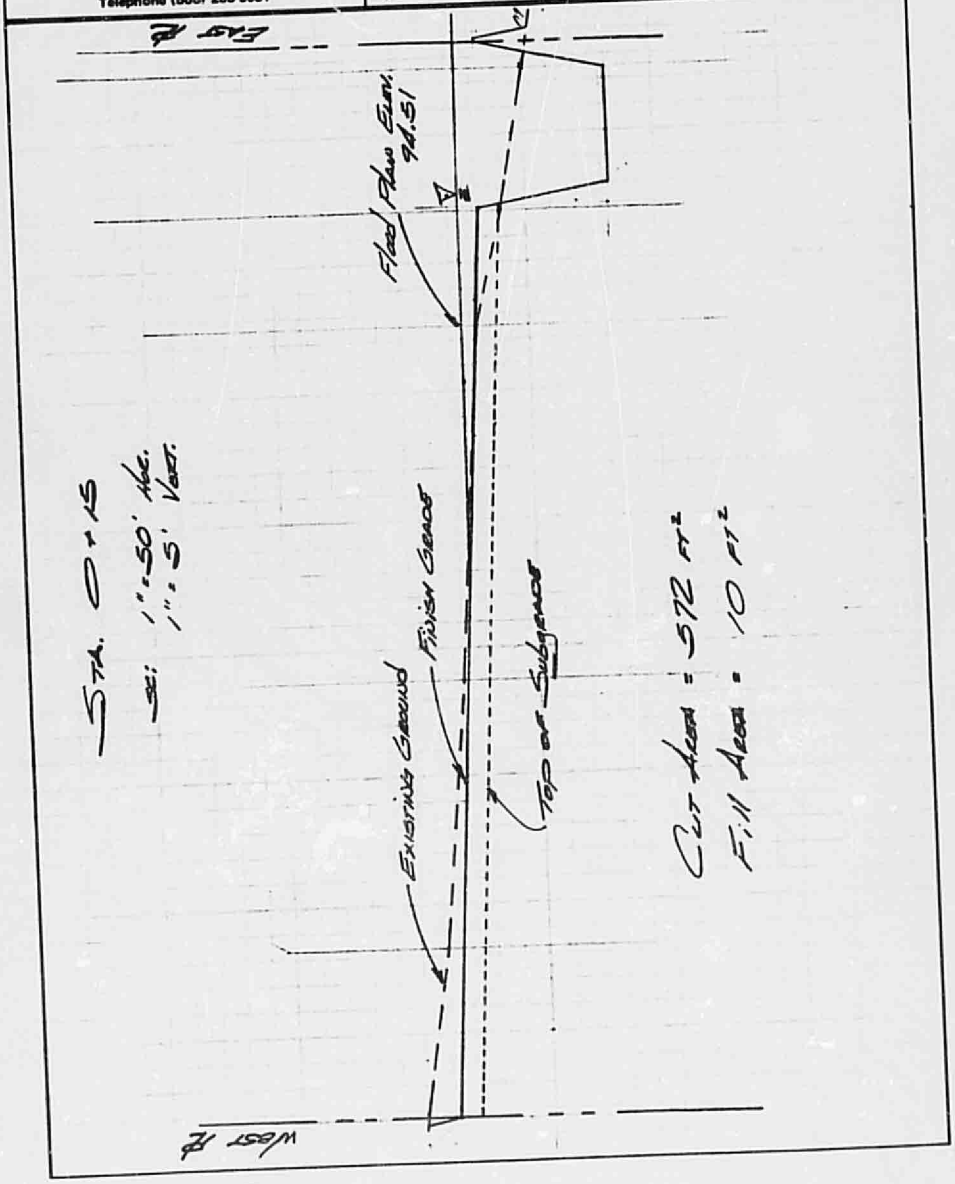
Project: MERCHANTS INC. SUPPLEMENT #1 | Sheet 5 of 25 | Job No. 246
By: RF | Chk'd: JBK | Date: 3/26/81



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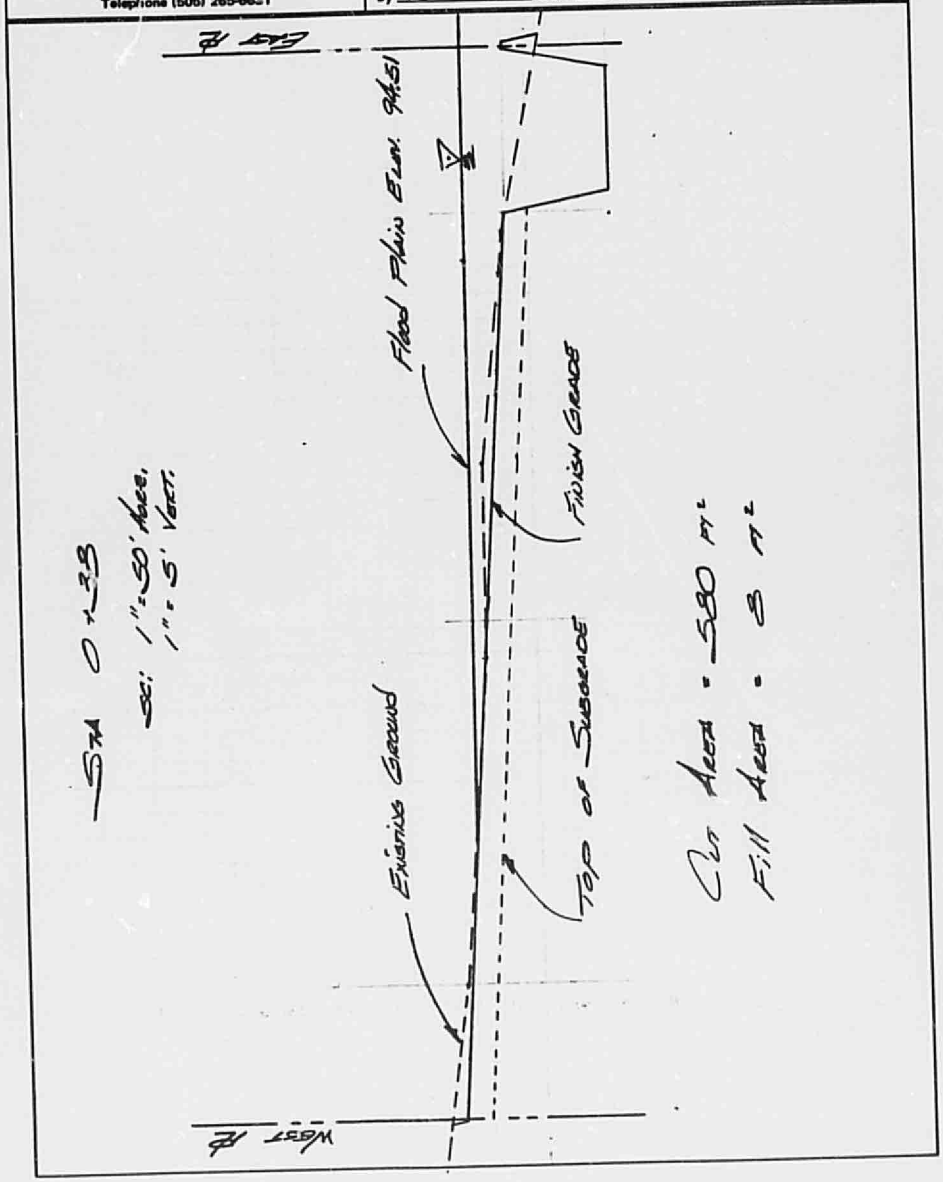
Project MERCHANTS INC. Sheet 6 of 25
SUPPLEMENT #1 Job No. 246
By RF Chk'd JBR Date 3/26/81



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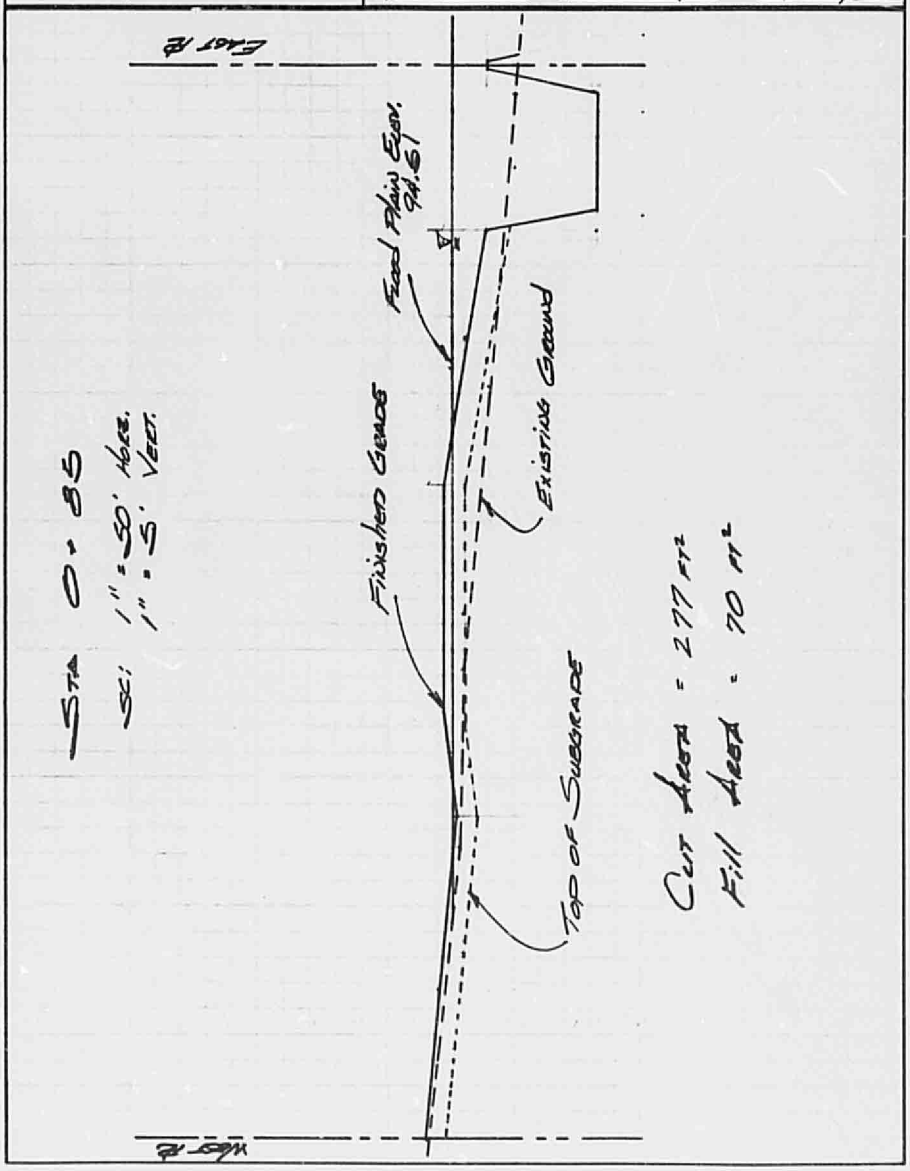

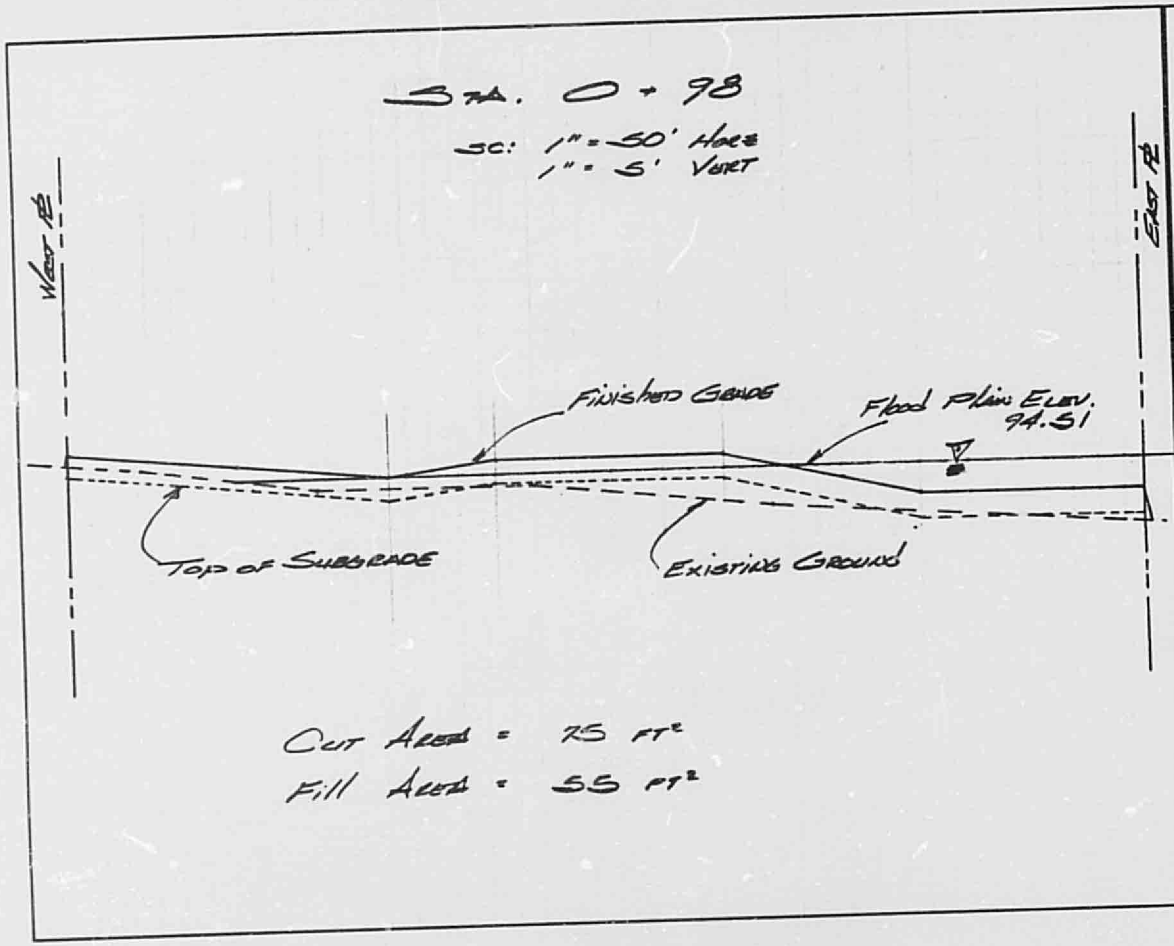

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Project Merchants Inc. Sheet 8 of 25
Subdivision #1 Job No. 246
By RF Chk'd JBR Date 3/26/81

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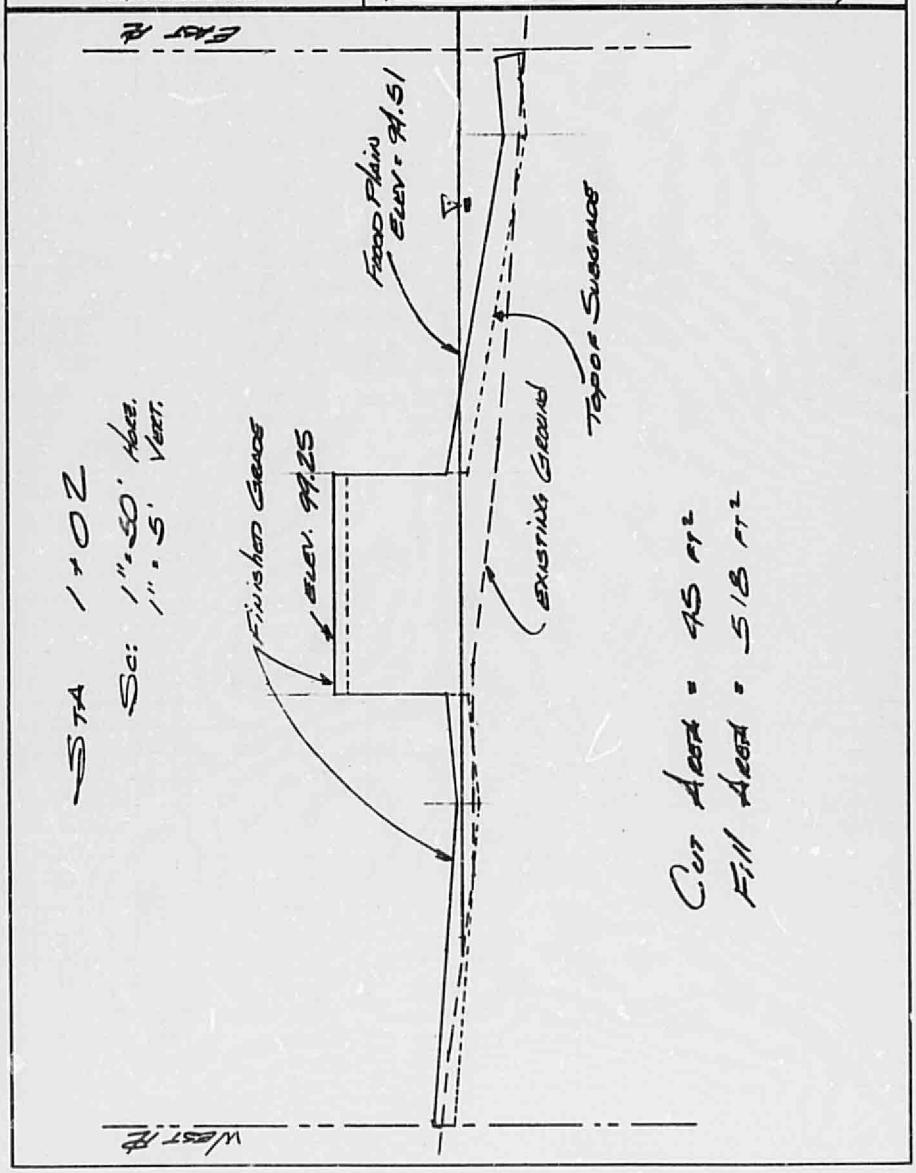

STA 1+02

Sc: 1" = 50' Horz.
1" = 5' Vert.

Cut Area = 45 ft²
Fill Area = 518 ft²

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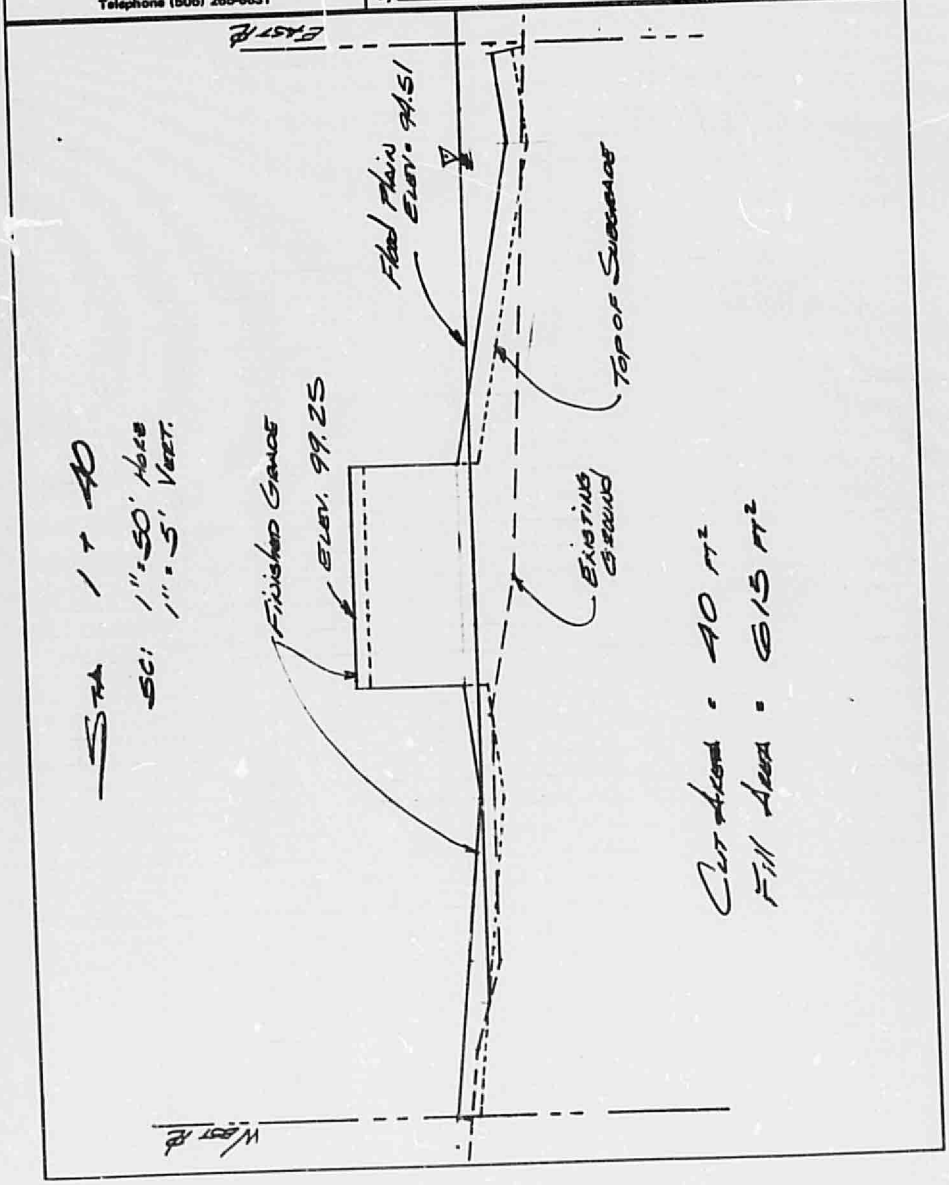
Project: MERCHANTS INC. Sheet 10 of 25
SUPPLEMENT #1 Job No. 246
By RF Chk'd JBK Date 3/26/81



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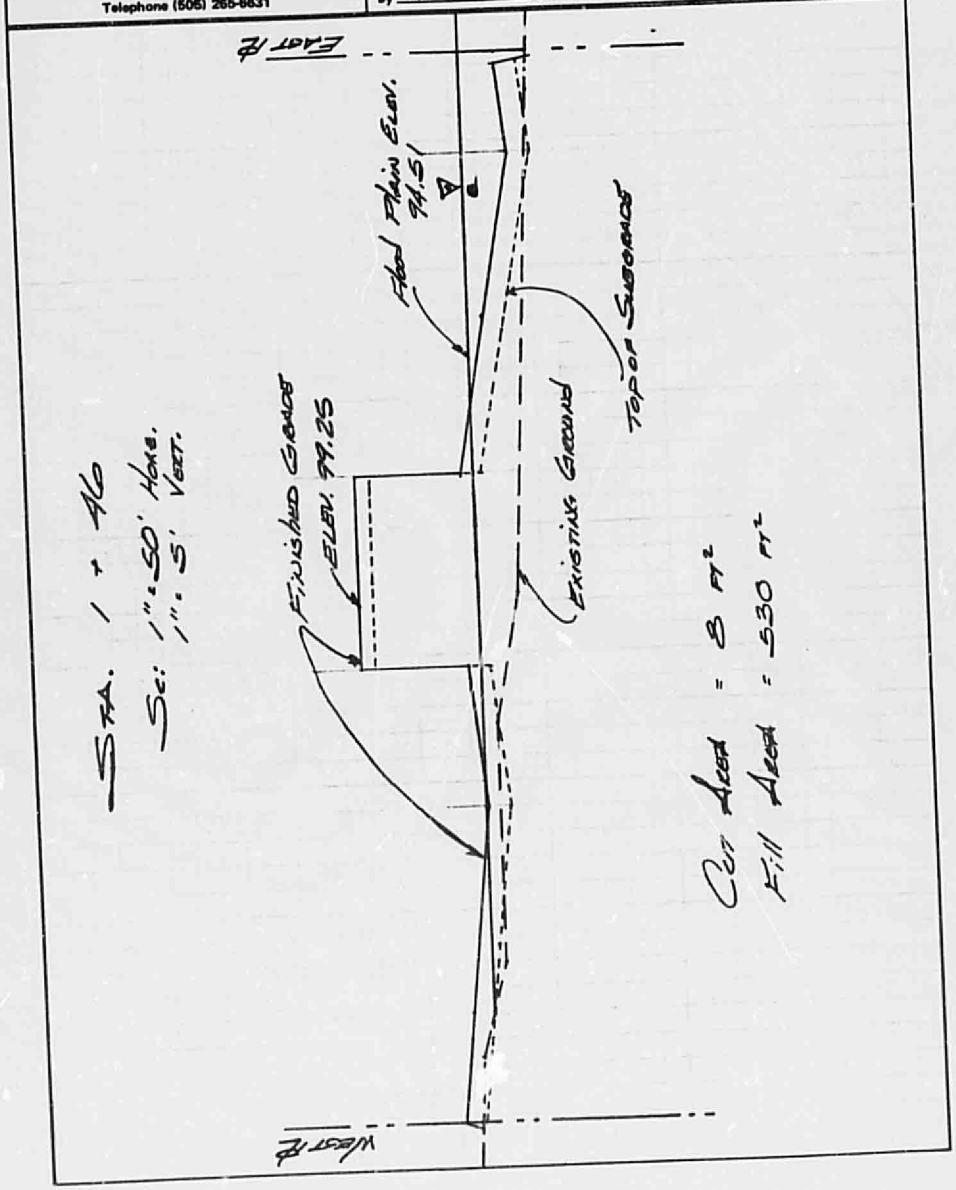
Project MERCHANTS INC. Sheet 11 of 25
SUPPLEMENT #1 Job No. 246
By RF Chk'd JBR Date 3/26/81



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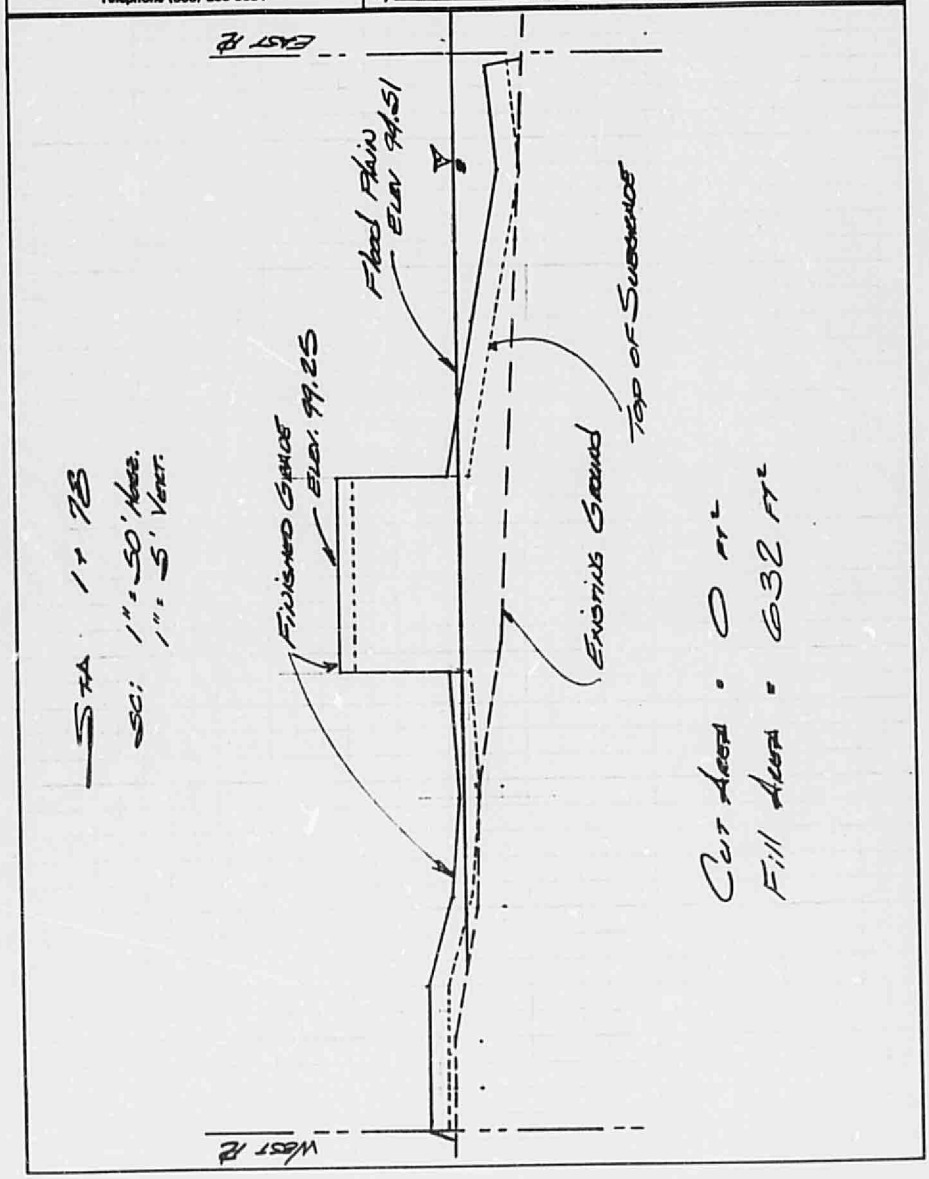

STA 1+73

SC: 1" = 50' HORZ.
1" = 5' VERT.

CUT AREA = 0 FT²

FILL AREA = 632 FT²

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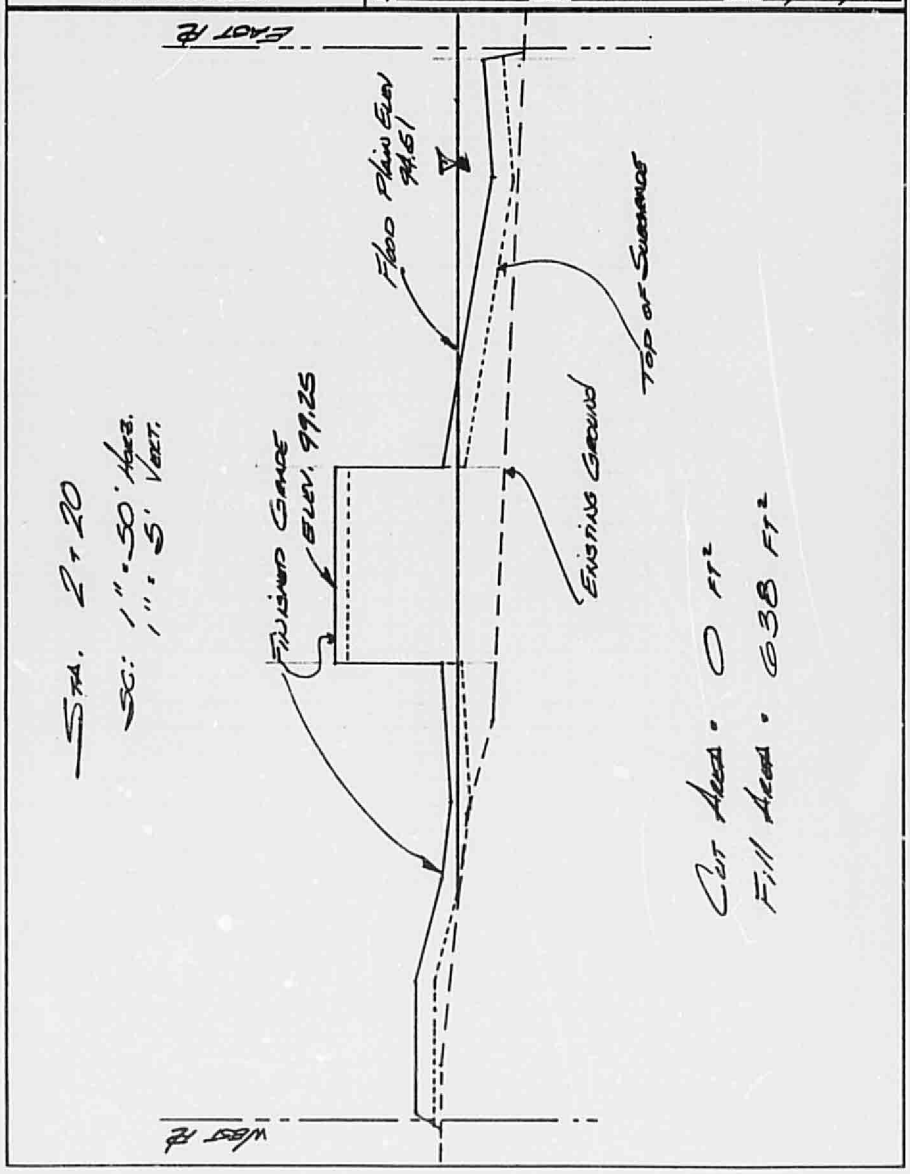

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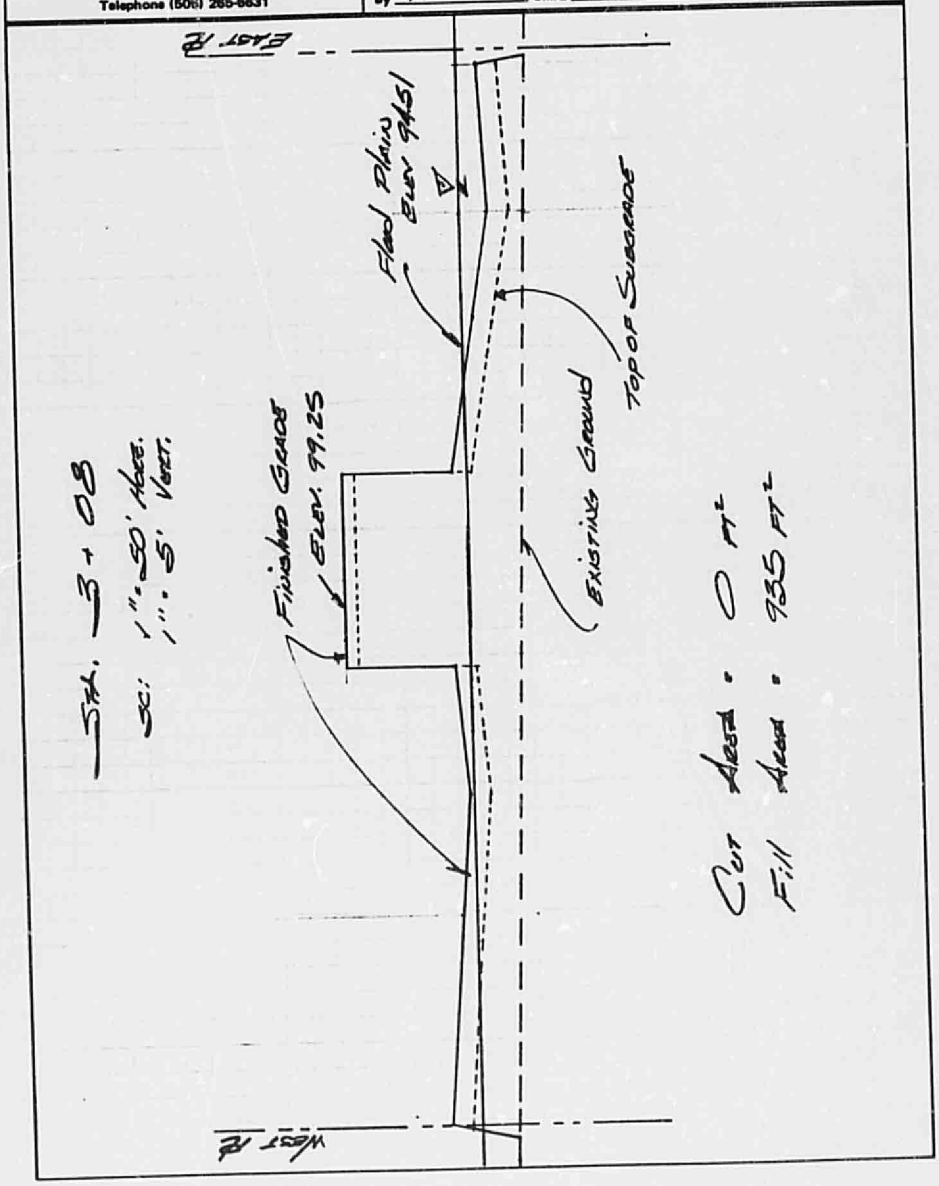
Project MERCHANTS, INC. Sheet 14 of 25
SUPPLEMENT #1 Job No. 246
By RF Chk'd JBL Date 3/26/81



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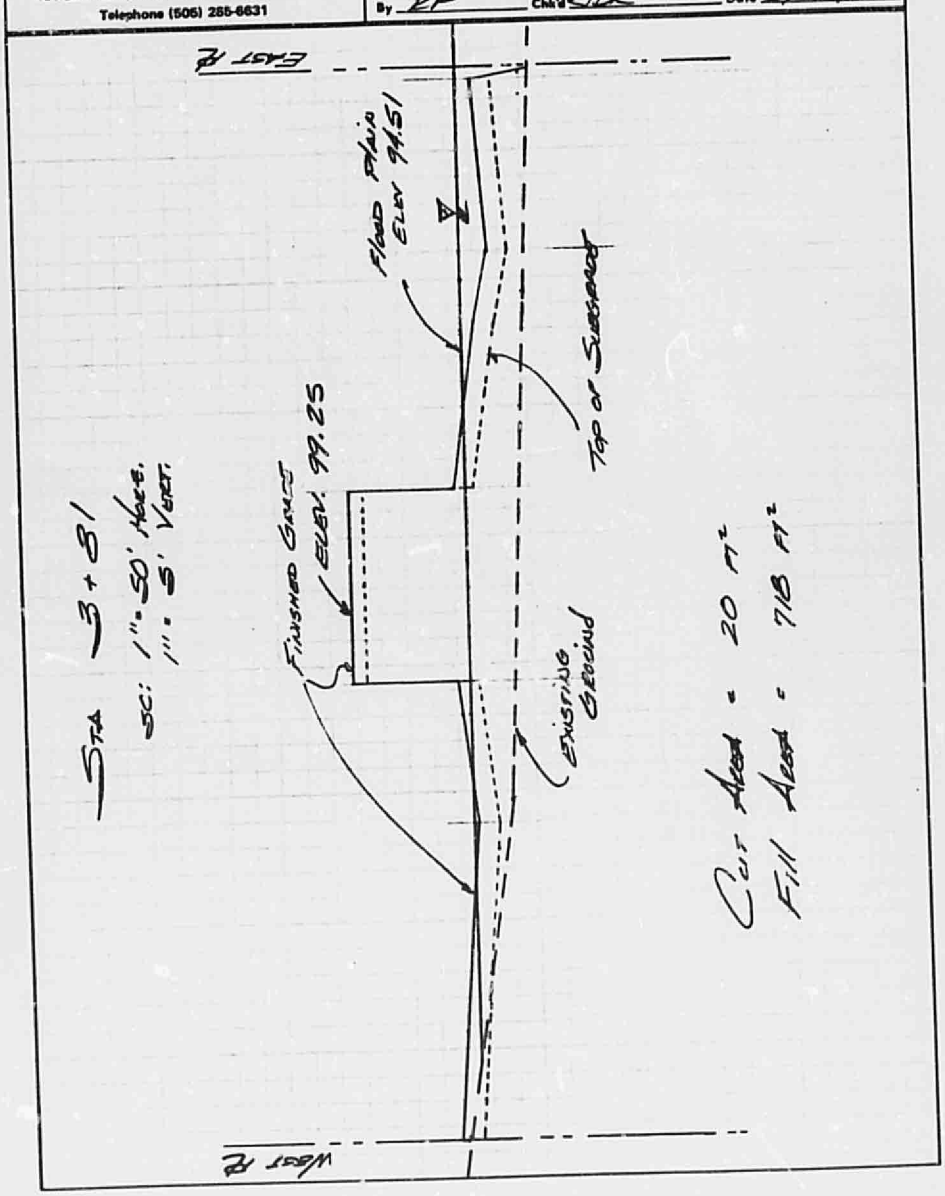
Project: MERCHANTS INC. Supplement #1
Sheet 15 of 25
Job No. 246
By: RF Chk'd: JBK
Date: 3/26/81



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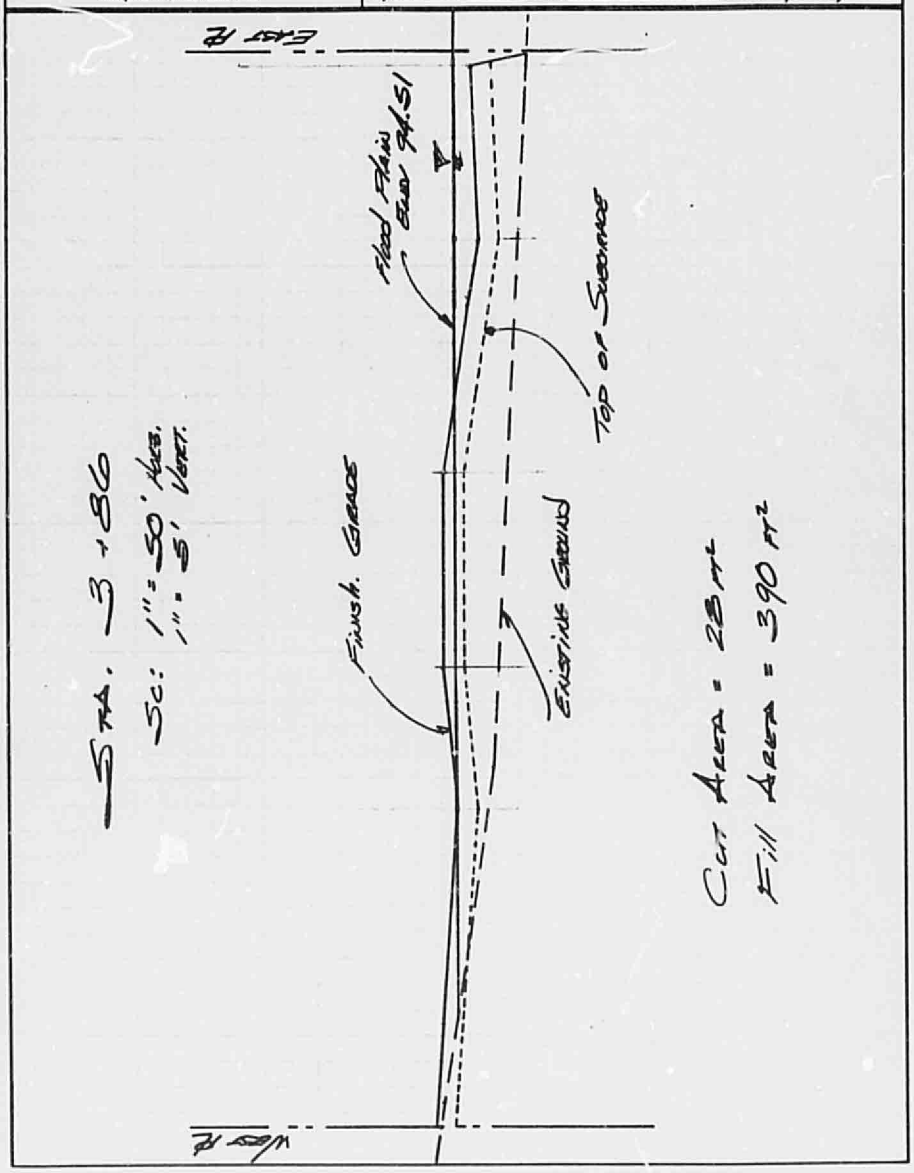
	By RF Chk'd JBR	Job No. 246 Date 3/26/81



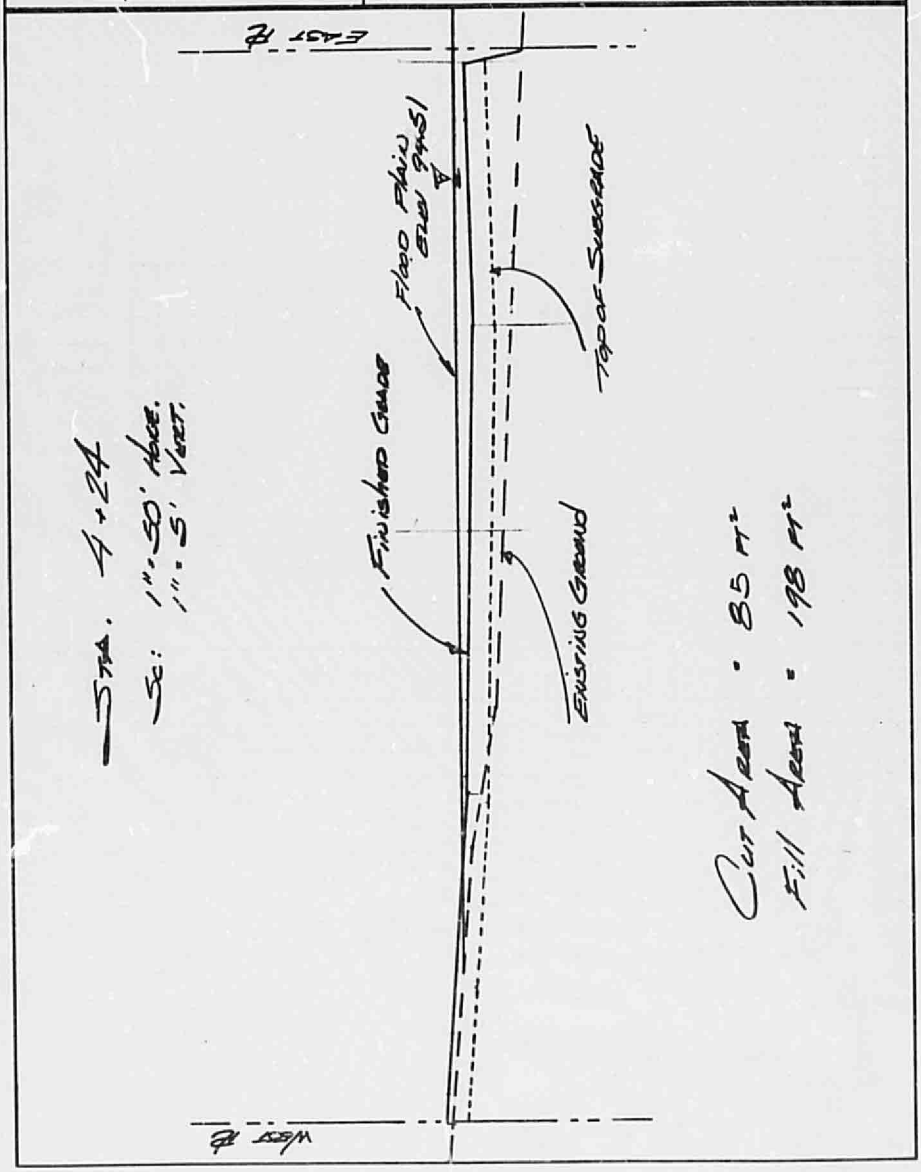
STA. 3+86

SC: 1" = 50' HORZ.
1" = 5' VERT.

CUT AREA = 28 m²

FILL AREA = 390 m²

ANDREWS, ASBURY & ROBERT, INC. CONSULTING ENGINEERS 401 San Pedro, NE., Albuquerque, N.M. 87108 Telephone (505) 265-6631	Project MERCHANTS INC. Sheet 17 of 25 SUPPLEMENT #1 Job No. 246 By RF Chk'd JBR Date 3/26/81



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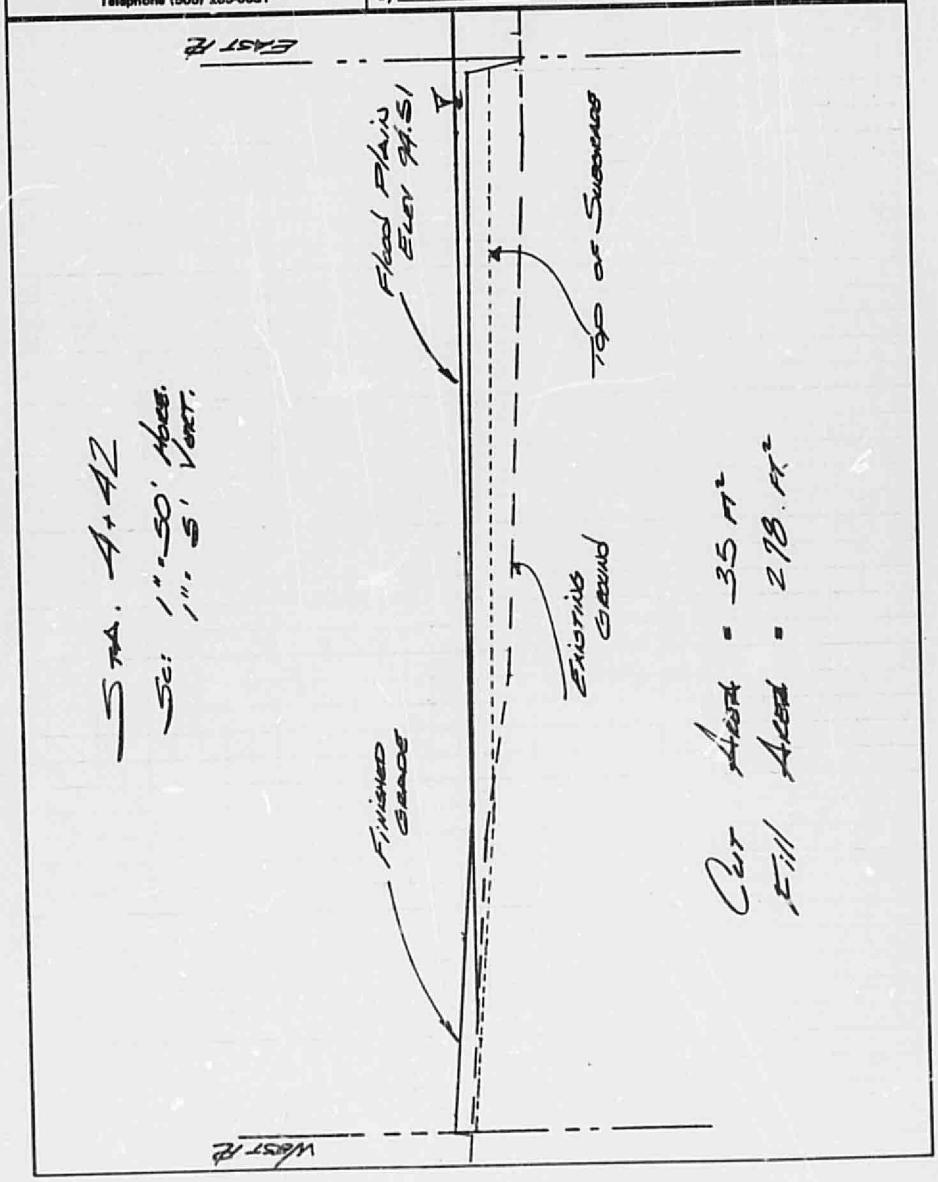
Project: MERCHANTS INC. SUPPLEMENT #1 | Sheet 18 of 25 | Job No. 246
By: RF | Chk'd: JBE | Date: 3/26/81



EARTHWORK COMPUTATION SHEET

ANDREWS, ASBURY & ROBERT, INC.
CONSULTING ENGINEERS
San Pedro, NE., Albuquerque, N.M. 87108

Project: MERCHANTS INC. SUPPLEMENT #1 Sheet 19 of 25
Job No. 246
By: RF Ck'd: JBR Date: 3/26/81

STATION	END AREA (Square Feet) CUT	END AREA (Square Feet) FILL	AVERAGE END AREA (Square Feet) CUT	AVERAGE END AREA (Square Feet) FILL	DISTANCE (Feet)	VOLUME (Cubic Yards) CUT	VOLUME (Cubic Yards) FILL
0+00	0	0					
			286	5	15	158	3
0+15	572	10					
			576	9	23	491	8
0+38	580	8					
			428	39	47	746	68
0+85	277	70					
			176	63	13	85	30
0+98	75	55					
			60	287	4	9	42
1+02	45	518					
			43	567	38	60	797
1+40	40	615					
			24	573	6	5	127
1+46	8	530					
			4	531	32	5	689
1+78	0	632					
			0	635	42	0	988
2+20	0	638					
			0	786	88	0	2563
3+08	0	935					
			10	826	73	27	2235
3+81	20	718					
			24	554	5	4	103
3+86	28	390					
			57	294	38	80	414
4+24	85	198					
			60	238	18	40	159
4+42	35	278					
			18	139	8	5	41
4+50	0	0					
				TOTAL		1715	8267

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ASSUME 20% SHRINKAGE FACTOR

$\therefore$ REQUIRED FILL VOL = $\frac{8267}{0.80}$ = 10334 yd^3

AVAILABLE CUT VOL. = 1715 yd^3

EXCESS FILL VOL = 8619 yd^3

A BORROW AREA NORTH OF THE AREA TO BE DEVELOPED WILL BE DESIGNATED AS A SOURCE FOR FILL MATERIAL (SEE ATTACHED MAP Nº4, REVISED MAR. 26, 1981). THE FOLLOWING 4 SHEETS REPRESENT CROSS-SECTIONS FOR THE BORROW AREA, LOCATIONS OF WHICH ARE SHOWN ON MAP Nº4.

HYDROLOGY J11/D10 2 of 2 5 PLANS

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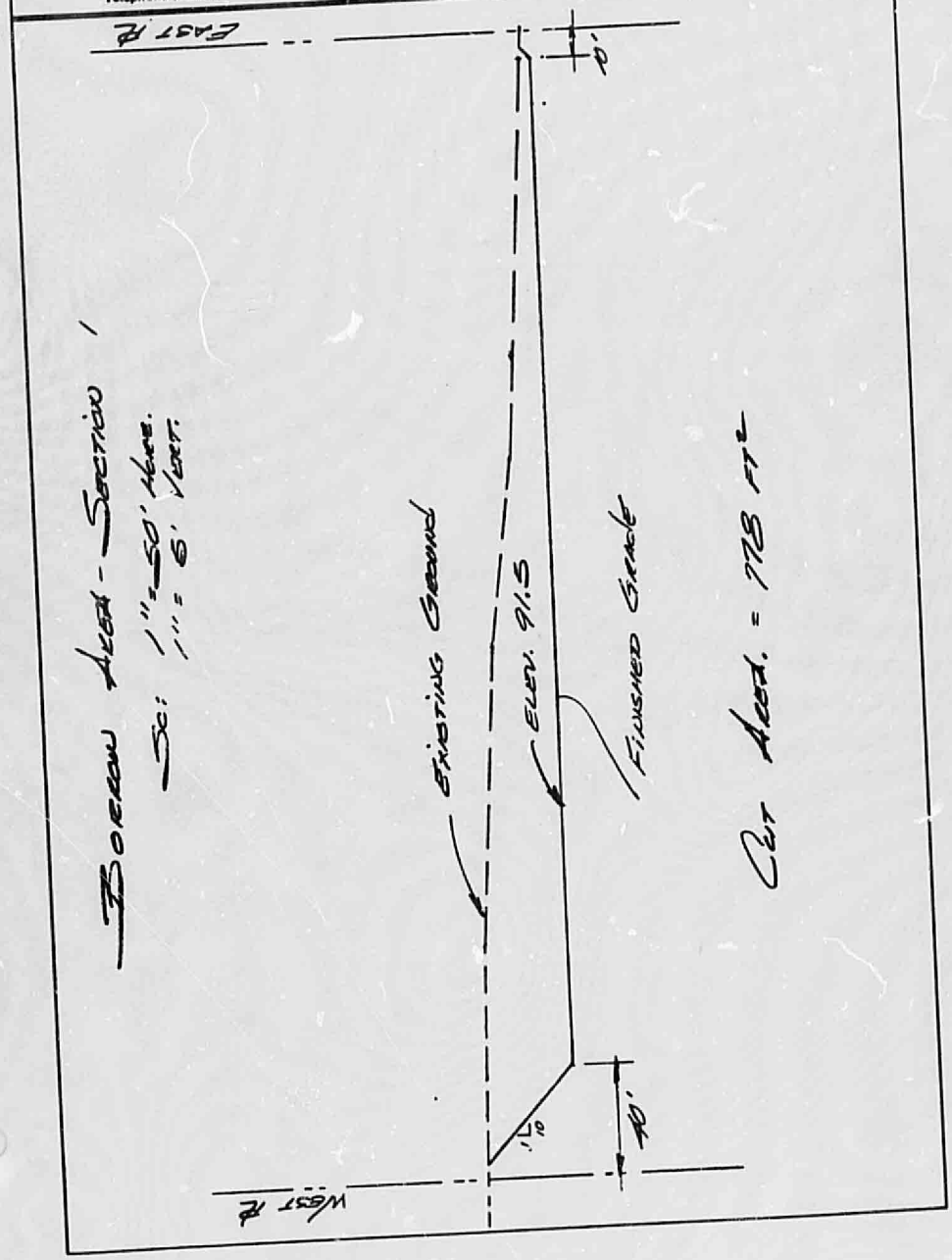
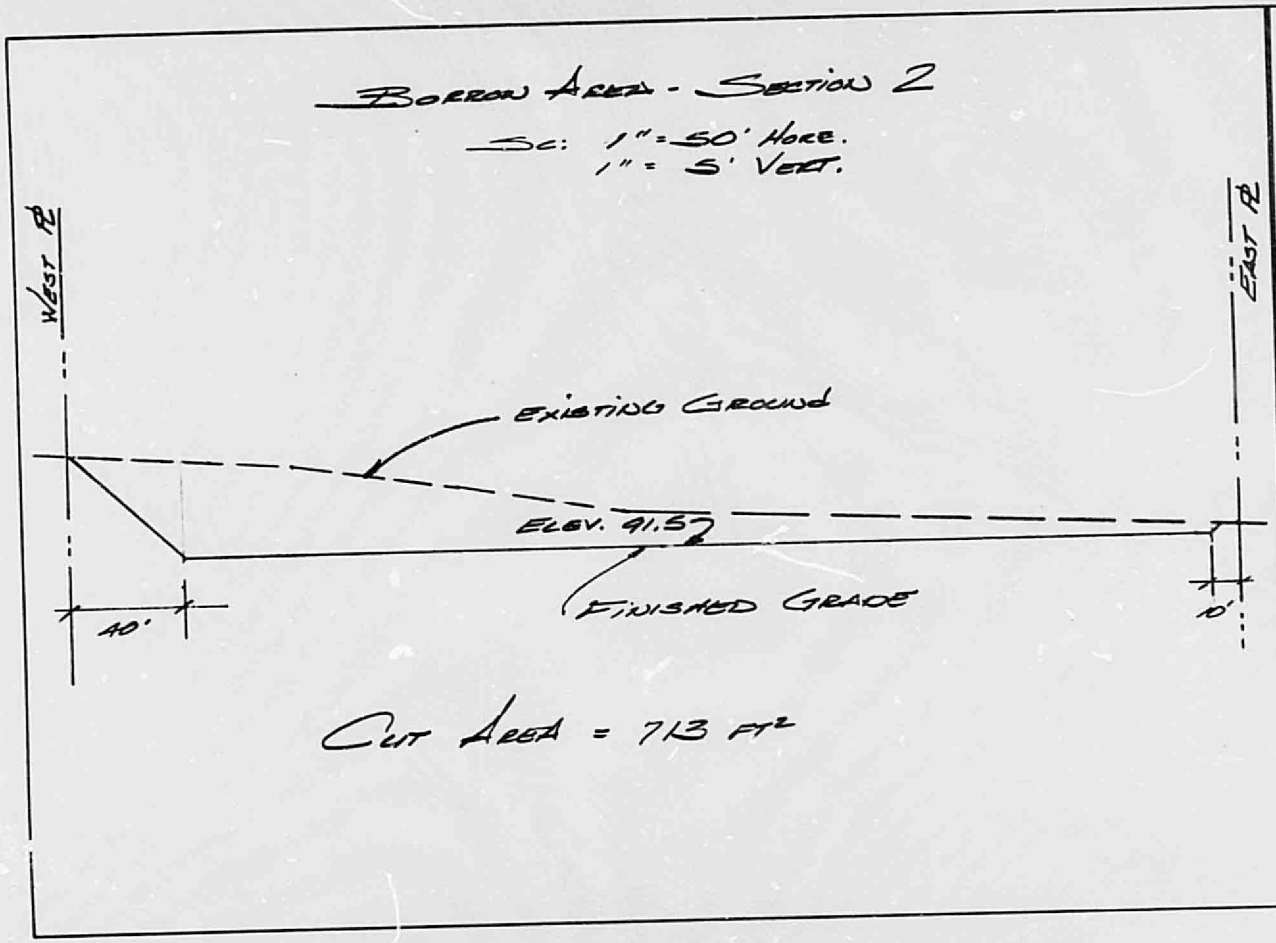
Project: MERCHANTS INC. SUPPLEMENT #1 | Sheet 21 of 25 | Job No. 246 | By RF | Chk'd JBR | Date 3/26/81





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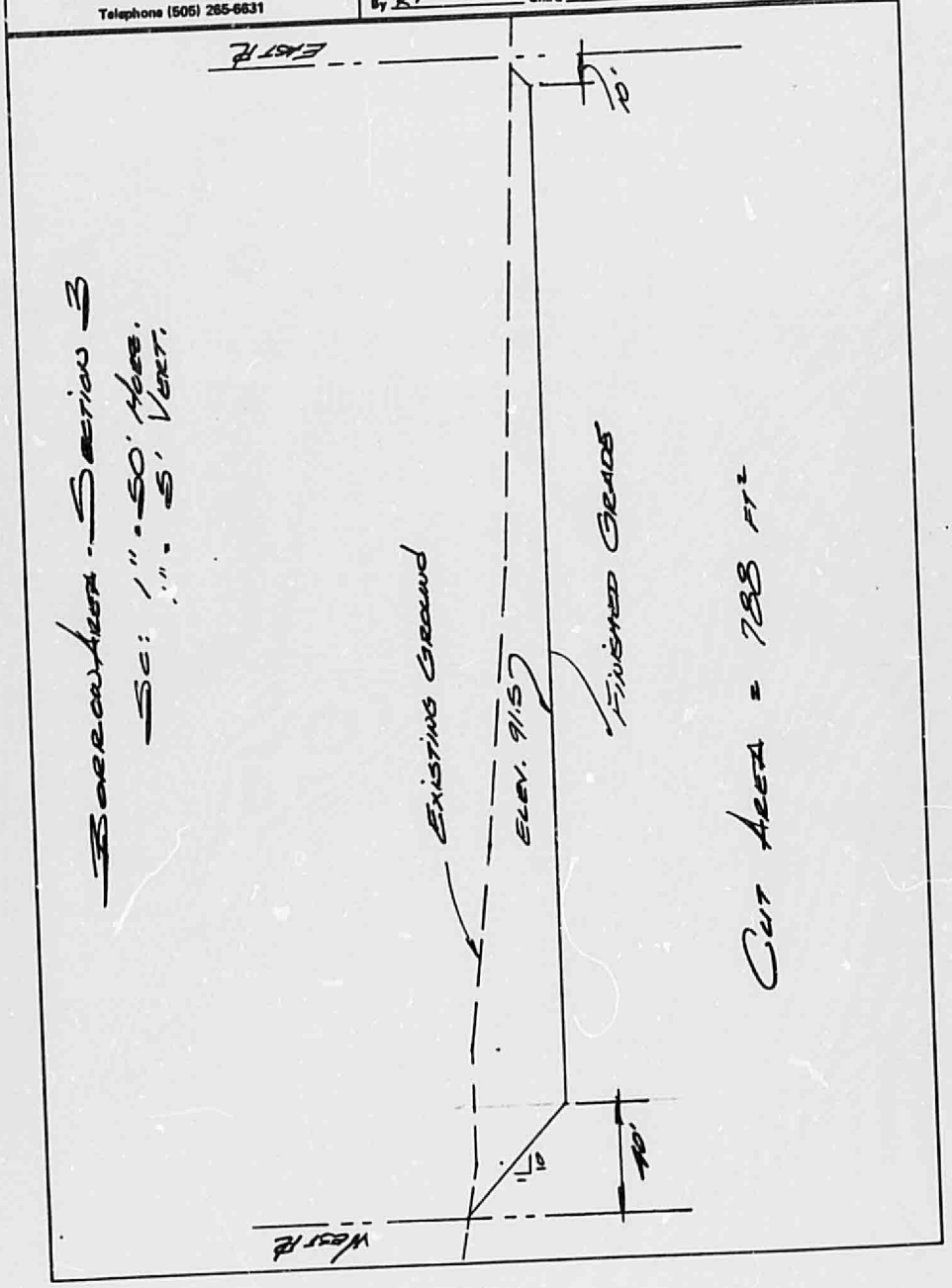
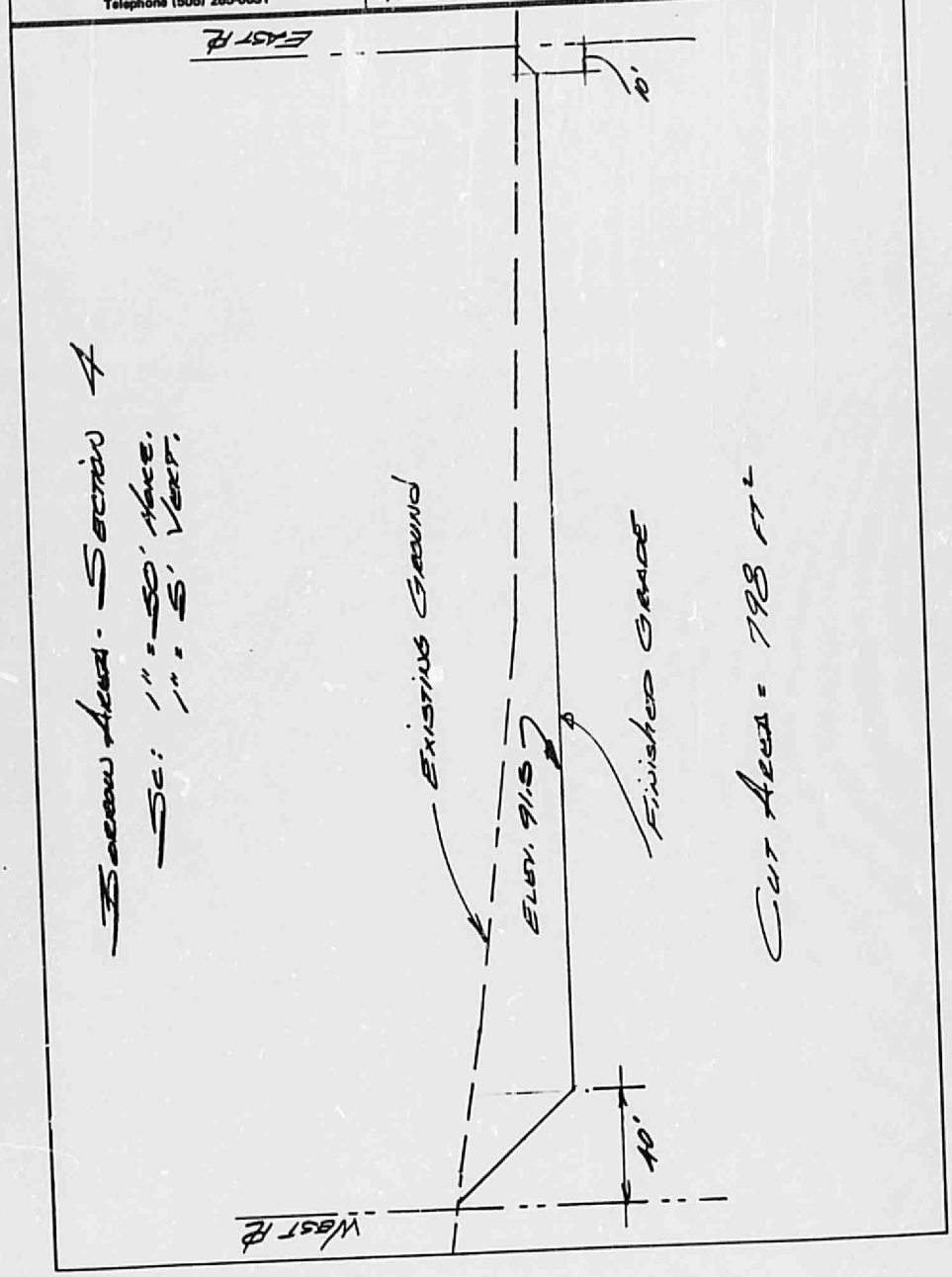
Project MERCHANTS INC. Sheet 22 of 25
SUPPLEMENT #1 Job No. 246
By RF Ck'd JBR Date 3/26/81

ANDREWS, ASBURY & ROBERT, INC. CONSULTING ENGINEERS 401 San Pedro, NE., Albuquerque, N.M. 87108 Telephone (505) 265-6631	Project MERCHANTS TAX. Supplement #1 Sheet 23 of 25 Job No. 246 By RF Chk'd JBR Date 3/26/81



ANDREWS, ASBURY & ROBERT, INC.
CONSULTING ENGINEERS
401 San Pedro, NE., Albuquerque, N.M. 87108
Telephone (505) 265-6631

Project MERCHANTS INC Sheet 24 of 25
Supplement #1 Job No. 246
By RF Chk'd JBR Date 3/26/81



EARTHWORK COMPUTATION SHEET

ANDREWS, ASBURY & ROBERT, INC.
CONSULTING ENGINEERS
401 [illegible] Pedro, NE., Albuquerque, N.M. 87108

Project: MERCHANTS INC. SUPPLEMENT #1 Sheet 25 of 25
Job No. 246
By RF Ch'd JBR Date 3/26/81

STATION	END AREA (Square Feet) CUT	END AREA (Square Feet) FILL	AVERAGE END AREA (Square Feet) CUT	AVERAGE END AREA (Square Feet) FILL	DISTANCE (Feet)	VOLUME (Cubic Yards) CUT	VOLUME (Cubic Yards) FILL
1	778	0					
			746	0	100	2763	0
2	713	0					
			751	0	100	2781	0
3	788	0					
			793	0	100	2937	0
4	798	0					
			TOTAL			8481	0

SMEAD–HASTINGS, MN.
NO. 119BE