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DRAINAGE PLAN AND

SUPPORTING CALCULATIONS

CHELSEA BROOKE ADDITION
WICHITA, SEDGWICK COUNTY, KS

APRIL 16, 1985

PREPARED BY:

PROFESSIONAL ENGINEERING CONSULTANTS, P.A.
WICHITA, KS

1440 EAST ENGLISH
WICHITA, KANSAS 67211
(316) 262-2691

PREFACE

This report has been prepared as partial fulfillment of the requirements of the platting of Chelsea Brooke Addition in Wichita, Sedgwick County, Kansas, to be approved by a representative of the City Engineer's Office.

This report is a general plan only, outlining the general method but not the specific details of handling drainage on the site. It is based on the best information available at this time.

This report has been subdivided into five parts as follows:

A. Hydrograph Development for D.A. No. 1 (Beech Property)

B. Analysis of Beech Radar Site Detention Facility

C. Analysis of Detention Facility Adjacent to Plat

D. Internal Drainage Computations

E. Appendix

June 4, 1985

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Mike Lindebak, City Engineer
7th Floor - City Hall
455 North Main
Wichita, Kansas 67202

Reference: Chelsea Brooke Addition
Revised Drainage Plan
PEC File No: 36-84019-2-177

Dear Mr. Lindebak:

Attached is a revised copy of the drainage plan for the above-referenced addition. The plan has been revised to delete the proposed detention basin at the south edge of the Beech property.

Beech representatives have indicated that they intend to proceed with the design and construction of an alternate detention system, for the 138 acre drainage basin, which will limit the peak discharge into the Chelsea Brooke Addition.

The revised plan proposes an intercept channel along the north side of Chelsea Brooke Addition to collect the drainage from the Beech property. The developers of Chelsea Brooke Addition will be required to construct the intercept channel and storm sewer outfall system. The drainage plan also proposes to impose a "temporary" drainage easement along the west and south sides of the addition which is to expire upon completion of the Beech detention system.

We will appreciate your early review and approval of this plan so we can proceed to schedule the final plat on the Subdivision Committee Agenda. If additional information is desired, please advise.

Very truly yours,

PROFESSIONAL ENGINEERING CONSULTANTS, P.A.

Richard W. Linn, P.E.
Project Manager
Land Development

enclosure

xc: Jeff Greenberg
Jim Beckett

RWL/mkm

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April 16, 1985

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Mr. Michael E. Lindebak, P.E.
City Engineer
7th. Floor - City Hall
455 N. Main
Wichita, Kansas 67202

Attention: Mr. Chris Breitenstein, P.E.

Reference: Chelsea Brooke Addition Drainage Plan
PEC File 36-84019-2-177

Dear Mr. Lindebak:

On behalf of Jeffrey S. Greenberg, Owner/Developer, transmitted herewith are two copies of the Drainage Plan and Supporting Calculations for the referenced plat. This drainage plan is contingent upon the construction of adequate detention facilities on Beech property as outlined below.

As you are aware, the evolution of the present drainage scheme has come along a circuitous path. There have been lengthy negotiations between the owner and Beech Aircraft Corporation concerning the 138 acre drainage area to the north of the plat. Beech has developed final plans for a new access road for their radar site. The embankment and 36 inch culvert for this road create a detention facility having 8.6 Ac-Ft of storage. The contributing area to this point is 75 acres, with a peak inflow rate of 225 cfs for the 100-year design event. The detention system reduces the outflow to 85 cfs.

In addition, the owner of the property has reached verbal agreement with Beech Aircraft Corporation for the construction of a detention basin on Beech property adjacent to the plat. A detention facility of approximately 16 Ac-Ft is to be built on Beech property by the owner. The outfall will consist of a 36 inch RCP to be placed in a 20 foot Drainage Easement. The maximum discharge through this outfall will be approximately 36 cfs for the 100-year design event.

The internal site contributing area is 19.3 acres. The 5-year discharge has been computed to be 62.6 cfs. When added to an assumed 5-year discharge from the Beech detention site of 36 cfs, a total of 99± cfs must be conveyed to the existing 6' X 3' reinforced concrete box curvert. This flow will be conveyed by conduit(s) equivalent to a 54-inch RCP located in a drainage easement as recorded on Film 636, Page 329. The internal drainage will be routed to the southeast corner of the plat by either site grading, private storm sewer(s), or other approved means.

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For flows in excess of the 5-year from the site, adequate site grading will be performed to enable excess water to overflow across the south line of the plat into the existing Kellogg roadside ditch without damaging adjacent improvements.

Drainage from the west and from the east of the property is presently conveyed to the roadside ditch on the north side of Kellogg, and is not considered in the report.

Please review the plan map and calculations at your earliest convenience. The final plat is tentatively scheduled for submission on April 26, 1985, to be heard May 9, 1985, by the Subdivision Committee. If you have any questions, please advise.

Very truly yours,

PROFESSIONAL ENGINEERING CONSULTANTS, P.A.

Michael W. Berry

Michael W. Berry, P.E.
Design Engineer

enclosures

xc: Jeffrey S. Greenberg

MWB/mkm

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Date 4/12/85 MMB Page A1 of

Project CHELSEA BROOKE ADDITION

Item ANALYSIS OF BEECH CONTRIB AREA (DA #1)

Drainage Area No. 1 has an area of 138 Ac. It is almost entirely on Beech property. Present development has approximately 20% Impervious Area.

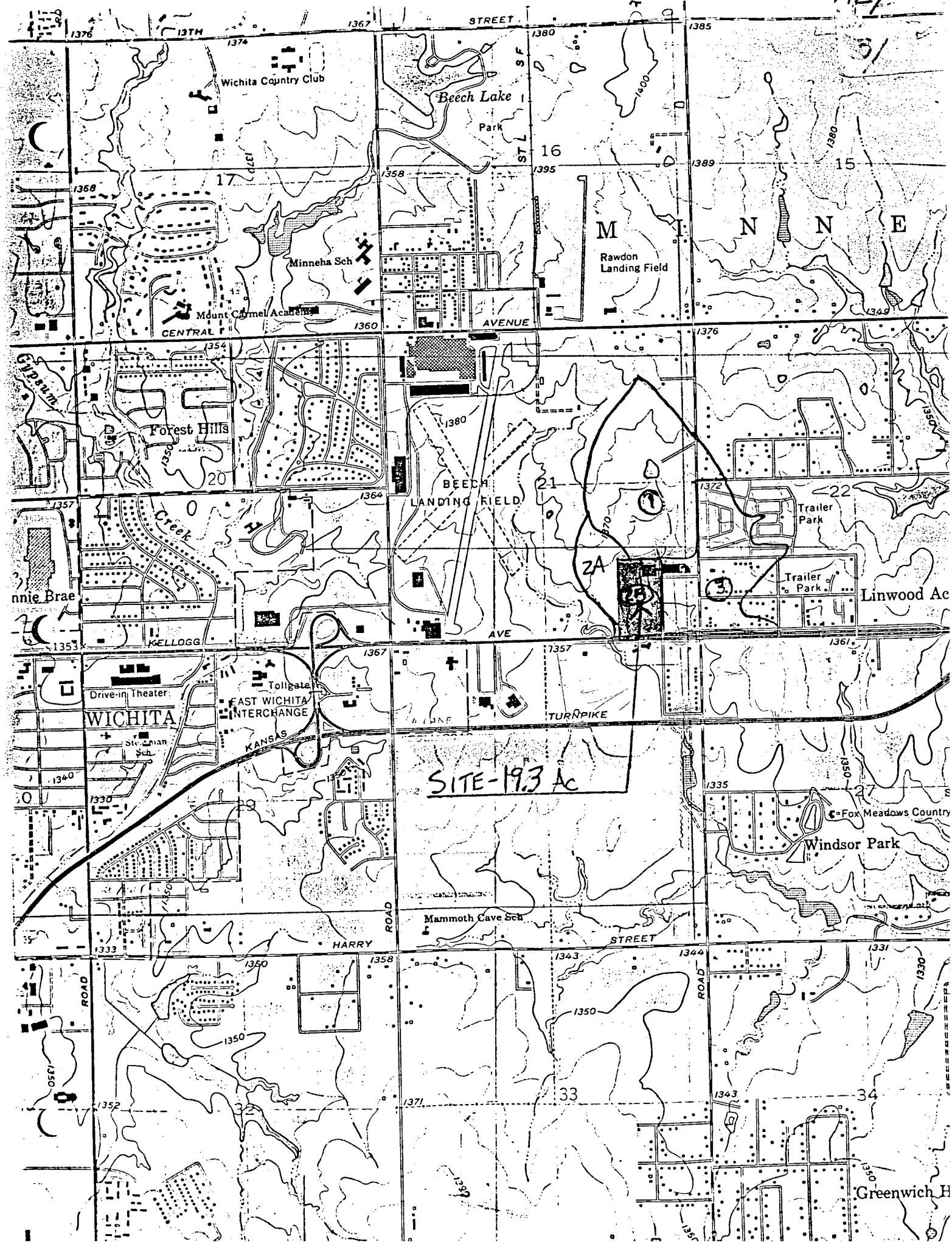
Pre-developed (Pasture) and Post developed (20% Impervious Area) hydrographs were developed. The assumptions used were as follows:

Hydrology by Rossmiller Rational, using the SCS modified curve number method for time of concentration.

The SCS tabular hydrograph was reduced to dimensionless coefficients to determine the 100-year, 24 hour storm hydrograph.

As can be seen on Sh No A5 the detention volume required to reduce $Q_{PRE} = 172$ cfs is 5.4 Ac Ft.

A21


Wichita Country Club
Beech Lake
Park
Minneha Sch
Mount Carmel Academy
Rawdon
Landing Field
Forest Hills
BEECH
LANDING FIELD
Trailer
Park
Trailer
Park
Linwood Ac
Drive-in Theater
Tollgate
EAST WICHITA
INTERCHANGE
WICHITA
TURNPIKE
KANSAS
SITE-19.3 Ac
Fox Meadows Country
Windsor Park
Mammoth Cave Sch
HARRY
STREET
AVENUE
KELLOGG
CENTRAL
Gypsum
Creek
ROAD
Greenwich H

Project No: 36-83295-1623 Date: 6/29/83 Sht No. A3 of ____

Project: David's East Drainage By: MWS Chk'd By: ____

TR-55 LAG - T_c METHOD PEAK DISCHARGE COMPUTATION SHEET

Location: DA #1 Watershed Condition AMC II

Remarks: Pre-developed

INPUT

1. P: 7.8 in (24-hour) (100-yr. freq.) — Rainfall — Table 2-1 or Figure 10
2. CN: 80 (D) — Runoff Curve No. — S: 2.50 — Max. Poss. Retention
3. l: 4600 ft — Hydraulic Length
4. Y: 2.2 % — Watershed Slope
5. 0 % — Hydr. Length Modified
6. 0 % — Impervious Area — Figure 3-5
7. 138 ac. × 1/640 = 0.18 sq. mi. — Drainage Area (DA)
8. 5 % — Ponds, Swamps — Table E-2, (E-3) or E-4 (Location determines table)

T_c FACTOR: 1.67 — Constant

Figure 3-3 × 9. 0.73 hr L — Basic Lag

Figure 3-4 × 10. 1.0 F_{HLM} — Hydr. Length Adj.

× 11. 1.0 F_{IMP} — Imp. Area Adj.

= 12. 1.21 hr T_c

Figure 5-2 × 14. 280 csm/in — Basic Peak Disch.

× 15. 0.18 sq.mi — Drainage Area

× 16. 0.78 — Ponds, Swamps Ad

= 17. 214 cfs — ADJUSTED PEAK DISCHARGE

PEAK FACTOR

13. 5.44 in Q — Runoff Volume

$Q = \frac{(P-0.2S)^2}{P+0.8S}$

$S = \frac{1000}{CN} - 10$

$L = \frac{l^{0.8}(S+1)^{0.7}}{1900\sqrt{Y}}$

$T_c = 1.67 L F_{HLM} F_{IMP}$

Possmiller

T_c = 72.6 min

i_{100} = 3.43 in/hr

C = 0.36

Q = 177 cfs

Project No: 36-B3295-1623 Date: 6/29/83 Sht No. 44 of ____

Project: DAVID'S EAST DRAINAGE By: MWB Chk'd By: ____

TR-55 LAG-T_c METHOD PEAK DISCHARGE COMPUTATION SHEET

Location: DA #1 Watershed Condition AMC II

Remarks: Developed Cond. - 20% Imp

INPUT

1. P: 7.8 in (24-hour) (100-yr. freq.) — Rainfall — Table 2-1 or Figure 10
2. CN: 84 — Runoff Curve No. → S: 1.96 — Max. Poss. Retention
3. l: 4600 ft — Hydraulic Length — Figure 3-3
4. Y: 2.0 % — Watershed Slope — Figure 3-4
5. 25 % — Hydr. Length Modified
6. 20 % — Impervious Area — Figure 3-5
7. 138 ac. × 1/640 = 0.22 sq. mi. — Drainage Area (DA)
8. 0 % — Ponds, Swamps — Table E-2, E-3 or E-4 (Location determines table)

T_c FACTOR

1.67 — Constant

× 9. 0.68 hr — Basic Lag (L)

× 10. 0.87 — F_{HLM} Hydr. Length Adj.

× 11. 0.89 — F_{IMP} Imp. Area Adj.

= 12. 0.88 hr — T_c

PEAK FACTOR

13. 5.86 in — Runoff Volume (Q)

× 14. 500 csm/in — Basic Peak Disch. — Figure 5-2

× 15. 0.22 sq.mi — Drainage Area

× 16. 1.0 — Ponds, Swamps Adj.

= 17. 632 cfs — ADJUSTED PEAK DISCHARGE

$$Q = \frac{(P-0.2S)^2}{P+0.8S}$$

$$S = \frac{1000}{CN} - 10$$

$$L = \frac{l^{0.8}(S+1)^{0.7}}{1900\sqrt{Y}}$$

$$T_c = 1.67\, L\, F_{HLM}\, F_{IMP}$$

Rossmiller

T_c = 51.8 min

i_{100} = 4.42 in/hr

C = 0.47

Q = 28% of

Location: David's East Drainage

Notes:

Project No. 36-83295-1 3

Project

Date 6/29/83 By MWB

HYDROGRAPH COMPUTATION BY TR-55 METHOD

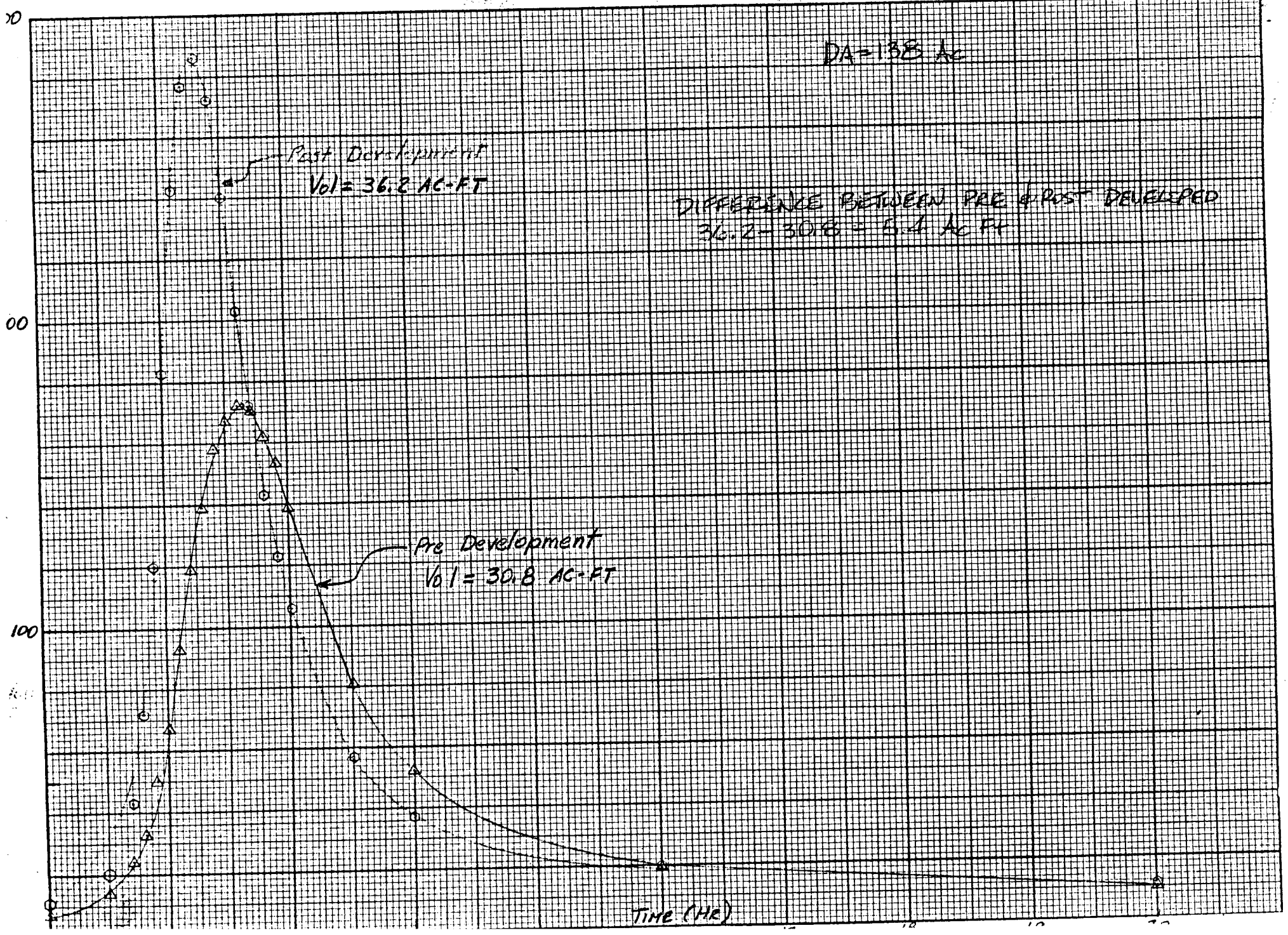
Discharge, cfs

Subarea	T_c hr	T_t hr	Q_{max} cfs / ~~mi² in~~	11.0 hrs.	11.5 hrs.	11.7 hrs.	11.8 hrs.	11.9 hrs.	12.0 hrs.	12.1 hrs.	12.2 hrs.	12.3 hrs.	12.4 hrs.	12.5 hrs.	12.6 hrs.	12.7 hrs.	12.8 hrs.	12.9 hrs.	13.0 hrs.	13.5 hrs.	14.0 hrs.	16.0 hrs.	20.0 hrs.
1 Pre-Dev	1.25	0	172	7	14	24	33	50	67	93	119	139	158	167	172	170	162	153	139	81	52	19	10
2	0.75	0	103	4	7	15	26	43	66	88	100	103	98	87	73	62	52	44	38	21	13	7	4
3	0.4	0	250	8	18	45	98	183	243	250	195	145	108	83	68	55	45	40	35	23	18	10	5
3W	0.2	0	55	2	3	14	35	55	45	29	17	12	9	8	7	6	5	5	5	3	3	2	1
Comp. @ 6x3' RCB				21	42	98	192	331	421	460	431	399	373	345	320	293	264	242	217	128	86	38	20
1 Post Dev	0.75		286	11	20	43	72	120	183	243	277	286	272	240	203	172	143	123	106	57	37	20	11
1+2 w/ Det				11	21	39	59	93	133	181	219	242	256	254	245	232	214	197	177	102	65	26	14
1+2 w/o Det				15	27	58	98	163	249	331	377	389	370	337	276	234	195	167	144	78	50	27	15

INFLOW HYDROGRAPHS

DA No. 1

PROJ. NO. 36-83295-1623 MWB 6/21/83



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Date 3-11-05 MWB Page B1 of

Project BEECH RADAR

Item INFLOW HYDROGRAPH

The design data for the Chelsea Brooke Add Drainage Plan will be used to generate an inflow hydrograph. The design point lies within DA #1. Design parameters used in the Drainage Plan for DA #1 are as follows:

DA #1

DA = 135 Ac

20% Imp

D Soil (SCS Hydrologic Soil Group)

CN = 0.2 x 98 + 0.8 x 80 = 84

ℓ = 4600'

Y = 2%

Assume 25% Hyd. Length Mod.

T_c = 33 min.

i_{100} = 4.33 in/hr

C = 0.47 (Rossmiller Method)

Q_{100} = 286 cfs

For design point:

DA = 75 Ac

20% Imp, D Soil

CN = 84

ℓ = 3000'

Y = 2%

Assume 25% HLM

$Lag = \frac{\ell^{0.8}(S+1)^{0.7}}{1900\sqrt{Y}} = 0.47$ hr

$T_c = \frac{60}{0.6} \text{ Lag from Above} = 37$ min

i_{100} = 5.76 in/hr

C = 0.52

$Q_{100} = 0.52 \times 5.76 \times 75 = 225$ cfs

Location: BEECH RADAR SITE

Notes: 100-Yr Discharge 75 Ac D.A.,
Q_{peak} = 225 cfs

Project No. 36-
Project BEECH RADAR
Date 3-11-85 By MW3

HYDROGRAPH COMPUTATION ~~BY TR-55 METHOD~~

Discharge, cfs

Subarea	T_c hr	T_t hr	K mi^2-in	11.0 hrs.	11.5 hrs.	11.7 hrs.	11.8 hrs.	11.9 hrs.	12.0 hrs.	12.1 hrs.	12.2 hrs.	12.3 hrs.	12.4 hrs.	12.5 hrs.	12.6 hrs.	12.7 hrs.	12.8 hrs.	12.9 hrs.	13.0 hrs.	13.5 hrs.	14.0 hrs.	16.0 hrs.	20.0 hrs.
DA #1	0.5	0		9	16	36	74	137	196	225	216	180	140	110	88	72	59	50	43	25	20	11	7

B2

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Date 3/25/85 MWB Page B3 of

Project BEECH RADAR

Item DETENTION STORAGE ANALYSIS

The 100-yr inflow hydrograph was routed thru the detention facility. One 36-in RCP outfall was assumed.

The important design parameters are as follows:

Inflow Q_{100} = 225 cfs

Outflow Q_{100} = 85 cfs

Max elev = 1366.3 ≈ 0.26' over crown @ sump

Max storage vol = 8.6 Ac Ft.

If you have any questions, see me.

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Date 3/25/85 Page B4 of

Project BEECH RADAR

Item STAGE STORAGE ANALYSIS

Area of each contour interval determined by planimeter on 1"=50' drawing (work print)

1362		1363		1364		1365		
1416	552	3036	2335	10007	3638	0912	4254	
1968	543	5371	2329	3645	3644	5166	4245	
2511	562	7700	2327	7289	3641	9411	4247	4249
3063		10027		10930		13658		
0.32 Ac		1.34 Ac		2.09 Ac		2.44 Ac		

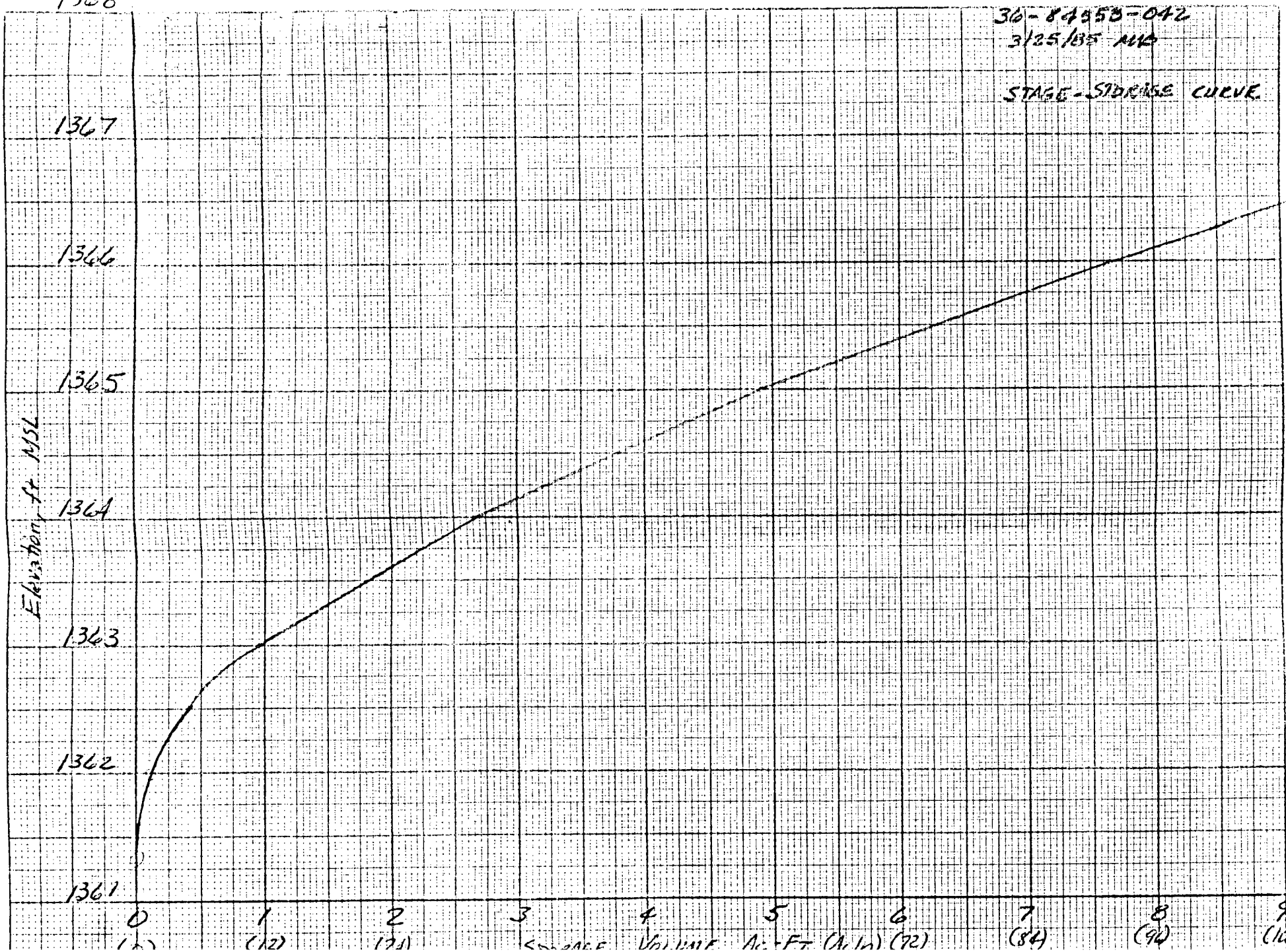
1366			1367	
2108	5238		3575 > 6342	
7346	~~5255~~		9917	
12599	5220	5224	2805 > 6349	
17819	5214		9154	
23033			15460 > ~~6~~	
3.00 Ac			3.64 Ac	

Elev	Area	Δh	Avg Area (Ac)	ΔVol	ΣVol
1361.3	0				
		0.7 ft	0.16	0.11 Ac Ft	
1362	0.32 Ac				0.11 Ac-Ft
		1 ft	0.83	0.83 Ac Ft	
1363	1.34 Ac				0.94 Ac-Ft
		1 ft	1.72	1.72 Ac Ft	
1364	2.09 Ac				2.66 Ac Ft
		1 ft	2.27	2.27 Ac Ft	
1365	2.44 Ac				4.93 Ac Ft
		1 ft	2.72	2.72 Ac Ft	
1366	3.00 Ac				7.65 Ac Ft
		1 ft	3.32	3.32	
1367	3.64 Ac				10.97 Ac Ft

BEECH RADAR [illegible]

30-84958-042
3/25/85 MH

STAGE - STORAGE CURVE



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Date 3/25/85 MJB Page B6 of

Project BEECH RADAR

Item STAGE ~~STORAGE~~ DISCHARGE ANALYSIS

Design discharge - use HEC-5 charts

Assume 1-36" RCP outfall

L = 80'

Type I End Sections

Inlet ℄ = 861.3 outlet ℄ = 1361.0

Cr Gr = ~~66.00~~ 66.04

Assume TW = 0

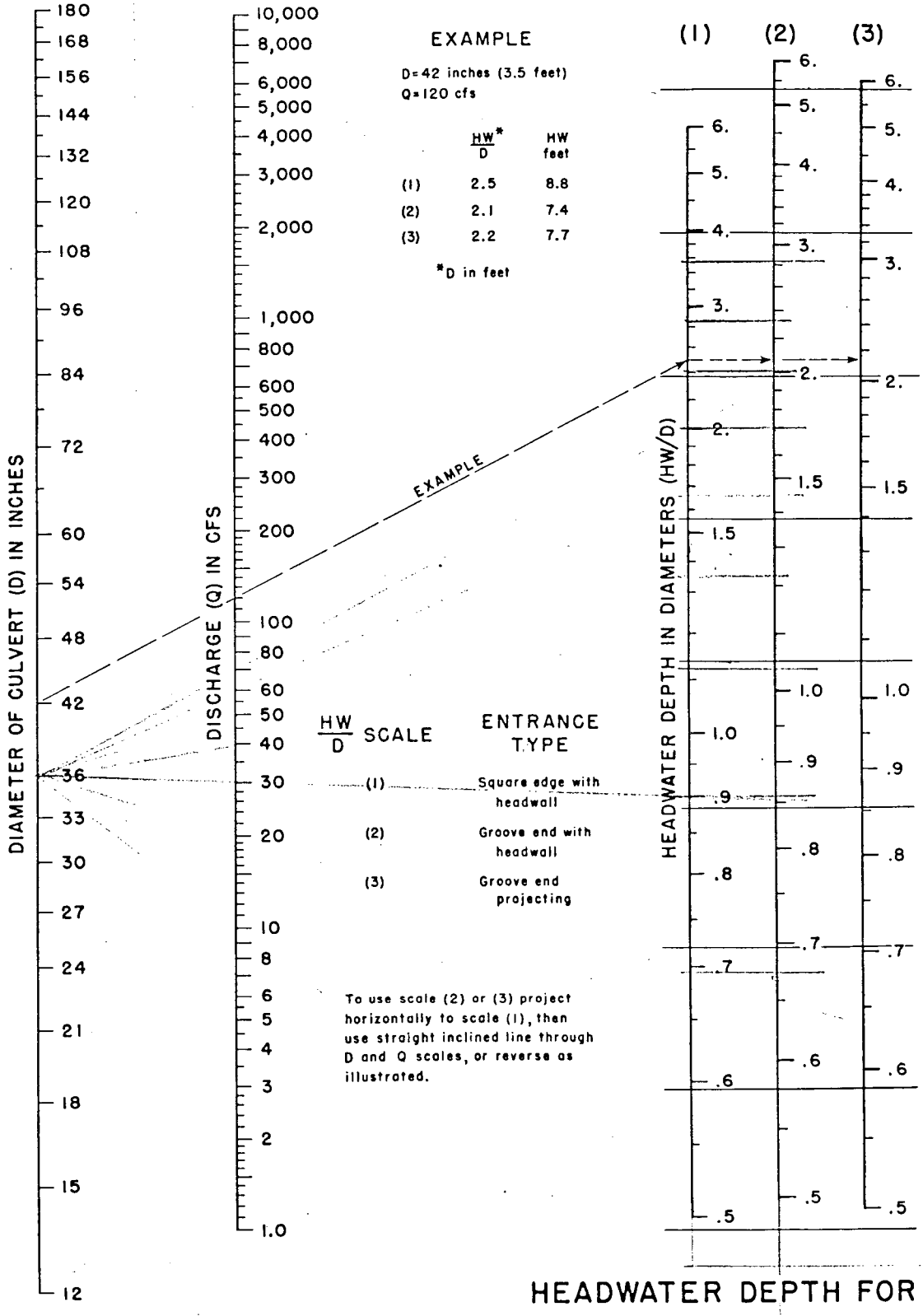
WEIR LENGTH @ elev. 1367 ± = 500'

	INLET CONTROL			OUTLET CONTROL						
DISCHARGE	HW/D	HW	Elev	H	d_c	$d_c+D/2$	h_o	LS_o	HW	elev.
0	—	—	1361.3	—	—	—	—	—	—	1361.3
10	0.4	1.2	62.5							
20	0.67	2	63.3							
30	0.85	2.55	63.85	0.6	1.7	2.35	2.35	0.3	2.65	63.95
40	1.05	3.15	64.45	1.0	2.1	2.55	2.55	0.3	3.25	64.55
50	1.2	3.60	64.90	1.6	2.3	2.65	2.65	0.3	3.95	65.25
60	1.45	4.35	65.75	2.2	2.5	2.75	2.75	0.3	4.65	65.95
70	1.7	5.1	66.40	3.1	2.7	2.85	2.85	0.3	5.65	66.95
80	2.0	6.0	67.30	4.1	2.8	2.9	2.9	0.3	6.70	68.00
90	2.3	6.9	68.20	5.2	3.0	3	3	0.3	7.90	69.20
100	2.8	8.4	69.70	6.5	3.0	3	3	0.3	9.20	70.50

= WEIR FLOW ($C=3.0$) $Q = CLH^{1.5}$ =

Elev.	H. Ft.	~~E~~. Adj (Ft)	L, ft.	Q cfs	TOTAL PIPE + WEIR FLOW (OUTLET CONT. CO
1366.1	0.05		100'	~~3.3~~	
1366.2	0.15	0.08	150	10	10 + 62 = 72
1366.3	0.25	0.12	200'	25	25 + 63 = 88
1366.4	0.35	0.17	225	47	47 + 65 = 112
1366.5	0.45	0.22	250'	77	77 + 66 = 143
1366.6	0.55	0.27	290'	122	122 + 67 = 189
1366.7	0.65	0.32	310'	168	168 + 69 = 237

CHART 2

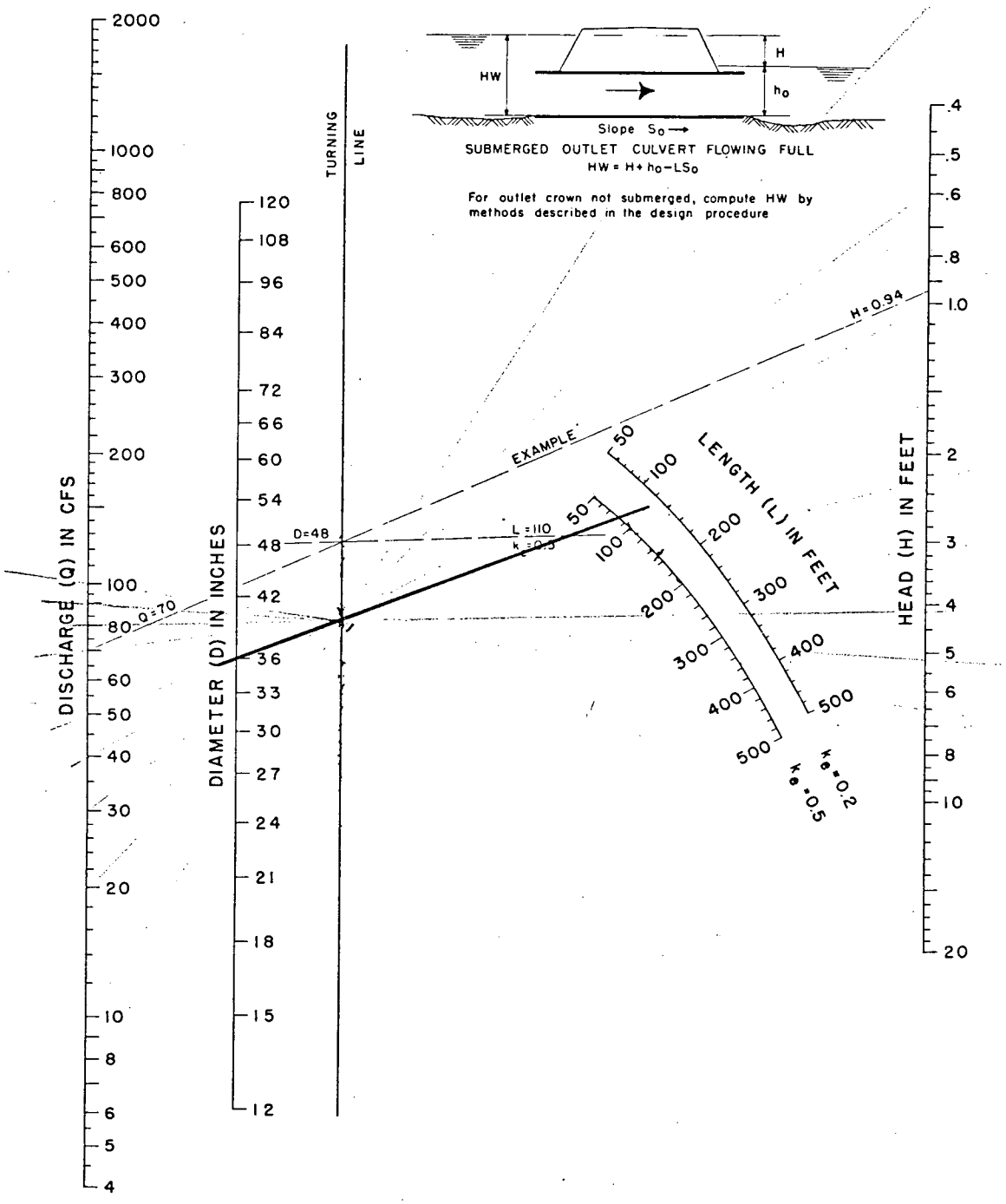


HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH INLET CONTROL

HEADWATER SCALES 2&3
REVISED MAY 1964

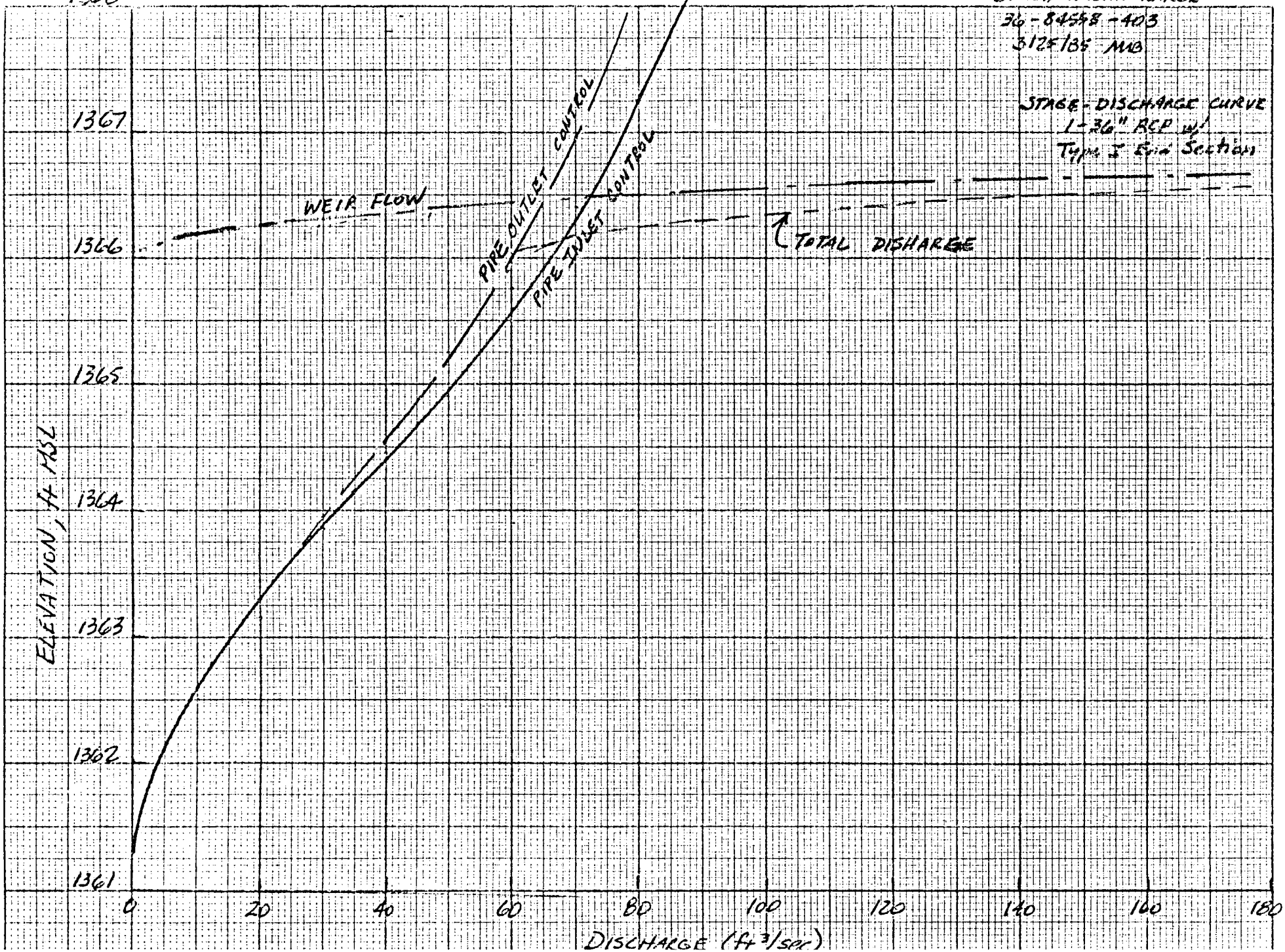
BUREAU OF PUBLIC ROADS JAN. 1963

CHART 9



HEAD FOR CONCRETE PIPE CULVERTS FLOWING FULL n = 0.012

BUREAU OF PUBLIC ROADS JAN. 1963



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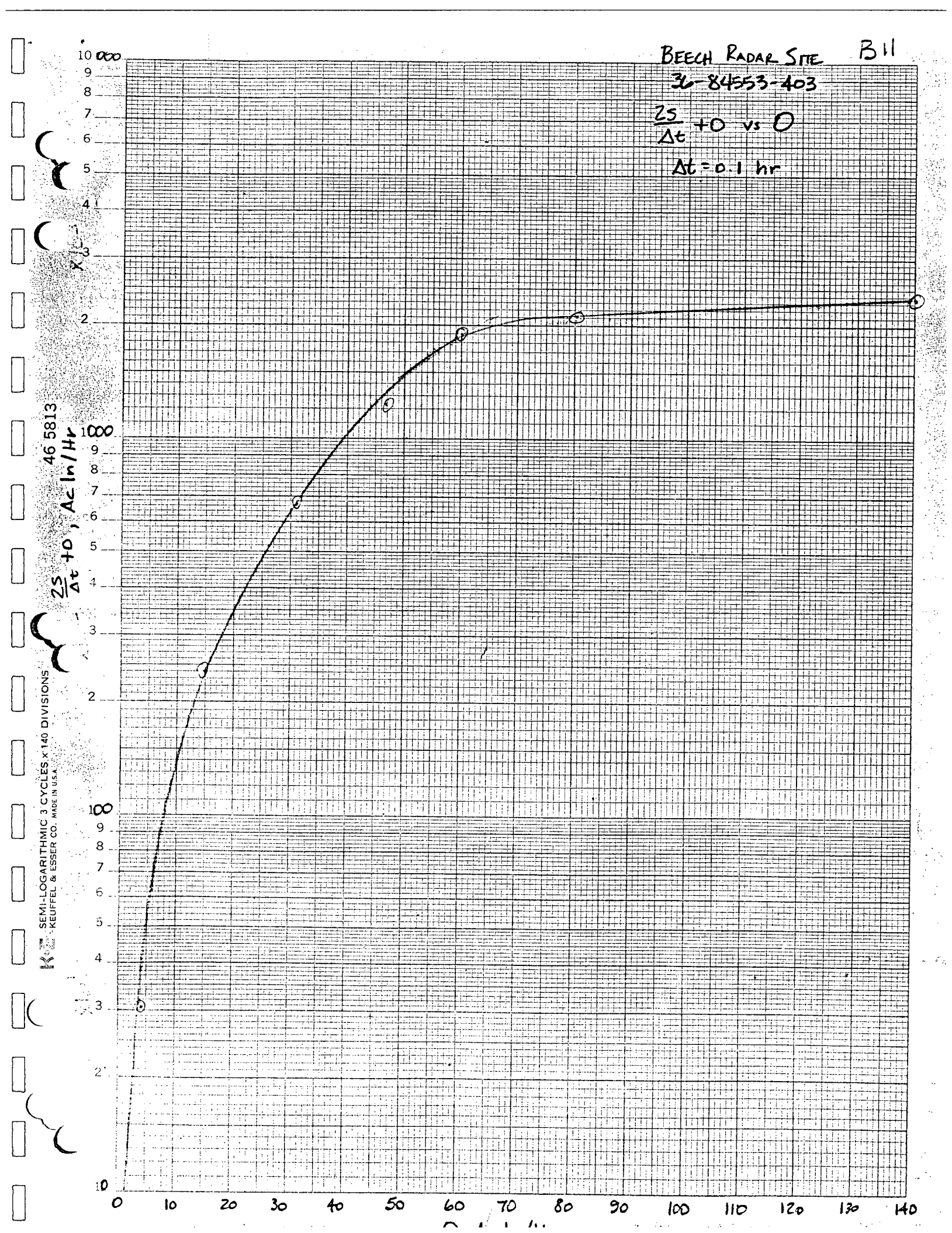
Date 3/25/85 MJB Page B10 of

Project BEECH RADAR RANGE

Item 2S/Δt+O vs O CURVE

Let Δt = 0.1 hr

Elev	Vol (Ac Ft)	Vol (Acln) S	2S/Δt (Acln/Hr)	O Acln/Hr	2S/Δt + O Acln/Hr
1361.3	0	0	0	0	0
1362	0.11	1.32	26.4	4	30.4
1363	0.94	11.28	225.6	15	240.6
1364	2.66	31.92	638.4	31	669.4
1365	4.93	59.16	1183.2	47	1230.2
1366	7.65	91.80	~~1101.60~~ 1836	60	1896
1366.25	8.48	101.76	2035	80	2115
1366.50	9.31	111.72	2234	140	2374
1366.75	10.14	121.68	2434	237+	2671+
1367	10.97	131.64	2633		


BEECH RADAR SITE B11
36-84553-403
$\frac{2S}{\Delta t} + O$ vs O
$\Delta t = 0.1$ hr
$\frac{2S}{\Delta t} + O$, Ac In/Hr
χ^2
46 5813
SEMI-LOGARITHMIC 3 CYCLES x 140 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.
10000
1000
100
10
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140

Project: BEECH RADAR
Job No.: 36-84552-403

RESERVOIR ROUTING TABLE

Date: 5/85
By: MWB
Page 1 of

(1) Time	(2) I_1	(3) I_1+I_2	(4) $\frac{2S_1}{\Delta t} - O_1$	(5) $\frac{2S_2}{\Delta t} + O_2$	(6) Outflow O_2	(7) Elev.	(8) Storage S_2 Ac Ft
11.0	9	19	0	—	0	1361.3	0
11.1	10	21	13	19	3	1361.85	0.05
11.2	11	24	26	34	4	1362	0.1
11.3	13	27	40	50	5	1362.15	0.2
11.4	14	30	55	67	6	1362.25	0.25
11.5	16	42	71	85	7	1362.35	0.3
11.6	26	62	95	113	9	1362.50	0.4
11.7	36	110	135	157	11	1362.70	0.7
11.8	74	211	215	245	15	1363	0.95
11.9	137	336	386	426	23	1363.55	1.9
12.0	196	421	658	722	32	1364.10	2.9
12.1	225	441	997	1079	41	1364.65	4.15
12.2	216	396	1340	1438	49	1365.15	5.3
12.3	180	320	1624	1736	56	1365.65	6.7
12.4	140	250	1816	1944	64	1366.10	8.0

$(3)_n + (4)_n = (5)_{n+1}$

$(5)_n - 2 \times (6)_n = (4)_n$

B12

Project:
Job No.:

RESERVOIR ROUTING TABLE

Date: 12/5/85
By: MJB
Page 2 of

(1) Time	(2) I_1	(3) I_1+I_2	(4) $\frac{2S_1}{\Delta t} - O_1$	(5) $\frac{2S_2}{\Delta t} + O_2$	(6) Outflow O_2	(7) Elev.	(8) Storage S_2
12.5	110	198	1926	2066	70	1366.2	8.3
12.6	88	160	1954	2124	85	1366.3	8.6
12.7	72	131	1944	2114	85	1366.3	8.6
12.8	59	109	1935	2075	70	1366.2	8.3
12.9	50	93	1908	2044	68	1366.15	8.15
13.0	43	82	1869	2001	66	1366.10	8.1
13.1	39	75	1825	1951	63		
13.2	36	68	1780	1900	60		
13.3	32	61	1730	1848	59		
13.4	29	54	1681	1791	55		
13.5	25	49	1625	1735	55		
13.6	24	47	1566	1674	54		
13.7	23	45	1507	1613	53		
13.8	22	43	1448	1552	52		
13.9	21	41	1391	1491	50		

$(3)_n + (4)_n = (5)_{n+1}$

$(5)_n - 2 \times (6)_n = (4)_n$

Project:
Job No.:

RESERVOIR ROUTING TABLE

Date: 4/2/86
By: MJP
Page 3 of

(1) Time	(2) I_1	(3) I_1+I_2	(4) $\frac{2S_1}{\Delta t} - O_1$	(5) $\frac{2S_2}{\Delta t} + O_2$	(6) Outflow O_2	(7) Elev.	(8) Storage S_2	
14.0	20	40	1334	1432	49			
14.1	20	39	1278	1374	48			
14.2	19	38	1223	1317	47			
14.3	19	37	1171	1261	45			
14.4	18	36	1120	1208	44			
14.5	18	36	1076	1156	40			
14.6	18	35	1026	1112	43			
14.7	17	34	1012	1096	42			
14.8	17	33	966	1046	40			
14.9	16	32	921	999	39			
15.0	16	31	877	953	38			
15.1	15	30	834	908	37			
15.2	15	29	792	864	36			
15.3	14	28	751	821	35			
15.4	14	27	711	779	34			

$(3)_n + (4)_n = (5)_{n+1}$

$(5)_n - 2 \times (6)_n = (4)_n$

B14

Project:
Job No.:

RESERVOIR ROUTING TABLE

Date: 12/85
By: MB
Page 4 of

(1) Time	(2) I_1	(3) I_1+I_2	(4) $\frac{2S_1}{\Delta t} - O_1$	(5) $\frac{2S_2}{\Delta t} + O_2$	(6) Outflow O_2	(7) Elev.	(8) Storage S_2
15.5	13	26	674	738	32		
15.6	13	25	636	700	32		
15.7	12	24	599	661	31		
15.8	12	23	565	623	29		
15.9	11	22	532	588	28		
16.0	11		500	554	27		

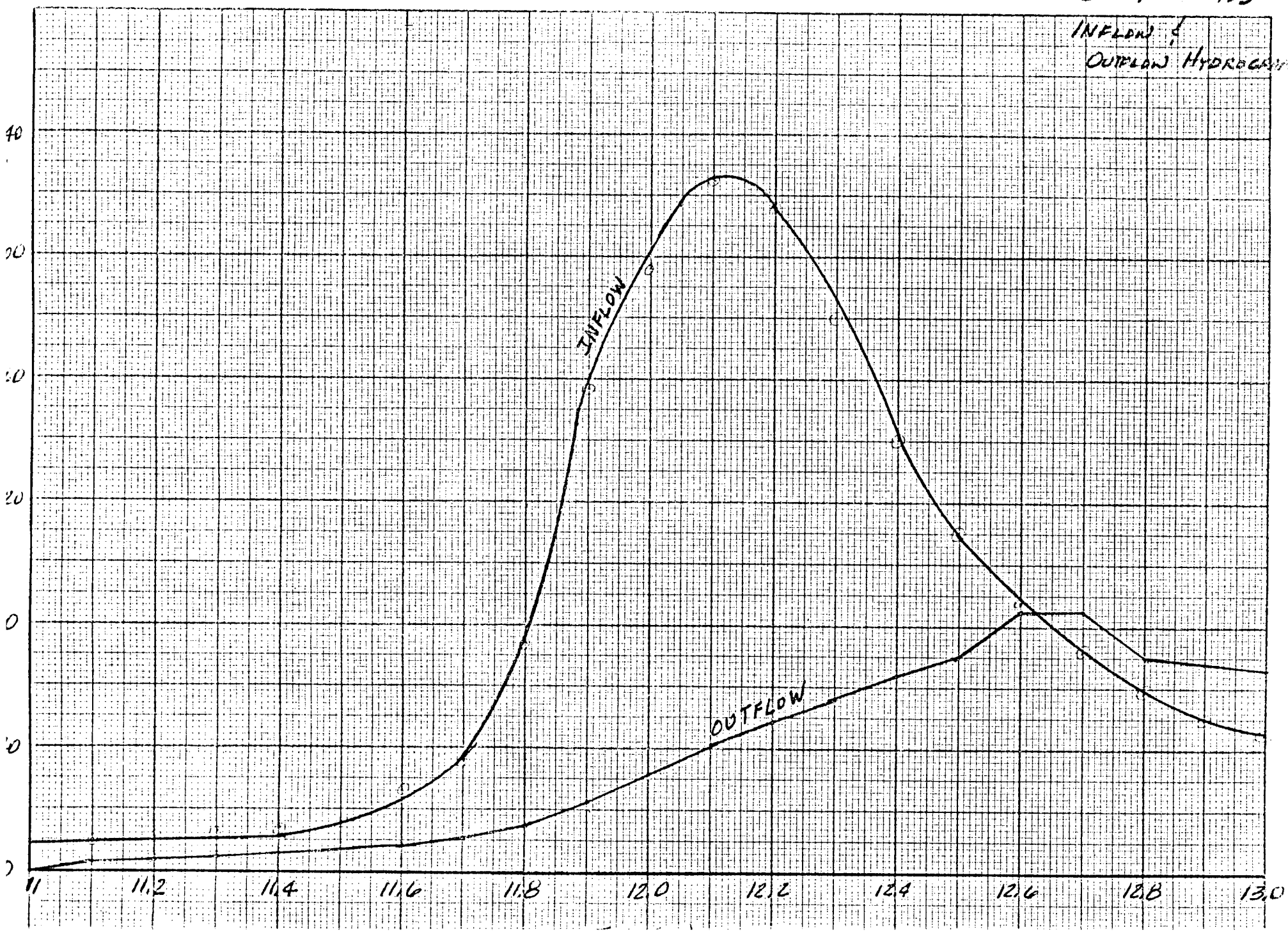
$(3)_n + (4)_n = (5)_{n+1}$

$(5)_n - 2 \times (6)_n = (4)_n$

B5

BEECH BAR RANGE
36-840-8-403

INFLOW & OUTFLOW HYDROGRAPHS



B16

C1/

Chelsea Brooke Add.

36-84019-2-177

4/2/85 MJB

With construction of the Beech Radar Site, a detention facility was created by virtue of road embankment and 36" CRP. The effect of this installation is analyzed in a set of computations dated 3/25/85. The peak outflow from this facility is 85 cfs. The contributing area is 75 ac and the outflow hydrograph is tabulated as (4) on the Sheet no. 2 attached.

The hydrograph for the balance of DA #1 is tabulated as (3) on #sh. no. 2. Summing the two hydrographs yields hydrograph (5), which would be the inflow hydrograph for a detention facility to be sited adjacent to the south Beech property line. A plot of the hydrograph has been made on sh no. 3.

To limit discharge ~~to~~ from this facility to the capacity of a 36" RCP outfall (36 cfs assuming $n = 0.013$, $S = 0.32\%$), ~~deten~~ additional detention volume of 16 ac-ft would be required.

A preliminary detention facility size can be determined making the following assumptions & definitions:

② Rectangular shape, assume, inverted frustrum of a pyramid

Fix $L_1 = 750'$ @ top

$z = 4:1$ side slope

Flr elev = 1349

Top elev = 1354.5

$L_2 = 750 - 2 \times 5.5 \times 4$ ~~= 694~~ $= 706$

~~So~~ W_1 = unknown

$W_2 = W_1 - 44$

$$Vol = \frac{h}{3}\left(B_1 + B_2 + \sqrt{B_1 B_2}\right)$$

$16 \text{ Ac-Ft} \times 43560 \text{ ft}^2/\text{Ac} = 696,960 \text{ cu ft}$

$$696,960 = \frac{5.5}{3}\left[(750)(W_1) + (706)(W_1 - 44) + \sqrt{(750)(W_1)(706)(W_1 - 44)}\right]$$

$$380,160 = 1456 W_1 - 31,064 + \sqrt{1529,500 W_1^2 - 23,298,500}$$

By iteration $W_1 = 188$ ft.

$\frac{188 \times 750}{43560} = 3.23$ Ac SURFACE AREA OF WATER

W_1

Location: DA #1, Beech prop. subdiv. to Chelsea Brooke Add

Notes: Post dev DA #1 – Inflow hydrograph for T.c = Hydrograph for balance
Outflow hydrograph Beech Point + Hydrograph for balance = Inflow hydrograph to det. basin

Project No. 36-84019-2.177 C2/
Project Chelsea Brooke
Date 4/2/85 By MWB

HYDROGRAPH COMPUTATION BY TR-55 METHOD

Discharge, cfs

Subarea	T_c hr	T_t hr	K mi^2-in	11.0 hrs.	11.5 hrs.	11.7 hrs.	11.8 hrs.	11.9 hrs.	12.0 hrs.	12.1 hrs.	12.2 hrs.	12.3 hrs.	12.4 hrs.	12.5 hrs.	12.6 hrs.	12.7 hrs.	12.8 hrs.	12.9 hrs.	13.0 hrs.	13.5 hrs.	14.0 hrs.	16.0 hrs.	20.0 hrs.
(1)				11	20	43	72	120	183	243	277	286	272	240	203	172	143	123	106	57	37	30	11
+ (2)				9	16	36	74	137	196	225	216	180	140	110	88	72	59	50	43	25	20	11	7
= (3)				2	4	7	10‡	13‡	15‡	18	61	106	132	130	142	100	84	73	63	32	17	9	4
+ (4)				0	7	11	15	23	32	41	47	56	64	70	85	85	70	68	66	55	49	27	
= (5)	INFLOW TO DETENTION BASIN			2	11	18	25	36	47	59	110	162	196	200	227	185	154	141	129	87	66	36	

‡ STRAIGHT LINE INTERPOLATION USED WHERE NEGATIVE VALUES COMPUTED.

C2

CHELSEA BROOKE ADDITION

36-8

PROPOSED DETENTION FACILITY

300

200

100

0

DISCHARGE (CFS)

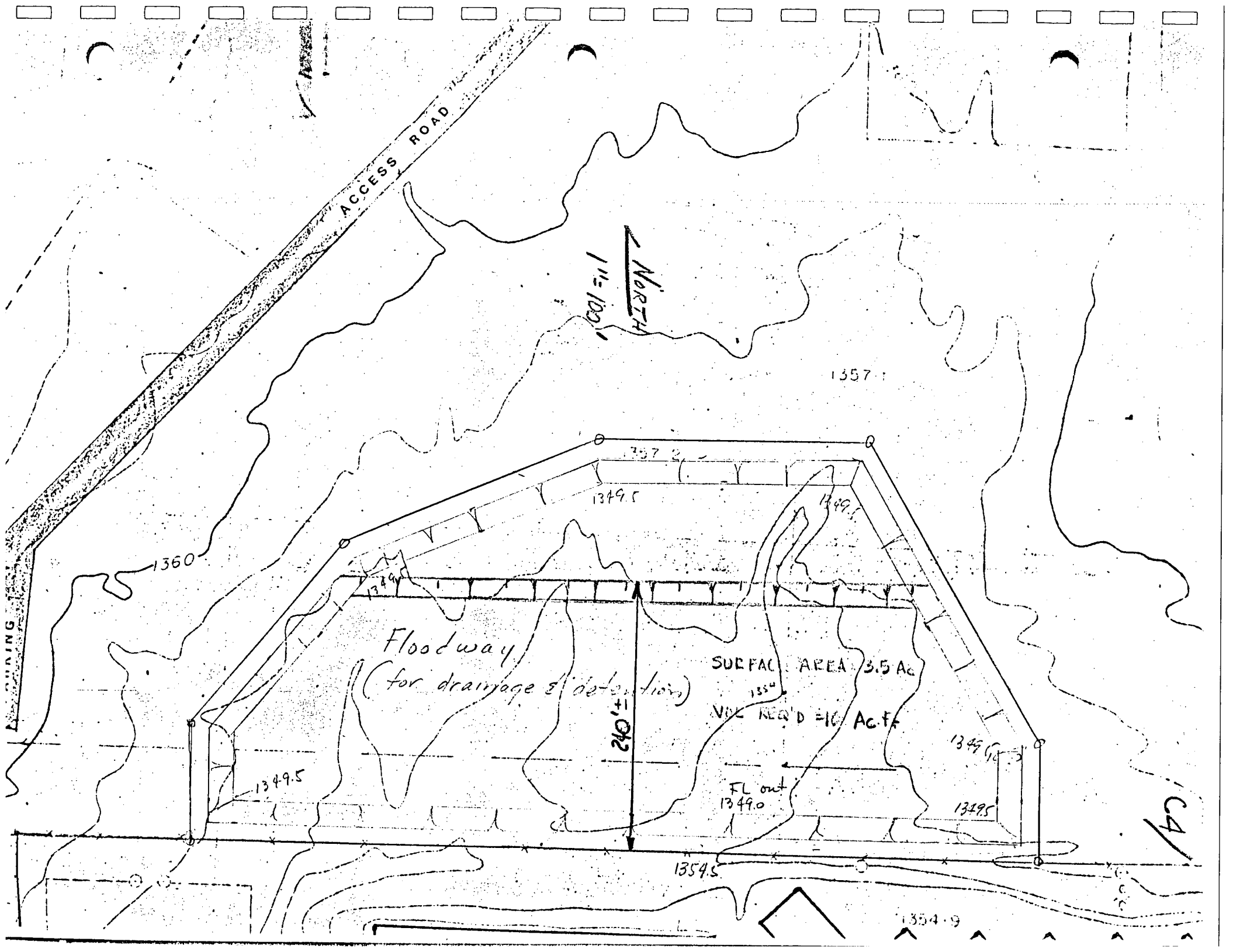
INFLOW HYDROGRAPH

VOL = 4.79 in^2 x 40 $\frac{Ac\text{-}In/Hr}{In}$ x 1 $\frac{Hr}{In}$ = 191.7 Ac In = 16 Ac Ft

Q = 36 cfs = MAX. DISCHARGE THRU 36" RCP

TIME (HR)

C3


ACCESS ROAD
1" = 100'
NORTH
1357
1360
1349.5
1354.5
1354.9
240'±
Floodway
(for drainage & detention)
SURFACE AREA 3.5 Ac
VOL REQ'D = 10 Ac.Ft
FL out
1349.0
C4

PROFESSIONAL ENGINEERING CONSULTANTS PROFESSIONAL ASSOCIATION
1440 EAST ENGLISH
WICHITA, KANSAS
ZIP CODE / 67211

Date 4/11/85 MAB Page D1 of

Project CHELSEA BROOKE ADDITION

Item DRAINAGE PLAN

HYDROLOGY

DA No. 1

For design purposes, the discharge from DA No. 1 will be taken as 36 cfs. See separate calculations for detention basin parameters.

100-Yr design discharge = 36 cfs
For design less than 100-Yr, use will be conservative

DA # 2A

This area will be diverted along the west side of the plat into the highway ditch along the north side of Kellogg

DA # 3

This area is conveyed through an open channel constructed with the Greenwich / Kellogg intersection improvements.

DA # 2B

DA = 19.3 Ac

Assume 1% slope for lot grading. "Bathtub" type grading may be required.

L = 1620 + 500 = 2120'
Hydrologic Soil Group D

Assume 80% Imp., 85% HLM
CN = 0.85 x 98 + 0.15 x 80 = 95

$S = 1000/CN - 10 = 0.49$

$L_{lg} = \frac{L^{0.8}(S+1)^{0.7}}{1900\sqrt{Y}} = 0.31$ hr

$F_{Imp} = 0.8 \quad F_{HLM} = 0.8$

$T_c = \frac{60 \cdot L_{lg}(F_{HLM})F_{Imp}}{0.6} = 20.4$ min

$i_5 = 4.66$ in/hr $C_5 = 0.70$ $Q_5 = 62.6$ cfs

$i_{100} = 8.03$ in/hr $C_{100} = 0.80$ $Q_{100} = 123.3$ cfs

PROFESSIONAL ENGINEERING CONSULTANTS
PROFESSIONAL ASSOCIATION
1440 EAST ENGLISH
WICHITA, KANSAS
ZIP CODE / 67211

Date 4/11/85 MWB Page D2 of

Project CHELSEA BROOKE ADDITION

Item DRAINAGE PLAN

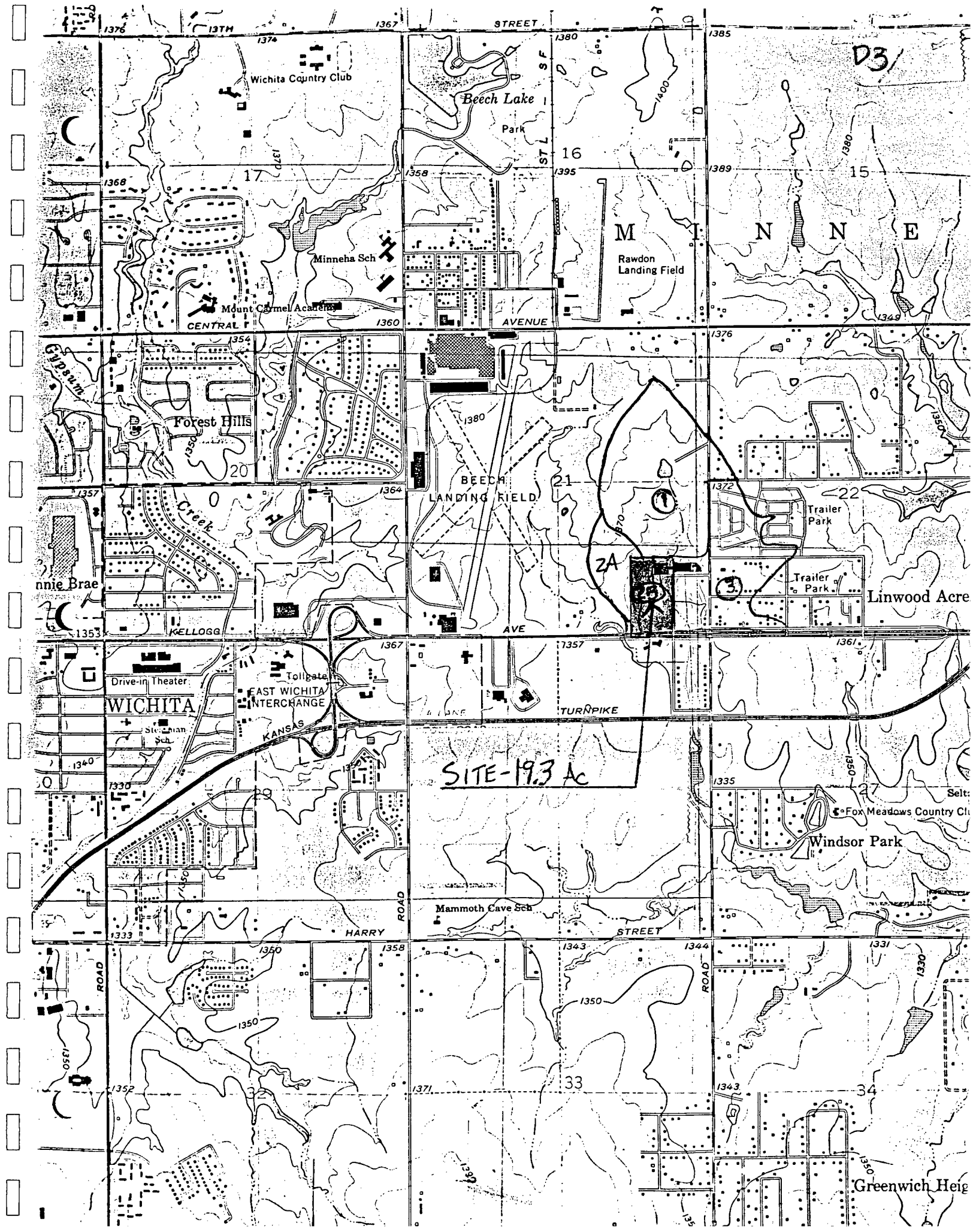
HYDRAULICS

The storm sewer system will be designed for the 5-Year Storm. For design, we will assume 36 cfs discharged from Beech detention pond, which should be conservative for a 5-Yr design.

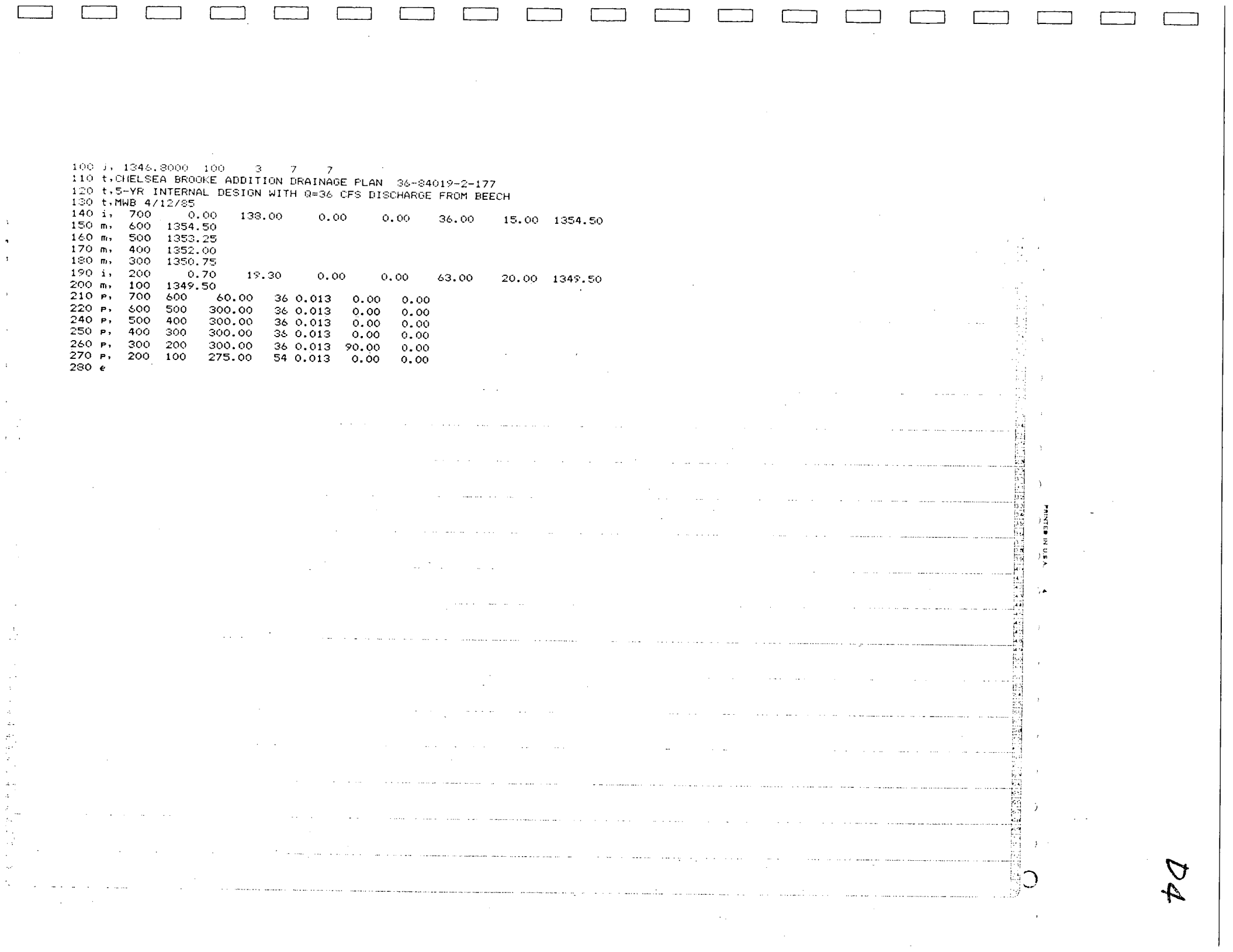
The public storm sewer from Node 200 to 100 must be sized to accomodate the additional drainage from the plat. It is assumed that a private storm sewer and/or site grading will convey the drainage to point 200 for collection.

A computer run was made using the PEC STORM program, assuming full flow in the pipes and utilizing a roughness coefficient n=0.013. The output is attached as sh. nos. _____.

The 100-Year storm which cannot be conveyed through the storm sewer will overflow across the south line of the plat into the Kellogg north ditch.


D3
Wichita Country Club
Beech Lake
Park
STREET
13TH
Minneha Sch
Mount Carmel Academy
CENTRAL
AVENUE
Rawdon
Landing Field
M I N N E
Forest Hills
Gypsum
Creek
BEECH
LANDING FIELD
Trailer
Park
Trailer
Park
Linwood Acre
KELLOGG
AVE
Drive-in Theater
Tollgate
EAST WICHITA
INTERCHANGE
WICHITA
TURNPIKE
KANSAS
SITE-19.3 Ac
Fox Meadows Country Cl
Windsor Park
Mammoth Cave Sch
HARRY
STREET
ROAD
Greenwich Heig

```
100 j, 1346.8000  100    3    7    7
110 t,CHELSEA BROOKE ADDITION DRAINAGE PLAN  36-84019-2-177
120 t,5-YR INTERNAL DESIGN WITH Q=36 CFS DISCHARGE FROM BEECH
130 t,MWB 4/12/85
140 i,  700     0.00    138.00      0.00      0.00     36.00     15.00  1354.50
150 m,  600  1354.50
160 m,  500  1353.25
170 m,  400  1352.00
180 m,  300  1350.75
190 i,  200     0.70     19.30      0.00      0.00     63.00     20.00  1349.50
200 m,  100  1349.50
210 p,  700  600     60.00   36 0.013    0.00    0.00
220 p,  600  500    300.00   36 0.013    0.00    0.00
240 p,  500  400    300.00   36 0.013    0.00    0.00
250 p,  400  300    300.00   36 0.013    0.00    0.00
260 p,  300  200    300.00   36 0.013   90.00    0.00
270 p,  200  100    275.00   54 0.013    0.00    0.00
280 e
```



Date: 04-12-1985
Time: 13:17:33

Input File: drainplan

CHELSEA BROOKE ADDITION DRAINAGE PLAN 36-84019-2-177
5-YR INTERNAL DESIGN WITH Q=36 CFS DISCHARGE FROM BEECH
MWB 4/12/85

Storm Frequency = 5-Year

* * * HYDROLOGY * * *

Node to Node		C	Tributary Area: Area (Ac)	Slope (%)	Length (Ft)	TC(O) (Min)	I(O) (In/Hr)	Q(O) (CFS)	Hydrology Summation: TC (Min)	I (In/Hr)	Q (CFS)	Sum Q (CFS)	Conduit Data: Size	Velocity (Ft/Sec)	Length (Ft)	TT (Min)	TT+TC (Min)
700	600	0.00	138.00	0.00	0.0	15.00	5.22	36.00	15.00	5.22	36.00	36.00	36"	5.09	60.00	0.20	15.20
600	500	0.00	0.00	0.00	0.0	0.00	0.00	0.00	15.20	5.19	0.00	36.00	36"	5.09	300.00	0.98	16.18
500	400	0.00	0.00	0.00	0.0	0.00	0.00	0.00	16.18	5.07	0.00	36.00	36"	5.09	300.00	0.98	17.16
400	300	0.00	0.00	0.00	0.0	0.00	0.00	0.00	17.16	4.95	0.00	36.00	36"	5.09	300.00	0.98	18.14
300	200	0.00	0.00	0.00	0.0	0.00	0.00	0.00	18.14	4.84	0.00	36.00	36"	5.09	300.00	0.98	19.12
200	100	0.70	19.30	0.00	0.0	20.00	4.66	63.00	20.00	4.66	63.00	98.38	54"	6.19	275.00	0.74	20.74

Input File: drainplan

Date: 04-12-1985
Time: 13:17:33

CHELSEA BROOKE ADDITION DRAINAGE PLAN 36-84019-2-177
5-YR INTERNAL DESIGN WITH Q=36 CFS DISCHARGE FROM BEECH
MWB 4/12/85

Storm Frequency = 5-Year

* * * HYDRAULICS * * *

Node	Hyd-Slope (Ft/Ft)	Friction (Ft)	Bend (Ft)	Transition (Ft)	Manhole (Ft)	Deflection (Ft)	Junction (Ft)	Total (Ft)	Hyd-Gl Elevation	Desired Elevation	Diff. (Ft)
700	0.00291	0.1748	0.0000	0.0000	0.0000	0.0000	0.0000	0.1748	1352.6835	1354.5000	1.82
600	0.00291	0.8740	0.0000	0.0000	0.0201	0.0000	0.0146	0.9087	1352.5087	1354.5000	1.99
500	0.00291	0.8740	0.0000	0.0000	0.0201	0.0000	0.0146	0.9087	1351.6000	1353.2500	1.65
400	0.00291	0.8740	0.0000	0.0000	0.0201	0.0000	0.0146	0.9087	1350.6913	1352.0000	1.31
300	0.00291	0.8740	0.0000	0.0000	0.0201	0.0000	0.0146	0.9087	1349.7826	1350.7500	0.97
200	0.00250	0.6882	0.0000	0.0191	0.0000	0.2014	1.1651	2.0739	1348.8739	1349.5000	0.63
100	0.00000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1346.8000	1349.5000	2.70

E1

DRAINAGE EASEMENT

THIS EASEMENT made this 31st day of January, 1984, by and between David's, Incorporated, formerly Greenwich Investments, Inc., of the first part and Jeffrey S. Greenberg, of the second part.

WITNESSETH: That the said first party, in consideration of the sum of One Dollar ($1.00) and other valuable consideration, the receipt whereof is hereby acknowledged, does hereby grant and convey unto the said second party, his heirs, grantees, successors and assigns, a perpetual right-of-way and easement for the purpose of construction, maintaining, and repairing an underground drainage system, under the following described real estate situated in Sedgwick County, Kansas, to-wit:

A portion of the SE 1/4 of the SE 1/4 of Section 21, Township 27 South, Range 2 East of the 6th P.M., Sedgwick County, Kansas, described as:

The North forty feet of the South sixty feet of the following described property:

Beginning at the point of intersection of the East line of the West 1/2 of the SE 1/4 of the SE 1/4 of Section 21, Township 27 South, Range 2 East of the 6th P.M. and the North line of U. S. 54 Highway (Case A-17549); thence East along said North line a distance of 291 feet; thence North a distance of 60 feet; thence West parallel to and 60 feet North of the North line of U. S. 54 a distance of 291 feet to the East line of the West 1/2 of the SE 1/4 of the SE 1/4 of said Section 21; thence South along said East line to the point of beginning.

And said second party is hereby granted the right to enter upon said premises at any time for the purpose of constructing, operating, maintaining, and repairing such drainage system.

It is understood and agreed that first party is making this grant of easement to second party specifically with the understanding that all costs of the construction, installation or maintenance of said drainage system will be borne by Jeffrey S. Greenberg, his heirs, grantees, successors and assigns, regardless of whether the installation is made by a special assessment by the City, County or State, or if by private installation. The covenant shall be binding upon all future owners of the benefited property and shall run with the land.

In the event installation of the drainage system has not been completed within ten (10) years from the date hereof, this easement shall expire and become null and void and of no further legal force nor effect.

It is specifically understood and agreed that this easement is given solely for an underground system. First party retains the right to pave and park over the easement area.

IN WITNESS WHEREOF, the said first party has signed these Presents the day and year first written.

DAVID'S, INCORPORATED

By _____
Daniel J. Taylor, President

STATE OF KANSAS)
)ss.:
COUNTY OF SEDGWICK)

Personally appeared before me, a notary public, in and for the County and State aforesaid, Daniel J. Taylor, President of David's, Incorporated, to me personally known to be the same person who executed the foregoing instrument for and on behalf of said corporation.

Dated at Wichita, Kansas this 31st day of January, 1984.

_____
Notary Public

My Commission Expires:

LOUISE WARREN
STATE NOTARY PUBLIC
SEDGWICK COUNTY, KS
MY APPT. EXP. _____

AE.2