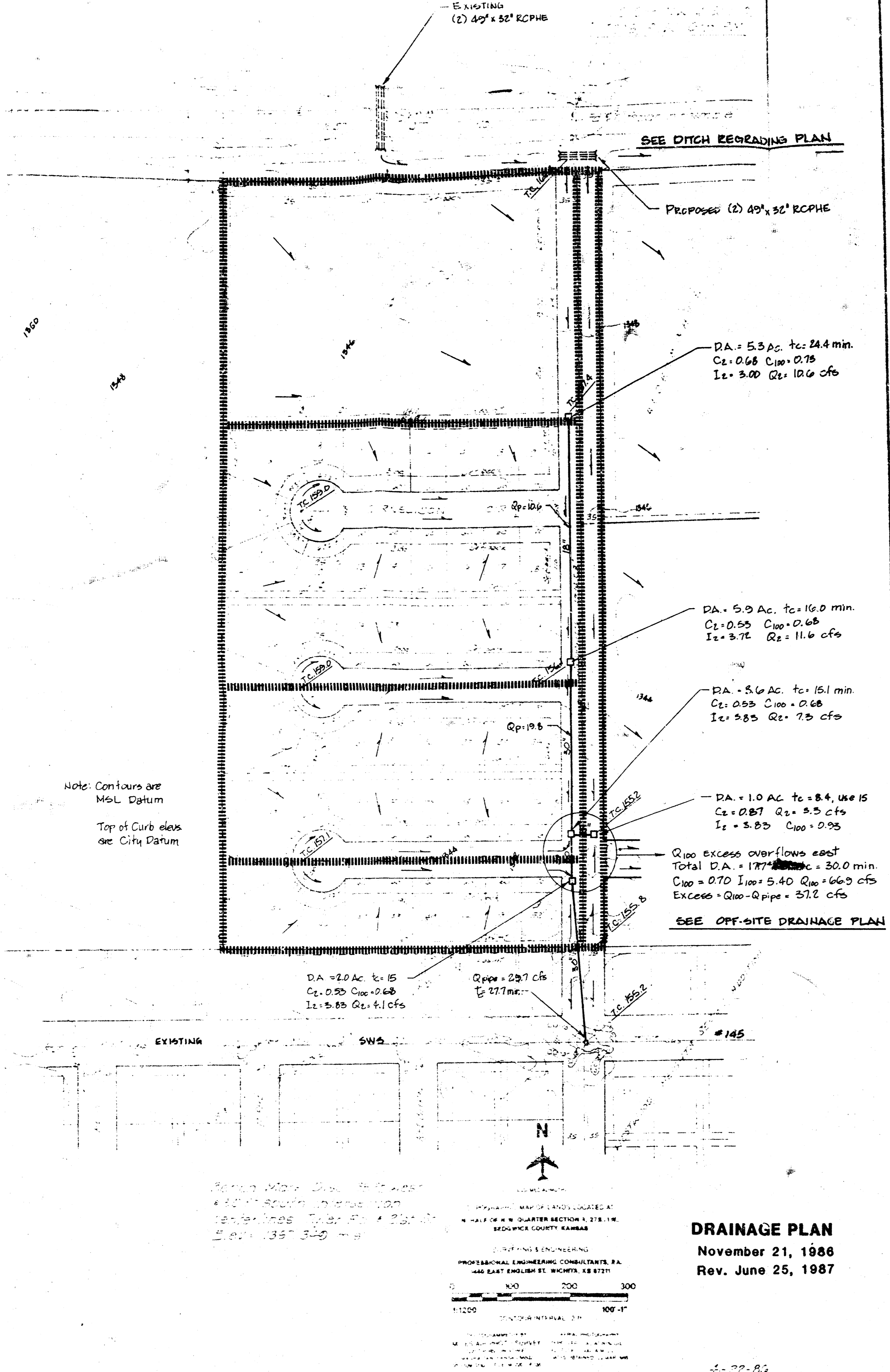


WESTWIND 2ND ADDITION

DRAINAGE PLAN

PART OF THE NW 1/4 OF SEC 9 T 17 N R 1 W SEDGWICK COUNTY KANSAS

WESTWIND ASSOCIATES II



DRAINAGE PLAN

November 21, 1986

Rev. June 25, 1987

BAUGHMAN COMPANY, P.A.
SURVEYING & ENGINEERING
31625-9271 • 315 ELLIS • WICHITA, KANSAS 67211

DRAINAGE PLAN
FOR
WESTWIND 2nd ADDITION

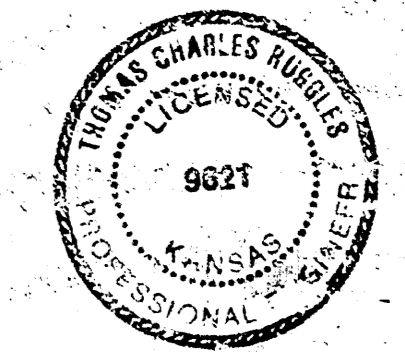
WICHITA, SEDGWICK COUNTY, KANSAS

BAUGHMAN COMPANY, P.A.
SURVEYING & ENGINEERING
31625-9271 • 315 ELLIS • WICHITA, KANSAS 67211

June 1987

WESTWIND 2ND ADDITION
REVISED DRAINAGE PLAN
JUNE 25, 1987

- This plan supersedes two previously submitted plans dated November, 1986, and March, 1987, and consists of three parts:
- I. Diversion of off-site drainage from the north, to the east.
 - II. Storm sewer system for the initial design storm (2-yr.).
 - III. Diversion of excess runoff (100-yr.) to the east.



WESTWIND 2ND ADDITION

Determination of Runoff
from area n. of 21st Street

Undeveloped Condition
DA = 68 Ac. Soil Group B, 5% pasture, 50% grass, remaining use Rational Method
C₁ = 0.22 C₁₀₀ = 0.40 (Attach D)
Length of Watershed = 2300' H = 1366 - 1346, S = 0.87%
1150 @ 1.05 fps / 1150 @ 0.26 fps. V_{avg} = 0.65 fps (Attach E)
2300 @ 0.25 = 600 59.0 to = 59 min.
I₁ = 2.18 hr I₁₀₀ = 3.77 hr (Attach A)
Q₁ = 32.6 cfs Q₁₀₀ = 102.5 cfs (use 103 cfs)

Developed Condition
Church Sites Golf Course D.A. = 28.5 Ac.
Area = 23.0 Ac. 3.0 Ac. Commercial Sites: 5.5 Ac.
Impervious = 20% 0% 70%
C₁ = 20% @ 0.31 @ 0.76
80% @ 0.22 @ 0.76
C₁₀₀ = 0.35
C₁₀₀ = 20% @ 0.30 @ 0.323
0.2% @ 0.1 @ 0.323
C₁₀₀ = 0.51
T₁ = L = 660', V = 0.44 fps T₁ = 25 min.
I₁ = 3.57 I₁₀₀ = 5.90 I₁ = 4.5 I₁₀₀ = 7.37
Q₁ = 25.0 cfs Q₁₀₀ = 2.4 cfs Q₁₀₀ = 16.2 cfs
Q₁₀₀ = 60.2 cfs Q₁₀₀ = 7.3 cfs Q₁₀₀ = 31.2 cfs
Total Q₁ = 43.6 cfs Total Q₁₀₀ = 38.7 (use 99 cfs)

Developed conditions per P&C development plan for Reflection Ridge 6-10-37

I. DIVERSION OF OFF-SITE DRAINAGE

An area of 68 acres located north of 21st Street naturally drains across the Westwind 2nd Addition site via two culvert pipes under the street. The undeveloped condition runoff from the area is 103 cfs (Q₁₀₀). This area is to be included in a planned development, with a reduced drainage area of 28.3 acres and peak runoff (Q₁₀₀) of 99 cfs, approximately equal to the existing condition (see page 3). However, no drainage right of way or easement exists south of 21st Street, and this runoff flows across private property (Westwind 2nd Addition). Since this and other drainage areas were excluded from the design of the storm sewer system to the south (SSS 145), sufficient capacity does not exist in that system to accept this runoff. Part I of this Drainage Plan will divert the flow along the south side of 21st Street within existing street right of way to an existing storm sewer at Ridge Road, thereby eliminating the overland flow to the south.

The existing culvert installation across 21st Street (see Plan) includes (2) 40" x 32" Reinforced Concrete Pipes (R.C.P.). Although the runoff to the culvert inlet is 99 cfs, the pipes will handle only 76 cfs, due to head limits controlled by the elevation of 21st Street. The excess flow east along the north side of the street (see page 4). The 76 cfs discharged by the pipes will be carried east in the south ditch by removing a ditch plug at Woodchuck and regrading the ditch in some areas to the east. A proposed double culvert at Woodchuck and culverts at the driveway downstream will be sized to pass this flow (see pages 4 and 5). Some filling along the south R/W line will be required to contain the flow within the ditch (see Ditch Regrading Plan).

II. STORM SEWER

An extension of Storm Sewer 145 will be constructed within Woodchuck right of way, and will drain all the area included in Westwind 2nd Addition (see Plan). This system will be designed to accept runoff from the design storm up to the limits of remaining capacity in the existing system, considering contributions from stormwater detention systems on Westwind 3rd and 4th Additions and Golf Park West, located to the west. (See approved Drainage plans for Westwind 3rd and 4th Addition, May 1987, and Golf Park West, June 1986). Inflow to the storm sewer will be limited by curb inlet capacity, controlled by an overflow to the east at the Westline intersection (see Part III).

Runoff from Westwind 2nd Addition was computed using the Rational Method, per City of Wichita Drainage Criteria. The initial design storm was the 2-yr. frequency, and the secondary storm was the 100-yr. frequency. Runoff coefficients used were from Attachment D, and rainfall intensities were from Attachment A of the above Criteria. All soils in the Westwind 2nd drainage area are Hydrologic Group B, per Sedgwick County Soil Survey. A minimum time of concentration of 15 minutes was used for inlets.

The excess capacity in the existing storm sewer has been determined to be 46 cfs at the point of inflow from this system, at a flow time of approximately 30 minutes in the pipe system (refer to analysis of SSS 145 included in the November 1986 plan). The time lag between inflow at the contributing points for the areas mentioned will allow approximately 30 cfs from the proposed storm sewer to enter the system at Woodchuck (see Plan). The contribution from Westwind 2nd Addition will be limited to 28.7 cfs (Q₁) per the Drainage Plan. The Q₁₀₀ excess of 37.2 cfs (66-28.7) will overflow at Westline Avenue to the east, as described in Part III.

III. DIVERSION OF EXCESS RUNOFF

Runoff in excess of the capacity of the storm sewer will overflow at the intersection of Woodchuck and Westline and drain to the east (see Plan). This flow will be carried by open ditch through a temporary drainage easement to two existing 1' x 3' RCP's at Ridge Road. Upon development of the land east of Woodchuck, this overflow will be carried in the street section and future storm sewer to Ridge Road (See Off-site Drainage Plan).

A temporary drainage easement and an agreement providing for this ditch will be executed by the Westwind developer and the owner of the property between Woodchuck and Ridge Road. This easement will expire at the time that street right of way is dedicated for the ditch area.

WESTWIND 2ND ADDITION
Ditch flow east (S. side 21st St.)

(2) 44" x 32" RCPHS @ 102' long incl. end sections (existing).
Determine discharge using FHWA HEC-NO.5.
(FHWA 1975 41-932 22 50' x 31")
MSFL = 159.40 DSFL = 159.26 Elev. E @ 21st = 162.71
Max. HW = 162.71 - 159.40 = 3.31' Slope = 0.2014
Inlet control: HW/D = 3.31 + 2.67 = 1.24 (use Chart 3)
Q = 60 cfs / pipe x 2 = 120 cfs
w/ outlet control: K_c = 0.5 H = 3.31 - 2.67 = 0.64' (use Chart 10)
Q = 38 cfs / pipe x 2 = 76 cfs
Outlet control governs: Q = 76 cfs through pipes
Note: High point in N. ditch = elev 162.02. When flooding reaches that elev., it begins to flow east. Excess flow drains east.

Recommend installing (2) 44" x 32" RCPHS @ street and driveway locations along south ditch of 21st St. Maintain HW depth of 3.0' @ all inlet ponds.

Check ditch section capacity in north ditch per plan/profile, to prove capacity > 76 cfs. Typical existing finished ditch section has 8' bottom.

DITCH CAPACITIES 6-21-87 JCA

Ditch Sta. 0+00 to 2+00: S = 0.0043 S² = 0.0176
try 4' x 2.0' A = 32.00 ft² W = 24.14' R = 13.07' r² = 1.10
V = 1.485 (1.485) (0.26) = 3.91 ft³ Q = 3.91 / 22.00 = 125 cfs > 76

Minimum elev. 161.11 along R/W for rigid HW @ 3'00 culvert exceeds 2.0' depth for this reach & capacity exceeds 76 cfs.

Ditch Sta. 3+55 to 7+00: S = 0.0020 S² = 0.0045
try 4' x 2.2' A = 35.60 ft² W = 26.14' R = 12.85' r² = 1.183
V = 1.485 (1.485) (0.26) = 2.16 ft³ Q = 2.16 / 24.14 = 89.6 cfs > 76 cfs

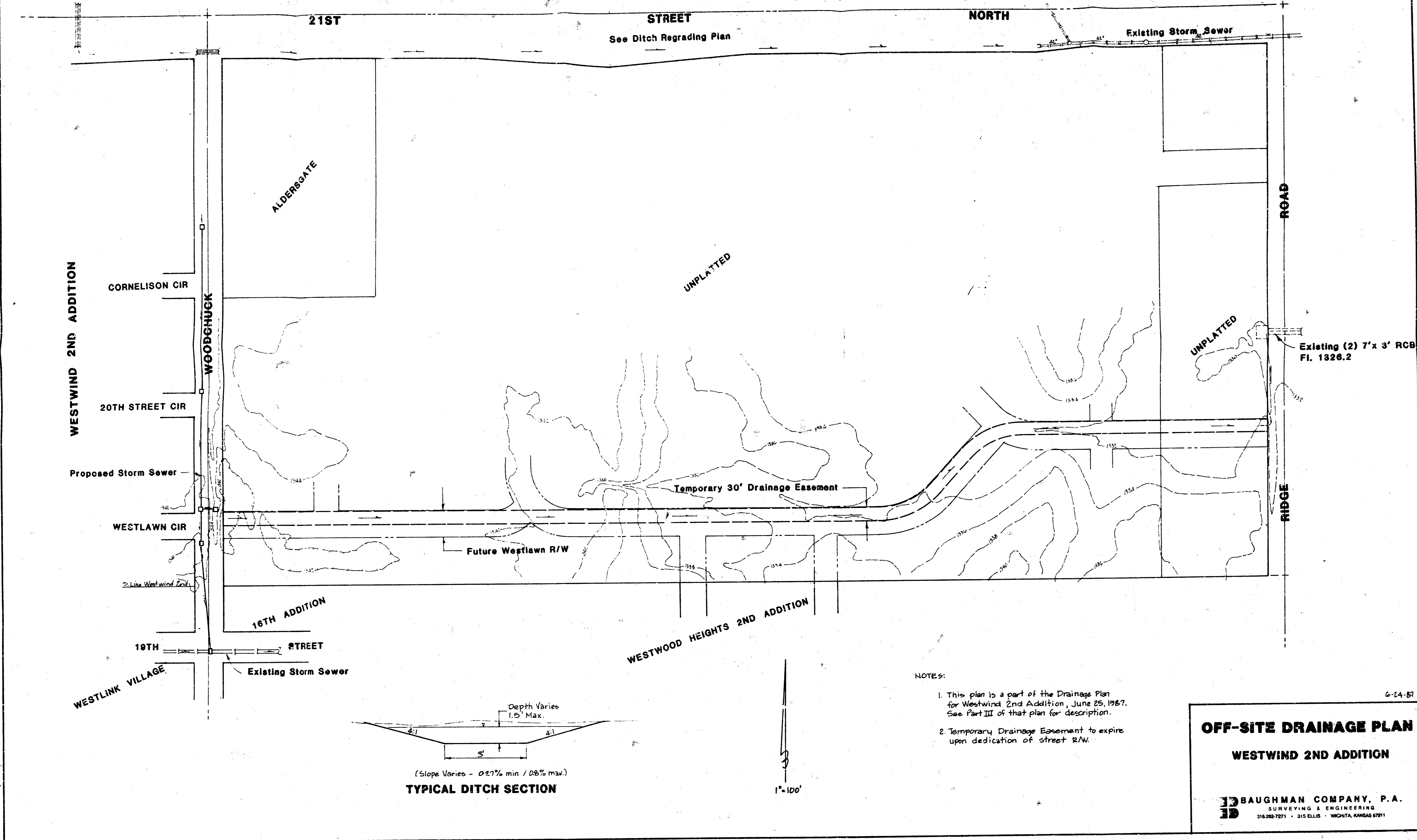
∴ ditch capacity for this reach exceeds 76 cfs @ 2.2' depth.

Ditch Sta. 7+00 to SWA inlet @ 23+90 ±:

Slopes exceed 0.43% (above) & with same ditch section, capacity will exceed 76 cfs @ depths < 2.0'.

LEGAL DESCRIPTION FOR TEMPORARY DRAINAGE EASEMENT

A strip of land 30 feet wide lying 15 feet either side of the following described centerline: Beginning at a point in the west line of the NW of the NE of Sec. 9, Twp. 27-S, R-1-W of the 6th P.M., and 153.0 feet north of the S.W. Corner of said NW of the NE of Sec. 9, 1650.0 feet to the P.C. of a curve said NW of the NE of Sec. 9, 1650.0 feet to the P.C. of a curve to the left having a radius of 195 feet; thence along said curve, through a central angle of 45°00', 153.15 feet; thence P.C. of a curve to the right having a radius of 195 feet; thence along said curve, through a central angle of 45°00', 153.15 feet; along said curve, through a central angle of 45°00', 153.15 feet; thence easterly along the tangent to last described curve, 648 feet more or less to a point 40 feet west of the east line of said Sec. 9.



- NOTES:**
- This plan is a part of the Drainage Plan for Westwind 2nd Addition, June 25, 1987. See Part III of that plan for description.
 - Temporary Drainage Easement to expire upon dedication of street R/W.

OFF-SITE DRAINAGE PLAN
WESTWIND 2ND ADDITION

BAUGHMAN COMPANY, P.A.
 SURVEYING & ENGINEERING
 316/262-7271 • 315 ELLIS • WICHITA, KANSAS 67211

Enclosed is the final drainage plan for the above plat. Attached are drainage calculations (3 pages) ditch plan and profile, and an analysis of Storm Sewer 145 checking available capacity (1 print, 3 pages, and computer print-out).

The final plat is being submitted today to MADD.

Culvert / Ditch Flow
 21st & Woodchuck
 TCR DATE 11-20-88 PAGE 1 OF 2

MILLCON CORPORATION

2 - 44" x 36" RCPHE Joints East St. L=102'
 (Using HEC, R.O.S., F.H.A.)
 USFL = 151.40 DSEL = 157.26 S = 0.0014
 elev. of 21st St. = 162.71
 Max HW = 162.71 - 159.40 = 3.31'
 Intake control: H₀/D₀ = 3.31 / 2.67 = 1.24 (Chart 3)
 Q = 60 cfs / pipe
 Outlet control (Chart 10) K_c = 0.5 H = 3.31 = 1.67 feet
 Q = 38 cfs / pipe x 2 = 76 cfs

Total Q through pipe = 76 cfs

D.A. n of 21st flow to culverts above = 68 ac.
 L = 2300' R = 1566 - 1336 = 230' 1/2 ft above station, 1/2 ft below station

Avn. velocity = (4.45 + 0.20) / 2 = 0.45 fps
 C for soil group E/C, active condition, 100% sep. = 0.40
 C = 2300' x 0.45 cfs = 59 min I₁₀₀ = 5.71 in/hr

Q₁₀₀ = 2.40(3.71)(6) = 102 cfs * see note above
 by R.O.S. 2.40(3.71)(6) = 102 cfs
 (by R.O.S. 2.40(3.71)(6) = 102 cfs)
 R = 0.023 S = 0.0014 R₀ = 0.023(0.0014) = 0.000322
 R₀ = 0.000322
 R₀ = 0.000322
 R₀ = 0.000322

Check ditch capacity - new section
 min. slope = 0.12% no noise
 V = 1.48(1.18)(1.02) = 1.76 fps
 R = 0.023
 R₀ = 0.000322

Q₁₀₀ = 2.40(1.76)(6) = 25.7 cfs

Check ditch inlet capacity (Sta. 23+82)
 2' RCP, n = 0.012, H₀ = 1.67, H₁ = 5.16' inlet control
 H₀/D₀ = 5.16 / 2.67 = 1.93 (K_c = 0.2) Q = 70 cfs (Chart 2)

MILLCON CORPORATION

Check drainage culvert / overtop capacity (Sta. 9+74)
 20' x 36" RCPHE, n = 0.012, L = 102'
 elev. of 21st St. = 162.71
 Intake control: H₀/D₀ = 3.31 / 2.67 = 1.24
 Q = 60 cfs / pipe

Recommendations: Install 2 - 54" x 36" RCPHE under Woodchuck in south ditch of 21st (location of existing driveway if no culvert).
 Suggest existing driveway culvert @ Sta. 7+74 and 14+57. Replace ditch to lowest elevation from 0-50 to 15+00, to pass Q₁₀₀ @ 2' depth.
 Sta. 14+57: 150.00 - 146.71 = 3.29' (L=30')
 Sta. 2-25: 150.00 - 146.71 = 3.29' (L=30')
 Sta. 2-25: 150.00 - 146.71 = 3.29' (L=30')
 Sta. 2-25: 150.00 - 146.71 = 3.29' (L=30')
 Sta. 2-25: 150.00 - 146.71 = 3.29' (L=30')

100-yr analysis SWS 145 II

DATE 11-19-88 PAGE 2 OF 3

MILLCON CORPORATION

Line identification same as 2-yr analysis (computer output attached)

Values in Run based on current C.F.D. drainage design criteria. See plan worksheet for Q calculations. Storage in sump ignored.

Note: Orig. design of system provided for Q₁₀₀ of 154.21 cfs in pipe from sump @ Woodchuck @ 194'. Current value calculated for Q₁₀₀ at same point = 156 cfs

Note: Orig. design of system provided for Q₁₀₀ of 233.26 cfs in pipe from sump @ Woodchuck @ 194'. Current value calculated for Q₁₀₀ at same point = 218 cfs

Sta.	Q ₁₀₀	Q ₂₅	Q ₅	Q ₁	Q _{0.2}	H ₀	H ₁	H ₂	Q ₁₀₀
1	156	156	156	156	156	156	156	156	156
2	156	156	156	156	156	156	156	156	156
3	156	156	156	156	156	156	156	156	156
4	156	156	156	156	156	156	156	156	156
5	156	156	156	156	156	156	156	156	156
6	156	156	156	156	156	156	156	156	156
7	156	156	156	156	156	156	156	156	156
8	156	156	156	156	156	156	156	156	156
9	156	156	156	156	156	156	156	156	156
10	156	156	156	156	156	156	156	156	156
11	156	156	156	156	156	156	156	156	156
12	156	156	156	156	156	156	156	156	156
13	156	156	156	156	156	156	156	156	156
14	156	156	156	156	156	156	156	156	156
15	156	156	156	156	156	156	156	156	156
16	156	156	156	156	156	156	156	156	156
17	156	156	156	156	156	156	156	156	156
18	156	156	156	156	156	156	156	156	156
19	156	156	156	156	156	156	156	156	156
20	156	156	156	156	156	156	156	156	156

BAUGHMAN COMPANY, P.A.
 SURVEYING & ENGINEERING
 316/262-7271 • 315 ELLIS • WICHITA, KANSAS 67211

June 25, 1987

Vicky Huang, P.E.
 City Engineer's Office
 455 North Main
 Wichita, KS 67202

Dear Vicki,

Transmitted herewith is a revised Drainage Plan for Westwind 2nd Addition. The plan consists of the written report and (3) additional sheets: Drainage Plan, Off-site Drainage Plan, and Ditch Regrading Plan/Profile. This plan is a revision of the one submitted in November, 1986.

A copy has also been submitted to Jim Weber at Sedgwick County. Some part of the subject property is in the County, I am unsure of whose approval is required.

Please review the plan and notify us of your recommendations.

Respectfully submitted,
 Thomas C. Ruggles, P.E.

File TCR/kab

Westwind Add - 21st St. Ditch (Revision)

TCR DATE 11-25-88 PAGE 1 OF 1

MILLCON CORPORATION

Minimum ditch section (Sta. 21+00)

Slope = 0.0012% A = 1.0 (1.0) V = 1.0
 R = 0.023 S = 0.0012 R₀ = 0.000322
 V = 1.48(1.18)(1.0) = 1.76 fps
 R = 0.023

Lower ditch @ 21+00 to elev. 154.78
 S₂ = 0.0030 R = 0.023 V = 1.76 fps
 S₂ = 0.0030 R = 0.023 V = 1.76 fps

Upper ditch @ 21+00 to elev. 154.78
 S₁ = 0.0012 R = 0.023 V = 1.76 fps
 S₁ = 0.0012 R = 0.023 V = 1.76 fps

Check culverts @ Sta. 14+57
 2 - 54" x 36" RCPHE Joints East St. L=102'
 (Using HEC, R.O.S., F.H.A.)
 USFL = 151.40 DSEL = 157.26 S = 0.0014
 elev. of 21st St. = 162.71
 Max HW = 162.71 - 159.40 = 3.31'
 Intake control: H₀/D₀ = 3.31 / 2.67 = 1.24 (Chart 3)
 Q = 60 cfs / pipe
 Outlet control (Chart 10) K_c = 0.5 H = 3.31 = 1.67 feet
 Q = 38 cfs / pipe x 2 = 76 cfs

Check culverts @ Sta. 7+74
 2 - 54" x 36" RCPHE Joints East St. L=102'
 (Using HEC, R.O.S., F.H.A.)
 USFL = 151.40 DSEL = 157.26 S = 0.0014
 elev. of 21st St. = 162.71
 Max HW = 162.71 - 159.40 = 3.31'
 Intake control: H₀/D₀ = 3.31 / 2.67 = 1.24 (Chart 3)
 Q = 60 cfs / pipe
 Outlet control (Chart 10) K_c = 0.5 H = 3.31 = 1.67 feet
 Q = 38 cfs / pipe x 2 = 76 cfs

100-yr analysis SWS 145 II

DATE 11-18-88 PAGE 1 OF 3

MILLCON CORPORATION

Analysis of SWS 145 using current design criteria
 Original design was based on old rainfall frequency-duration-intensity curves.

For current design standards, initial design storm frequency is 2-yr (use R₀). Runoff coefficients (for Rational Method) are 0.4 for 2-yr and 0.6 for 100-yr, based on 1% are rainfall for size, 20% Soil Group B and 50% Soil Group C.

New I and Q values are based on Rainfall Intensity Table for Sedgwick County (Apr. 15, 1986), Drainage Criteria Manual, Part A.

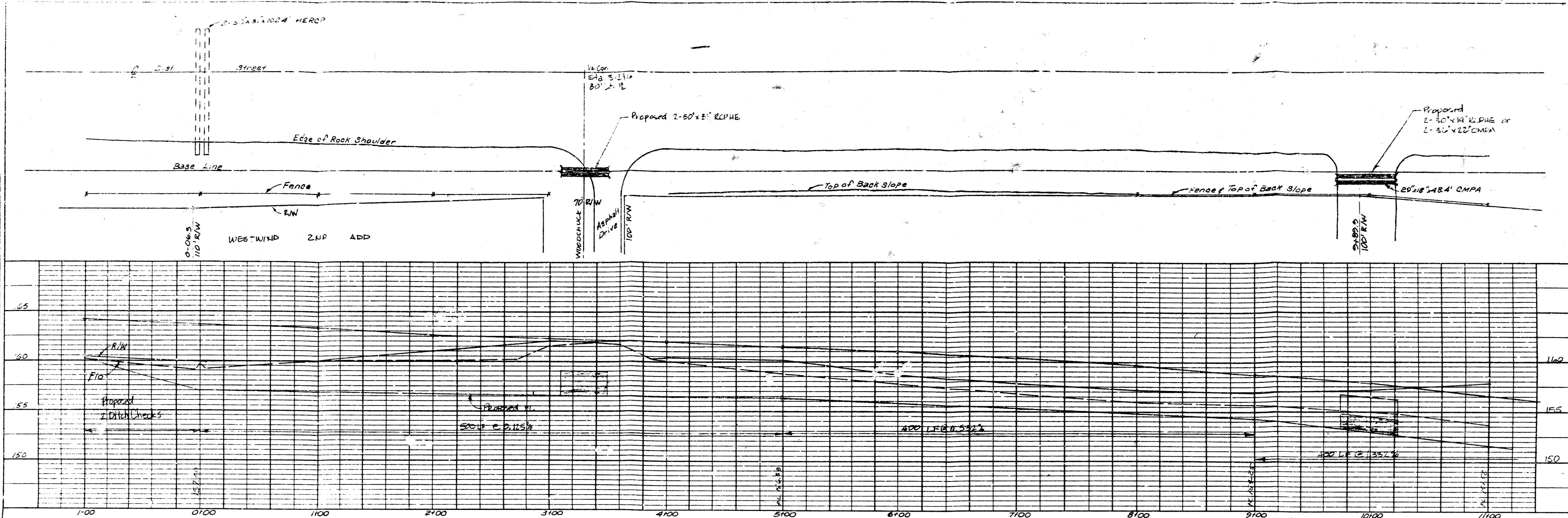
Time of concentration and drainage areas are per original design by C.H.P. (Lerby).

Analysis I: existing system under existing conditions (Q₁₀₀)
 Q values used are for 2-yr frequency (Q₂) except that Q₁₀₀ was selected through street and storm sewer.

Analysis II: existing system with effect of Q₁₀₀

Three analyses considered the flow in laterals for the first section only above their junction with the main line (points 7, 3, and 1). In the original design, since Q (Q₁₀₀) at those points was sufficient to fill the pipe, the flow in laterals was not considered.

PLAN
 SCALE: HORIZONTAL 1" = 100'
 VERTICAL 1" = 10'



PROFILE
 SCALE: HORIZONTAL 1" = 100'
 VERTICAL 1" = 10'

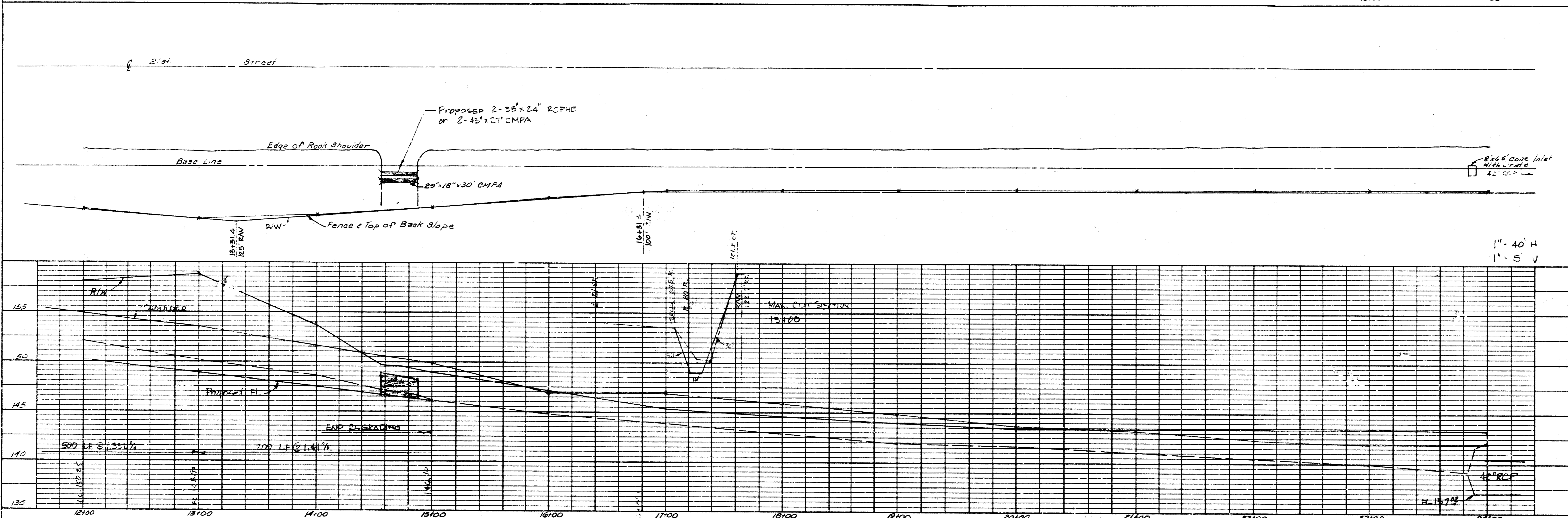


PLATE 2: PLAN, PROFILE, & S
 CLEARANCE PANELS 3, 4, 5
 NO. 10000-2
 PRELIMINARY DITCH PROFILES
 21st St Ditch - Westwind Addition 11-21-86

Project: STORM WATER SEWER NO. 145
 Date: 11/18/1986
 Time: 9:35:4

STORM DRAIN ANALYSIS RESULTS

Line No	D (fts)	U (in)	Dn (in)	Dc (ft)	Flow (cfs)	SI-Full (ft)	V.1 (ft/s)	V.2 (ft/s)	FL 1 (ft)	FL 2 (ft)	HG 1 Calc (ft)	HG 2 Calc (ft)	D.1 (ft)	D.2 (ft)	TU Calc	TU CK	
1																	
2	173.0	54	96	2.35	2.44	Full	.00109	4.8	4.8	128.64	130.95	136.57	137.23	7.93	6.28	.00	.00
3	171.0	54	96	2.30	2.42	Full	.00106	4.8	4.8	130.95	131.80	137.29	137.50	6.33	5.70	.00	.00
4	163.0	54	96	2.12	2.34	Seal	.00097	4.5	5.0	131.60	133.80	137.59	137.91	5.78	4.11	.00	.00
5	157.0	54	96	2.18	2.28	Seal	.00090	4.4	5.0	133.80	134.86	138.64	138.75	4.84	3.89	.00	.00
6	151.0	54	96	2.13	2.23	Part	.00083	4.7	5.2	134.86	135.25	138.88	138.88	4.02	3.63	.00	.00
7	151.0	54	96	2.01	2.23	Part	.00083	5.1	10.3	135.25	136.45	138.96	138.20	3.71	1.83	.00	.00 HJ
8	147.0	54	96	1.98	2.19	Part	.00078	11.5	8.4	136.45	138.50	138.05	140.49	1.60	2.19	.00	.00
9	81.3	72	0	2.21	2.41	Part	.00037	4.3	7.6	138.52	140.74	142.35	143.35	3.03	2.41	.00	.00 HJ
10	76.1	72	0	2.13	2.33	Part	.00032	5.4	7.5	140.74	142.21	143.85	144.54	2.09	2.33	.00	.00 HJ
11	72.2	72	0	2.07	2.27	Part	.00029	5.8	7.4	142.21	143.45	144.96	145.72	2.73	2.27	.00	.00 HJ
12	72.2	72	0	2.08	2.27	Part	.00029	5.8	7.4	143.47	144.07	146.19	146.34	2.72	2.27	.00	.00 HJ
13	71.5	72	0	2.48	2.26	Part	.00028	6.1	6.5	144.10	144.98	146.70	147.46	2.60	2.48	.00	.00
14	58.1	60	0	2.49	2.13	Part	.00050	5.0	15.9	145.09	145.73	147.93	146.93	2.84	1.20	.00	.00 HJ
15	54.4	60	0	1.71	2.07	Part	.00044	9.1	7.1	148.00	149.84	149.71	151.90	1.71	2.07	.00	.00
16	51.2	50	0	1.80	2.01	Part	.00039	5.4	7.0	149.87	151.22	152.30	153.23	2.43	2.01	.00	.00 HJ

STORM DRAIN ANALYSIS RESULTS (cont)

21	131.24	0	1.15	1.33	Part	.00325	4.2	13.4	159.25	161.23	161.29	162.08	2.05	1.85	.00	.00 HJ	
22	131.1	21	0	1.00	1.35	Part	.00684	8.9	6.6	161.48	162.67	162.51	164.02	1.03	1.35	164.69	.00
3																	
23	153.27	0	1.12	1.36	Part	.00244	7.4	6.1	143.23	143.50	144.39	144.86	1.16	1.36	145.44	.00	

Project: STORM WATER SEWER NO. 145
 Date: 11/18/1986
 Time: 9:35:4

STORM DRAIN ANALYSIS RESULTS (cont)

4																	
24	15.4	18	0	1.50	1.41	Seal	.02149	8.9	8.7	141.86	143.50	143.27	146.85	1.41	3.35	148.03	.00
7																	
25	75.3	54	0	1.71	2.53	Part	.00147	13.4	8.2	140.00	143.92	141.73	146.45	1.73	2.53	147.49	.00

- LIST OF ABBREVIATIONS
- V.1, FL 1, D.1 and HG 1 refer to downstream end
 - V.2, FL 2, D.2 and HG 2 refer to upstream end
 - X - Distance in feet from downstream end to point where water surface reaches normal depth by either drawdown or backwater
 - X(N) - Distance in feet from downstream end to point where HG intersects soffit in seal condition
 - X(J) - Distance in feet from downstream end to point where hydraulic jump occurs in line
 - F(J) - The computed force at the hydraulic jump
 - D(BJ) - Depth of water before the hydraulic jump (upstream side)
 - D(AJ) - Depth of water after the hydraulic jump (downstream side)
 - SEAL indicates flow changes from part to full or from full to part
 - HJ indicates that flow changes from supercritical to subcritical through a hydraulic jump
 - HJ1 indicates that hydraulic jump occurs at the junction at the upstream end of the line
 - HJ2 indicates that hydraulic jump occurs at the junction at the downstream end of the line

