P.E & Associates of Kansas Inc.
1720 East Morris
WICHITA, KANSAS 67211

(316) 262-1497

LETTER OF TRANSMITTAL

DATE 1-3-93 | JOB NO 1296

ATTENTION

RE Burlington Northern Industrial Center - Drainage Plan

TO Mr. Chris Breitenstein
Drainage and Flood Control Engineer
City of Wichita, 455 North Main
Wichita, Kansas 67202

GENTLEMEN:

WE ARE SENDING YOU [X] Attached [ ] Under separate cover via _____ the following items:

[ ] Shop drawings [ ] Prints [ ] Plans [ ] Samples [X] Specifications
[ ] Copy of letter [ ] Change order [X] Design Calculations

COPIES	DATE	NO	DESCRIPTION
1	12-23	1	Drainage Plan
1	12-12	2	
1	12-23	1	Design Calculations

THESE ARE TRANSMITTED as checked below:

[X] For approval [ ] Approved as submitted [ ] Resubmit ___ copies for approval
[ ] For your use [ ] Approved as noted [ ] Submit ___ copies for distribution
[ ] As requested [ ] Returned for corrections [ ] Return ___ corrected prints
[ ] For review and comment
[ ] FOR BIDS DUE _____ 19 ____ [ ] PRINTS RETURNED AFTER LOAN TO US

REMARKS

Please call as soon as you have reviewed this plan.

COPY TO

SIGNED:

If enclosures are not as noted, kindly notify us at once.

12-23-92

REVISED DRAINAGE PLAN (STREET STORM SEWER TO INCLUDE 150' D.A. WEST OF CT 2/W AS SHOWN ON PLAN

D.A. 5-A 6.5± AC — TRY T_C = 15 MIN — i_5 = 6.21 — CN = 93
50% IMPERVIOUS — C = .58 (BOHANNILLER) — OVERLAND S = 0.003

Q_5 = 0.55 x .58 x 5.21 = 19.8 cfs — ALLOWABLE DEPTH 3.5 Q_5 = 10.0 cfs PER SIDE STREET. FLOW 3.0082 O.K.

CHECK T_C — a = 4.0 @ 0.5' DEEP

$V = \frac{Q}{A} = \frac{19.8/2}{4} = 2.48$ cfs — 1.24 fps AVERAGE

220' @ 1.24 fps = 177 min — USE T_C = 15 ABOVE

i_{100} = 8.98

Q_{100} = 2.61 x .58 x 8.98 = 13.1 cfs — D = 0.72' OK

D.A. 6-A 3.5 AC — T_C = 15 MIN — i_5 = 6.21 — CN = 93
50% IMPERVIOUS — C = .58 (BOHANNILLER) — OVERLAND S = 0.003

Q_5 = 0.55 x .58 x 3.5 = 11.2 cfs — D = 0.59' OK

Q_{100} = 2.61 x .58 x 8.98 = 13.1 cfs

Q_5 = 0.55 x .58 x 6.03 = 19.2 cfs — D = 0.72' OK

Q_{100} = 2.61 x .58 x 8.98 = 13.6 cfs

Q_5 = 0.55 x .58 x 5.03 = 16.0 cfs

Q_{100} = 2.61 x .58 x 8.98 = 13.6 cfs

Q_5 = (5.5 - 0.5) x .58 x 5.03 = 14.6 cfs

Q_{100} = 2.61 x .58 x 8.98 = 13.6 cfs

Q_5 = 19.8 + 16.0 + 14.6 = 50.4 cfs — STREET FLOW D = 0.72'

Q_{100} = (2.61 - 0.5) x .58 x 8.98 = 11.0 cfs

Q_{100} = 13.6 + 13.6 + 11.0 = 38.2 cfs — USE 42" RCP FLOW D = 0.72' WHERE FL = 127.5 AT T.C. O.K.

(1)

12-14-92

BURLINGTON NORTHERN DRAINAGE PLAN

D.A. 5 = 6.5 AC

$T_C = 1.5 \sqrt{\frac{n L}{4 S}}$

WEST LOT LINE — L = 600 — n = .02 — S = $\frac{2.22}{600}$ = .0037

$T_C = 1.5 \sqrt{\frac{.02 \times 600}{4\sqrt{.0037}}}$ = 10.2 MIN

SOUTH LINE — L = 600 — n = 0.4 — S = .0015

$T_C = 1.5 \sqrt{\frac{.02 \times 600}{4\sqrt{.0015}}}$ = 12.0 MIN

TOTAL T_C = 22.4 MIN. — i_2 = 3.4 — i_{100} = 7.7

CN = .71 (SEE PREL. DESIGN) — AVERAGE C = .604 — 60% IMP.

C_{100} = 0.85 — POMMERLER NOMOGRAPH
C_2 = 0.23

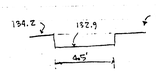
Q_{100} = 7.42 x 0.35 x 7.7 = 20.0 cfs (EXIST. CONDITIONS)

Q_2 = 7.42 x 0.23 x 3.4 = 5.8 cfs

CONST. WEIR W/ F.L. = 132.9 DISCHARGING 20.0 cfs WHEN W.S. IS AT 134.2.

$Q = 3.087 L H^{3/2}$ — $3.087 L (1.3)^{3/2}$ = 20 — L = 4.4' USE 4.5'

$4.8 = 3.087 \times 4.5 \times H^{3/2}$ — H = 0.58' FOR 2 YR STORM



(2)

DA # 12 8.54 Ac

V = 1.0 fps @ 40 cfs (SEE CHART)

670' @ 1.2 fps = 11.2 MIN.

T_C = 22.4 + 11.2 = 33.6 MIN. — i_2 = 2.7 — i_{100} = 6.2

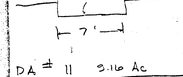
C_{100} = 0.36 — USE SAME AS DA # 13 FOR SAFTY FACTOR
C_2 = 0.25

Q_{100} = 15.96 x .35 x 6.2 = 34.6 cfs

Q_2 = 15.96 x .23 x 2.7 = 9.9 cfs

$Q = 3.087 L H^{3/2}$ — $3.087 L (1.8)^{3/2}$ = 14.6 cfs — L = 6.8' USE 7'

$9.9 = 3.087 \times 7.0 \times H^{3/2}$ — H = 0.59' FOR 2YR STORM



Q_{100} UPSTREAM MAX. CHANNEL DEPTH 0.75' USE 0.8'

STORAGE = CHANNEL 0.98 AC/FT

DA # 11 3.16 Ac

V = 1.2 fps @ 60 cfs

660' @ 1.2 = 9.2 MIN — T_C = 33.6 - 9.2 = 42.8

i_{100} = 5.2 — i_2 = 2.2 — C_{100} = .95 — C_2 = .23

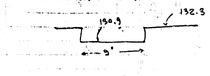
Q_{100} = 25.12 x .35 x 5.2 = 45.7 cfs

Q_2 = 25.12 x .23 x 2.2 = 12.7 cfs

(3)

$Q = 3.087 L H^{3/2}$ — $3.087 L (1.8)^{3/2}$ = 12.7 cfs — L = 8.9 USE 9'

$12.7 = 3.087 \times 9.0 \times H^{3/2}$ — H = 0.59' FOR 2 YR STORM



Q_{100} UPSTREAM MAX CHANNEL DEPTH 0.5'

STORAGE 1.08 AC/FT

D = ± 10 — 15.0 AC

V = 1.7 fps @ 100 cfs

690' @ 1.2 = 9.6 MIN — T_C = 42.8 + 9.6 = 52.4 MIN

i_2 = 1.9 — i_{100} = 4.4 — C_2 = .23 — C_{100} = .35

Q_{100} = 35.12 x .35 x 4.4 = 54.1 cfs

Q_2 = 35.12 x .23 x 1.9 = 15.3 cfs

$Q = 3.087 L H^{3/2}$ — $3.087 L (1.8)^{3/2}$ = 54.1 — L = 12.6

$15 = 3.087 \times 11.0 \times H^{3/2}$ — H = 0.59' FOR 2 YEAR STORM

Q_{100} UP STREAM MAX CHANNEL DEPTH 0.95

STORAGE 1.10 AC/FT

(4)

DA # 7A 8.65 Ac

V = 1.2 @ 70 cfs (SEE GRADED CHANNEL B)

730' @ 1.2 = 10.1 MIN — T_C = 52.4 + 10.1 = 62.5 MIN.

i_2 = 1.65 — i_{100} = 3.85

Q_{100} = 43.77 x 0.35 x 3.85 = 59.0 cfs

Q_2 = 43.77 x 0.23 x 1.65 = 16.6 cfs

$Q = 3.087 L H^{3/2}$ — $3.087 L (1.5^{3/2})$ = 59 — L = 10.4' USE 11.0'

$26 = 3.087 \times 11.0 \times H^{3/2}$ — H = 0.62'

Q_{100} UPSTREAM MAX CHANNEL DEPTH 0.75'

STORAGE 1.62 AC/FT

DA # 7B 11.92 Ac

V = 1.2 @ 70 cfs

730' @ 1.2 = 10.1 MIN — T_C = 62.5 + 10.1 = 72.6 MIN

i_2 = 1.5 — i_{100} = 3.4

Q_{100} = 55.05 x 0.35 x 3.4 = 66.2 cfs

Q_2 = 55.05 x 0.23 x 1.5 = 19.2 cfs

$T = 3.087 L H^{3/2}$ — $66.2 = 3.087 L (1.5^{3/2})$ — L = 11.07 USE 12'

$27.2 = 3.087 \times 12.0 \times H^{3/2}$ — H = 0.65' FOR 2 YR STORM

(5)

Q_{100} UPSTREAM MAX CHANNEL DEPTH 1.05'

STORAGE 1.95 AC FT

D.A. # 7C 35 Ac

USE 12 fps V TO OUTLET NEAREST D410

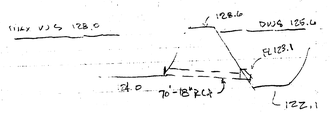
1350' @ 1.2 fps = 25.7 MIN. T_C = 72.6 + 25.7 = 98.3 MIN.

i_2 = 1.2 — i_{100} = 2.7

Q_{100} = 90.65 x 0.35 x 2.7 = 85.7 cfs

Q_2 = 90.65 x 0.23 x 1.2 = 25.0 cfs

CHECK CAPACITY OF OUTLET STRUCTURES — REVISED 05.7



12 cfs TOTAL OUT WITH CHANNEL @ DWG AND UPSTREAM ELEV 126

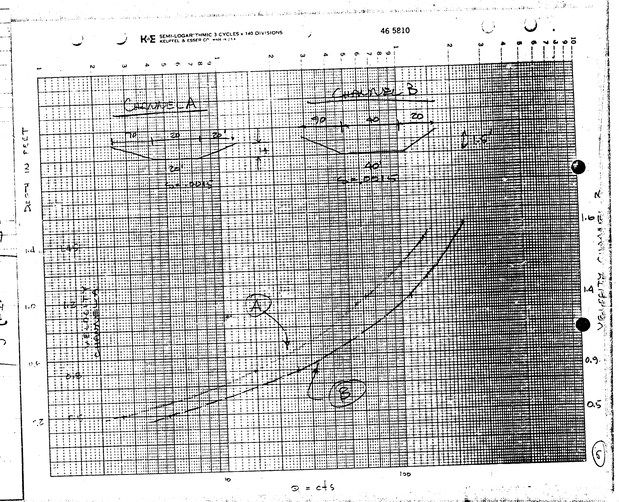
D.A. 5A — Q = 12 cfs @ STA 127+50 CHANNEL PLANS

@ STA 123+00 → DWG = 125.4 — H = 2.6 — 2-24" x 28° RCP x 28'

Q = 30 cfs EA.

@ STA 140+00 DWG = 125.4 — H = 2.6 — 2-24" RCP x 32'

Q = 30 cfs EA



(6)

DA # 9 5.25 Ac

$T_C = 1.5 \sqrt{\frac{n L}{4 S}}$ = $1.5 \sqrt{\frac{.02 \times 960}{4\sqrt{.003}}}$ = 8.8 MIN.

TRY V = 1.2 IN DITCH FOR 950' = 13.2 MIN — 50% IMP. CN = 93

TOTAL T_C = 22 MIN. — i_2 = 3.9 — i_{100} = 7.74

C_2 = 0.43 — C_{100} = 0.70

Q_{100} = 5.25 x 10.7 x 7.74 = 28.4 cfs

Q_2 = 5.25 x .68 x 3.9 = 11.5 cfs

DITCH FLOW 2' DEEP — 4' bottom, 2:1 — Q = 31.8 V = 2.0

AVERAGE V = 1.0 ABOVE 1.2 OK.

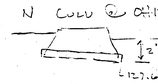
ADD 1.0 AC TO D.A. W OF D410 TOTAL DA = 6.25

550' @ 2.0 fps = 4.6 MIN — T_C = 26.6

i_2 = 2.2 — i_{100} = 7.2

Q_{100} = 6.25 x 0.7 x 7.2 = 31.5 cfs

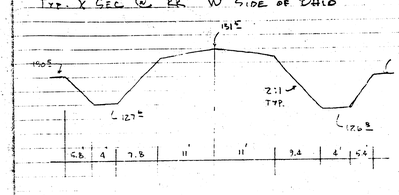
N CULV @ D410

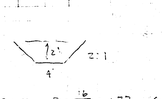


TW = 129.6

(7)

TYP. X SEC @ RR W SIDE OF D410





Q = 16 — $R = \frac{18}{12}$ = 1.33 — S = .0015

$Q = 16 \frac{1.486}{.035} 1.33^{2/3} .0015^{1/2}$ = 31.8 cfs — V = 2.0 fps

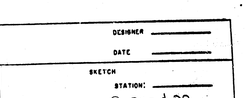
(8)

PROJECT. _____ DESIGNER _____ DATE _____

HYDROLOGIC AND CHANNEL INFORMATION

Q_1 = _____
Q_2 = _____
TW_1 = _____
TW_2 = _____

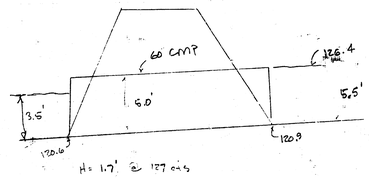
SKETCH — STATION: — @ D410 & RR



ALLOWABLE OUTLET VELOCITY = _____

CULVERT TYPE	Q	SIZE	HEADWATER COMPUTATION: INLET CONT. $\frac{HW}{D}$	OUTLET CONTROL: HW	Y_2	d_c	$\frac{d_c+D}{2}$	h_o	H	L_o	HW	HEADWALL	HW/D	OUTLET VELOCITY	COST	COMMENTS
RCP	42	36'	1	3.2	2.5	1.4	1.7	2.5	0.9	3.3	3.6	7.6		4.5		USE 2-24" RCP D410
1.5% RCP	127	60'	1.02	9.1	6.5	5.3	5.1	4.1	1.7	4.3	5.5	5.5		6.4		USE 2-60" RCP @ D2 AND W. CHANNEL

(9)



H = 1.7' @ 127 cfs

(7A)

Q_{100} = 179 cfs IN CHANNEL @ 33RD — T_C = 60 MIN

DA A-A Q_{100} = 206.8

DA A-B Q_{100} = 48.0

TOTAL Q_{100} = 253.8

Q_{100} WILL ACTUALLY BE LESS IF 60 MIN T_C IS USED DID NOT TAKE THIS INTO ACCOUNT FOR SAFTY FACTOR

(10)

DA A-B 4.28 Ac

T_C = 26.6 MIN. FROM DA # 9 + 1 ACRE

i_2 = 3.2 — i_{100} = 7.2

INCLUDE DA # 9 TO STRUCTURE AT W. CHANNEL

4.28 + 5.25 = 9.53 Ac. TOTAL

Q_{100} = 9.53 x 0.7 x 7.2 = 48 cfs

H = 1.7' ON 24" RCP EXIST. — DWG = 126.4 + 1.5 — HW = 127.9

RAISE TOP OF DIKE TO 129.0

(11)

DA # 8 5.53 Ac

$T_C = 1.5 \sqrt{\frac{.05 \times 200}{4\sqrt{.002}}}$ = 1.2 MIN.

750' @ 1.5 fps = 10.9 MIN.

INITIAL T_C = 22.1 — i_2 = 3.19 — i_{100} = 7.74

Q_{100} = 5.53 x 0.7 x 7.74 = 30.0 cfs

Q_2 = 5.53 x 0.68 x 3.19 = 12.2 cfs

MIN. #W = 130.0 (SEE DA # 9 PIPE SIZE ADDED 0.3')

DA # 3 5.95 Ac

+50 750' @ 2 fps TO DA # 4 T_C = 6.25 + 22.1 = 28.4 MIN.

i_{100} = 7.0

Q_{100} = 11.84 x 0.7 x 7.0 = 56.3 cfs — CHANNEL 120.5 — DWG @ 251 cfs = 124.0

USE SAME STRUCTURE AS AT 149+00

2-24" RCP x 22° H = 3' Q = 20 cfs EA. HW 127.0

DA # 2 4.75 Ac L = 900

(12)

DA # 1 2.64 Ac L = 500

$T_C = 1.5 \frac{\frac{.05 \times 500}{4\sqrt{.005}}}{} + 1.10$ MIN — i_{100} = 8.76

Q_{100} = 2.64 x 0.7 x 8.76 = 16.2 cfs

max DWG = 124.6 — EL INLET = 125.1 — L = 36'

H = 0.8' REQ'D @ 16.2 cfs — 24" RCP EXIST

HW = 125.4 — HW = 125.6 TO GET 0.5' ABOVE INLET

DRAINAGE PLAN

BURLINGTON NORTHERN INDUSTRIAL CENTER

DRAINAGE

DA # 5 4.71 Ac

Assume Average Flow 1.5 cfs

1730' @ 1.5 cfs = 19.2 MIN

USE 15 MIN $i_5 = 5.21$ $i_{100} = 8.98$ CN = 93 86% IMP

$C_5 = 0.62$ $C_{100} = 0.80$ (RATIONAL)

$Q_5 = 4.71 \times .62 \times 5.21 = 15.2$ cfs

$Q_{100} = 4.71 \times .80 \times 8.98 = 33.8$ cfs

DA # 6 4.34 Ac

USE TC = 12 MIN FROM PREVIOUS STORM SEWER

$i_5 = 3.01$ $i_{100} = 5.22$ C = 0.7

$Q_5 = 4.34 \times 0.7 \times 3.01 = 9.1$ cfs

$Q_{100} = 4.34 \times 0.7 \times 5.22 = 15.9$ cfs

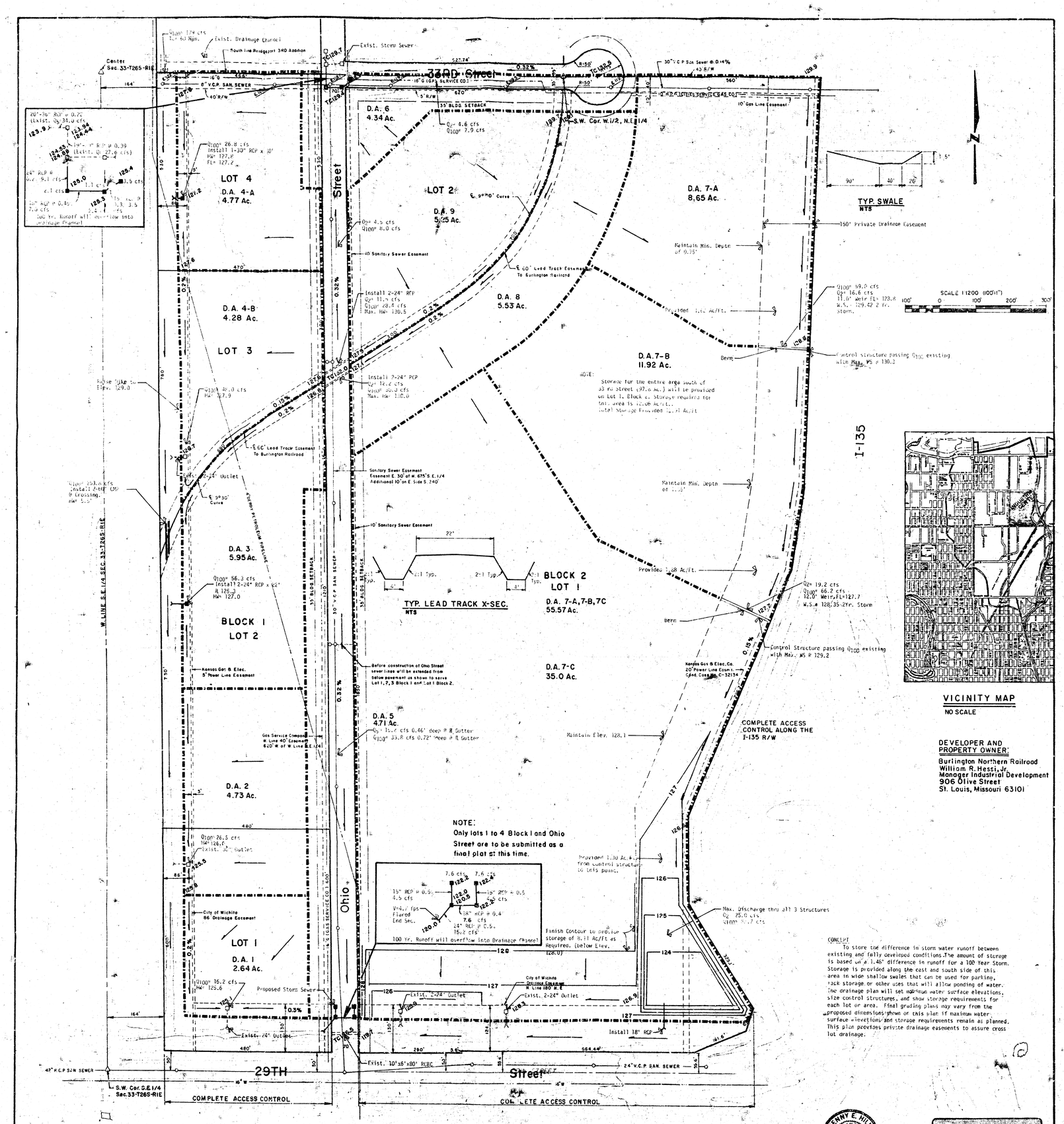
DA. 4-A 4.77 Ac

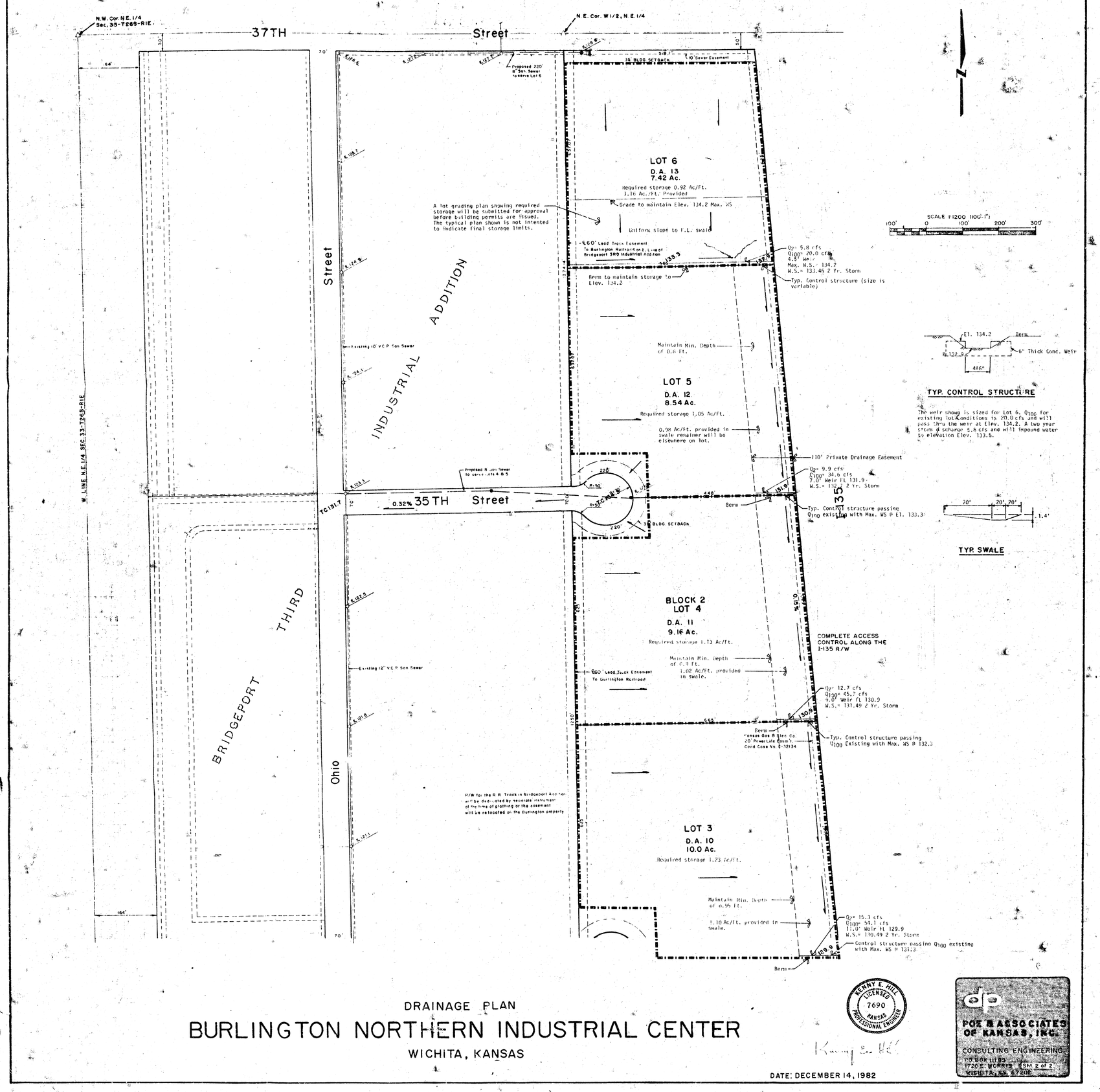
$T_c = 15 + \frac{870 \times 0.40}{\sqrt{1.00}} = 19.2$

$Q_{100} = 4.77 \times 0.7 \times 8.03 = 26.8$ cfs

1 - 30" - 36" RCP HW = 0.8'

TW = 127.0 + .5 = 127.5 HW = 127.8


33RD Street
29TH Street
Center Sec. 33-T26S-R1E
S.W. Cor. W.1/2, N.E.1/4
S.W. Cor. S.E.1/4 Sec.33-T26S-R1E
W. LINE S.E.1/4 SEC. 33-T26S-R1E
Exist. Drainage Channel
South Line Resurvey 3RD Addition
Exist. Storm Sewer
8" V.C.P. SAN. SEWER
16" G (GPU SERVICE CO.)
40' R/W
5' R/W
35' BLDG SETBACK
10' Gas Line Easement
30" V.C.P. SAN SEWER
42" R.C.P. SAN SEWER
24" V.C.P. SAN. SEWER
Exist. 10'x6'x80' RCBC
Exist. 24" Outlet
Exist. 2-24" Outlet
Exist. 2-72" Outlet
Proposed Storm Sewer
Install 18" RCP
Install 2-24" RCP
Install 3-24" RCP
Install 2-24" CMP @ Crossing.
Raise Manhole to Elev. 129.0
Before construction of Ohio Street sewer lines will be extended from below pavement as shown to serve Lot 1, 2, 3 Block 1 and Lot 1 Block 2.
Maintain Elev. 128.1
Maintain Min. Depth of 9.75'
Maintain Min. Depth of ...0'
Provided 1.68 Ac/Ft.
Provided 1.30 Ac/Ft. from control structure to this point.
Provided 1.61 Ac/Ft.
Finish Contour to provide storage of 8.11 Ac/Ft as Required. (below Elev. 128.0)
100 Yr. Runoff will overflow into Drainage Channel
Berm
Control structure passing Q100 existing with Max. WS = 129.2
Q100 = 59.0 cfs Q25 = 16.6 cfs 11.0' Weir FL= 128.8 W.S. = 129.42 2 Yr. Storm.
Q100 = 19.2 cfs Q100 = 66.2 cfs 12.0' Weir, FL=127.7 W.S.= 128.35-2Yr. Storm
Max. Discharge thru all 3 Structures Q25 = 25.0 cfs Q100 = 37.7 cfs
Kansas Gas & Elec. 5' Power Line Easement
Kansas Gas & Elec. Co. 20' Power Line Easm't. Cand. Case No. C-32134
Gas Service Company N. Line 40' Easement 620' W of W Line S.E.1/4
City of Wichita 86' Drainage Easement
City of Wichita Drainage Easement N. Line 180' N.E.
LOT 1
LOT 2
LOT 3
LOT 4
BLOCK 1 LOT 2
BLOCK 2 LOT 1
D.A. 1 2.64 Ac.
D.A. 2 4.73 Ac.
D.A. 3 5.95 Ac.
D.A. 4-A 4.77 Ac.
D.A. 4-B 4.28 Ac.
D.A. 5 4.71 Ac.
D.A. 6 4.34 Ac.
D.A. 7-A 8.65 Ac.
D.A. 7-B 11.92 Ac.
D.A. 7-C 35.0 Ac.
D.A. 7-A,7-B,7C 55.57 Ac.
D.A. 8 5.53 Ac.
D.A. 9 5.25 Ac.
TYP. LEAD TRACK X-SEC.
NTS
TYP. SWALE
NTS
150' Private Drainage Easement
40' Sanitary Sewer Easement
10' Sanitary Sewer Easement
60' Lead Track Easement To Burlington Railroad
Q100 = 26.8 cfs Install 1-30" RCP x 30' HW = 127.2 FL= 127.2
Q100 = 56.3 cfs Install 2-24" RCP x 62' R 126.3 HW = 127.0
Q100 = 16.2 cfs HW = 126.6
Q100 = 26.5 cfs HW = 126.6
Q100 = 4.6 cfs Q100 = 7.9 cfs
Q25 = 4.5 cfs Q100 = 8.0 cfs
Q25 = 11.0 cfs Q100 = 28.8 cfs Max. HW = 130.5
Q25 = 12.4 cfs Q100 = 30.0 cfs Max. HW = 130.0
Q25 = 15.7 cfs 0.46' deep @ R Gutter Q100 = 33.8 cfs 0.72' deep @ R Gutter
7.6 cfs 7.6 cfs 15" RCP @ 0.5 4.5 cfs 18" RCP @ 0.5 7.6 cfs 24" RCP @ 0.5 15.2 cfs
V=4.2 fps Flared End Sec.
NOTE: Storage for the entire area south of 33rd Street (97.6 Ac.) will be provided on Lot 1, Block 2. Storage required for this area is 12.08 Ac/Ft.. Total Storage Provided 13.41 Ac/Ft
NOTE: Only lots 1 to 4 Block 1 and Ohio Street are to be submitted as a final plat at this time.
Ohio Street
Q25 = 15.2 cfs Q100 = 33.8 cfs
Q25 = 19.2 cfs Q100 = 42.7 cfs
Q25 = 11.0 cfs Q100 = 28.8 cfs
Q25 = 12.4 cfs Q100 = 30.0 cfs
Q25 = 16.6 cfs Q100 = 37.7 cfs
Q25 = 25.0 cfs Q100 = 56.3 cfs
Q25 = 15.7 cfs Q100 = 33.8 cfs
Q25 = 19.2 cfs Q100 = 42.7 cfs
Q25 = 25.0 cfs Q100 = 56.3 cfs
Q25 = 16.6 cfs Q100 = 37.7



DRAINAGE PLAN

BURLINGTON NORTHERN INDUSTRIAL CENTER

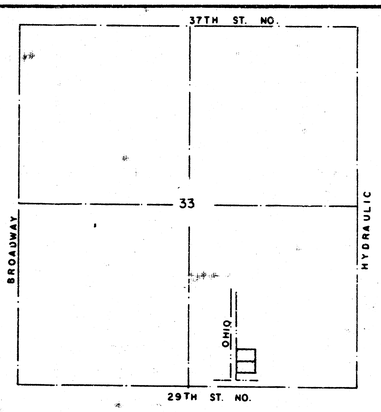
WICHITA, KANSAS

DATE: DECEMBER 14, 1982

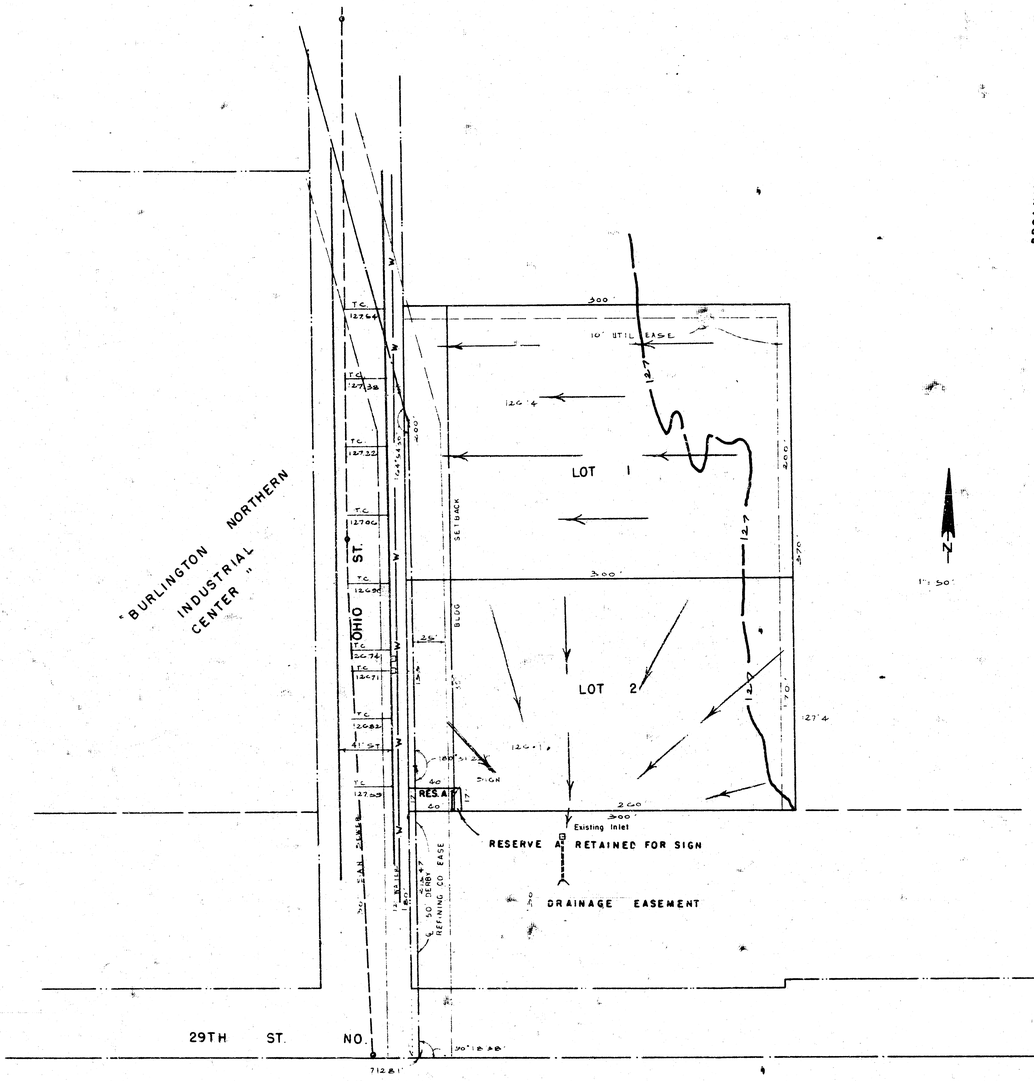
KENNY E. HILL LICENSED 7690 KANSAS PROFESSIONAL ENGINEER

POE & ASSOCIATES OF KANSAS, INC.
CONSULTING ENGINEERING
PO Box 11189
1720 S. HOWARD (Shi. 2 of 2)
WICHITA, KS. 67208

BURLINGTON NOETHERN INDUSTRIAL CENTER
SECOND ADDITION
(Drainage)



VICINITY MAP



DRAINAGE PLAN
BURLINGTON NORTHERN INDUSTRIAL CENTER, SECOND ADDITION

FOR:
CLARKLAND, INC.

LOWELL D. HIGH, L.S.
APRIL 24, 1986