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

REVISE DRAINAGE AREA 7 (STREET SPLIT) SPLIVER TO INCLUDE 150' D.A. WEST OF ST 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 (SCHAMILLER) — OVERLAND S = 0.003'

Q_5 = 0.55 x .58 x 5.21 = 19.8 cfs — ALLOWABLE DEPTH DIS Q = 10.0 cfs PER SIDE STREET. FLOW 3.0032 OK.

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 sec = 2.9 min — USE T_C = 15 ABOVE

i_{100} = 8.98

Q_{100} = 2.61 x .58 x 8.98 = 13.1 cfs — D = .72' OK

D.A. 7 — 3.5 AC — C = .58 — i_5 = 6.21 — i_{100} = 8.98

Q_5 = (3.5 + 6.5) x .58 x 6.21 = 20.2 cfs

Q_{100} = 2.61 x .58 x 8.98 = 13.6 cfs — STREET FLOW OK.

Q_{in} = (2.65 - 1.55) x .58 x 8.98 = 5.73 cfs

STREET + INLET + PIPE = 27.3 cfs — 100' WIDE FL - 22' FLOW T.C. OK.

[DRAINAGE]

12-14-92

Burlington Drainage Plan

D.A. 1 = 10.2 AC

$T_C = 1.5 \sqrt{\frac{nL}{4\sqrt{s}}}$

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 PFEIL. DESIGN) — AVERAGE C = .604 — 0% IMP.

C_{100} = 0.35 — POMMERLEN NOMOGRAPH
C_2 = 0.23

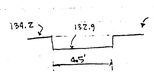
Q_{100} = 7.42 x 0.35 x 7.7 = 20.0 cfs (EXIST. CONDITIONS)

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'

$6.8 = 3.087 \times 4.5 \times H^{3/2}$ — H = 0.58' FOR 2 YR STORM



DA # 12 — 8.54 Ac

V = 1.0 fps @ 40 cfs (SEE CHART) — 1.2

670' @ 1.2 fps = 11.2 MIN.

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

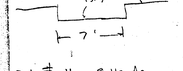
C_{100} = 0.36 — USE SAME AS DA # 13 FOR SAFTY FACTOR
C_2 = 0.25

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

Q_2 = 15.96 x .23 x 2.7 = 9.9 cfs

$Q = 3.087 L H^{3/2}$ — $3.087 L (1.6)^{3/2}$ = 38.6 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

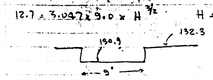
i_{100} = 5.2 — i_2 = 2.2 — C_{100} = .35 — C_2 = .23

Q_{100} = 35.12 x .35 x 5.2 = 45.7 cfs

Q_2 = 35.12 x .23 x 2.2 = 17.7 cfs

$Q = 3.087 L H^{3/2}$ — $3.087 L (1.6)^{3/2}$ = 45.7 — 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

L = ± 10 — 10.0 AC

V = 1.7 fps @ 100 cfs

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

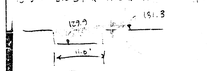
i_2 = 1.9 — i_{100} = 4.4 — C_2 = .23 — C_{100} = .35

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

Q_2 = 35.12 x .23 x 1.9 = 15.3 cfs

$Q = 3.087 L H^{3/2}$ — $3.087 L (1.6)^{3/2}$ = 54.1 — L = 12.6

$5.3 = 3.087 \times 11.0 \times H^{3/2}$ — H = 0.59' FOR 2 YEAR STORM



Q_{100} UP STREAM MAX CHANNEL DEPTH 0.95

STORAGE 1.10 AC/FT

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.

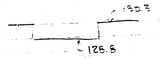
i_2 = 1.65 — i_{100} = 3.85

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 1.2 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

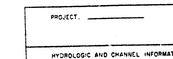
i_2 = 1.5 — i_{100} = 3.6

Q_{100} = 55.65 x 0.35 x 3.6 = 70.2 cfs

Q_2 = 55.65 x 0.23 x 1.5 = 19.2 cfs

$T = 3.087 L H^{3/2}$ — $36.2 = 3.087 L (1.5^{3/2})$ — L = 11.07 USE 12'

$7.7 = 3.087 \times 12.0 \times H^{3/2}$ — H = 0.65' FOR 2 YR STORM



Q_{100} UPSTREAM MAX CHANNEL DEPTH 1.05'

STORAGE 1.25 AC FT

D.A. # 7C — 35 Ac

USE 12 fps V TO OUTLET NEAREST 04+10

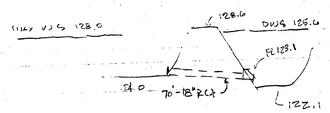
1350' @ 1.2 fps = 25.7 MIN. T_C = 72.6 + 25.7 = 98.3 MIN.

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

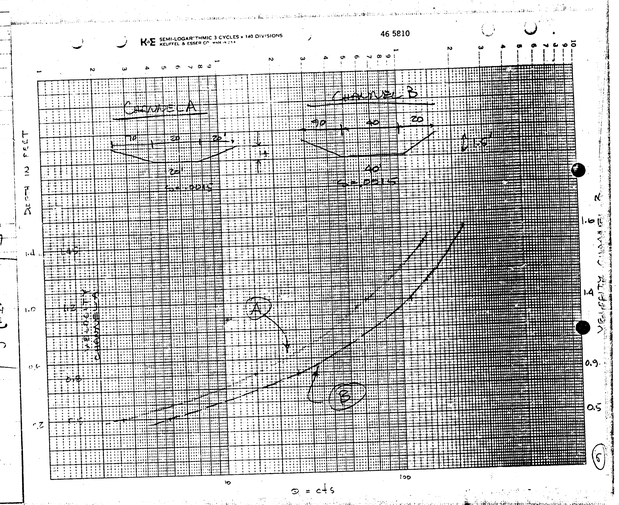


12 cfs TOTAL OUT WITH CHANNEL @ DWG AND UPSTREAM ELEV 126

@ STA 127+50 CHANNEL PLANS

@ STA 123+00 → DWG = 125.4 — H = 2.6 — 2-24" RCP x 32'
Q = 50 cfs EA.

@ STA 140+00 DWG = 125.4 — H = 2.6 — 2-24" RCP x 32'
Q = 50 cfs EA



DA # 9 — 5.25 Ac

$T_C = 1.5 \sqrt{\frac{nL}{4\sqrt{s}}}$ = $1.5 \sqrt{\frac{.02 \times 960}{4\sqrt{.008}}}$ = 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' — 2:1 — Q = 31.8 — V = 2.0

AVERAGE V = 1.0 ABOVE 1.2 OK.

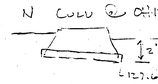
ADD 1.0 AC TO D.A. W OF OHIO TOTAL DA = 6.25

550' @ 2.0 fps = 4.6 MIN — T_C = 26.6

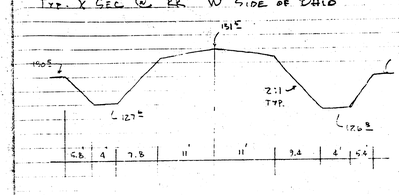
i_2 = 2.2 — i_{100} = 7.2

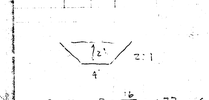
Q_{100} = 6.25 x 0.7 x 7.2 = 31.5 cfs

N CULV @ OHIO



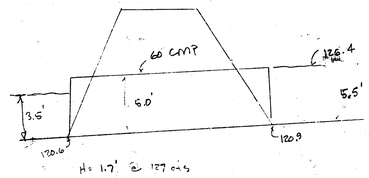
TYP. X SEC @ RR W SIDE OF OHIO





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

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



DA 4-B — 4.28 Ac

T_C = 26.6 MIN. FROM DA # 9 + LAKE

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. — DWS = 126.4 + 1.5 — HW = 127.9

RAISE TOP OF DIKE TO 129.0

DA # 8 — 5.53 Ac

$T_C = 1.5 \frac{.05 \times 200}{4\sqrt{.002}}$ = 11.2 MIN.

950 @ 1.5 fps = 10.9 MIN

TOTAL 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 0.63 x 3.19 = 12.2 cfs

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

DA # 3 — 5.95 Ac

USE 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 DWS @ 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

$T_C = 1.5 \frac{.05 \times 200}{4\sqrt{.002}}$ = 11.2 MIN.

900 @ 1.5 fps = 10.0 MIN

TOTAL T_C = 21.2 — i_2 = 3.3 — i_{100} = 7.4

Q_{100} = 4.75 x 0.7 x 7.4 = 24.6 cfs

Q_2 = 4.75 x 0.63 x 3.3 = 9.9 cfs

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

DA # 1 — 2.64 Ac — L = 500

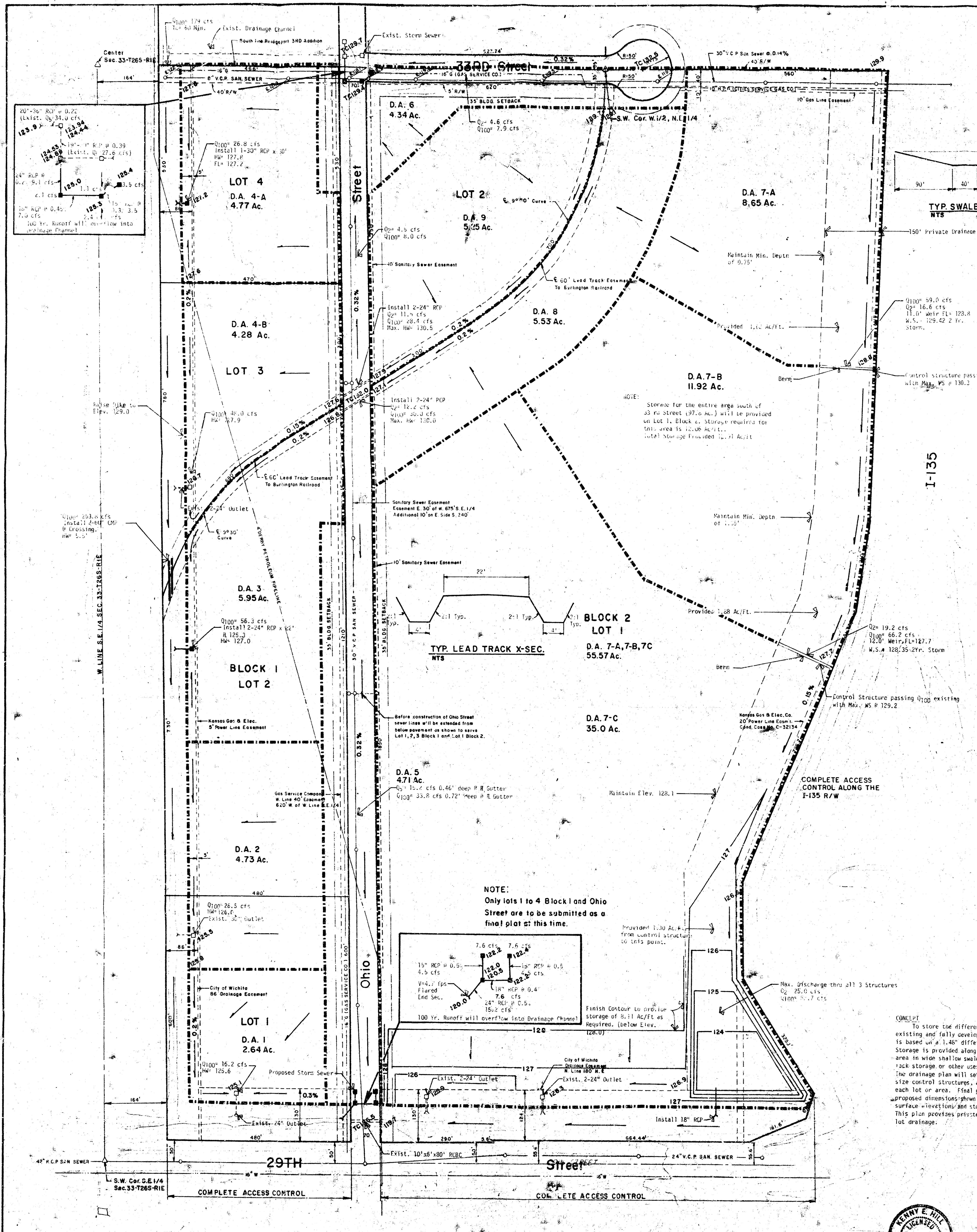
$T_C = 1.5 \frac{.05 \times 500}{4\sqrt{.005}}$ = 7.50 MIN — i_{100} = 8.76

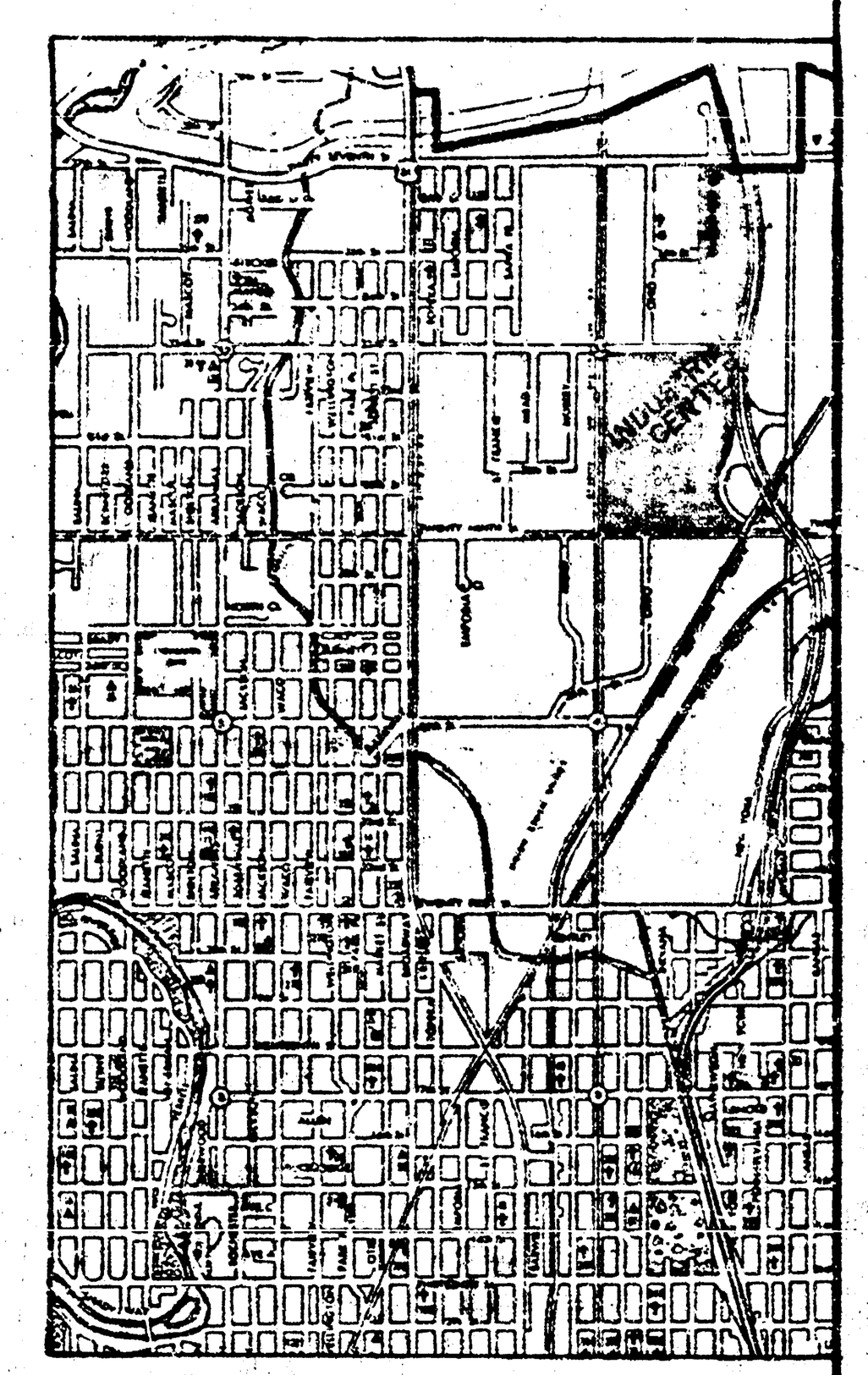
Q_{100} = 2.64 x 0.7 x 8.76 = 16.2 cfs

MAX DWS = 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





VICINITY MAP
NO SCALE

DEVELOPER AND PROPERTY OWNER:
Burlington Northern Railroad
William R. Hessi, Jr.
Manager Industrial Development
906 Olive Street
St. Louis, Missouri 63101

CONCEPT

To store the difference in storm water runoff between existing and fully developed conditions. The amount of storage is based on a 1.46" difference in runoff for a 100 Year Storm. Storage is provided along the east and south side of this area in wide shallow swales that can be used for parking, rack storage or other uses that will allow ponding of water. The drainage plan will set maximum water surface elevations, size control structures, and show storage requirements for each lot or area. Final grading plans may vary from the proposed dimensions shown on this plan if maximum water surface elevations and storage requirements remain as planned. This plan provides private drainage easements to assure cross lot drainage.

DRAINAGE PLAN

BURLINGTON NORTHERN INDUSTRIAL CENTER

KENNY E. HILL LICENSED 7690 KANSAS PROFESSIONAL ENGINEER

POE & ASSOCIATES OF KANSAS, INC.

BURLINGTON NORTHERN INDUSTRIAL CENTER
(DRAINAGE)

DA # 5 4.71 Ac

Assume Average Flow 1.5 fps

1730' @ 1.5 fps = 19.2 min

Use 15 min i_5 = 5.21 i_{100} = 8.98 CN = 93 80% IMP

C_5 = 0.62 C_{100} = 0.80 (Bellmiller)

Q_5 = 4.71 x .62 x 5.21 = 15.2 cfs

Q_{100} = 4.71 x .80 x 8.98 = 33.8 cfs

DA # 6 4.34 Ac

Use Tc = 42 min from Previous Storm Sewer

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

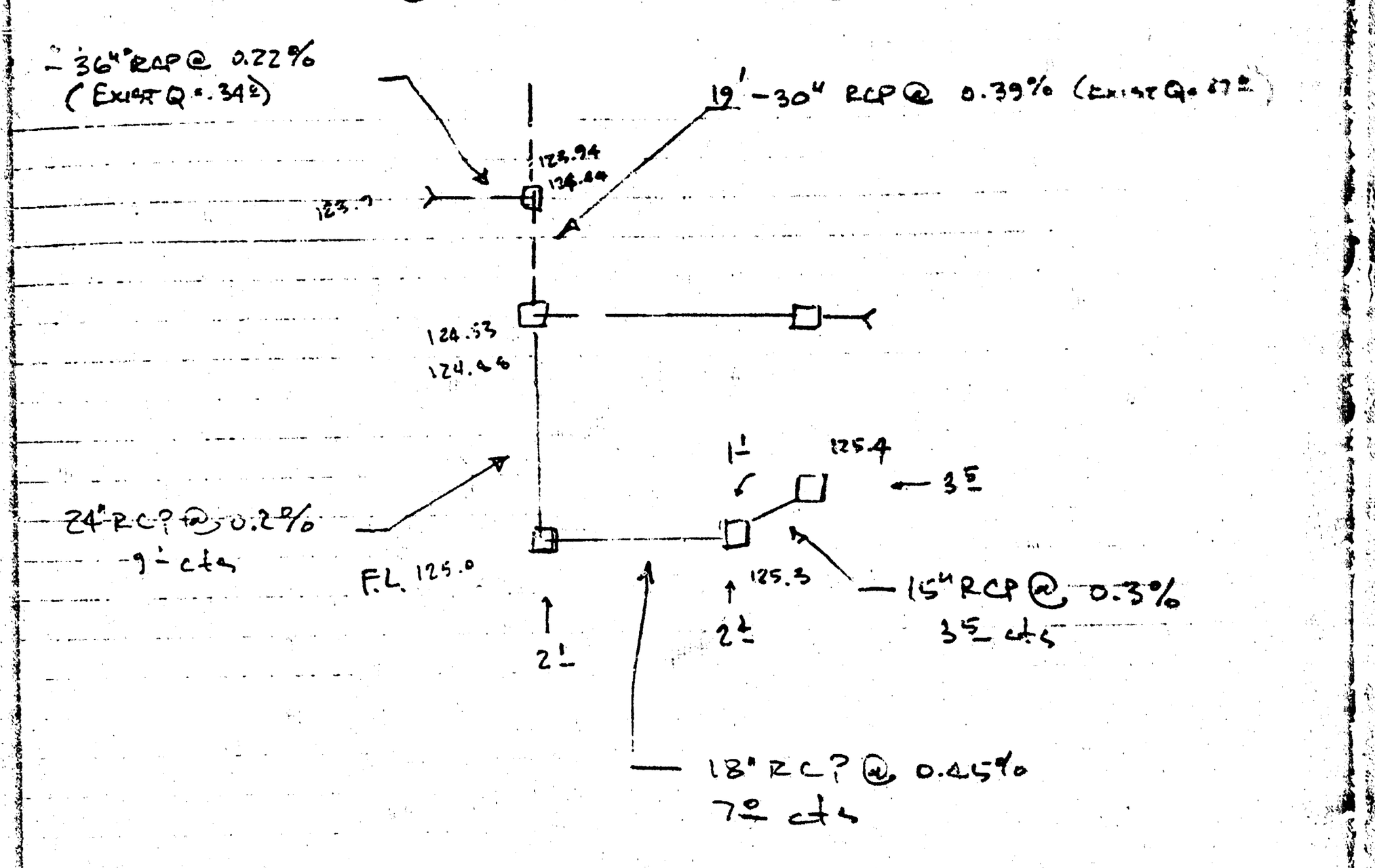
Q_5 = 4.34 x 0.7 x 3.01 = 9.1 cfs

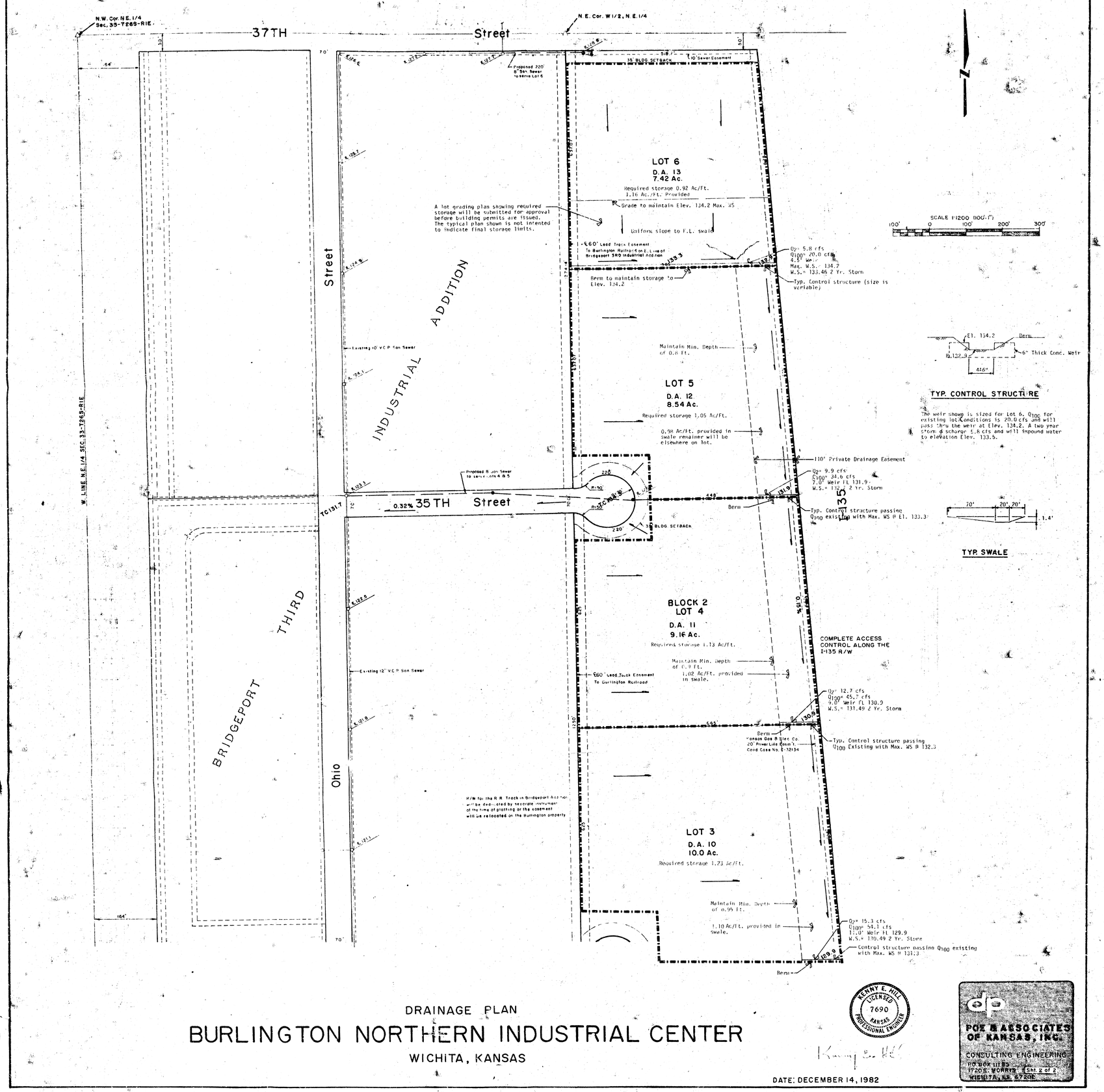
Q_{100} = 4.34 x 0.7 x 5.22 = 15.9 cfs

D.A. 4-A 4.77 Ac

Q = 4.77 x 0.7 x 8.03 = 26.8 cfs

1 - 30' - 30" RCP HW = 0.6'





DRAINAGE PLAN

BURLINGTON NORTHERN INDUSTRIAL CENTER

WICHITA, KANSAS

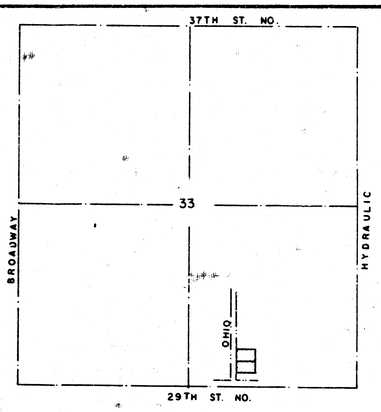
DATE: DECEMBER 14, 1982

KENNY E. HILL LICENSED 7690 KANSAS PROFESSIONAL ENGINEER

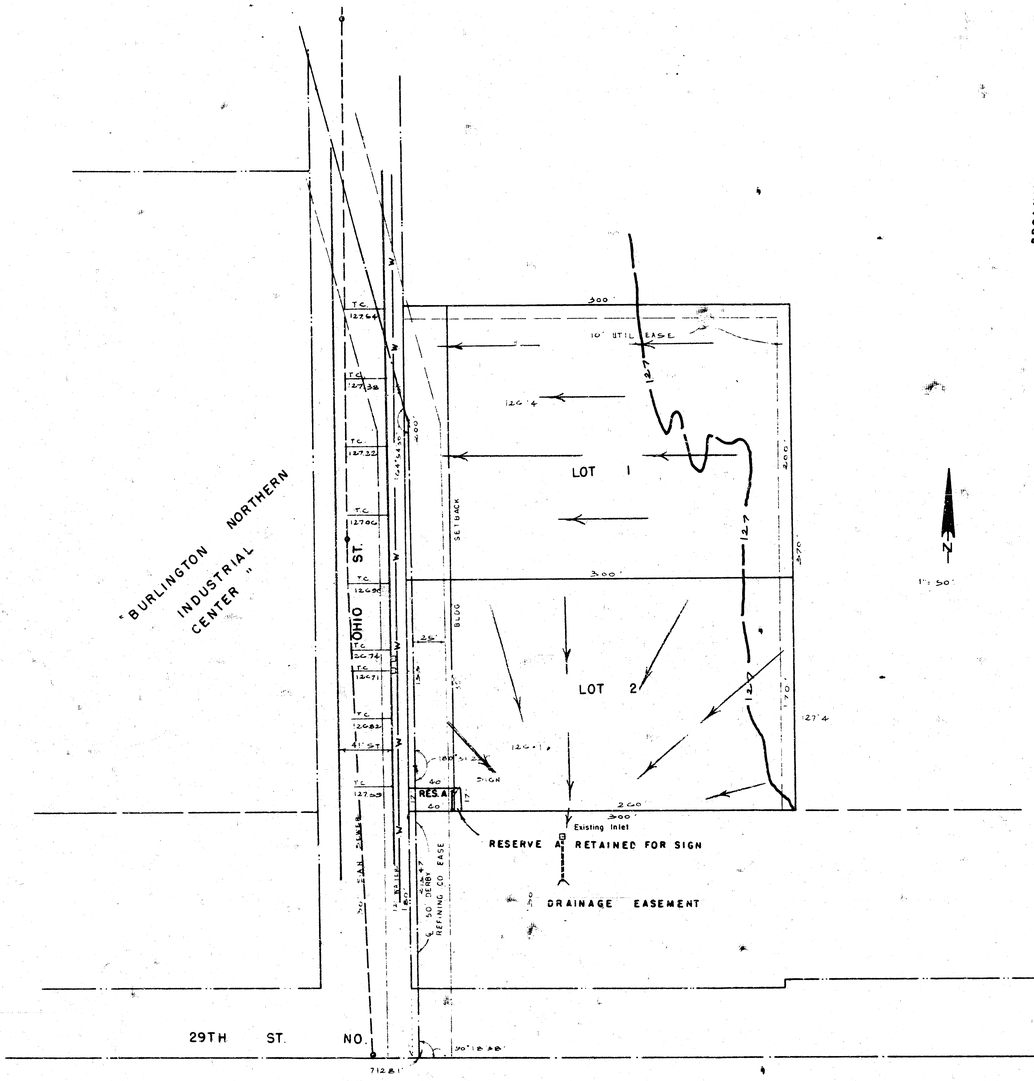
Kenny E. Hill

POE & ASSOCIATES OF KANSAS, INC.
CONSULTING ENGINEERING
PO Box 11129
1720 S. HOWARD (Shi. 2 of 2)
WICHITA, KS. 67211

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