Drainage Report

Spencer's Cove

April 4,2005

Poe and Associates
5940 E. Central
Wichita, Ks

POE & ASSOCIATES, INC.
5940 E. Central, Suite 200
Wichita, Kansas 67208

CONSULTING ENGINEERS
Office: (316) 685-4114
Fax: (316) 685-4444

April 6, 2005

Mr. Jeff Bannon

Bannon Auction and Realty
201 N. Wood
Wichita, KS 67212

Re: Drainage Report
Spencer's Cove

Dear Jeff:

The proposed drainage plan has a ponding area that can store approximately 31 acre feet of storm water from elevation 1343.2 to 1352.0. This area is located on the west side of your property as shown on the enclosed map.

To compensate for the existing wetlands that will be filled the top 12" of soil from the designated wetland area within Spencer's Cove shall be placed on an equal area of the pond. All except one foot of water will drain from the bottom of pond so as to provide an area to replace the wetlands that now exist on your property. If this is not acceptable, or it is not required, the bottom of the ponds will be lowered to provide extra fill material for site grading. The normal water surface elevation will remain at 1343.2.

The pond bottom will be excavated 1342.0 which is below the elevations that will allow it to drain south. The pond will drain by gravity to elevation 1346.2. Any storage below that elevation will need to be pumped. The ponds to the south of your property have been constructed with a water surface of 1343.2. Yours will drain by gravity to this elevation (1343.2) if arrangements can be made to drain with a pipe connection into these ponds. This will require that the water stored in your ponds between elevation 1343.2 and 1346.2 will need to be pumped from the ponds to the south.

Our proposed design is to leave water in your pond between elevation 1342.0 and 1343.2 to compensate for the wetlands that will be filled.

The proposed pond control structure is a 30 foot weir with its crest at 1346.2. A 466.4 acre drainage area discharges storm water to this structure producing a peak design flow of 455.88cfs during a 100 year storm after complete development of your property. This flow is reduced to 449.52cfs by providing 22 acre feet of storage below the maximum pond water surface elevation of 1349.4. This flow equals the proposed discharge through the triple 6'x3'

box culvert across 29th Street. Our calculations indicate that this flow can be increased to 725cfs or by 61% and still maintain a pond water surface of 1350.5. The maximum elevation of the pond impoundment is 1352.0 which will provide 2.6 feet of freeboard above the 100 year design.

Another area will drain through a proposed culvert crossing 29th street about 300 feet west of your east property line. 34.3 acres of this drainage area will produce design flows at your south property line of 92.9cfs during a 100 year rainfall after full development of your property. Two 30" pipe storm sewers will provide for 53.79cfs of this flow with a head water elevation of 1350.5. At this elevation 6" of the storm water will drain across the proposed parking lot providing a total capacity of 98.7cfs.

The outlet flow line elevation of the 30" storm sewer pipes is below existing ground at your south property line. This will require that the property owners to the south are willing to accept this drainage into their drainage system.

The enclosed site plan shows the location of the ponding area, the proposed storm sewers and the areas to be filled. We have specified a minimum low opening elevation of 1353.0 for buildings located on this property.

Earthwork calculations indicate that 53,600 cubic yards can be excavated from the pond and 76,400 cubic yards will be needed to fill the lots to an elevation of 1351.0. This requires that 22,800 cubic yards of fill be brought in from off site or that the ponds be excavated to a greater depth.

If this plan is satisfactory we will proceed with the application for a floodplain fill permit.

Sincerely,
Poe and Associates, Inc.

Kenny E. Hill, P.E.
Vice President

POE & ASSOCIATES, INC. CONSULTING ENGINEERS
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March 22, 2005

Spencer's Cove
Detention Pond

DA=466.4 acres Length=8335 feet Slope=(1362-1347)/8335=.0018ft/ft or 0.18%

Soil Type		Group	CN Cultivated	
Va	25%	B	81	2025
Vb	10%	B	81	810
Sa	10%	B	81	810
Wb	30%	D	91	2730
Ba	20%	C	88	1760
Ta	05%	D	91	455
				8590/100=CN 85.9

Lag Existing Condition=3.361hr Tc=336.1 min.
Q100=442.61cfs

Developed Condition

20.0 ac @ CN95 1900
446.4 ac @ CN85.9 38346
40246/446.4=CN86.3 Developed

Hydraulic Length Modified (velocity will not increase through pond)

Percent Impervious

20 ac 85% 1700
446.4ac 1% 446.4
2146.4/466.4=4.6% impervious Lag Factor=0.98

Lag=3.36x0.98=3.29hr Tc=329 min.

Q100=455.88cfs (Spencer's Cove Developed) Peak flow into pond

Route the peak flow (455.88cfs through the ponding area with a 30 foot weir control structure with its crest at elevation 1346.2)

Q100=449.52cfs Peak outflow

This flow equals the proposed design flow (450cfs) through the double 6'x3' box culvert across 29th Street.

The design water surface in the pond at this flow rate is 1349.41 and impounds 22.02 acre feet of storage.

We increased the flow to 725cfs to show approximately a 60% safety factor. With this flow rate the design water surface raises to 1350.5 and has a freeboard of 1.5 feet before reaching the top of the ponding area.

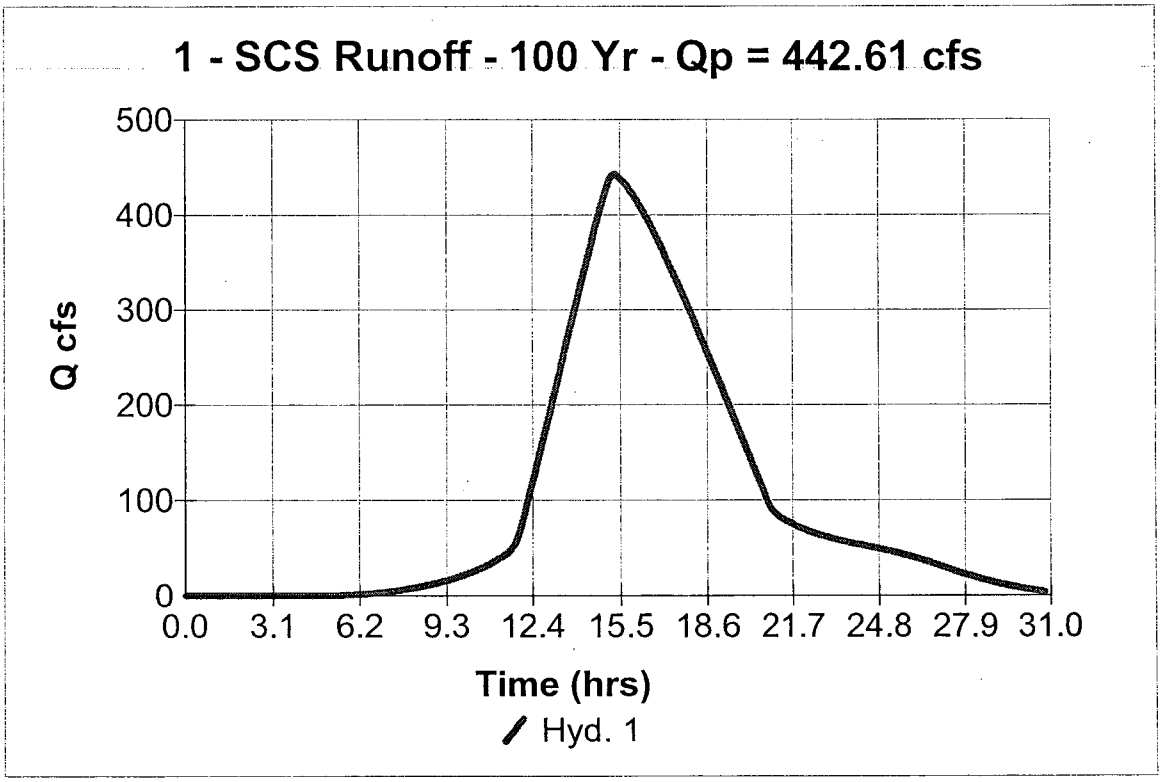
Hydrograph Plot

Hyd. No. 1

Existing Condition

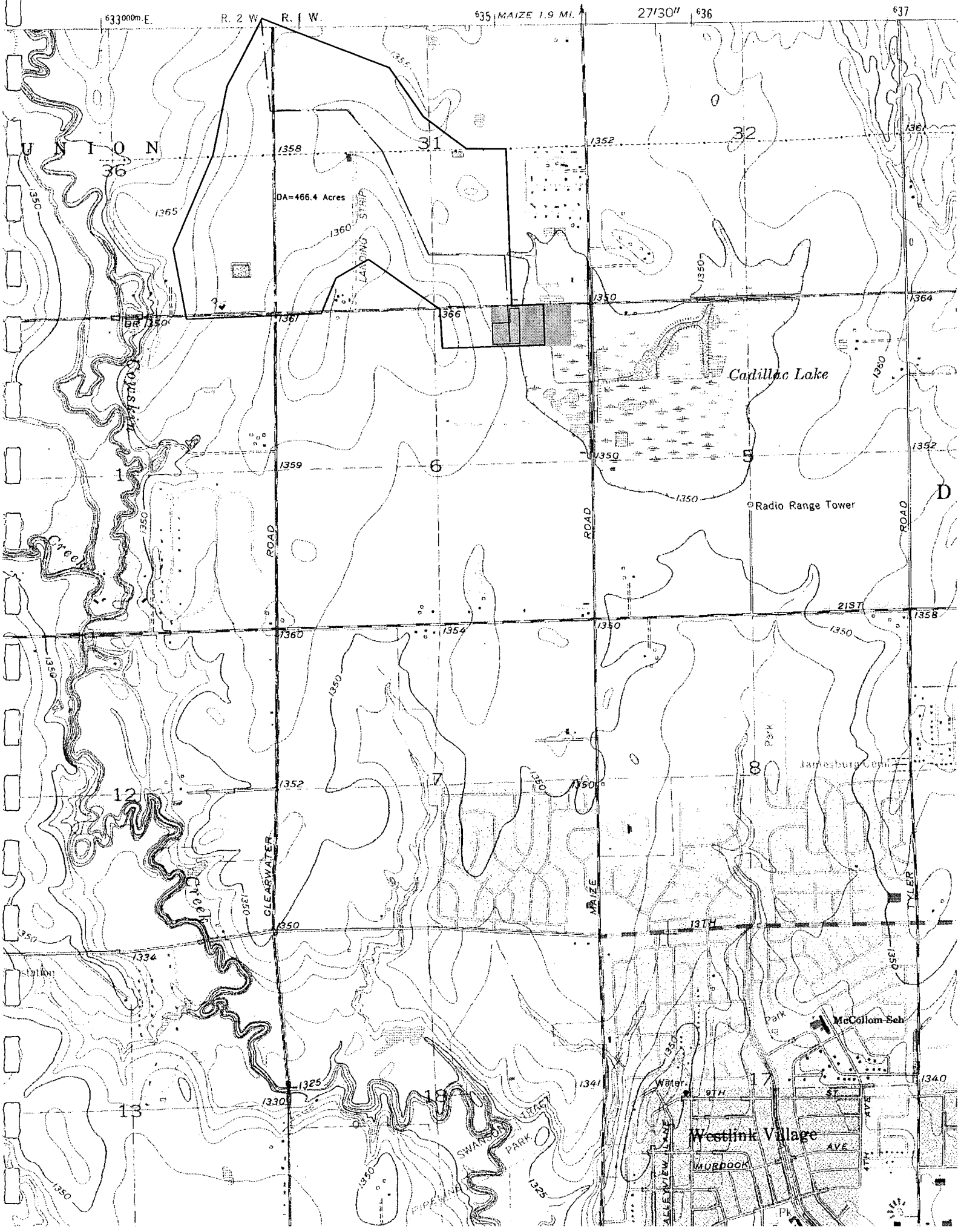
Hydrograph type	= SCS Runoff	Peak discharge	= 442.61 cfs
Storm frequency	= 100 yrs	Time interval	= 6 min
Drainage area	= 466.40 ac	Curve number	= 85.9
Basin Slope	= 0.2 %	Hydraulic length	= 8335 ft
Tc method	= LAG	Time of conc. (Tc)	= 336.1 min
Total precip.	= 8.00 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 246.524 acft



Hydrograph Return Period Recap

Hyd. No.	Hydrograph type (origin)	Inflow Hyd(s)	Peak Outflow (cfs)								Hydrograph description
			1-Yr	2-Yr	3-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr	
1	SCS Runoff	-------	107.73	151.48	-------	222.80	269.02	328.92	375.68	442.61	Spencer Cove Existing


633000m E.
R. 2 W.
R. 1 W.
635
MAIZE 1.9 MI.
27'30"
636
637
UNION
36
31
32
DA=466.4 Acres
LANDING STRIP
Cadillac Lake
Radio Range Tower
ROAD
ROAD
ROAD
1
6
5
12
7
8
13
18
17
CLEARWATER
MAIZE
TYLER
21ST
13TH
Park
McCollom Sch
Water
9TH
ST
AVE
Westlink Village
MURDOOK
ALLENVIEW
SWANSON TRACT
PARK
PIPELINE
1358
1352
1350
1359
1360
1354
1334
1330
1325
1341
1340
1364
1366
1367
1365

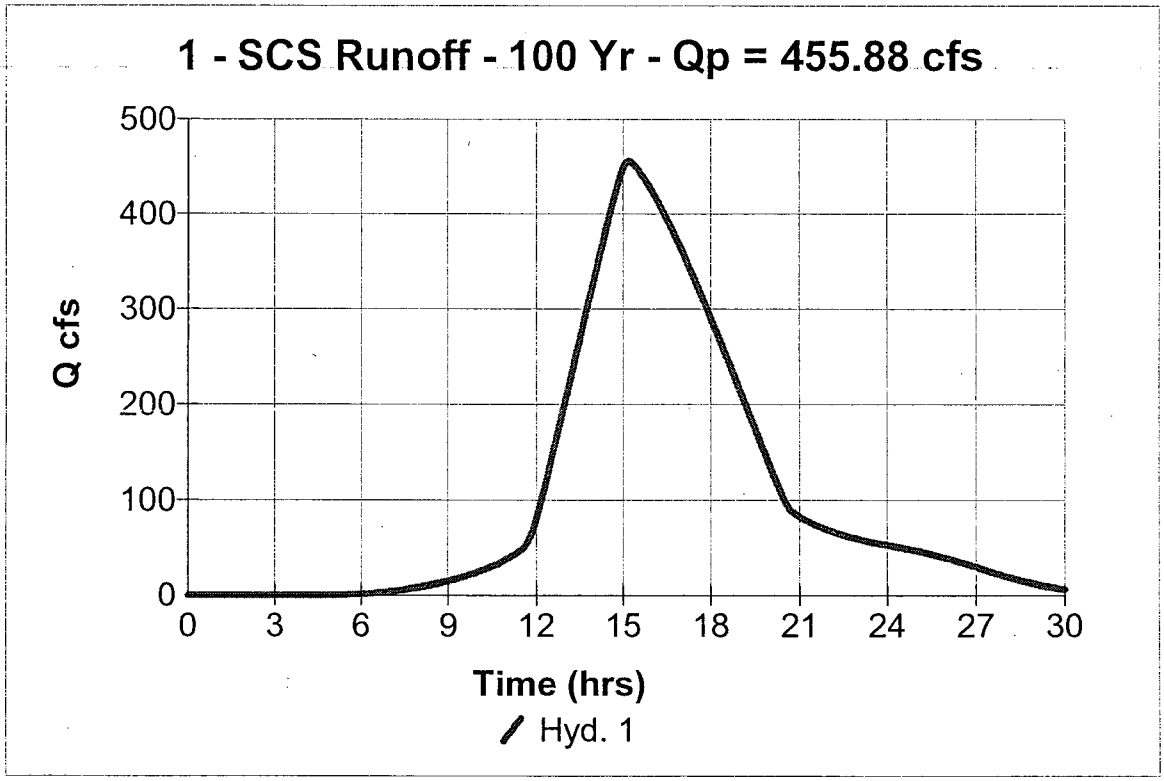
Hydrograph Plot

Hyd. No. 1

Spencer Cove Developed

Hydrograph type	= SCS Runoff	Peak discharge	= 455.88 cfs
Storm frequency	= 100 yrs	Time interval	= 6 min
Drainage area	= 466.40 ac	Curve number	= 86.3
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 329 min
Total precip.	= 8.00 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 247.459 acft



Hydrograph Return Period Recap

Hyd. No.	Hydrograph type (origin)	Inflow Hyd(s)	Peak Outflow (cfs)								Hydrograph description
			1-Yr	2-Yr	3-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr	
1	SCS Runoff	-------	112.68	157.74	-------	230.95	278.32	339.63	387.47	455.88	Spencer Cove Developed
2	Reservoir	1	107.58	153.63	-------	226.52	273.45	334.24	381.60	449.52	Route through pond

Hydrograph Plot

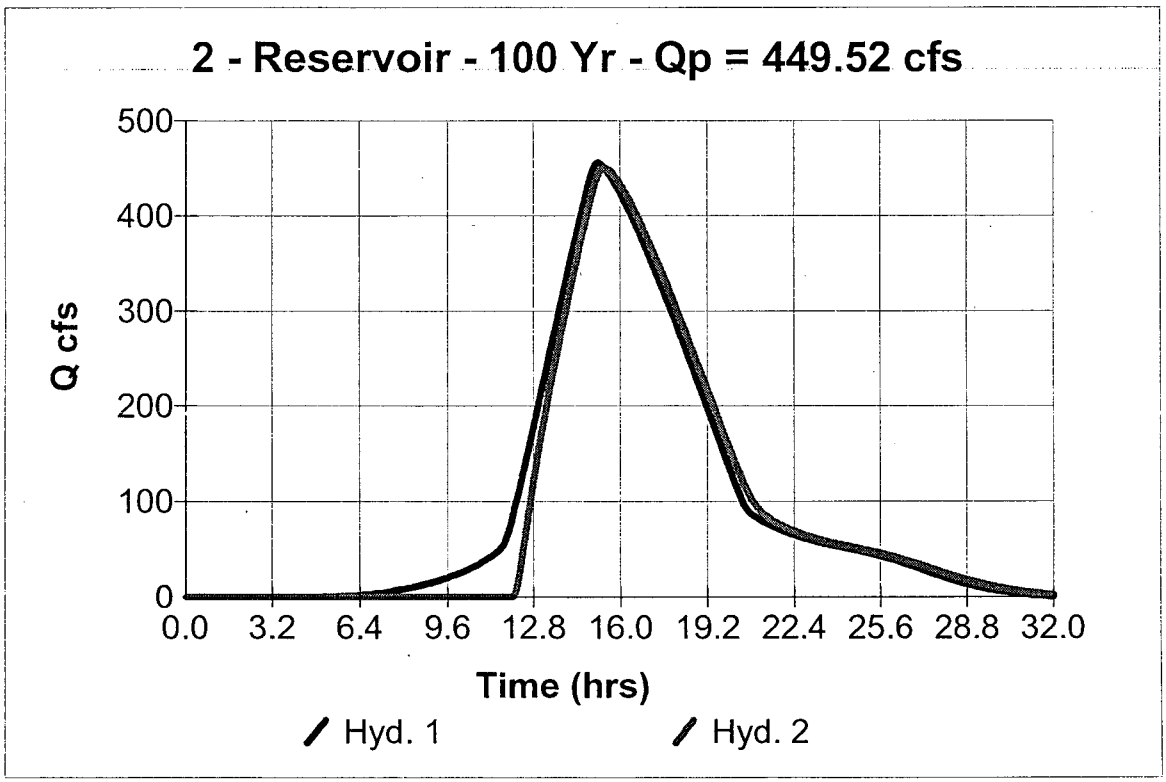
Hyd. No. 2

Route through pond

Hydrograph type	= Reservoir	Peak discharge	= 449.52 cfs
Storm frequency	= 100 yrs	Time interval	= 6 min
Inflow hyd. No.	= 1	Reservoir name	= Detention Pond
Max. Elevation	= 1349.41 ft	Max. Storage	= 22.017 acft

Storage Indication method used.

Hydrograph Volume = 236.831 acft



Reservoir Report

Hydraflow Hydrographs by Intelisolve

Reservoir No. 1 - Detention Pond

Pond Data

Pond storage is based on known values

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (acft)	Total storage (acft)
0.00	1343.20	00	0.000	0.000
0.80	1344.00	00	2.830	2.830
1.80	1345.00	00	3.550	6.380
2.80	1346.00	00	3.540	9.920
3.80	1347.00	00	3.540	13.460
4.80	1348.00	00	3.550	17.010
5.80	1349.00	00	3.540	20.550
6.80	1350.00	00	3.540	24.090
7.80	1351.00	00	3.550	27.640
8.80	1352.00	00	3.540	31.180

Culvert / Orifice Structures

	[A]	[B]	[C]	[D]
Rise in	= 0.0	0.0	0.0	0.0
Span in	= 0.0	0.0	0.0	0.0
No. Barrels	= 0	0	0	0
Invert El. ft	= 0.00	0.00	0.00	0.00
Length ft	= 0.0	0.0	0.0	0.0
Slope %	= 0.00	0.00	0.00	0.00
N-Value	= .013	.000	.000	.000
Orif. Coeff.	= 0.60	0.00	0.00	0.00
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len ft	= 30.00	0.00	0.00	0.00
Crest El. ft	= 1346.20	0.00	0.00	0.00
Weir Coeff.	= 2.60	0.00	0.00	0.00
Weir Type	= Broad	---	---	---
Multi-Stage	= No	No	No	No

Exfiltration Rate = 0.00 in/hr/sqft Tailwater Elev. = 0.00 ft

Note: All outflows have been analyzed under inlet and outlet control.

Stage / Storage / Discharge Table

Stage ft	Storage acft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Total cfs
0.00	0.000	1343.20	---	---	---	---	0.00	---	---	---	---	0.00
0.80	2.830	1344.00	---	---	---	---	0.00	---	---	---	---	0.00
1.80	6.380	1345.00	---	---	---	---	0.00	---	---	---	---	0.00
2.80	9.920	1346.00	---	---	---	---	0.00	---	---	---	---	0.00
3.80	13.460	1347.00	---	---	---	---	55.82	---	---	---	---	55.82
4.80	17.010	1348.00	---	---	---	---	188.37	---	---	---	---	188.37
5.80	20.550	1349.00	---	---	---	---	365.46	---	---	---	---	365.46
6.80	24.090	1350.00	---	---	---	---	577.80	---	---	---	---	577.80
7.80	27.640	1351.00	---	---	---	---	820.28	---	---	---	---	820.28
8.80	31.180	1352.00	---	---	---	---	1089.54	---	---	---	---	1089.54

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (acft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (acft)	Hydrograph description
1	SCS Runoff	455.88	6	912	247.459	----	------	------	Spencer Cove Developed
2	Reservoir	449.52	6	924	236.831	1	1349.41	22.017	Route through pond

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March 22, 2005

Spencer's Cove
Drainage across 29th Street 300 feet west of the east line of Spencer's Cove

DA=34.3 acres Length=2210 feet Slope=(1350-1346)/2210=.0018ft/ft or 0.18%

Soil Type		Group	CN Cultivated	
Vb	5%	B	81	405
Va	30%	B	81	2430
Wb	65%	D	91	5915
				8750/100=CN 87.5

Lag Existing Condition=1.095hr Tc=109.5 min.
Q100=78.32cfs

Developed Condition

27.5 ac @ CN87.5 2406
6.8 ac @ CN95 646
3052/34.3=CN89.0 Developed

Hydraulic Length Modified 630/2210=28.5% Lag Factor= 0.87

Percent Impervious

6.8 ac 85% 578
27.5 ac 1% 27.5
605.5/34.3=17.7% impervious Lag Factor=0.94

Lag=1.095x0.87x0.94=0.90hr Tc=90.0 min.

Q100=92.9cfs (Spencer's Cove Developed)

Hydrograph Plot

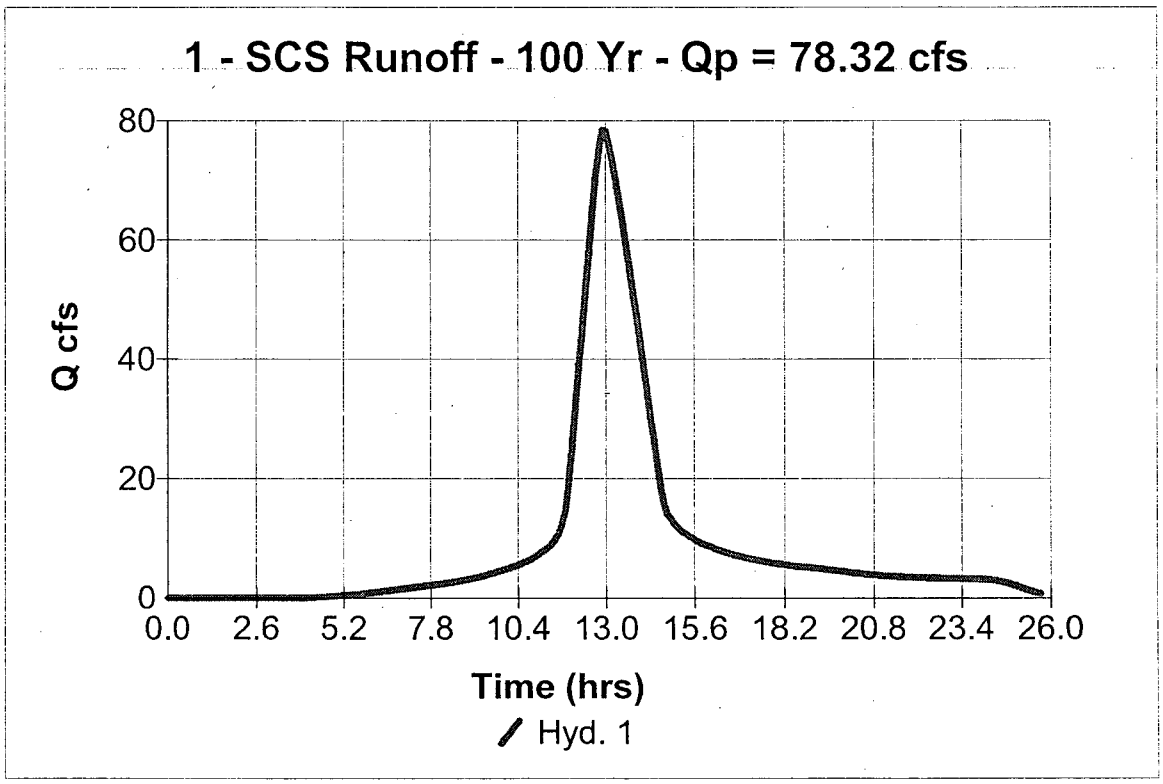
Hydraflow Hydrographs by Intelisolve

Hyd. No. 1

DA East Side - Existing Condition

Hydrograph type	= SCS Runoff	Peak discharge	= 78.32 cfs
Storm frequency	= 100 yrs	Time interval	= 6 min
Drainage area	= 34.30 ac	Curve number	= 87.5
Basin Slope	= 0.2 %	Hydraulic length	= 2210 ft
Tc method	= LAG	Time of conc. (Tc)	= 109.5 min
Total precip.	= 8.00 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 18.393 acft



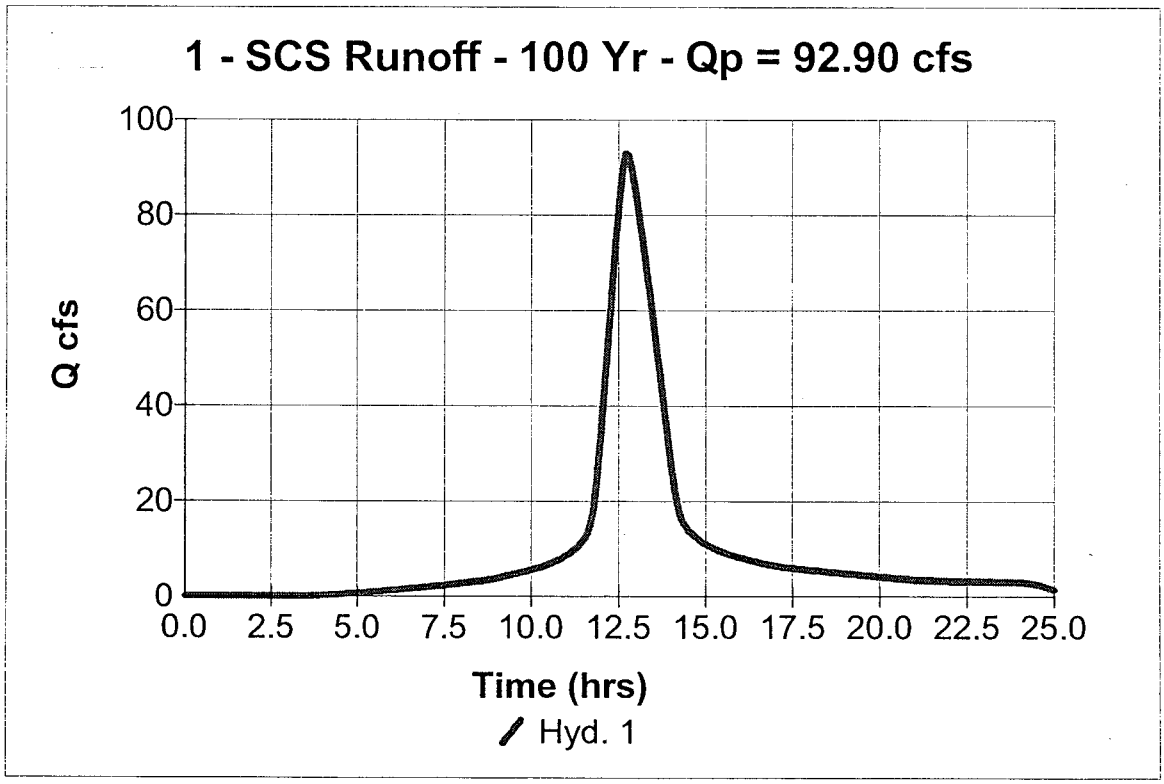
Hydrograph Plot

Hyd. No. 1

DA East Side

Hydrograph type	= SCS Runoff	Peak discharge	= 92.90 cfs
Storm frequency	= 100 yrs	Time interval	= 6 min
Drainage area	= 34.30 ac	Curve number	= 89
Basin Slope	= 0.2 %	Hydraulic length	= 2210 ft
Tc method	= USER	Time of conc. (Tc)	= 90 min
Total precip.	= 8.00 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 19.113 acft

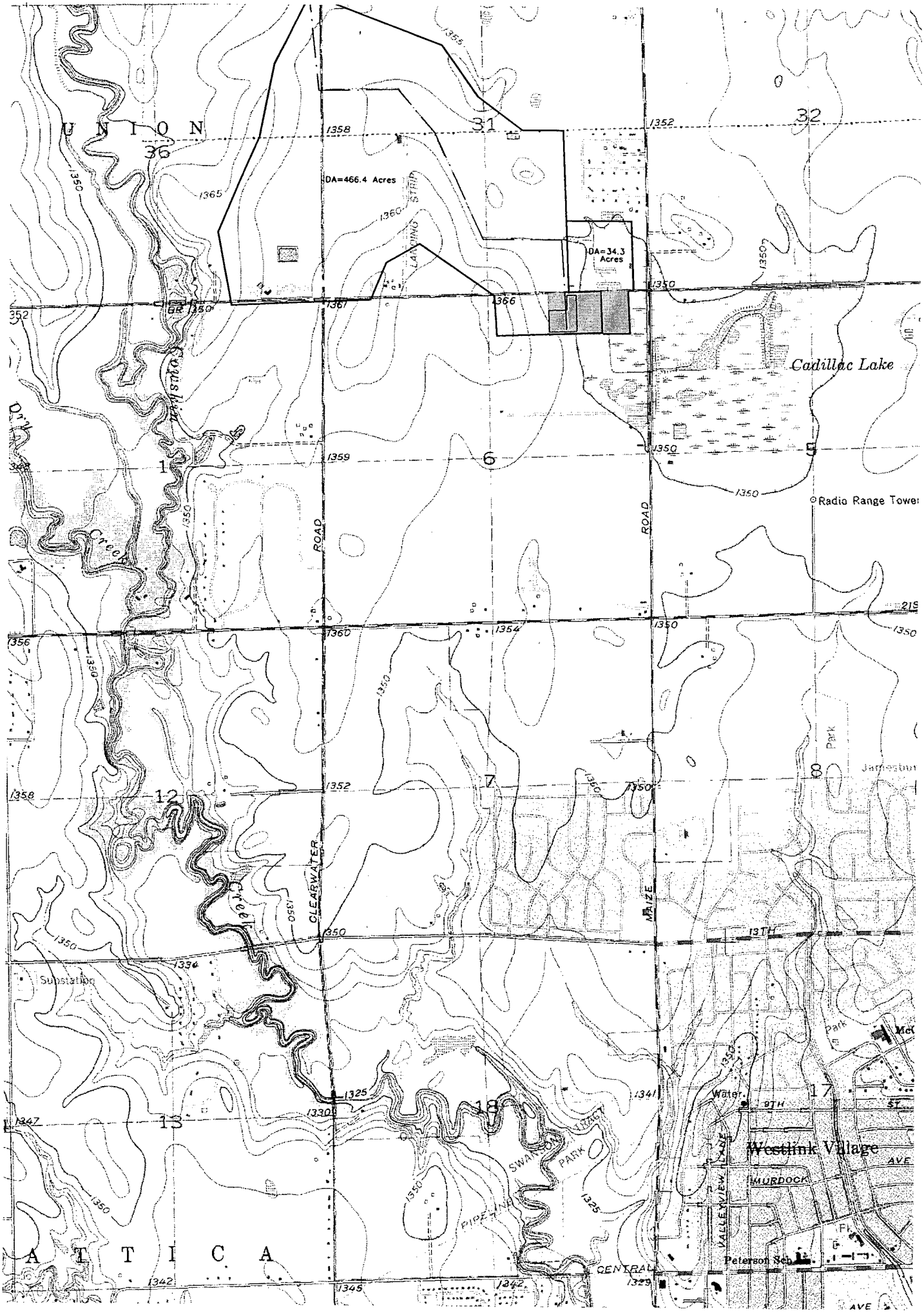


Hydrograph Return Period Recap

Hyd. No.	Hydrograph type (origin)	Inflow Hyd(s)	Peak Outflow (cfs)								Hydrograph description
			1-Yr	2-Yr	3-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr	
1	SCS Runoff	-------	25.88	34.97	-------	49.40	58.66	70.55	79.77	92.90	DA East Side

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (acft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (acft)	Hydrograph description
1	SCS Runoff	92.90	6	762	19.113	----	------	------	DA East Side


UNION
ATTICA
DA=466.4 Acres
DA=34.3 Acres
LANDING STRIP
Cadillac Lake
Radio Range Tower
Wallstown Creek
CLEARWATER ROAD
MAIZE ROAD
13TH
9TH
Substation
Water
Westlink Village
MURDOCK AVE
VALLEYVIEW DRIVE
SWANSON PARK
PIPELINE
CENTRAL
Peterson Sch.
Park
1358
1352
1365
1360
1355
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1330
1342
1345
1329

Reservoir Report

Reservoir No. 1 - New Pond1

Pond Data

Pond storage is based on known values

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (acft)	Total storage (acft)
0.00	1346.50	00	0.000	0.000
0.50	1347.00	00	0.000	1.000
1.00	1347.50	00	0.000	1.000
1.50	1348.00	00	0.000	1.000
2.00	1348.50	00	0.000	1.000
2.50	1349.00	00	0.000	1.000
3.00	1349.50	00	0.000	1.000
3.50	1350.00	00	0.000	1.000
4.00	1350.50	00	0.000	1.000
4.50	1351.00	00	0.000	1.000
5.00	1351.50	00	0.000	1.000
5.50	1352.00	00	0.000	1.000
6.00	1352.50	00	0.000	1.000

Culvert / Orifice Structures

	[A]	[B]	[C]	[D]
Rise in	= 30.0	0.0	0.0	0.0
Span in	= 30.0	0.0	0.0	0.0
No. Barrels	= 2	0	0	0
Invert El. ft	= 1346.50	0.00	0.00	0.00
Length ft	= 630.0	0.0	0.0	0.0
Slope %	= 0.30	0.00	0.00	0.00
N-Value	= .013	.000	.000	.000
Orif. Coeff.	= 0.60	0.00	0.00	0.00
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len ft	= 0.00	0.00	0.00	0.00
Crest El. ft	= 0.00	0.00	0.00	0.00
Weir Coeff.	= 0.00	0.00	0.00	0.00
Weir Type	= ---	---	---	---
Multi-Stage	= No	No	No	No

Exfiltration Rate = 0.00 in/hr/sqft Tailwater Elev. = 0.00 ft

Note: All outflows have been analyzed under inlet and outlet control.

Stage / Storage / Discharge Table

Stage ft	Storage acft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Total cfs
0.00	0.000	1346.50	0.00	---	---	---	---	---	---	---	---	0.00
0.50	1.000	1347.00	3.38	---	---	---	---	---	---	---	---	3.38
1.00	1.000	1347.50	12.49	---	---	---	---	---	---	---	---	12.49
1.50	1.000	1348.00	25.68	---	---	---	---	---	---	---	---	25.68
2.00	1.000	1348.50	38.11	---	---	---	---	---	---	---	---	38.11
2.50	1.000	1349.00	40.17	---	---	---	---	---	---	---	---	40.17
3.00	1.000	1349.50	45.17	---	---	---	---	---	---	---	---	45.17
3.50	1.000	1350.00	49.67	---	---	---	---	---	---	---	---	49.67
4.00	1.000	1350.50	53.79	---	---	---	---	---	---	---	---	53.79
4.50	1.000	1351.00	57.62	---	---	---	---	---	---	---	---	57.62
5.00	1.000	1351.50	61.21	---	---	---	---	---	---	---	---	61.21
5.50	1.000	1352.00	64.61	---	---	---	---	---	---	---	---	64.61
6.00	1.000	1352.50	67.83	---	---	---	---	---	---	---	---	67.83

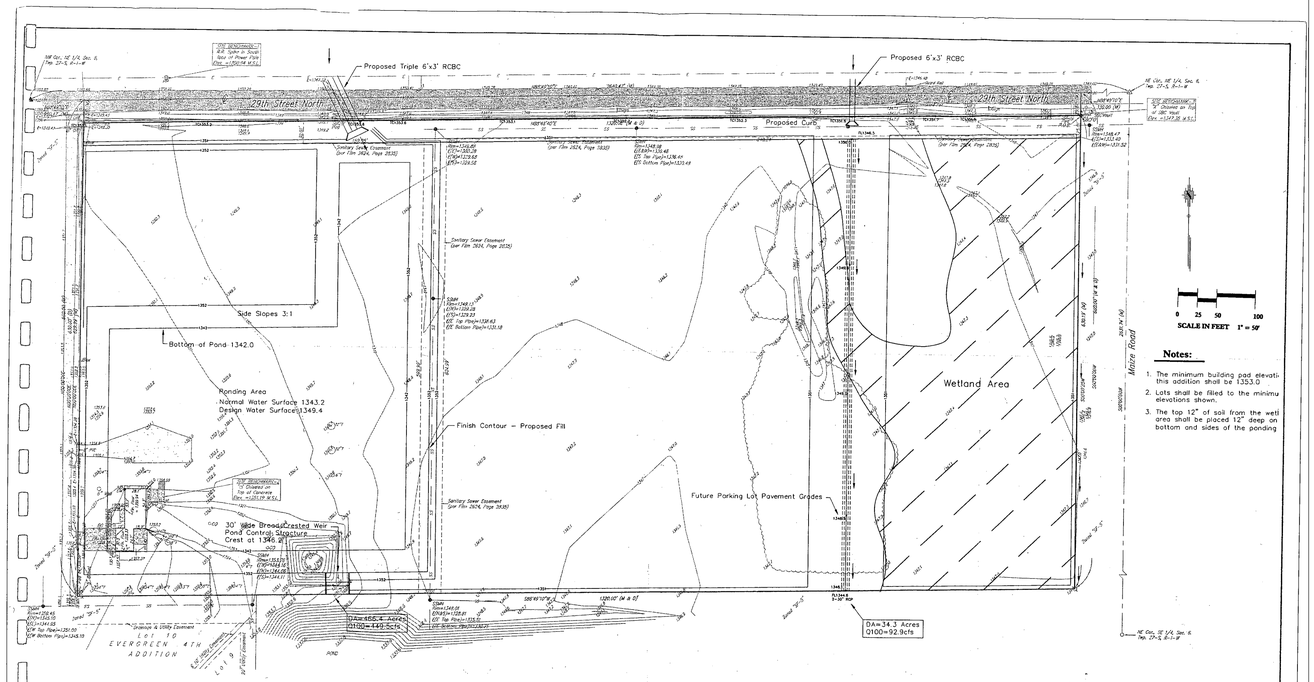
Flow across parking lot

Man Made Channels -- English Units

Civil Tools for Windows

(04-04-2005, 08:31:32)

```
          Flow Depth = 0.500 ft
            Flowrate = 44.860 cfs
Channel Bottom Width = 0.000 ft
  Channel Side Slope = 100.000 ft/ft
       Channel Slope = 0.00300 ft/ft
    Channel Roughness = 0.018
         Wetted Area = 25.00 sf
     Wetted Perimeter = 100.00 ft
            Velocity = 1.79 fps
          Froude No. = 0.63
                Flow = Sub-Critical
```



Notes:

1. The minimum building pad elevati this addition shall be 1353.0
2. Lots shall be filled to the minimu elevations shown.
3. The top 12" of soil from the wetl area shall be placed 12" deep on bottom and sides of the ponding

Legal Description:
That part of the N 1/2 of the NE 1/4 of Section 6, Township 27 South, Range 1 West of the Sixth P.M., Sedgwick County, Kansas, described as commencing at the NE Corner thereof; thence, S88°49'10"W along the north line of said NE 1/4 a distance of 130 feet for a Point of Beginning; thence, S00°05'06"W parallel with the east line of the NE 1/4 a distance 660.00 feet; thence, S88°49'10"W parallel with the North line of the NE 1/4 a distance 1320.09 feet; thence N00°09'06"E parallel with the east line of the NE 1/4 a distance of 660.00 feet to a point on the north line of the NE 1/4; thence N88°49'10"E along the north line of the NE 1/4 a distance of 1320.00 feet to the Point of Beginning, subject to public right-of-ways of record.

SITE PLAN

SPENCER'S COVE

Commercial Community Unit Plan DP-269

Date: April 5, 2005

PEC AND ASSOCIATES, INC.
CONSULTING ENGINEER