CREEKSIDE EST. #5

JR Engineering, Ltd.
6455 N. Union Blvd., Ste. 202
Colorado Springs, Colorado 80918
(719) 593-2593 • FAX (719) 528-6613

6110 Greenwood Plaza Blvd.
Englewood, Colorado 80111
(303) 740-9393 • FAX (303) 721-9019

MASTER DEVELOPMENT DRAINAGE PLAN

ADDENDUM

FOR

CREEKSIDE ESTATES

March 1994

Prepared For:

RAYMOND O'SULLIVAN
3935 Hill Circle
Colorado Springs, CO 80910
(719) 592-9383

Prepared By:

JR ENGINEERING, LTD.
6455 North Union Boulevard, Suite 202
Colorado Springs, CO 80918
(719) 593-2593

Job No. 8535.02

Recycled

MASTER DEVELOPMENT DRAINAGE PLAN ADDENDUM FOR CREEKSIDE ESTATES

DRAINAGE REPORT STATEMENT

ENGINEER'S STATEMENT:
The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by the City for drainage reports and said report is in conformity with the master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors, or omissions on my part in preparing this report.

Joseph W. DesJardin, Colorado P.E. #24207 — Date 5.24.94
For and On Behalf of JR Engineering, Ltd.

DEVELOPER'S STATEMENT:
I, the developer, have read and will comply with all of the requirements specified in this drainage report and plan.

Business Name: Creekside Ventures, L.L.C.

By: Raymond O'Sullivan

Title: Manager

Address: 1401 North Potter, Suite 201
Colorado Springs, CO 80909

CITY OF COLORADO SPRINGS ONLY:
Filed in accordance with Section 15-3-906 of the Code of the City of Colorado Springs, 1980, as amended.

City Engineer — Date 5/26/94

Conditions:

MASTER DEVELOPMENT DRAINAGE PLAN ADDENDUM FOR CREEKSIDE ESTATES

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MASTER DEVELOPMENT DRAINAGE PLAN ADDENDUM FOR CREEKSIDE ESTATES

PURPOSE

The purpose of this Master Development Drainage Plan (MDDP) Addendum for Creekside Estates is to identify alternative ponding/detention facilities, and locations of drainage facilities/areas tributary to a proposed development. This report analyzes alternative routing for developed flows and the ability of downstream facilities to convey developed runoff from the proposed developments and tributary areas. This report is an addendum to the Master Development Drainage Plan for Creekside Estates prepared by JR Engineering, Ltd. and approved by the City of Colorado Springs on January 1, 1994.

GENERAL DESCRIPTION

Creekside Estates proposed development contains approximately 60 acres. It is located between Lexington Drive and Otero Avenue along Old Ranch Road. This subdivision is divided into two areas. Approximately 20 acres north and adjacent to Old Ranch Road and approximately 40 acres south and adjacent to Old Ranch Road.

Refer to the approved M.D.D.P. for Creekside Estates for additional information and details regarding this site.

SOIL TYPE

Soil type information was obtained from the SCHIST "Soil Survey of El Paso County Area, Colorado." That report indicates the study area has portions of Stapleton-Bernal sandy loams, Truckton sandy loams, and Truckton-Blakeland complex. Composition and hydrologic soil groups associated with the above soil groups are as follows:

Stapleton-Bernal: (25% of Total)	60% Stapleton Soil 40% Bernal Soil	Group 'B' Group 'D'
Truckton: (25% of Total)	100% Truckton Soil	Group 'B'
Truckton-Blakeland: (50% of Total)	60% Truckton Soil 25% Blakeland Soil 15% Miscellaneous	Group 'B' Group 'A'

For this report, hydrologic soil group 'A/B' will be used.

HYDROLOGIC CRITERIA/CHARACTERISTICS

The methodology and hydrologic basin characteristics used in this report conform with standards as set forth in the "City of Colorado Springs and County of El Paso Drainage Criteria Manual."

Runoff flows for storm sewer facilities were calculated using the Rational Method. Design storms are of 24-hour duration with recurrence intervals of 10 years and 100 years. Basin hydrologic characteristics are detailed later in this report. See also Basin Summaries and Land Use Summaries, Appendices 1A and 1B.

Some basins defined within this study have no preliminary layouts for interior streets or building designs. The only controls available are the approximate property lines, land use designations, existing terrain, and adjacent Pine Creek Basin limits.

BASIN OUTFALLS

Historic runoff patterns indicate two outfalls to Kettle Creek within the study area. One north of the existing bridge in Old Ranch Road and another south of this bridge. Basin H-2 historic flows (Q_{10} = 34 cfs and Q_{100} = 69 cfs) travel westerly in an existing graded ditch on the southerly side of Old Ranch Road. A portion of the flow travels to the north side of Old Ranch Road (Q_{10} = 34 cfs and Q_{100} = 57 cfs) with the remaining 100-year flows (Q_{100} = 12 cfs) continuing to travel westerly down the south side of Old Ranch Road. This flowby combines with historic Basin H-4 (Q_{10} = 7 cfs and Q_{100} = 14 cfs) for a resultant historic discharge at Design Point 3 of Q_{10} = 7 cfs and Q_{100} = 25 cfs.

Basin H-1 historic flows (Q_{10} = 33 cfs and Q_{100} = 69 cfs) travel overland to Design Point 4. This flow is tributary to an existing pond that ultimately discharges to Kettle Creek through and exist 24" C.M.P.

Basin H-3 historic flows (Q_{10} = 47 cfs and Q_{100} = 87 cfs) travel overland to Design Point 1. These flows are released directly into Kettle Creek. Basin H-6 historic flow (Q_{10} = 3 cfs and Q_{100} = 6 cfs) also travel overland to Kettle Creek.

Basin H-5 historic flows (Q_{10} = 3 cfs and Q_{100} = 7 cfs) travel westerly in an existing roadside ditch on the northerly side of Old Ranch Road. these flows discharge into Kettle Creek at Design Point 2.

Historic Flow Discharge Summary

Design Point 1	Q_{10} = 47 cfs	Q_{100} = 87 cfs
Design Point 2	Q_{10} = 3 cfs	Q_{100} = 7 cfs
Design Point 3	Q_{10} = 7 cfs	Q_{100} = 25 cfs
Design Point 4	Q_{10} = 33 cfs	Q_{100} = 69 cfs

BASIN SUMMARY

SOUTH OUTFALL

Developed flows from Basin 1, Q_{10}= 19 cfs and Q_{100}= 34 cfs @ T_c=27.9 minutes, can be collected with a 10' sump inlet. This runoff can be routed to an 8' on-grade inlet located along the south curbline of Old Ranch Road where runoff from Basin 2, Q_{10}= 6 cfs and Q_{100}= 10 cfs @ T_c= 5.8 minutes, can be totally intercepted. The storm sewer runoff can then be routed north across Old Ranch Road to an 8' on-grade inlet located along the north curbline of Old Ranch Road where runoff from Basin 3, Q_{10}= 5 cfs and Q_{100}= 8 cfs @ T_c= 5.8 minutes, can be totally intercepted. This runoff, combined with runoff from Basins 1 and 2, can then be routed north to a proposed pond north of Old Ranch Road via storm sewer. This will represent the ultimate build-out of Basins 1 through 3. Improvements at the intersection of Lexington Drive and Old Ranch Road would include removal of the existing 36" C.M.P. which channels current flows from Basins 1 and 2 underneath Lexington Drive west into the graded ditch along Lexington Drive. Please note, the existing 36" C.M.P. currently does not function due to significant sedimentation within the pipe and flows are historically shown to cross Old Ranch Road and flow to the north.

A portion of runoff from Basin No. 4, Q_{10}= 14 cfs and Q_{100}= 14 cfs, must be intercepted on site within an 8' sump inlet. This runoff can then be channeled via 18" storm sewer to the sump location within Lexington Drive where the remaining runoff from Basin 4 and runoff from Basin 5 will collect within a pair of 14' sump curb inlets located on each side of Lexington Drive. Improvements at this location will include removal of an existing grated inlet and 24" C.M.P. Future development with Basin No. 6 (Creekside Filing No. 4) will require interception of this discharge with a 30" RCP storm sewer system to prevent further erosion within the natural existing stream channel. The intercepted runoff can be routed to an 18' sump inlet where developed runoff from Basin 6, Q_{10}= 31 cfs and Q_{100}= 57 cfs @ T_c=19.4 minutes, can be collected. This runoff can be routed via storm sewer north towards Old Ranch Road where it can combine with developed runoff from Basin 7, Q_{10}= 4 cfs and Q_{100}= 8 cfs @ T_c=16.0 minutes, collected within an 8' on-grade inlet.

Basin 8 flows (Q_{10} = 13 cfs and Q_{100} = 23 cfs) travel southwesterly to the intersection of two future streets where two 4' sump inlets will intercept all flows generated from Basin 8. A 24' R.C.P. will carry these flows to Old Ranch Road where they will join the Basin 4, 5, 6, and 7 flows in a 42" R.C.P.

Basin 10A flows (Q_{10} = 15 cfs and Q_{100} = 24 cfs) will travel westerly along the southerly Old Ranch Road curb and gutter flowline to a 20' at-grade inlet that intercepts Q_{10} = 8 cfs and Q_{100} = 11 cfs and generates a flowby of Q_{10} = 7 cfs and Q_{100} = 13 cfs. This flowby joins Basin 10C flows (Q_{10} = 4 cfs and Q_{100} = 6 cfs) for a resultant flow of Q_{10} = 10 cfs and Q_{100} = 18 cfs being partially intercepted by a 20' at-grade inlet. The flowby (Q_{10} = 4 cfs and Q_{100} = 8 cfs) joins the Basin 10B flows (Q_{10} = 3 cfs and Q_{100} = 6 cfs) for a total developed flow heading west on the southerly side of Old Ranch Road of Q_{10} = 7 cfs and Q_{100} = 14 cfs. These flows will then enter an existing C.M.P. pipe located within the Old Ranch R.O.W. that discharges directly into Kettle Creek. The construction drawings for Old Ranch Road will detail the transition necessary to direct the curb flow to the existing C.M.P. outfall.

Developed runoff from Basin 13 (Q_{10} = 29 cfs and Q_{100} = 53 cfs) will be partially intercepted in three 20' and one 14' at-grade inlets. The flowby from these inlets is totally intercepted by a 4' sump inlet that discharges Q_{10} = 5 cfs and Q_{100} = 13 cfs in a 18" R.C.P. that joins Basin 10 flowby for a resultant developed flow of Q_{10} = 9 cfs and Q_{100} = 18 cfs at Design Point 3. The historic flows of Q_{10} = 7 cfs and Q_{100} = 25 cfs are only slightly increased during a 10-year event and substantially reduce during a 100-year storm.

Developed runoff from Basin 11, Q_{10}= 18 cfs and Q_{100}= 33 c.f.s. @ T_c= 14.1 minutes, can be collected within a 10' sump inlet. This runoff can be routed north via storm sewer to a 4' sump inlet which can collect Q_{10}= 4 cfs and Q_{100}= 8 cfs @ T_c=14.7 minutes from Basin 12. The developed runoff can then be routed north via storm sewer and discharged to the existing natural channel which in turn discharges into the existing south Kettle Creek outfall. A rip-rap energy dissipator will be installed at the outfall point into the natural channel to mitigate any potential erosion problems. Total flow discharging to Design Point 4 (Q_{10} = 29 cfs and Q_{100} = 57 cfs) is well below the historic values of Q_{10} = 33 cfs and Q_{100} = 69 cfs.

NORTH OUTFALL

Basin 9A flows (Q_{10} = 10 cfs and Q_{100} = 17 cfs) head westerly down the northerly curb and gutter flowline to a 20' at-grade inlet. Flowby from this inlet (Q_{10} = 3 cfs and Q_{100} = 8 cfs) combines with Basin 9C flows (Q_{10} = 4 cfs and Q_{100} = 6 cfs) for a resultant flow of Q_{10} = 6 cfs and Q_{100} = 13 cfs. This flow is partially intercepted by a 20 at-grade inlet. The flowby (Q_{10} = 2 cfs and Q_{100} = 5 cfs) joins Basin 9B flows (Q_{10} = 3 cfs and Q_{100} = 5 cfs) for a resultant developed discharge at Design Point 2 of Q_{10} = 5 cfs and Q_{100} = 10 cfs. These flows are only slightly larger than the historic flows of Q_{10} = 3 cfs and Q_{100} = 7 cfs. The existing grouted rip-rap spillway can easily handle the minor increase in flows. This existing spillway will be incorporated into the new design of Old Ranch Road to provide a discharge point for Old Ranch curb flows. The construction drawings for Old Ranch Road will detail this transition.

The flows intercepted by the easterly pair of 20' at-grade inlets on Old Ranch Road are carried westerly in a 42" R.C.P. at a 3% minimum grade. The flows intercepted from Basin 13 (Q_{10} = 18 cfs and Q_{100} = 37 cfs) travel northerly in a 24" R.C.P. at a 3% minimum grade. The flows intercepted by the westerly pair of 20' at-grade on Old Ranch Road and the flows in the 42" R.C.P. are then added for a total flow of Q_{10} = 124 cfs and Q_{100} = 224 cfs heading north in a 42" R.C.P. at 4.5% minimum grade.

Developed runoff from Basin 15 (Q_{10} = 31 cfs and Q_{100} = 56 cfs) is collected in two 10' sump inlets that join the northerly pipe flow for a total of Q_{10} = 148 cfs and Q_{100} = 268 cfs. Basin 16 overland flow is then added for a resultant developed runoff of Q_{10} = 152 cfs and Q_{100} = 275 cfs at Design Point 1. A 5.3 acre feet public detention pond will restrict the developed flow to their historic Q_{10} = 47 cfs and Q_{100} = 87 cfs values. This public pond will be located in a 5-acre public tract.

DRAINAGE FEES

All areas included in this drainage study are within the Kettle Creek Drainage Basin. As of this writing there is no Drainage Basin Planning Study (D.B.P.S.) in place for Kettle Creek. This report will only cover the Creekside Development and tributary areas. An agreement was reached to use an interim Drainage Fee of $3,161.00/acre until a D.B.P.S. is completed for this basin.

5095.

SUMMARY/CONCLUSIONS

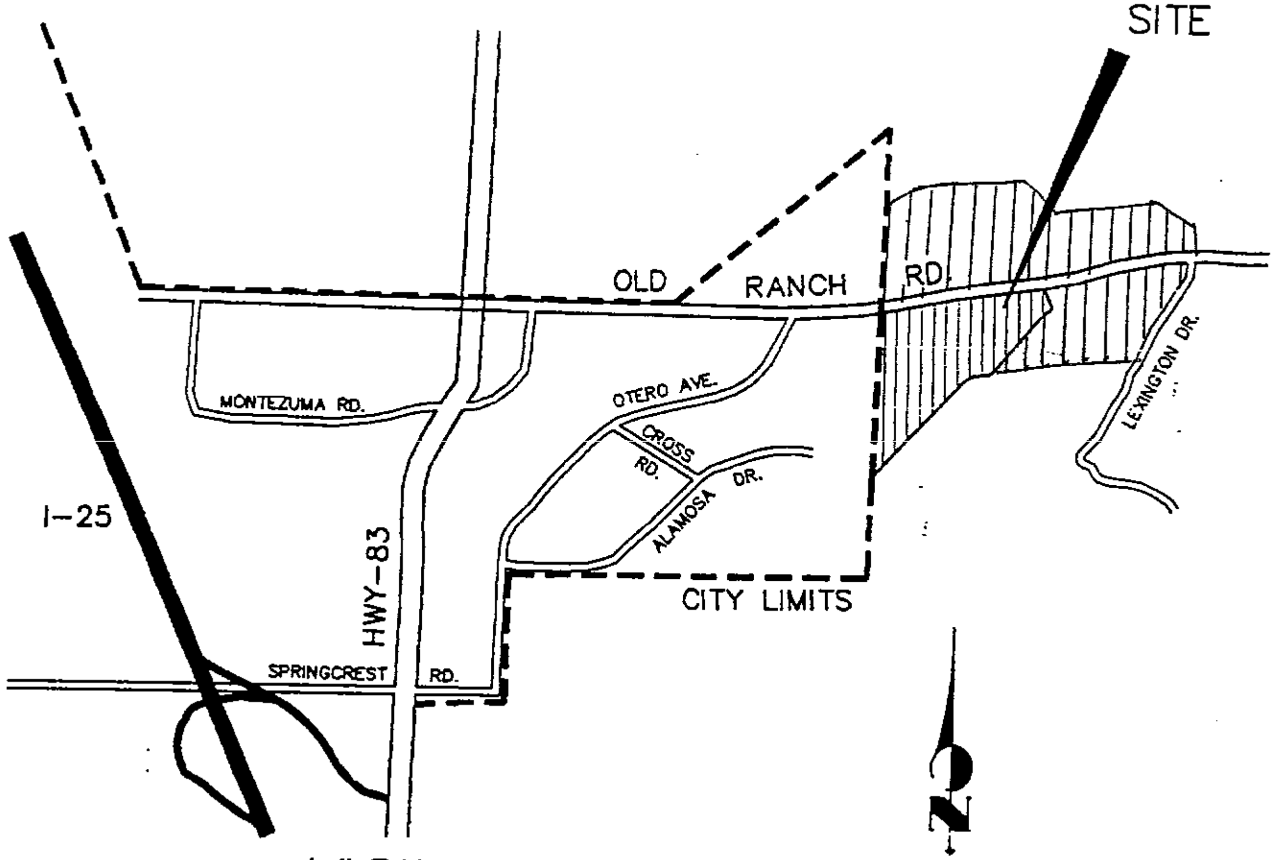
Runoff from historic and developed flows are summarized as follows:

Design Point	Historic Q_{10}	Historic Q_{100}	Developed Q_{10}	Developed Q_{100}
1	47	87	152	275
2	3	7	5	10
3	7	25	9	18
4	33	69	29	57

Design Point 4 developed flows are well below historic values. The minor flows at Design Point 2 and 3 are relatively unchanged from historic values. Design Point 1 developed flows exceed historic flows and therefore, this M.D.D.P. addendum recommends the detention of non-historic flows in a proposed pond located north of Old Ranch Road. The historic outfall from this pond will be released directly into Kettle Creek.

Development adjacent to Kettle Creek will require rip-rap bank stabilization. The location and extent of these improvements will be detailed within the Preliminary and Final Drainage reports prior to platting of those properties.

VICINITY MAP



VICINITY MAP

N.T.S.

KEY MAP

CREEKSIDE ESTATES

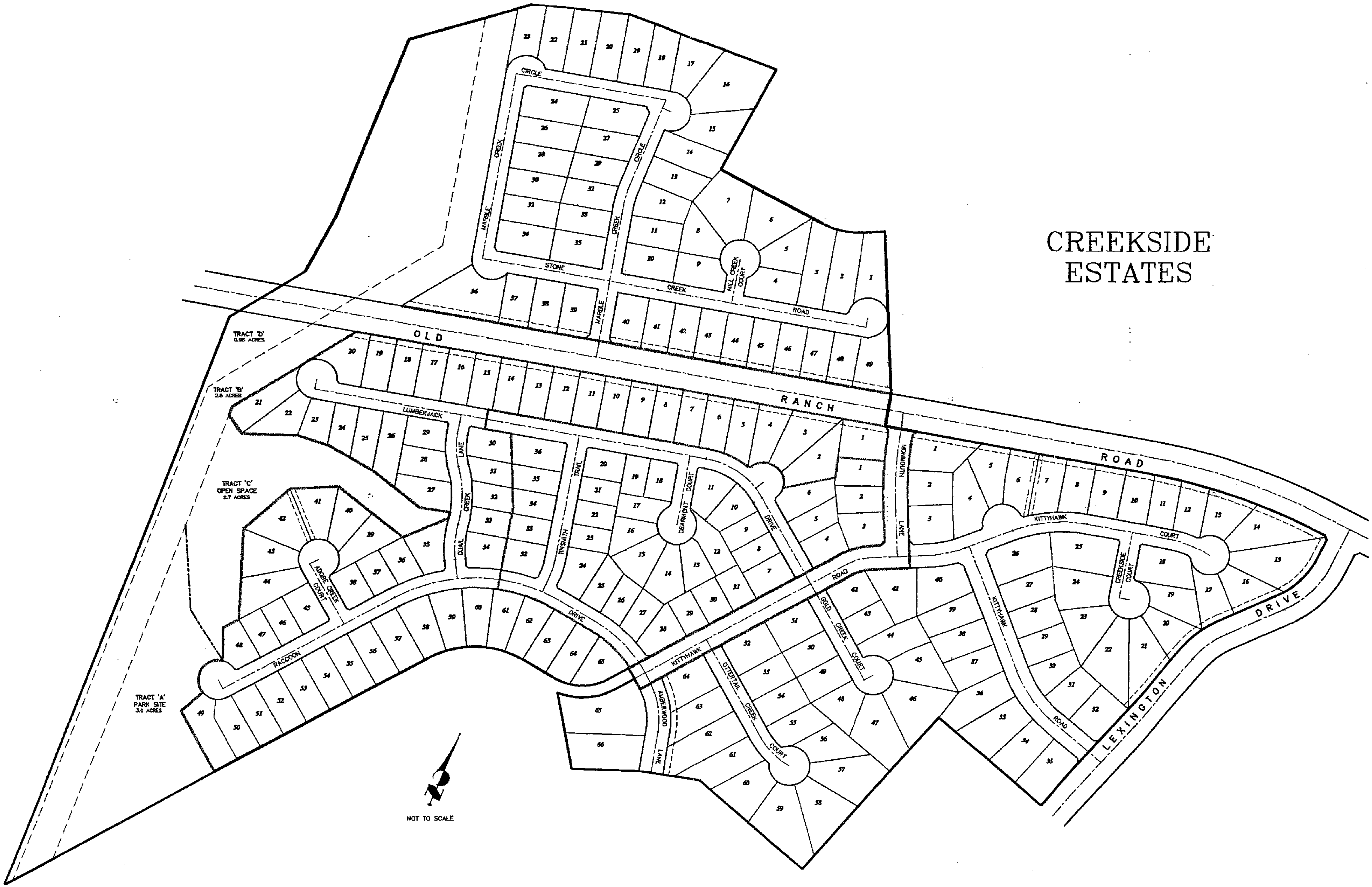
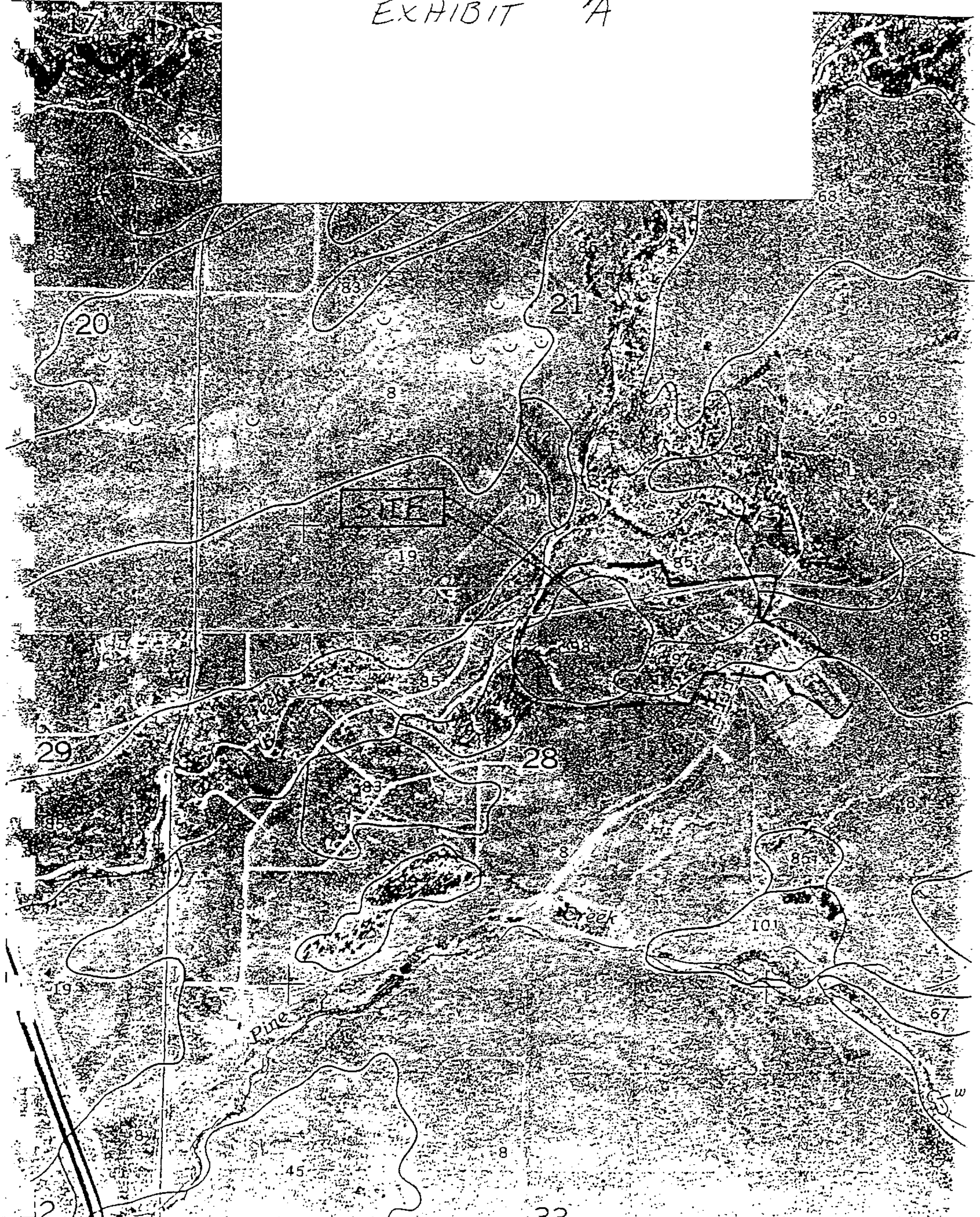


EXHIBIT A

SOIL MAP (S.C.S. SURVEY)

EXHIBIT 'A'



APPENDICES

APPENDIX I.A

- LAND USE SUMMARY -

BASIN	LAND USE	C(10)	C(100)
A	1/5 ACRE LOTS	0.52	0.62
B	1/5 ACRE LOTS	0.52	0.62
C	1/5 ACRE LOTS	0.52	0.62
D	1/5 ACRE LOTS	0.52	0.62
E	1/5 ACRE LOTS	0.52	0.62
F	1/5 ACRE LOTS	0.52	0.62
G	1/5 ACRE LOTS	0.52	0.62
H	1/5 ACRE LOTS	0.52	0.62
I	NORTH RAVINE/BACKYARDS	0.33	0.43
J	SOUTH RAVINE/BACKYARDS PARK SITE	0.34	0.51

- LAND USE SUMMARY -

BASIN	LAND USE	C(10)	C(100)
H-1	EXISTING GROUND	0.25	0.35
H-2	EXISTING GROUND	0.27	0.37
H-3	EXISTING GROUND	0.25	0.35
H-4	EXISTING GROUND	0.25	0.35
H-5	EXISTING GROUND	0.25	0.35
H-6	EXISTING GROUND	0.25	0.35

WEIGHTED 'C' FOR BASIN 'I'

C(10) =0.52(.7/2.5) + 0.25(1.8/2.5) = 0.33

C(100)=0.62(.7/2.5) + 0.35(1.8/2.5) = 0.43

WEIGHTED 'C' FOR BASIN 'J'

C(10) =0.25(1.5/6.0) + 0.50(1.6/6.0) + 0.30(2.9/6.0) = 0.34

C(100)=0.35(1.5/6.0) + 0.60(1.6/6.0) + 0.55(2.9/6.0) = 0.51

ANALYSIS OF HISTORIC FLOWS TO KETTLE CREEK

- BASIN SUMMARY -

BASIN	AREA (Ac)	C(10)	C(100)	OVER LAND HEIGHT (ft.)	OVER LAND LENGTH (ft.)	Tc (min.)	STREET FLOW SLOPE (ft./ft.)	STREET FLOW LENGTH (ft.)	Tc (min.)	TOTAL Tc (min.)	I(10) (in./hr.)	I(100) (in./hr.)	Q(10) (c.f.s.)	Q(100) (c.f.s.)
							V (f.p.s.)	Length (ft.)						
H-1	38.0	0.25	0.35	42	340	12.8	4.8000	1100	3.1	18.6	3.5	5.2	33	69
							7.4000	900	2.5					
							(ASSUME TRI. CHANNEL FLOW)							
H-2	44.6	0.27	0.37	14	350	18.8	3.0000	1200	6.7	30.1	2.8	4.2	34	69
							(ASSUME TRI. CHANNEL FLOW)							
							0.0400	300	0.7					
							(ASSUME STREET FLOW)							
							6.0000	1400	3.9					
							(ASSUME TRI. CHANNEL FLOW)							

-BASIN H-2 CONFLUENCE POINT IS THE EXISTING 36" C.M.P. CULVERT UNDERNEATH OLD RANCH ROAD.
-MAXIMUM FLOW POSSIBLE THROUGH THIS EXISTING CULVERT IS Q=57 c.f.s. W/ HEADWALL
-THEREFORE, Q(10)=34 c.f.s. AND Q(100)=57 c.f.s. WOULD PROCEED NORTHERLY TO BASIN NO. H-3,
-AND Q(10)/Q(100)=0/12 c.f.s. WILL PROCEED WITHIN THE EXISTING DITCH ALONG THE S'LY PORTION OF O.R.R.
-EQUIVALENT 'CA' FOR FLOWBY AT THE CULVERT IS ... CA(10)/CA(100)=0/2.86 OR AN EQUIVALENT AREA OF 7.7 Acres.

ANALYSIS OF HISTORIC FLOWS TO KETTLE CREEK

- BASIN SUMMARY -

BASIN	AREA (Ac)	C(10)	C(100)	OVER LAND HEIGHT (ft.)	OVER LAND LENGTH (ft.)	Tc (min.)	STREET FLOW SLOPE (ft./ft.)	STREET FLOW LENGTH (ft.)	Tc (min.)	TOTAL Tc (min.)	I(10) (in./hr.)	I(100) (in./hr.)	Q(10) (c.f.s.)	Q(100) (c.f.s.)
H-3	24.8	0.25	0.35	-	-	30.1	6.0000	1200	3.3	33.4	2.6	3.9	16	34
							(ASSUME TRI. CHANNEL FLOW)							
H-4	10.2	0.25	0.35	-	-	30.1	6.0000	1200	3.3	33.4	2.6	3.9	7	14
							(ASSUME TRI. CHANNEL FLOW)							
H-5	2.2	0.25	0.35	-	-	6.4	-	-	-	6.4	5.4	8.2	3	7
H-6	4.2	0.25	0.35	-	-	33.4	-	-	-	33.4	2.6	3.9	3	6

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¦ APPENDIX I.A ¦
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LAND USE SUMMARY

CREEK SIDE ESTATES - M.D.D.P.

BASIN	LAND USE	C(10)	C(100)
1	SINGLE FAMILY / PARK	0.45	0.55
2	MINOR ARTERIAL / LANDSCAPING	0.60	0.65
3	MINOR ARTERIAL	0.90	0.95
4	SINGLE FAMILY (LIGHT - MEDIUM)	0.55	0.65
5	SCHOOL / LANDSCAPING	0.50	0.65
6	1/4 ACRE LOTS	0.50	0.60
7	1/4 ACRE LOTS	0.50	0.60
8	1/4 ACRE LOTS	0.50	0.60
9A	MINOR ARTERIAL / LANDSCAPING	0.70	0.80
9B,9B	MINOR ARTERIAL / LANDSCAPING	0.70	0.80
10A	MINOR ARTERIAL / LANDSCAPING	0.65	0.70
10B,10B	MINOR ARTERIAL / LANDSCAPING	0.65	0.70
11	1/6 ACRE LOTS	0.53	0.63
12	1/6 ACRE LOTS	0.53	0.63
13	1/6 ACRE LOTS	0.53	0.63
14	OPEN SPACE / NATURAL GROUND	0.30	0.35
15	1/4 ACRE LOTS	0.50	0.60
16	NATURAL GROUND / BACKYARDS	0.30	0.35

WEIGHTED 'C' FOR BASIN 5 - PORTION OF SCHOOL SITE
C(10) = (1.85/6.45)(0.90) + (4.6/6.45)(0.30) = 0.47 SAY 0.50
C(100)= (1.85/6.45)(0.90) + (4.6/6.45)(0.55) = 0.65

WEIGHTED 'C' FOR BASIN 1 - PARK / RESIDENTIAL
C(10) = (3.4/14.2)(0.30) + (10.8/14.2)(0.50) = 0.45
C(100)= (3.4/14.2)(0.35) + (10.8/14.2)(0.60) = 0.55

WEIGHTED 'C' FOR BASIN 2 - MINOR ARTERIAL / LANDSCAPING
C(10) = (0.9/1.8)(0.90) + (0.9/1.8)(0.25) = 0.60
C(100)= (0.9/1.8)(0.95) + (0.9/1.8)(0.35) = 0.65

WEIGHTED 'C' FOR BASIN NO. 9A & 9B - INCLUDES BACKYARDS, SLOPES,
STREET SECTIONS AND LANDSCAPING FOR NORTHERLY HALF OF O.R.R.
C(10) = (2.8/5.6)(0.50) + (2.8/5.6)(0.90) = 0.70
C(100)= (2.8/5.6)(0.60) + (2.8/5.6)(0.95) = 0.78 SAY 0.80

WEIGHTED 'C' FOR BASIN NO. 10A & 10B - INCLUDES BACKYARDS, SLOPES,
STREET SECTIONS AND LANDSCAPING FOR SOUTHERLY HALF OF O.R.R.
C(10) = (5.9/8.7)(0.50) + (2.8/8.7)(0.90) = 0.63 SAY 0.65
C(100)= (5.9/8.7)(0.60) + (2.8/8.7)(0.95) = 0.71 SAY 0.70

APPENDIX	I.B

- BASIN SUMMARY / CREEKSIDE ESTATES / M.D.D.P. -

BASIN	AREA (Ac)	C(10)	C(100)	OVER LAND HEIGHT (ft.)	OVER LAND LENGTH (ft.)	Tc (min.)	STREET FLOW SLOPE (ft./ft.)	STREET FLOW LENGTH (ft.)	Tc (min.)	TOTAL Tc (min.)	I(10) (in./hr.)	I(100) (in./hr.)	Q(10) (c.f.s.)	Q(100) (c.f.s.)
1	14.2	0.45	0.55	12	500	25.1	0.0280	1000	2.8	27.9	2.9	4.4	19	34
2	1.8	0.60	0.65	-	-	-	0.0250	950	2.9	5.0	5.8	8.8	6	10
3	0.9	0.90	0.95	-	-	-	0.0250	950	2.9	5.0	5.8	8.8	5	8
4	14.9	0.55	0.65	14	320	11.3	-	-	-	11.3	4.4	6.7	36	65
5	6.5	0.50	0.65	16	300	11.2	-	-	-	11.2	4.5	6.7	14	28
6	17.8	0.50	0.60	4	180	16.4	0.0600	620	1.2	19.4	3.5	5.3	31	57
							0.0200	540	1.8					
7	2.3	0.50	0.60	0.75	75	13.8	0.0400	75	0.2	16.0	3.9	5.8	4	8
							0.0800	200	0.3					
							0.0400	160	0.4					
							0.0100	280	1.3					
8	6.4	0.50	0.60	2	100	12.6	0.0500	400	0.9	14.9	4.0	6.0	13	23
							0.0250	300	0.9					
							0.0100	100	0.5					
9A	3.3	0.70	0.80	1	50	8.9	0.0200	300	1.0	12.8	4.2	6.4	10	17
							0.0550	1380	2.8					
10A	5.8	0.65	0.70	2	100	12.6	0.0300	300	0.8	15.0	4.0	6.0	15	24
							0.0550	750	1.5					
9B	1.2	0.70	0.80	-	-	-	-	-	-	14.4	4.0	5.9	3	6
10B	1.5	0.65	0.70	-	-	-	-	-	-	16.0	3.8	5.7	4	6
9C	1.1	0.70	0.80	-	-	-	-	-	-	14.4	3.9	5.9	3	5
10C	1.4	0.65	0.70	-	-	-	-	-	-	16.0	3.8	5.7	3	6

APPENDIX	1.B

- BASIN SUMMARY / CREEKSIDE ESTATES / M.D.D.P. -

BASIN	AREA (Ac)	C(10)	C(100)	OVER LAND HEIGHT (ft.)	OVER LAND LENGTH (ft.)	Tc (min.)	STREET FLOW SLOPE (ft./ft.)	STREET FLOW LENGTH (ft.)	Tc (min.)	TOTAL Tc (min.)	I(10) (in./hr.)	I(100) (in./hr.)	Q(10) (c.f.s.)	Q(100) (c.f.s.)
11	8.5	0.53	0.63	2	100	12.6	0.0200	430	1.4	14.1	4.1	6.1	18	33
12	2.1	0.53	0.63	2	100	12.6	0.0200	430	1.4	14.7	4.0	6.0	4	8
							0.0400	250	0.6					
13	14.6	0.53	0.63	2	100	12.6	0.0600	100	0.2	17.9	3.7	5.5	28	51
							0.0200	350	1.2					
							0.0300	350	1.0					
							0.0600	810	1.6					
							0.0100	290	1.4					
14	8.3	0.30	0.35	40	370	9.8	-	-	-	18.4	3.6	5.5	9	16
				30	280	8.6								
15	14.0	0.50	0.60	2	100	8.9	0.0600	950	1.8	11.5	4.4	6.7	31	56
							0.0300	280	0.8					
16	3.4	0.30	0.35	10	230	10.5	-	-	-	14.6	4.0	6.1	4	7
				10	75	4.1								

APPENDIX	I.C

SURFACE ROUTING

CONTRIBUTING BASINS	CA(10) (Ac)	CA(100) (Ac)	TRAVEL Tc (min.)	BASIN Tc (min.)	TOTAL CONCENTRATION TIME	I(10) (in./hr.)	I(100) (in./hr.)	Q(10) (c.f.s.)	Q(100) (c.f.s.)
1	6.39	7.81	-	25.1	25.1	3.1	4.7	20	36
---- SIZE AN 8' SUMP INLET.									
2	1.08	1.17	-	5.0	5	5.8	8.8	6	10
---- SIZE AN 8' AT GRADE INLET. NO FLOWBY.									
3	0.81	0.86	-	5.0	5	5.8	8.8	5	8
---- SIZE AN 8' AT GRADE INLET. NO FLOWBY.									
POR. 4	3.18	2.09	-	11.3	11.3	4.4	6.7	14	14
---- SIZE AN 8' SUMP INLET TO INTERCEPT RUNOFF PRIOR TO LEXINGTON DRIVE. NOTE: Q(10) FLOWS WILL EXCEED THE MAXIMUM AS DESIGNATED FOR A MINOR ARTERIAL.									
POR. 4,5	8.27	11.82	-	11.3	11.3	4.4	6.7	37	79
---- SIZE A 14' SUMP CURB INLET ON BOTH SIDES OF LEXINGTON DRIVE.									
6	8.90	10.68	-	19.4	19.4	3.5	5.3	31	57
---- SIZE AN 18' CURB INLET WITHIN A SUMP.									
7	1.15	1.38	-	13.8	13.8	4.1	6.2	5	9
---- SIZE AN 8' CURB INLET AT GRADE. NO FLOWBY.									
9A	2.31	2.64	-	12.8	12.8	4.2	6.4	10	17
---- SIZE A 20' INLET AT GRADE. FLOWBY - Q(10)=3 / Q(100)=8 EQUIV. CA(10)=0.71 / CA(100)=1.25									
FB,9B	1.55	2.21	-	14.4	14.4	4.0	5.9	6	13
---- SIZE A 20' INLET AT GRADE. FLOWBY - Q(10)=2 / Q(100)=5.									
10A	3.77	4.06	-	15.0	15.0	4.0	6.0	15	24
---- SIZE A 20' INLET AT GRADE. FLOWBY - Q(10)=7 / Q(100)=13 EQUIV. CA(10)=1.75 / CA(100)=2.17									
FB,10B	2.73	3.22	-	16.0	16	3.9	5.8	10	18
---- SIZE A 20' INLET AT GRADE. FLOWBY Q(10)=4 / Q(100)=8.									
11	4.51	5.36	-	14.1	14.1	4.1	6.1	18	33
---- SIZE AN 8' CURB INLET WITHIN A SUMP.									

(cont.)

APPENDIX	I.C

SURFACE ROUTING

CONTRIBUTING BASINS	CA(10) (Ac)	CA(100) (Ac)	TRAVEL Tc (min.)	BASIN Tc (min.)	TOTAL CONCENTRATION TIME	I(10) (in./hr.)	I(100) (in./hr.)	Q(10) (c.f.s.)	Q(100) (c.f.s.)
12	1.11	1.32	-	14.7	14.7	4.0	6.0	4	8
---- SIZE A 4' CURB INLET WITHIN A SUMP.									
13	7.74	9.20	-	16.5	16.5	3.8	5.7	29	53
---- SIZE AN THREE(3) 20' AND ONE(1) 14' AT-GRADE INLET. FLOWBY - Q(10) = 2 / Q(100) = 7 EQUIV. CA(10)=0.73 / CA(100)=1.16									
FB(13)	1.61	2.21	-	16.5	16.5	3.8	5.7	6	13
---- SIZE A 4' CURB INLET WITHIN A SUMP.									
15	7.00	8.40	-	11.5	11.5	4.4	6.7	31	56
---- SIZE (2) - 10' CURB INLETS WITHIN A SUMP.									
8	3.20	3.84	-	14.9	14.9	4.0	6.0	13	23
---- SIZE (2) - 4' CURB INLETS WITHIN A SUMP.									

APPENDIX	I.D

PIPE ROUTING

CONTRIBUTING BASINS	CA(10) (Ac)	CA(100) (Ac)	TRAVEL Tc (min.)	BASIN Tc (min.)	TOTAL CONCENTRATION TIME	I(10) (in./hr.)	I(100) (in./hr.)	Q(10) (c.f.s.)	Q(100) (c.f.s.)
1,2	7.47	8.98	-	27.9	27.9	2.9	4.4	22	40
---- SIZE 80' - 18" R.C.P. @ 1.0%									
\/									
3	8.28	9.84	-	27.9	27.9	2.9	4.4	24	43
---- SIZE 150' - 18" R.C.P. @ 1.0%									
POR. 4	3.18	2.09	-	11.3	11.3	4.4	6.7	14	14
---- SIZE 350' - 18" R.C.P. @ 3.0% ----									
\/									
1/2 POR.4,5	7.32	8.00	0.7	11.3	12.0	4.3	6.6	32	52
---- SIZE 80' - 30" R.C.P. @ 2.0% ----									
\/									
1/2 POR.4,5	11.45	13.91	-	12.0	12.0	4.3	6.6	50	91
---- SIZE 500' - 30" R.C.P. @ 5.0% ----									
\/									
7	12.60	15.47	-	16.0	16.0	3.9	5.8	49	90
---- SIZE 50' - 36" R.C.P. @ 2.0%									
\/									
6	21.50	26.15	-	19.4	19.4	3.5	5.3	76	139
---- SIZE 850' - 36" R.C.P. @ 4.5%									
\/									
8,9A,10A (20' INLETS)	28.37	33.04	-	19.4	19.4	3.5	5.3	99	176
---- SIZE 1,070' - 42" R.C.P. @ 3.0%									
\/									
FB,9B,10B,13 (20' INLETS)	35.35	42.26	-	20.6	20.6	3.5	5.3	120	224
---- SIZE 430' - 48" R.C.P. @ 2.0%									
\/									
15	42.35	50.66	-	20.6	20.6	3.5	5.3	148	268
---- SIZE 100' - 48" R.C.P. @ 3.5% TO POND									
11	4.51	5.36	-	14.1	14.1	4.1	6.1	18	33
---- SIZE 250' - 18" R.C.P. @ 2.0% ----									
\/									
11,12	5.62	6.68	-	14.7	14.7	4.0	6.0	22	40
---- SIZE 150' - 18" R.C.P. @ 2.0%									
13 (2 - 8' INLETS)	6.66	6.30	-	16.5	16.5	3.8	5.7	25	36
---- SIZE 250' - 30" R.C.P. @ 1.0 %									
\/									
FB (4' INLET)	7.74	9.20	-	17.9	17.9	3.7	5.5	28	51
---- SIZE 30" R.C.P.									

JR Engineering, Ltd.

CLIENT ______ JOB NO. 853507

PROJECT CREEKSIDE BY KRC CHK. BY ______ DATE ______

SUBJECT AT-GRADE INLET CAPACITY SHEET NO. 1 OF 1

So=4% N=0.016

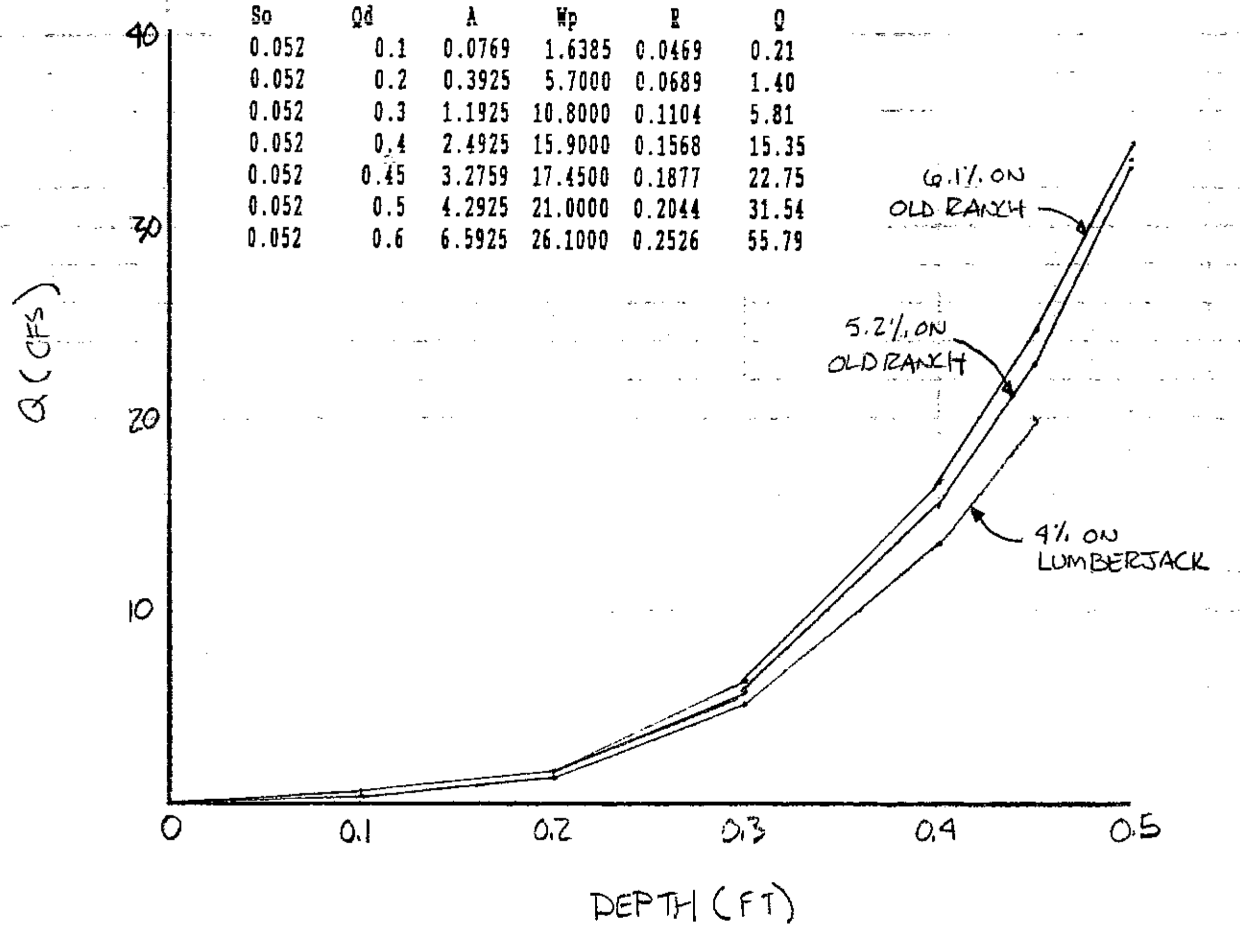
So	Qd	A	Wp	R	Q
0.04	0.1	0.0769	1.6385	0.0469	0.19
0.04	0.2	0.4156	5.7000	0.0729	1.35
0.04	0.3	1.1925	10.8000	0.1104	5.10
0.04	0.4	2.4925	15.9000	0.1568	13.46
0.04	0.45	3.2759	17.4500	0.1877	19.95

So=6.06% N=0.016

So	Qd	A	Wp	R	Q
0.0606	0.1	0.0769	1.6385	0.0469	0.23
0.0606	0.2	0.3925	5.7000	0.0689	1.51
0.0606	0.3	1.1925	10.8000	0.1104	6.27
0.0606	0.4	2.4925	15.9000	0.1568	16.57
0.0606	0.45	3.2759	17.4500	0.1877	24.55
0.0606	0.5	4.2925	21.0000	0.2044	34.05
0.0606	0.6	6.5925	26.1000	0.2526	60.22

So=5.20% N=0.016

So	Qd	A	Wp	R	Q
0.052	0.1	0.0769	1.6385	0.0469	0.21
0.052	0.2	0.3925	5.7000	0.0689	1.40
0.052	0.3	1.1925	10.8000	0.1104	5.81
0.052	0.4	2.4925	15.9000	0.1568	15.35
0.052	0.45	3.2759	17.4500	0.1877	22.75
0.052	0.5	4.2925	21.0000	0.2044	31.54
0.052	0.6	6.5925	26.1000	0.2526	55.79



INLET @ GRADE -
NORTH SIDE OF ROAD FLOWS WITHIN LUMBERJACK DRIVE EAST OF FULTON DRIVE

100-YR. FLOW

Q(100) =	18	I(100) =	6.0		
DEPTH =	0.43	Fr =	2.68	Inlet size ? L(i) =	20
SPREAD =	17.0	L(1) =	35.1	If Li < L(2) then Qi =	11
CROSS SLOPE =	2.0%	L(2) =	21.1	If Li > L(2) then Qi =	11
STREET SLOPE =	4.0%	L(3) =	75.2	FB =	7
				CA(eqv.) =	1.17

10-YR. FLOW

Q(10) =	6	I(10) =	4.0		
DEPTH =	0.31	Fr =	2.46	Inlet size ? L(i) =	20
SPREAD =	11.0	L(1) =	20.8	If Li < L(2) then Qi =	6
CROSS SLOPE =	2.0%	L(2) =	12.5	If Li > L(2) then Qi =	5
STREET SLOPE =	4.0%	L(3) =	44.7	FB =	1
				CA(eqv.)=	0.25

INLET @ GRADE -
SOUTH SIDE OF ROAD FLOWS WITHIN LUMBERJACK DRIVE EAST OF FULTON DRIVE

100-YR. FLOW

Q(100) =	18	I(100) =	6.2		
DEPTH =	0.43	Fr =	2.68	Inlet size ? L(i) =	20
SPREAD =	17.0	L(1) =	35.1	If Li < L(2) then Qi =	11
CROSS SLOPE =	2.0%	L(2) =	21.1	If Li > L(2) then Qi =	11
STREET SLOPE =	4.0%	L(3) =	75.2	FB =	7
				CA(eqv.) =	1.13

10-YR. FLOW

Q(10) =	14	I(10) =	4.1		
DEPTH =	0.40	Fr =	2.63	Inlet size ? L(i) =	20
SPREAD =	15.5	L(1) =	31.4	If Li < L(2) then Qi =	9
CROSS SLOPE =	2.0%	L(2) =	18.9	If Li > L(2) then Qi =	9
STREET SLOPE =	4.0%	L(3) =	67.3	FB =	5
				CA(eqv.)=	1.22

INLET @ GRADE -
NORTH SIDE OF ROAD FLOWS WITHIN LUMBERJACK DRIVE WEST OF FULTON DRIVE

100-YR. FLOW

Q(100) =	7	I(100) =	6.0		
DEPTH =	0.32	Fr =	2.49	Inlet size ? L(i) =	14
SPREAD =	11.8	L(1) =	22.6	If Li < L(2) then Qi =	4
CROSS SLOPE =	2.0%	L(2) =	13.6	If Li > L(2) then Qi =	5
STREET SLOPE =	4.0%	L(3) =	48.4	FB =	2
				CA(eqv.) =	0.33

10-YR. FLOW

Q(10) =	1	I(10) =	4.0		
DEPTH =	0.20	Fr =	2.10	Inlet size ? L(i) =	14
SPREAD =	5.5	L(1) =	8.9	If Li < L(2) then Qi =	2
CROSS SLOPE =	2.0%	L(2) =	5.3	If Li > L(2) then Qi =	1
STREET SLOPE =	4.0%	L(3) =	19.1	FB =	0
				CA(eqv.)=	0

INLET @ GRADE -
SOUTH SIDE OF ROAD FLOWS WITHIN LUMBERJACK DRIVE WEST OF FULTON DRIVE

100-YR. FLOW

Q(100) =	15	I(100) =	6.0		
DEPTH =	0.41	Fr =	2.65	Inlet size ? L(i) =	20
SPREAD =	16.0	L(1) =	32.6	If Li < L(2) then Qi =	9
CROSS SLOPE =	2.0%	L(2) =	19.6	If Li > L(2) then Qi =	10
STREET SLOPE =	4.0%	L(3) =	69.9	FB =	5
				CA(eqv.) =	0.83

10-YR. FLOW

Q(10) =	9	I(10) =	4.1		
DEPTH =	0.35	Fr =	2.54	Inlet size ? L(i) =	20
SPREAD =	13.0	L(1) =	25.5	If Li < L(2) then Qi =	7
CROSS SLOPE =	2.0%	L(2) =	15.3	If Li > L(2) then Qi =	6
STREET SLOPE =	4.0%	L(3) =	54.6	FB =	3
				CA(eqv.)=	0.73

INLET @ GRADE -
SOUTH SIDE OF OLD RANCH

100-YR. FLOW

Q(100) =	24	I(100) =	6.0			
DEPTH =	0.44	Fr =	3.32	Inlet size ?	L(i) =	20
SPREAD =	17.5	L(1) =	44.7	If Li < L(2) then	Qi =	11
CROSS SLOPE =	2.0%	L(2) =	26.8	If Li > L(2) then	Qi =	13
STREET SLOPE =	6.1%	L(3) =	95.8		FB =	13
					CA(eqv.) =	2.17

10-YR. FLOW

Q(10) =	15	I(10) =	4.0			
DEPTH =	0.38	Fr =	3.20	Inlet size ?	L(i) =	20
SPREAD =	14.5	L(1) =	35.7	If Li < L(2) then	Qi =	8
CROSS SLOPE =	2.0%	L(2) =	21.5	If Li > L(2) then	Qi =	9
STREET SLOPE =	6.1%	L(3) =	76.5		FB =	7
					CA(eqv.)=	1.75

INLET @ GRADE -
NORTH SIDE OF OLD RANCH

100-YR. FLOW

Q(100) =	17	I(100) =	6.4			
DEPTH =	0.40	Fr =	3.24	Inlet size ?	L(i) =	20
SPREAD =	15.5	L(1) =	38.7	If Li < L(2) then	Qi =	9
CROSS SLOPE =	2.0%	L(2) =	23.2	If Li > L(2) then	Qi =	10
STREET SLOPE =	6.1%	L(3) =	82.9		FB =	8
					CA(eqv.) =	1.25

10-YR. FLOW

Q(10) =	10	I(10) =	4.2			
DEPTH =	0.33	Fr =	3.08	Inlet size ?	L(i) =	20
SPREAD =	12.0	L(1) =	28.5	If Li < L(2) then	Qi =	7
CROSS SLOPE =	2.0%	L(2) =	17.1	If Li > L(2) then	Qi =	6
STREET SLOPE =	6.1%	L(3) =	61.0		FB =	3
					CA(EQUV) =	0.71

INLET @ GRADE -
SOUTH SIDE OF OLD RANCH (WEST)

100-YR. FLOW

Q(100) =	18	I(100) =	5.7		
DEPTH =	0.41	Fr =	3.02	Inlet size ? L(i) =	20
SPREAD =	16.0	L(1) =	37.2	If Li < L(2) then Qi =	10
CROSS SLOPE =	2.0%	L(2) =	22.3	If Li > L(2) then Qi =	10
STREET SLOPE =	5.2%	L(3) =	79.7	FB =	8
				CA(eqv.) =	1.40

10-YR. FLOW

Q(10) =	10	I(10) =	3.8		
DEPTH =	0.34	Fr =	2.88	Inlet size ? L(i) =	20
SPREAD =	12.5	L(1) =	27.7	If Li < L(2) then Qi =	7
CROSS SLOPE =	2.0%	L(2) =	16.6	If Li > L(2) then Qi =	6
STREET SLOPE =	5.2%	L(3) =	59.4	FB =	4
				CA(eqv.)=	1.07

INLET @ GRADE -
NORTH SIDE OF OLD RANCH (WEST)

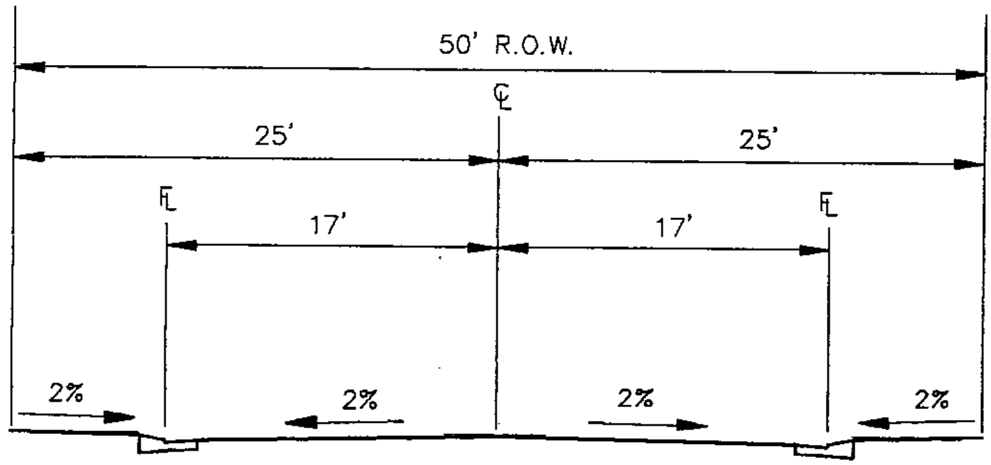
100-YR. FLOW

Q(100) =	13	I(100) =	5.9		
DEPTH =	0.37	Fr =	2.94	Inlet size ? L(i) =	20
SPREAD =	14.0	L(1) =	31.7	If Li < L(2) then Qi =	8
CROSS SLOPE =	2.0%	L(2) =	19.1	If Li > L(2) then Qi =	8
STREET SLOPE =	5.2%	L(3) =	68.0	FB =	5
				CA(eqv.) =	0.85

10-YR. FLOW

Q(10) =	6	I(10) =	4.0		
DEPTH =	0.30	Fr =	2.78	Inlet size ? L(i) =	20
SPREAD =	10.5	L(1) =	22.5	If Li < L(2) then Qi =	5
CROSS SLOPE =	2.0%	L(2) =	13.5	If Li > L(2) then Qi =	4
STREET SLOPE =	5.2%	L(3) =	48.2	FB =	2
				[illegible]	0.51

STREET CAPACITY CALCULATIONS
50' R.O.W. w/ TYPE 2 CURB



TO CROWNLINE

AREA = 3.13 s.f.
WETTER PERIMETER = 18.25 ft.

Q = (1.49/0.016) (3.13/18.25)^2/3 (S)^1/2 (3.13)
OR
Q = 89 (S)^1/2

TO TOP OF CURB

AREA = 10.30 s.f.
WETTER PERIMETER = 36.92 ft.

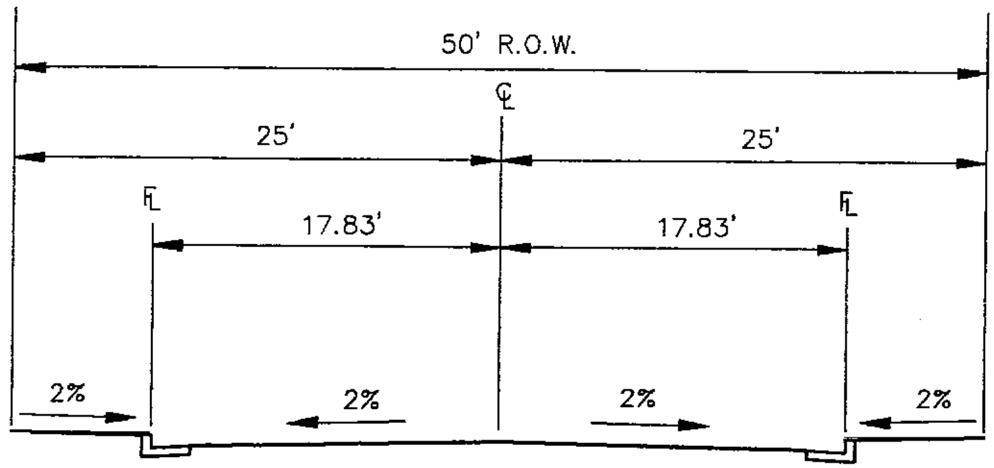
Q = (1.49/0.016) (10.30/36.92)^2/3 (S)^1/2 (10.32)
OR
Q = 408 (S)^1/2

TO R.O.W.

AREA = 15.92 s.f.
WETTER PERIMETER = 50.26 ft.

Q = (1.49/0.016) (15.92/50.26)^2/3 (S)^1/2 (15.92)
OR
Q = 686 (S)^1/2

STREET CAPACITY CALCULATIONS
50' R.O.W. w/ TYPE 1 CURB



TO CROWNLINE

AREA = 3.27 s.f.
WETTER PERIMETER = 18.28 ft.

Q = (1.49/0.016) (3.27/18.28)^2/3 (S)^1/2 (3.27)
OR
Q = 97 (S)^1/2

TO TOP OF CURB

AREA = 18.64 s.f.
WETTER PERIMETER = 37.00 ft.

Q = (1.49/0.016) (18.64/37.00)^2/3 (S)^1/2 (18.64)
OR
Q = 1097 (S)^1/2

TO R.O.W.

AREA = 24.64 s.f.
WETTER PERIMETER = 51.34 ft.

Q = (1.49/0.016) (24.64/51.34)^2/3 (S)^1/2 (24.64)
OR
Q = 1,398 (S)^1/2

Quick TR-55 Ver.5.46   S/N:
Executed: 07:43:22   03-16-1994

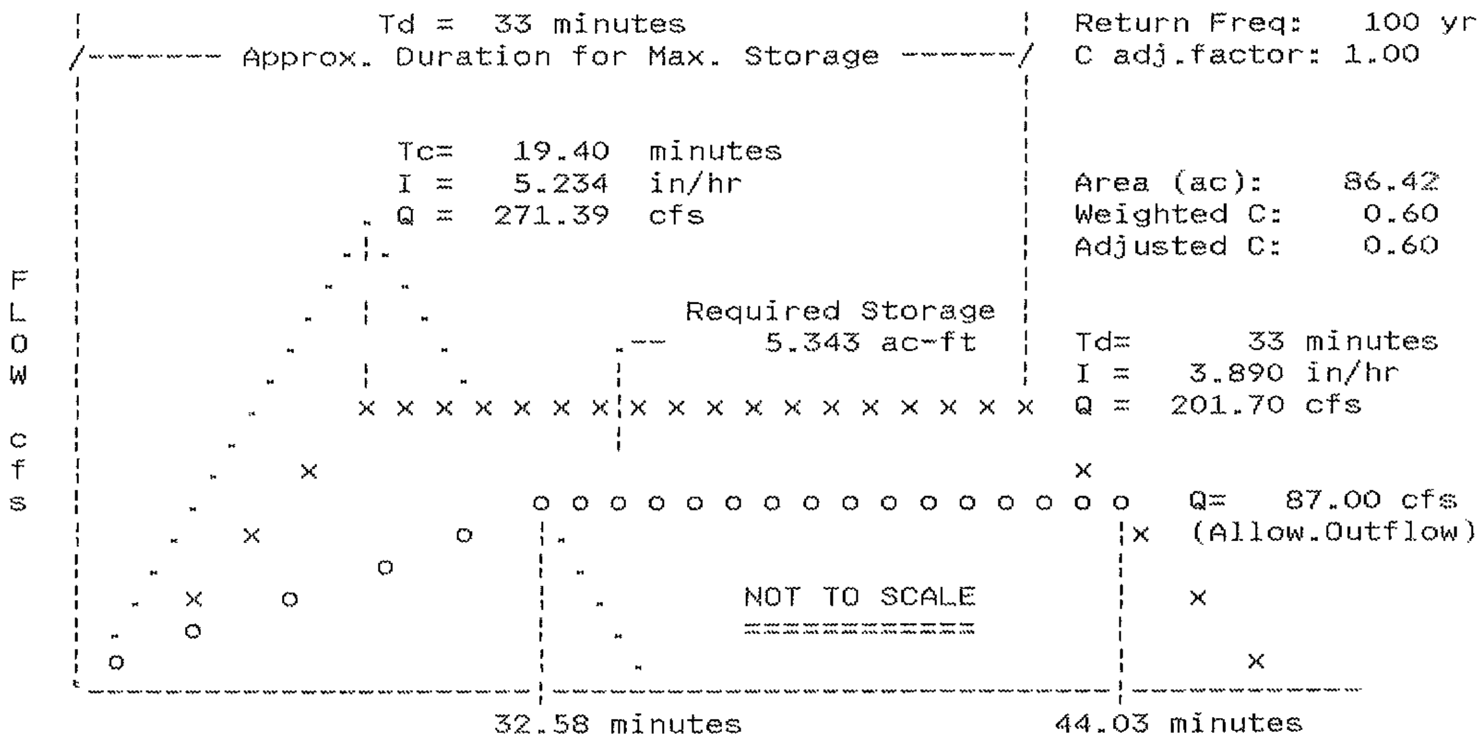
MODIFIED RATIONAL METHOD

---- Graphical Summary for Maximum Required Storage ----

First peak outflow point assumed to occur at Tc hydrograph recession leg.

CREEKSIDE 100YR DETENTION ANALYSIS

```
**********************************************************************
*  RETURN FREQUENCY: 100 yr      |  Allowable Outflow:    87.00 cfs    *
*  "C" Adjustment: 1.000         |  Required Storage:     5.343 ac-ft  *
*--------------------------------------------------------------------*
*  Peak Inflow:  201.70 cfs        Inflow .HYD stored: CREEK100.HYD   *
**********************************************************************
```



Quick TR-55 Ver.5.46 S/N:
Executed: 07:43:22 03-16-1994

CREEKSIDE 100YR DETENTION ANALYSIS

**** Modified Rational Hydrograph *****

Weighted C = 0.600 Area= 86.420 acres Tc = 19.40 minutes

Adjusted C = 0.600 Td= 33.00 min. I= 3.89 in/hr Qp= 201.70 cfs

RETURN FREQUENCY: 100 year storm Adj.factor = 1.00
Output file: CREEK100.HYD

HYDROGRAPH FOR MAXIMUM STORAGE
For the 100 Year Storm

Time Hours	Time increment = 0.017 Hours Time on left represents time for first Q in each row.						
0.007	4.16	14.56	24.95	35.35	45.75	56.14	66.54
0.123	76.94	87.34	97.73	108.13	118.53	128.92	139.32
0.240	149.72	160.12	170.51	180.91	191.31	201.70	201.70
0.357	201.70	201.70	201.70	201.70	201.70	201.70	201.70
0.473	201.70	201.70	201.70	201.70	201.70	197.55	187.15
0.590	176.75	166.35	155.96	145.56	135.16	124.77	114.37
0.707	103.97	93.57	83.18	72.78	62.38	51.99	41.59
0.823	31.19	20.79	10.40	0.00			

Quick TR-55 Ver.5.46 S/N:
Executed: 07:43:22 03-16-1994

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************************************************************************
************************************************************************
*                                                                      *
*                                                                      *
*                     MODIFIED RATIONAL METHOD                         *
*           ---- Grand Summary For All Storm Frequencies ----          *
*                                                                      *
*                                                                      *
************************************************************************
************************************************************************
```

First peak outflow point assumed to occur at Tc hydrograph recession leg.

CREEKSIDE 100YR DETENTION ANALYSIS

Area = 86.42 acres Tc = 19.40 minutes

Frequency (years)	Adjusted 'C'	Duration minutes	Intens. in/hr	Qpeak cfs	Allowable cfs	VOLUMES Inflow (ac-ft)	Storage (ac-ft)
100	0.600	33	3.890	201.70	87.00	9.168	5.343

Quick TR-55 Ver.5.46 S/N:
Executed: 07:43:22 03-16-1994

MODIFIED RATIONAL METHOD
---- Summary for Single Storm Frequency ----

First peak outflow point assumed to occur at Tc hydrograph recession leg.

CREEKSIDE 100YR DETENTION ANALYSIS

RETURN FREQUENCY: 100 yr 'C' Adjustment = 1.000 Allowable Q = 87.00 cfs

Hydrograph file duration= 33.00 minutes
Hydrograph file: CREEK100.HYD Tc = 19.40 minutes

Weighted 'C'	Adjusted 'C'	Duration minutes	Intens. in/hr	Areas acres	Qpeak cfs	VOLUMES Inflow (ac-ft)	Storage (ac-ft)
0.600	0.600	19	5.234	86.42	271.39	7.252	4.927
0.600	0.600	20	5.150	86.42	267.04	7.356	4.966
0.600	0.600	30	4.100	86.42	212.59	8.785	5.293
****** Storage Maximum							
0.600	0.600	33	3.890	86.42	201.70	9.168	5.343
0.600	0.600	40	3.450	86.42	178.89	9.856	5.255
0.600	0.600	50	3.000	86.42	155.56	10.713	4.999
0.600	0.600	60	2.600	86.42	134.82	11.142	4.329