Preliminary/Permit Use

Jensen Park

Arlington, Snohomish County, Washington

Stormwater Analysis (Infiltration Pond) Report

Prepared For: Landed Gentry Development, Inc.
540 E. Fairhaven Avenue
Burlington, WA 98233
(360) 755-9021

Prepared By: ***SUMMIT Engineers & Surveyors, Inc.***
2218 Old Highway 99 So.
Mount Vernon, WA 98273
(360) 416-4999

Date: January 2, 2001
Addendum: September 4, 2001
Addendum: February 27, 2002
Revision: February 24, 2003

SUMMIT
ENGINEERS & SURVEYORS, INC.

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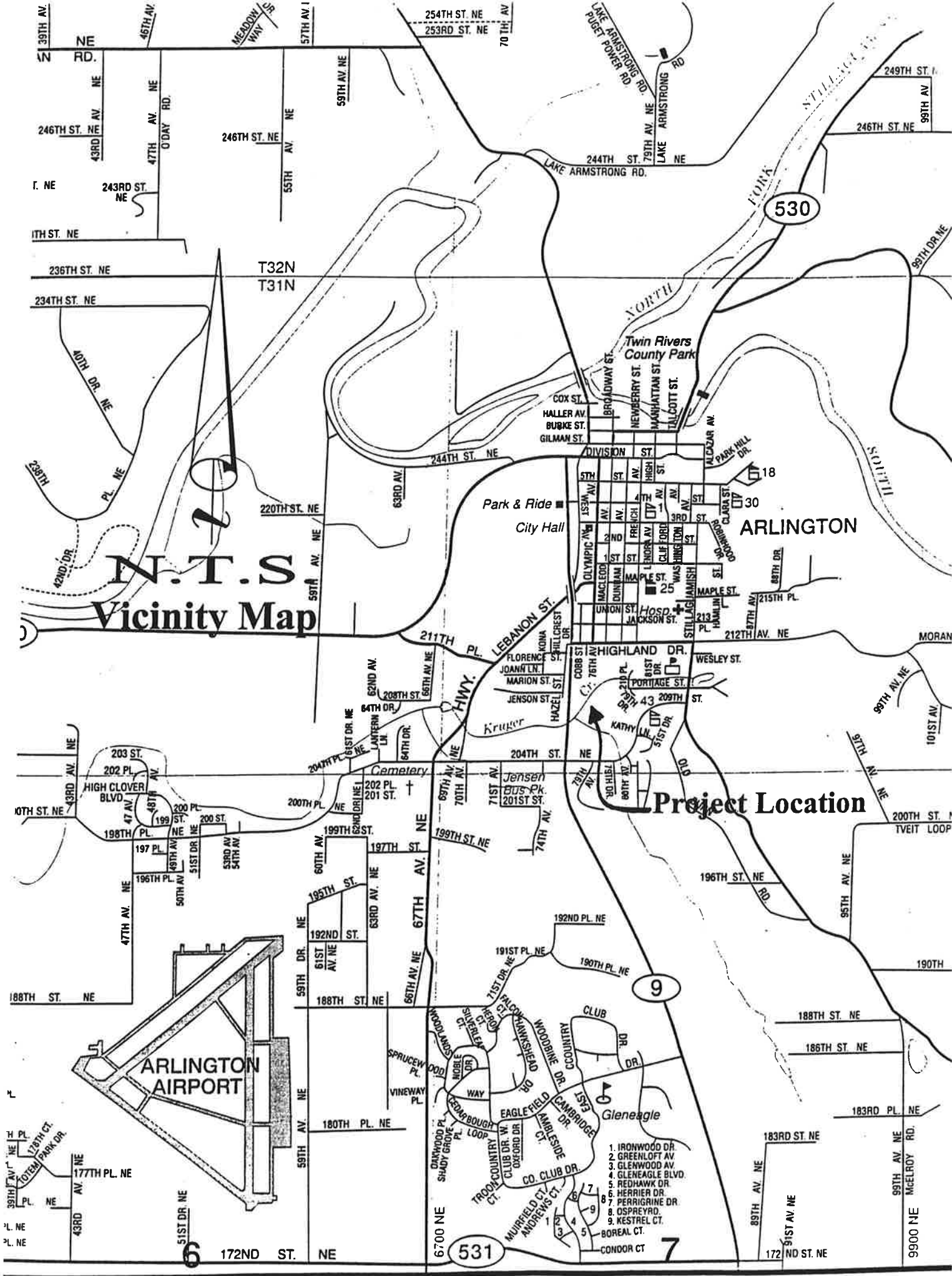
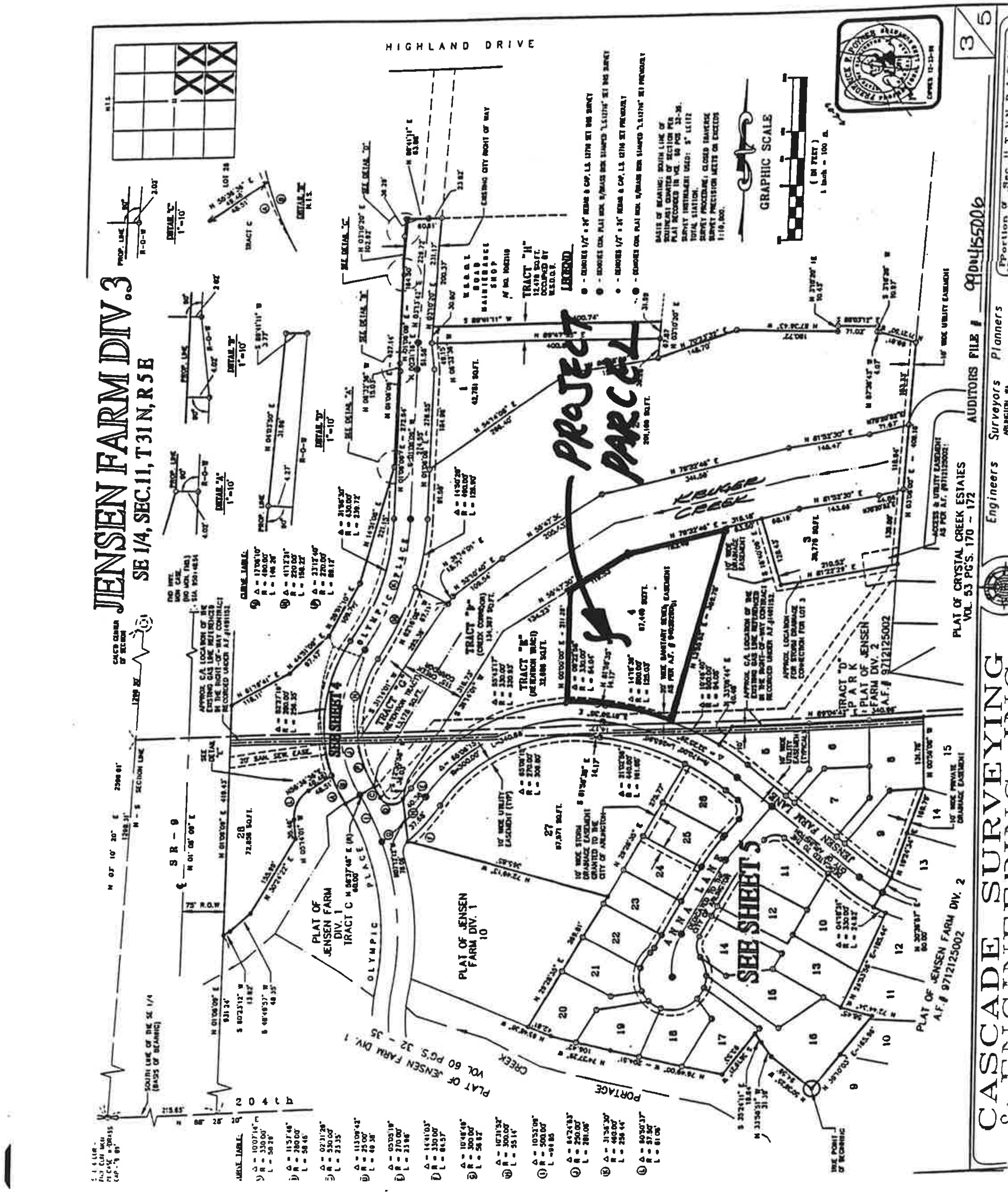

N.T.S.
Vicinity Map
Project Location
ARLINGTON
Twin Rivers County Park
Park & Ride
City Hall
ARLINGTON AIRPORT
Jensen Bus. Pk.
Cemetery
Kruger
Gleneagle
T32N
T31N
530
531
9
1. IRONWOOD DR.
2. GREENLOFT AV.
3. GLENWOOD AV.
4. GLENEAGLE BLVD.
5. REDHAWK DR.
6. HERRIER DR.
7. PERRIGRINE DR.
8. OSPREY RD.
9. KESTREL CT.
BOREAL CT.
CONDOR CT

Figure i



PARCEL MAP

Figure ii

Preliminary Site Plan

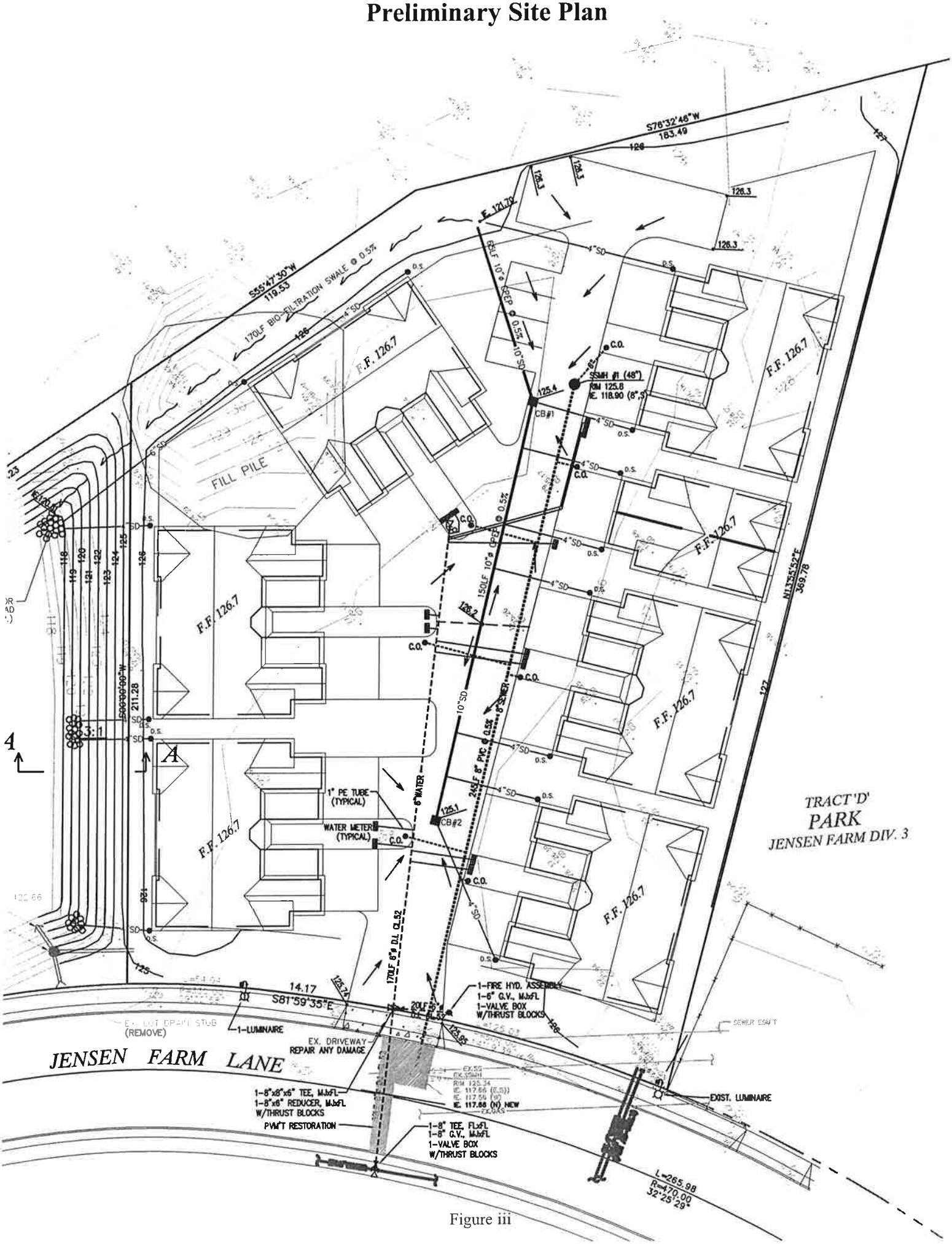


Figure iii

USGS Topo Map

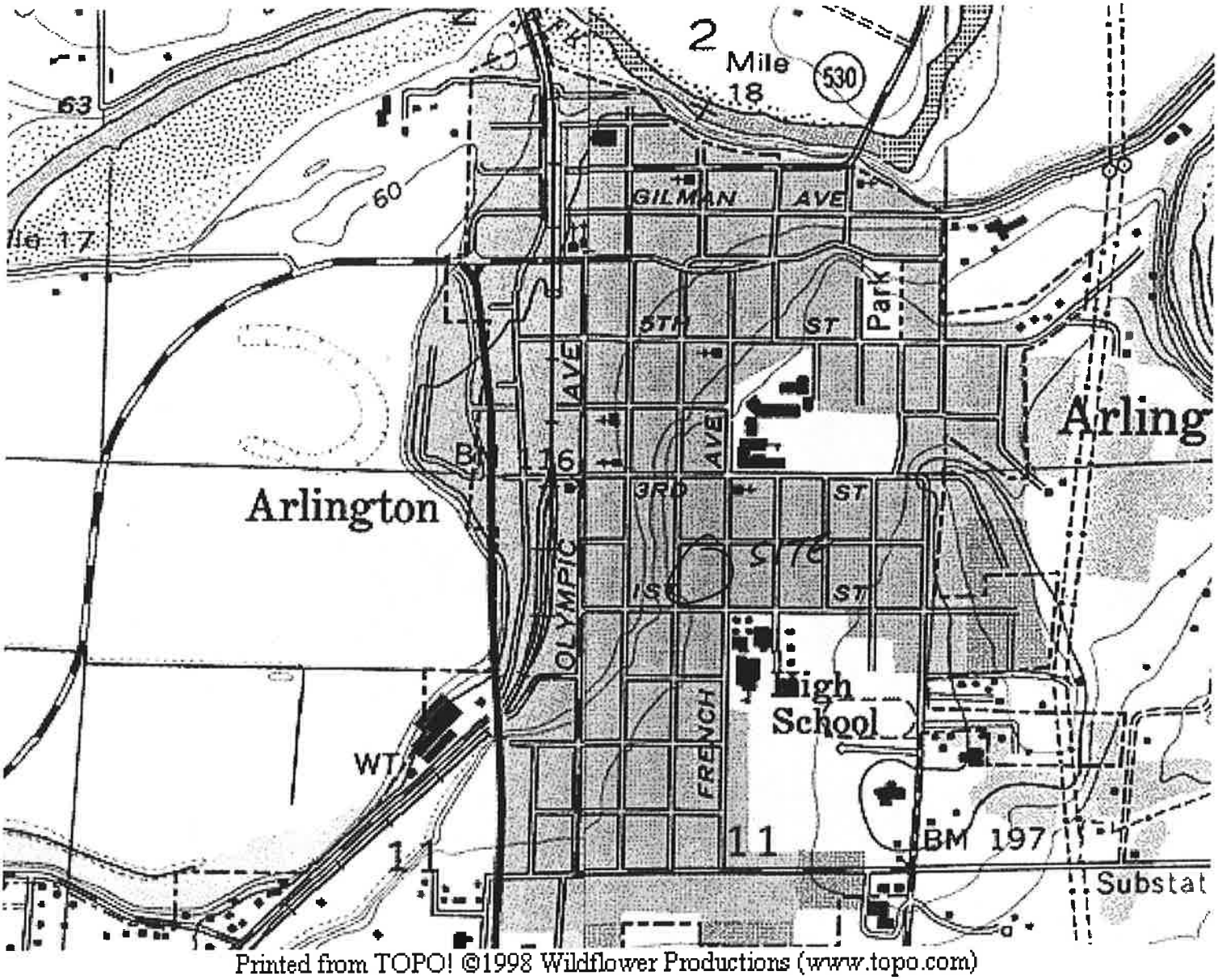
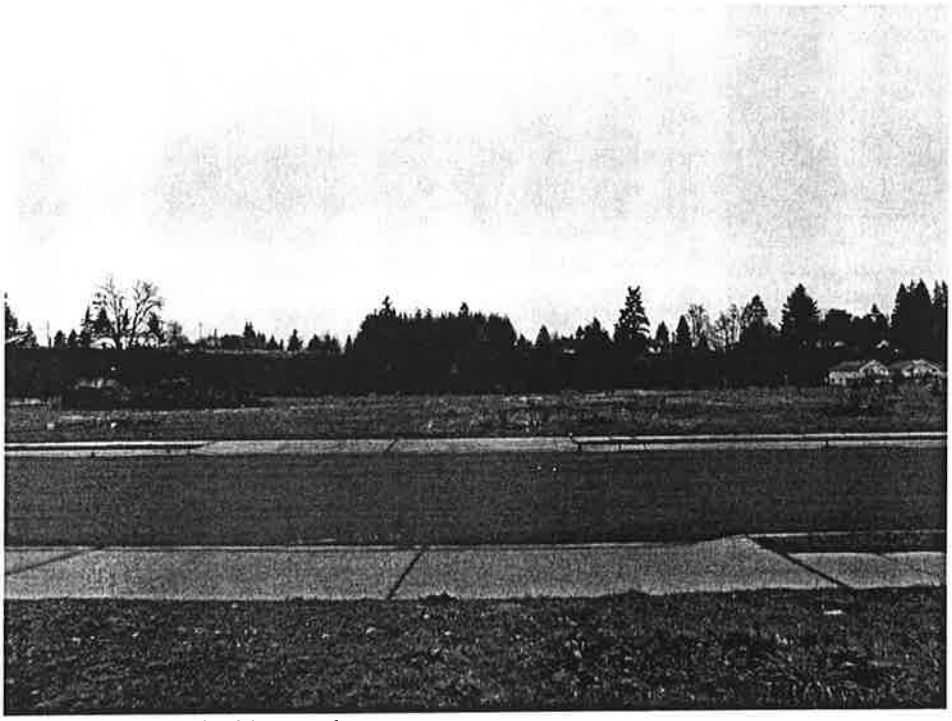


Figure vi

Site Photographs

South side of property looking northwest.



South of property looking north.

Methods:

A topographic survey of the project site and adjacent areas was conducted by Summit Engineers & Surveyors, using Standard field procedures. Results of this survey have been incorporated into the project drawings used for development of the overall preliminary design and for use in the drainage analysis.

An on-site field reconnaissance was conducted by a Professional Engineer from Summit Engineers & Surveyors to determine key drainage features and to gather general site information such as topography, vegetation, land use, existing drainage facility and systems, both on-site and off-site. For the reconnaissance, distances were measured by taping and pacing.

Available records utilized for the drainage analysis include the City's Comprehensive Storm Drainage Plan, the City Stormwater Design Standards, Soil Survey and the drainage calculations for "The Jensen Farm Subdivision 3", prepared by Cascade Surveying and Engineering, Inc.

The hydrologic analysis, level pool routing, and design of the infiltration system was done using NRCS (SCS) methodology as implemented through "Hydraflow Hydrographs" which utilizes SCS National Engineering Handbook, Section 4 – urban hydrosystems. Analysis to the program was performed by Summit Engineers & Surveyors to model the drainage system in conformance with the City Drainage Ordinance and the Washington State Department of Ecology.

Existing Conditions:

The area proposed for development is located in the northeast quadrant of the road intersection, Olympic Place and Jensen Farm Lane. The site is all cleared with some imported fill material and construction debris on-site. Most of the site is very much vegetated with grass. The site is slopped westerly towards the existing infiltration pond for Jensen Farm Division 3. Northerly Kruger Creek runs westerly with more than 50 feet of buffer in between the north property line to the creek centerline. A small soil stalk pile exists along the north property line. Due to the site soil condition being porous, even when the site inspection was conducted in December of year 2000, the soil surface was fairly dry. No water was observed in the existing infiltration pond west of the project site.

Developed Conditions:

Proposed development "Jensen Park Townhouses/Condominiums" includes 26 residential units, parking lot, paved driveway, and landscaped throughout the perimeter of the site. As part of the project, a stormwater quantity facility will be constructed to the west of the site by expanding the size of the existing infiltration pond. The quality facility will be located to the north.

In year 2001, the developer of the subject property proposed "Homeplace Adult Care Center". During the permit/review process, the city has approved the stormwater control concept of utilizing the existing city owned infiltration pond for the proposed project. Also, the city approved "stormfilter" for the stormwater quality control but this project will propose a biofiltration swale.

The infiltration pond was designed by Cascade Surveying and Engineering, Inc. with an infiltration rate of 1.205 in./hr. which is one half of the D.O.E. recommended rate for loamy sand. Since the site soil is being consistently loamy sand and gravel, the same is used for this project's infiltration area and volume calculation. For emergency overflow, already a pipe is located above the 100 year designed storm elevation and releases into the unnamed drainage that flows southwest under Olympic Place.

The site is not affected by any off-site runoff.

Hydrologic Data:

Basin Area:	1.55 acres on-site	0.00 acres off-site
	Total: 1.55 acres	
Soil:	Loamy Sand & Gravel	
Permeability:	2.41 inches/hour (per off-site existing pond design)	

Curve Number: 79.8

House, Road and Driveways – 98 - 0.95 acres
Lawn and Landscape good condition – 80 - 0.60 acres

Rainfall Precipitation:

2-year 24-hour storm:	2.0
10-year 24-hour storm:	3.1
25-year 24-hour storm:	3.5
100-year 24-hour storm:	4.6

Erosion and Sedimentation Control:

The risk of erosion and subsequent sedimentation for this project will be associated with grading and excavation operations, and the construction of buildings with associated driveways, utilities and construction of the parking lot. Most of the area where land disturbance is proposed is fairly flat and hence does not appear to require extensive Temporary Erosion and Sedimentation Control (TESC) facilities. However, as required by the Treatment BMPs, a silt fence, drainage structure protection, and temporary vegetation will be needed. The infiltration pond should be cleaned when the project improvement is completed.

The specific TESC facilities will be shown on TESC Plan to be submitted with the permit plan set.

Summary:

The development of the Jensen Park will result in an increase in stormwater runoff at the 100-year storm event within the drainage basin considered without the infiltration pond. However, as required by the City of Arlington Ordinance and the Washington State Department of Ecology, the developed site runoff is to be detained and infiltrated.

Providing 420 square feet of additional pond base area with 4.8 feet of storage depth this pond will be able to detain and percolate the required storm event runoff. The pond will not only function as a quantity control but also, function as a quality control facility in addition to the project provided bio-filtration swale. In an emergency overflow condition, the existing pond's facility will be utilized. The proposed improvement will not adversely impact the drainage system within the immediate vicinity.

Analysis Result

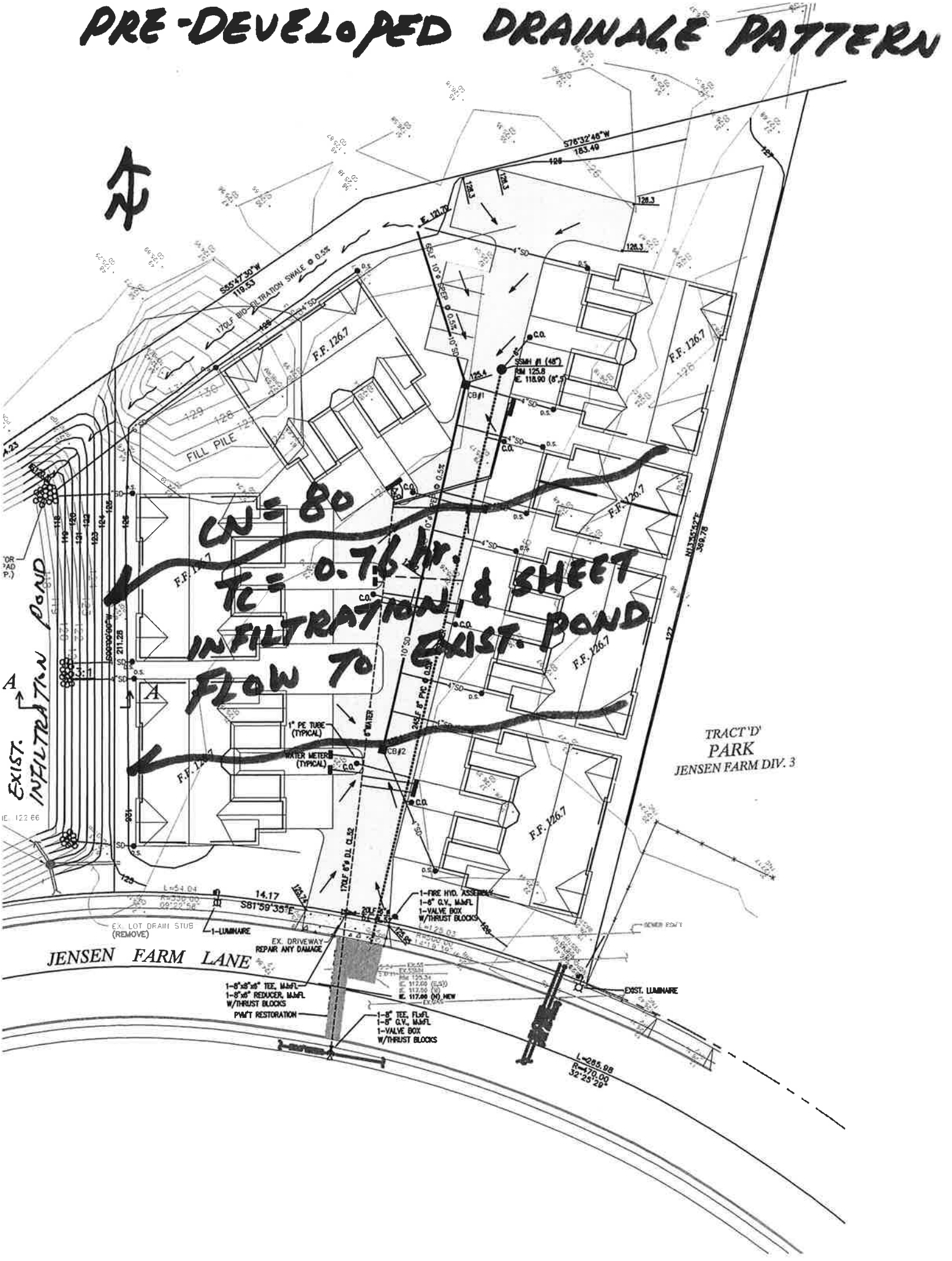
Additional Pond Size – 420 square feet base area (with 2 safety factor)
Detention Volume – required 332 cu ft. provided 2018 cu ft.
Pond Depth – 4.8 feet plus 2 foot freeboard
Detention Duration – required 48 hours provided 31.9 hours

I, Young-Soo Kim, a Professional Engineer registered in the State of Washington as a Civil Engineer, do hereby declare that this report/plan was prepared by, or under my personal supervision, that this report/plan was prepared in accordance with generally accepted engineering practices.

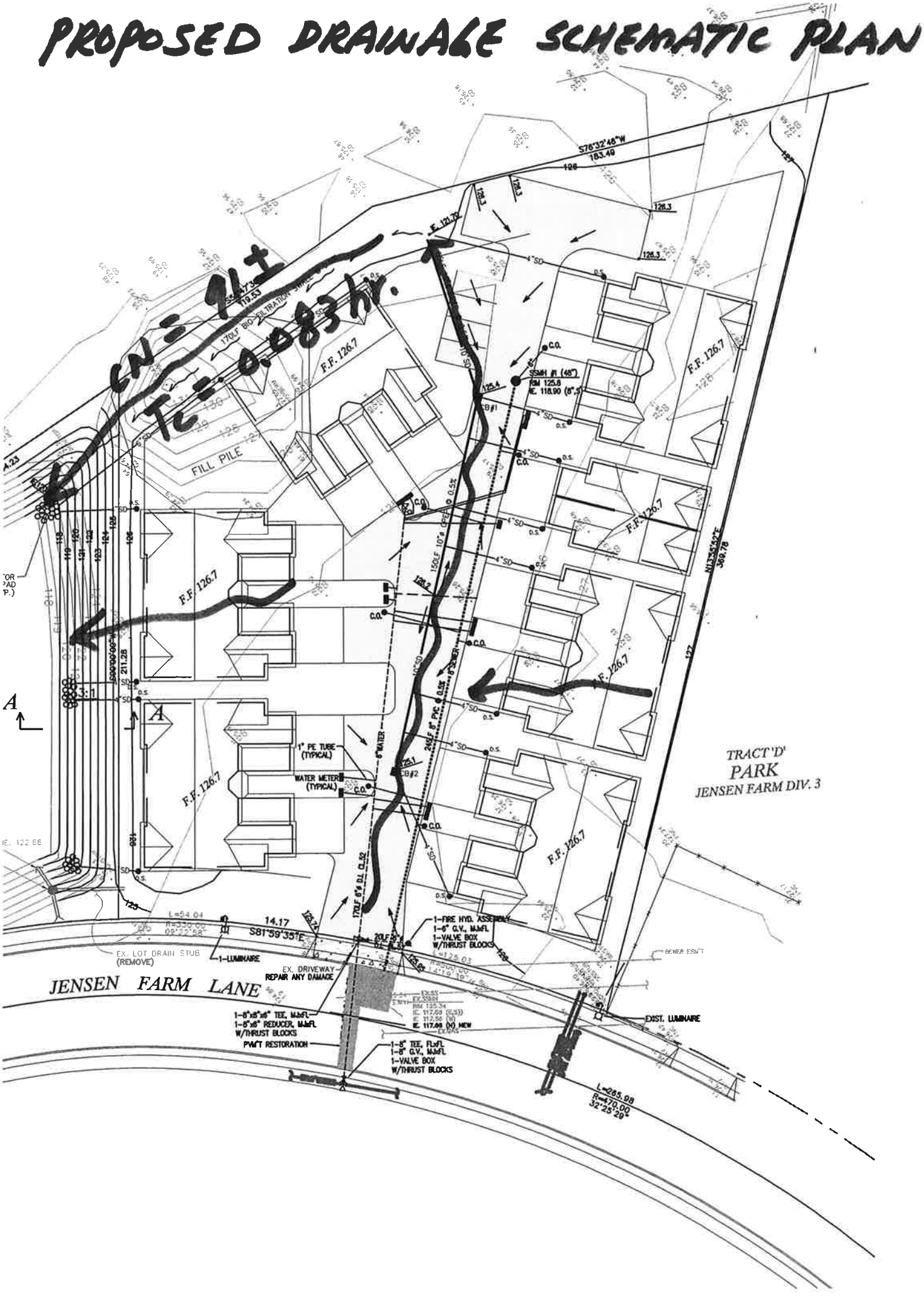
Young-Soo Kim, P.E.
Registration Number: 32169
Date: February 24, 2003

Appendix

PRE-DEVELOPED DRAINAGE PATTERN



PROPOSED DRAINAGE SCHEMATIC PLAN



INFILTRATION POND SIZING BY: Y.S.K DATE: 12/30/00

— CURRENTLY THE EXISTING INFILTRATION POND LOCATED WEST OF THE PROJECT IS SIZED INCLUDING THE PRE-DEVELOPED PROJECT'S SURFACE RUNOFF.
THE DIFFERENCE OF PRE & POST-DEVELOPED RUNOFF VOLUME WILL NEED TO BE TREATED.
THE CONCEPT IS TO ENLARGE THE EXISTING POND TO ACCOMODATE THE VOLUME INCRESE DUE TO THE PROJECT

— 100 YR POST-DEVELOPED RUNOFF (SCS 24-hr STORM)

$Q_{PEAK} = 1.08$ cfs $Q_{PRE} = 0.74$ cfs

$VOL = 15,493\ ft^3$ $VOL_{PRE} = 14,149\ ft^3$

ΔVOL TO BE TREATED $= 15,493 - 14,149 = \underline{1,344\ ft^3}$

— INFILTRATION RATE (½ OF D.O.E.'s RECOMMENDATION)

$= 1.205$ in/hr $= \underline{2.789 * 10^{-5}\ ft/sec.}$

— EXPANDED POND BOTTOM AREA: 3' avg. width * ±140' length = 420 sf

— DETERMINE INFILTRATION FLOW (INTO GROUND) RATE

$2.789 * 10^{-5}\ ft/sec * 420\ ft^2 = \underline{0.0117\ cfs}$

— VOLUME INFILTRATED IN 24HRS.

$0.0117\ cfs * 3600\ sec/hr * 24\ hr = \underline{1012\ ft^3}$

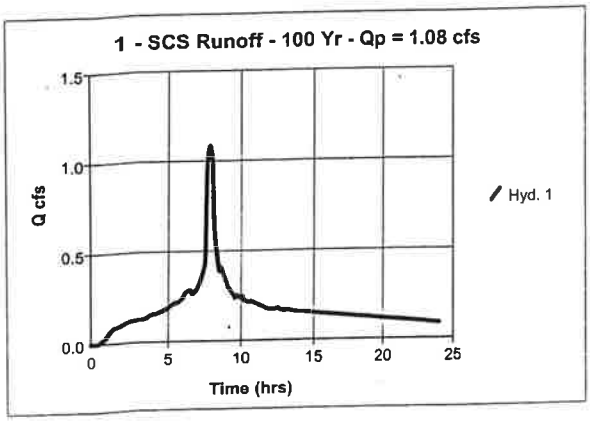
English

Hyd. No. 1

Homeplace - PostDev'p 100yr storm

Hydrograph type	= SCS Runoff	Peak discharge	= 1.08 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Drainage area	= 0.95 ac	Curve number	= 98
Basin Slope	= 1.5 %	Hydraulic length	= 100 ft
Tc method	= USER	Time of conc. (Tc)	= 5 min
Total precip.	= 4.60 in	Distribution	= Type IA
Storm duration	= 24 hrs	Shape factor	= 484

Total Volume = 15,493 cuft



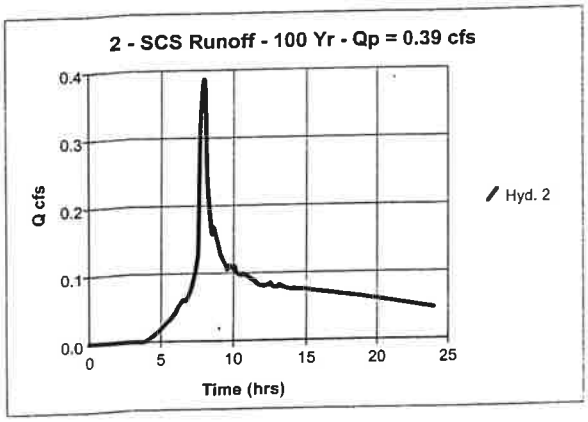
English

Hyd. No. 2

Homeplace - Post Devp't 100yr. storm

Hydrograph type	= SCS Runoff	Peak discharge	= 0.39 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Drainage area	= 0.60 ac	Curve number	= 80
Basin Slope	= 1.5 %	Hydraulic length	= 100 ft
Tc method	= USER	Time of conc. (Tc)	= 5 min
Total precip.	= 4.60 in	Distribution	= Type IA
Storm duration	= 24 hrs	Shape factor	= 484

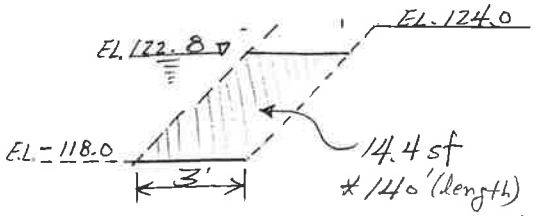
Total Volume = 5,707 cuft



∴ VOLUME TO BE DETAINED

$1{,}344 ft^3 - 1{,}012 ft^3 = 332 ft^3$

VOLUME PROVIDED)



$= 2016 ft^3 >> 332$

PROVIDED VOL.

CHECK: TIME TO TAKE IT TO INFILTRATE

$332 ft^3 \Rightarrow$ 7.88 hrs.

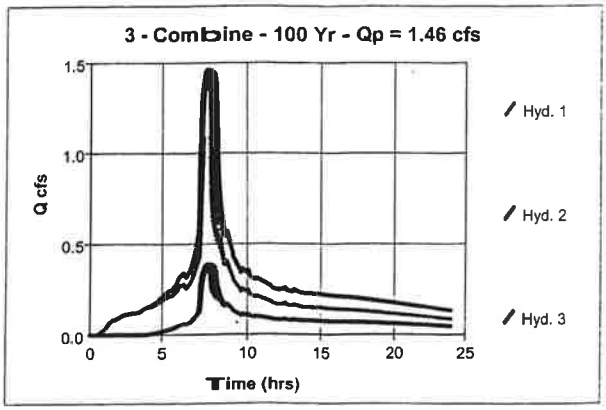
English

Hyd. No. 3

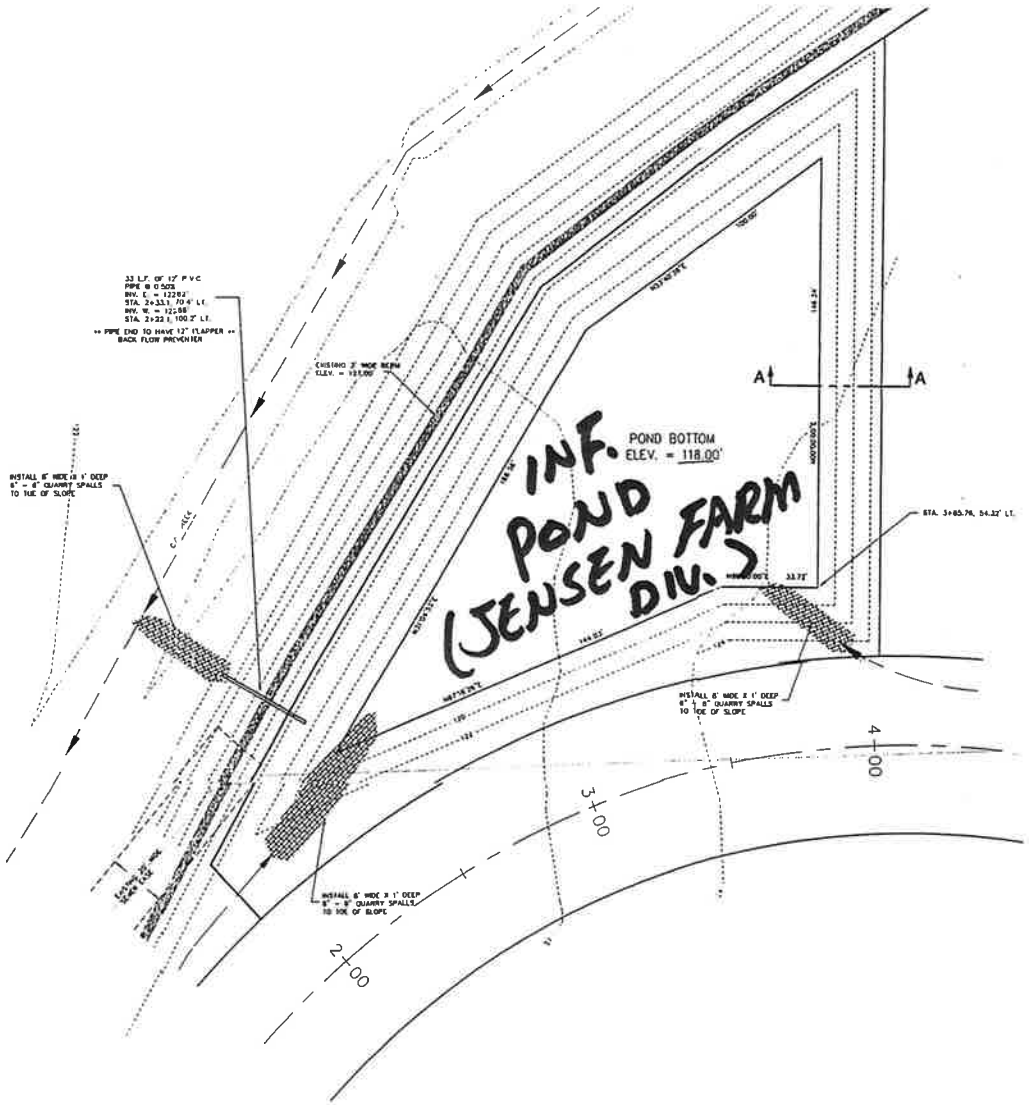
Homeplace

Hydrograph type	= Combine	Peak discharge	= 1.46 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
1st inflow hyd. No.	= 1	2nd inflow hyd. No.	= 2

Total Volume = 21,200 cuft



SEC. 11, T. 31 N., R. 5 E., W.M.



NORTH

1" = 20'

SECTION AA

PROJECT SITE

EXAMINED AND APPROVED FOR CONSTRUCTION ON THIS 23 DAY OF June 19 97

CITY OF ARLINGTON ENGINEER

DESIGNED Dc. Stutt DATE 3/97
DRAWN J. Mitchell DATE 3/97
CHECKED DATE
SCALE-HORIZONTAL 1" = 20'
- VERTICAL 1" = 2'
JOB NUMBER 11093
FIELD BOOK No. 41
MUNICIPALITY CITY OF ARLINGTON

by CASCADE SURVEYING & ENGINEERING, INC.
P.O. BOX 328
ARLINGTON, WASHINGTON 98223
(360)435-1311
(360)652-7979
FAX(360)435-4012
1-800-892-8881

PLAT OF
JENSEN FARM-DIV. 2
DETENTION POND
PLAN AND PROFILE

8 of 10

#11094

JENSEN PARK
2/24/03

BIO-FILTRATION SWALE SIZING

$Q_{wq} = 0.28$ cfs

$y = 5''$, $S = 0.5\%$

$n = 0.20$

$$\therefore b_{WIDTH} = \frac{Q_{wq} * n}{1.49 y^{1.67} S^{0.5}}$$

$$= \frac{(0.28)(0.20)}{1.49 (5/12)^{1.67} (0.005)^{0.5}}$$

$= 2.29$ ft.

SAY 2.3 ft

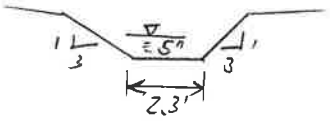
$$\therefore V_{wq} = \frac{Q_{wq}}{A_{wq}}$$

$A_{wq} = by + zy^2$

$= (2.3)(\frac{5}{12}) + (3)(\frac{5}{12})^2 = 1.48$

$$\therefore V_{wq} = \frac{0.28}{1.48} = 0.19 \text{ ft/sec} < 1 \text{ ft/sec}$$

$\therefore L = 540 V_{wq} = 540 * 0.19 = \underline{103 \text{ ft}}$ SWALE LENGTH



CHECK FOR CONVEYANCE

$Q_{100} = 1.46$ cfs

$$Q_{capacity} = \frac{1.49}{n} A R^{2/3} S^{1/2} = \frac{1.49}{0.2} (5.3)(0.61)^{2/3} (0.005)^{1/2} = \underline{2.06 \text{ cfs}} \quad @y = 1'$$

CHECK

Velocity = 0.40 ft/sec << 5 fps

Hydrograph Plot

English

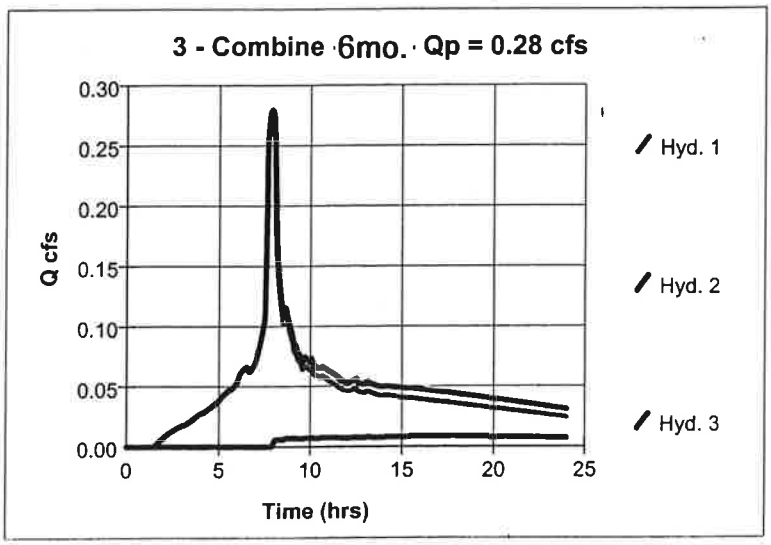
Hyd. No. 3

Homeplace

Hydrograph type = Combine
Storm frequency = 6 mo.
1st inflow hyd. No. = 1

Peak discharge = 0.28 cfs
Time interval = 1 min
2nd inflow hyd. No. = 2

Total Volume = 4,280 cuft



Hydrograph Plot

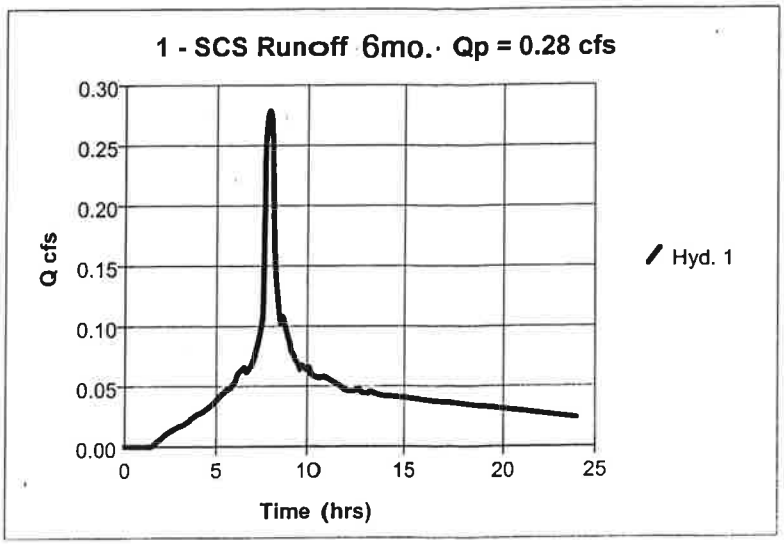
English

Hyd. No. 1

Homeplace - PostDev'p 6mo. storm

Hydrograph type	= SCS Runoff	Peak discharge	= 0.28 cfs
Storm frequency	= 6 mo.	Time interval	= 1 min
Drainage area	= 0.95 ac	Curve number	= 98
Basin Slope	= 1.5 %	Hydraulic length	= 100 ft
Tc method	= USER	Time of conc. (Tc)	= 5 min
Total precip.	= 1.30 in	Distribution	= Type IA
Storm duration	= 24 hrs	Shape factor	= 484

Total Volume = 3,846 cuft



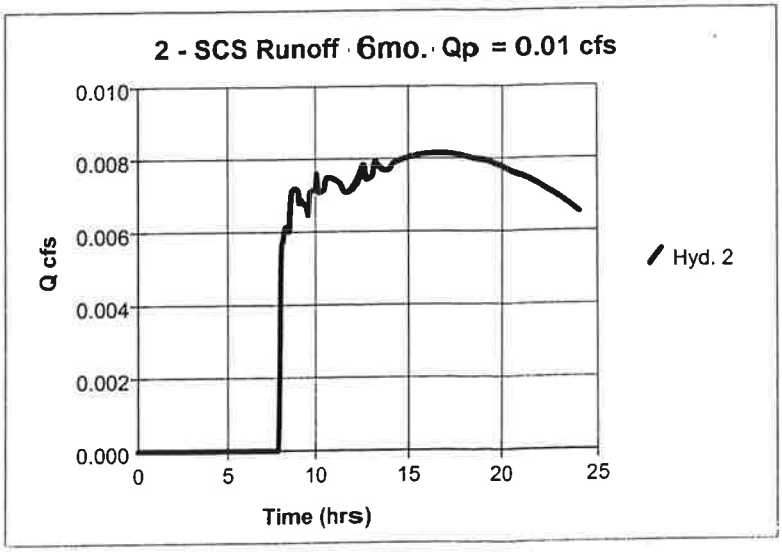
for Bio-filtration swale design.

Hyd. No. 2

Homeplace - PostDevp't 6mo. storm

Hydrograph type	= SCS Runoff	Peak discharge	= 0.01 cfs
Storm frequency	= 6 mo.	Time interval	= 1 min
Drainage area	= 0.60 ac	Curve number	= 80
Basin Slope	= 1.5 %	Hydraulic length	= 100 ft
Tc method	= USER	Time of conc. (Tc)	= 5 min
Total precip.	= 1.30 in	Distribution	= Type IA
Storm duration	= 24 hrs	Shape factor	= 484

Total Volume = 434 cuft



Worksheet 2: Runoff curve number and runoff

Project Jenson Park Homeplace - Arlington By YSK Date 2/24/03 12/30/02

Location Jensen Farm Lane Checked ____ Date ____

Circle one: (Present) Developed

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☒ acres ☐ mi² ☐ %	Product of CN x area
loamy Sand	DENSE/SHORT GRASS	80			1.55	
					1.55	

1/ Use only one CN source per line. Totals =

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = ____ = ____; Use CN = ____

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
Runoff, Q ..... in (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)			

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project Jensen Park ~~HOME PLACE~~ – ARLINGTON By YSK Date ~~12/30/02~~ 2/24/03

Location Jensen Farm Lane Checked ____ Date ____

Circle one: ~~Present~~ Developed

Circle one: T_c T_t through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)		Segment ID		
1. Surface description (table 3-1)		DENSE/SHORT GRASS (70:30)		
2. Manning's roughness coeff., n (table 3-1)		0.15 * 0.3 + 0.24 * 0.7 = 0.21		
3. Flow length, L (total L ≤ 300 ft)	ft	270		
4. Two-yr 24-hr rainfall, P_2	in	2.0		
5. Land slope, s	ft/ft	0.011		
6. $T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$	Compute T_t hr	0.760	+	= 0.760

Shallow concentrated flow		Segment ID		
7. Surface description (paved or unpaved)				
8. Flow length, L	ft			
9. Watercourse slope, s	ft/ft			
10. Average velocity, V (figure 3-1)	ft/s			
11. $T_t = \frac{L}{3600\ V}$	Compute T_t hr		+	=

Channel flow		Segment ID		
12. Cross sectional flow area, a	ft^2			
13. Wetted perimeter, p_w	ft			
14. Hydraulic radius, $r = \frac{a}{p_w}$	Compute r ft			
15. Channel slope, s	ft/ft			
16. Manning's roughness coeff., n				
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$	Compute V ft/s			
18. Flow length, L	ft			
19. $T_t = \frac{L}{3600\ V}$	Compute T_t hr		+	=

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19) ..... hr 0.760

46 min. reasonable

Worksheet 2: Runoff curve number and runoff

Project Jensen Park ~~Homeplace~~ - Arlington By YSK Date ~~12/30/02~~ 2/24/03

Location Jensen Farm Lane Checked ____ Date ____

Circle one: Present (Developed)

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2 ~~2-3~~	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area ☒ acres ☐ mi^2 ☐ %	Product of CN x area
Loamy Sand	Pavements - Roof	98			0.949	
	Landscape/Lawn area - good condition	80			0.601	
					1.55	

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = ____ = ____; Use CN = ____

2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
Runoff, Q ..... in (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)			

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project Jensen Park ~~Homeplace - Arlington~~ By ~~YSK~~ Date ~~12/30/02~~ 2/24/03

Location Jensen Farm Lane Checked ____ Date ____

Circle one: Present (Developed)

Circle one: (T_c) T_t through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)	Segment ID				
1. Surface description (table 3-1)		PAVED PARKING			
2. Manning's roughness coeff., n (table 3-1) ..		0.011			
3. Flow length, L (total L ≤ 300 ft)	ft	100			
4. Two-yr 24-hr rainfall, P_2	in	2.0			
5. Land slope, s	ft/ft	0.015			
6. $T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr	0.029	+		= 0.029
Shallow concentrated flow	Segment ID				
7. Surface description (paved or unpaved)		PAVED			
8. Flow length, L	ft	50			
9. Watercourse slope, s	ft/ft	0.015			
10. Average velocity, V (figure 3-1)	ft/s	2.5			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.006	+		= 0.006
Channel flow	Segment ID				
12. Cross sectional flow area, a	ft^2	0.785		(12")	
13. Wetted perimeter, p_w	ft	π			
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft	0.25			
15. Channel slope, s	ft/ft	0.01			
16. Manning's roughness coeff., n		0.011			
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s	5.38			
18. Flow length, L	ft	380			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.020	+		= 0.020
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19)	hr	0.055 = 3.3 min.			

D.O.E. Recommends
T_c = 5 minutes for minimum.
∴ T_c = 0.083 = 5 min ←

Hydrograph Plot

KEEPT HOMEPLACE DATA FOR JENSEN PARK DUE TO SIMILAR DRAINAGE CONCEPT, IMPERVIOUS AREA, CN, Tc. etc.

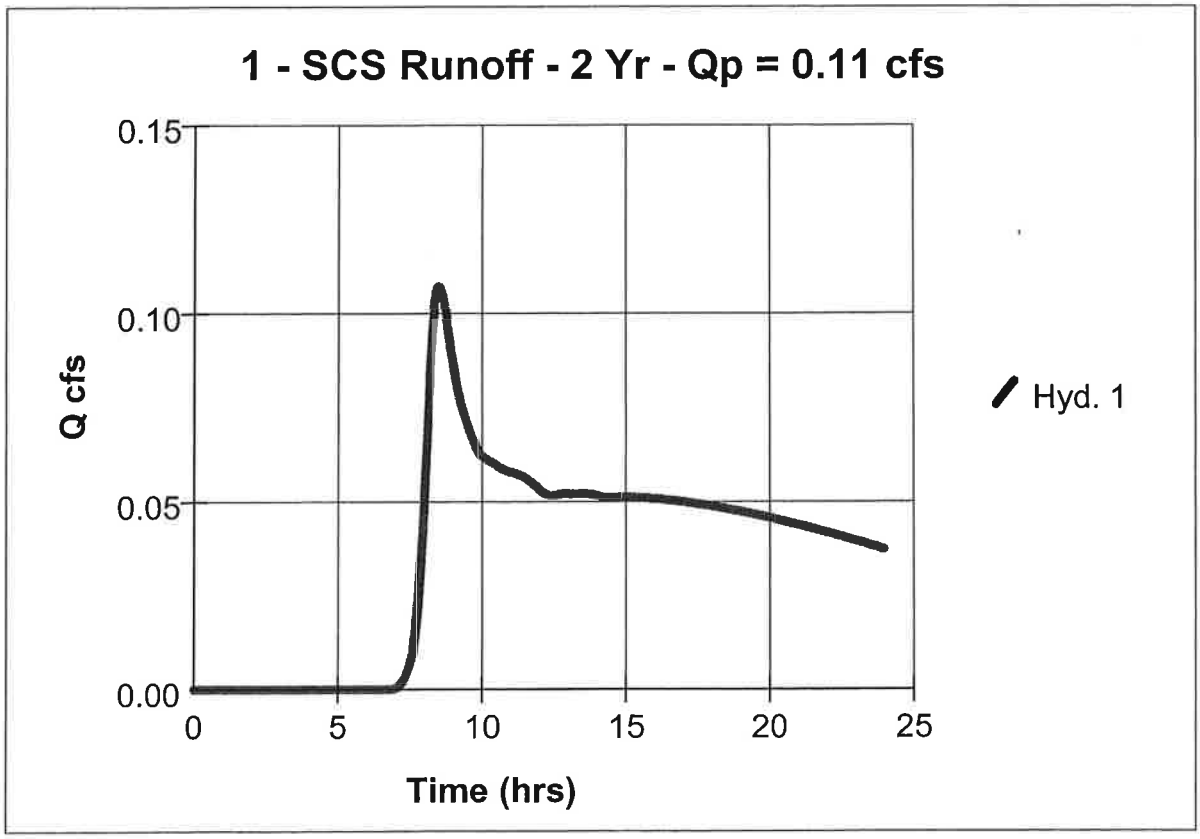
English

Hyd. No. 1

Homeplace - 2yr. Storm Pre-devp't

Hydrograph type	= SCS Runoff	Peak discharge	= 0.11 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Drainage area	= 1.55 ac	Curve number	= 80
Basin Slope	= 1.1 %	Hydraulic length	= 100 ft
Tc method	= USER	Time of conc. (Tc)	= 46 min
Total precip.	= 2.00 in	Distribution	= Type IA
Storm duration	= 24 hrs	Shape factor	= 484

Total Volume = 3,103 cuft



Hydrograph Plot

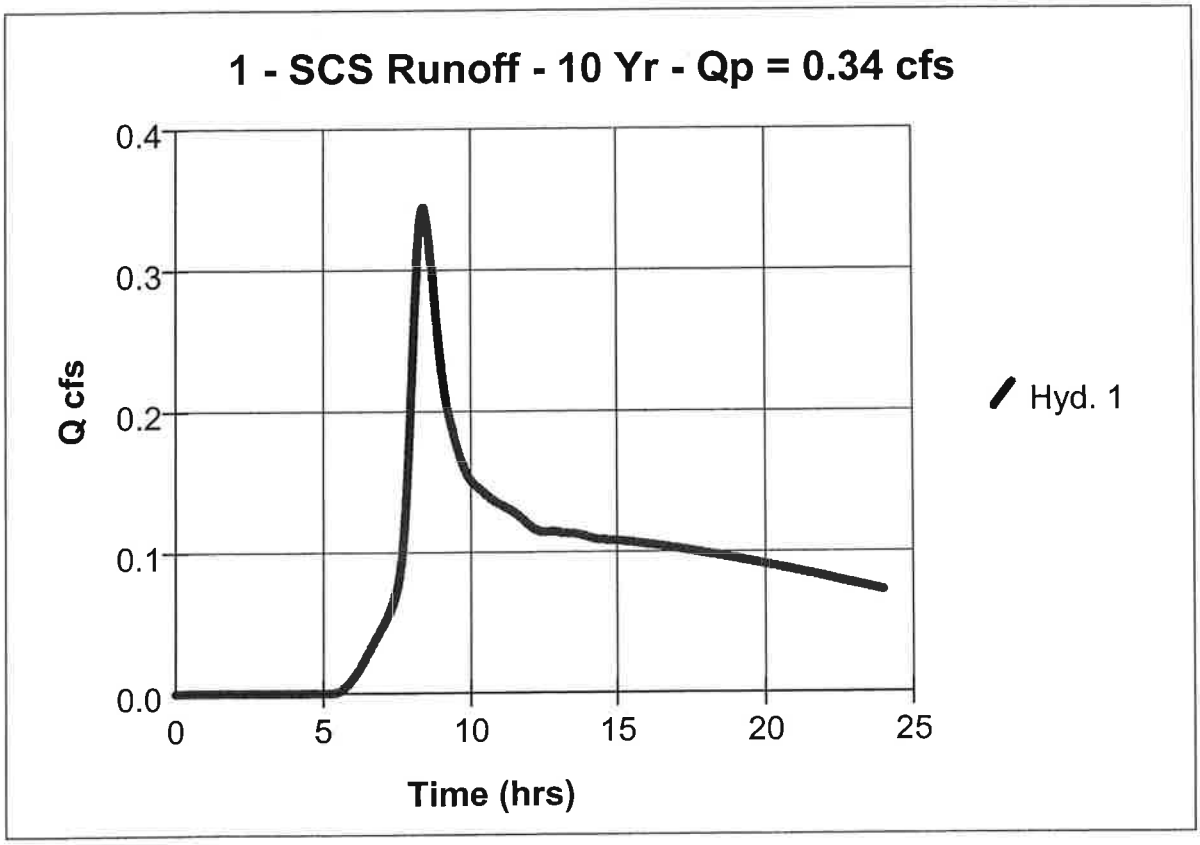
English

Hyd. No. 1

Homeplace - 10yr. Storm Pre-devp't

Hydrograph type	= SCS Runoff	Peak discharge	= 0.34 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
Drainage area	= 1.55 ac	Curve number	= 80
Basin Slope	= 1.1 %	Hydraulic length	= 100 ft
Tc method	= USER	Time of conc. (Tc)	= 46 min
Total precip.	= 3.10 in	Distribution	= Type IA
Storm duration	= 24 hrs	Shape factor	= 484

Total Volume = 7,344 cuft



Hydrograph Plot

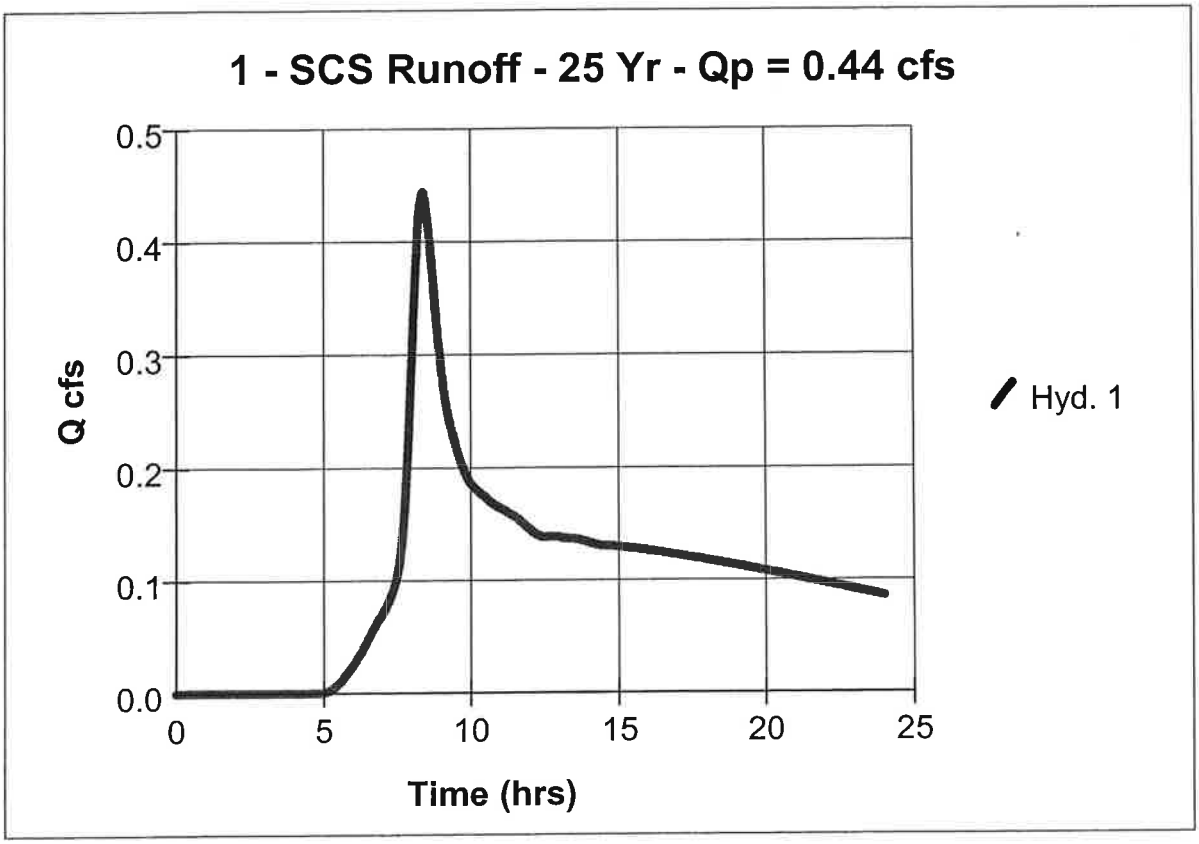
English

Hyd. No. 1

Homeplace - 25yr. Storm Pre-devp't

Hydrograph type	= SCS Runoff	Peak discharge	= 0.44 cfs
Storm frequency	= 25 yrs	Time interval	= 1 min
Drainage area	= 1.55 ac	Curve number	= 80
Basin Slope	= 1.1 %	Hydraulic length	= 100 ft
Tc method	= USER	Time of conc. (Tc)	= 46 min
Total precip.	= 3.50 in	Distribution	= Type IA
Storm duration	= 24 hrs	Shape factor	= 484

Total Volume = 9,075 cuft



Hydrograph Plot

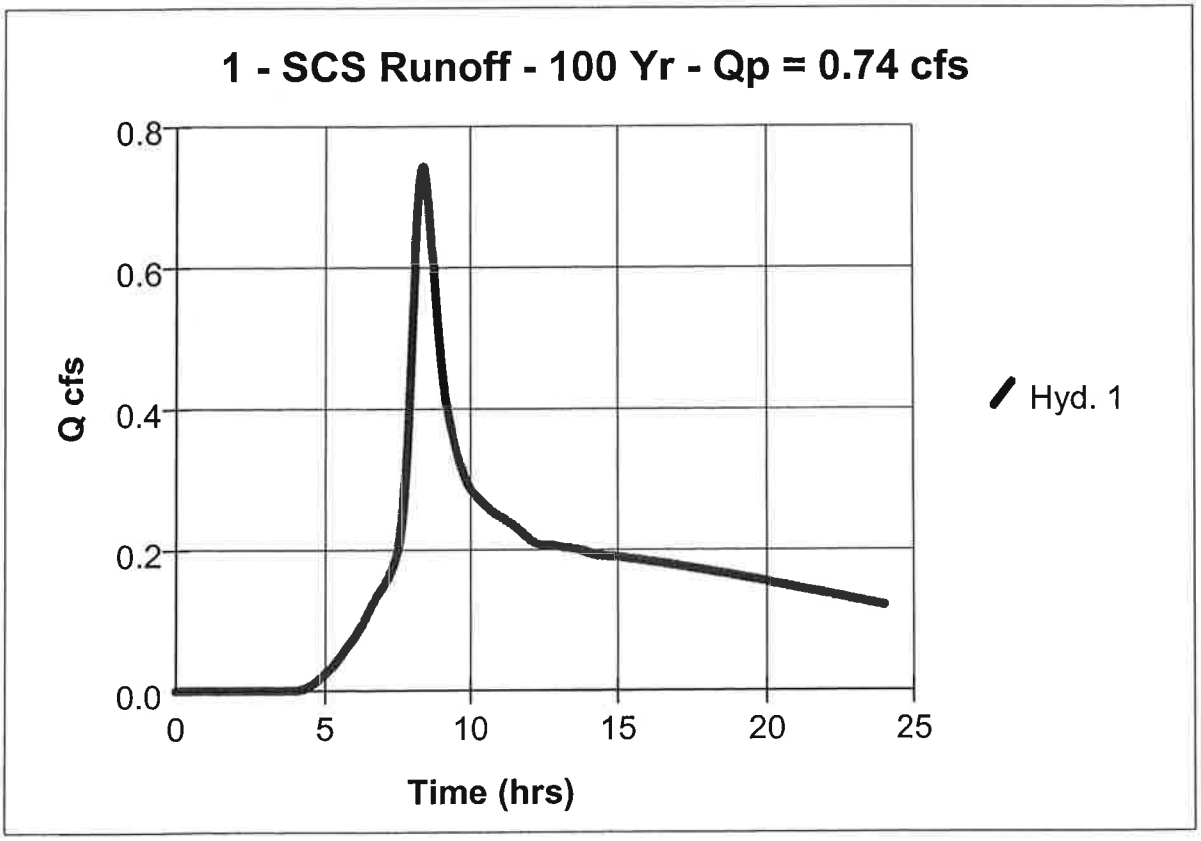
English

Hyd. No. 1

Homeplace - 100yr. Storm Pre-devp't

Hydrograph type	= SCS Runoff	Peak discharge	= 0.74 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Drainage area	= 1.55 ac	Curve number	= 80
Basin Slope	= 1.1 %	Hydraulic length	= 100 ft
Tc method	= USER	Time of conc. (Tc)	= 46 min
Total precip.	= 4.60 in	Distribution	= Type IA
Storm duration	= 24 hrs	Shape factor	= 484

Total Volume = 14,149 cuft



Hydrograph Plot

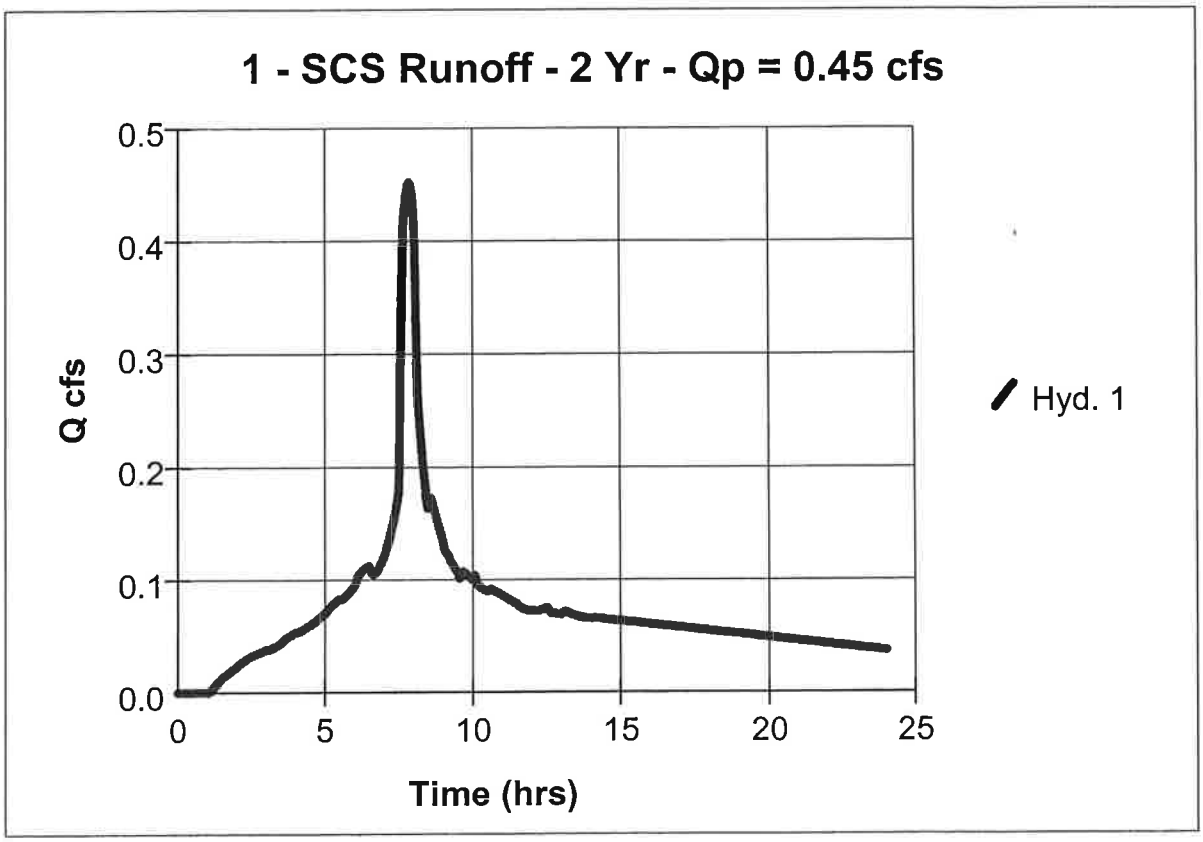
English

Hyd. No. 1

Homeplace - PostDev'p 2yr storm

Hydrograph type	= SCS Runoff	Peak discharge	= 0.45 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Drainage area	= 0.95 ac	Curve number	= 98
Basin Slope	= 1.5 %	Hydraulic length	= 100 ft
Tc method	= USER	Time of conc. (Tc)	= 5 min
Total precip.	= 2.00 in	Distribution	= Type IA
Storm duration	= 24 hrs	Shape factor	= 484

Total Volume = 6,299 cuft



Hydrograph Plot

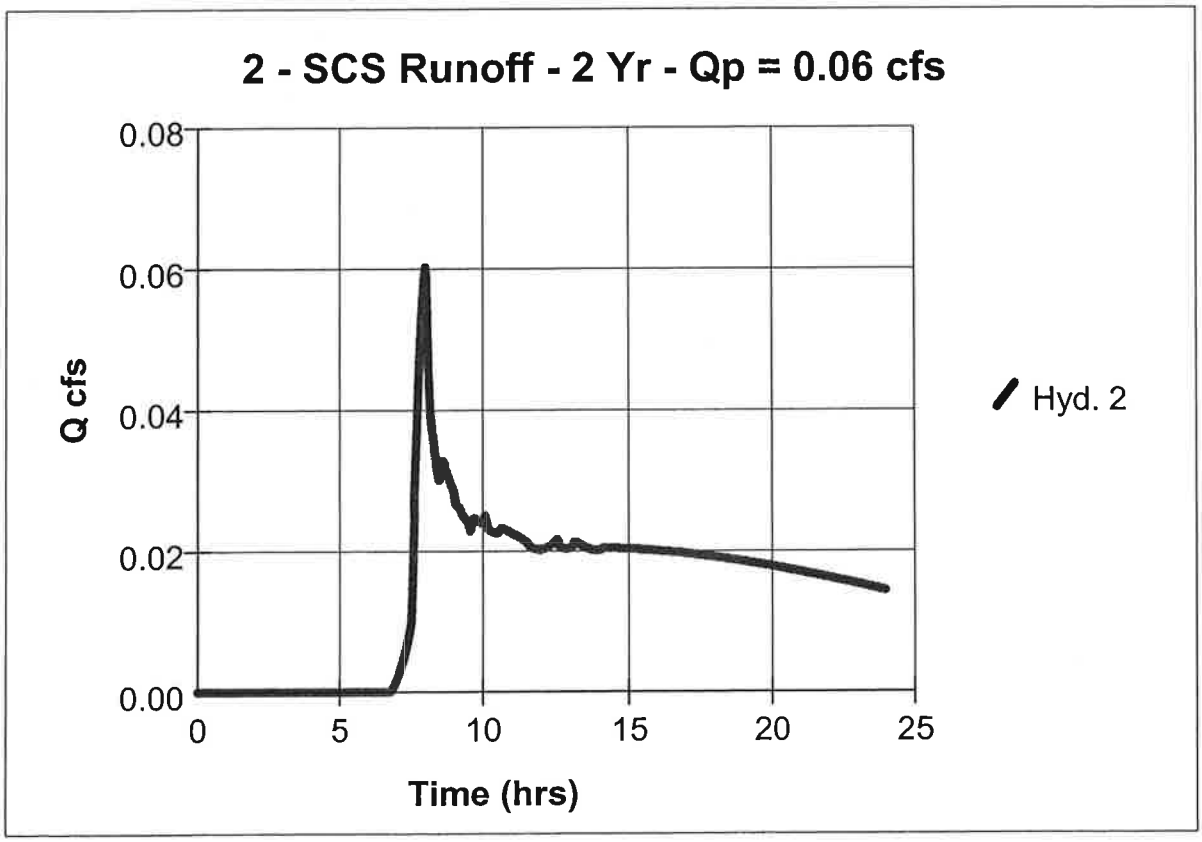
English

Hyd. No. 2

Homeplace - ~~Pre~~Post Devp't 2yr. storm

Hydrograph type	= SCS Runoff	Peak discharge	= 0.06 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Drainage area	= 0.60 ac	Curve number	= 80
Basin Slope	= 1.5 %	Hydraulic length	= 100 ft
Tc method	= USER	Time of conc. (Tc)	= 5 min
Total precip.	= 2.00 in	Distribution	= Type IA
Storm duration	= 24 hrs	Shape factor	= 484

Total Volume = 1,259 cuft



Hydrograph Plot

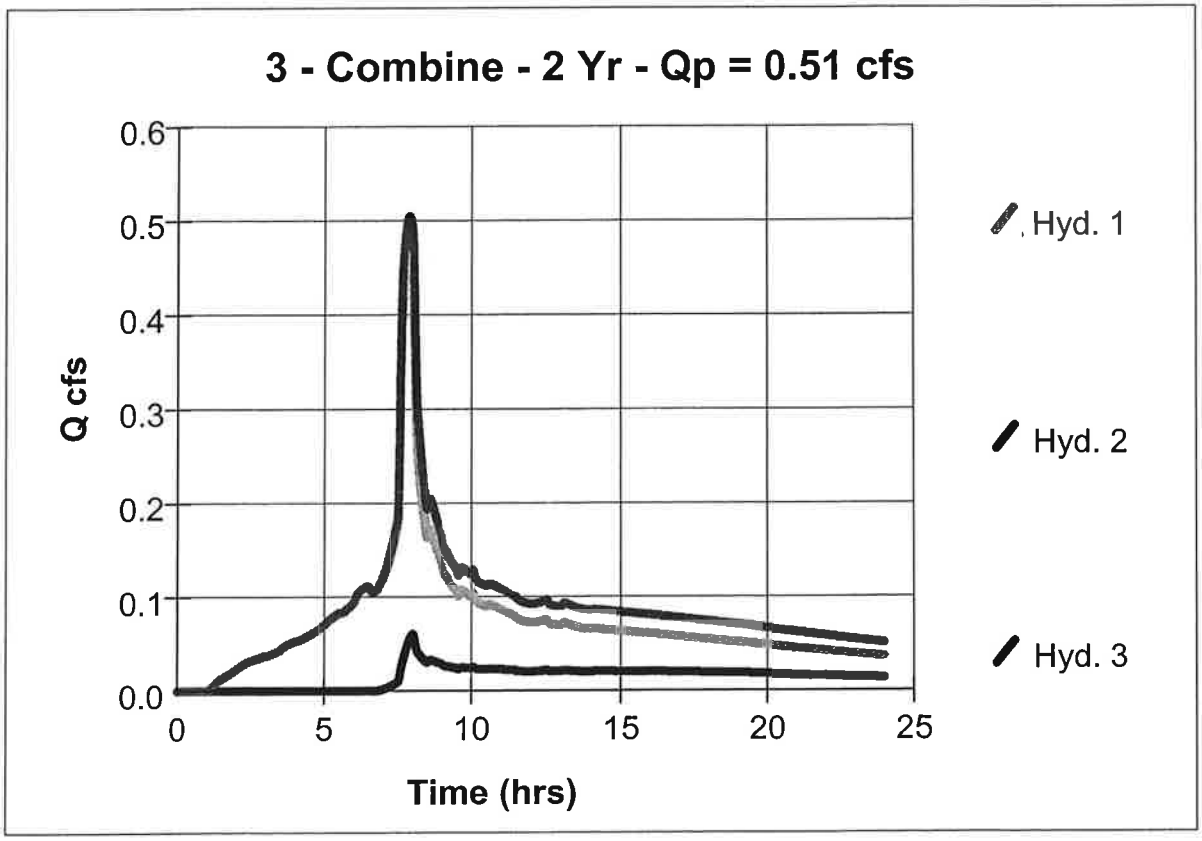
English

Hyd. No. 3

Homeplace

Hydrograph type	= Combine	Peak discharge	= 0.51 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
1st inflow hyd. No.	= 1	2nd inflow hyd. No.	= 2

Total Volume = 7,558 cuft



Hydrograph Plot

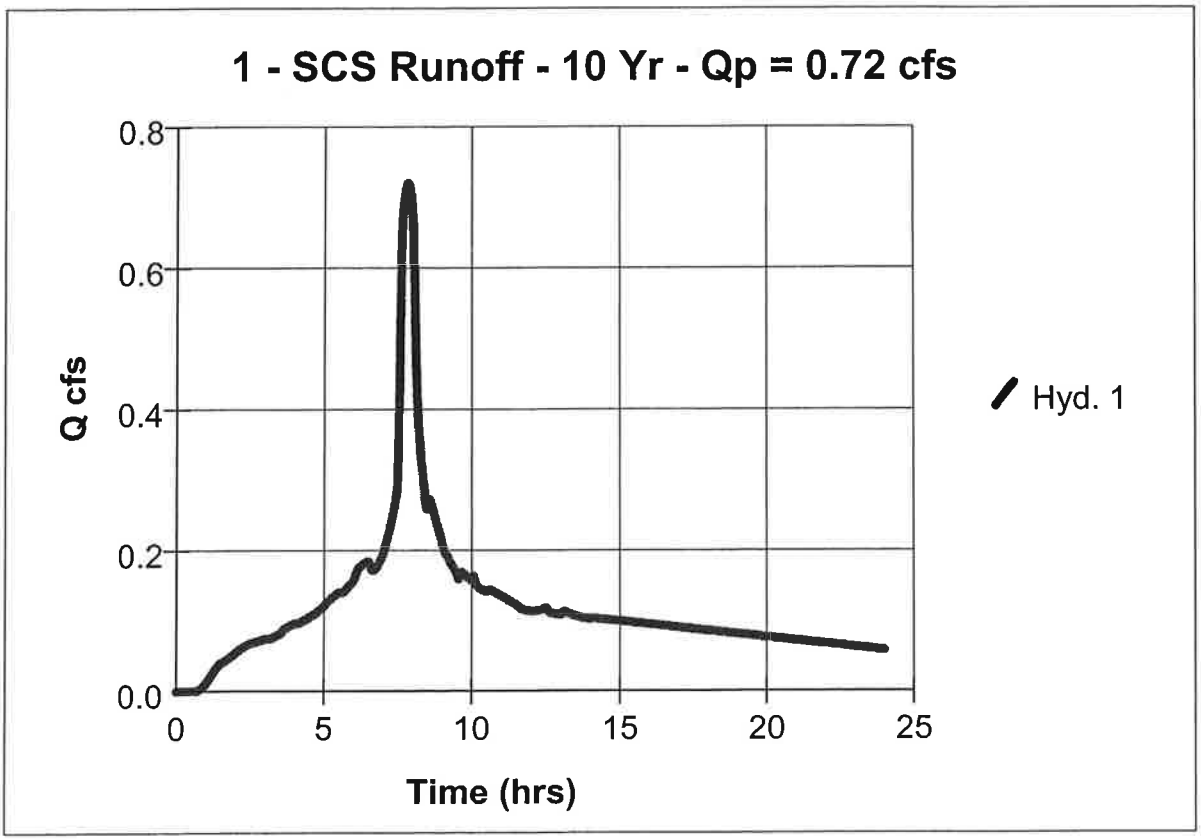
English

Hyd. No. 1

Homeplace - PostDev'p 10yr storm

Hydrograph type	= SCS Runoff	Peak discharge	= 0.72 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
Drainage area	= 0.95 ac	Curve number	= 98
Basin Slope	= 1.5 %	Hydraulic length	= 100 ft
Tc method	= USER	Time of conc. (Tc)	= 5 min
Total precip.	= 3.10 in	Distribution	= Type IA
Storm duration	= 24 hrs	Shape factor	= 484

Total Volume = 10,182 cuft



Hydrograph Plot

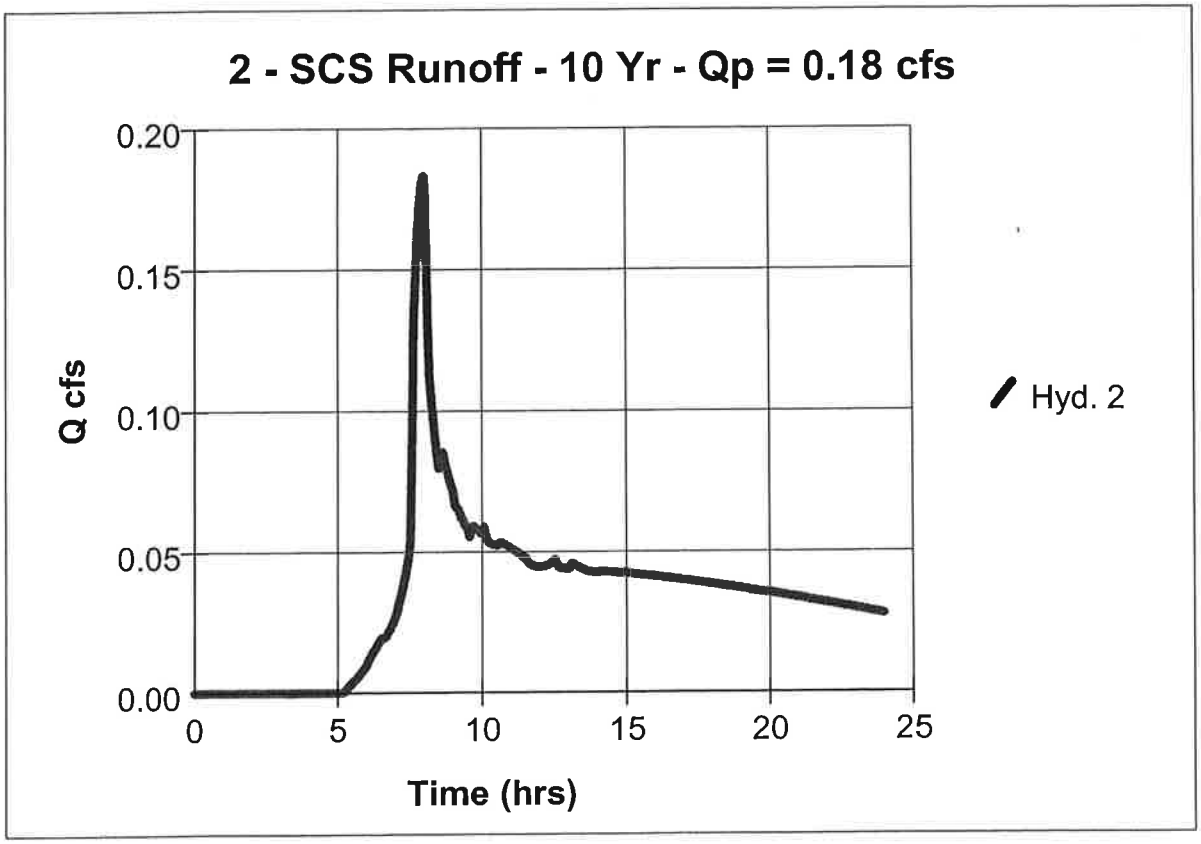
English

Hyd. No. 2

Homeplace - ~~Pre~~Post Devp't 10yr. storm

Hydrograph type	= SCS Runoff	Peak discharge	= 0.18 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
Drainage area	= 0.60 ac	Curve number	= 80
Basin Slope	= 1.5 %	Hydraulic length	= 100 ft
Tc method	= USER	Time of conc. (Tc)	= 5 min
Total precip.	= 3.10 in	Distribution	= Type IA
Storm duration	= 24 hrs	Shape factor	= 484

Total Volume = 2,969 cuft



Hydrograph Plot

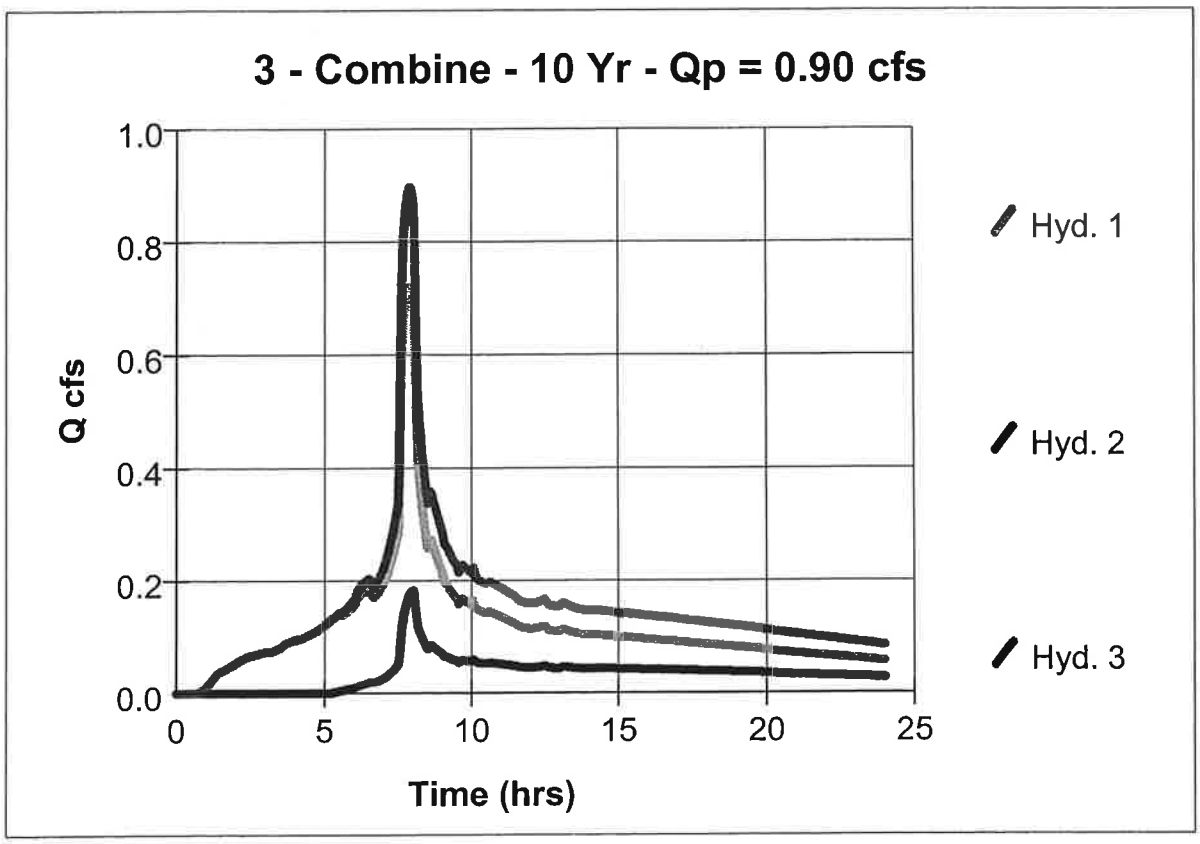
English

Hyd. No. 3

Homeplace

Hydrograph type	= Combine	Peak discharge	= 0.90 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
1st inflow hyd. No.	= 1	2nd inflow hyd. No.	= 2

Total Volume = 13,150 cuft



Hydrograph Plot

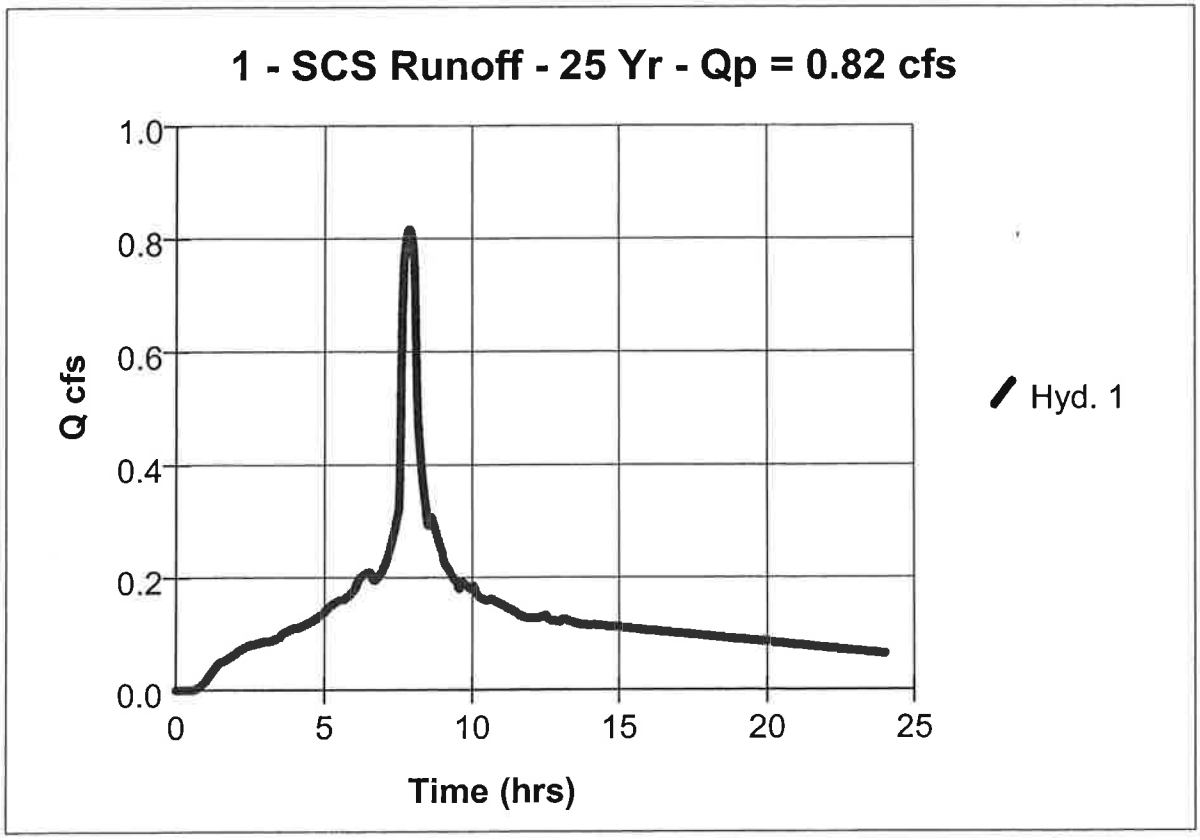
English

Hyd. No. 1

Homeplace - PostDev'p 25yr storm

Hydrograph type	= SCS Runoff	Peak discharge	= 0.82 cfs
Storm frequency	= 25 yrs	Time interval	= 1 min
Drainage area	= 0.95 ac	Curve number	= 98
Basin Slope	= 1.5 %	Hydraulic length	= 100 ft
Tc method	= USER	Time of conc. (Tc)	= 5 min
Total precip.	= 3.50 in	Distribution	= Type IA
Storm duration	= 24 hrs	Shape factor	= 484

Total Volume = 11,597 cuft



Hydrograph Plot

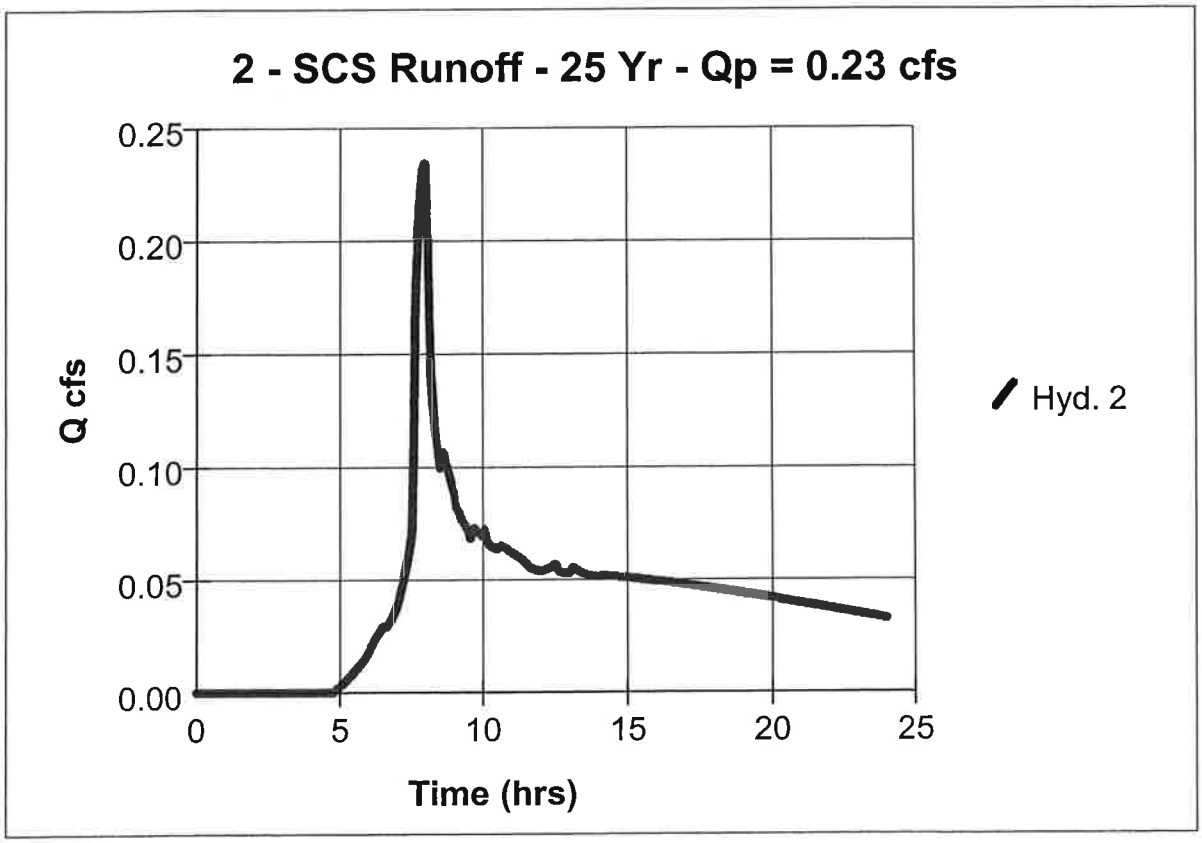
English

Hyd. No. 2

Homeplace - ~~Pre~~Post Devp't 25yr. storm

Hydrograph type	= SCS Runoff	Peak discharge	= 0.23 cfs
Storm frequency	= 25 yrs	Time interval	= 1 min
Drainage area	= 0.60 ac	Curve number	= 80
Basin Slope	= 1.5 %	Hydraulic length	= 100 ft
Tc method	= USER	Time of conc. (Tc)	= 5 min
Total precip.	= 3.50 in	Distribution	= Type IA
Storm duration	= 24 hrs	Shape factor	= 484

Total Volume = 3,666 cuft



Hydrograph Plot

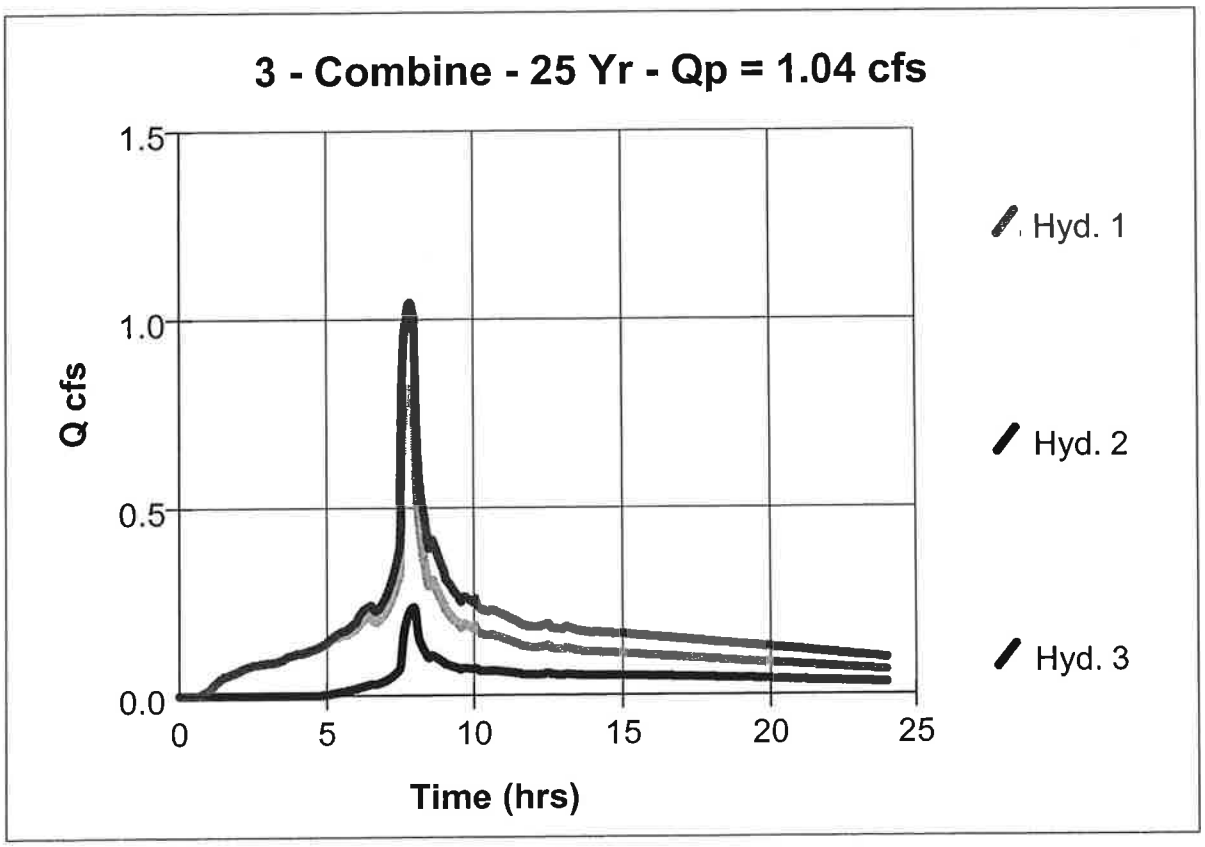
English

Hyd. No. 3

Homeplace

Hydrograph type	= Combine	Peak discharge	= 1.04 cfs
Storm frequency	= 25 yrs	Time interval	= 1 min
1st inflow hyd. No.	= 1	2nd inflow hyd. No.	= 2

Total Volume = 15,262 cuft



Hydrograph Plot

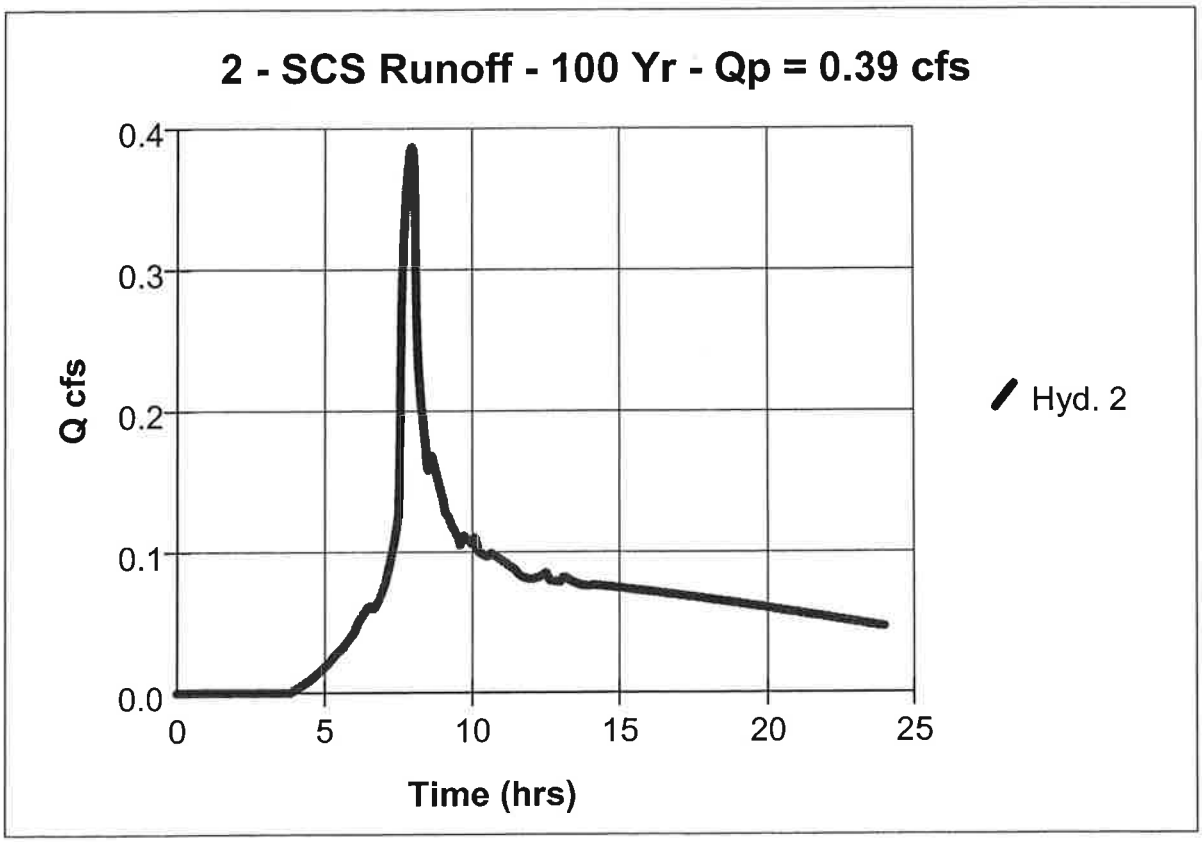
English

Hyd. No. 2

Homeplace - Post Devp't 100yr. storm

Hydrograph type	= SCS Runoff	Peak discharge	= 0.39 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Drainage area	= 0.60 ac	Curve number	= 80
Basin Slope	= 1.5 %	Hydraulic length	= 100 ft
Tc method	= USER	Time of conc. (Tc)	= 5 min
Total precip.	= 4.60 in	Distribution	= Type IA
Storm duration	= 24 hrs	Shape factor	= 484

Total Volume = 5,707 cuft



Hydrograph Plot

English

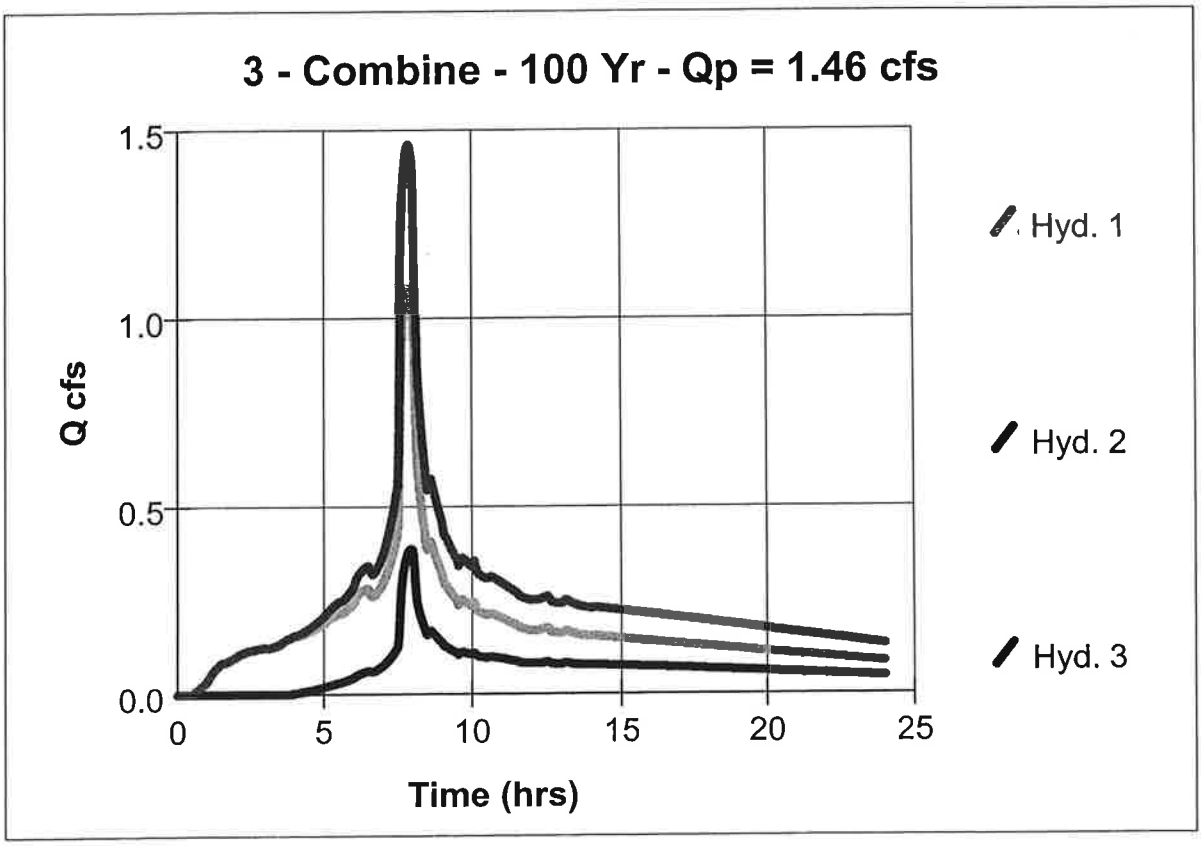
Hyd. No. 3

Homeplace

Hydrograph type = Combine
Storm frequency = 100 yrs
1st inflow hyd. No. = 1

Peak discharge = 1.46 cfs
Time interval = 1 min
2nd inflow hyd. No. = 2

Total Volume = 21,200 cuft



Hydrograph Plot

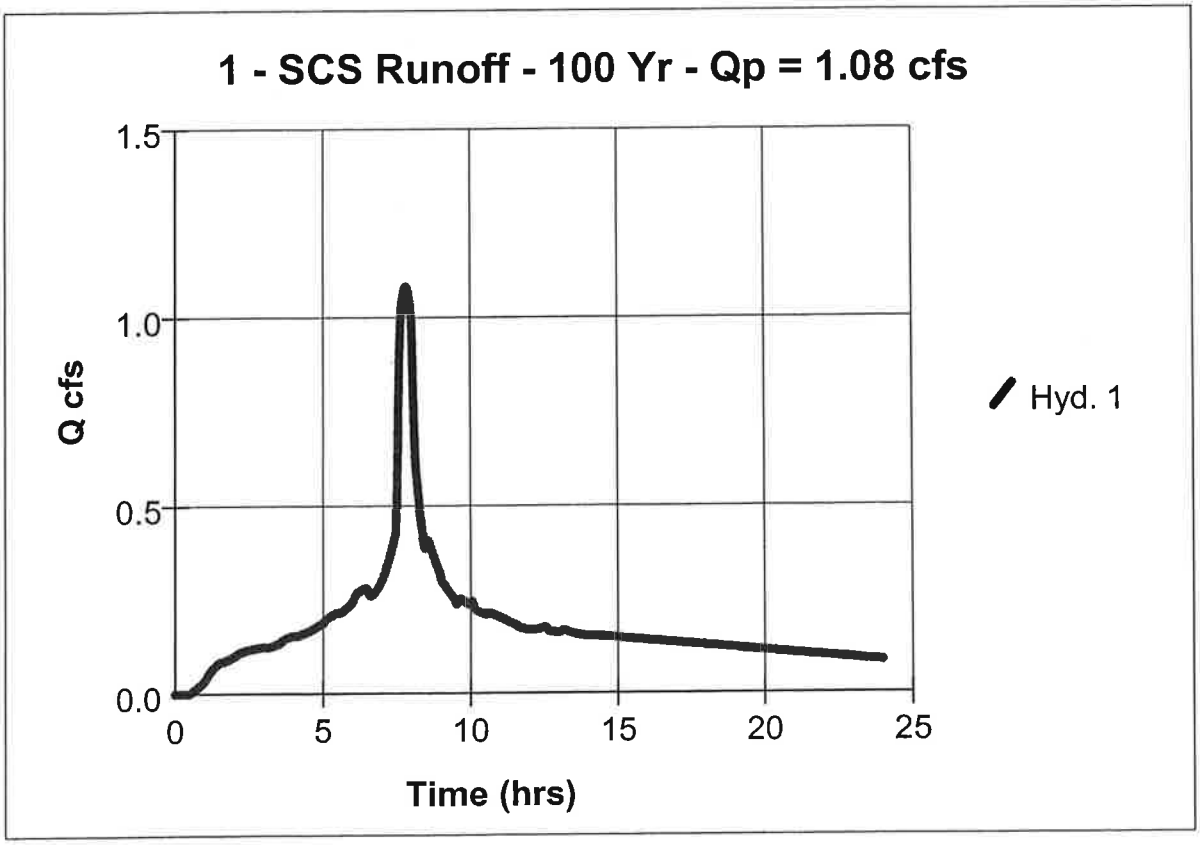
English

Hyd. No. 1

Homeplace - PostDev'p 100yr storm

Hydrograph type	= SCS Runoff	Peak discharge	= 1.08 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Drainage area	= 0.95 ac	Curve number	= 98
Basin Slope	= 1.5 %	Hydraulic length	= 100 ft
Tc method	= USER	Time of conc. (Tc)	= 5 min
Total precip.	= 4.60 in	Distribution	= Type IA
Storm duration	= 24 hrs	Shape factor	= 484

Total Volume = 15,493 cuft



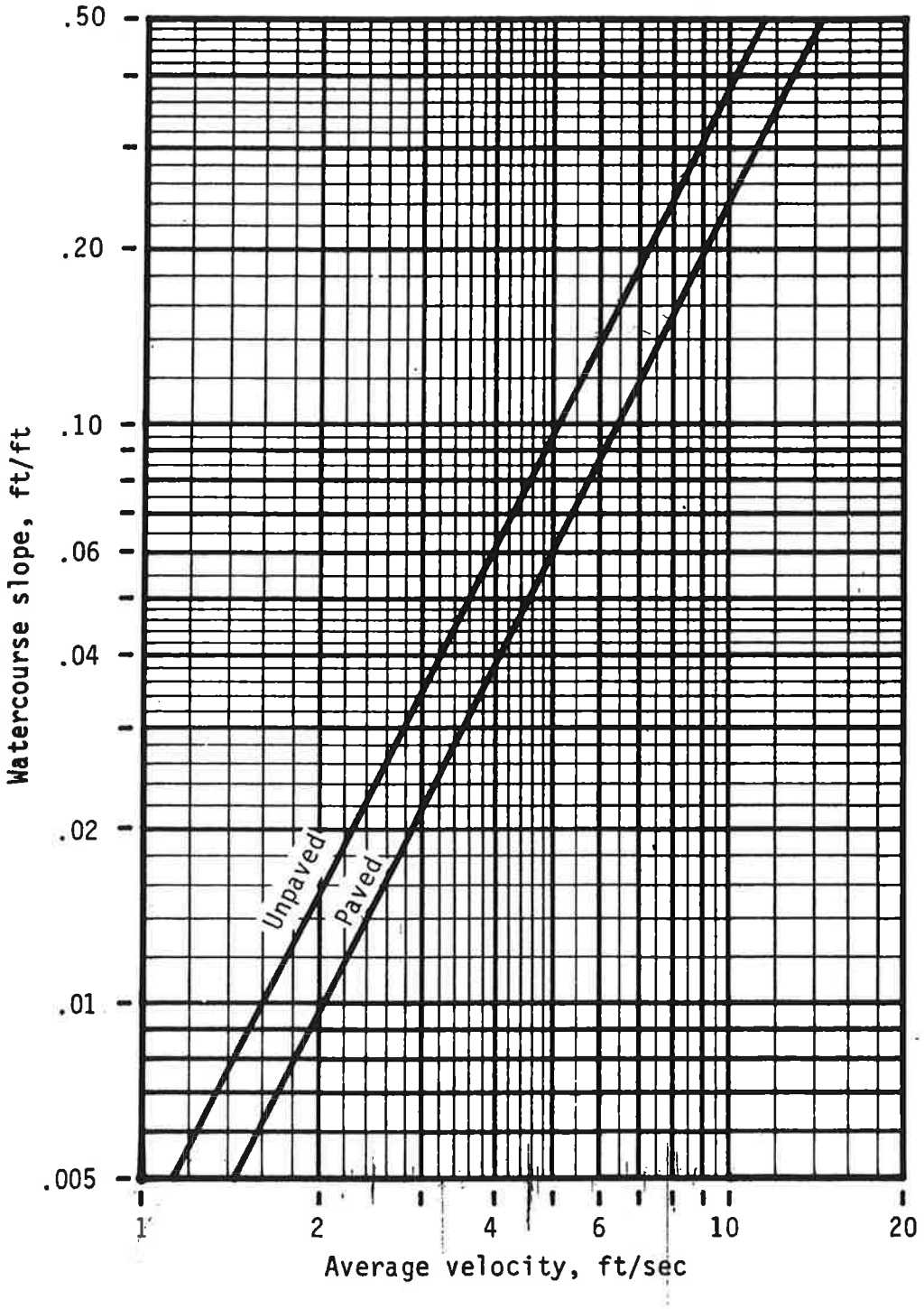


Figure 3-1.—Average velocities for estimating travel time for shallow concentrated flow.

Table III-1.3 SCS Western Washington Runoff Curve Numbers
(Published by SCS in 1982) Runoff curve numbers for selected agricultural, suburban and urban land use for Type 1A rainfall distribution, 24-hour storm duration.

LAND USE DESCRIPTION		CURVE NUMBERS BY HYDROLOGIC SOIL GROUP A	B	C	D
Cultivated land(1):	winter condition	86	91	94	95
Mountain open areas:	low growing brush & grasslands	74	82	89	92
Meadow or pasture:		65	78	85	89
Wood or forest land:	undisturbed	42	64	76	81
Wood or forest land:	young second growth or brush	55	72	81	86
Orchard:	with cover crop	81	88	92	94
Open spaces, lawns, parks, golf courses, cemeteries, landscaping.					
Good condition:	grass cover on ≥75% of the area	68	80	86	90
Fair condition:	grass cover on 50-75% of the area	77	85	90	92
Gravel roads & parking lots:		76	85	89	91
Dirt roads & parking lots:		72	82	87	89
Impervious surfaces, pavement, roofs etc.		98	98	98	98
Open water bodies:	lakes, wetlands, ponds etc.	100	100	100	100
Single family residential(2):					
Dwelling Unit/Gross Acre	%Impervious(3)				
1.0 DU/GA	15				
1.5 DU/GA	20				
2.0 DU/GA	25				
2.5 DU/GA	30				
3.0 DU/GA	34				
3.5 DU/GA	38				
4.0 DU/GA	42				
4.5 DU/GA	46				
5.0 DU/GA	48				
5.5 DU/GA	50				
6.0 DU/GA	52				
6.5 DU/GA	54				
7.0 DU/GA	56				
PUD's, condos, apartments, commercial businesses & industrial areas	%impervious must be computed				
		Separate curve number shall be selected for pervious & impervious portions of the site or basin			

(1) For a more detailed description of agricultural land use curve numbers refer to National Engineering Handbook, Sec. 4, Hydrology, Chapter 9, August 1972.
(2) Assumes roof and driveway runoff is directed into street/storm system.
(3) The remaining pervious areas (lawn) are considered to be in good condition for these curve numbers.

Sheet flow

Sheet flow is flow over plane surfaces. It usually occurs in the headwater of streams. With sheet flow, the friction value (Manning's n) is an effective roughness coefficient that includes the effect of raindrop impact; drag over the plane surface; obstacles such as litter, crop ridges, and rocks; and erosion and transportation of sediment. These n values are for very shallow flow depths of about 0.1 foot or so. Table 3-1 gives Manning's n values for sheet flow for various surface conditions.

For sheet flow of less than 300 feet, use Manning's kinematic solution (Overton and Meadows 1976) to compute T_t:

$$T_t = \frac{0.007\,(nL)^{0.8}}{(P_2)^{0.5}\,s^{0.4}} \qquad \text{[Eq. 3-3]}$$

Table 3-1.—Roughness coefficients (Manning's n) for sheet flow

Surface description	n[1]
Smooth surfaces (concrete, asphalt, gravel, or bare soil)	0.011
Fallow (no residue)	0.05
Cultivated soils:	
Residue cover ≤20%	0.06
Residue cover >20%	0.17
Grass:	
Short grass prairie	0.15
Dense grasses[2]	0.24
Bermudagrass	0.41
Range (natural)	0.13
Woods:[3]	
Light underbrush	0.40
Dense underbrush	0.80

[1]The n values are a composite of information compiled by Engman (1986).
[2]Includes species such as weeping lovegrass, bluegrass, buffalo grass, blue grama grass, and native grass mixtures.
[3]When selecting n, consider cover to a height of about 0.1 ft. This is the only part of the plant cover that will obstruct sheet flow.

where

T_t = travel time (hr),
n = Manning's roughness coefficient (table 3-1),
L = flow length (ft),
P_2 = 2-year, 24-hour rainfall (in), and
s = slope of hydraulic grade line (land slope, ft/ft).

This simplified form of the Manning's kinematic solution is based on the following: (1) shallow steady uniform flow, (2) constant intensity of rainfall excess (that part of a rain available for runoff), (3) rainfall duration of 24 hours, and (4) minor effect of infiltration on travel time. Rainfall depth can be obtained from appendix B.

Shallow concentrated flow

After a maximum of 300 feet, sheet flow usually becomes shallow concentrated flow. The average velocity for this flow can be determined from figure 3-1, in which average velocity is a function of watercourse slope and type of channel. For slopes less than 0.005 ft/ft, use equations given in appendix F for figure 3-1. Tillage can affect the direction of shallow concentrated flow. Flow may not always be directly down the watershed slope if tillage runs across the slope.

After determining average velocity in figure 3-1, use equation 3-1 to estimate travel time for the shallow concentrated flow segment.

Open channels

Open channels are assumed to begin where surveyed cross section information has been obtained, where channels are visible on aerial photographs, or where blue lines (indicating streams) appear on United States Geological Survey (USGS) quadrangle sheets. Manning's equation or water surface profile information can be used to estimate average flow velocity. Average flow velocity is usually determined for bank-full elevation.

Table III-3.1 Soil Properties Classified by Soil Texture

Texture Class	Infiltration Rate Hydrologic (inches/hr.)	Cation Exchange Capacity (milliequivalents/ 100 grams)	Effective Water Capacity (inches per inch)	Hydrologic Soil Group
Coarse Sands or Cobbles	20.00	<5.0	—	A
Sand	8.27	<5.0	0.35	A
Loamy Sand	2.41	5.0	0.31	A
Sandy Loam	1.02	>5.0	0.25	B
Loam	0.52	>5.0	0.19	B
Silt Loam	0.27	>5.0	0.17	C
Sandy Clay Loam	0.17	>5.0	0.14	C
Clay Loam	0.09	>5.0	0.14	D
Silty Clay Loam	0.06	>5.0	0.11	D
Sandy Clay	0.05	>5.0	0.09	D
Silty Clay	0.04	>5.0	0.09	D
Clay	0.02	>5.0	0.08	D

Source (except for cation exchange capacity): Rawls, Brakensiek, and Saxton, 1982 (16)

Cation exchange capacity values are estimated from Buckman and Brady, 1969, (23)

CASCADE SURVEYING & ENGINEERING, INC.

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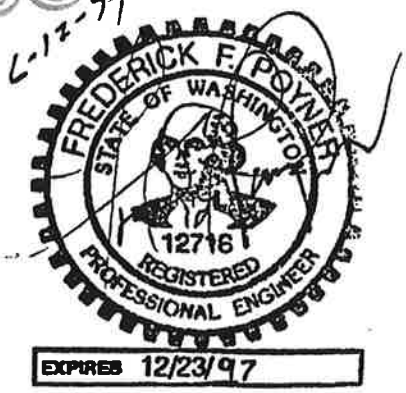
Surveyors
Engineers
Planners

Plat of Jensen Farm Div. II Drainage Calculations Revised on 6/10/97 to include Plat of Jensen Farm Div. III

The plat of Jensen Farm Division 2 is proposed to consist of 22 lots with asphalt roads. The plat of Jensen Farm Division 3 is also proposed to consist of 22 lots with asphalt roads. The calculations also include the portion of Portage Drive that extends West to Olympic Ave. The total storm area is 10.39 acres and consists of generally flat grades. The site is not affected by any off site runoff. It is proposed to direct flow from the southern portion of Jensen Farm Division 2 (lots 1 - 12, and adjacent roadway) into the existing detention pond South of the plat. It is proposed to handle the remaining portions with an infiltration pond located at the West end of Portage drive. An emergency overflow pipe will be located above the 100 year storm elevation and release into the unnamed drainage that flows southwest under Olympic Avenue.

The drainage calculations were derived using the Pizer Inc. Hydra Storm Analysis Software. The pond was modeled using the Reservoir command with a release rate equaling the bottom area multiplied by the infiltration rate. On site soils investigation found that the soils in the pond site are loamy sands. An infiltration rate of 1.205 in./hr., which is one half the D.O.E. recommended rate for loamy sand, was used for calculations. The pond bottom will have a bottom area of 14,400 sq. ft. with 3:1 side slopes. The release rate from infiltration was staged in the model to include the side slopes of the pond as the water level rises. See sheet 8 for more explanation of the staging. The required storage in the pond during the 2 year storm event will be 15,071 cubic feet (link 29 page 15) at a depth of 1.00 feet. The required storage during the 25 year storm event will be 55,444 cubic feet (link 29 page 21) at a depth of 3.27 feet. The required storage during the 100 year storm event will be 87,815 cubic feet (link 29 page 27) this will be at a depth of 4.82 feet. A 12" pipe with a backflow prevention flapper will be placed at this 4.82' elevation in the case of overflow conditions.



EXPIRES 12/23/97

Preliminary/Permit Use

HOMEPLACE

Arlington, Snohomish County, Washington

Stormwater Analysis (Infiltration Pond) Report

Prepared For: Landed Gentry Development, Inc.
504 E. Fairhaven
Burlington, WA 98233
(360) 755-9021

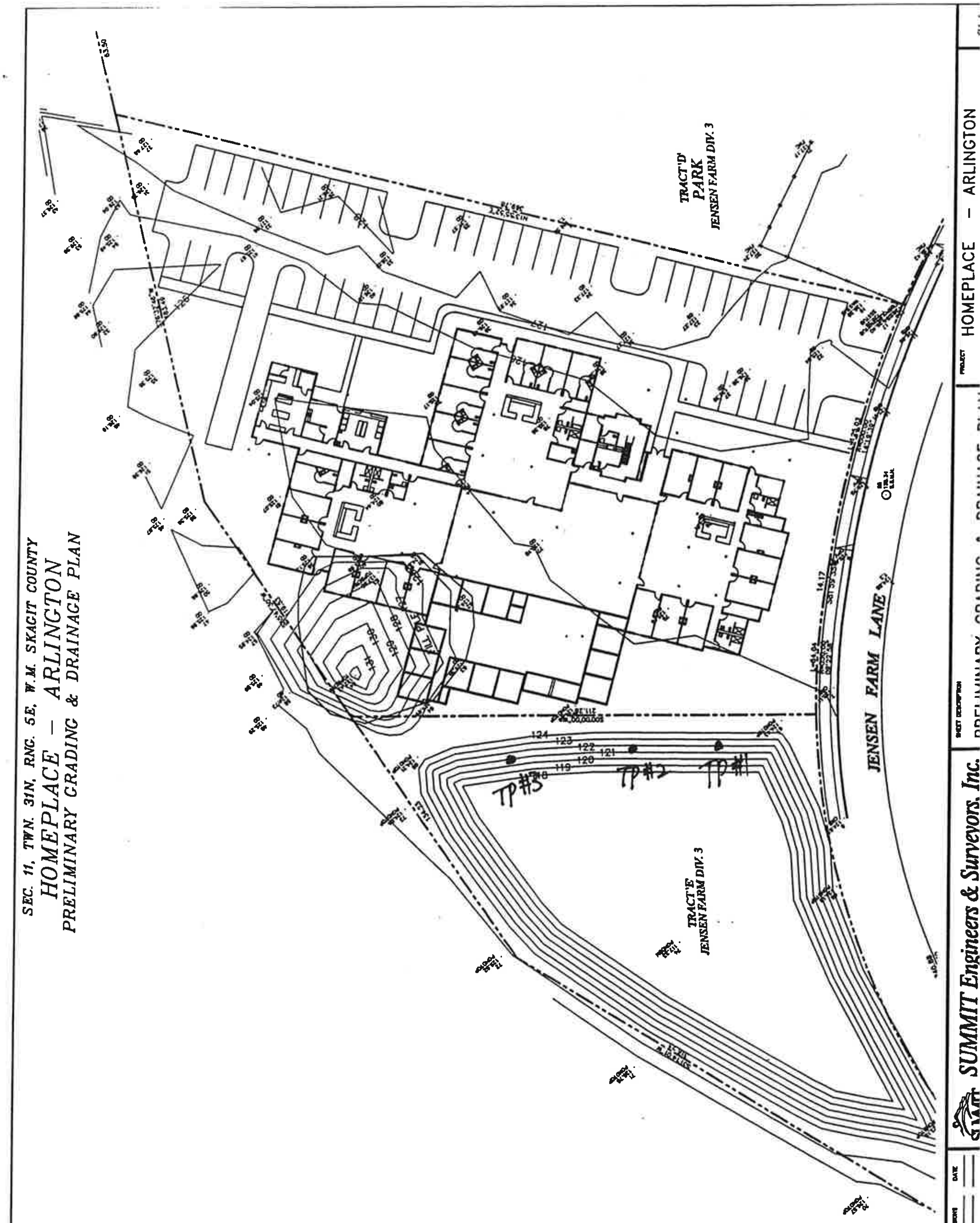
Prepared By: SUMMIT Engineers & Surveyors
2218 Old Highway 99 So.
Mount Vernon, WA 98273
(360) 416-4999

Date: January 2, 2001

ADDENDUM: Sept. 4, 2001

THE PURPOSE OF THIS ADDENDUM IS TO ADDRESS EARTH TECH'S REVIEW COMMENTS REGARDING THE INFILTRATION POND & SOIL LOGS.

BASED ON THE ANALYSIS, THE PREVIOUSLY PROPOSED DESIGN/CALCULATION IS STILL A CONSERVATIVE APPROACH TO HANDLE THE ADDITIONAL RUNOFF CREATED BY THE PROPOSED PROJECT, HOMEPLACE.



PRELIMINARY SITE PLAN

TEST PIT LOCATIONS

Figure iii

Photograph of Existing Infiltration Pond

Tests	Moist %	Blows/4"	Sample	Elev.	Depth Ft.	USCS	Soil Description	TP# 1 6/5/01
					1	ML	Topsoil, light brown Inorganic silts & very fine sand	
					2	GP	Poorly-graded gravels, yellowish brown	
					3	SW	Well-graded sand-gravel mixture, yellowish light brown	
					4	GW	Well-graded gravels, very gravelly, yellowish brown w/ YELLOWISH SAND	
					5			
					6		Existing Pond Base (el. ±117)	
					7	GW	Well-graded gravels, very gravelly, brown – darker as the test pit went deeper	
					8			
					9			
					10		BOTTOM OF TEST PIT: 10' NO GROUNDWATER DETECTED	
					11			

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TEST PIT LOG:

Home Place - Arlington

JOB NO
S00031

Tests	Moist %	Blows/4"	Sample	Elev.	Depth Ft.		USCS	Soil Description
			▯		0–1		ML	Topsoil, light brown Inorganic silts & very fine sand
					1–2.5		GP	Poorly-graded gravels, yellowish brown
					2.5–4		SW	Well-graded sand-gravel mixture, yellowish light brown
					4–7		GW	Well-graded gravels, very gravelly, yellowish brown W/ YELLOWISH SAND Existing Pond Base (el. ±117)
					7–10		GW	Well-graded gravels, very gravelly, brown – darker as the test pit went deeper
					10–11			BOTTOM OF TEST PIT: 10' NO GROUNDWATER DETECTED

TP# 2
6/5/01

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TEST PIT LOG:

Home Place - Arlington

JOB NO
S00031

Tests	Moist %	Blows/4"	Sample	Elev.	Depth Ft.	USCS	Soil Description	TP# 3 6/5/01
					1	ML	Topsoil, light brown Inorganic silts & very fine sand	
					2	GP	Poorly-graded gravels, yellowish brown	
					3	SW	Well-graded sand-gravel mixture, yellowish light brown	
					4 5 6	GW	Well-graded gravels, very gravelly, yellowish brown w/ YELLOWISH SAND Existing Pond Base (el. ±117)	
					7 8 9	GW	Well-graded gravels, very gravelly, brown – darker as the test pit went deeper	
					10 11		BOTTOM OF TEST PIT: 10' NO GROUNDWATER DETECTED	

SUMMIT
ENGINEERS & SURVEYORS
360. 416. 4999 360. 416. 4949 Fax

TEST PIT LOG:

Home Place - Arlington

JOB NO
S00031

UNIFIED SOIL CLASSIFICATION

MAJOR DIVISIONS				DESCRIPTION
COARSE GRAINED SOILS more than 50% retained on the #200 sieve	GRAVELS more than 50% coarse fraction is larger than #4 sieve	Gravels with less than 5% fines	GW	Well-graded gravels or gravel-sand mixtures
			GP	Poorly-graded gravels or gravel-sand mixtures
		Gravels with more than 12% fines	GM	Silty-gravels or gravel-sand-silt mixtures
			GC	Clayey gravels or gravel-sand-clay mixtures
	SANDS more than 50% coarse fraction is smaller than #4 sieve	Sands with less than 5% fines	SW	Well-graded sand or gravelly mixtures
			SP	Poorly-graded sands or sand-silt mixtures
		Sands with more than 12% fines	SM	Silty sands or sand-silt mixtures
			SC	Clayey sands or sand-clay mixtures
FINE GRAINED SOILS more than 50% passing the #200 sieve	SILTS AND CLAYS Liquid Limit less than 50		ML	Inorganic silts & very fine sands, rock flour, silty or clayey fine sands w/ slight plasticity
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
			OL	Organic silts and organic silty clays of low plasticity
	SILTS AND CLAYS Liquid Limit greater than 50		MH	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
			CH	Inorganic clays of high plasticity, fat clays
			OH	Organic clays of medium to high plasticity
HIGHLY ORGANIC SOILS			PT	Peat, or other highly organic soils
UNCONTROLLED FILL / DUFF LAYER				Uncontrolled fills, with variable constituents Humus and duff layer
BEDROCK			BR	Bedrock

LEGEND

- ☐ GRAB SAMPLE
- ■ 2" O.D. SPLIT SPOON
- I SAMPLE
- II SHELBY TUBE SAMPLE

SOIL CONSISTENCY:

NON-COHESIVE SOILS		COHESIVE SOILS	
DESCRIPTION	SPT-N-VALUE	DESCRIPTION	SPT-N-VALUE
very loose	4 or less	very soft	2 or less
loose	5 to 10	soft	3 to 4
medium dense	11 to 30	medium stiff	5 to 8
dense	31 to 50	stiff	9 to 15
very dense	51 or more	very stiff	16 to 30
		hard	31 or more

SYMBOL

qu	PENETROMETER READING, tsf
C	TORVANE SHEAR READING, tsf
pcf	DRY DENSITY, pcf
LL	LIQUID LIMIT
PI	PLASTICITY INDEX
SA	SIEVE ANALYSIS
▼	GROUNDWATER LEVEL

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SOIL CLASSIFICATION & LEGEND

INFILTRATION POND SIZING BY: Y.S.K DATE: 12/30/00

— CURRENTLY THE EXISTING INFILTRATION POND LOCATED WEST OF THE PROJECT IS SIZED INCLUDING THE PRE-DEVELOPED PROJECT'S SURFACE RUNOFF.
THE DIFFERENCE OF PRE & POST-DEVELOPED RUNOFF VOLUME WILL NEED TO BE TREATED.
THE CONCEPT IS TO ENLARGE THE EXISTING POND TO ACCOMODATE THE VOLUME INCRESE DUE TO THE PROJECT

— 100 YR POST-DEVELOPED RUNOFF (SCS 24-hr STORM)

$Q_{PEAK} = 1.08$ cfs $Q_{PRE} = 0.74$ cfs

$Vol = 15,493\ ft^3$ $Vol_{PRE} = 14,149\ ft^3$

ΔVol TO BE TREATED $= 15,493 - 14,149 = \underline{1,344\ ft^3}$

— INFILTRATION RATE (½ OF D.O.E.'s RECOMMENDATION)
$= 1.205$ in/hr $= \underline{2.789 * 10^{-5}\ ft/sec.}$

— EXPANDED POND BOTTOM AREA: 3' avg. width * ±140' length = 420 sf

— DETERMINE INFILTRATION FLOW (INTO GROUND) RATE
$2.789 * 10^{-5}\ ft/sec * 420\ ft^2 = \underline{0.0117\ cfs}$

— VOLUME INFILTRATED IN 24HRS.
$0.0117\ cfs * 3600\ sec/hr * 24\ hr = \underline{1012\ ft^3}$

Table III-3.1 Soil Properties Classified by Soil Texture

Texture Class	Infiltration Rate Hydrologic (inches/hr.)	Cation Exchange Capacity (milliequivalents/100 grams)	Effective Water Capacity (inches per inch)	Hydrologic Soil Group
Coarse Sands or Cobbles	20.00	<5.0	—	A
Sand	8.27	<5.0	0.35	A
Loamy Sand	2.41	5.0	0.31	A
Sandy Loam	1.02	>5.0	0.25	B
Loam	0.52	>5.0	0.19	B
Silt Loam	0.27	>5.0	0.17	C
Sandy Clay Loam	0.17	>5.0	0.14	C
Clay Loam	0.09	>5.0	0.14	D
Silty Clay Loam	0.06	>5.0	0.11	D
Sandy Clay	0.05	>5.0	0.09	D
Silty Clay	0.04	>5.0	0.09	D
Clay	0.02	>5.0	0.08	D

Source (except for cation exchange capacity): Rawls, Brakensiek, and Saxton, 1982 (16)

Cation exchange capacity values are estimated from Buckman and Brady, 1969, (23)

CASCADE SURVEYING & ENGINEERING, INC.

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FAX (360) 435-4012

Surveyors
Engineers
Planners

PER CITY RECORD, THIS IS THE COMPLETE DRAINAGE STUDY FOR

Plat of Jensen Farm Div. II Drainage Calculations Revised on 6/10/97 to include Plat of Jensen Farm Div. III

The plat of Jensen Farm Division 2 is proposed to consist of 22 lots with asphalt roads. The plat of Jensen Farm Division 3 is also proposed to consist of 22 lots with asphalt roads. The calculations also include the portion of Portage Drive that extends West to Olympic Ave. The total storm area is 10.39 acres and consists of generally flat grades. The site is not affected by any off site runoff. It is proposed to direct flow from the southern portion of Jensen Farm Division 2 (lots 1 - 12, and adjacent roadway) into the existing detention pond South of the plat. It is proposed to handle the remaining portions with an infiltration pond located at the West end of Portage drive. An emergency overflow pipe will be located above the 100 year storm elevation and release into the unnamed drainage that flows southwest under Olympic Avenue.

The drainage calculations were derived using the Pizer Inc. Hydra Storm Analysis Software. The pond was modeled using the Reservoir command with a release rate equaling the bottom area multiplied by the infiltration rate. On site soils investigation found that the soils in the pond site are loamy sands. An infiltration rate of 1.205 in./hr., which is one half the D.O.E. recommended rate for loamy sand, was used for calculations. The pond bottom will have a bottom area of 14,400 sq. ft. with 3:1 side slopes. The release rate from infiltration was staged in the model to include the side slopes of the pond as the water level rises. See sheet 8 for more explanation of the staging. The required storage in the pond during the 2 year storm event will be 15,071 cubic feet (link 29 page 15) at a depth of 1.00 feet. The required storage during the 25 year storm event will be 55,444 cubic feet (link 29 page 21) at a depth of 3.27 feet. The required storage during the 100 year storm event will be 87,815 cubic feet (link 29 page 27) this will be at a depth of 4.82 feet. A 12" pipe with a backflow prevention flapper will be placed at this 4.82' elevation in the case of overflow conditions.

6-12-97

FREDERICK F. POYNER
STATE OF WASHINGTON
12716
REGISTERED
PROFESSIONAL ENGINEER

EXPIRES 12/23/97


CREEK
POND
3-M
PARK
CRYSTAL CREEK ESTATES
KENT PRAIRIE ESTATES (PHASE 2)
KENT PR
2-M
10
11
12
PORTAGE DRIVE
NO NAME AVE. (P)
LANE
LOT
204th ST. N.E.
EX.
POND
1"=200'

C:ÑHYDRANCMDÑ11094DEV.CMD 10:45 12-Jun-97

Status of DEFAULTS at start of run. (* May be reset by SET)

Command file	: C:NHYDRANCMDÑ11094DEV.CMD
Input units are read as	: USA
* Output sent to display	: Brief
* Output sent to printer	: Brief
* Output sent to file	: Off
Paper width in inches	: 8.000
String to reset printer	: 27 51 36 18
String to set printer to compressed .	: 17.16 15
String to set printer to 8 lines/inch	: 8 27 51 27
Name of printer	: Panasonic, KX-P1080
Print heading at top of page	: True
Number of steps in hydrograph	: 196
Step length in minutes	: 15
Significant flow in hydrograph	: 0.000
* Maximum plot value	: Selected by HYDRA
Type of hydrographic plot	: Compact
Sanitary flow by	: Diurnal Curve
Delay to start of actual storm	: 0.00
Rational Method computations	: Off
SCS computations	: Santa Barbara
Continuous simulation computations	: On
* Maximum d/D for pipe design/analysis	: 0.900
* Match point position on pipe	: 0.00 or Invert
* Number of allowable diam drops	: 999
* Mimimum drop thru manhole	: 0.000
Routing technique	: Quick
* Calculate sanitary flows	: True
* Calculate infiltration flows	: True
* Calculate storm flows	: True
* Calculate misc flows	: True

```
  1: JOB 11094 Jensen Farm Div.2 & 3 (Developed Conditions)
  2: STE 15
  3: REM TOTAL RAINFALL: 2 year 2.0/ 25 year 3.5/ 100 year 4.6
  4: TOT 3.5

  5: FIL T1A34I15.INC
-----START OF SUB-FILE------
  1: REM SCS TYPE 1A 24 HR HYEtograph FOR 3.4 TOTAL RAINFALL
  2: REM TIME INTERVAL 15 MINUTES
  3: HYE 15 0,.017,.017,.017,.0238,.0238,.0272,.0272,.0272,.0272,.0272,.02
       72+
  4:       ,.0272,.0272,.0272,.0272,.0306,.0306,.034,.0374,.0408,.0442,.047
       6,.0476+
```

```
  5:      ,.051,.051,.051,.0544,.0578,.0884,.102,.17,.187,.0952,.0646,.061
        2+
  6:      ,.0578,.0544,.0544,.051,.0476,.0442,.0408,.0374,.034,.0306,.0306
        ,.0306+
  7:      ,.0306,.0306,.0306,.0306,.0306,.0306,.0306,.0306,.0306,.0306,.03
        06,.0306+
  8:      ,.0306,.0272,.0272,.0272,.0272,.0272,.0272,.0238,.0204,.0204,.02
        04,.0204+
  9:      ,.0204,.0204,.0204,.0204,.0204,.0204,.0204,.0204,.0204,.0204,.02
        04,.0204+
 10:      ,.0204,.0204,.0204,.0204,.0204,.0204,.0204,.0204,.0204,.0204,.02
        04,.0204+
 11:      ,.0136
          /          Total in original hyetograph :        0.85 Inches
     Total volume rain in production hyetograph :        3.50 Inches
                                Maximum intensity :        0.77 Inches/Hr

 12: RET
------ END OF SUB-FILE ------
  6: PAV .018, .01, .02, .2, .15, 30, .4
  7: UNP .06, .5, .1, .1, .2, 2, .04, 1.5, .4, 20, 120, .97, 6, 12, 24
  8:
  9: NEW A
 10: HYD 0.20, 120, 0.01, 0.32 (C)

 11: HYD 0.20, 125, 0.01, 0.32 (D)

 12: HYD 0.11, 100, 0.005, 0.9 (K)

 13: PDA .013, 8, 2, 1, 3, .004
 14: PIP 60, 131, 129.8, 129, 127.8
       NOTE: No flow to inlet.

 15: HOL A

 16:
 17: NEW B
 18: HYD 0.27, 250, 0.01, 0.25 (E)

 19: HYD 0.39, 300, 0.01, 0.17 (F)

 20: HYD 0.35, 200, 0.01, 0.17 (G)

 21: HYD 0.25, 120, 0.01, 0.32 (H)

 22: HYD 0.11, 100, 0.005, 0.9 (J)

 23: REC A
 24: HYD 0.08, 120, 0.005, 0.9 (M)

 25: PIP 120, 129.8, 129.2, 127.8, 127.2
       NOTE: No flow to inlet.
```

```
 26: HOL B

 27:
 28: NEW C
 29: HYD 0.10, 150, 0.005, 0.9 (A)

 30: HYD 0.22, 130, 0.01, 0.32 (B)

 31: HYD 0.08, 120, 0.005, 0.9 (L)

 32: PIP 60, 129.5, 129.2, 127.5, 127.2
         NOTE: No flow to inlet.

 33: REC B  /
 34: HYD 0.16, 220, 0.005, 0.9 (N)

 35: PIP 120, 129.2, 128.6, 127.2, 126.6
         NOTE: No flow to inlet.

 36: HOL C

 37:
 38: NEW D
 39: HYD 0.35, 130, 0.01, 0.17 (R)

 40: HYD 0.28, 120, 0.01, 0.30 (I)

 41: PIP 50, 130.0, 129.2, 128, 127.2
         NOTE: No flow to inlet.

 42: HYD 0.20, 120, 0.01, 0.32 (Q)

 43: PIP 40, 129.2, 129.0, 127.2, 127
         NOTE: No flow to inlet.

 44: HYD 0.27, 100, 0.01, 0.28 (S)

 45: PIP 20, 129.0, 128.9, 127.0, 126.9
         NOTE: No flow to inlet.

 46: HYD 0.24, 120, 0.01, 0.32 (P)

 47: PIP 60, 128.9, 128.6, 126.9, 126.6
         NOTE: No flow to inlet.

 48: HOL D

 49:
 50: NEW E
 51: HYD 0.11, 180, 0.005, 0.9 (O)

 52: HYD 0.35, 110, 0.01, 0.25 (V)
```

```
53: PIP 60, 128.9, 128.6, 126.9, 126.6
        NOTE: No flow to inlet.

54: REC C
55: REC D
56: PIP 130, 128.6, 127.9, 126.6, 125.9

57: HYD 0.18, 120, 0.005, 0.9 (U,T)

58: HYD 0.25, 125, 0.001, 0.32 (EE)

59: PIP 70, 127.9, 127.55, 125.9, 125.55
        NOTE: No flow to inlet.

60: HYD 0.24, 170, 0.01, 0.32, (FF)

61: PIP 90, 127.55, 127.10, 125.55, 125.10
        NOTE: No flow to inlet.

62: HOL E

63:
64: NEW F
65: HYD 0.30, 180, 0.005, 0.9 (LL)

66: HYD 0.21, 180, 0.01, 0.32 (X)

67: HYD 0.22, 120, 0.01, 0.32 (Z)

68: PIP 180, 128.4, 127.5, 126.4, 125.5
        NOTE: No flow to inlet.

69: HYD 0.29, 250, 0.01, 0.32 (Z)

70: HYD 0.23, 120, 0.01, 0.32 (AA)

71: HYD 0.27, 120, 0.01, 0.32 (BB)

72: HYD 0.25, 180, 0.005, 0.9 (OO,PP)

73: PIP 80, 127.5, 127.10, 125.5, 125.10
        NOTE: No flow to inlet.

74: HYD 0.21, 150, 0.005, 0.9 (CC,DD)

75: REC E
76: HYD 0.31, 120, 0.01, 0.30, (GG)

77: PIP 130, 127.10, 126.45, 125.1, 124.45
        NOTE: No flow to inlet.

78: HOL F

79:
```

```
 80: NEW G
 81: HYD 0.54, 200, 0.01, 0.32 (Y)

 82: CHA 100, 130.5, 130, 0.027, 3, 1, 3
         NOTE: No flow to inlet.

 83: HYD 0.20, 120, 0.01, 0.32 (HH)

 84: CHA 200, 130, 129, 0.027, 3, 1, 3
         NOTE: No flow to inlet.

 85: HYD 0.25, 100, 0.01, 0.32 (II)

 86: CHA 80,/129, 128.6, 0.027, 3, 1, 3
         NOTE: No flow to inlet.

 87: HYD 0.19, 130, 0.01, 0.32 (JJ)

 88: CHA 70, 128.6, 128.25, 0.027, 3, 1, 3
         NOTE: No flow to inlet.

 89: HYD 0.19, 130, 0.01, 0.32 (KK)

 90: CHA 70, 128.25, 127.9, 0.027, 3, 1, 3
         NOTE: No flow to inlet.

 91: HYD 0.19, 130, 0.01, 0.32 (MM)

 92: CHA 70, 127.9, 127.55, 0.027, 3, 1, 3
         NOTE: No flow to inlet.

 93: HYD 0.19, 130, 0.01, 0.32 (NN)

 94: CHA 70, 127.55, 127.2, 0.027, 3, 1, 3
         NOTE: No flow to inlet.

 95: HYD 0.19, 130, 0.01, 0.32 (QQ)

 96: CHA 70, 127.2, 126.85, 0.027, 3, 1, 3
         NOTE: No flow to inlet.

 97: HYD 0.20, 120, 0.01, 0.32 (RR)

 98: PIP 60, 126.85, 126.45, 124.85, 124.45
         NOTE: No flow to inlet.

 99: HYD 0.21, 150, 0.005, 0.9 (SS)

100: REC F
101: PIP 120, 126.45, 125.85, 124.45, 123.85
         NOTE: No flow to inlet.
```

```
102: HYD 0.16, 120, 0.005, 0.90 (TT)

103: PIP 130, 125.85, 125.2, 123.85, 123.2
         NOTE: No flow to inlet.

104: HYD 0.21, 150, 0.005, 0.9 (UU)

105: PIP 20, 125.2, 125.1, 123.2, 123.1
         NOTE: No flow to inlet.

106: HOL G

107:
108: NEW H  /
109: HYD 0.19, 150, 0.02, 0.9 (VV)

110: HYD 0.20, 150, 0.005, 0.9 (WW)

111: PIP 60, 125.4, 125.1, 123.4, 123.1
         NOTE: No flow to inlet.

112: REC G
113: RES 123 0/0 50/0.40 15138/0.44 55416/0.54 88150/0.62

114: REM CALCULATIONS BASED ON AN INFILTRATION POND WITH A
115: REM BOTTOM OF 120 X 120.  THE BOTTOM AREA IS 14,400 SQ. FT.
116: REM THE INFILTRATION RATE IS BASED ON A PERC RATE OF 1.205 in/hr
117: REM WHICH IS HALF OF THE DOE RATE FOR LOAMY SAND
118: REM RATE OF (14,400 X 1.205 / 43200 = 0.40)
119: REM THE RESERVOIR COMMAND WILL BE STAGED BETWEEN THE STORMS
120: REM TO CALCULATE FOR THE INCREASED BOTTOM AREA WHICH WILL INCLUDE
121: REM THE SIDES OF THE POND.
122: REM AT THE PEAK OF THE 2 YEAR STORM THE POND WILL BE 1.0' DEEP WHICH
123: REM WILL CREATE A NEW BOTTOM AREA OF 126 X 126 = 15,876 SQ. FT.
124: REM (15,876 X 1.205 / 43200 = .44)
125: REM AT THE PEAK OF THE 25 YEAR STORM THE POND WILL BE 3.27' DEEP WHIC
         H
126: REM WILL CREATE A NEW BOTTOM AREA OF 139.62 X 139.62 = 19,493 SQ. FT.
127: REM (19,493 X 1.205 / 43200 = .54
128: REM AT THE PEAK OF THE 100 YEAR STORM THE POND WILL BE 4.82' DEEP WHI
         CH
129: REM WILL CREATE A NEW BOTTOM AREA OF 148.92 X 148.92 = 22,177 SQ. FT.
130: REM (22,177 X 1.205 / 43200 = .62)
131: END
```

------ S U M M A R Y O F A N A L Y S I S ------

Run number on command file :	74	
Number of links :	29	
Number of hydrographs :	120	
Total sanitary population :	0	
Total sanitary area :	0.00	Acres
Total storm area :	10.39	Acres
Number of pumps :	0	
Number of reservoirs :	1	
Number of diversion structures :	0	
Number of inlets :	0	
Length of new pipe :	1660.00	Feet
Length of existing pipe :	0.00	Feet
Length of channel :	730.00	Feet
Length of gutter :	0.00	Feet
Length of transport units :	0.00	Feet
Length of pressure pipe :	0.00	Feet

C:\HYDRA\CMD\11094DEV.CMD

11094 Jensen Farm Div.2 & 3 (Developed Conditions)

2 yr

Pipe Design

*** A

Link	Long	Diam	Invert Up/Dn	Slope	Depth Up/Dn	Min Cover	San Inf	Sto Mis	Vel d/D	Design CFS	Estimated Cost
1	60	8	129.00 127.80	0.0200	2.00 2.00	1.28	0.0 0.0	0.1 0.0	2.27 0.19	0.10	0

Lateral length= 60 Upstream length= 60

Pipe Design

*** B

Link	Long	Diam	Invert Up/Dn	Slope	Depth Up/Dn	Min Cover	San Inf	Sto Mis	Vel d/D	Design CFS	Estimated Cost
2	120	8	127.80 127.20	0.0050	2.00 2.00	1.28	0.0 0.1	0.3 0.0	1.88 0.46	0.30	0

Lateral length= 120 Upstream length= 180

Pipe Design

*** C

Link	Long	Diam	Invert Up/Dn	Slope	Depth Up/Dn	Min Cover	San Inf	Sto Mis	Vel d/D	Design CFS	Estimated Cost
3	60	8	127.50 127.20	0.0050	2.00 2.00	1.28	0.0 0.0	0.1 0.0	1.38 0.27	0.10	0
4	120	8	127.20 126.60	0.0050	2.00 2.00	1.28	0.0 0.1	0.5 0.0	2.15 0.59	0.46	0

Lateral length= 180 Upstream length= 360

Pipe Design

*** D

Link	Long	Diam	Invert Up/Dn	Slope	Depth Up/Dn	Min Cover	San Inf	Sto Mis	Vel d/D	Design CFS	Estimated Cost
5	50	8	128.00 127.20	0.0160	2.00 2.00	1.28	0.0 0.0	0.1 0.0	1.84 0.16	0.06	0
6	40	8	127.20 127.00	0.0050	2.00 2.00	1.28	0.0 0.1	0.1 0.0	1.35 0.26	0.09	0
7	20	8	127.00 126.90	0.0050	2.00 2.00	1.28	0.0 0.1	0.1 0.0	1.44 0.29	0.13	0

11094 Jensen Farm Div.2 & 3 (Developed Conditions)
2yr

*** D

Pipe Design

Link	Long	Diam	Invert Up/Dn	Slope	Depth Up/Dn	Min Cover	San Inf	Sto Mis	Vel d/D	Design CFS	Estimated Cost
8	60	8	126.90 126.60	0.0050	2.00 2.00	1.28	0.0 0.1	0.2 0.0	1.53 0.32	0.16	0

Lateral length= 170 Upstream length= 170

*** E

Pipe Design

Link	Long	Diam	Invert Up/Dn	Slope	Depth Up/Dn	Min Cover	San Inf	Sto Mis	Vel d/D	Design CFS	Estimated Cost
9	60	8	126.90 126.60	0.0050	2.00 2.00	1.28	0.0 0.0	0.1 0.0	1.33 0.25	0.08	0
10	130	8	126.60 125.90	0.0054	2.00 2.00	1.28	0.0 0.2	0.7 0.0	2.50 0.75	0.70	0
11	70	8	125.90 125.55	0.0050	2.00 2.00	1.28	0.0 0.3	0.8 0.0	2.52 0.85	0.80	0
12	90	8	125.55 125.10	0.0050	2.00 2.00	1.28	0.0 0.3	0.8 0.0	2.54 0.88	0.84	0

Lateral length= 350 Upstream length= 880

*** F

Pipe Design

Link	Long	Diam	Invert Up/Dn	Slope	Depth Up/Dn	Min Cover	San Inf	Sto Mis	Vel d/D	Design CFS	Estimated Cost
13	180	8	126.40 125.50	0.0050	2.00 2.00	1.28	0.0 0.0	0.2 0.0	1.61 0.35	0.18	0
14	80	8	125.50 125.10	0.0050	2.00 2.00	1.28	0.0 0.1	0.4 0.0	2.03 0.53	0.39	0
15	130	10	125.10 124.45	0.0050	2.00 2.00	1.10	0.0 0.4	1.3 0.0	2.87 0.80	1.35	0

Lateral length= 390 Upstream length= 1270

*** G

Channel
//

Ditch Shape	Invert	Surface Width	San	Sto	Flow	Cost

11094 Jensen Farm Div.2 & 3 (Developed Conditions) 24hr.

Link	Long	Lft/Ctr/Rht	Slope	Up/Dn	Up/Dn	Depth	Inf	Mis	Vel	
16	100	3.00 3.00	0.0050	130.50	130.59	1.5	0.0	0.1	0.08	0
		1.00		130.00	130.09	0.09	0.0	0.0	0.68	
17	200	3.00 3.00	0.0050	130.00	130.11	1.6	0.0	0.1	0.10	0
		1.00		129.00	129.11	0.11	0.0	0.0	0.75	
18	80	3.00 3.00	0.0050	129.00	129.12	1.7	0.0	0.1	0.14	0
		1.00		128.60	128.72	0.12	0.1	0.0	0.81	
19	70	3.00 3.00	0.0050	128.60	128.74	1.8	0.0	0.2	0.16	0
		1.00		128.25	128.39	0.13	0.1	0.0	0.85	
20	70	3.00 3.00	0.0050	128.25	128.40	1.9	0.0	0.2	0.18	0
		1.00		127.90	128.04	0.14	0.1	0.0	0.89	
21	70	3.00 3.00	0.0050	127.90	128.05	1.9	0.0	0.2	0.21	0
		1.00		127.55	127.70	0.15	0.1	0.0	0.92	
22	70	3.00 3.00	0.0050	127.55	127.71	2.0	0.0	0.2	0.23	0
		1.00		127.20	127.36	0.16	0.1	0.0	0.95	
23	70	3.00 3.00	0.0050	127.20	127.37	2.0	0.0	0.3	0.26	0
		1.00		126.85	127.02	0.17	0.1	0.0	0.98	

*** G Pipe Design

Link	Long	Diam	Invert Up/Dn	Slope	Depth Up/Dn	Min Cover	San Inf	Sto Mis	Vel d/D	Design CFS	Estimated Cost
24	60	8	124.65	0.0067	2.00	1.28	0.0	0.3	2.04	0.28	0
			124.45		2.00		0.1	0.0	0.41		
25	120	12	124.45	0.0050	2.00	0.92	0.0	1.7	3.00	1.70	0
			123.85		2.00		0.5	0.0	0.67		
26	130	12	123.85	0.0050	2.00	0.92	0.0	1.8	3.04	1.76	0
			123.20		2.00		0.5	0.0	0.69		
27	20	12	123.20	0.0050	2.00	0.92	0.0	1.8	3.08	1.83	0
			123.10		2.00		0.5	0.0	0.71		

Lateral length= 1060 Upstream length= 2330

*** H Pipe Design

Link	Long	Diam	Invert Up/Dn	Slope	Depth Up/Dn	Min Cover	San Inf	Sto Mis	Vel d/D	Design CFS	Estimated Cost

28	60	8	123.40	0.0050	2.00	1.28	0.0	0.2	1.53	0.16	0

11094 Jensen Farm Div.2 & 3 (Developed Conditions) 24R

123.10 2.00 0.0 0.0 0.32

*** H Reservoir

Link	Invert Up/Dn		Maximum Flow Values San	Inf	Sto	Mis	Design	Cost
29	123.10	Discharge :	0.00	0.39	0.42	0.00	0.44	0
	123.00	Stored :	0	13033	6957	0	15071	
		Incoming :	0.00	0.51	1.98	0.00	1.98	

Lateral length= 60 Upstream length= 2390

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11094 Jensen Farm Div.2 & 3 (Developed Conditions) 25yr

*** A Pipe Design

Link	Long	Diam	Invert Up/Dn	Slope	Depth Up/Dn	Min Cover	San Inf	Sto Mis	Vel d/D	Design CFS	Estimated Cost
1	60	8	129.00 127.80	0.0200	2.00 2.00	1.28	0.0 0.1	0.2 0.0	2.65 0.25	0.18	0

Lateral length= 60 Upstream length= 60

*** B Pipe Design

Link	Long	Diam	Invert Up/Dn	Slope	Depth Up/Dn	Min Cover	San Inf	Sto Mis	Vel d/D	Design CFS	Estimated Cost
2	120	8	127.80 127.20	0.0050	2.00 2.00	1.28	0.0 0.2	0.5 0.0	2.22 0.63	0.52	0

Lateral length= 120 Upstream length= 180

*** C Pipe Design

Link	Long	Diam	Invert Up/Dn	Slope	Depth Up/Dn	Min Cover	San Inf	Sto Mis	Vel d/D	Design CFS	Estimated Cost
3	60	8	127.50 127.20	0.0050	2.00 2.00	1.28	0.0 0.0	0.2 0.0	1.61 0.35	0.18	0
4	120	8	127.20 126.60	0.0050	2.00 2.00	1.28	0.0 0.3	0.8 0.0	2.52 0.85	0.81	0

Lateral length= 180 Upstream length= 360

*** D Pipe Design

Link	Long	Diam	Invert Up/Dn	Slope	Depth Up/Dn	Min Cover	San Inf	Sto Mis	Vel d/D	Design CFS	Estimated Cost
5	50	8	128.00 127.20	0.0160	2.00 2.00	1.28	0.0 0.1	0.1 0.0	2.15 0.21	0.11	0
6	40	8	127.20 127.00	0.0050	2.00 2.00	1.28	0.0 0.1	0.2 0.0	1.53 0.32	0.16	0
7	20	8	127.00 126.90	0.0050	2.00 2.00	1.28	0.0 0.1	0.2 0.0	1.72 0.39	0.22	0

11094 Jensen Farm Div.2 & 3 (Developed Conditions) 25yr

*** D

Pipe Design

Link	Long	Diam	Invert Up/Dn	Slope	Depth Up/Dn	Min Cover	San Inf	Sto Mis	Vel d/D	Design CFS	Estimated Cost
8	60	8	126.90	0.0050	2.00	1.28	0.0	0.3	1.83	0.28	0
			126.60		2.00		0.2	0.0	0.44		

Lateral length= 170 Upstream length= 170

*** E

Pipe Design

Link	Long	Diam	Invert Up/Dn	Slope	Depth Up/Dn	Min Cover	San Inf	Sto Mis	Vel d/D	Design CFS	Estimated Cost
9	60	8	126.90	0.0050	2.00	1.28	0.0	0.1	1.50	0.14	0
			126.60		2.00		0.0	0.0	0.31		
10	130	10	126.60	0.0054	2.00	1.10	0.0	1.2	2.86	1.23	0
			125.90		2.00		0.5	0.0	0.73		
11	70	10	125.90	0.0050	2.00	1.10	0.0	1.4	2.89	1.41	0
			125.55		2.00		0.5	0.0	0.82		
12	90	10	125.55	0.0050	2.00	1.10	0.0	1.5	2.92	1.46	0
			125.10		2.00		0.5	0.0	0.85		

Lateral length= 350 Upstream length= 880

*** F

Pipe Design

Link	Long	Diam	Invert Up/Dn	Slope	Depth Up/Dn	Min Cover	San Inf	Sto Mis	Vel d/D	Design CFS	Estimated Cost
13	180	8	126.40	0.0050	2.00	1.28	0.0	0.3	1.90	0.32	0
			125.50		2.00		0.1	0.0	0.47		
14	80	8	125.50	0.0050	2.00	1.28	0.0	0.7	2.41	0.68	0
			125.10		2.00		0.2	0.0	0.75		
15	130	12	125.10	0.0050	2.00	0.92	0.0	2.4	3.29	2.36	0
			124.45		2.00		0.7	0.0	0.84		

Lateral length= 390 Upstream length= 1270

*** G

Channel

Ditch Shape	Invert Surface	Width	San	Sto	Flow	Cost

11094 Jensen Farm Div.2 & 3 (Developed Conditions) 25yr

Link	Long	Lft/Ctr/Rht	Slope	Up/Dn	Up/Dn Depth	Inf	Mis	Vel	
16	100	3.00 3.00 1.00	0.0050	130.50 130.00	130.62 130.12	1.7 0.12	0.0 0.1	0.13 0.81	0
17	200	3.00 3.00 1.00	0.0050	130.00 129.00	130.14 129.14	1.9 0.14	0.0 0.1	0.18 0.88	0
18	80	3.00 3.00 1.00	0.0050	129.00 128.60	129.17 128.77	2.0 0.17	0.0 0.1	0.24 0.96	0
19	70	3.00 3.00 1.00	0.0050	128.60 128.25	128.78 128.43	2.1 0.18	0.0 0.1	0.28 1.01	0
20	70	3.00 3.00 1.00	0.0050	128.25 127.90	128.45 128.10	2.2 0.20	0.0 0.2	0.33 1.05	0
21	70	3.00 3.00 1.00	0.0050	127.90 127.55	128.11 127.76	2.3 0.21	0.0 0.2	0.37 1.09	0
22	70	3.00 3.00 1.00	0.0050	127.55 127.20	127.77 127.42	2.3 0.22	0.0 0.2	0.41 1.12	0
23	70	3.00 3.00 1.00	0.0050	127.20 126.85	127.43 127.08	2.4 0.23	0.0 0.2	0.46 1.15	0

*** G

Pipe Design

Link	Long	Diam	Invert Up/Dn	Slope	Depth Up/Dn	Min Cover	San Inf	Sto Mis	Vel d/D	Design CFS	Estimated Cost
24	60	8	124.85 124.45	0.0067	2.00 2.00	1.28	0.0 0.3	0.5 0.0	2.41 0.56	0.50	0
25	120	15	124.45 123.85	0.0050	2.00 2.00	0.65	0.0 1.0	3.0 0.0	3.45 0.66	2.99	0
26	130	15	123.85 123.20	0.0050	2.00 2.00	0.65	0.0 1.0	3.1 0.0	3.48 0.67	3.08	0
27	20	15	123.20 123.10	0.0050	2.00 2.00	0.65	0.0 1.0	3.2 0.0	3.52 0.69	3.21	0

Lateral length= 1060 Upstream length= 2330

*** H

Pipe Design

Link	Long	Diam	Invert Up/Dn	Slope	Depth Up/Dn	Min Cover	San Inf	Sto Mis	Vel d/D	Design CFS	Estimated Cost

28	60	8	123.40	0.0050	2.00	1.28	0.0	0.3	1.81	0.27	0

11094 Jensen Farm Div.2 & 3 (Developed Conditions) 25yr

123.10 2.00 0.0 0.0 0.43

*** H Reservoir

Link	Invert Up/Dn	Maximum Flow Values	San	Int	Sto	Mis	Design	Cost
29	123.10	Discharge :	0.00	0.38	0.45	0.00	0.54	0
	123.00	Stored :	0	38217	24427	0	55444	
		Incoming :	0.00	1.02	3.48	0.00	3.48	

Lateral length= 60 Upstream length= 2390

11094 Jensen Farm Div.2 & 3 (Developed Conditions) 100yr

*** A

Pipe Design

Link	Long	Diam	Invert Up/Dn	Slope	Depth Up/Dn	Min Cover	San Inf	Sto Mis	Vel d/D	Design CFS	Estimated Cost
1	60	8	129.00	0.0200	2.00	1.28	0.0	0.2	2.83	0.23	0
			127.80		2.00		0.1	0.0	0.28		
			Lateral length= 60				Upstream length= 60				

*** B

Pipe Design

Link	Long	Diam	Invert Up/Dn	Slope	Depth Up/Dn	Min Cover	San Inf	Sto Mis	Vel d/D	Design CFS	Estimated Cost
2	120	8	127.80	0.0050	2.00	1.28	0.0	0.7	2.41	0.68	0
			127.20		2.00		0.3	0.0	0.75		
			Lateral length= 120				Upstream length= 180				

*** C

Pipe Design

Link	Long	Diam	Invert Up/Dn	Slope	Depth Up/Dn	Min Cover	San Inf	Sto Mis	Vel d/D	Design CFS	Estimated Cost
3	60	8	127.50	0.0050	2.00	1.28	0.0	0.2	1.75	0.24	0
			127.20		2.00		0.0	0.0	0.40		
4	120	10	127.20	0.0050	2.00	1.10	0.0	1.1	2.67	1.06	0
			126.60		2.00		0.4	0.0	0.68		
			Lateral length= 180				Upstream length= 360				

*** D

Pipe Design

Link	Long	Diam	Invert Up/Dn	Slope	Depth Up/Dn	Min Cover	San Inf	Sto Mis	Vel d/D	Design CFS	Estimated Cost
5	50	8	128.00	0.0160	2.00	1.28	0.0	0.1	2.37	0.15	0
			127.20		2.00		0.1	0.0	0.25		
6	40	8	127.20	0.0050	2.00	1.28	0.0	0.2	1.69	0.21	0
			127.00		2.00		0.2	0.0	0.38		
7	20	8	127.00	0.0050	2.00	1.28	0.0	0.3	1.85	0.29	0
			126.90		2.00		0.2	0.0	0.45		

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11094 Jensen Farm Div.2 & 3 (Developed Conditions) 100 YR

*** D

Pipe Design

Link	Long	Diam	Invert Up/Dn	Slope	Depth Up/Dn	Min Cover	San Inf	Sto Mis	Vel d/D	Design CFS	Estimated Cost
8	60	8	126.90 126.60	0.0050	2.00 2.00	1.28	0.0 0.2	0.4 0.0	1.98 0.51	0.37	0
			Lateral length= 170				Upstream length= 170				

*** E

Pipe Design

Link	Long	Diam	Invert Up/Dn	Slope	Depth Up/Dn	Min Cover	San Inf	Sto Mis	Vel d/D	Design CFS	Estimated Cost
9	60	8	126.90 126.60	0.0050	2.00 2.00	1.28	0.0 0.1	0.2 0.0	1.64 0.36	0.19	0
10	130	12	126.60 125.90	0.0054	2.00 2.00	0.92	0.0 0.7	1.6 0.0	3.04 0.64	1.61	0
11	70	12	125.90 125.55	0.0050	2.00 2.00	0.92	0.0 0.7	1.9 0.0	3.08 0.71	1.85	0
12	90	12	125.55 125.10	0.0050	2.00 2.00	0.92	0.0 0.7	1.9 0.0	3.12 0.73	1.92	0
			Lateral length= 350				Upstream length= 880				

*** F

Pipe Design

Link	Long	Diam	Invert Up/Dn	Slope	Depth Up/Dn	Min Cover	San Inf	Sto Mis	Vel d/D	Design CFS	Estimated Cost
13	180	8	126.40 125.50	0.0050	2.00 2.00	1.28	0.0 0.1	0.4 0.0	2.07 0.55	0.42	0
14	80	10	125.50 125.10	0.0050	2.00 2.00	1.10	0.0 0.2	0.9 0.0	2.54 0.61	0.90	0
15	130	15	125.10 124.45	0.0050	2.00 2.00	0.65	0.0 1.0	3.1 0.0	3.50 0.68	3.10	0
			Lateral length= 390				Upstream length= 1270				

*** G

Channel

Ditch Shape	Invert	Surface Width	San	Sto	Flow	Cost

11094 Jensen Farm Div.2 & 3 (Developed Conditions) 100YR

Link	Long	Lft/Ctr/Rht	Slope	Up/Dn	Up/Dn Depth	Inf	Mis	Vel	
16	100	3.00 3.00 1.00	0.0050	130.50 130.00	130.64 130.14	1.9 0.14	0.0 0.1	0.2 0.0	0.18 0.88	0
17	200	3.00 3.00 1.00	0.0050	130.00 129.00	130.17 129.17	2.0 0.17	0.0 0.1	0.2 0.0	0.24 0.96	0
18	80	3.00 3.00 1.00	0.0050	129.00 128.60	129.19 128.79	2.2 0.19	0.0 0.2	0.3 0.0	0.31 1.04	0
19	70	3.00 3.00 1.00	0.0050	128.60 128.25	128.81 128.46	2.3 0.21	0.0 0.2	0.4 0.0	0.37 1.09	0
20	70	3.00 3.00 1.00	0.0050	128.25 127.90	128.48 128.13	2.4 0.23	0.0 0.2	0.4 0.0	0.43 1.13	0
21	70	3.00 3.00 1.00	0.0050	127.90 127.55	128.14 127.79	2.5 0.24	0.0 0.3	0.5 0.0	0.49 1.17	0
22	70	3.00 3.00 1.00	0.0050	127.55 127.20	127.81 127.46	2.5 0.26	0.0 0.3	0.5 0.0	0.54 1.21	0
23	70	3.00 3.00 1.00	0.0050	127.20 126.85	127.47 127.12	2.6 0.27	0.0 0.3	0.6 0.0	0.60 1.24	0

Pipe Design

*** G

Link	Long	Diam	Invert Up/Dn	Slope	Depth Up/Dn	Min Cover	San Inf	Sto Mis	Vel d/D	Design CFS	Estimated Cost
24	60	8	124.85 124.45	0.0067	2.00 2.00	1.38	0.0 0.4	0.7 0.0	2.64 0.67	0.66	0
25	120	15	124.45 123.85	0.0050	2.00 2.00	0.65	0.0 1.4	3.9 0.0	3.74 0.79	3.94	0
26	130	15	123.85 123.20	0.0050	2.00 2.00	0.65	0.0 1.4	4.1 0.0	3.77 0.81	4.06	0
27	20	15	123.20 123.10	0.0050	2.00 2.00	0.65	0.0 1.4	4.2 0.0	3.81 0.84	4.23	0

Lateral length= 1060 Upstream length= 2330

Pipe Design

*** H

Link	Long	Diam	Invert Up/Dn	Slope	Depth Up/Dn	Min Cover	San Inf	Sto Mis	Vel d/D	Design CFS	Estimated Cost

28	60	8	123.40	0.0050	2.00	1.28	0.0	0.4	1.98	0.36	0

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11094 Jensen Farm Div.2 & 3 (Developed Conditions) 100YR.

123.10 2.00 0.0 0.0 0.51

*** H Reservoir

Link	Invert Up/Dn		Maximum Flow Values San	Inf	Sto	Mis	Design	Cost
29	123.10	Discharge :	0.00	0.41	0.48	0.00	0.62	0
	123.00	Stored :	0	57710	40082	0	87815	
		Incoming :	0.00	1.40	4.59	0.00	4.59	

Lateral length= 60 Upstream length= 2390

Preliminary/Permit Use

HOMEPLACE

Arlington, Snohomish County, Washington

Stormwater Analysis (Infiltration Pond) Report

Prepared For: Landed Gentry Development, Inc.
540 E. Fairhaven Avenue
Burlington, WA 98233
(360) 755-9021

Prepared By: SUMMIT Engineers & Surveyors, Inc.
2218 Old Highway 99 So.
Mount Vernon, WA 98273
(360) 416-4999

Date: January 2, 2001
Addendum: September 4, 2001
Addendum: February 27, 2002

SUMMIT
ENGINEERS & SURVEYORS, INC.

PURPOSE

THE PURPOSE OF THIS ADDENDUM IS TO ADDRESS EARTH TECH'S REVIEW COMMENTS DATED SEPTEMBER 27, 2001.

1. The engineer has provided three soil logs showing the soils in the area where pond is to be expanded. The soil logs show the soils to be sandy gravel or g of which have a cation exchange rate of 5 or greater and therefore, the soils suitable for treatment. Treatment of the runoff must be provided prior to th discharged to the infiltration pond. Those BMP's providing treatment are Chapter I-4 of the Ecology manual. (Note: An oil/water separator does no adequate treatment).

2/24/03 PROPOSING BIO-FILTRATION SWALE INSTEAD OF "STORMFILTER"

IN STEAD OF AN OIL/WATER SEPARATOR, PROVIDED A "STORMCEPTER" PRIOR TO DISCHARGING STORMWATER TO THE INFILTRATION POND

2. The engineer has provided a copy of the original report prepared for the design of the existing infiltration pond. However, the copy only includes input data and does not include any output or sizing data. Therefore, it is not possible to verify the adequacy of the existing facility. As stated in our original review, the calculations for the Homeplace Adult Care Center must demonstrate that the infiltration facility will be adequate to handle all runoff that enters the pond after construction of the care center, not just show the additional area needed.

THE PROVIDED INFORMATION (JENSEN FARM DIV. II DRAINAGE CALCULATIONS) IS FROM THE CASCADE SURVEYING & ENGINEERING, INC. & THE CITY. THE CITY RECORD SHOWS AS APPROVED. IT MUST MET THE CITY'S (DOE'S) CRITERIA. AND THE WAS CONSTRUCTED IN YEAR 1998.

HOMEPLACE IS PROPOSING THE SAME DRAINAGE CONCEPT AS JENSEN FARM DIV. II.

TO CHECK THE POND FUNCTION, ON FEBRUARY 23,

AN ENGINEER, FIELD VISITED THE SITE TO REVIEW THE CONSTRUCTED POND. AS YOU RECALL, WE HAD A HEAVY STORM BACK TO BACK FOR 2 DAYS. NO STANDING WATER IN THE POND OBSERVED EVEN THE INLET PIPE TO THE POND WAS FLOWING HALF FULL. ALL THE WATER INFILTRATED WITHIN 50 FEET FROM THE END OF THE PIPE. (SEE ENCLOSED PHOTOS)

3. The infiltration facility must be located a minimum of 20 feet from all buildings. Based on the information provided it appears that some of the buildings may be closer than 20 feet to the pond.

THE POND BASE ELEVATION IS 117.0. PER THE JENSEN FARM DIV. II REPORT, THE WATER DEPTH MAY REACH TO 121.82 feet (4.82 DEPTH).
BASED ON THE PROPOSED GRADE 122.0 IS MORE THAN 20 feet FROM THE PROPOSED HOMEPLACE BUILDING CORNER.

CASCADE SURVEYING & ENGINEERING, INC.

ARLINGTON, WA
102 E Division • PO Box 326 98223
(360) 435-5551 • (360) 652-7572
FAX (360) 435-4012

Surveyors
Engineers
Planners

PER CITY RECORD, THIS IS THE COMPLETE DRAINAGE STUDY FOR

Plat of Jensen Farm Div. II Drainage Calculations Revised on 6/10/97 to include Plat of Jensen Farm Div. III

The plat of Jensen Farm Division 2 is proposed to consist of 22 lots with asphalt roads. The plat of Jensen Farm Division 3 is also proposed to consist of 22 lots with asphalt roads. The calculations also include the portion of Portage Drive that extends West to Olympic Ave. The total storm area is 10.39 acres and consists of generally flat grades. The site is not affected by any off site runoff. It is proposed to direct flow from the southern portion of Jensen Farm Division 2 (lots 1 - 12, and adjacent roadway) into the existing detention pond South of the plat. It is proposed to handle the remaining portions with an infiltration pond located at the West end of Portage drive. An emergency overflow pipe will be located above the 100 year storm elevation and release into the unnamed drainage that flows southwest under Olympic Avenue.

The drainage calculations were derived using the Pizer Inc. Hydra Storm Analysis Software. The pond was modeled using the Reservoir command with a release rate equaling the bottom area multiplied by the infiltration rate. On site soils investigation found that the soils in the pond site are loamy sands. An infiltration rate of 1.205 in./hr., which is one half the D.O.E. recommended rate for loamy sand, was used for calculations. The pond bottom will have a bottom area of 14,400 sq. ft. with 3:1 side slopes. The release rate from infiltration was staged in the model to include the side slopes of the pond as the water level rises. See sheet 8 for more explanation of the staging. The required storage in the pond during the 2 year storm event will be 15,071 cubic feet (link 29 page 15) at a depth of 1.00 feet. The required storage during the 25 year storm event will be 55,444 cubic feet (link 29 page 21) at a depth of 3.27 feet. The required storage during the 100 year storm event will be 87,815 cubic feet (link 29 page 27) this will be at a depth of 4.82 feet. A 12" pipe with a backflow prevention flapper will be placed at this 4.82' elevation in the case of overflow conditions.

6-12-97

FREDERICK F. POYNER
STATE OF WASHINGTON
12716
REGISTERED
PROFESSIONAL ENGINEER

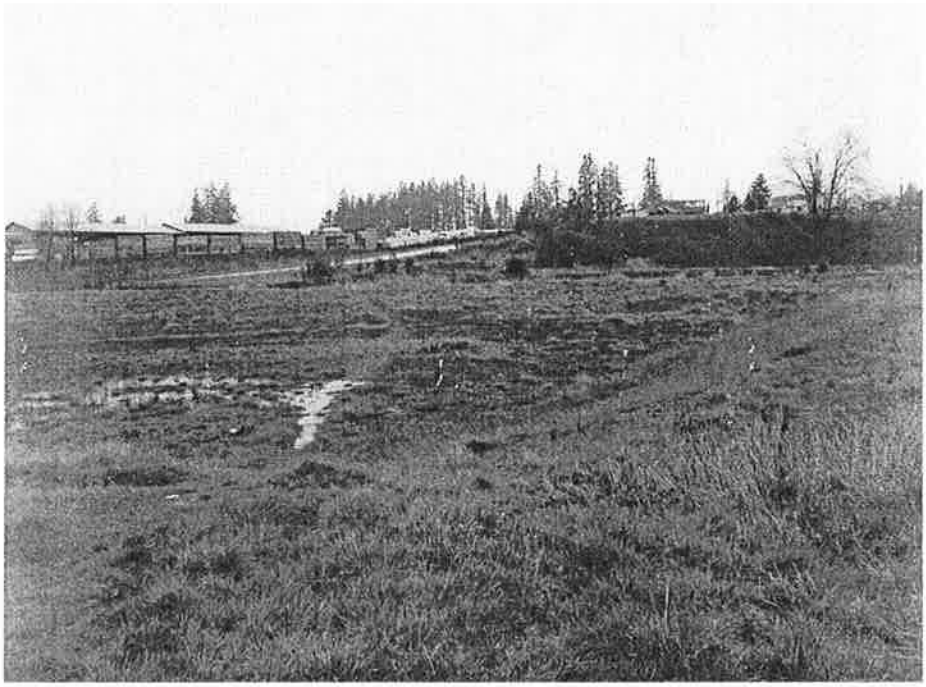
EXPIRES 12/23/97

Stormwater into exist. pond 1/2 full.

Saturday, February 23, 2002 9:02 AM

Exist. Inf. Pond during a large storm event.

Saturday, February 23, 2002 9:01 AM



Exist. Inf. Pond during a large storm event.

Saturday, February 23, 2002 9:01 AM

City
Of
Arlington
Development
Services

238 N. Olympic Ave.
Arlington, WA 98223

Administration
360.403.3500

Building
360.403.3431

Engineering
360.403.3500

Planning
360.403.3434

Utilities
360.403.3500

May 10, 2002

Kendall Gentry
Landed Gentry Development, Inc.
Old City Hall Building
504 E. Fairhaven Avenue
Burlington, WA 98233

RE: Additional Comments on Homeplace (MN-01-007)

Dear Mr. Gentry:

The revised drainage information submitted on February 27, 2002 has been reviewed. There are two concerns/comments that must be addressed in order for the proposed drainage to pass conceptual review. Enclosed are the review comments from Debbie Maroon of Earth Tech. Please address her comments and submit 3 sets of the revised drainage information to me.

Also enclosed is the City's Homeplace pond mitigation proposal. Please contact Gregg Eaton at 360.403.3527 to discuss the proposal.

The revised site plan, landscape plan, planting schedule, or irrigation plan that were submitted on May 7, 2002 are being reviewed. I will let you know the results when the review has been completed.

For your information, we are still waiting for comments from Snohomish County and Washington State Department of Transportation on your traffic mitigation offers.

Please submit the revised drainage information within **30** days from the date of this letter or the application will be deemed null and void. If you have questions, please contact me at 360.403.3436.

Sincerely,

Yvonne Page

Yvonne Page, Senior Planner
Planning Division

Enclosures

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