Appendix K-5: Urtica Solar Project Drainage Report

Tuusso Energy
Urtica Solar Project:
DRAINAGE REPORT

Date: July 2017

Prepared by:
Encompass Engineering & Surveying
407 Swiftwater Blvd
Cle Elum, WA 98922

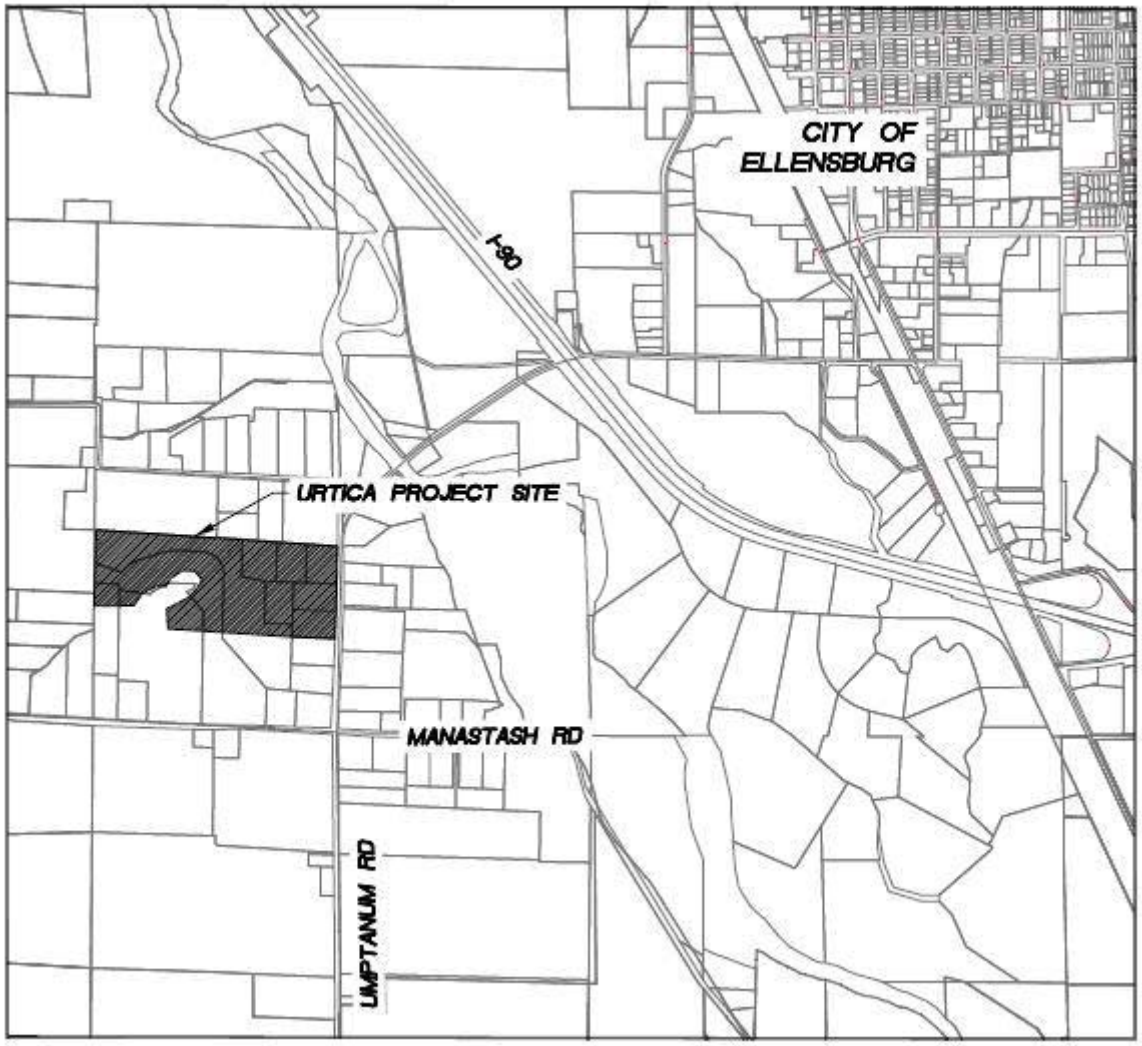
Table of Contents

List of Figures

Appendix

I. INTRODUCTION

Per Kittitas County assessor records the Tuusso Energy: Urtica Solar Project site is comprised of Tax Parcel Nos. 950243, 950244, 950245, 950246, 950247, and 950248 and portions of 808533, 869436, 879436, and 889436. It is in the northwest corner of the intersection of Manastash Road and Umptanum Road in Ellensburg, WA, in the SW ¼ of Section 10, Township 17 North, Range 18 East W.M. The project site is 51.49 acres and currently used as agricultural land to produce hay. See Vicinity Map below.



VICINITY MAP

The purpose of this project is to convert the site to a photovoltaic solar project with minimal change to the existing topography and site features. The proposed site will consist of rows of modular trackers with solar panels, all-weather access roads, and inverter stations to convert power from the solar panels. The solar panels are attached to horizontal supports that run north-south, and the panels themselves rotate east to west, in order to maximize sun exposure. Access to the site is from the east side of the site, off of Umptanum Road.

II. EXISTING CONDITIONS

The site is currently an open field used to make hay using flood irrigation methods. The overall topography of the site gently slopes to the east. The surface water that does not infiltrate flows to the east. Two ponds are located near the middle of the site and discharge into an existing irrigation ditch that runs west to east through the site. Existing conditions can be seen in Figure 1.

a. Drainage Basins

For the purpose of this report, the site is considered to be made up of two drainage basins, which can be seen in Figure 1. Drainage Basin 1 is the smaller of the two and encompasses the southern portion of the site. Drainage from this area flows east, to the south-east corner of the site, where it enters a culvert and crosses under Umptanum Road. Drainage Basin 2 is the larger drainage basin the encompasses the northern portion of the site. Drainage from Basin 2 flows into the existing irrigation pond and ditch that flows through the site to the east. There are no structures on the existing site, however there is an existing gravel road, which results in 0.33 acres of the site being impervious. The remaining 51.16 acres are pervious.

b. Downstream Analysis

The majority of the site (Basin 2) drains to the east into the irrigation ponds are/or irrigation ditch that flows west to east through the site. The pond and ditch are currently maintained by the current landowner. The irrigation pond and ditch are part of a larger irrigation network that serves the rural areas southwest of Ellensburg. As this pond and ditch are irrigation facilities, the flow rates are currently controlled as needed. The ditch flows into a culvert and crosses under Umptanum road, and then continues on to the southeast as part of the existing irrigation network. Basin 1 drains to the south-east corner of the site, where it enters a culvert and crosses under Umptanum Road. It then becomes part of the larger irrigation network that serves the whole area. No issues have been brought up in relation to the existing irrigation infrastructure downstream of the project site.

c. Soil Report

An NRCS Web Soil Survey was performed for the site in order to obtain onsite soil types. The results of the report give descriptions of the soils found in the project area and the corresponding hydrologic soil groups. The results can be seen in APPENDIX A. The site is composed of Nanum ashy loam with 2-5% slopes, Brickmill gravelly ashy loam with 0-2% slopes, Ackna Ashy loam with 0-2% slopes and Brysill cobbly ashy loam with 0-2% slopes. Both the Brickmill Loam and Brysill loam belong to Hydrologic Soil Group C, while the Ackna loam belongs to Group B. The Nanum loam has a dual C/D rating, meaning it is classified as Group C for drained areas and Group D for undrained areas. For this study, it is classified as Group D, which a conservative classification.

III. PROPOSED CONDITIONS

The proposed development on this site consists of adding solar trackers, fencing, and associated electrical infrastructure as well as improving and building upon the existing access road. The new impervious surface will be a portion of the solar trackers (described below), the proposed all-weather

access road (which may be compacted soil or gravel) that will run east/west through the site, and the electrical infrastructure that is made up of five inverters and one utility disconnect with a project metering location. Each inverter as well as the utility disconnect, resides on its own concrete pad. The access road was conservatively modeled as a gravel road.

a. Solar Panel Array

A series of modular trackers will be installed throughout the site. Each tracker is essentially a long horizontal support (of various lengths), held in place by evenly spaced, driven H-beams. The trackers are oriented north-south, with solar panels attached to the entire length of the tracker. The solar panels rotate and tilt east to west to maximize sun exposure. The panels will generate runoff within the site, however, due to the way the panels tilt and that they are not continuous structures, they are not considered impervious in the proposed conditions calculations. The panels do not reduce available ground surface for infiltration. The ground below the solar panels will have native plantings, and therefore it will continue to intercept and infiltrate runoff water from the panels. The only impervious area due to the solar panels is from the posts in the ground upon which the solar panels are attached. For impervious calculations, the posts are conservatively estimated to make up 5% of the total area of the solar tracker configuration.

b. Drainage Basin

Minimal grading and ground disturbance will take place as part of this project. The access road, concrete pads for the electrical infrastructure, and solar tracker posts are the only impervious surfaces proposed for the site. The portion of the solar panel array installation that disturbs the ground is very minimal as well. Because of this, existing topography and drainage patterns will remain relatively undisturbed, and the proposed drainage basins encompass the same area as the existing drainage basins. Proposed conditions can be seen in Figure 2.

IV. HYDROLOGIC MODELING- SANTA BARBARA URBAN HYDROGRAPH METHOD

Hydrologic analysis for the proposed project is consistent with Title 12 of the Kittitas County Code and the 2004 *SWMMEW*. In order to properly analyze the impacts of the proposed development on the watershed, runoff modeling was done using the Santa Barbara Urban Hydrograph method (SBUH), SCS Type 1A 24-hour storm event for Region 2 per the 2004 *SWMMEW*. This was done to determine peak runoff during the 2-year, 10-year, 25-year and 100-year storm events. Calculations were performed utilizing HydroCAD version 10.00-18, which is accepted by the Department of Ecology as a proper simulation modeling program.

a. Precipitation

The precipitation information used for the pre-development and post-development run-off calculations is based on the Isopluvials provided in the 2004 *SWMMEW* and can be seen in APPENDIX B. The inputs for this project site southwest of Ellensburg are seen below:

P_{2yr} = 1.0”
P_{10yr} = 1.2”
P_{25yr} = 1.6”
P_{100yr} = 2.0”

b. Curve Number

The SCS Curve Number (CN) is a function of the soil type and ground cover. It is used to determine the portion of the precipitation depth that will be conveyed as runoff. The curve numbers are pulled from *Technical Release 55 Urban Hydrology for Small Watersheds*, and the curve numbers used can be seen in Table 1.

Table 1: Curve Numbers Used

DESCRIPTION	HYDROLOGIC SOIL GROUP			
	A	B	C	D
Meadow	30	58	71	78
Impervious areas	98	98	98	98
Gravel Roads	76	85	89	91
Dirt Roads	72	87	87	89

Using the soils report and the curve number table, a composite curve number was determined for the proposed and existing basins. A detailed curve number breakdown can be seen in APPENDIX C. Calculations can also be seen in APPENDIX D and E as part of the HydroCAD report.

c. Time of Concentration

Time of concentration is the time it takes for the runoff to get from the most hydrologically distant location to the point of collection for the basin. The flow path is broken up into three segments, with the hydrologic travel time calculated separate for each segment.

- Sheet flow- flow over plane surfaces which usually occurs at the headwaters of a catchment area. The maximum allowable length for sheet flow is 300-ft
- Shallow concentrated flow-flow in headwater areas where flow begins to concentrate in small rills or rough channels
- Channel flow- flow that is concentrated in defined channels

The time of concentration is the total of the travel times for each flow segment. Time of concentration calculations can be seen in APPENDIX D and E as part of the HydroCAD report.

d. Flow Calculations

HydroCAD uses all of the inputs described above in order to determine the peak flows for various storm events. All the inputs are combined to create an instantaneous hydrograph which is then routed through a modeled reservoir with a time delay equal to the time of concentration in order to generate the runoff hydrograph. The runoff hydrograph can be found in APPENDIX D and E as part of the HydroCAD report. The peak runoff values for the 2, 10, 25 and 100-year storms for each basin can be seen below in Table 2.

Table 2: Flow rates

Q (cfs)				
Time Span	**2-yr**	10-yr	**25-yr**	100-yr
Existing Basin 1	**0.00**	0.00	**0.03**	0.10
Existing Basin 2	**0.00**	0.04	**0.18**	0.47
Proposed Basin 1	**0.02**	0.03	**0.04**	0.11
Proposed Basin 2	**0.00**	0.05	**0.20**	0.54

V. HYDROLOGIC ANALYSIS

As seen in the calculated peak flow rates, the increased runoff due to proposed site development is minimal. For Basin 1, the 2-yr peak flow is increased by 0.02 cfs and the 25-yr peak flow is increased by 0.01 cfs. For Basin 2, the 2-yr peak flow remains at 0 cfs and the 25-yr peak flow is increased by 0.02 cfs. Typically, *SWMMEW* requires developments to release runoff at or below one half of the existing 2-yr peak flow and at or below the existing 25-yr peak flow, as well as for that runoff to be treated.

Per Chapter 2.2.6 of the *SWMMEW* there are exemptions for new development when flow control is not required as long as certain conditions are met. Per chapter 2.6.6 exemption 1, states: "Any project able to disperse, without discharging to surface waters, the total 25-year runoff volume for the proposed development condition" is exempt from meeting the flow control requirements. The Urtica project will use full dispersion as the main way to handle increased flows due to impervious areas. As outlined in *SWMMEW* Chapter 6.5, BMP F6.42, full dispersion allows up to 10% of the site that is impervious to be characterized as non-effective impervious area by dispersing runoff into the native vegetation area. On the Urtica site, the impervious areas may conservatively make up to 3.2% of the site while the rest of the site maintains plantings similar to existing vegetation. This is under the 10% threshold, making full dispersion a viable option.

Chapter 2.2.5 of the *SWMMEW* summarizes the requirements for treating storm water runoff to reduce pollutant loads and concentrations. Runoff treatment is required for all projects creating 5,000 square feet or more of pollutant-generating impervious surfaces (PGIS). The Urtica site is not classified as a high use site and all of the proposed impervious surfaces are considered Non-Pollutant Generating Impervious Surfaces (NPGIS). Infrequently used maintenance access roads are classified as NPGIS, and thus are exempt from basic treatment requirements. The solar panels are detached impervious surfaces which the water flows off of and into natural vegetation below. The inverter pads are concrete pads, which the inverters and transformers sit on. The inverters contain no fluids. The transformers may be "dry", meaning they contain no fluids, or they may contain fluids, that has not been finalized yet. If they do contain fluid, it would be Envirotemp or a similar biodegradable vegetable based coolant. Therefore, the inverter pads will be considered NPGIS as well, however if that classification is challenged, they make up no more than 3,600 square feet, which is below the 5,000 square feet threshold. The Urtica site meets the exemption requirement, therefore no treatment measures will be necessary or put in place.

While analyzing the effects of increased storm water runoff, it is also important to note any other changes that will occur on the site due to the development. One thing of note on the Urtica site is that it is currently cultivated using flood irrigation methods. In this method, an excess amount of water is delivered to the site for irrigation, and the general assumption is that half of the applied water actually goes to the crop while the other half is lost to evaporation, runoff, infiltration or transpiration (*Alliance for Water Efficiency: Flood Irrigation Introduction*). With the construction of this project, the flood irrigation will be minimized, if not stopped completely. The net loss of surface water due to reducing flood irrigation will be greater than the minimal increases in stormwater runoff due to the construction associated with the solar panel farm. Therefore, the additional runoff of the peak 2-yr and 25-yr storms ranging from 0.00 and 0.02 cfs, is considered negligible when analyzing the site as a whole.

VI. COMPLIANCE WITH *SWMMEW* CORE ELEMENTS

All new development projects must comply with the 8 Core Elements outlined in Chapter 2 in the *SWMMEW* when applicable. Exemptions exist for each Core Element and vary depending on requirements that must be met. The Core Elements are listed below in relation to the proposed development of the Tuusso Energy: Urtica Solar Project, and exemptions are noted when applicable.

1. Preparation of a Stormwater Site Plan:
    - This can be seen in Figure 2- Proposed Drainage Basin Map, and will be included in the civil plans.
2. Construction Stormwater Pollution Prevention:
    - This will be included as part of the SWPPP submittal.
3. Source Control Pollution
    - The only potential fluid on the site is a biodegradable vegetable based coolant, which is not classified as a pollutant. Therefore, no point source pollutants are on the site.
4. Preservation of Natural Drainage Systems
    - Minimal grading will occur on site and natural drainage patterns will be maintained.
5. Runoff Treatment
    - The site satisfies the requirement for full dispersion and is not a high use site, making it exempt from runoff treatment.
6. Flow Control
    - Per Exemption 1 in chapter 2.6.6 of *SWMMEW*, the site will use full dispersion to control the 2 and 25-yr flows.
7. Operation and Maintenance
    - No on-site maintenance is required for full dispersion. Maintenance of the existing drainage ditches will be performed by the current landowner.
8. Local Requirements
    - There are no local ordinances above and beyond what is outlined in *SWMMEW*

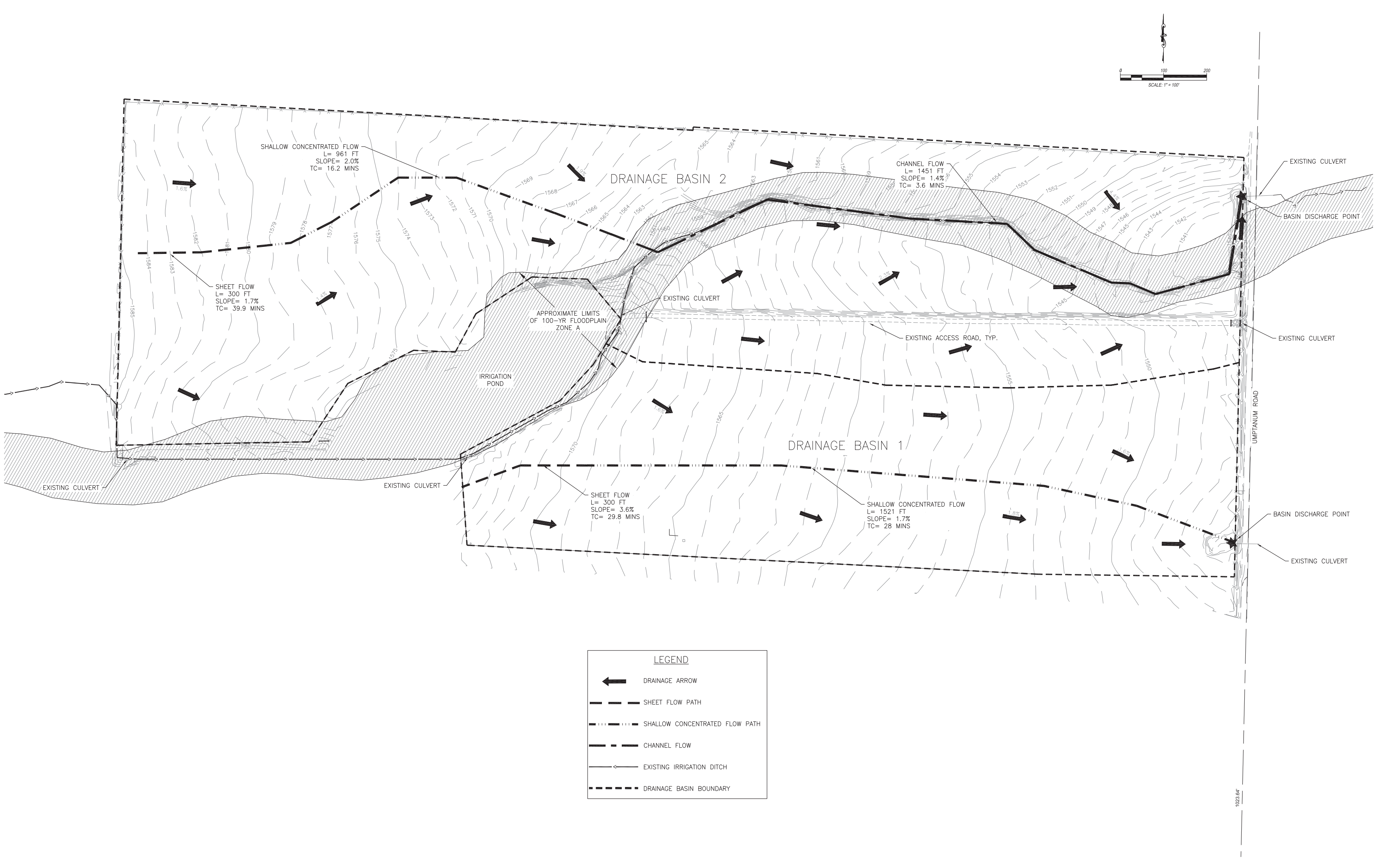
VII. CONCLUSION

The Tuusso Energy: Urtica Solar Project involves transforming 53.49 acres of an existing hay field, into a solar project. The project consists of adding an array of solar panels, an access road, and the

associated electrical infrastructure. Existing topography will be preserved to the maximum extent possible and native plantings will be made throughout the site. From a stormwater and drainage standpoint, the biggest impacts of the project will be from converting 1.67 acres into impervious surfaces in the form of an all-weather access road, electrical infrastructure, and posts for the solar trackers. 1.67 acres is an overestimate of impervious area, as it maxes out the percentage of impervious to pervious surfaces based on the design of the solar panel trackers. All site and location factors were taken into account in order to perform the SBUH hydrologic modelling method. The calculations from the modelling showed that the runoff generated from the 2-yr storm increased from 0.00 cfs to 0.02 cfs for Basin 1, and remained the same at 0.00 cfs for Basin 2. Runoff generated from the 25-yr storm increased from 0.03 cfs to 0.04 cfs for Basin 1 and from 0.18 cfs to 0.20 cfs for Basin 2. This increased runoff can be handled by full dispersion throughout the site, due to protecting a majority of the existing vegetation. The increased runoff is also considered negligible, due to the reduction of flood irrigation to the site which will accompany the project.

TUUSSO ENERGY - URTICA SITE

A PORTION OF THE SW 1/4 SECTION 10, T. 17 N., R. 18 E., W.M.
KITTITAS COUNTY, STATE OF WASHINGTON



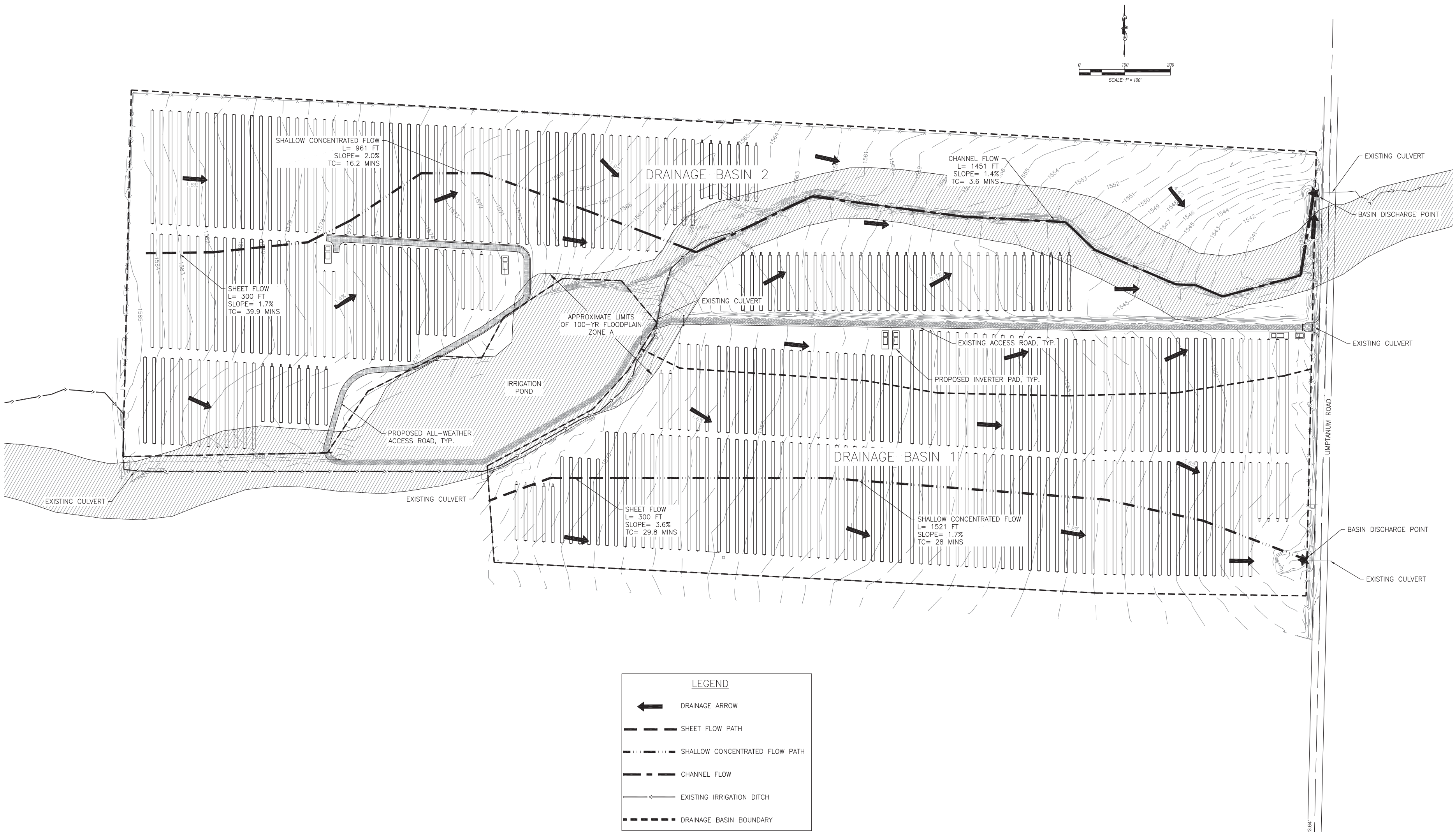
TUUSSO ENERGY, LLC
URTICA SITE
EXISTING DRAINAGE CONDITIONS

Encompass
ENGINEERING & SURVEYING
Western Washington Division
165 NE Juniper Street, Suite 201 • Issaquah, WA 98027 • Phone: (425) 392-0250 • Fax: (425) 391-3055
Eastern Washington Division
407 Swiftwater Blvd. • Cle Elum, WA 98922 • Phone: (509) 674-7433 • Fax: (509) 674-7419

JOB NO.	17016
DATE	July 2017
SCALE	AS SHOWN
DESIGNED	SF
DRAWN	SF
CHECKED	GG/MKK
APPROVED	TML
SHEET	FIG-1

TUUSSO ENERGY - URTICA SITE

A PORTION OF THE SW 1/4 SECTION 10, T. 17 N., R. 18 E., W.M.
KITTITAS COUNTY, STATE OF WASHINGTON



TUUSSO ENERGY, LLC

URTICA SITE

PROPOSED DRAINAGE CONDITIONS

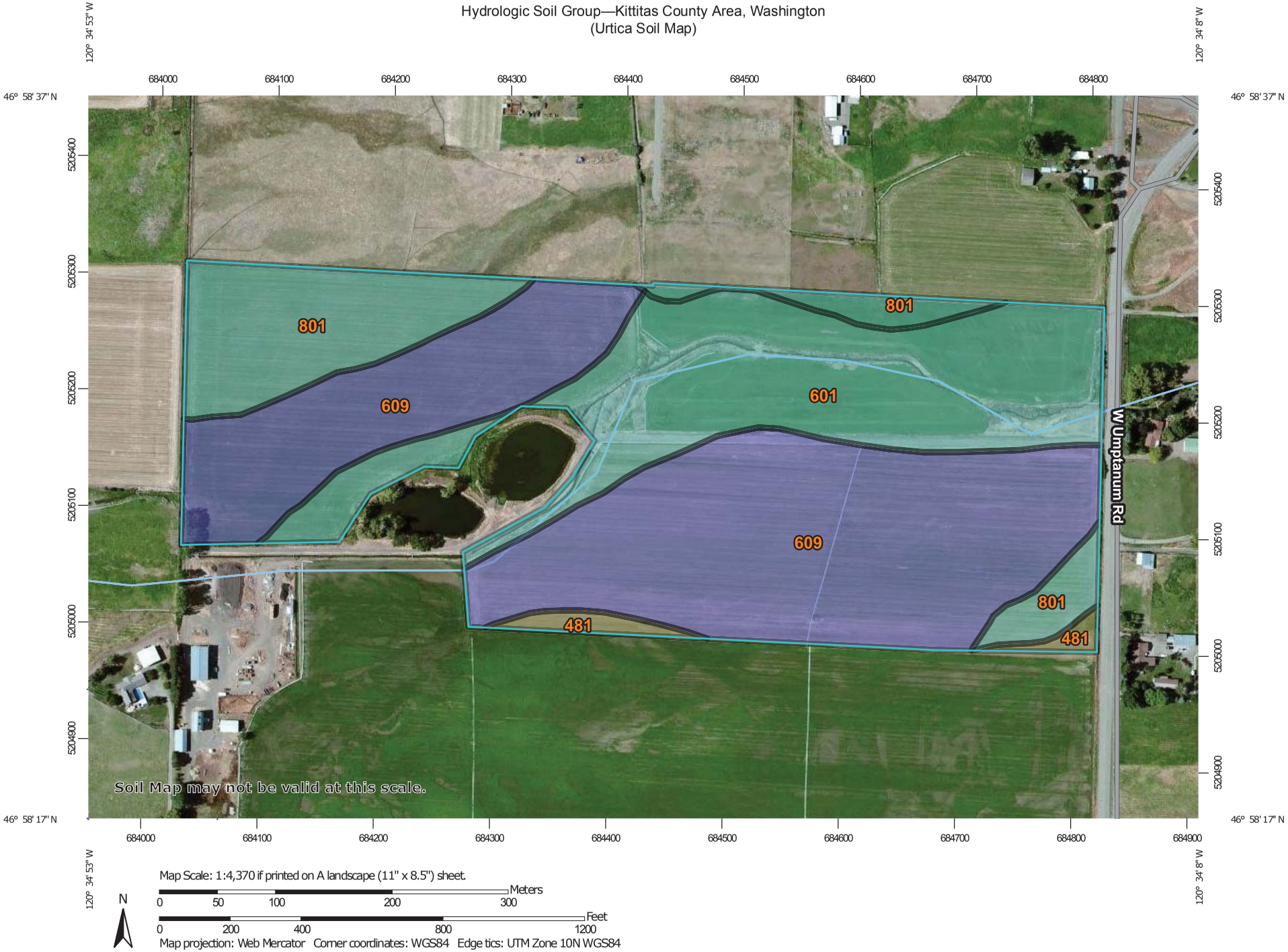
Encompass
ENGINEERING & SURVEYING
Western Washington Division
165 NE Juniper Street, Suite 201 • Issaquah, WA 98027 • Phone: (425) 392-0250 • Fax: (425) 391-3055
Eastern Washington Division
407 Swiftwater Blvd. • Cle Elum, WA 98922 • Phone: (509) 674-7433 • Fax: (509) 674-7419

JOB NO.	17018
DATE	July 2017
SCALE	AS SHOWN
DESIGNED	SF
DRAWN	SF
CHECKED	GG/MKK
APPROVED	TML
SHEET	FIG-2

Appendix A:

NRCS WEB SOIL SURVEY

Hydrologic Soil Group—Kittitas County Area, Washington
(Urtica Soil Map)



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Kittitas County Area, Washington
Survey Area Data: Version 9, Sep 9, 2016

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jul 19, 2010—Aug 19, 2010

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

K-5-14

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Kittitas County Area, Washington (WA637)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
481	Nanum ashy loam, 2 to 5 percent slopes	C/D	0.9	1.8%
601	Brickmill gravelly ashy loam, 0 to 2 percent slopes	C	15.4	29.9%
609	Ackna ashy loam, 0 to 2 percent slopes	B	26.9	52.3%
801	Brysill cobbly ashy loam, 0 to 2 percent slopes	C	8.3	16.1%
Totals for Area of Interest			**51.5**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

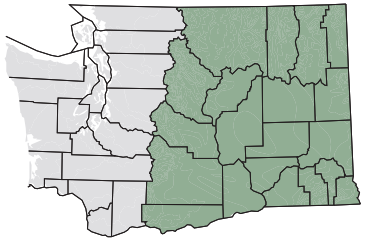
Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Appendix B:

SWMMEW ISOPLUVIAL MAPS

Eastern Washington Stormwater Manual



2-Year 24-Hour Isopluvials

Source: NOAA Atlas 2, Volume IX, 1973
Precipitation in inches

County(2003, 1:24,000)
City(2003, 1:24,000)
Latitude/Longitude(1/10 degree)
Isopluvial(1973, 1:2,000,000)
NOAA/NWS Station(1931-1998)

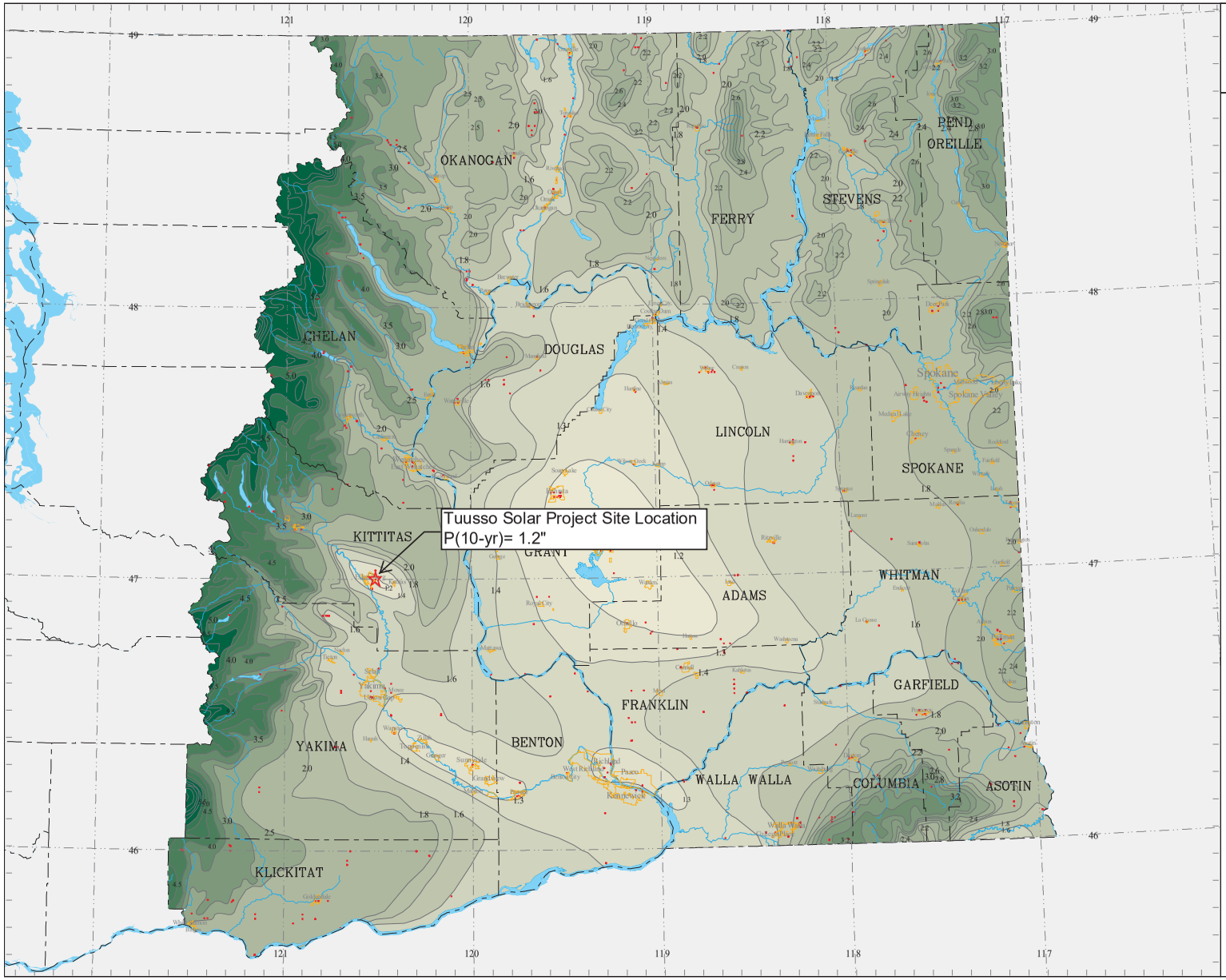
N

Scale 1:1,600,000
Miles
0 16.5 33

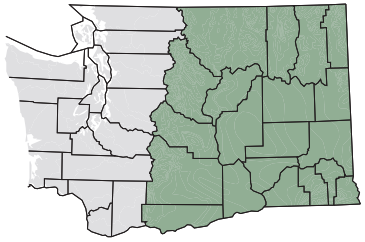
Water Quality Program

WASHINGTON STATE DEPARTMENT OF ECOLOGY

GIS Technical Services
02/25/04
Figure_4.3.3



Eastern Washington Stormwater Manual



10-Year 24-Hour Isopluvials

Source: NOAA Atlas 2, Volume IX, 1973
Precipitation in inches

County(2003, 1:24,000)
City(2003, 1:24,000)
Latitude/Longitude(1/10 degree)
Isopluvial(1973, 1:2,000,000)
NOAA/NWS Station(1931-1998)

N

Scale 1:1,600,000
Miles
0 16.5 33

Water Quality Program

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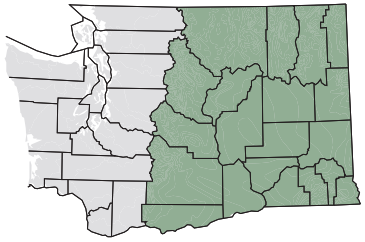
Eastern Washington Stormwater Manual



25-Year 24-Hour Isopluvials

Source: NOAA Atlas 2, Volume IX, 1973
Precipitation in inches

- County(2003, 1:24,000)
- City(2003, 1:24,000)
- Latitude/Longitude(1/10 degree)
- Isopluvial(1973, 1:2,000,000)
- NOAA/NWS Station(1931-1998)

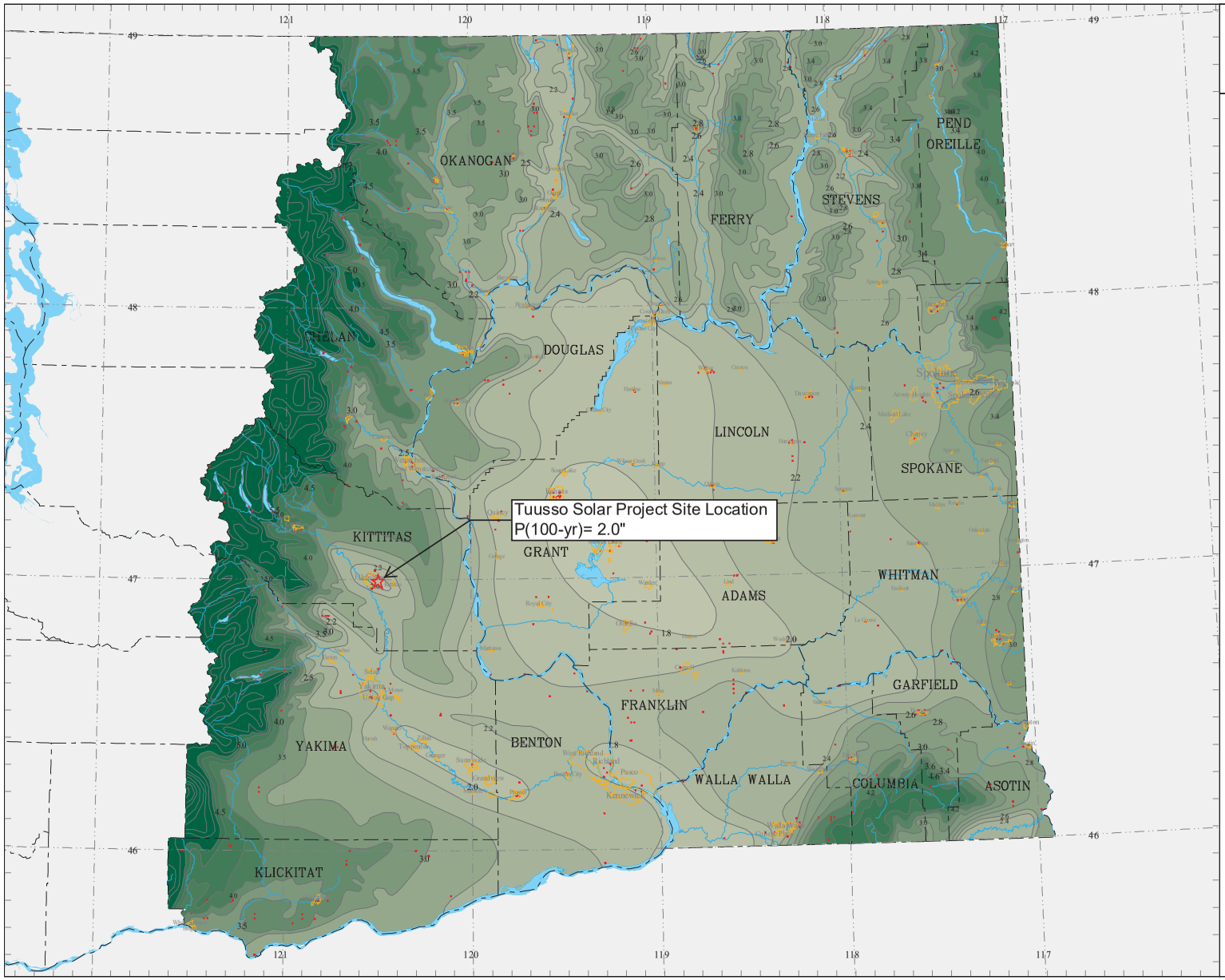
N

Scale 1:1,600,000
Miles
0 16.5 33

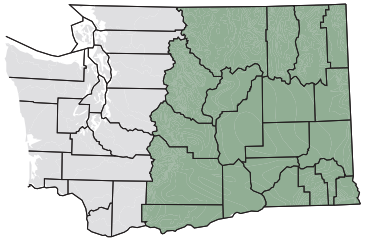
Water Quality Program

WASHINGTON STATE DEPARTMENT OF ECOLOGY

GIS Technical Services
02/25/04
Figure_4.3.5



Eastern Washington Stormwater Manual



100-Year 24-Hour Isopluvials

Source: NOAA Atlas 2, Volume IX, 1973
Precipitation in inches

County(2003, 1:24,000)
City(2003, 1:24,000)
Latitude/Longitude(1/10 degree)
Isopluvial(1973, 1:2,000,000)
NOAA/NWS Station(1931-1998)

Scale 1:1,600,000
Miles
0 16.5 33

Water Quality Program

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GIS Technical Services
02/25/04
Figure_4.3.7

Appendix C:

CURVE NUMBER CALCULATIONS

Predevelopment Conditions

Basin Name	Total Area (sf)	Total Area (ac)	Meadow (sf)	Meadow (ac)	HSG	CN	Meadow (sf)	Meadow (ac)	HSG	CN	Meadow (sf)	Meadow (ac)	HSG	CN	Dirt Road (sf)	Dirt Road (ac)	HSG	CN	**Composite CN**
Exisiting Basin 1	749232	17.20	631620	14.50	B	58	78408.00	1.80	C	71	39204.00	0.90	D	78	0.00	0.00	-	-	**60**
Existing Basin 2	1490892.4	34.23	540144	12.40	B	58	936308.42	21.49	C	71	0.00	0.00	D	78	14440.00	0.33	C	87	**66**

Postdevelopment Conditions

Basin Name	Total Area (sf)	Total Area (ac)	Impervious Area (sf)	Impervious Area (ac)	HSG	CN	Meadow (sf)	Meadow (ac)	HSG	CN	Meadow (sf)	Meadow (ac)	HSG	CN	Meadow (sf)	Meadow (ac)	HSG	CN	**Composite CN**
Proposed Basin 1	749232	17.20	9375.275	0.22	D	98	622244.73	14.28	B	58	78408.00	1.80	C	71	39204.00	0.90	D	78	**61**
Proposed Basin 2	1490892.4	34.23	62317.1	1.43	D	93	508985.45	11.68	B	58	919589.87	21.11	C	71	0.00	0.00	-	-	**67**

Impervious Area Break Down							Basin 1 Post Area					Basin 2 Post Area				
	Basin 1			Basin 2			Solar Trackers	Length	Width	#	area (sf)	Solar Trackers	Length	Width	#	area (sf)
							72 ft trackers	248	6.5	92	148304	72 ft trackers	248	6.5	105	169260
Lot or Tract	Area (sf)	CN classification	CN	Area (sf)	CN classification	CN	52 ft trackers	188	6.5	25	30550	52 ft trackers	188	6.5	29	35438
Road	0	Gravel	91	46280	Gravel	91	36 ft traclers	121	6.5	11	8651.5	36 ft trackers	121	6.5	56	44044
Inverters	0	Impervious	98	3600	Impervious	98				Total	187506				Total	248742
Post	9375	Impervious	98	12437	Impervious	98				assumed % impervious (posts)	5%				assumed % impervious (posts)	5%
		Composite CN	98		Composite CN	93				impervious area	9375.28				impervious area	12437.1

Appendix D:

HydroCAD REPORT:
EXISTING BASINS

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
14.500	58	HSG B Meadow (1S)
1.800	71	HSG C Meadow (1S)
0.900	78	HSG D Meadow (1S)

Ground Covers (selected nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	14.500	1.800	0.900	0.000	17.200		1S

Time span=5.00-72.00 hrs, dt=0.05 hrs, 1341 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Existing Basin 1 Runoff Area=17.200 ac 0.00% Impervious Runoff Depth=0.00"
Flow Length=1,821' Tc=57.8 min CN=60/0 Runoff=0.00 cfs 0.000 af

Summary for Subcatchment 1S: Existing Basin 1

[45] Hint: Runoff=Zero

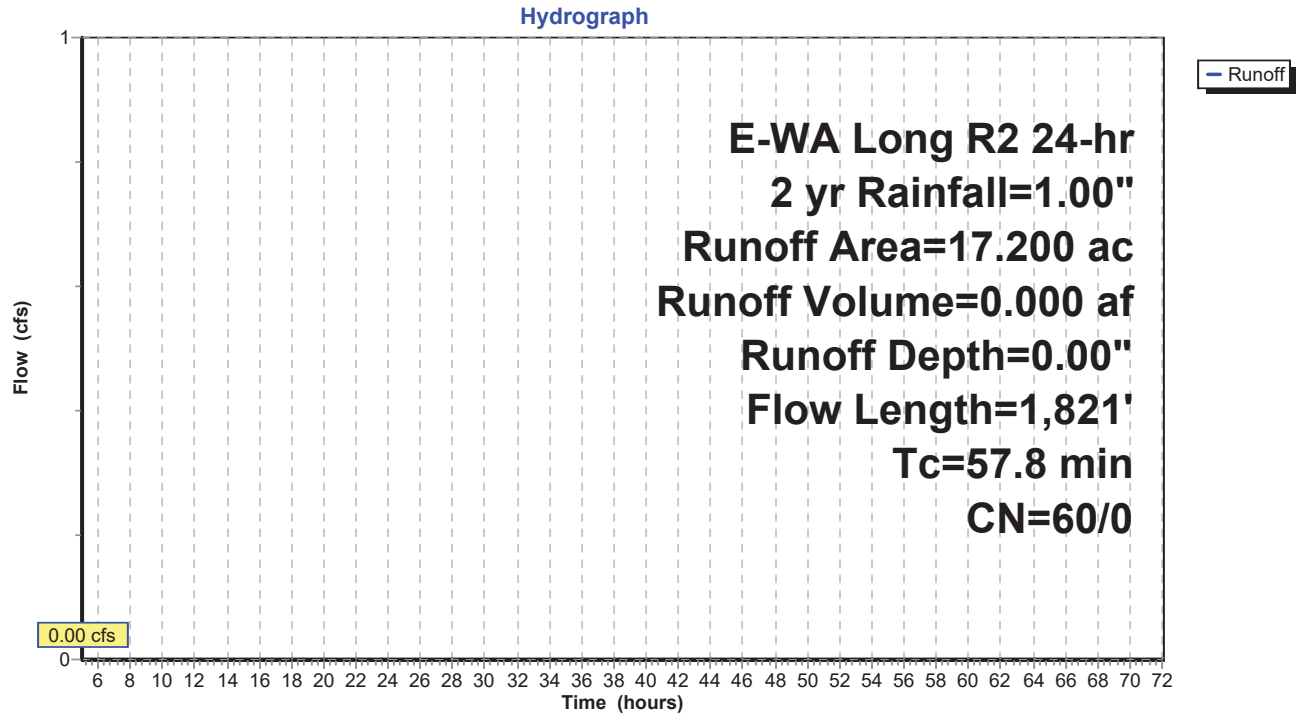
Runoff = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
E-WA Long R2 24-hr 2 yr Rainfall=1.00"

	Area (ac)	CN	Description
*	14.500	58	HSG B Meadow
*	1.800	71	HSG C Meadow
*	0.900	78	HSG D Meadow
	17.200	60	Weighted Average
	17.200	60	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
29.8	300	0.0360	0.17		**Sheet Flow,** Range n= 0.130 P2= 1.00"
28.0	1,521	0.0167	0.90		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
57.8	1,821	Total			

Subcatchment 1S: Existing Basin 1



Time span=5.00-72.00 hrs, dt=0.05 hrs, 1341 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Existing Basin 1 Runoff Area=17.200 ac 0.00% Impervious Runoff Depth=0.00"
Flow Length=1,821' Tc=57.8 min CN=60/0 Runoff=0.00 cfs 0.000 af

Summary for Subcatchment 1S: Existing Basin 1

[45] Hint: Runoff=Zero

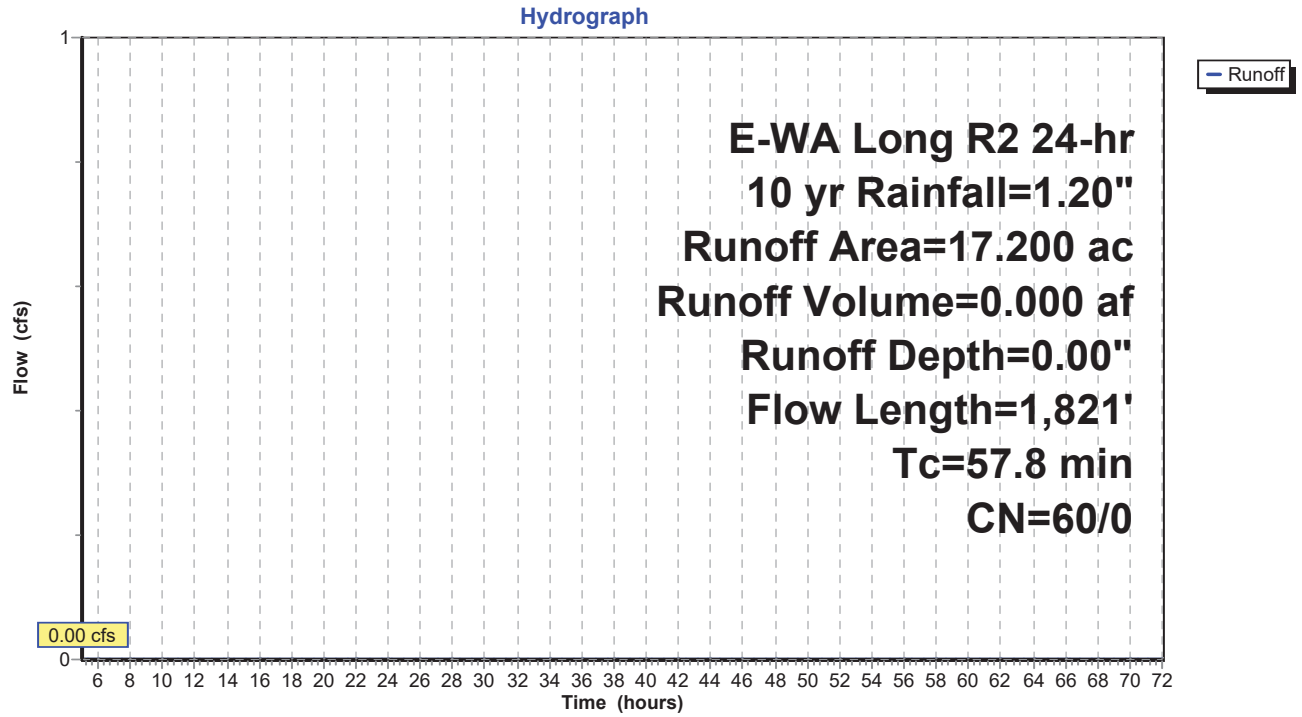
Runoff = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
E-WA Long R2 24-hr 10 yr Rainfall=1.20"

	Area (ac)	CN	Description
*	14.500	58	HSG B Meadow
*	1.800	71	HSG C Meadow
*	0.900	78	HSG D Meadow
	17.200	60	Weighted Average
	17.200	60	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
29.8	300	0.0360	0.17		**Sheet Flow,** Range n= 0.130 P2= 1.00"
28.0	1,521	0.0167	0.90		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
57.8	1,821	Total			

Subcatchment 1S: Existing Basin 1



Time span=5.00-72.00 hrs, dt=0.05 hrs, 1341 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Existing Basin 1 Runoff Area=17.200 ac 0.00% Impervious Runoff Depth=0.01"
Flow Length=1,821' Tc=57.8 min CN=60/0 Runoff=0.03 cfs 0.015 af

Summary for Subcatchment 1S: Existing Basin 1

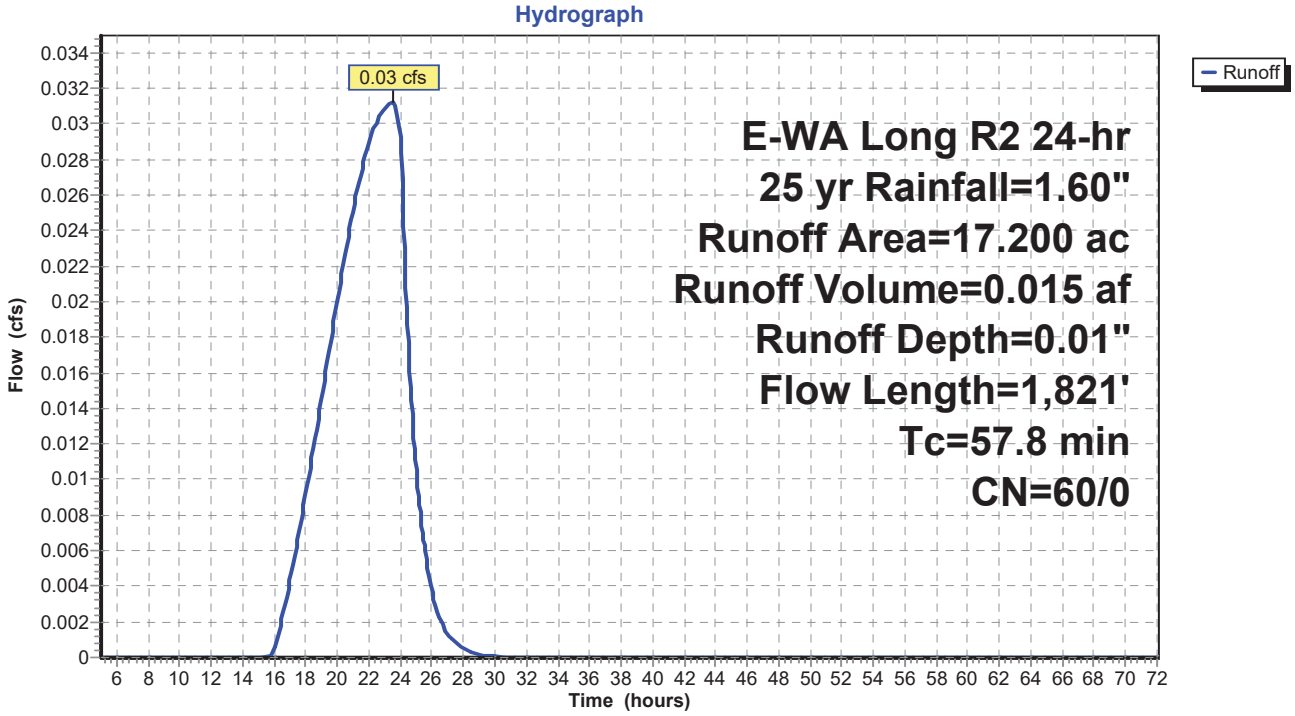
Runoff = 0.03 cfs @ 23.53 hrs, Volume= 0.015 af, Depth= 0.01"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
E-WA Long R2 24-hr 25 yr Rainfall=1.60"

	Area (ac)	CN	Description
*	14.500	58	HSG B Meadow
*	1.800	71	HSG C Meadow
*	0.900	78	HSG D Meadow
	17.200	60	Weighted Average
	17.200	60	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
29.8	300	0.0360	0.17		**Sheet Flow,** Range n= 0.130 P2= 1.00"
28.0	1,521	0.0167	0.90		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
57.8	1,821	Total			

Subcatchment 1S: Existing Basin 1



Time span=5.00-72.00 hrs, dt=0.05 hrs, 1341 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Existing Basin 1 Runoff Area=17.200 ac 0.00% Impervious Runoff Depth=0.06"
Flow Length=1,821' Tc=57.8 min CN=60/0 Runoff=0.10 cfs 0.087 af

Summary for Subcatchment 1S: Existing Basin 1

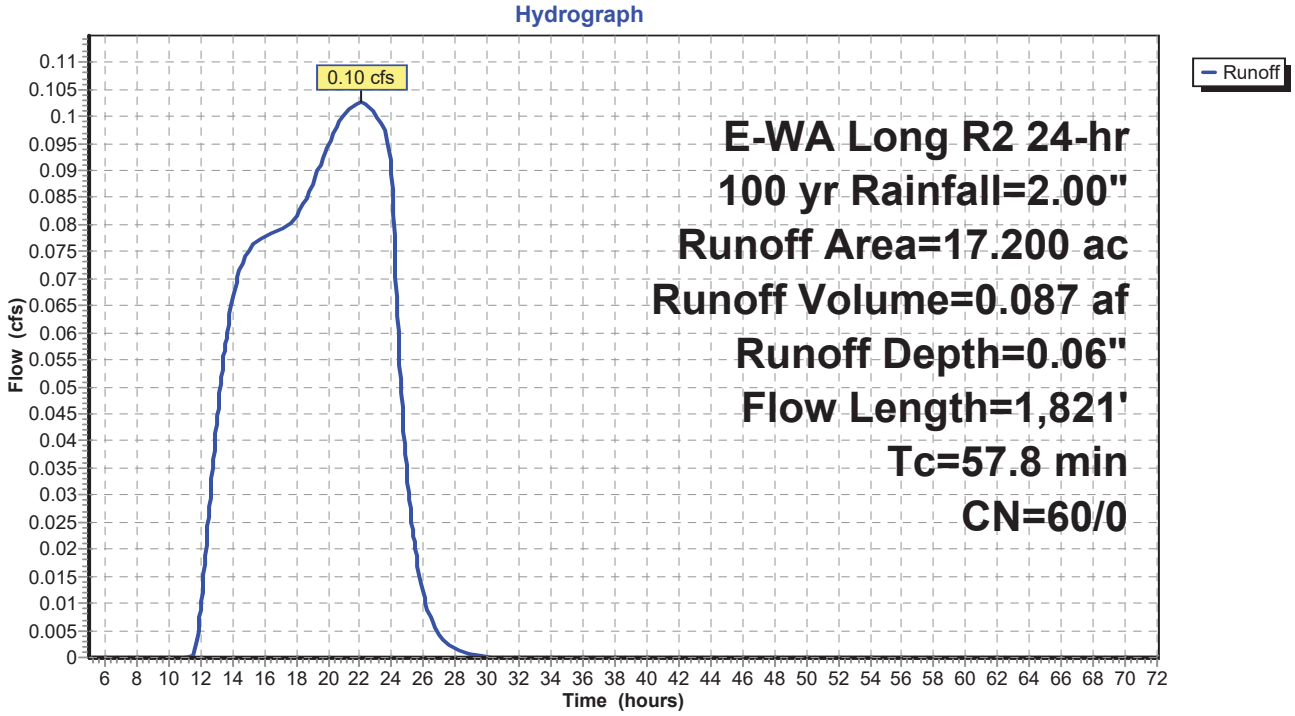
Runoff = 0.10 cfs @ 22.04 hrs, Volume= 0.087 af, Depth= 0.06"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
E-WA Long R2 24-hr 100 yr Rainfall=2.00"

	Area (ac)	CN	Description
*	14.500	58	HSG B Meadow
*	1.800	71	HSG C Meadow
*	0.900	78	HSG D Meadow
	17.200	60	Weighted Average
	17.200	60	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
29.8	300	0.0360	0.17		**Sheet Flow,** Range n= 0.130 P2= 1.00"
28.0	1,521	0.0167	0.90		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
57.8	1,821	Total			

Subcatchment 1S: Existing Basin 1



Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.330	87	Dirt Road (2S)
12.400	58	HSG B Meadow (2S)
21.490	71	HSG C Meadow (2S)

Ground Covers (selected nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	12.400	21.490	0.000	0.000	33.890		2S
0.000	0.000	0.000	0.000	0.330	0.330	Dirt Road	2S

Time span=5.00-72.00 hrs, dt=0.05 hrs, 1341 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 2S: Existing Basin 2 Runoff Area=34.220 ac 0.00% Impervious Runoff Depth=0.00"
Flow Length=2,712' Tc=59.7 min CN=66/0 Runoff=0.00 cfs 0.000 af

Summary for Subcatchment 2S: Existing Basin 2

[45] Hint: Runoff=Zero

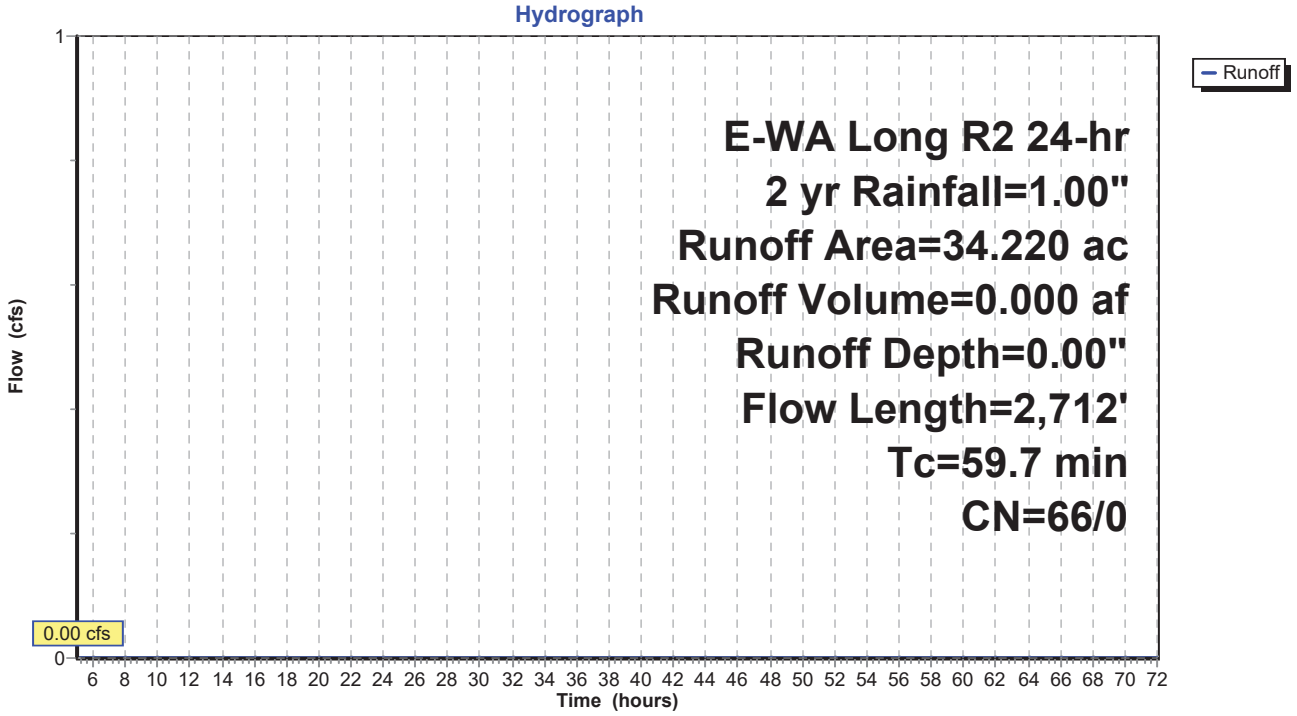
Runoff = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
E-WA Long R2 24-hr 2 yr Rainfall=1.00"

	Area (ac)	CN	Description
*	12.400	58	HSG B Meadow
*	21.490	71	HSG C Meadow
*	0.330	87	Dirt Road
	34.220	66	Weighted Average
	34.220	66	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
39.9	300	0.0173	0.13		**Sheet Flow,** Range n= 0.130 P2= 1.00"
16.2	961	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.6	1,451	0.0141	6.67	233.45	**Channel Flow,** Area= 35.0 sf Perim= 23.0' r= 1.52' n= 0.035 Earth, dense weeds
59.7	2,712	Total			

Subcatchment 2S: Existing Basin 2



Time span=5.00-72.00 hrs, dt=0.05 hrs, 1341 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 2S: Existing Basin 2 Runoff Area=34.220 ac 0.00% Impervious Runoff Depth=0.01"
Flow Length=2,712' Tc=59.7 min CN=66/0 Runoff=0.04 cfs 0.015 af

Summary for Subcatchment 2S: Existing Basin 2

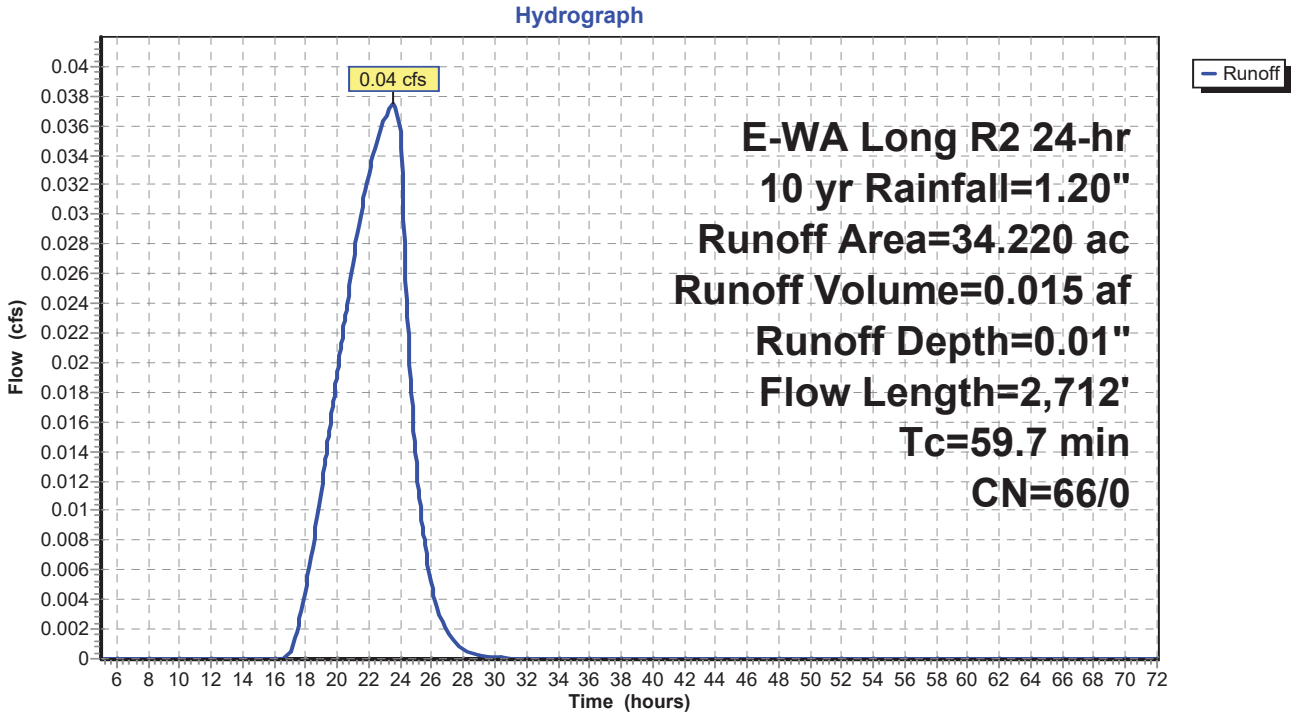
Runoff = 0.04 cfs @ 23.58 hrs, Volume= 0.015 af, Depth= 0.01"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
E-WA Long R2 24-hr 10 yr Rainfall=1.20"

	Area (ac)	CN	Description
*	12.400	58	HSG B Meadow
*	21.490	71	HSG C Meadow
*	0.330	87	Dirt Road
	34.220	66	Weighted Average
	34.220	66	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
39.9	300	0.0173	0.13		**Sheet Flow,** Range n= 0.130 P2= 1.00"
16.2	961	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.6	1,451	0.0141	6.67	233.45	**Channel Flow,** Area= 35.0 sf Perim= 23.0' r= 1.52' n= 0.035 Earth, dense weeds
59.7	2,712	Total			

Subcatchment 2S: Existing Basin 2



Time span=5.00-72.00 hrs, dt=0.05 hrs, 1341 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 2S: Existing Basin 2 Runoff Area=34.220 ac 0.00% Impervious Runoff Depth=0.06"
Flow Length=2,712' Tc=59.7 min CN=66/0 Runoff=0.18 cfs 0.162 af

Summary for Subcatchment 2S: Existing Basin 2

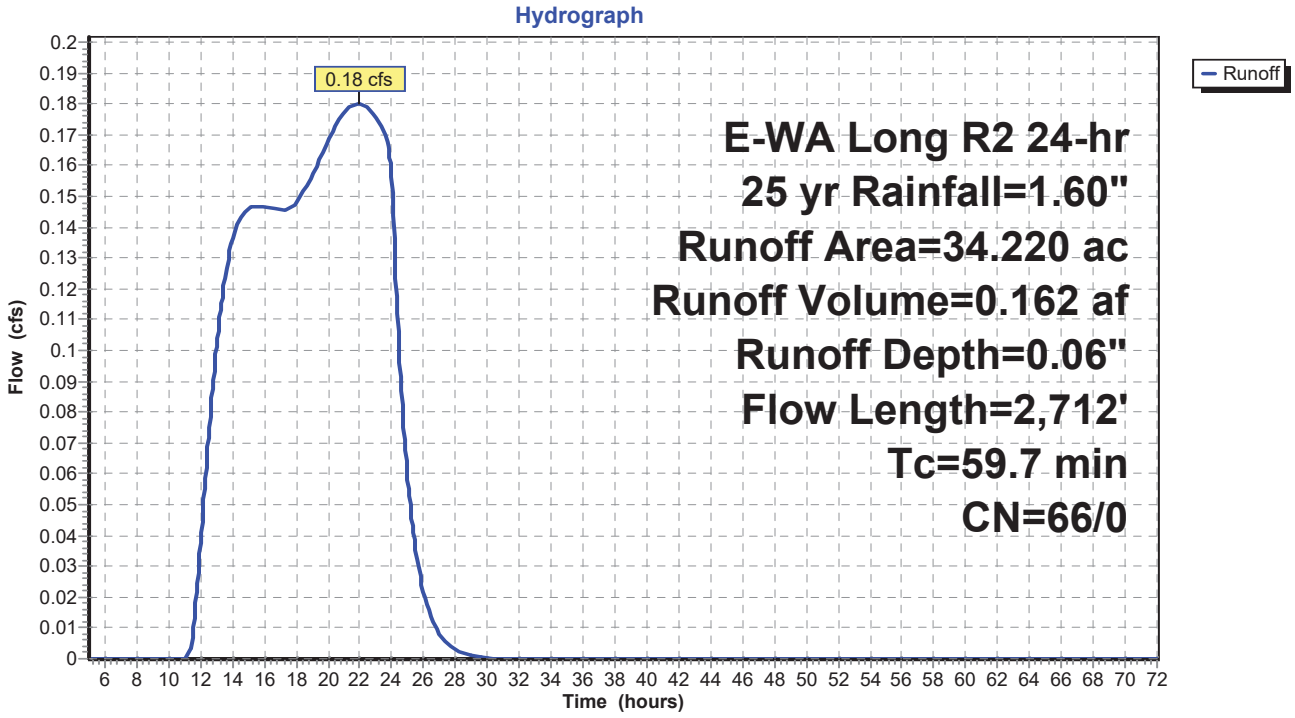
Runoff = 0.18 cfs @ 21.95 hrs, Volume= 0.162 af, Depth= 0.06"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
E-WA Long R2 24-hr 25 yr Rainfall=1.60"

	Area (ac)	CN	Description
*	12.400	58	HSG B Meadow
*	21.490	71	HSG C Meadow
*	0.330	87	Dirt Road
	34.220	66	Weighted Average
	34.220	66	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
39.9	300	0.0173	0.13		**Sheet Flow,** Range n= 0.130 P2= 1.00"
16.2	961	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.6	1,451	0.0141	6.67	233.45	**Channel Flow,** Area= 35.0 sf Perim= 23.0' r= 1.52' n= 0.035 Earth, dense weeds
59.7	2,712	Total			

Subcatchment 2S: Existing Basin 2



Time span=5.00-72.00 hrs, dt=0.05 hrs, 1341 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 2S: Existing Basin 2 Runoff Area=34.220 ac 0.00% Impervious Runoff Depth=0.15"
Flow Length=2,712' Tc=59.7 min CN=66/0 Runoff=0.47 cfs 0.438 af

Summary for Subcatchment 2S: Existing Basin 2

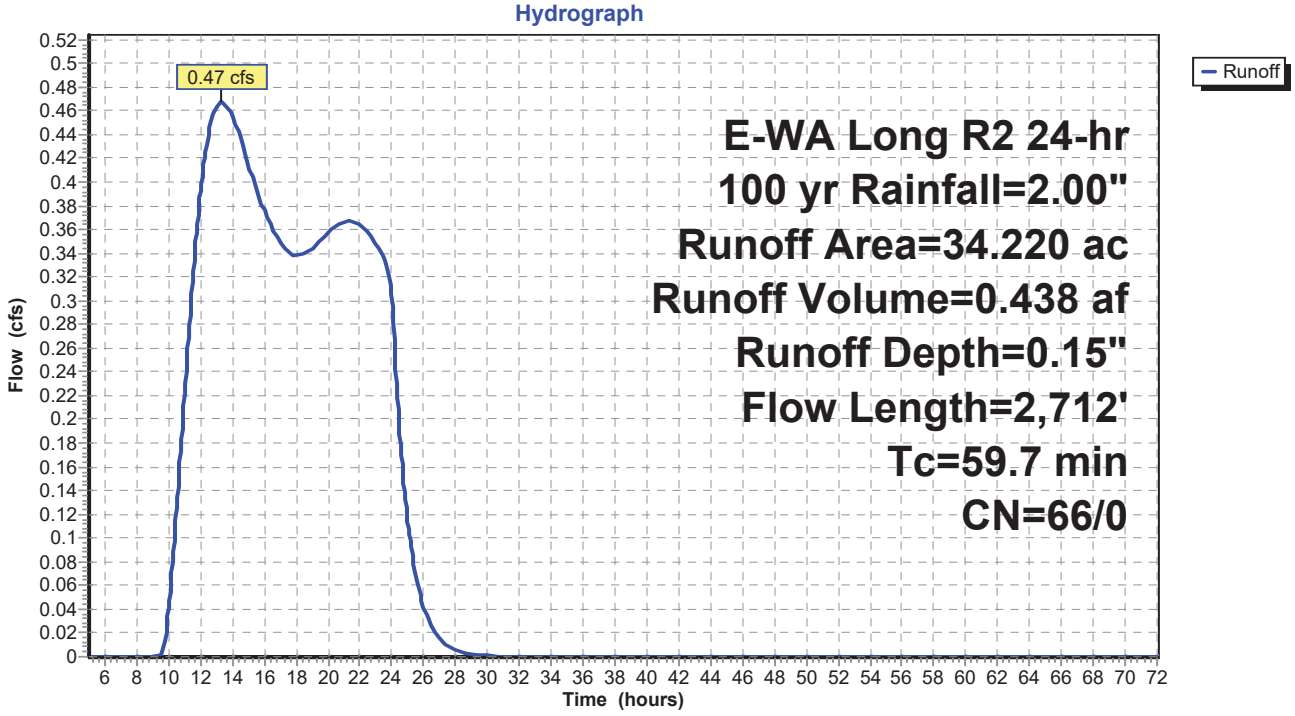
Runoff = 0.47 cfs @ 13.33 hrs, Volume= 0.438 af, Depth= 0.15"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
E-WA Long R2 24-hr 100 yr Rainfall=2.00"

	Area (ac)	CN	Description
*	12.400	58	HSG B Meadow
*	21.490	71	HSG C Meadow
*	0.330	87	Dirt Road
	34.220	66	Weighted Average
	34.220	66	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
39.9	300	0.0173	0.13		**Sheet Flow,** Range n= 0.130 P2= 1.00"
16.2	961	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.6	1,451	0.0141	6.67	233.45	**Channel Flow,** Area= 35.0 sf Perim= 23.0' r= 1.52' n= 0.035 Earth, dense weeds
59.7	2,712	Total			

Subcatchment 2S: Existing Basin 2



Appendix E:

HydroCAD REPORT:
PROPOSED BASINS

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.220	98	Impervious Areas (3S)
14.280	58	Meadow HSG B (3S)
1.800	71	Meadow HSG C (3S)
0.900	78	Meadow HSG D (3S)

Ground Covers (selected nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	0.000	0.220	0.220	Impervious Areas	3S
0.000	14.280	1.800	0.900	0.000	16.980	Meadow	3S

Time span=5.00-72.00 hrs, dt=0.05 hrs, 1341 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 3S: Proposed Basin 1 Runoff Area=17.200 ac 1.28% Impervious Runoff Depth>0.01"
Flow Length=1,821' Tc=57.8 min CN=60/98 Runoff=0.02 cfs 0.014 af

Summary for Subcatchment 3S: Proposed Basin 1

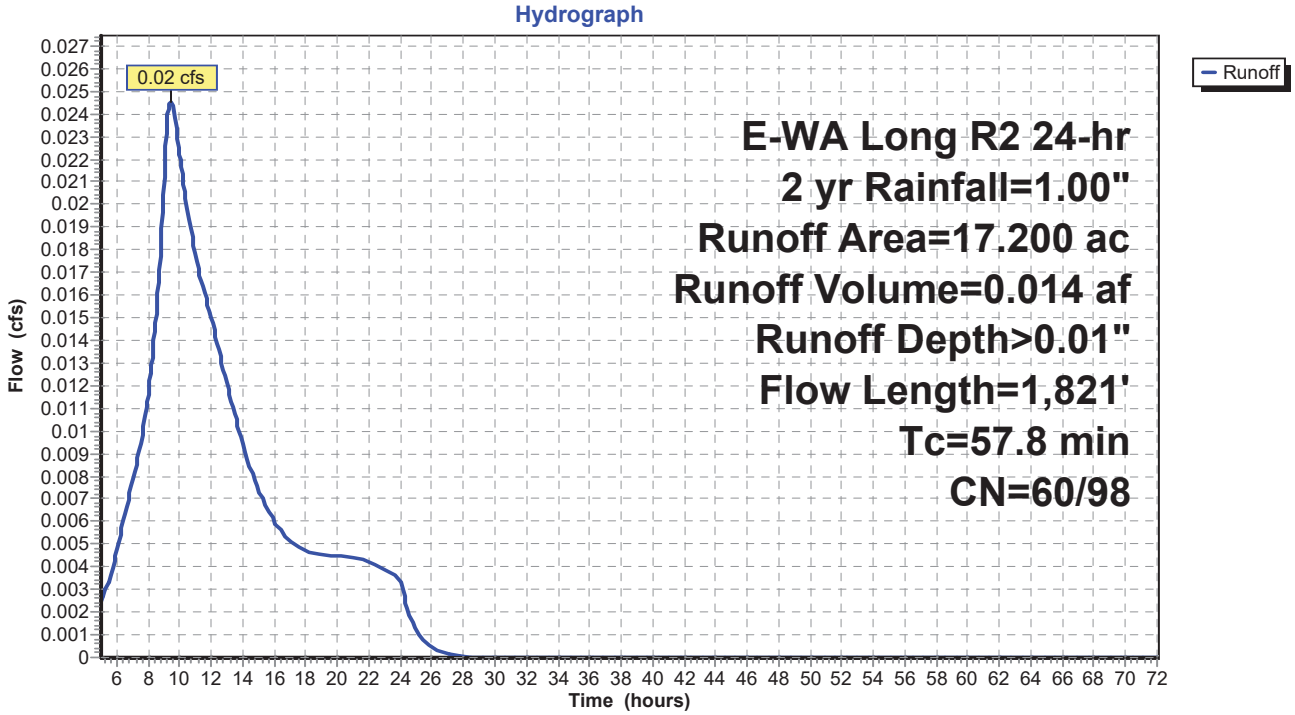
Runoff = 0.02 cfs @ 9.43 hrs, Volume= 0.014 af, Depth> 0.01"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
E-WA Long R2 24-hr 2 yr Rainfall=1.00"

	Area (ac)	CN	Description
*	0.220	98	Impervious Areas
*	14.280	58	Meadow HSG B
*	1.800	71	Meadow HSG C
*	0.900	78	Meadow HSG D
	17.200	61	Weighted Average
	16.980	60	98.72% Pervious Area
	0.220	98	1.28% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
29.8	300	0.0360	0.17		**Sheet Flow,** Range n= 0.130 P2= 1.00"
28.0	1,521	0.0167	0.90		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
57.8	1,821	Total			

Subcatchment 3S: Proposed Basin 1



Time span=5.00-72.00 hrs, dt=0.05 hrs, 1341 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 3S: Proposed Basin 1 Runoff Area=17.200 ac 1.28% Impervious Runoff Depth>0.01"
Flow Length=1,821' Tc=57.8 min CN=60/98 Runoff=0.03 cfs 0.018 af

Summary for Subcatchment 3S: Proposed Basin 1

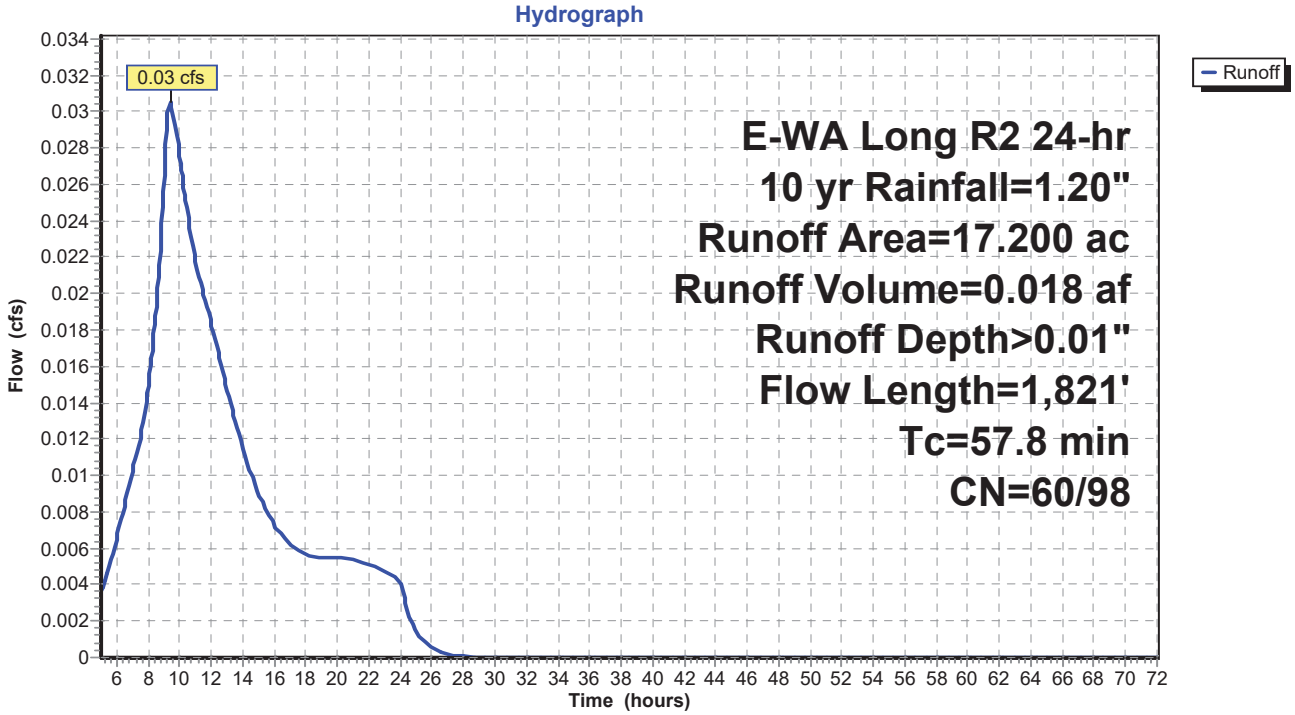
Runoff = 0.03 cfs @ 9.42 hrs, Volume= 0.018 af, Depth> 0.01"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
E-WA Long R2 24-hr 10 yr Rainfall=1.20"

	Area (ac)	CN	Description
*	0.220	98	Impervious Areas
*	14.280	58	Meadow HSG B
*	1.800	71	Meadow HSG C
*	0.900	78	Meadow HSG D
	17.200	61	Weighted Average
	16.980	60	98.72% Pervious Area
	0.220	98	1.28% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
29.8	300	0.0360	0.17		**Sheet Flow,** Range n= 0.130 P2= 1.00"
28.0	1,521	0.0167	0.90		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
57.8	1,821	Total			

Subcatchment 3S: Proposed Basin 1



Time span=5.00-72.00 hrs, dt=0.05 hrs, 1341 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 3S: Proposed Basin 1 Runoff Area=17.200 ac 1.28% Impervious Runoff Depth>0.03"
Flow Length=1,821' Tc=57.8 min CN=60/98 Runoff=0.04 cfs 0.039 af

Summary for Subcatchment 3S: Proposed Basin 1

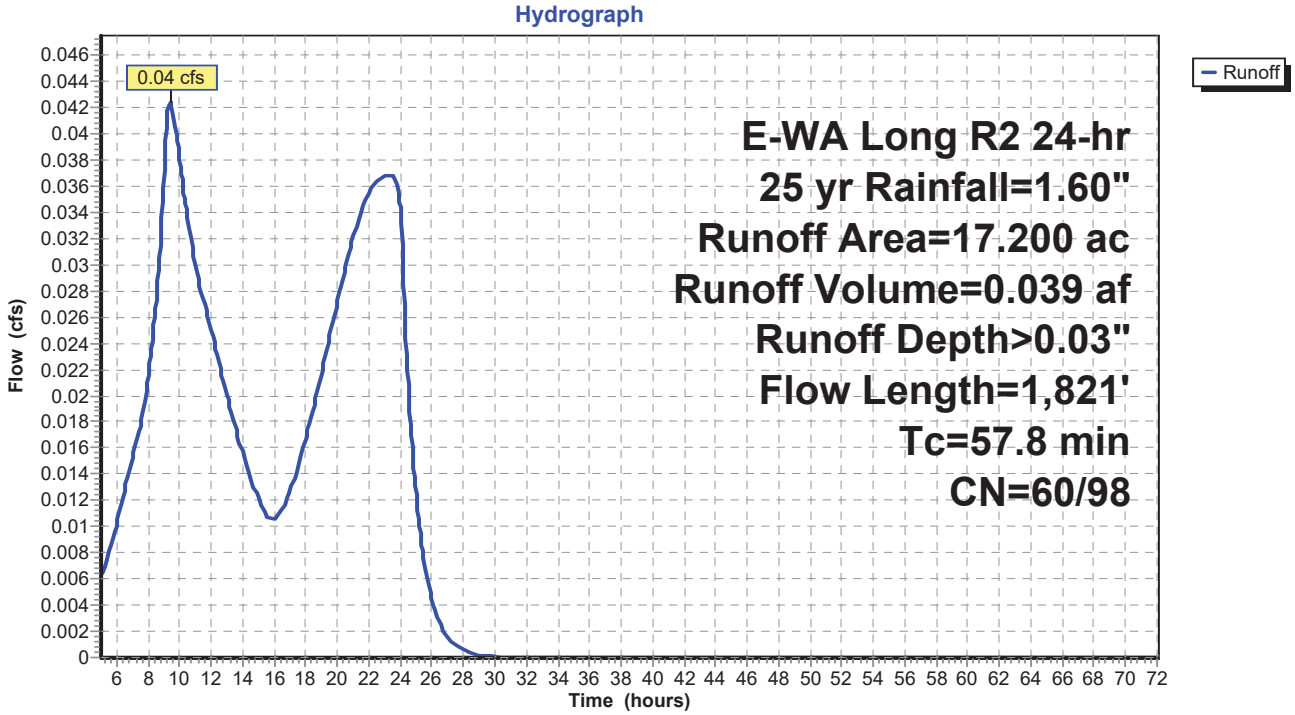
Runoff = 0.04 cfs @ 9.41 hrs, Volume= 0.039 af, Depth> 0.03"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
E-WA Long R2 24-hr 25 yr Rainfall=1.60"

	Area (ac)	CN	Description
*	0.220	98	Impervious Areas
*	14.280	58	Meadow HSG B
*	1.800	71	Meadow HSG C
*	0.900	78	Meadow HSG D
	17.200	61	Weighted Average
	16.980	60	98.72% Pervious Area
	0.220	98	1.28% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
29.8	300	0.0360	0.17		**Sheet Flow,** Range n= 0.130 P2= 1.00"
28.0	1,521	0.0167	0.90		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
57.8	1,821	Total			

Subcatchment 3S: Proposed Basin 1



Time span=5.00-72.00 hrs, dt=0.05 hrs, 1341 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 3S: Proposed Basin 1 Runoff Area=17.200 ac 1.28% Impervious Runoff Depth>0.08"
Flow Length=1,821' Tc=57.8 min CN=60/98 Runoff=0.11 cfs 0.117 af

Summary for Subcatchment 3S: Proposed Basin 1

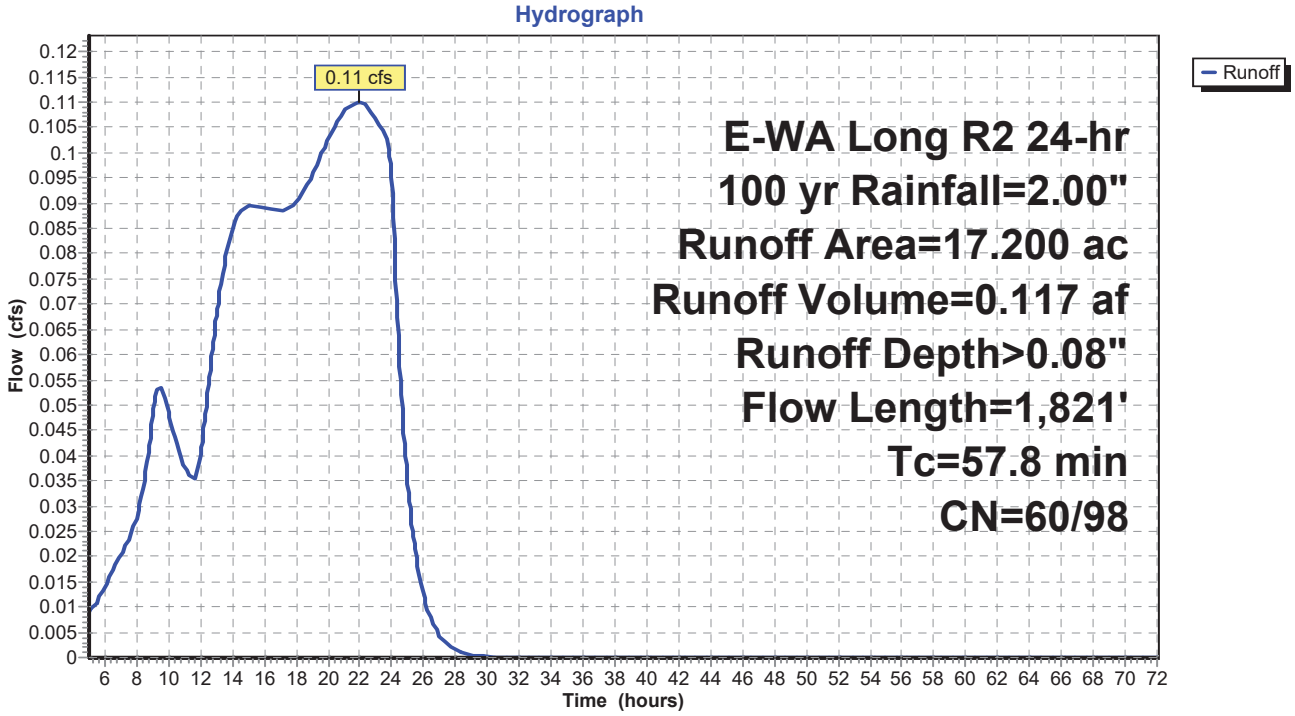
Runoff = 0.11 cfs @ 21.94 hrs, Volume= 0.117 af, Depth> 0.08"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
E-WA Long R2 24-hr 100 yr Rainfall=2.00"

	Area (ac)	CN	Description
*	0.220	98	Impervious Areas
*	14.280	58	Meadow HSG B
*	1.800	71	Meadow HSG C
*	0.900	78	Meadow HSG D
	17.200	61	Weighted Average
	16.980	60	98.72% Pervious Area
	0.220	98	1.28% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
29.8	300	0.0360	0.17		**Sheet Flow,** Range n= 0.130 P2= 1.00"
28.0	1,521	0.0167	0.90		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
57.8	1,821	Total			

Subcatchment 3S: Proposed Basin 1



Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.430	93	Impervious (4S)
11.680	58	Meadow HSG B (4S)
21.110	71	Meadow HSG C (4S)

Ground Covers (selected nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	0.000	1.430	1.430	Impervious	4S
0.000	11.680	21.110	0.000	0.000	32.790	Meadow	4S

Time span=5.00-72.00 hrs, dt=0.05 hrs, 1341 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 4S: Proposed Basin 2 Runoff Area=34.220 ac 0.00% Impervious Runoff Depth=0.00"
Flow Length=2,712' Tc=59.7 min CN=67/0 Runoff=0.00 cfs 0.000 af

Summary for Subcatchment 4S: Proposed Basin 2

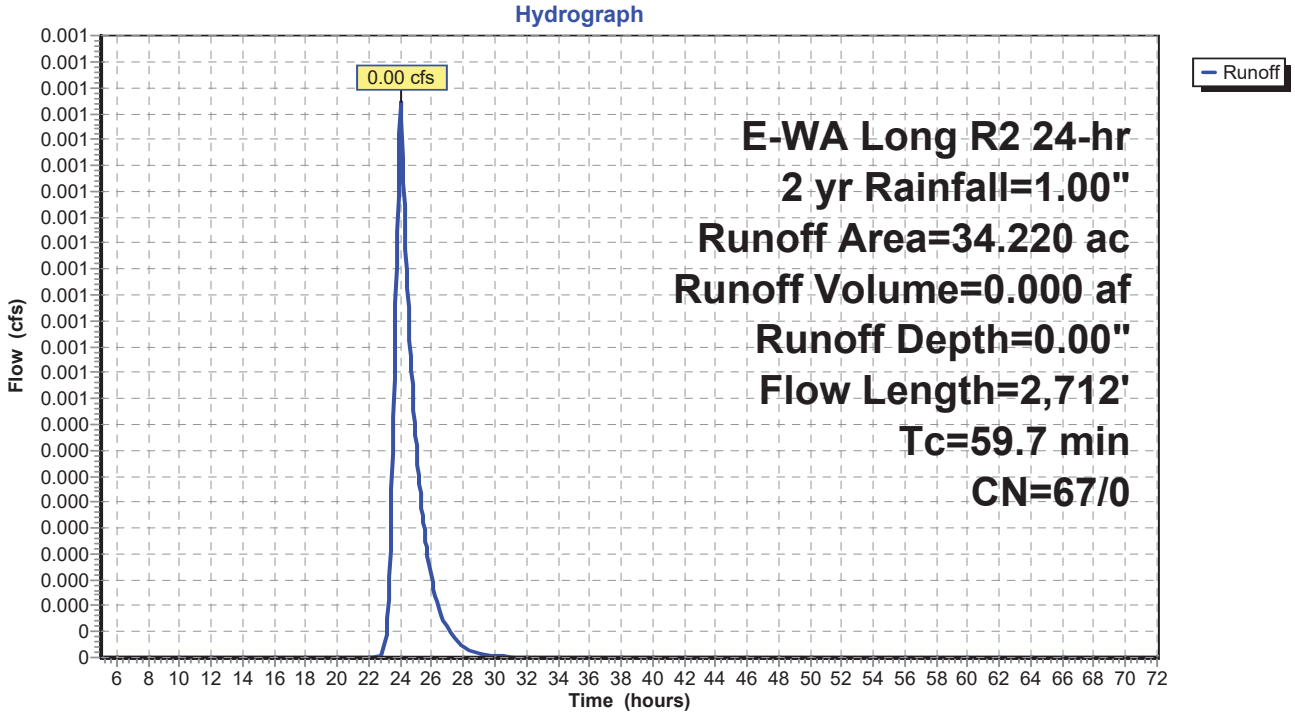
Runoff = 0.00 cfs @ 24.02 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
E-WA Long R2 24-hr 2 yr Rainfall=1.00"

	Area (ac)	CN	Description
*	1.430	93	Impervious
*	11.680	58	Meadow HSG B
*	21.110	71	Meadow HSG C
	34.220	67	Weighted Average
	34.220	67	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
39.9	300	0.0173	0.13		**Sheet Flow,** Range n= 0.130 P2= 1.00"
16.2	961	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.6	1,451	0.0141	6.67	233.45	**Channel Flow,** Area= 35.0 sf Perim= 23.0' r= 1.52' n= 0.035
59.7	2,712	Total			

Subcatchment 4S: Proposed Basin 2



Time span=5.00-72.00 hrs, dt=0.05 hrs, 1341 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 4S: Proposed Basin 2 Runoff Area=34.220 ac 0.00% Impervious Runoff Depth=0.01"
Flow Length=2,712' Tc=59.7 min CN=67/0 Runoff=0.05 cfs 0.026 af

Summary for Subcatchment 4S: Proposed Basin 2

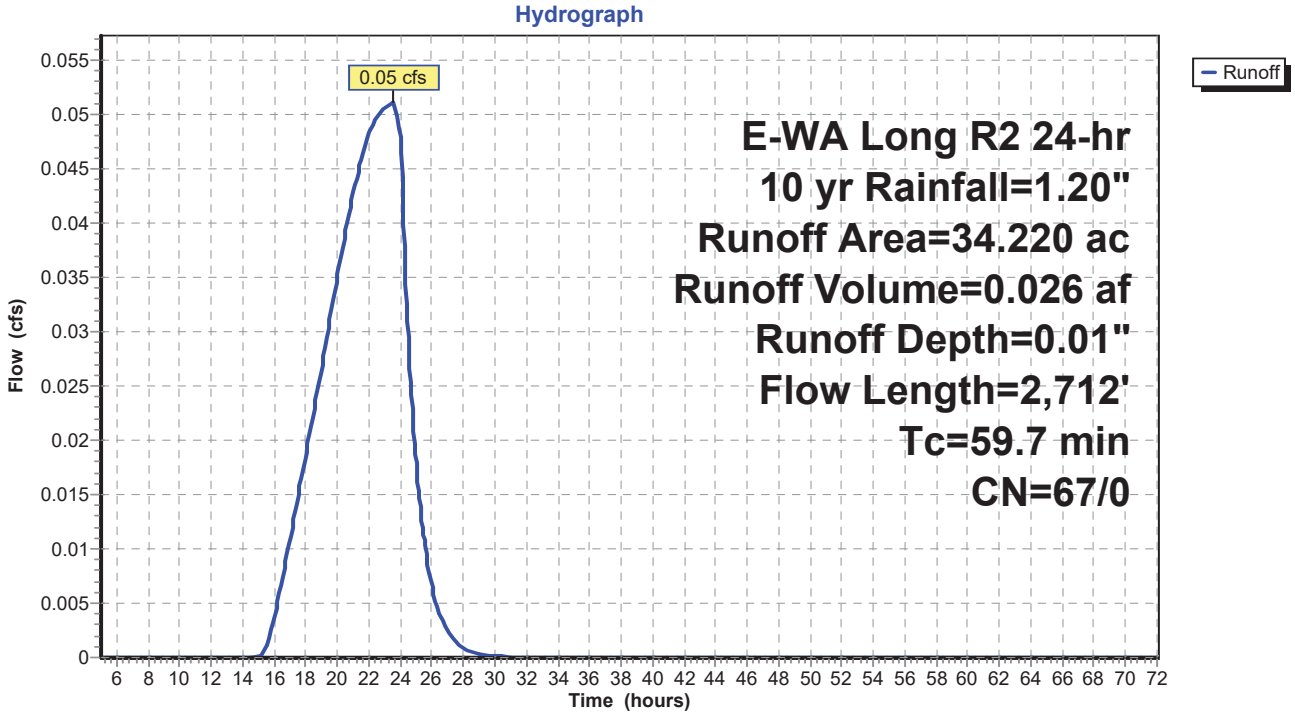
Runoff = 0.05 cfs @ 23.50 hrs, Volume= 0.026 af, Depth= 0.01"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
E-WA Long R2 24-hr 10 yr Rainfall=1.20"

	Area (ac)	CN	Description
*	1.430	93	Impervious
*	11.680	58	Meadow HSG B
*	21.110	71	Meadow HSG C
	34.220	67	Weighted Average
	34.220	67	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
39.9	300	0.0173	0.13		**Sheet Flow,** Range n= 0.130 P2= 1.00"
16.2	961	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.6	1,451	0.0141	6.67	233.45	**Channel Flow,** Area= 35.0 sf Perim= 23.0' r= 1.52' n= 0.035
59.7	2,712	Total			

Subcatchment 4S: Proposed Basin 2



Time span=5.00-72.00 hrs, dt=0.05 hrs, 1341 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 4S: Proposed Basin 2 Runoff Area=34.220 ac 0.00% Impervious Runoff Depth=0.07"
Flow Length=2,712' Tc=59.7 min CN=67/0 Runoff=0.20 cfs 0.195 af

Summary for Subcatchment 4S: Proposed Basin 2

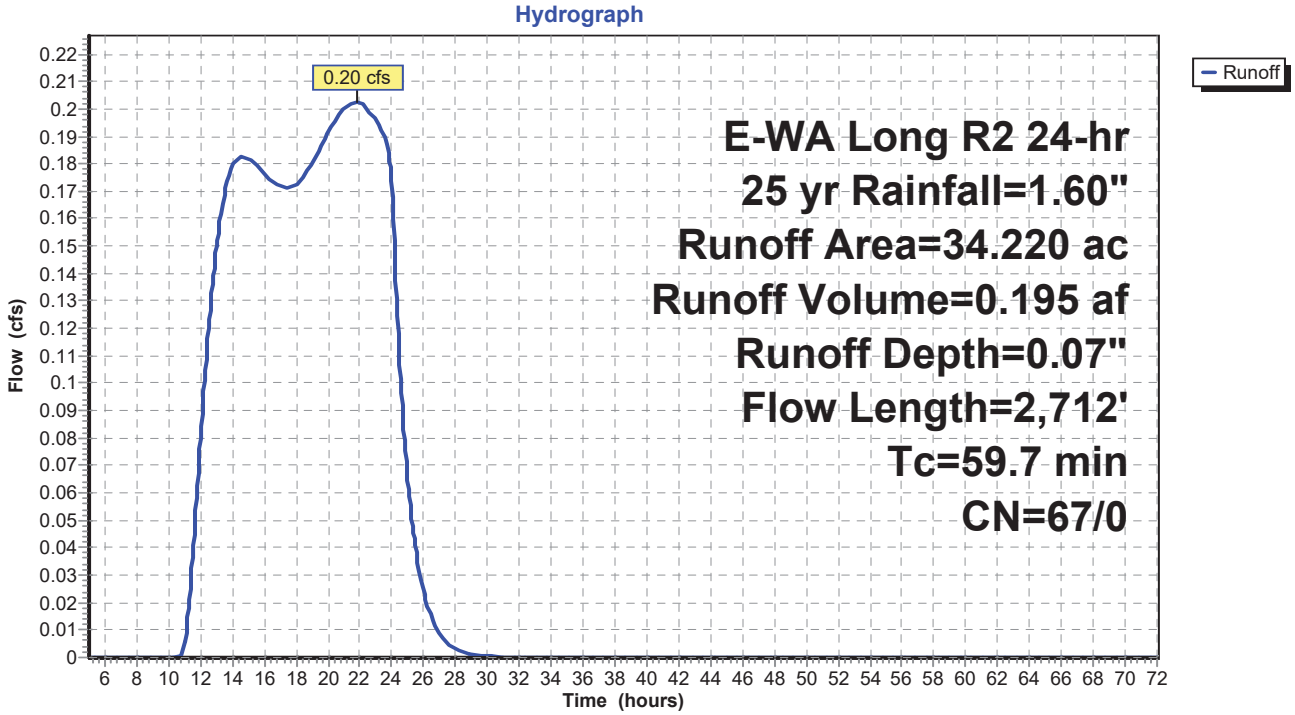
Runoff = 0.20 cfs @ 21.79 hrs, Volume= 0.195 af, Depth= 0.07"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
E-WA Long R2 24-hr 25 yr Rainfall=1.60"

	Area (ac)	CN	Description
*	1.430	93	Impervious
*	11.680	58	Meadow HSG B
*	21.110	71	Meadow HSG C
	34.220	67	Weighted Average
	34.220	67	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
39.9	300	0.0173	0.13		**Sheet Flow,** Range n= 0.130 P2= 1.00"
16.2	961	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.6	1,451	0.0141	6.67	233.45	**Channel Flow,** Area= 35.0 sf Perim= 23.0' r= 1.52' n= 0.035
59.7	2,712	Total			

Subcatchment 4S: Proposed Basin 2



Time span=5.00-72.00 hrs, dt=0.05 hrs, 1341 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 4S: Proposed Basin 2 Runoff Area=34.220 ac 0.00% Impervious Runoff Depth=0.17"
Flow Length=2,712' Tc=59.7 min CN=67/0 Runoff=0.54 cfs 0.494 af

Summary for Subcatchment 4S: Proposed Basin 2

Runoff = 0.54 cfs @ 13.13 hrs, Volume= 0.494 af, Depth= 0.17"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
E-WA Long R2 24-hr 100 yr Rainfall=2.00"

	Area (ac)	CN	Description
*	1.430	93	Impervious
*	11.680	58	Meadow HSG B
*	21.110	71	Meadow HSG C
	34.220	67	Weighted Average
	34.220	67	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
39.9	300	0.0173	0.13		**Sheet Flow,** Range n= 0.130 P2= 1.00"
16.2	961	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.6	1,451	0.0141	6.67	233.45	**Channel Flow,** Area= 35.0 sf Perim= 23.0' r= 1.52' n= 0.035
59.7	2,712	Total			

Subcatchment 4S: Proposed Basin 2