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ENGINEERING ● SURVEYING ● PLANNING

PRELIMINARY DRAINAGE REPORT

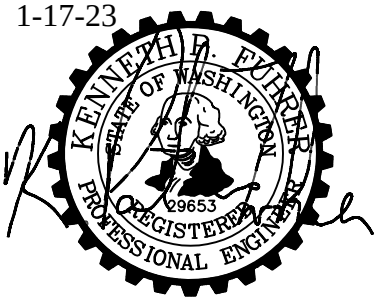
FOR

RYAN'S ROOST MIXED-USE APARTMENTS

SW ¼ SECTION 14, TOWNSHIP 26 NORTH, RANGE 1 EAST, W.M.

ASSESSOR PARCEL:	142601-3-115-2005
SITE ADDRESS:	No Situs Address
PREPARED FOR:	Tim Ryan Properties 19307 8th AVE NE Suite A Poulsbo, WA 98370
CONTACT:	Dan Ryan 360-779-7667
PREPARED BY:	Map, Ltd. J# 5393.01
DATE:	January 17, 2023

1-17-23



NOTE: THIS DOCUMENT IS INSCRIBED WITH A DIGITIZED SIGNATURE BY THE ENGINEER AS PROVIDED BY WAC 196-23-070(2)

"I hereby state that this Drainage Report has been prepared by me or under my supervision and meets the standard of care and expertise which is usual and customary in this community of professional engineers. The analysis has been prepared utilizing procedures and practices specified by the City of Poulsbo and within the standard accepted practices of the industry. I understand that the City of Poulsbo does not and will not assume liability for the sufficiency, suitability or performance of drainage facilities prepared by me."

REFERENCES

Stormwater Management Manual for Western Washington. ***Washington State Department of Ecology, 2019***

Western Washington Hydrology. ***Washington State Department of Ecology and Clear Creek Solutions, 2012***

Hydrological Analysis for Poulsbo Village Midwest prepared by MAP, Ltd and dated 11-29-1999.

Storm Drainage Computations for Poulsbo Village SW Phase III prepared by ADA Engineering and dated March 1996.

Geologic Report for Commercial Property prepared for this project by Envirotech Engineering and dated 8-29-22.

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DRAINAGE REPORT

FOR

RYAN'S ROOST MIXED-USE APARTMENTS

I. PROJECT DESCRIPTION

The applicant and property owner, Tim Ryan Properties, is proposing to develop a 1.27 acre site for use as mixed-use commercial and individual apartments contained in a single building. The site is located north of Iverson street and west of 7th Avenue, immediately south of the Poulsbo Athletic Club, in the Poulsbo Commercial C-3 zone. The property has access and utility rights via easements through adjacent commercial properties as disclosed on city of Poulsbo Short Plat P-79. The tax parcel number is 142601-3-115-2005. A pre-application meeting was held with City Staff on November 1, 2022, and a summary letter issued on November 15 File No. P-09-26-22-01. The project proposes 15 apartment units and up to 5 additional mixed-use commercial units with associated parking, landscaping, and utilities and requires Site Plan Review, Critical Area Review, and Design Review in accordance with the PMC. Upon SPR approval, subsequent permits will include Clearing and Grading Permit and the subsequent Building-related Permit(s).

On-site stormwater management facilities are proposed for this project as required by the Poulsbo Municipal Code and as shown on the attached Site Plan Review Civil plans and as detailed in this Report. Other utility improvements include sanitary sewer and water service from the City, both of which are available within the drive aisle fronting the east side of the property.

II. EXISTING CONDITIONS

The property was part of a larger development that occurred in the late 1990's that was known as Poulsbo Village Midwest, which included utilities and grading to support the construction of the Poulsbo Athletic Club and stubbed out utilities and drive aisles to the adjacent parcels owned by the applicant. A stormwater management system was approved and constructed, but this property did not "vest" to the previous code since no building permit and subsequent construction occurred. This lot was raised with fill material from the adjacent project, and the existing vegetation consists of blackberries and grasses. West of the drainage swale that was constructed along the grading limits, a steep slope with second-growth conifers exists. The topography in the area of the proposed building is flat to moderately sloped from 2-5% in a northwest descending slope, and the ascending slope to the west towards 4th Avenue averages 18% with isolated areas of less than 8% and more than 30%.

A. SOIL TYPE

According to the "Soil Survey of Kitsap County Area, Washington", USDA, SCS, Sept. 1980, on-site soils are classified as Norma Fine Sandy Loam in the proposed building area, and Kitsap Silt Loam 15-30% slopes on the ascending western part of the property. Norma Fine Sandy Loam soils lie in Hydrological Soil Group C/D soils, which are not suited for infiltration potential. Given this site's undocumented fill material above native ground, infiltration BMP's are not suitable for this project.

Please refer to the Geological Report attached herein for further soils discussion and construction recommendations.

Soil Map—Kitsap County Area, Washington Ryan's Roost

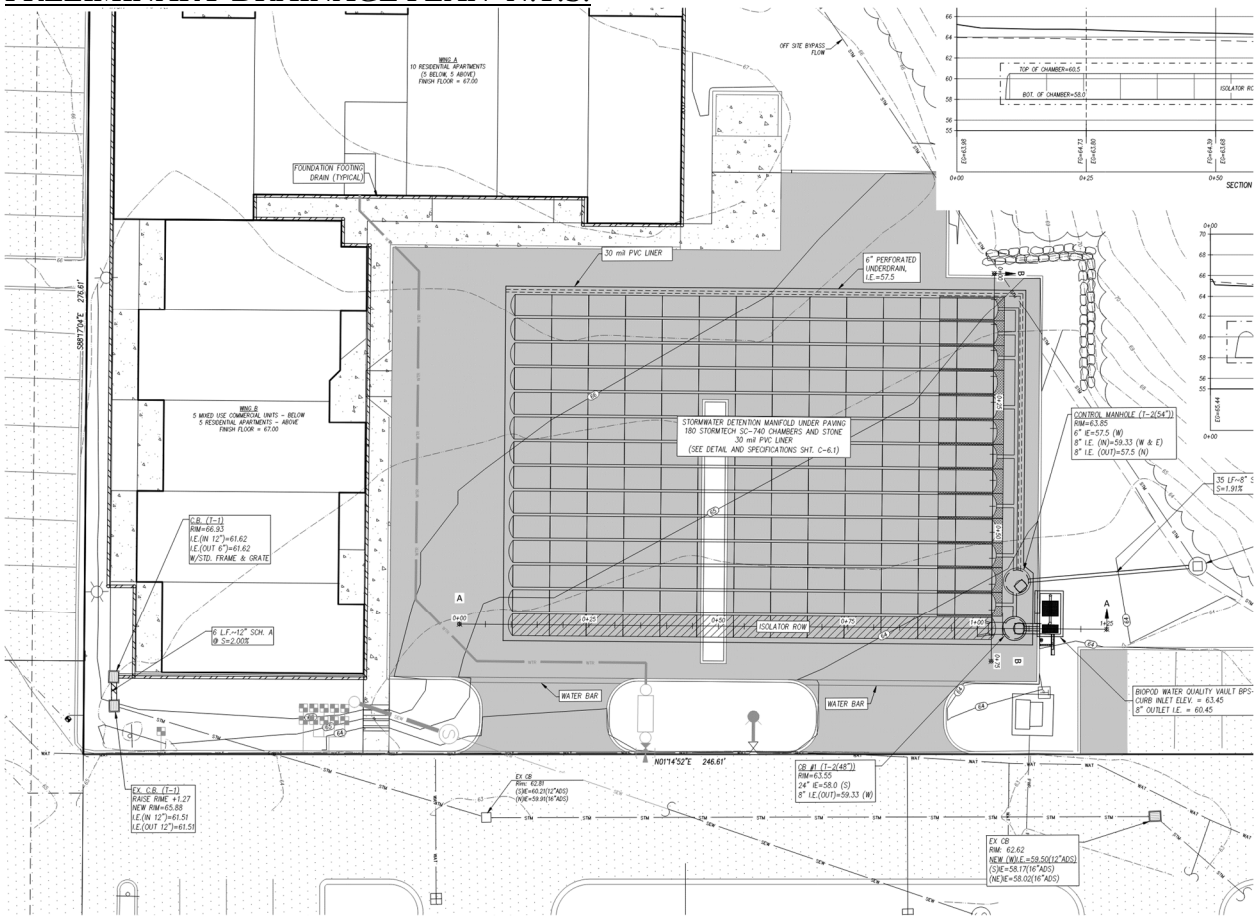
Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
30	Kitsap silt loam, 15 to 30 percent slopes	1.1	67.0%
37	Norma fine sandy loam	0.5	33.0%
Totals for Area of Interest		**1.6**	**100.0%**

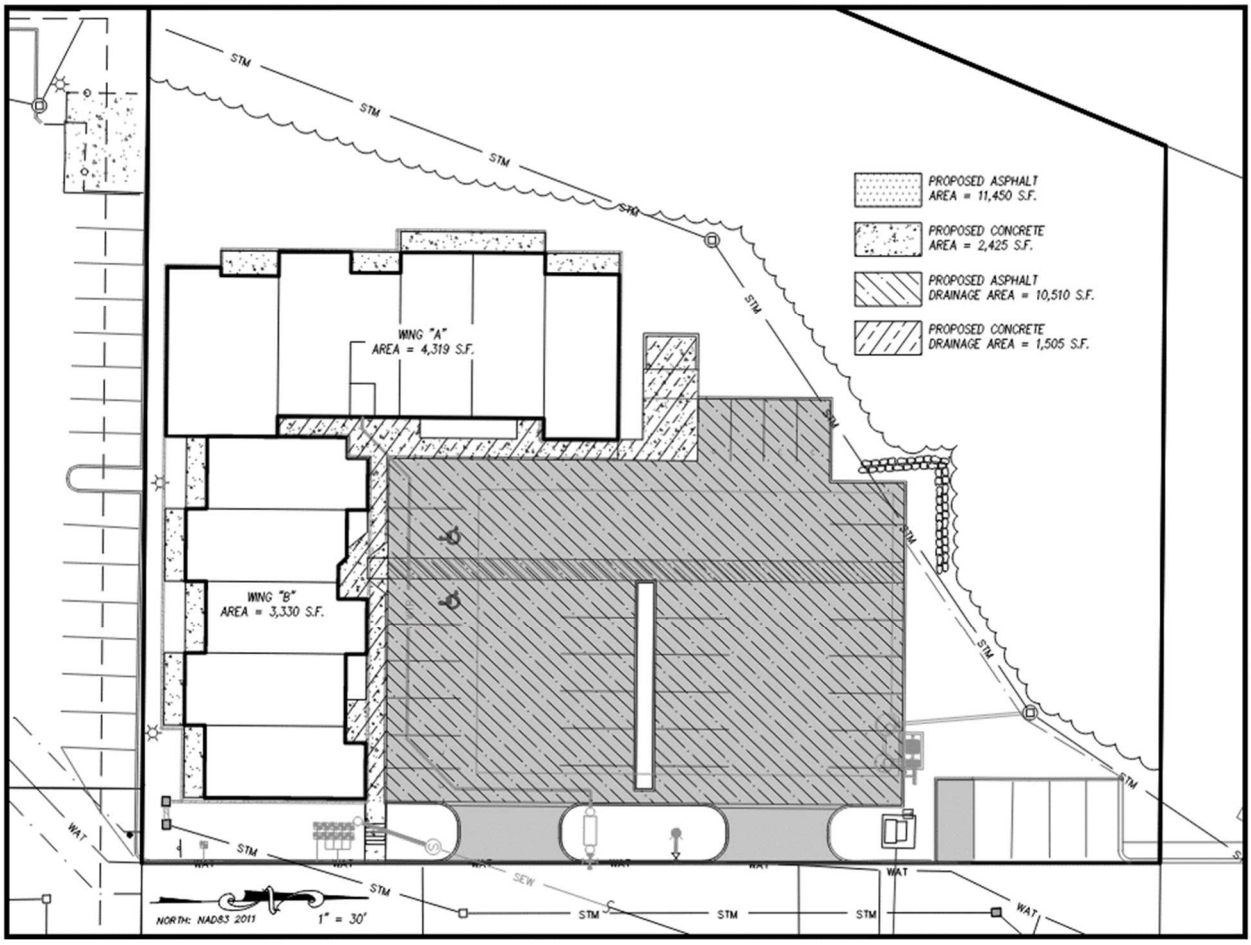
III. DEVELOPED CONDITIONS

Storm water management proposed for the site includes Enhanced Water Quality treatment through a BioPod™ Vault, and Flow Mitigation detention storage in a lined StormTech™ chamber manifold under the parking area. Runoff will be connected to the storm water conveyance system that lies along the western edge of the development area.

PRELIMINARY DRAINAGE PLAN N.T.S.

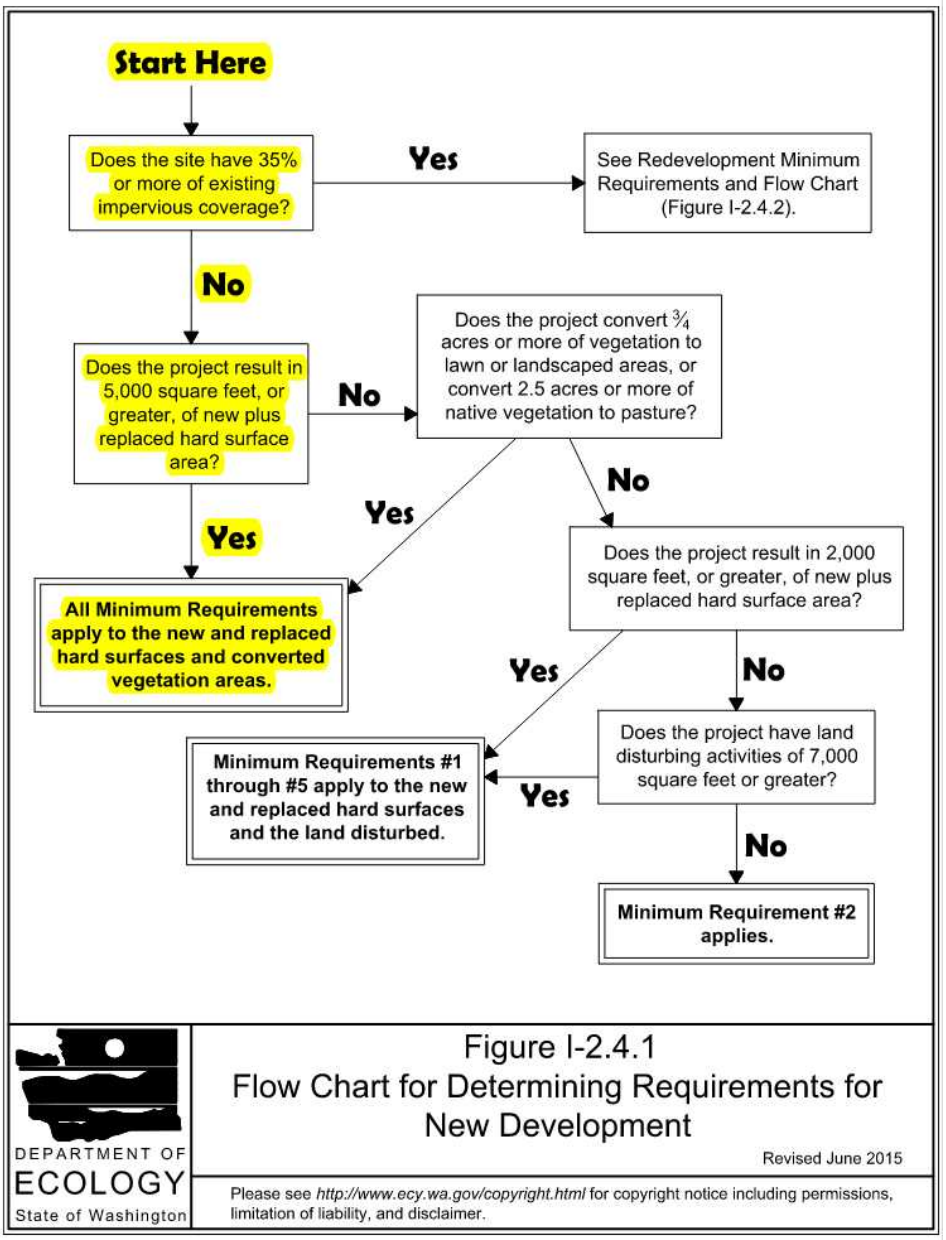


CATCHMENT AREAS N.T.S.



IV. MINIMUM REQUIREMENTS

The minimum requirements are determined based on the Flow Chart for New Development. According to the Flow Chart, all minimum requirements apply to the new and replaced hard surfaces and converted vegetation areas for this project.



1 *Minimum Requirement #1: Preparation of Stormwater Site Plan*

The Stormwater Site Plan will be prepared for review and approval by the City of Poulsbo for the Site Plan Review and following that for the Clearing and Grading Permit. It also includes the Drainage Report existing conditions analysis, with map and descriptions of areas, the developed

site with map and descriptions, and an offsite analysis. Designs for the stormwater system are included in the Drainage Report, along with specifications, details and construction requirements. **MR #1 is satisfied.**

V. Minimum Requirement #2: Construction Stormwater Pollution Prevention (SWPP)

Silt and erosion control measures will include silt fencing at the toe of all fill slopes, a rocked construction entrance, and catch basin inlet protection barriers. The contractor will use either straw mulch, temporary hydroseeding or plastic sheeting to cover exposed soils during inclement weather. As the area to be cleared and disturbed is less than 1 acre, a Construction Stormwater General Permit from the Washington State Department of Ecology is not required. **MR #2 is satisfied.**

VI. Minimum Requirement #3: Source Control of Pollution

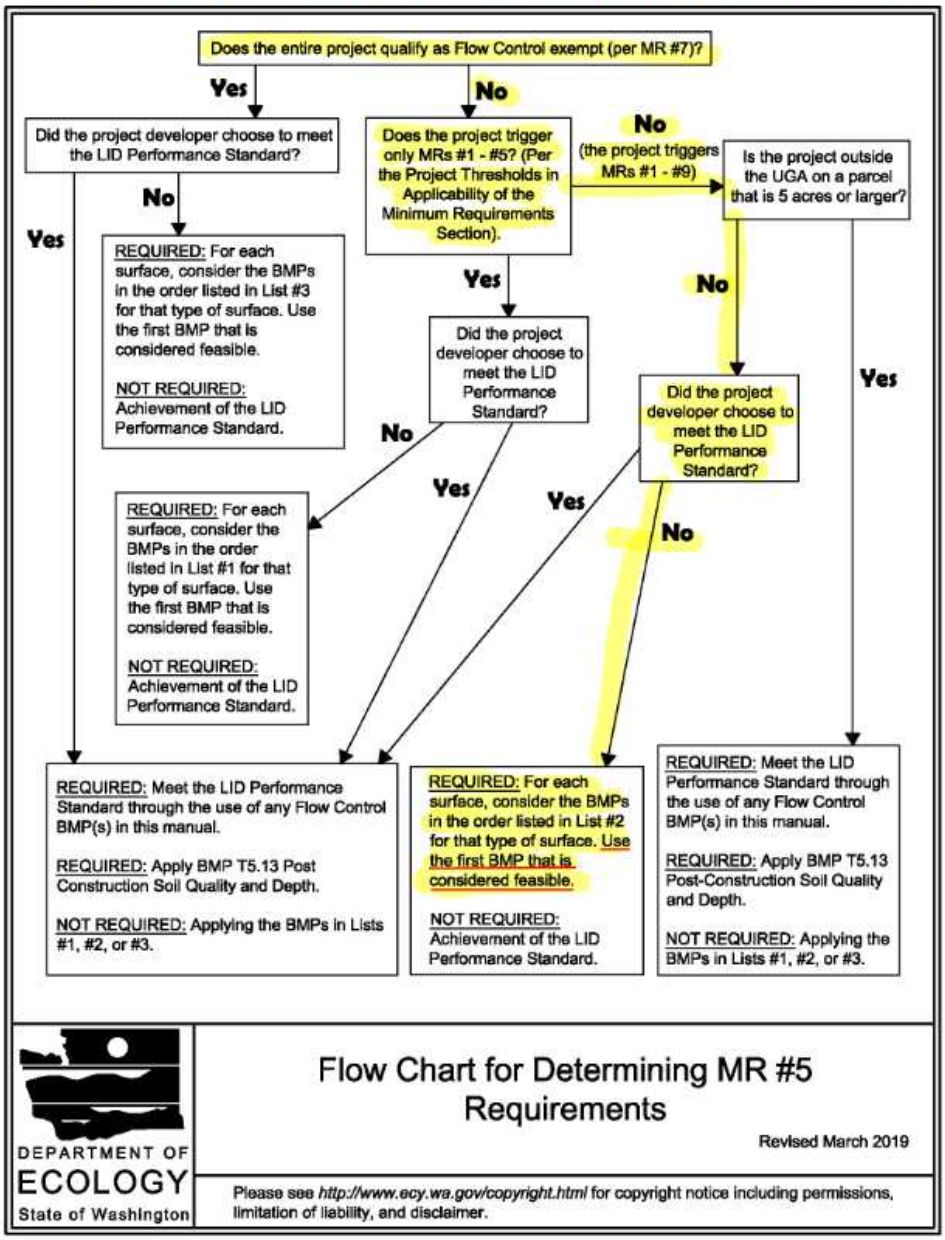
Source control of pollution means schedules of activities, prohibition of practices, maintenance procedures, and other physical, structural, and/or managerial practices that prevent or reduce the release of pollutants and other adverse impacts to waters of Washington State. Best Management Practices can be used singularly or in combination. For this project, outdoor vehicle parking is the primary potential for pollution. Source control BMP's for this activity include capture of pollutants within the water quality treatment vault. **MR #3 is satisfied.**

VII. Minimum Requirement #4: Preservation of Natural Drainage Systems and Outfalls

The proposed drainage system connects to the existing storm conveyance system constructed in 2000 that the property discharges to in the existing condition. **MR #4 is satisfied.**

VIII. Minimum Requirement #5: On-site Stormwater Management

Figure I-3.3: Flow Chart for Determining MR #5 Requirements



2019 Stormwater Management Manual for Western Washington

Volume I - Chapter 3 - Page 118

The List #2 Feasibilities for this previously disturbed graded/compacted site are discussed and are determined by the Project Engineer to be Feasible or Infeasible as follows:

IX. *Lawn and Landscaped areas:*

- ***Post-Construction Soil Quality and Depth in Accordance with BMP T5.13 of Volume 5***

Soil amendment will be provided for all landscaped and disturbed grade areas with grades less than 25% (4H:1V).

Roofs:

- ***Full dispersion:*** **No horizontal flow path available.**
- ***Rain Gardens:*** **Infiltration under rain gardens is not feasible on this site due to the previous site grading/disturbance.**
- ***Downspout dispersion*** **Not feasible on this site due to the previous site grading/disturbance and lack of flow path.**
- Perforated stub-out connections **Not feasible on this site due to the previous site grading/disturbance and lack of flow path.**

Other Hard Surfaces:

- ***Full Dispersion*** **Not feasible on this site due to limited area available on-site disturbed by past clearing and grading activities and lack of a native vegetation flow path in areas with slopes < 15%.**
- ***Rain Gardens*** **Infiltration under rain gardens is not feasible on this site due to the previous site grading/disturbance.**
- ***Permeable pavement*** **Permeable pavement is not feasible due to the previous site grading/disturbance/compaction, and the applicant's concerns over short service life.**
- ***Sheet flow dispersion*** **No horizontal flow path available.**

Minimum Requirement #5 will be met for this site with the use of soil amendment for landscaped and other pervious disturbed areas having a grade less than or equal to 25% (4H:1V). Roof and pavement BMP's from List #2 are infeasible for this project as discussed above

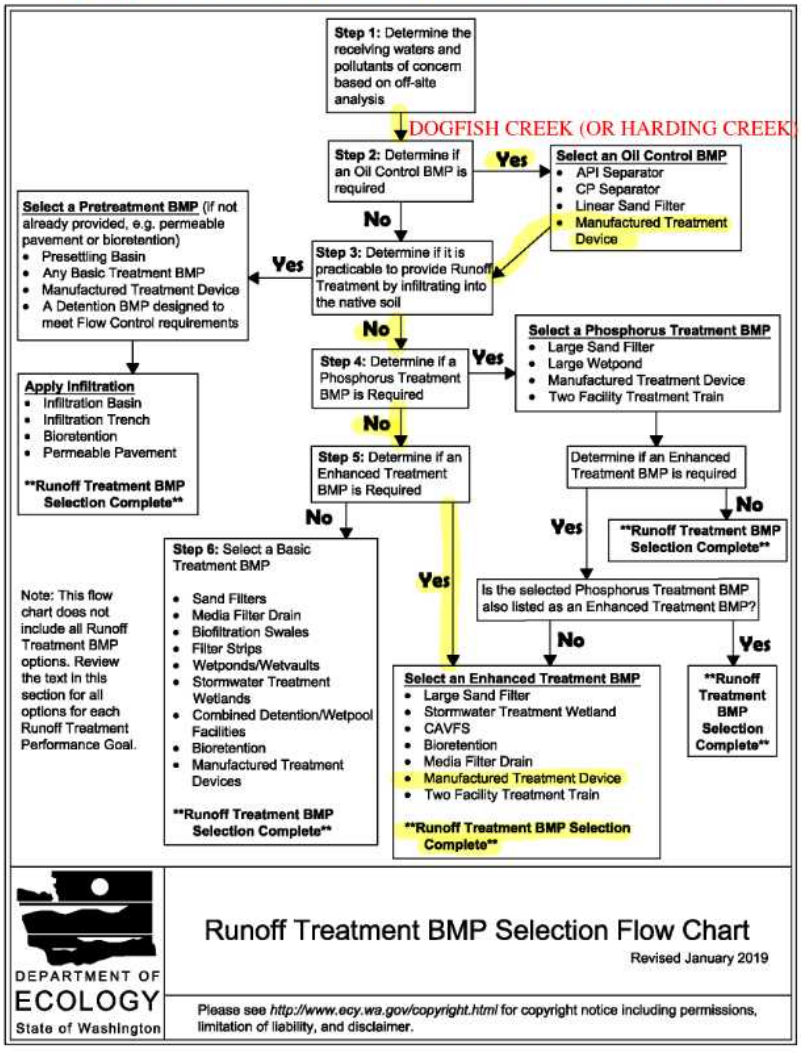
X. Minimum Requirement #6: Runoff Treatment

The following require construction of stormwater treatment facilities:

Projects in which the total of, pollution-generating hard surface (PGHS) is 5,000 square feet or more in a threshold discharge area or,

Projects in which the total of pollution-generating pervious surfaces (PGPS)- not including permeable pavements- is three quarters of an acre or more in a threshold discharge area, and from which there will be a surface discharge in a natural or man made conveyance system from the site.

Figure III-1.1: Runoff Treatment BMP Selection Flow Chart



Since the project proposes 11,450 s.f. of PGHS (Conventional Asphalt on-site) AND flows to Dogfish Creek, water quality mitigation for parking lot runoff is proposed by an Oldcastle-manufactured Biopod® vault, which is a WSDOE GULD approved manufactured treatment device for Enhanced Treatment. Please refer to the sizing calculations herein.

Minimum Requirement #6 has been satisfied.

XI. Minimum Requirement: #7: Flow Control

The following TDAs require construction of Flow Control BMPs to achieve the Flow Control Performance Standard. If a TDA meets any of the following thresholds, Flow Control BMPs are required. The project proponent must demonstrate that the TDA does not meet any of the following thresholds for Flow Control BMPs to not be required for that TDA.

- TDAs that have a total of 10,000 square feet or more of effective impervious surfaces, or
- TDAs that convert ¾ acres or more of native vegetation, pasture, scrub/shrub, or unmaintained non-native vegetation to lawn or landscape, or convert 2.5 acres or more of native vegetation to pasture, and from which there is a surface discharge in a natural or man-made conveyance system from the TDA, or
- TDAs that through a combination of effective hard surfaces and converted vegetation areas cause a 0.15 cubic feet per second (cfs) or greater increase in the 100-year flow frequency as estimated using an approved continuous simulation model and 15-minute time steps.

  The 0.15 cfs increase should be a comparison of the post project runoff to the existing condition runoff. For the purpose of applying this threshold, the existing condition is either the pre-project land cover, or the land cover that existed at the site as of a date when the local jurisdiction first adopted Flow Control requirements into code or rules.

Since this project proposes 23,030 sf of new hard surface, a stormwater detention system is proposed as designed herein and specified on the plans.

Minimum requirement #7 has been satisfied.

XII. Minimum Requirement #8 Wetland Protection

There are no wetlands associated with this project. The project does not discharge into a wetland, either directly or indirectly through a conveyance system.

Minimum requirement #8 does not apply.

XIII. Minimum Requirement #9: Operation & Maintenance

An Operation and Maintenance Manual with a Maintenance Schedule for the project's stormwater BMP's will be prepared in accordance with Poulsbo's requirements prior to final occupancy of the project.

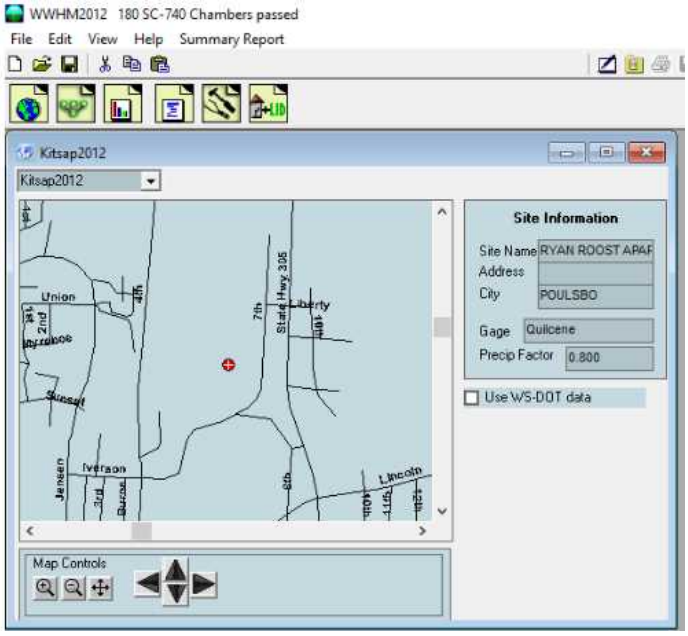
Minimum Requirement #9 is met.

IV. STORM WATER FLOW CONTROL

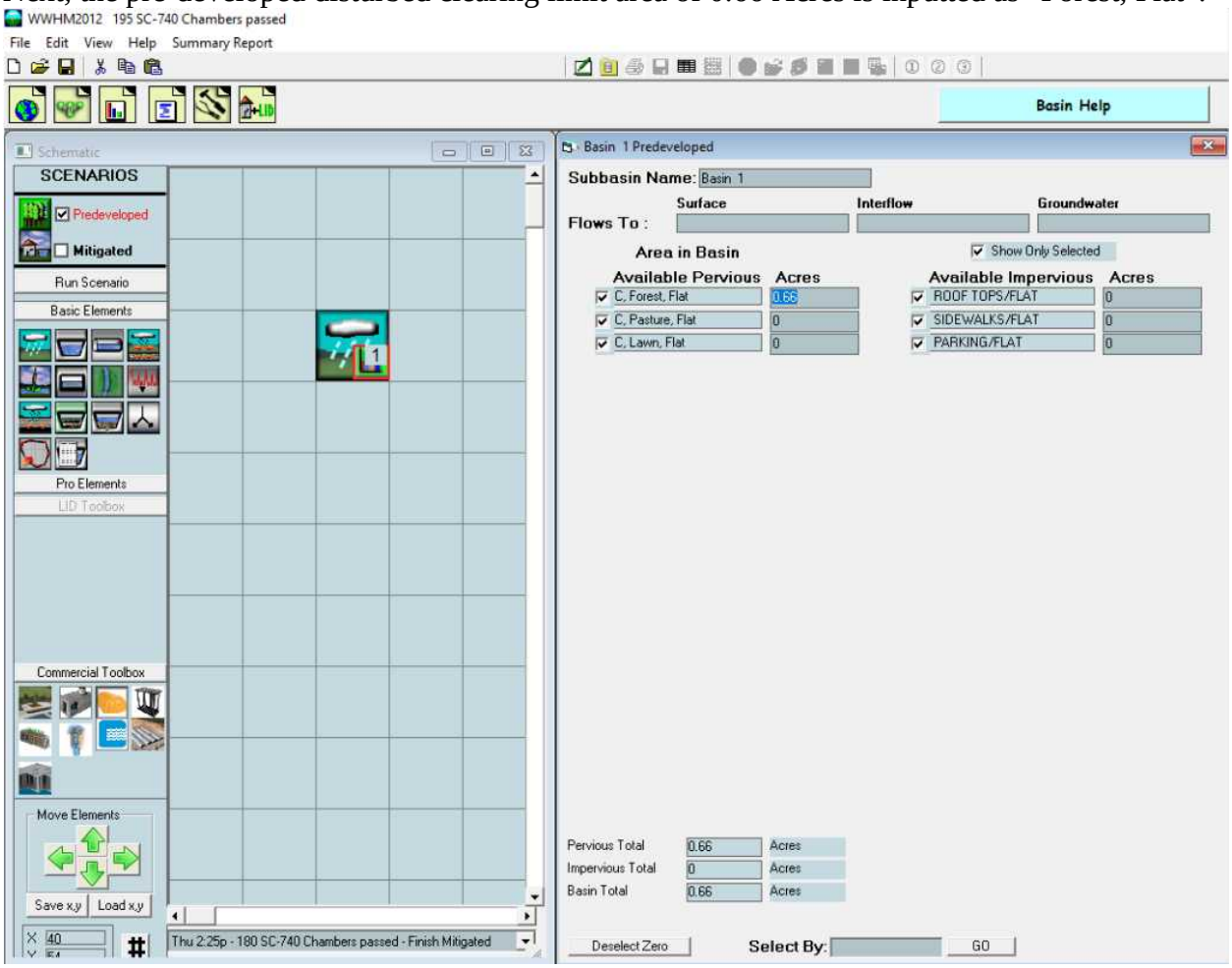
This project has limited vertical clearance between the finish pavement grades in the parking areas to the stormwater connection invert in the existing catch basin at the northern part of the site. After analyzing several different low-profile structural detention systems, a StormTech™ SC-740 manifold detention system with a 30-mil PVC liner was found to meet the cover requirements under paving as well as have enough detention storage to connect to the existing storm conveyance.

The WWHM2012 modeling software was utilized to analyze and model the pre-developed and mitigated land use coverage scenarios coupled with the SC-740 manifold storage to develop a system that meets the Flow Control Performance Standard of the 2019 DOE SSWMWW and Poulsbo Municipal Code.

First, the geographic location is established and the Quilcene gage assigned:

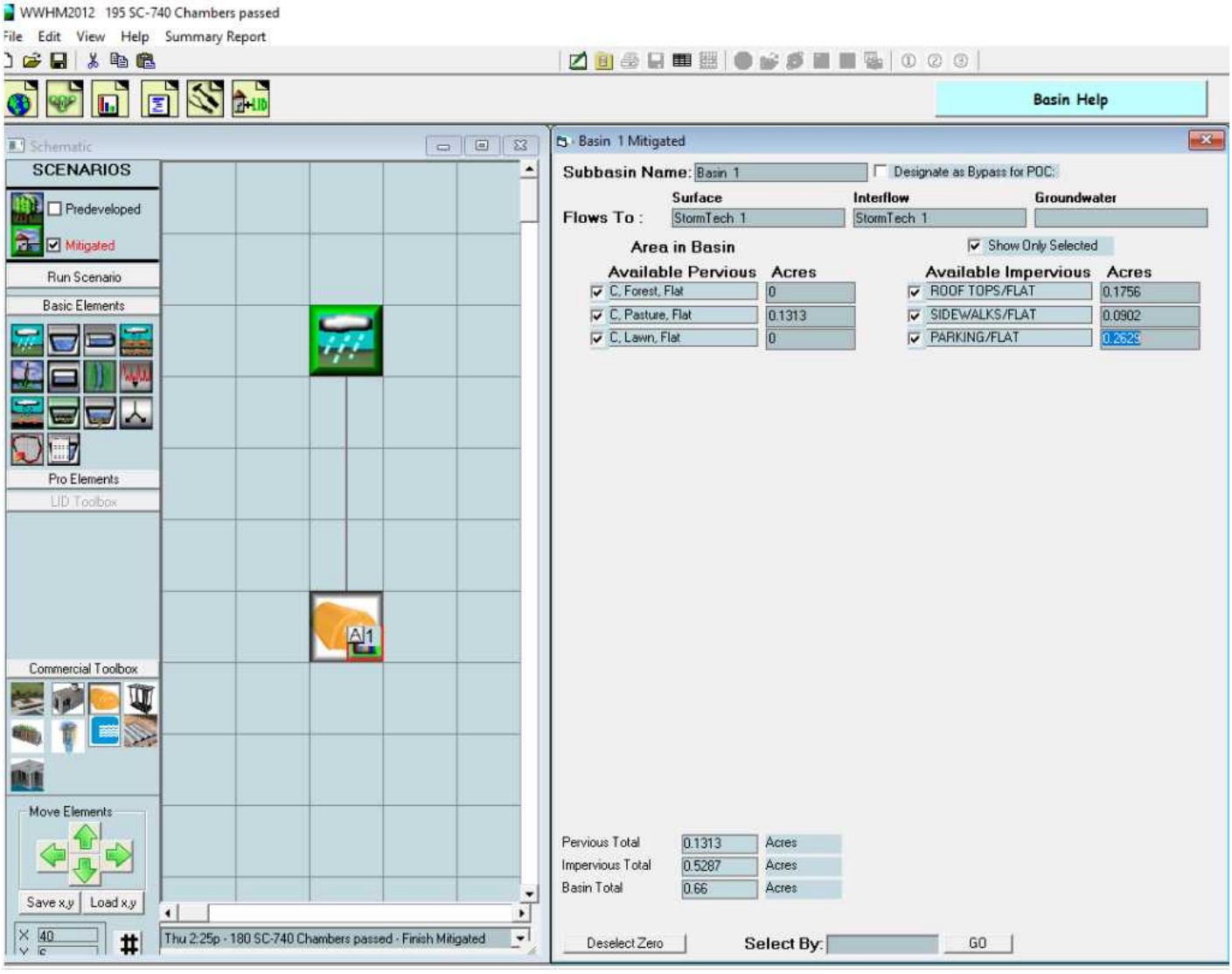


Next, the pre-developed disturbed clearing limit area of 0.66 Acres is inputted as "Forest, Flat":

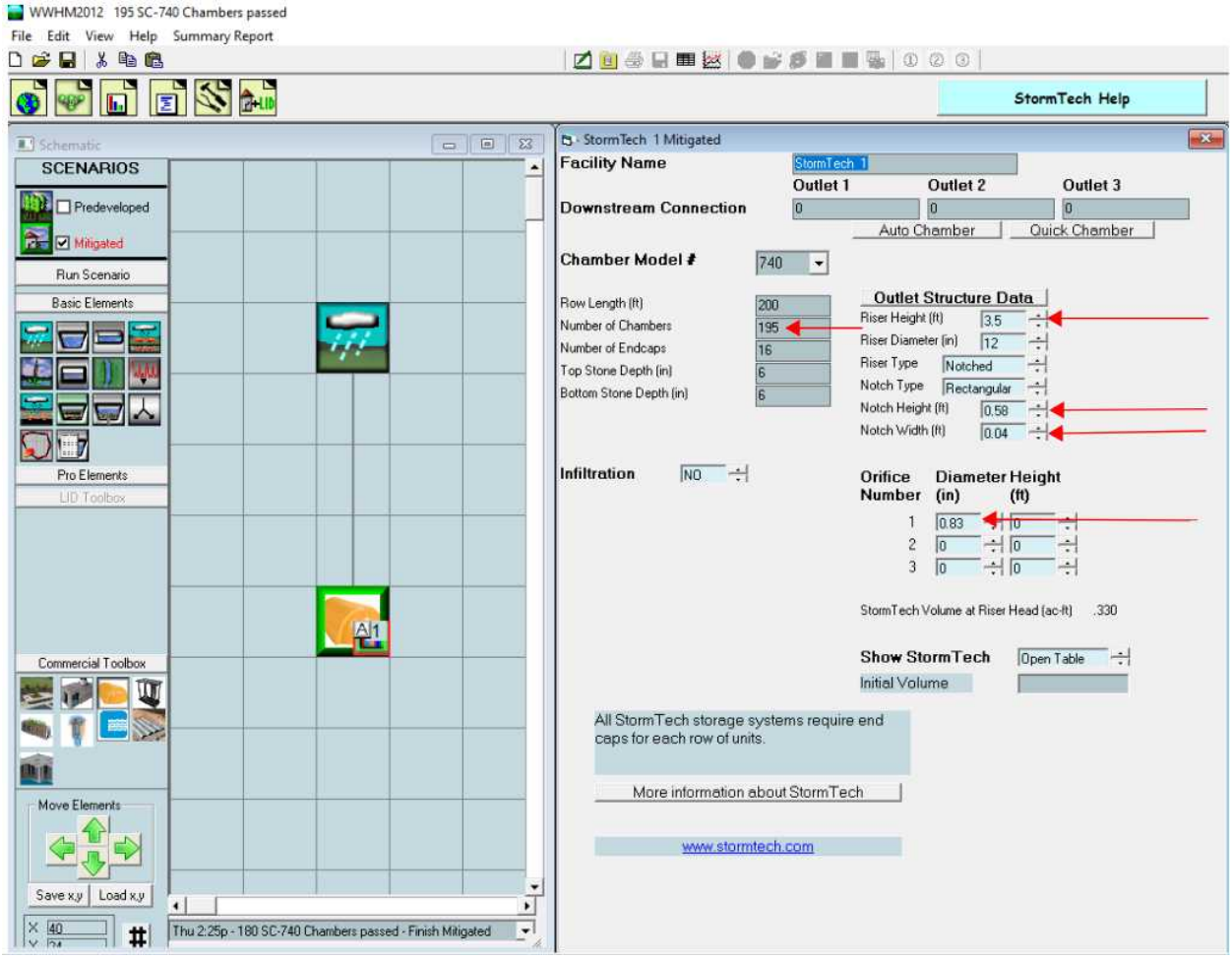


This next screenshot defines the developed mitigated areas shown on Page 6 draining to the detention manifold system:

Building rooftop area: 7,649 sf (0.1756 Acres)
Paved Parking area: 11,450 sf (0.2629 Acres)
Sidewalk and patio area: 3,930 sf (0.0902 Acres)
Landscaped area: 5,719 sf (0.1313 Acres)

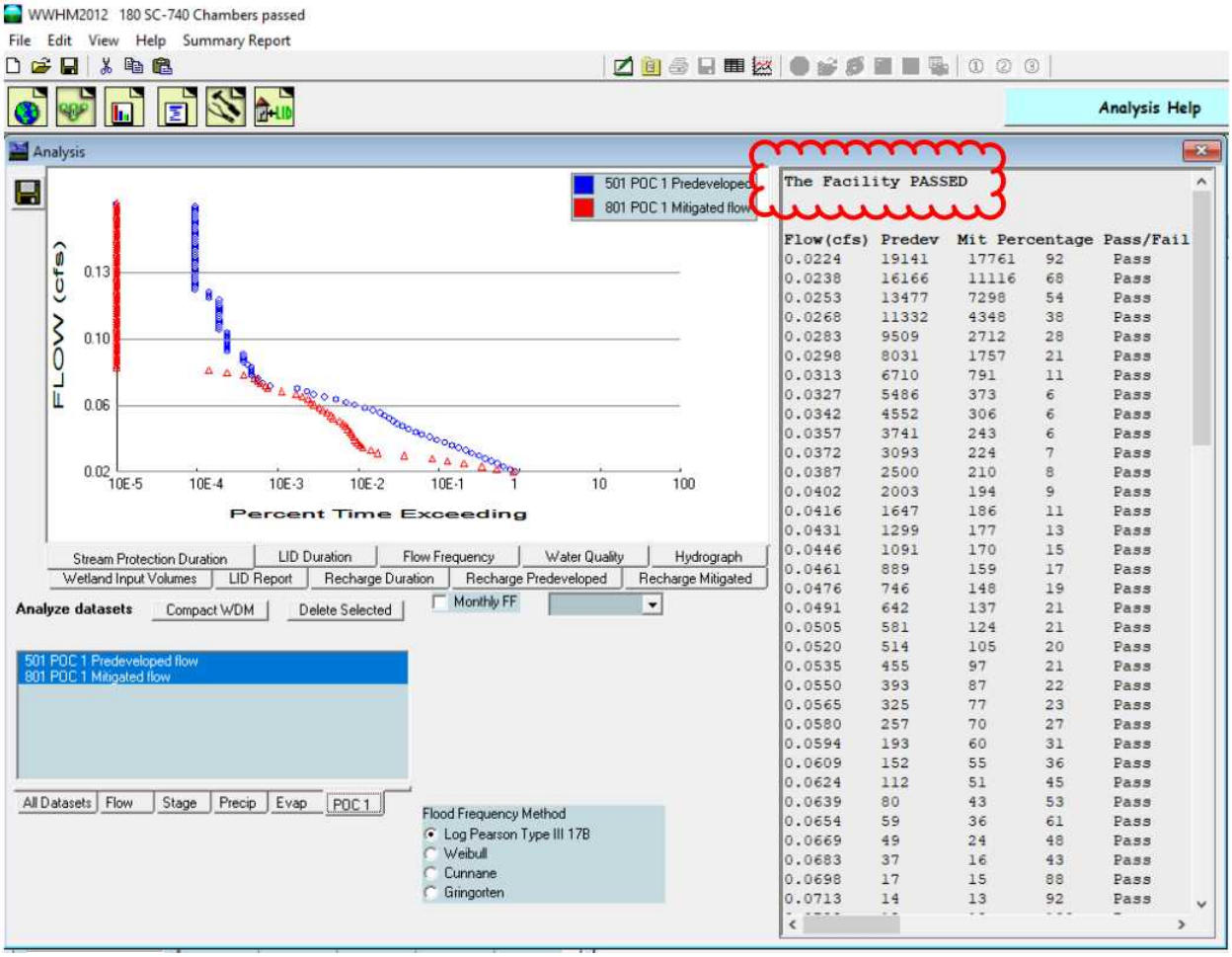


The SC-740 manifold is then designed using the StormTech commercial toolbox within the program, and the outlet control structure is defined:



195 StormTech SC-740 chambers coupled to a control structure with a 10" lower orifice and a notched weir ½" wide and 0.58' in height and an overflow standpipe elevation 3.5 feet above the invert was found to meet the performance standard.

Lastly, the mitigation scenario duration volume and flows are shown to be less than the pre-developed duration and flows, and earns a passing grade:



V. STORM WATER QUALITY MITIGATION

Stormwater runoff quality mitigation for this project is proposed with a BioPod™ water quality vault as manufactured by Oldcastle Precast.

BioPod™ have received GULD-approval from DOE for Enhanced Treatment meeting their design specifications below, which in essence allows for 1.6 gpm per square foot of media and a minimum of 18" of media thickness for the off-line water quality flow rate as determined through the WWHM model:

WASHINGTON STATE DEPARTMENT OF ECOLOGY

March 2022

GENERAL USE LEVEL DESIGNATION FOR BASIC (TSS), DISSOLVED METALS (ENHANCED), AND PHOSPHORUS TREATMENT

For

Oldcastle Infrastructure, Inc.'s
The BioPod™ Biofilter
(Formerly the TreePod Biofilter)

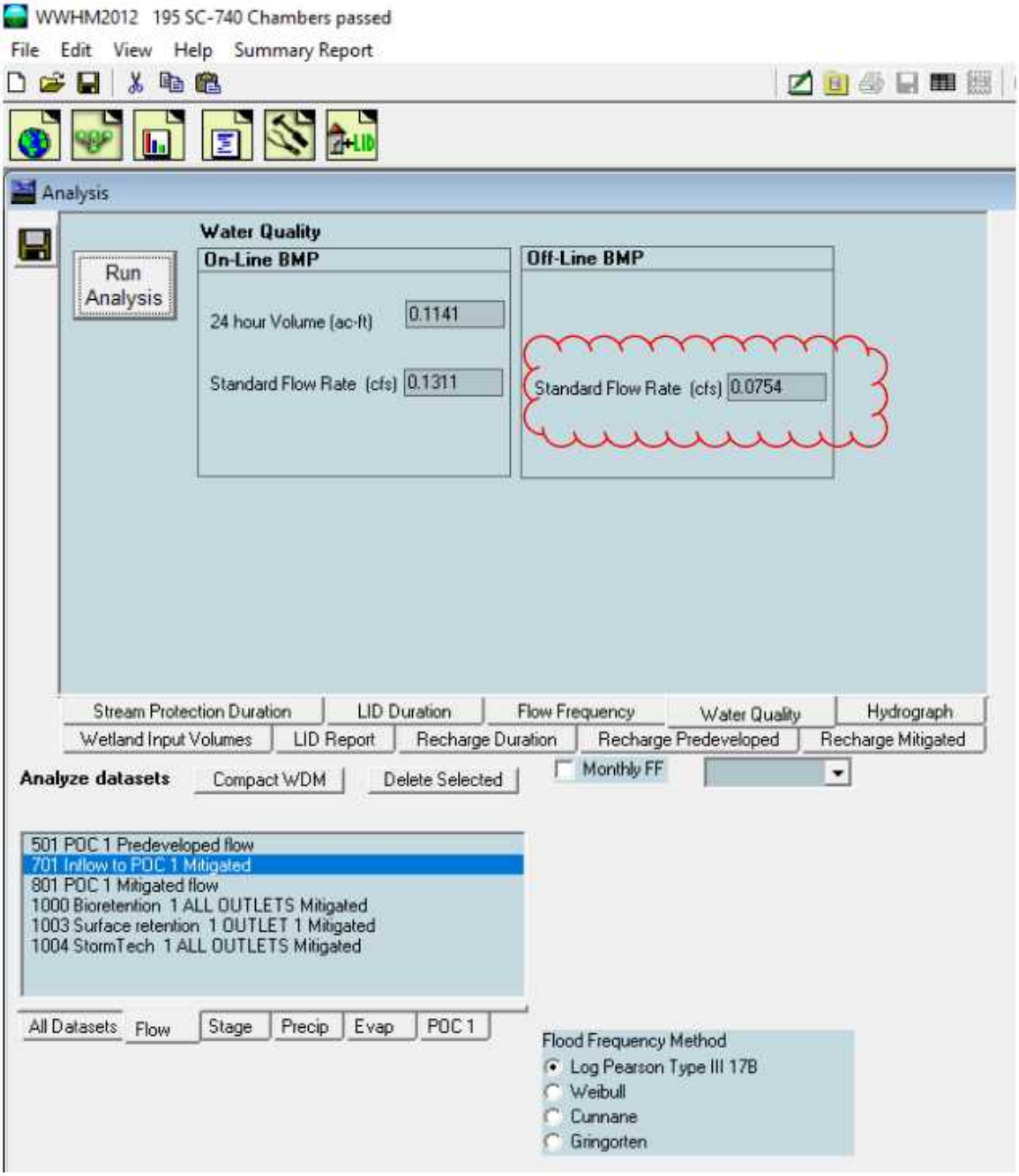
Ecology's Decision

Based on Oldcastle Infrastructure, Inc. application submissions for The BioPod™ Biofilter (BioPod), Ecology hereby issues the following use level designation:

1) General Use Level Designation (GULD) for Basic, Enhanced, and Phosphorus Treatment:
   - Sized at a hydraulic loading rate of 1.6 gallons per minute (gpm) per square foot (sq ft) of media surface area.
   - Constructed with a minimum media thickness of 18-inches (1.5-feet)

This vault has an internal bypass so the off-line flow rate is used to size the vault.

Using the same inputs and assuming conservatively the mitigated scenario catchments all flow to the curb inlet, the off-line flow rate is determined to be 0.0754 cfs



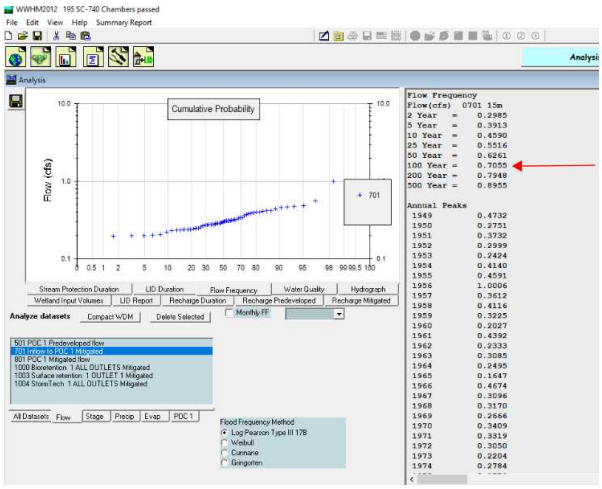
The BioPod Model BPS-46IB is the smallest vault they manufacture, and it has a listed treatment capacity of 0.074 cfs, which is 0.4 gpm shy of the calculated off-line flow rate however the rooftops will bypass the vault. Therefore the vault is conservatively sized to treat the Water Quality flow from the site's Pollution-Generating paved surfacing.

ø4.00" PVC SLOTTED UNDERDRAIN PIPE — SECTION A-A

MODEL	VAULT SIZE [1] (ID)		VAULT FOOTPRINT [1] (OD)		TREATMENT FLOW CAPACITY (GPM/CFS)	
	A DIM	B DIM	A1 DIM	B1 DIM	1.6 GPM/SF (WA GULD[2])	1.8 GPM/SF (NJCAT[3])
BPS-46IB-SI	4'	6'	5'	7'	33.4 / 0.074	37.5 / 0.084
BPS-48IB-SI	4'	8'	5'	9'	46.2 / 0.103	51.9 / 0.116
BPS-412IB-SI	4'	12'	5'	13'	71.8 / 0.160	80.7 / 0.180
BPS-66IB-SI	6'	6'	7'	7'	52.6 / 0.117	59.1 / 0.132
BPS-68IB-SI	6'	8'	7'	9'	71.8 / 0.160	80.7 / 0.180
BPS-612IB-SI	6'	12'	7'	13'	110.2 / 0.245	123.9 / 0.276
BPS-812IB-SI	8'	12'	9'	13'	148.5 / 0.331	167.0 / 0.372
BPS-816IB-SI	8'	16'	9'	17'	199.8 / 0.445	224.7 / 0.501

[1] All Dimensions are nominal, ID=Inside Dimension, OD=Outside Dimension.
[2] Treatment flow capacity at 1.6 gpm/sf media surface area based on an WA Ecology GULD Approval for Basic, Enhanced & Phosphorus.
[3] Treatment flow capacity at 1.8 gpm/sf media surface area based on an NJCAT Verification & NJ DEP Certification.

The 100-yr peak flow was estimated by the WWHM2012 model as 0.71 cfs, well under the bypass capacity of the vault of 2 cfs:



VI. SILT AND EROSION CONTROL

An engineered Erosion Control Plan will be included as part of the final civil construction plan set. A Rock construction entrance will be required at the site construction entrances. Other measures include straw mulch and/ or plastic sheeting, catch basin filter socks and water to control fugitive dust during construction.

Total area disturbed related to the construction of this project will be less than 1 acre, therefore a Construction Stormwater General Permit from the Washington State Department of Ecology is not required.

VII. UPSTREAM ANALYSIS

The stormwater conveyance piping and structures that were constructed on the property in 2000 were designed to convey offsite runoff around the site, and as such there are no off-site sources of stormwater runoff to the developed portion of the property.

VIII. DOWNSTREAM ANALYSIS

A downstream analysis was prepared for Poulsbo Village Midwest in 2000 as part of the construction of the nearby Poulsbo Athletic Club and infrastructure to support the other adjoining parcels, including the subject property. Please refer to pages 36-74 of Appendix D herein. In summary, the downstream piping was sized for a 25-yr storm event, as was the code requirement at the time of construction.

IX. DETERMINING CONSTRUCTION SITE SEDIMENT DAMAMGE POTENTIAL

The following rating system allows objective evaluation of a particular development site's potential to discharge sediment. Permittees may use the rating system below or develop alternative process designed to identify site-specific features, which indicate that the site must be inspected prior to clearing and construction. Any alternative evaluation process must be documented and provide for equivalent environmental review.
Step 1 is to determine if there is a sediment/erosion sensitive feature downstream of the development site. If there is such a site downstream complete step two, assessment of hydraulic nearness. If there is a sediment/erosion sensitive feature and it is hydraulically near the site then go to step three to determine the construction site sediment transport potential.

STEP 1 - Sediment/Erosion Sensitive Feature Identification
Sediment/erosion sensitive features are areas subject to significant degradation due to the effect of sediment deposition or erosion. Special

protection must be provided to protect them. Sediment/erosion sensitive features include but are not limited to:
A. Salmonid bearing fresh water streams and their tributaries or freshwater streams that would be Salmonid bearing if not for anthropogenic barriers; **Yes**
B. Lakes; **No**
C. Wetlands; **No**
D. Marine near-shore habitat; **No**
E. Sites containing contaminated soils where erosion could cause dispersal of contaminants; **None known**
F. Steep slopes (25% or greater) associated with one of the above features. **No**
Identify any sediment/erosion sensitive features, and proceed to step two. If there are none the assessment is complete.
The south fork of Dogfish Creek lies approximately 1400 feet downstream of the site through a piped conveyance.

STEP 2 - Hydraulic Nearness Assessment

Sites are hydraulically near a feature if the pollutant load and peak quantity of runoff from the site will not be naturally attenuated before entering the feature. The conditions that render a site hydraulically near to a feature include, but are not limited to, the following:
A. The feature or a buffer to protect the feature is within 200 feet downstream of the site. **No**
B. Runoff from the site is tight-lined to the feature or flows to the feature through a channel or ditch. **Yes**
C. A site is not hydraulically near a feature if one of the following takes place to provide attenuation before runoff from the site enters the feature:

1. Sheet flow through a vegetated area with dense ground cover (Western Washington Phase II Municipal Stormwater Permit, January 17,2007 Appendix 7- Determining Sediment Damage Potential, Page 2 of 3) **No**
2. Flow through a wetland not included as a sensitive feature **No**
3. Flow through a significant shallow or adverse slope, not in a conveyance channel, between the site and the sensitive feature. **No**

Identify any of the sediment/erosion sensitive features from step one that are hydraulically near the site, and proceed to step three. If none of the sediment/erosion sensitive features are hydraulically near the site the assessment is complete.
Site is hydraulically connected to Dogfish Creek, therefore on to Step 3

STEP 3 - Construction Site Sediment Transport Potential

Using the worksheet below, determine the total points for each development site. Assign points based on the most critical condition that affects 10% or more of the site. If soil testing has been performed on site, the results should be used to determine the predominant soil type on the site. Otherwise, soil information should be obtained from the county soil survey to determine Hydrologic Soil Group (Table of Engineering Index Properties for step 1.D) and Erosion Potential (Table of Water Features for step 1.E).

When using the county soil survey, the dominant soil type may be in question, particularly when the site falls on a boundary between two soil types or when one of two soil types may be present on a site. In this case, the soil type resulting in the most points on the rating system will be assumed unless site soil tests indicate that another soil type dominates the site. Use the point score from Step 3 to determine whether the development site has a high potential for sediment transport off of the site.

Total Score	Transport Rating
<100	Low
≥100	High

A high transport rating indicates a higher risk that the site will generate sediment contaminated runoff.

Construction Site Sediment Transport Potential Worksheet

A. Existing slope of site (average, weighted by aerial extent): Points

2% or less.....0

>2-5%..... **5**

>5-10%..... 15

>10-15%..... 30

>15%..... 50

B. Site Area to be cleared and/or graded:

<5,000 sq. ft..... 0

5,000 sq. ft. – 1 acre.....**30**

>1 acres..... 50

Quantity of cut and/or fill on site:

<500 cubic yards..... 0

500 - 5,000 cubic yards..... **5**

>5,000 - 10,000 cubic yards..... 10

>10,000- 20,000 cubic yards..... 25

>20,000 cubic yards..... 40

Runoff potential of predominant soils(Natural Resources Conservation Service):

Hydrologic soil group A.....0

Hydrologic soil group B..... 10

Hydrologic soil group C..... **20**

Hydrologic soil group D..... 40

Erosion Potential of predominant soils(Natural Resource Conservation Service):

GW,GP,SW, SP soils.....0

Dual Classifications(GW-GM,GP-GM,GW-GC, GP-GC,
SW-SM,SW-SC, SP-SM,SP-SC) 10

GM, GC, SM, SC soils..... **20**

ML, CL, MH, CH soils..... 40

Surface or Groundwater entering site identified and intercepted:

Yes..... **0**

No..... 25

G. Depth of cut or height of fill >10 feet:

Yes..... 25

No **0**

H. Clearing and grading will occur in the wet season (October 1 - May 1):

Yes 50

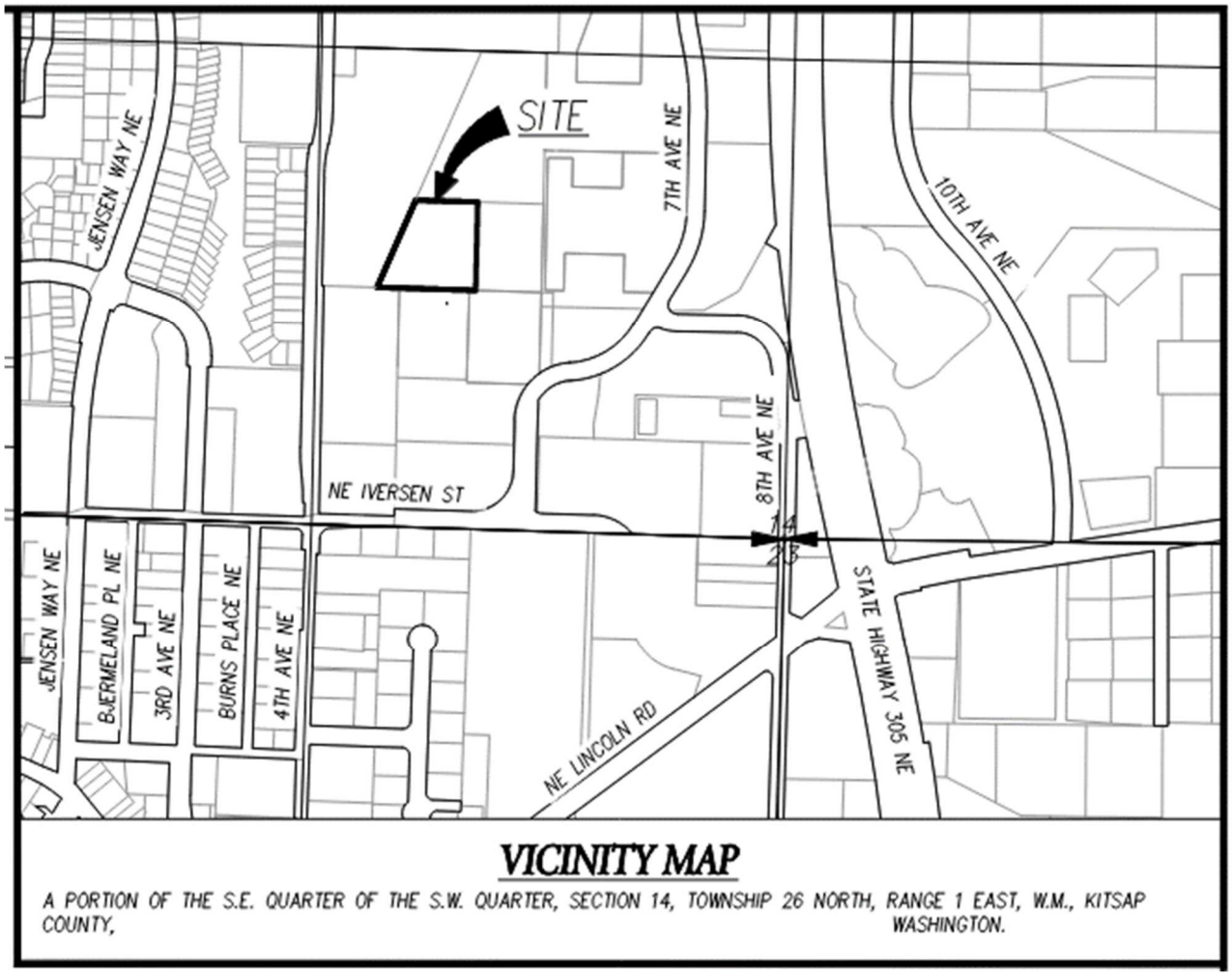
No **0**

TOTAL POINTS..... **80**

1 If no surface or groundwater enters site, give 0 points.

Since the rating is less than 100, this site has a lower degree of risk of sediment transport.

APPENDIX A VICINITY MAP



VICINITY MAP

A PORTION OF THE S.E. QUARTER OF THE S.W. QUARTER, SECTION 14, TOWNSHIP 26 NORTH, RANGE 1 EAST, W.M., KITSAP COUNTY, WASHINGTON.

APPENDIX B GEOLOGICAL REPORT

Geologic Report
for
Commercial Property

XXX 7th Ave NE
Parcel No. 142601-3-115-2005
Poulsbo, Washington

August 29, 2022
Project #22225

Prepared For:

Tim Ryan Properties
19307 8th Ave NE Suite A
Poulsbo, WA 98370

Prepared By:

Envirotech Engineering
PO Box 984
Belfair, Washington 98528
Phone: 360-275-9374

8/29/2022

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1.0 INTRODUCTION

Envirotech Engineering, PLLC (Envirotech) has completed this geologic report for a commercial property located at XXX 7th Ave NE, identified as parcel number 142601-3-115-2005 in Poulsbo, Washington. As presented herein, this assessment includes information pertaining to the project in this Introduction Section; observations of the property and surrounding terrain in the Surface Conditions Section; field methods and soils descriptions in the Subsurface Investigation Section; and, assessments for landslides, erosion, seismic hazards, and other considerations in the Conclusions Section.

An initial geological/ geotechnical evaluation of the project was conducted by Envirotech on 8/9/2022. It was determined that development activity is within an area of geologic concern per the City of Poulsbo Ordinance 16.20.410, and subsequently, the project requires a Geologic Report pursuant to Ordinance 16.20.760.

During the evaluation and site visit by Envirotech, surface and subsurface conditions were assessed in order to determine if further geotechnical studies are required. After completion of the field work and applicable Project research, Envirotech prepared this geological assessment.

1.1 Project Information

Information pertaining to the project was provided by the proponent of the property, and observations from a field visit by Envirotech. The proposed development is expected to consist of a commercial complex including a building, paved parking, utilities, stormwater management, and other ancillary features typical of this type of development. Due to past grading, the owner will assure that any fill areas are tested and approved to support the development, or the fill will be removed or replaced. Approximate site development area with relation to existing site features are illustrated in the Site Map in Appendix A.

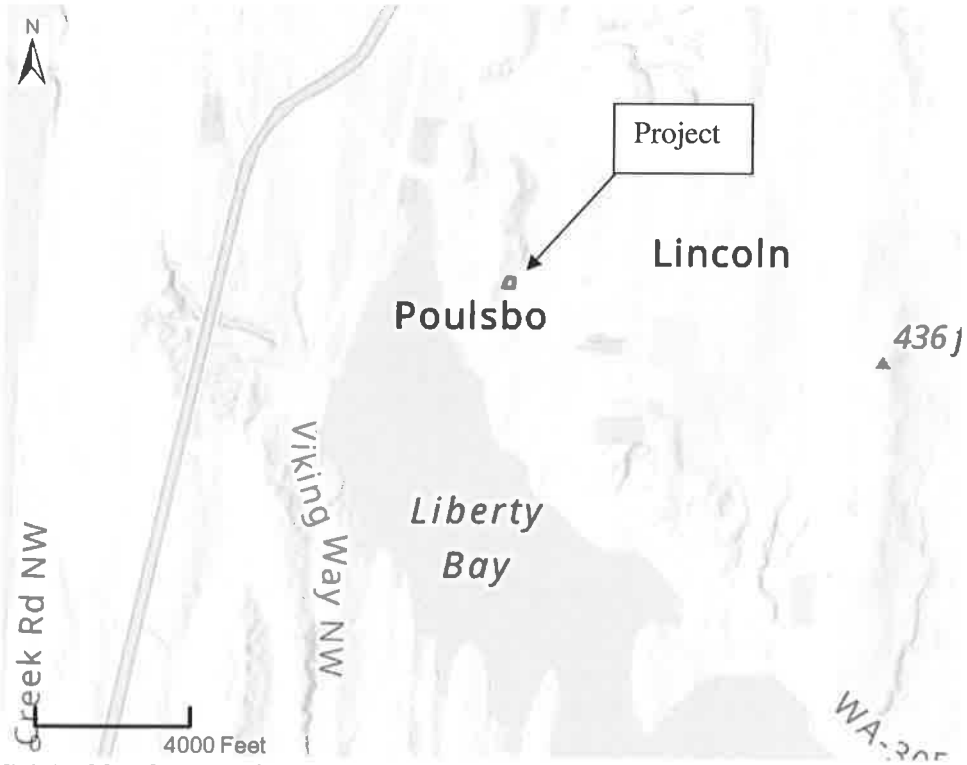
1.2 Purpose of Investigation and Scope of Work

The purpose of this geologic report was to evaluate the project in order to confirm that the proposed development is outside of any landslide hazard area and its associated buffers and setbacks as determined in the prevailing ordinance. The investigation included characterizing the general project surface and subsurface conditions, and evaluating the suitability of the soils to support the planned site development. In order to fulfill the purpose of investigation, the geological/ geotechnical program completed for the proposed improvements of the project include:

- Review project information provided by the project owner's representative;
- Conduct a site visit to document the site conditions that may influence the construction and performance of the proposed improvements;
- Define general subsurface conditions of the site by observing soils within test pit excavations, review well logs from existing wells near the project, and evaluate geological maps depicting the site geology for the vicinity of the project;
- Perform soils testing, such as visual classifications, to determine selected index properties of the soils;
- Complete an engineering assessment supported by planned site alterations and the surface and subsurface conditions that were identified by the field investigation, soil testing, and

applicable project research; and,

- Establish engineering conclusions based on findings and anticipated project.



Vicinity Map from Washington Department of Natural Resources

2.0 SURFACE CONDITIONS

Information pertaining to the existing surface conditions for the project was gathered on 8/9/2022 by a representative with Envirotech. During the site visit, site features were documented that may influence construction or reveal potential geological hazards. This Surface Conditions Section provides information on general observations, vegetation, topography, drainage and slope/ erosion conditions for the project and surrounding areas.

2.1 General Observations

The property is accessed from a shared easement via 7th Ave NE, an existing paved roadway within the city limits of Poulsbo. The roadway is connected by the access road to the east end of the property. The project is vacant land with evidence of past clearing and grading. Beyond the project, both commercial and residential development exists. The lot currently consists mostly of blackberry, weeds, and grass and other typical vegetation common to this area.

2.2 Topography

The property, including areas of development, has varying natural slopes ascending to the northwest. The entire property where development will occur is nearly flat. The ascending slope has grades averaging 18% with isolated areas of less than 8% and more than 30%.

2.3 Surface Drainage

The natural drainage from the site appears to sheet flow towards the east. Indications of significant scour or erosion from surface drainage were not observed on the property where development is expected to occur. Some surface seeping from the hillside was observed.

2.4 Slope and Erosion Observations

The existing moderate slopes near the project signal a potential landslide or erosion hazard area. Some indicators that may suggest past slope movements include:

- Outwash of sediments near the bottom of the slope,
- Fissures, tension cracks or naturally stepped land masses on the face or top of the slope, and parallel to the slope,
- Fine, saturated subsurface soils,
- Old landslide debris,
- Significant bowing or leaning trees, or,
- Slope sloughing or calving.

The above mentioned indicators, or other signs of significant mass wasting on the property or within the general vicinity of the project were not observed or discovered during research. Indications of past landslides, current unstable slopes, deep-seated slope problems, or surficial slope failures were not observed during the site visit.

Aerial Photo from Kitsap County Website

3.0 SUBSURFACE INVESTIGATION

Information on subsurface conditions pertaining to the project was gathered during research and a site reconnaissance. The site visit was accomplished on 8/9/2022 by a representative with Envirotech. Specific information on field methods, sampling, field testing, subsurface conditions, and results from soil testing are presented in this section of the report. Appendix B has pertinent information on subsurface conditions for the project, including test pit log representative of the site soils, and USDA soil descriptions.

3.1 Field Methods, Sampling and Field Testing

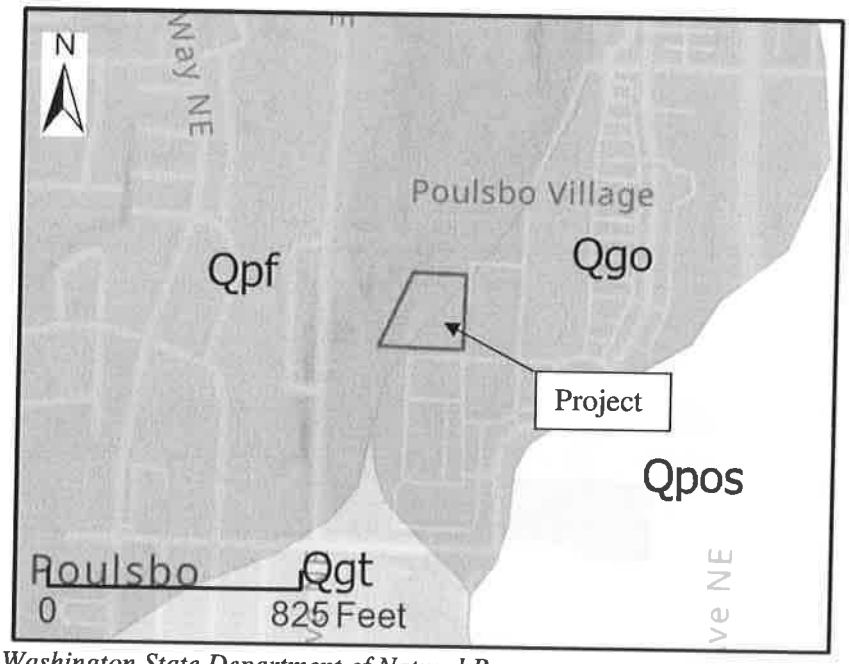
Information on subsurface conditions for the project was accomplished by probing anticipated foundation areas with hand tools, and observing soils within test pit excavations and/ or earth cuts. Information on subsurface conditions also included reviewing geological maps within the project vicinity, and water well reports originating from nearby properties. No soil samples were collected for this project. Envirotech measured the relative density of the in-situ soils by gauging the resistance of hand tools.

3.2 Geologic Conditions

In general, soils at the project are composed of materials from glacial advances. The geologic conditions as presented in the "Geologic Map of Washington," compiled by J. Eric Schuster, 2002 indicates Quaternary sediments, Q_g. Quaternary sediments are generally unconsolidated deposits, and dominantly deposited from glacial drift, including alluvium deposits. This project is located within the Puget Lowland. Typically, "lower tertiary sedimentary rocks unconformably overlie the Crescent Formation." as revealed in the Geologic Map. Initial sedimentary rocks were formed from shales, sandstones and coal deposits from rivers. During the Quaternary period, the Puget Lowland was covered by numerous ice sheets, with the most recent being the Fraser glacier with a peak of approximately 14,000 years ago. Upon the glacial retreat, the landscape was formed by glacial erosion glacial drift deposits.

The "Geologic map of the Seabeck and Poulsbo 7.5-minute quadrangles, Kitsap and Jefferson Counties, Washington" by Polenz, Michael; Cakir, Recep; Paulin, G. L.; Stone, K. A.; Contreras, T. A; Petro, G. T., 2013, provides the following caption(s) for the project area:

Unit	Age	Description
Qpf	Pleistocene	Silt, locally ranging to clay or sand, with rare dropstones; dark to pale gray, commonly bluish-gray, with some exposures ranging to brown; compact. Most exposures are horizontally laminated, but some appear structureless.
Qgo	Pleistocene	Sand and pebble and cobble gravel, some silt and clay; clasts and matrix mostly fresh, but commonly iron-stained to brown, red, and yellow, and in some exposures more weathered than recent alluvium; clasts subrounded to well rounded; moderately sorted.



Washington State Department of Natural Resources

3.3 Specific Subsurface Conditions

The following subsurface conditions are estimated descriptions of the project subgrade utilizing information from the depth of penetration at all testing, sampling, observed and investigated locations. Soils for this project were described utilizing the Unified Soil Classification System (USCS). Using the USCS in conjunction with estimated relative densities and other anticipated engineering properties of the soil, susceptibility for potential landslides, erosion and seismic hazards may be assessed.

Native soils within the upper 2 feet of natural ground were observed to be silty clay with fine sand (CL-ML). Up to 3 feet of fill was observed throughout the site.

According to the "Soil Survey of Kitsap County," by the United States Department of Agriculture, Soil Conservation Service, the site soils are described as Kitsap silt loam, 30, with 15% to 30% slopes, and Norma fine sandy loam, 37.

Expanded and specific subsurface descriptions, other than what is provided in this section, are provided in the soil logs located in Appendix B of this report.

Soil Survey From USDA Natural Resources Conservation Service

3.3.1 Groundwater

From the water well report(s) and knowledge of the general area, permanent groundwater is at least 50 feet directly below the property at the building pad location. Surface seepage was observed on the adjacent hillside. Perched groundwater at shallow depths was not noted on-site where development will occur.

4.0 ENGINEERING CONCLUSIONS

The following sections present engineering assessments and conclusions concerning the project. These conclusions have been made available based on the planned construction activities as outlined in the Introduction Section of this report; general observations of drainage and topography as summarized in the Surface Conditions Section; and soil conditions that were identified by the field investigation and soils testing as outlined in the Subsurface Investigation Section. Conclusions for the project that is provided herein, includes pertinent information for landslide, erosion and seismic hazards.

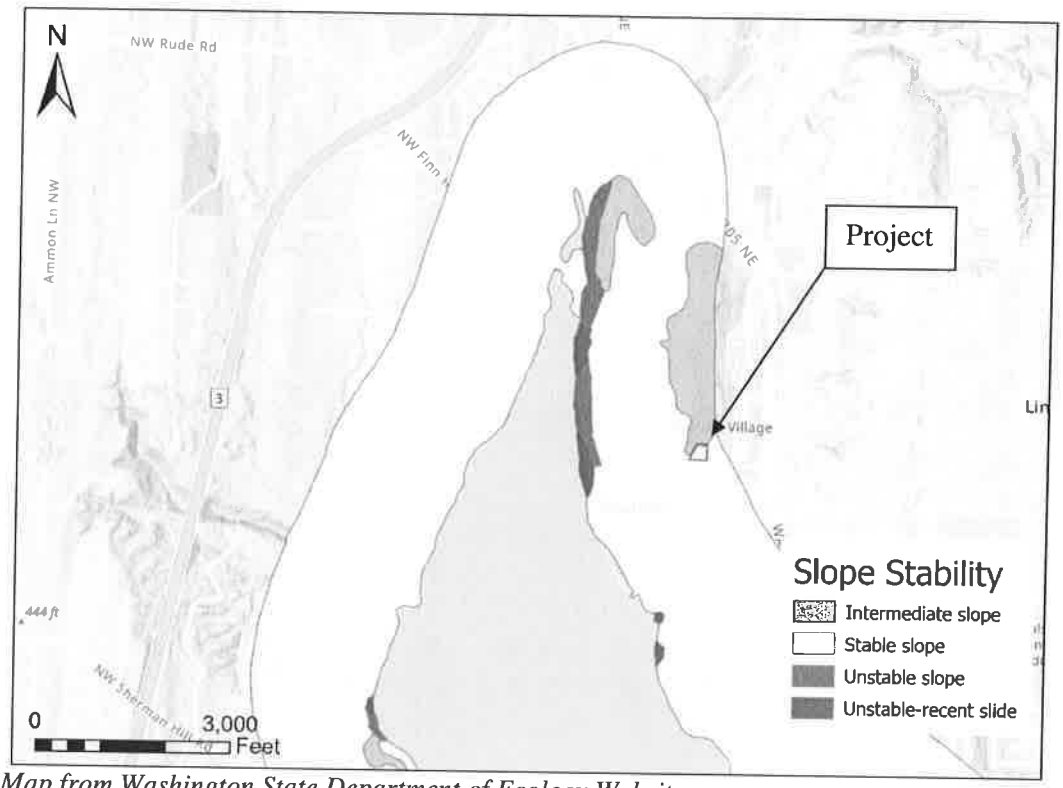
4.1 Landslide Hazards

For the planned development, as provided in the Introduction Section, surface and subsurface conditions as presented in this report, it is Envirotech's opinion that the proposed development is not subjected to or cause adverse impacts to a landslide hazard area or its associated buffer or setbacks.

Landslides are natural geologic processes, and structures near slopes possess an inherent risk of adverse settlement, sliding or structural damage due to these processes. Geotechnical engineering cannot eliminate these risks for any site with sloping grades because gravity is constantly inducing strain on the sloping soil mass. Excessive wet weather and/ or earthquakes will exacerbate these strains. Geotechnical engineering considers excessive wet weather and 'design' earthquakes in order to provide an acceptable factor of safety for developing on or near sloping terrain. These factors of safeties are based on engineering standards such as defining engineering properties of the soil, topography, water conditions, seismic acceleration and surcharges.

Surface sloughing or other types of surficial slope movements usually do not affect the deep-seated structural capability of the slope. However, excessive and/or repeated surficial slope movements, if not repaired, may represent a threat to the structural integrity of the slope. Maintenance of the slope should be completed if the situation does arise in order to prevent the possibility of further surficial or deep seated slope movements that may be damaging to life or property.

According to the Coastal Zone Atlas of Kitsap County, Washington, the project is within and near terrain labeled 'Stable' and 'Intermediate' regarding potential landslide activity. Stable slopes are generally not prone to landslides due to small grades and accommodating geology. Historically, intermediate terrains have no known landslides. However, this site is considered inherently hazardous due the existing geology and/ or topography, and additional analyses and recommendations concerning the slopes are presented herein. A Stability Map from the Coastal Zone Atlas for the general area of this project is provided below:



Map from Washington State Department of Ecology Website

According to the Department of Natural Resources (DNR) Interactive mapping, previous landslide activity is not recorded on or within the influence of the project. Per the Resource Map from DNR, the project is not within terrain labeled 'highly unstable' or 'highly erodible' relating to soils. DNR labeled portions of this project as medium slope instability with relation to slopes. This delineation is primarily dependent upon slopes and convergence. Secondly, lithology and precipitation are modeled within this delineation. In summary, this designation is based on mapping without field observations or knowledge of the specific site geology or soils. A resource map from DNR is provided below:

Map from Washington State Department of Natural Resources Website

Past landslide activity or high slope instability indicators near the proposed development was not revealed during the project research. In addition, detrimental landslide activity or potential high landslide indicators were not observed during the site visit as outlined in the Surface and Subsurface Conditions Sections of this report.

4.2 Erosion Hazards and Control

Based on the USCS description of the project soils, the surface soils are considered moderately erodible. According to the Resource Map from the Washington State DNR, as provided above, the project is not within terrain labeled 'highly erodible.'

Temporary and/ or permanent erosion control measures are required for any site when land disturbance is involved. Erosion control will mostly depend on the timeliness of construction, moisture content of the soil, and amount of rainfall during construction. Soil erosion typical to the existing conditions and planned disturbance of this project include wind-borne silts during dry weather, and sediment transport during prolonged wet weather. Sediment transport of disturbed soils could be from stormwater runoff or tracking off-site with construction equipment. Although an engineered erosion control plan is not warranted for this project, Best Management Practices (BMP's) should be employed during and after construction. Ordinary BMP's includes silt fencing, protection of drainage outlets and vegetating denuded areas.

Erosion control information and specifications may be found in the applicable "Stormwater Management Manual for Western Washington," prepared by the Washington State Department of Ecology Water Quality Program and its equivalent local jurisdiction drainage manual.

4.3 Seismic Hazards

Soils immediately below the expected foundation depth for this project are generally Type D, corresponding to the International Building Code (IBC) soil profiles. According to the IBC, the regional seismic zone is 3 for this project. The estimated peak ground acceleration ranges from 0.50g to 0.60g. This estimation is based on the United States Geological Survey (USGS) National Seismic Hazard project in which there is an estimated 2% probability of exceedance within the next 50 years.

There are no known faults beneath this project. The nearest Class 'A' or 'B' fault to this property is the Dabob Bay Fault. This fault is a Class 'B', and is located less than 5 miles to the southwest of the project. This information is supported by the USGS Quaternary Fault and Fold Database for the United States.

The potential for liquefaction and other earthquake induced hazards are believed to be low for this project. This is based on subsurface conditions such as soil characteristics and the lack of a permanent and substantial shallow water table. Subgrade characteristics that particularly contribute to problems caused by seismic events include submerged and confined, poorly-graded granular soils. Although gravel- and silt-sized soil particles could be problematic, fine and medium grained sands are typically subjected to these types of seismic hazards.

4.4 Slope Impacts

Considering the planned construction as summarized in the Introduction Section of this report; the aforementioned surface and subsurface conditions for the project; the slope stability assessment provided herein; and our engineering conclusions, it is our opinion that the project is not within a landslide hazard area, and that the proposed site alterations will not encourage a landslide hazard.

Additional methods and practices that avoid and/or reduce slope impacts include following best management practices for site development drainage.

4.5 Upland/ Slope Drainage Control and Groundwater Control

Positive drainage should be provided in the final design for all planned buildings. Drainage shall include sloping the ground surface, driveways and sidewalks away from the project structures. All constructed surface and subsurface drains should be adequately maintained during the life of the structure. If drainage problems occur during or after construction, additional engineered water mitigation will be required. This may include a combination of swales, berms, drain pipes, infiltration facilities, or outlet protection in order to divert water away from the structures to an appropriate protected discharge area.

Although some seepage was observed, this project does not appear to experience significant subsurface drainage or surface runoff that would be detrimental to the development. It is our opinion that groundwater or surface drainage is not a limiting factor for this project. Drainage

control per City development standards should be sufficient for this project.

4.6 Vegetation Management

Vegetation may be cleared on the subject property, and it is our opinion that clearing will not be problematic with relation to landslides. Denuded areas should be re-vegetated per standard practice.

Conclusions in this report are based on the type and location of the anticipated development, and existing on-site and off-site conditions. Site development that significantly deviates from the anticipated improvements presented in this report, or nearby development that influences this project may require geotechnical design recommendations.

5.0 CLOSURE

Based on the project information and site conditions as presented in this report, it is Envirotech's opinion that additional geotechnical studies are not required to further evaluate this project.

Due to the inherent natural variations of the soil stratification and the nature of the geotechnical subsurface exploration, there is always a possibility that soil conditions encountered during construction are different than those described in this report. Therefore, it is recommended that either a qualified engineer observes and documents the construction, or Envirotech is promptly notified if project and subsurface conditions found on-site are not as presented in this report so that we can re-evaluate our recommendations.

This report presents a geological/ geotechnical assessment, and is intended only for the owner, or owners' representative. Furthermore, this report is only valid for the project information and location described herein.

The services described in this report were prepared under the responsible charge of Michael Staten, a professional engineer with Envirotech. Michael Staten has appropriate education and experience in the field of geotechnical engineering in order to assess landslide hazards, earthquake hazards, and general soil mechanics.

Please contact Michael Staten at 360-275-9374 if you have any questions, comments, or require additional information.

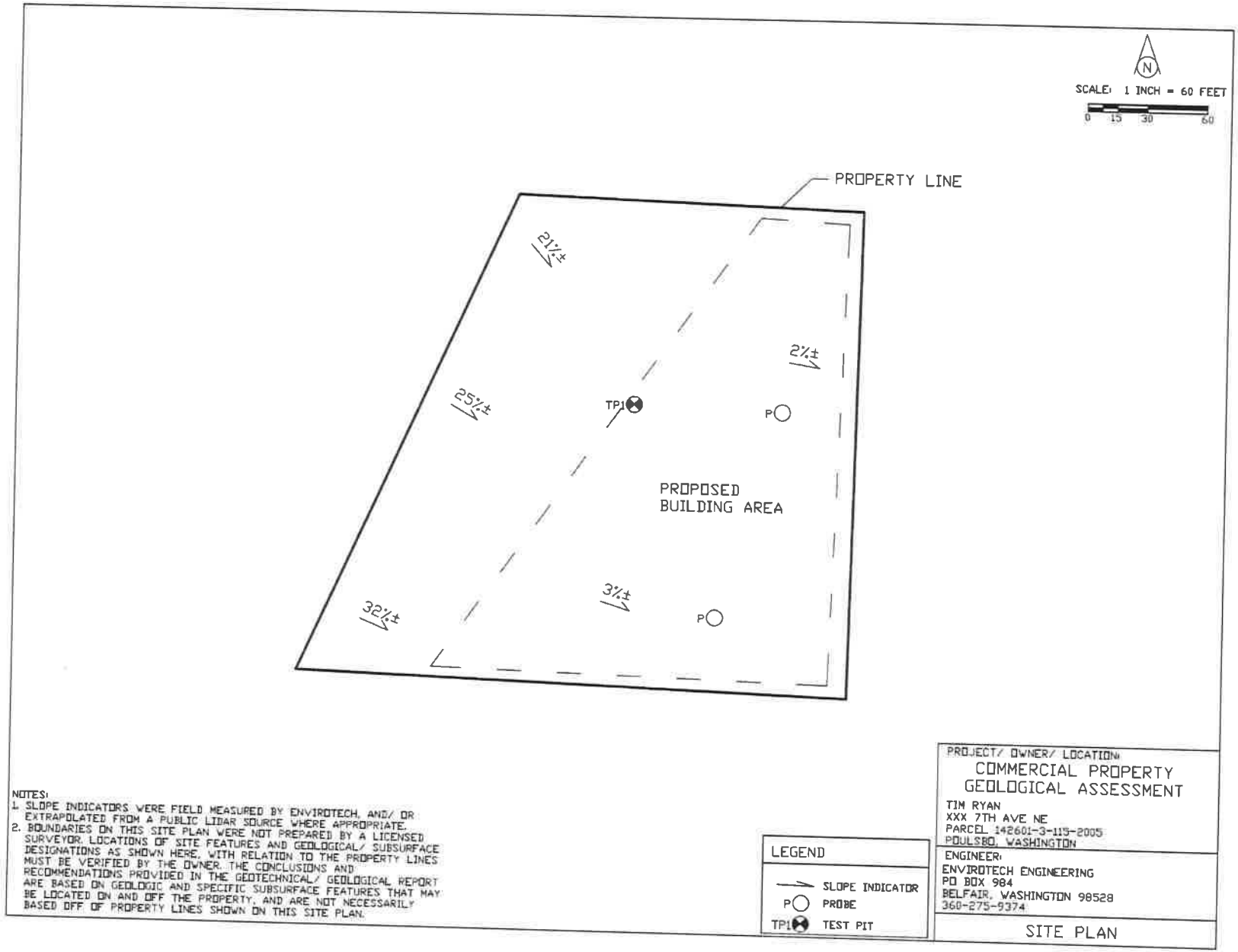
Sincerely,
Envirotech Engineering

Jessica Smith, M.S.
Staff Geologist

Michael Staten, P.E.
Geotechnical Engineer

APPENDIX A

SITE PLAN



NOTES:
1. SLOPE INDICATORS WERE FIELD MEASURED BY ENVIROTECH, AND/ OR EXTRAPOLATED FROM A PUBLIC LIDAR SOURCE WHERE APPROPRIATE.
2. BOUNDARIES ON THIS SITE PLAN WERE NOT PREPARED BY A LICENSED SURVEYOR. LOCATIONS OF SITE FEATURES AND GEOLOGICAL/ SUBSURFACE DESIGNATIONS AS SHOWN HERE, WITH RELATION TO THE PROPERTY LINES MUST BE VERIFIED BY THE OWNER. THE CONCLUSIONS AND RECOMMENDATIONS PROVIDED IN THE GEOTECHNICAL/ GEOLOGICAL REPORT ARE BASED ON GEOLOGIC AND SPECIFIC SUBSURFACE FEATURES THAT MAY BE LOCATED ON AND OFF THE PROPERTY, AND ARE NOT NECESSARILY BASED OFF OF PROPERTY LINES SHOWN ON THIS SITE PLAN.

LEGEND	
	SLOPE INDICATOR
P	PROBE
TP1	TEST PIT

PROJECT/ OWNER/ LOCATION:
COMMERCIAL PROPERTY
GEOLOGICAL ASSESSMENT
TIM RYAN
XXX 7TH AVE NE
PARCEL 142601-3-115-2005
POULSBO, WASHINGTON

ENGINEER:
ENVIROTECH ENGINEERING
PO BOX 984
BELFAIR, WASHINGTON 98528
360-275-9374

SITE PLAN

APPENDIX B

SOIL INFORMATION

TEST PIT LOG

TEST PIT NUMBER TP-1

PROJECT: Ryan Geological Assessment
PROJECT NO: 22225
CLIENT: Tim Ryan
LOCATION: Parcel 142601-3-115-2005
Poulsbo, Washington

DATE OF LOG: 8/9/2022
LOGGED BY: MCS
EXCAVATOR: N/A
DRILL RIG: None
ELEVATION: N/A

INITIAL DEPTH OF WATER: N/A

FINAL DEPTH OF WATER: N/A

DEPTH	SOIL STRATA, SAMPLERS AND TEST DATA	USCS	DESCRIPTION	LL	PI	STANDARD PENETRATION TEST DEPTH	N	CURVE 10 30 50
0		CL-ML	SILTY CLAY with fine SAND.					
1								
2			Excavation terminated at approximately 2.0 feet					
3								
4								
5								
6								
7								
8								
9								
10								

No Groundwater Encountered

This information pertains only to this boring and should not be interpreted as being indicitive of the entire site.

ENVIROTECH ENGINEERING
Geotechnical Engineering

Kitsap County Area, Washington

30—Kitsap silt loam, 15 to 30 percent slopes

Map Unit Setting

National map unit symbol: 2h6l
Elevation: 0 to 490 feet
Mean annual precipitation: 37 inches
Mean annual air temperature: 50 degrees F
Frost-free period: 160 to 200 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Kitsap and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kitsap

Setting

Landform: Terraces
Parent material: Lacustrine deposits with volcanic ash in the upper part

Typical profile

H1 - 0 to 5 inches: ashy silt loam
H2 - 5 to 35 inches: silty clay loam
H3 - 35 to 60 inches: stratified silt to silty clay loam

Properties and qualities

Slope: 15 to 30 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 11.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Forage suitability group: Sloping to Steep Soils (G002XN702WA)
Hydric soil rating: No

Data Source Information

Soil Survey Area: Kitsap County Area, Washington
Survey Area Data: Version 14, Sep 10, 2018

Mason County, Washington

Nd—Norma sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2hmf
Elevation: 0 to 1,000 feet
Mean annual precipitation: 35 to 60 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 150 to 200 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Norma and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Norma

Setting

Landform: Depressions, drainageways
Parent material: Alluvium

Typical profile

H1 - 0 to 6 inches: ashy sandy loam
H2 - 6 to 14 inches: ashy sandy loam
H3 - 14 to 30 inches: sandy loam
H4 - 30 to 60 inches: stratified loamy sand to silty clay loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Available water supply, 0 to 60 inches: Moderate (about 8.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B/D
Ecological site: F002XA007WA - Puget Lowlands Wet Forest
Forage suitability group: Wet Soils (G002XN102WA)
Other vegetative classification: Wet Soils (G002XN102WA)

Hydric soil rating: Yes

Data Source Information

Soil Survey Area: Mason County, Washington
Survey Area Data: Version 17, Aug 31, 2021

APPENDIX C POULSBO VILLAGE MIDWEST HYDROLOGICAL AND DOWNSTREAM ANALYSIS

MAP, LTD.
P.O. Box 720
SILVERDALE, WASHINGTON 98383
(360) 692-5525 FAX (360) 698-0546

JOB 5393.00 - POULSBO VILLAGE MIDWEST
SHEET NO. 1 OF 74
CALCULATED BY P.F. DATE 11/4/99
CHECKED BY _____ DATE _____
SCALE _____

PRELIMINARY HYDROLOGICAL ANALYSIS FOR POULSBO VILLAGE MIDWEST

CLIENT: TIM RYAN PROPERTIES, L.L.C.
10570 SEABECK HWY N.W.
SEABECK, WA 98380

DATE: NOVEMBER 4, 1999

11/29/99

PREPARED BY: PAT FUHRER
MAP, LTD. ENGINEERS

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REFERENCES

- KITSAP COUNTY STORMWATER MANAGEMENT DESIGN MANUAL. KITSAP COUNTY, 1997
- WATERSHED MODELING VERSION 7, ENGINEERING DATA SYSTEMS CORPORATION, 1994
- SOIL SURVEY OF THE KITSAP COUNTY AREA, WASHINGTON. US DEPT. OF AGRICULTURE, SOIL CONSERVATION SERVICE, 1980
- STORMWATER MANAGEMENT MANUAL FOR THE PUGET SOUND BASIN. WA D.O.E., 1992
- URBAN HYDROLOGY FOR SMALL WATERSHEDS T.R. #55, SCS, 1975
- STORM DRAINAGE COMPUTATIONS FOR POULSBO VILLAGE S.W. PHASE III, A.D.A. ENGINEERING, MARCH, 1996

MAP, LTD.
P.O. Box 720
SILVERDALE, WASHINGTON 98383
(360) 692-5525 FAX (360) 698-0546

JOB 5393.00 - POULSBO VILLAGE MIDWEST
SHEET NO. 2 OF 79
CALCULATED BY P.F. DATE 11/4/99
CHECKED BY _____ DATE _____
SCALE _____

A. PROJECT DESCRIPTION

THE APPLICANT IS PROPOSING THE CONSTRUCTION OF THREE COMMERICIAL BUILDINGS IMMEDIATELY WEST OF POULSBO VILLAGE CENTER. THE PROPOSAL, AS DETAILED ON THE ATTACHED PRELIMINARY GRADING AND UTILITIES PLAN, CONTEMPLATES CLEARING AND GRADING OF 3.28 ACRES OUT OF 4.93 ACRES OF PROPERTY OWNED BY THE APPLICANT.

THE PORTION OF THE PROPERTY TO BE CLEARED CONSISTS OF A BRUSHY LOWLAND (HISTORICALLY PART OF THE POULSBO GOLF COURSE) ON THE SOUTHEASTERLY 2/3 OF THE SITE, AND A FORESTED SLOPE ON THE ORDER OF 20-25% ON THE NORTHWESTERLY 1/3 OF THE SITE. A DRAINAGE DITCH RUNS ALONG THE TOE OF THE SLOPE, CONVEYING RUNOFF FROM APPROXIMATELY 17.05 ACRES OF UPSTREAM CONTRIBUTING AREA.

THE PURPOSE OF THIS ANALYSIS IS TO DEMONSTRATE THAT, UPON CONSTRUCTION OF THE PROJECT, NO ADVERSE DRAINAGE IMPACTS FROM EITHER DOWNSTREAM STREAMBANK EROSION, PIPE CAPACITY/FLOODING, OR WATER QUALITY POLLUTION WILL OCCUR. THE STORMWATER MANAGEMENT CRITERIA TO BE UTILIZED FOR THIS PROJECT WILL BE IN CONFORMANCE WITH THE KITSAP COUNTY STORMWATER MANAGEMENT MANUAL. UNDERGROUND DETENTION PIPING WILL STORE THE INCREASE IN EXISTING RUNOFF FROM THE SITE, AND 6" OF DEAD STORAGE WILL BE PROVIDED TO ALLOW FOR SETTLING OF CONTAMINANTS CONTAINED IN TYPICAL URBAN STORMWATER RUNOFF.

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SILVERDALE, WASHINGTON 98383
(360) 692-5525 FAX (360) 698-0546

JOB 5393.00 - POULSBO VILLAGE MIDWEST
SHEET NO. 3 OF 74
CALCULATED BY P.F. DATE 11/4/99
CHECKED BY _____ DATE _____
SCALE _____

B. EXISTING RUNOFF DETERMINATION

1. AREA - SEE SHT. 4

ON-SITE AREA TO BE DISTURBED = 3.28 ACRES

BRUSHY AREA EAST OF DITCH = 2.20 Acres ←
FORESTED AREA WEST OF DITCH = 1.08 Acres ←
3.28 Acres TOTAL

2. RUNOFF CURVE NUMBERS

SOIL CONSERVATION SERVICE CLASSIFICATION OF THE ON-SITE SOILS ARE KITSAP SERIES SOILS (SHT. 5), WHICH HAVE A HYDROLOGIC SOIL GROUP DESIGNATION "C" (SHT. 6).

CURVE NUMBERS: (SHT. 7)
EAST OF DITCH, "YOUNG SECOND GROWTH OR BRUSH", $C_N = 81$ → COMPOSITE $C_N = 80$
WEST OF DITCH, "ESTABLISHED SECOND GROWTH", $C_N = 78$

3. TIME OF CONCENTRATION

THE HYDRAULICALLY-MOST REMOTE POINT WITHIN THE AREA TO BE DEVELOPED IS APPROXIMATELY 200' FROM THE EXISTING DITCH. RUNOFF THEN FLOWS IN THE EXISTING DITCH 350' TO THE 18" OUTFALL WEST OF ALBERTSONS.

200' OF SHEETFLOW:

$$T_t = \frac{(0.42)(n_s L)^{0.8}}{(P_2)^{0.5}(s)^{0.4}}$$, where $n_s = 0.24$ (Dense Grasses - Sht. 8), $L = 200'$, $P_2 = 2.5"$ (SHT. 10), $s = 3.1\%$

$$= \frac{(0.42)(0.24)(200))^{0.8}}{(2.5)^{0.5}(0.031)^{0.4}}$$

$= 23.6$ min.

350' OF CHANNEL FLOW

$$T_t = \frac{L}{V \times 60}$$, where $V = K\sqrt{S_o}$, where $K = 0.807/n$, $n = 0.027$

$$V = \frac{0.807}{0.027}\sqrt{0.008} = 2.7 \text{ ft/sec}$$

$T_t = 350/(2.7)(60) = 2.2$ min.

(CONTINUES ON SHT. 9)

1) SEE SURVEY FOR "RYAN" (J.O.#84-7833)
2) SEE SURVEY FOR "BOGACHUS" (J.O.#91-736)
3) SEE SURVEY FOR "SECURITY PROPERTIES" (J.O.#97-2825)

SHT. 4 OF 4

74

N

142601-3-001-2002
RICHARD LINDQUIST

N88°23'35"W 534.27'
352.96'
181.31'

NW CORNER
NW 1/4, NE 1/4, SW1/4

142601-3-004-2001
CITY OF POULSBO

80.00'
S01°13'35"W
59.94'
S88°23'35"E
N01°13'26"E
93.35'
N88°46'32"W
(R)

142601-3-005-2008
RW RYAN PROPERTIES LP

A
Area = 185,679
(4.26 acres)

(HIGH DENSITY RESIDENTIAL ZONING)
(COMMERCIAL ZONING)
456.21'

B
Area = 113,800 sq ft

20' EASEMENT FOR INGRESS, EGRESS, AND UTILITIES
142601-3-042-2003
RYAN RW ENTERPRISES

CONC. LOADING DOCK

CONC. SLABS
EX. BUILDING
142601-3-
ALBERTSON

422.53'

R=474.94'
Δ12°06'13"
L=100.33'
S76°40'24"E
(R)

CLEARING LIMITS
(TYP.)

RYAN WEST BASIN
2nd GROWTH
1.08 Acres

R=425.00'
Δ12°05'56"
L=89.75'
N88°46'20"W
(R)

N23°39'00"E 722.70'

ON-SITE
DEVELOPED
AREA = 3.28 Acres

N88°17'
173.61'
S88°17'12"E 196.08'

142601-3-043-2002
RW RYAN ENTERPRISES

N01°14'44"E 669.15'

15' ESM'T FOR ROAD
PER AFN 571799

6TH AVENUE NE
(SEE CONDEMNATION SC83-2-00220-8)

S01°13'39"W 305.86'

C
Area = 55,513 sq ft

6' WIDE DRAINAGE DITCH

D
Area = 45,385 sq ft

N01°14'44"E 246.61'

246.61'

EX. BUILDING
CITY OF POULSBO
SHORT PLAT NO.
AFN 8903280
142601-2-
PAYLESS

PROPOSED
30' ACCESS &
UTILITIES ESM'T

GUARD RAIL

N23°39'00"E 234.07'
266.48'

RYAN EAST BASIN
2.20 Acres
"BRUSHY"

PRE-DEVELOPED
Tc: 200' SHEET
360' CHANNEL

CONC. SLAB

CONC. RAMP

15.00'
N88°17'12"W 143.40'
153.34'

276.61'

84.04'

SE CORNER
NW1/4, SE1/4,
SW1/4

S88°46'20"E 15.06'

142601-3-039-2008
JANET STIMACH

1/16TH LINE

195.96'

EX. 10' ESM'T.
TO CITY OF
POULSBO

202.00'

(SET IN ASPHALT @ COR PARKING LOT

10' BLDG. SETBACK (TYP)

N88°17'12"W
33.09'

20' A&U EA

LOT-A
(49,169 SQ. FT.)

LOT-B
(52031 SQ.FT)

EX. 10' ESM'T TO
CITY OF POULSBO

252.01'

S1°37'45"W 252.01'

260.01'

142601-3-048-2007
KIM BARNEY

N01°14'44"E 669.19'

TL091

TL092

EXIST BLDG.

VALLEY
VIEW
APARTMENTS

(TL039)
"J.L. STITMAC"

203'W. OF 6'
CHAIN LINK FNC.

10' WATER LINE
ESM'T. TO CITY
OF POULSBO

10' SAN. SEWER ESM'T.
TO CITY OF POULSBO

10' BLDG. SETBACK
S88°16'53"E 194.26'

10' BLDG. SETBACK

S88°16'53"E
171.34'

1"=100'

POULSBO VILLAGE
PHASE III

POINT OF BEGINNING
CABLE TEL

(SET TACK IN CONC. @ INTERSECTION OF CENTERLINES OF PAULSEN & FJORD)

LOT-C
(58,640 SQ.FT.)

10' SANI. SEWER
ESM'T. TO CITY
OF POULSBO

10' STORM DRAIN
ESM'T.

PROP. BLDG.

10' BLDG. SETBACK
(TYP)

N88°10'32"W 330.23'

203'W. OF
6' CHAN LNK FNC.

10' BLDG SETBACK
(TYP)

LOT-D
(59,591 SQ.FT.)

EXIST BLDG.

S88°37'59"E
(R)

10' WATER LINE
ESM'T. TO CITY
OF POULSBO

(TL090)
"L.E. NORMAN"

6' CH. LNK FNC.

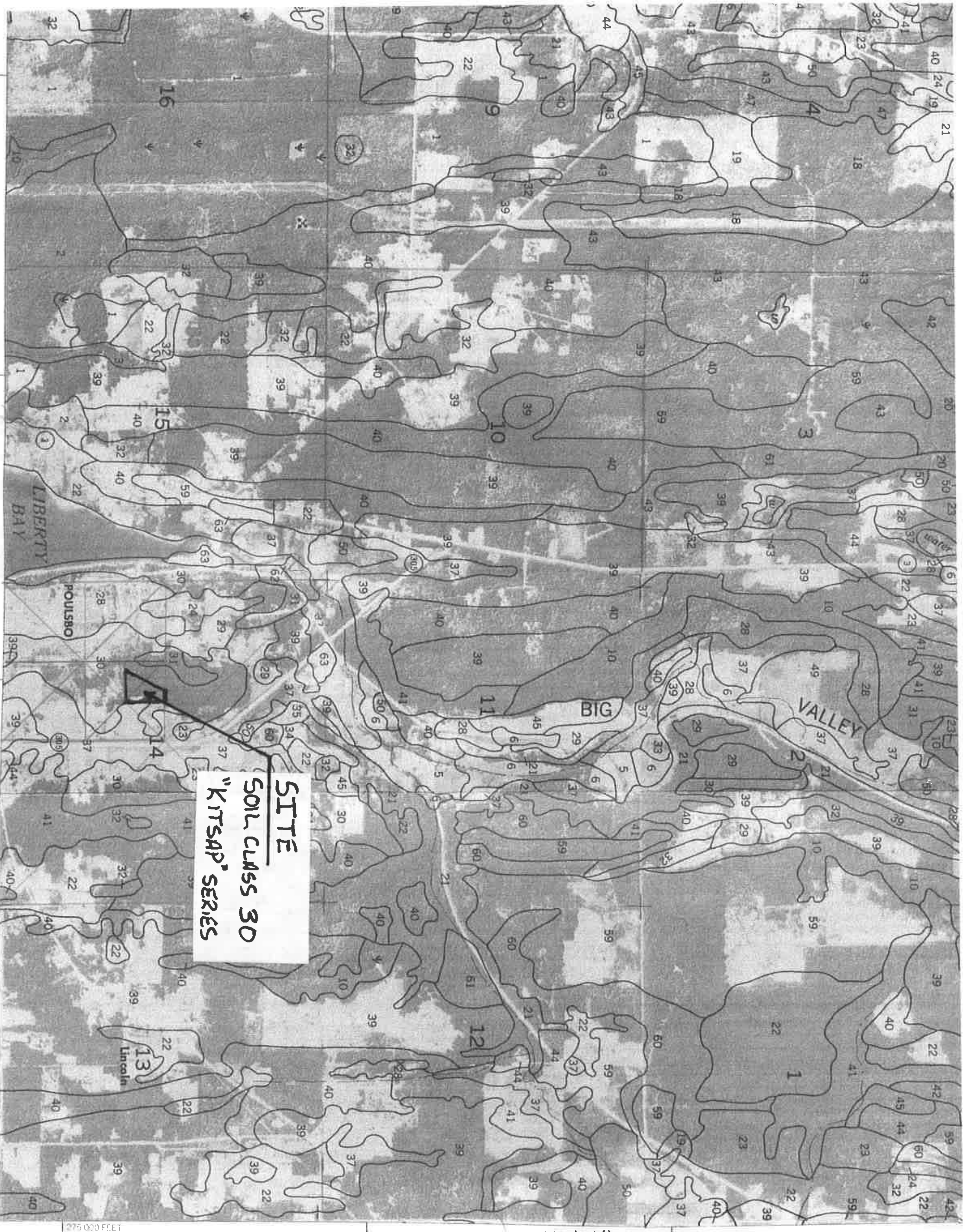
MEDIUM DENSITY RESIDEN

N1°14'32"E 616.40'

NORMAN
PARCEL

SW COR., SE1/4
SE 1/4, SW1/4
661.92' (SECT

52"E 2647.66'



(Joins sheet 7)

(Joins sheet 6)

Table 5-1 HYDROLOGIC SOIL GROUP OF THE SOILS OF KITSAP COUNTY*

SOIL GROUP	HYDROLOGIC GROUP*	SOIL GROUP	HYDROLOGIC GROUP*
Alderwood	C	Mukilteo	C/D
Beaches	Variable	Neilton	A
Belfast	B	Norma	C/D
Bellingham	C/D	Pits	Variable
Cathcart	B	Poulsbo	D
Dystric Xerorthents	Variable	Ragnar	B
Grove	A	Schneider	B
Harstine	C	Semiahmoo	C/D
Indianola	A	Shalcar	C/D
Kapowsin	D	Shelton	C
Kilchis	D	Sinclair	C
Kitsap	C	Tacoma	D
McKenna	C/D	Urban	Variable

HYDROLOGIC SOIL GROUP CLASSIFICATIONS

A. (Low runoff potential). Soils having high infiltration rates, even when thoroughly wetted, and consisting chiefly of deep, well-to-excessively drained sands or gravels. These soils have a high rate of water transmission.

B. (Moderately low runoff potential). Soils having moderate infiltration rates when thoroughly wetted, and consisting chiefly of moderately fine to moderately coarse textures. These soils have a moderate rate of water transmission.

C. (Moderately high runoff potential). Soils having slow infiltration rates when thoroughly wetted, and consisting chiefly of soils with a layer that impedes downward movement of water, or soils with moderately fine to fine textures. These soils have a low rate of water transmission.

D. (High runoff potential). Soils having very slow infiltration rates when thoroughly wetted and consisting chiefly of clay soils with a high swelling potential, soils with a permanent high water table, soils with a hardpan or clay layer at or near the surface, and shallow soils over nearly impervious material. These soils have a very slow rate of water transmission.

Note: Two Hydrologic soil groups such as C/D indicates the Drained/Undrained situation.

* From SCS, TR-55, Second Edition, June 1986, Exhibit A-1.

Table 5-2 MODIFIED CURVE NUMBERS

SCS Western Washington Runoff Curve Numbers

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

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 & grassland	74	82	89	92
Meadow or pasture:		65	78	85	89
Wood or forest land:	Undisturbed	42	64	76	81
	Established second growth [4]	48	68	78	83
	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 area	68	80	86	90
Fair condition:	Grass cover on 50-75% of 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
PUDs, condos, apartments, commercial businesses & industrial areas	% impervious must be computed

Separate curve number shall be selected for pervious and impervious portions of the site or basin.

△ - PRE-DEVELOPED CURVE #'S

□ - DEVELOPED CURVE #'S

[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.

[4] Modified by KCPW, 1995.

Table 5-3 MANNING'S COEFFICIENTS/"K" FACTORS

"n" AND "k" Values Used in Time Calculations for Hydrographs "n_s" Sheet Flow Equation Manning's Values (for the initial 300 ft. of travel)	n_s
Smooth surfaces (concrete, asphalt, gravel, or bare hand packed soil)	0.011
Fallow fields or loose soil surface (no residue)	0.05
Cultivated soil with residue cover (s≤ 0.20 ft/ft)	0.06
Cultivated soil with residue cover (s > 0.20 ft/ft)	0.17
Short prairie grass and lawns	0.15
Dense grasses	0.24
Bermuda grass	0.41
Range (natural)	0.13
Woods or forest with light underbrush	0.40
Woods or forest with dense underbrush	0.80

*Manning values for sheet flow only, from Overton and Meadows 1976 (See TR-55, 1986)

"k" Values Used in Travel Time/Time of Concentration Calculations Shallow Concentrated Flow (After the initial 300 ft. of sheet flow, R = 0.1)	k_s
1. Forest with heavy ground litter and meadows (n = 0.10)	3
2. Brushy ground with some trees (n = 0.060)	5
3. Fallow or minimum tillage cultivation (n = 0.040)	8
4. High grass (n = 0.035)	9
5. Short grass, pasture, and lawns (n = 0.030)	11
6. Nearly bare ground (n = 0.025)	13
7. Paved and gravel areas (n = 0.012)	27

**Channel flow (intermittent) (At beginning of visible channels R = 0.2)	k_c
1. Forested swale with heavy ground litter (n = 0.10)	5
2. Forested drainage course/ravine with defined channel bed (n = 0.050)	10
3. Rock-lined waterway (n = 0.035)	15
4. Grassed waterway (n = 0.030)	17
5. Earth-lined waterway (n = 0.025)	20
6. CMP pipe (n = 0.024)	21
7. Concrete pipe (0.012)	42
8. Other waterways and pipe 0.508/n	

Channel Flow (Continuous stream, R = 0.4)	k_c
9. Meandering stream with some pools (n = 0.040)	20
10. Rock-lined stream (n = 0.035)	23
11. Grass-lined stream (n = 0.030)	27
12. Other streams, man-made channels and pipe 0.807/n**	

**See Table 7-3 for additional Mannings "n" values for open channels.

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B. EXISTING RUNOFF DETERMINATION (CONTINUED)

3. TIME OF CONCENTRATION

T_C = SHEET FLOW T_t + CHANNEL FLOW T_t
= 23.6 min + 2.2 min
= 25.8 min

4. DESIGN PRECIPITATION VALUES

P_2 = 2.5" (SHT. 10)
P_{10} = 3.5" (SHT. 11)
P_{25} = 3.8" (SHT 12) - USED LATER IN THIS ANALYSIS FOR "DOWNSTREAM ANALYSIS"
P_{100} = 4.5" (SHT. 13)

5. EXISTING PEAK FLOWS

Q_2 = 0.40 cfs (SHT. 14)

Q_{10} = 0.87 cfs (SHT. 15)

Q_{100} = 1.42 cfs (SHT. 16)

THEREFORE ⟹ TARGET RELEASE RATES ARE

1/2 EXISTING 2-YR (0.20 cfs) ←

EXISTING 10-YR (0.87 cfs) ←

EXISTING 100-YR (1.42 cfs) ←

(CONTINUES ON SHT. 17)

Figure 5-1 ISOPLUVIAL MAP - 2 YEAR

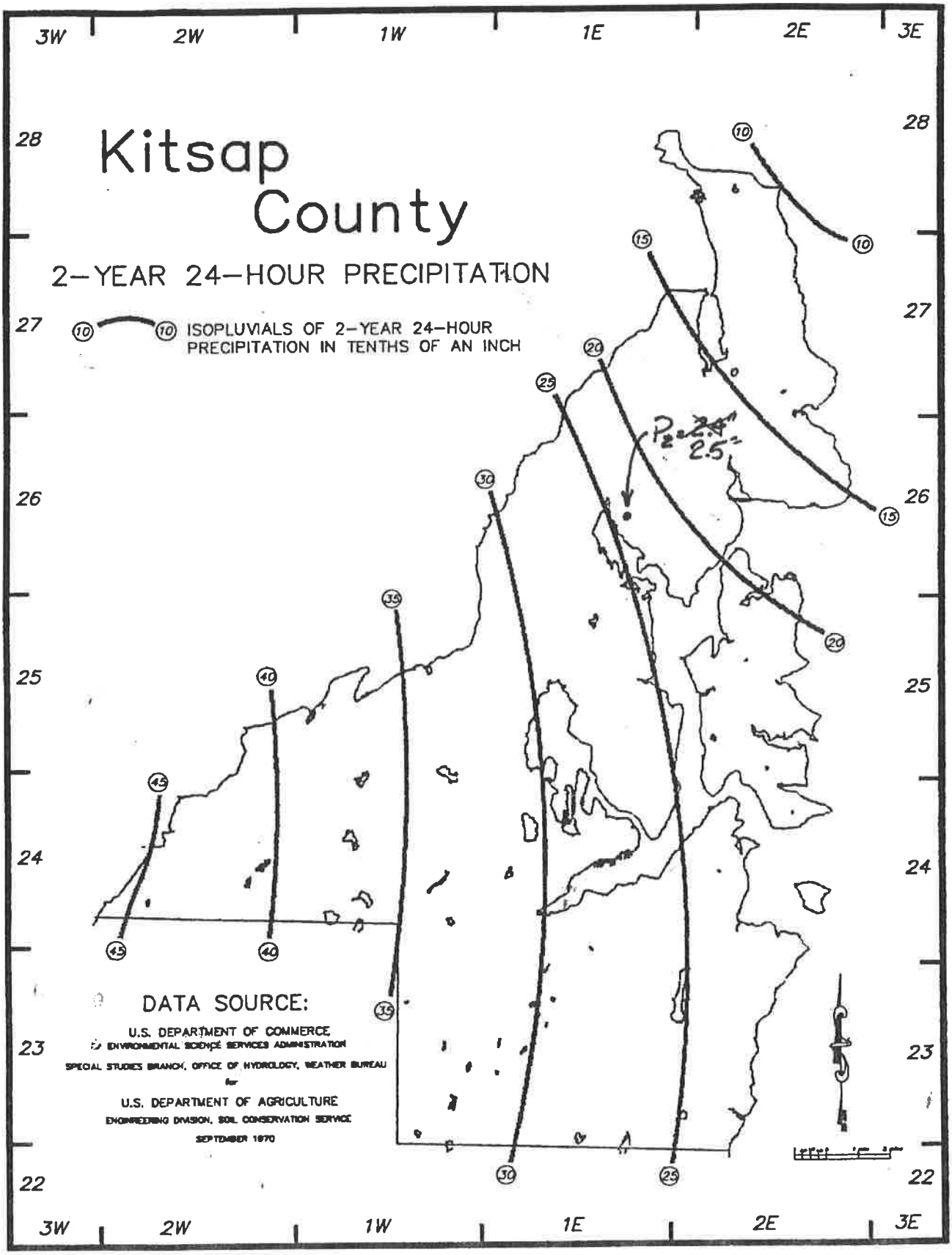


FIGURE 5-3 ISOPLUVIAL MAP - 10 YEAR

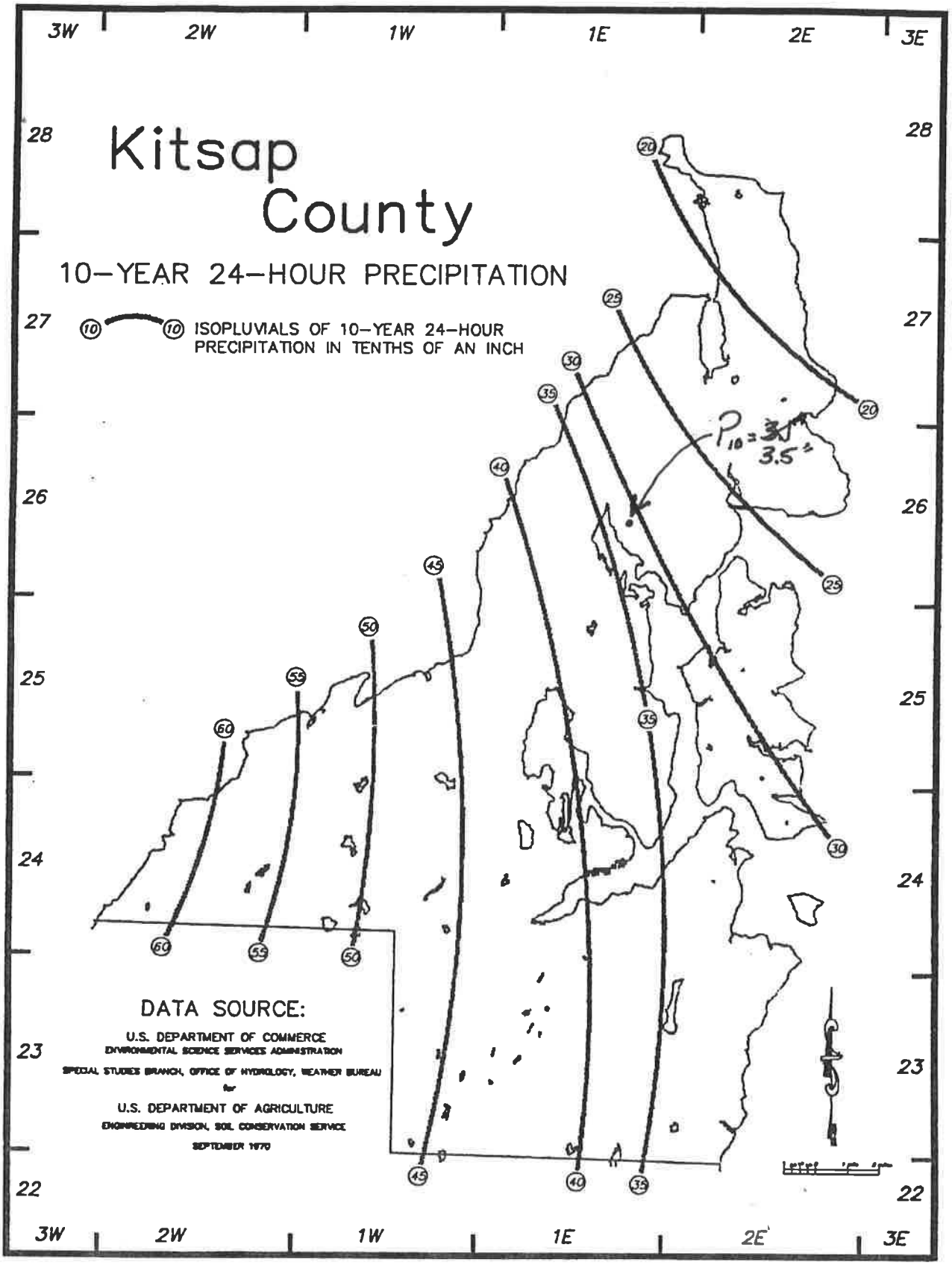


Figure 5-4 ISOPLUVIAL MAP - 25 YEAR

SHT. 12 OF 74

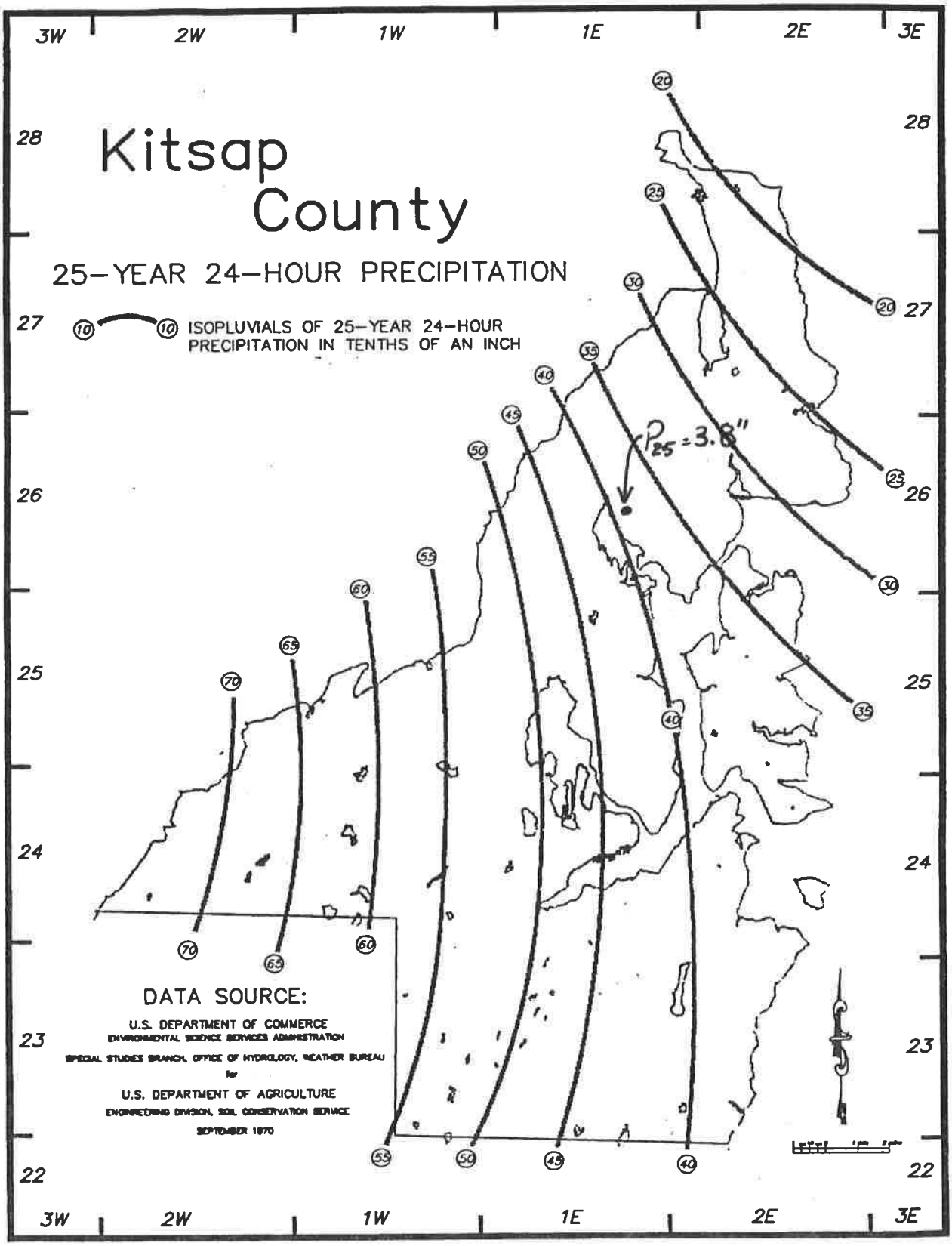
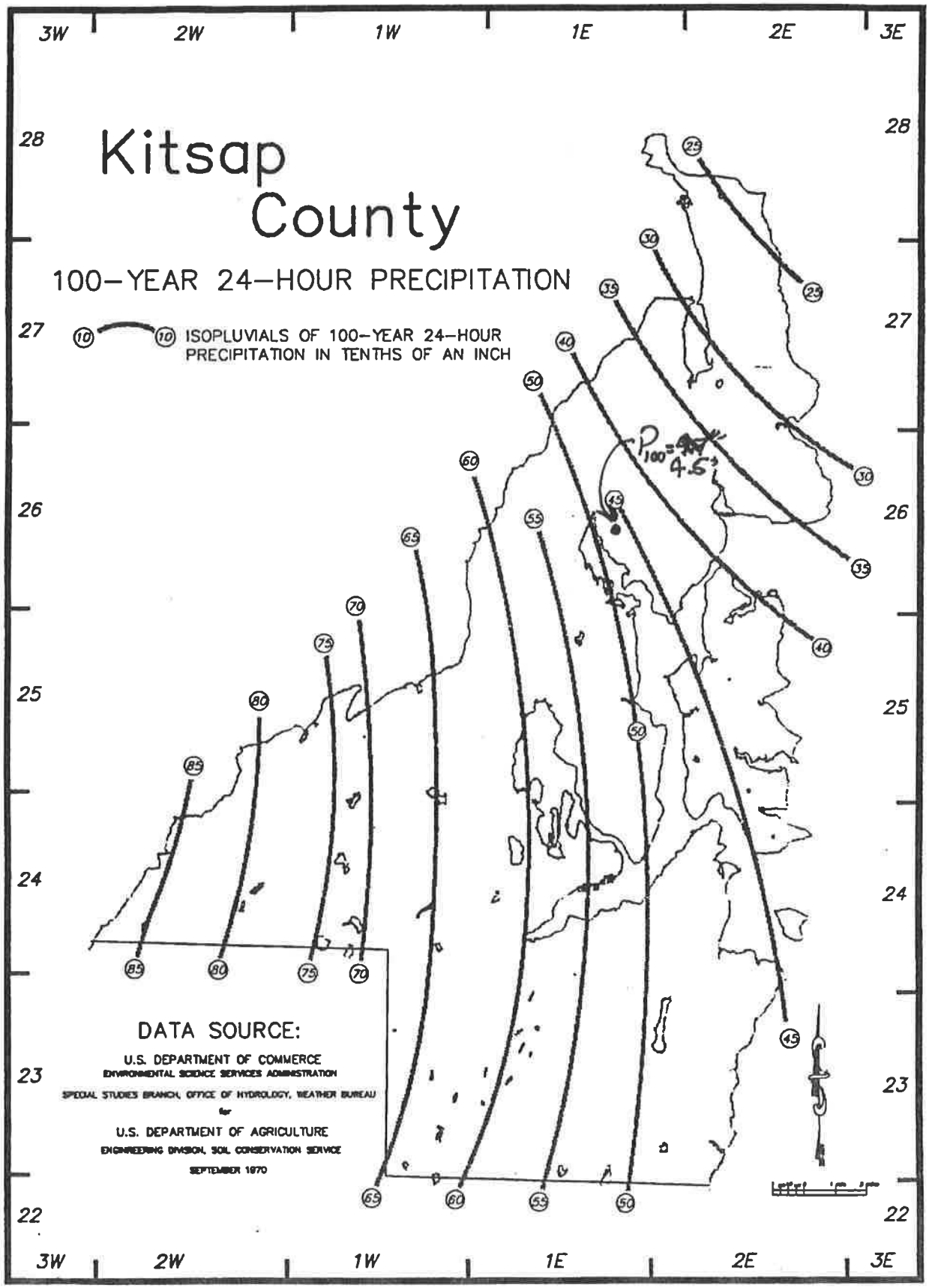


Figure 5-6 ISOPLUVIAL MAP - 100 YEAR



POULSBO VILLAGE MIDWEST
HYDROGRAPH REPORT

NUMBER : 1
TYPE : SANTA BARBARA
DESCRIPTION : 2-YR PRE-DEVELOPED ON-SITE

[HYDROGRAPH INFORMATION]

Peak Discharge	=	0.40 (cfs)
Volume	=	0.24 (acft)
Time Interval	=	0.08 (hr)
Time to Peak	=	8.08 (hr)
Time of Base	=	27.08 (hr)
Multiplication factor	=	1.00

[BASIN DESCRIPTION]

Watershed Area	=	3.28 (ac)
Curve Number	=	80

[RAINFALL DESCRIPTION]

Distribution Type	=	SCS IA
Total Precipitation	=	2.50 (in)
Return Period	=	2 (yr)
Storm Duration	=	24.00 (hr)

[TIME CONCENTRATION -- USER DEFINED]

Time of Concentration	=	25.80 (min)

[Hydrograph Flow Values Time vs. Flow]
(The time interval is 1.0 hr)

TIME (hr)	OUTFLOW (cfs)
6.1	0.00
7.1	0.04
8.1	0.40
9.1	0.28
10.1	0.21
11.1	0.19
12.1	0.17
13.1	0.16
14.1	0.16
15.1	0.16
16.1	0.16
17.1	0.15
18.1	0.15
19.1	0.14
20.1	0.14
21.1	0.13
22.1	0.12
23.1	0.12
24.1	0.11
25.1	0.01
26.1	0.00

POULSBO VILLAGE MIDWEST
HYDROGRAPH REPORT

NUMBER : 2
TYPE : SANTA BARBARA
DESCRIPTION : 10-YR PRE-DEVELOPED ON-SITE

[HYDROGRAPH INFORMATION]

Peak Discharge	=	0.87 (cfs)
Volume	=	0.45 (acft)
Time Interval	=	0.08 (hr)
Time to Peak	=	8.08 (hr)
Time of Base	=	27.33 (hr)
Multiplication factor	=	1.00

[BASIN DESCRIPTION]

Watershed Area	=	3.28 (ac)
Curve Number	=	80

[RAINFALL DESCRIPTION]

Distribution Type	=	SCS IA
Total Precipitation	=	3.50 (in)
Return Period	=	10 (yr)
Storm Duration	=	24.00 (hr)

[TIME CONCENTRATION -- USER DEFINED]

Time of Concentration	=	25.80 (min)

[Hydrograph Flow Values Time vs. Flow]
(The time interval is 1.0 hr)

TIME (hr)	OUTFLOW (cfs)
5.1	0.01
6.1	0.07
7.1	0.17
8.1	0.87
9.1	0.55
10.1	0.39
11.1	0.34
12.1	0.30
13.1	0.28
14.1	0.28
15.1	0.27
16.1	0.26
17.1	0.26
18.1	0.25
19.1	0.24
20.1	0.23
21.1	0.21
22.1	0.20
23.1	0.19
24.1	0.18
25.1	0.02
26.1	0.00

POULSBO VILLAGE MIDWEST
HYDROGRAPH REPORT

NUMBER : 3
TYPE : SANTA BARBARA
DESCRIPTION : 100-YR PRE-DEVELOPED ON-SITE

[HYDROGRAPH INFORMATION]

Peak Discharge	=	1.42 (cfs)
Volume	=	0.68 (acft)
Time Interval	=	0.08 (hr)
Time to Peak	=	8.08 (hr)
Time of Base	=	27.42 (hr)
Multiplication factor	=	1.00

[BASIN DESCRIPTION]

Watershed Area	=	3.28 (ac)
Curve Number	=	80

[RAINFALL DESCRIPTION]

Distribution Type	=	SCS IA
Total Precipitation	=	4.50 (in)
Return Period	=	100 (yr)
Storm Duration	=	24.00 (hr)

[TIME CONCENTRATION -- USER DEFINED]

Time of Concentration	=	25.80 (min)

[Hydrograph Flow Values Time vs. Flow]
(The time interval is 1.0 hr)

TIME (hr)	OUTFLOW (cfs)
4.1	0.00
5.1	0.06
6.1	0.17
7.1	0.33
8.1	1.42
9.1	0.85
10.1	0.59
11.1	0.50
12.1	0.44
13.1	0.41
14.1	0.40
15.1	0.39
16.1	0.37
17.1	0.36
18.1	0.35
19.1	0.33
20.1	0.31
21.1	0.30
22.1	0.28
23.1	0.26
24.1	0.25
25.1	0.03
26.1	0.00

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SHEET NO. 17 OF 74
CALCULATED BY P.F. DATE 11/10/99
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SCALE

C. DEVELOPED RUNOFF DETERMINATION

1. AREAS - REFER TO "PRELIMINARY SITE GRADING & UTILITY PLAN" SUBMITTED WITH THE LANDUSE APPLICATION DATED 10/11/99

ASPHALTED AREAS - 66,271 s.f. (1.5214 Acres)
BUILDINGS/WALKS - 33,555 s.f. (0.7703 Acres)
LANDSCAPING 43,235 s.f. (0.9925 Acres)
3.28 ✓

2. RUNOFF CURVE NUMBERS

DEVELOPED CURVE #'s (SHT. 7)

ASPHALT/BUILDINGS, $C_N = 98$
PERVIOUS LANDSCAPING, $C_N = 90$ (FAIR CONDITION)
COMPOSITE $C_N = [(1.5214 + 0.7703)98 + (0.9925)(90)]/3.2842 = 96$

3. TIME OF CONCENTRATION

A CONSERVATIVE $T_c = 5$ MINUTES WILL BE ASSUMED. THIS IS A CONSERVATIVE ESTIMATE WHICH ACCOUNTS ONLY FOR THE INITIAL COLLECTION AND DOES NOT ACCOUNT FOR ANY TRAVEL TIME

4. DEVELOPED PEAK FLOWS

$Q_2 = 1.75$ cfs (SHT. 18)

$Q_{10} = 2.57$ cfs (SHT. 19)

$Q_{100} = 3.38$ cfs (SHT. 20)

(CONTINUES ON SHT. 21)

POULSBO VILLAGE MIDWEST
HYDROGRAPH REPORT

NUMBER : 4
TYPE : SANTA BARBARA
DESCRIPTION : 2-YR DEVELOPED ON-SITE

[HYDROGRAPH INFORMATION]

Peak Discharge	=	1.75 (cfs)
Volume	=	0.57 (acft)
Time Interval	=	0.03 (hr)
Time to Peak	=	7.90 (hr)
Time of Base	=	24.63 (hr)
Multiplication factor	=	1.00

[BASIN DESCRIPTION]

Watershed Area	=	3.28 (ac)
Curve Number	=	96

[RAINFALL DESCRIPTION]

Distribution Type	=	SCS IA
Total Precipitation	=	2.50 (in)
Return Period	=	2 (yr)
Storm Duration	=	24.00 (hr)

[TIME CONCENTRATION -- USER DEFINED]

Time of Concentration	=	5.00 (min)

[Hydrograph Flow Values Time vs. Flow]
(The time interval is 1.0 hr)

TIME (hr)	OUTFLOW (cfs)
2.0	0.04
3.0	0.10
4.0	0.17
5.0	0.24
6.0	0.34
7.0	0.46
8.0	1.61
9.0	0.54
10.0	0.42
11.0	0.35
12.0	0.30
13.0	0.29
14.0	0.27
15.0	0.26
16.0	0.25
17.0	0.24
18.0	0.23
19.0	0.21
20.0	0.20
21.0	0.19
22.0	0.18
23.0	0.17
24.0	0.15

POULSBO VILLAGE MIDWEST
HYDROGRAPH REPORT

NUMBER : 5
TYPE : SANTA BARBARA
DESCRIPTION : 10-YR DEVELOPED ON-SITE

[HYDROGRAPH INFORMATION]

Peak Discharge	=	2.57 (cfs)
Volume	=	0.84 (acft)
Time Interval	=	0.03 (hr)
Time to Peak	=	7.90 (hr)
Time of Base	=	24.67 (hr)
Multiplication factor	=	1.00

[BASIN DESCRIPTION]

Watershed Area	=	3.28 (ac)
Curve Number	=	96

[RAINFALL DESCRIPTION]

Distribution Type	=	SCS IA
Total Precipitation	=	3.50 (in)
Return Period	=	10 (yr)
Storm Duration	=	24.00 (hr)

[TIME CONCENTRATION -- USER DEFINED]

Time of Concentration	=	5.00 (min)

[Hydrograph Flow Values Time vs. Flow]
(The time interval is 1.0 hr)

TIME (hr)	OUTFLOW (cfs)
2.0	0.11
3.0	0.20
4.0	0.29
5.0	0.39
6.0	0.54
7.0	0.69
8.0	2.35
9.0	0.78
10.0	0.60
11.0	0.50
12.0	0.42
13.0	0.41
14.0	0.38
15.0	0.37
16.0	0.35
17.0	0.34
18.0	0.32
19.0	0.30
20.0	0.29
21.0	0.27
22.0	0.25
23.0	0.23
24.0	0.22

POULSBO VILLAGE MIDWEST
HYDROGRAPH REPORT

NUMBER : 6
TYPE : SANTA BARBARA
DESCRIPTION : 100-YR DEVELOPED ON-SITE

[HYDROGRAPH INFORMATION]

Peak Discharge	=	3.38 (cfs)
Volume	=	1.11 (acft)
Time Interval	=	0.03 (hr)
Time to Peak	=	7.90 (hr)
Time of Base	=	24.70 (hr)
Multiplication factor	=	1.00

[BASIN DESCRIPTION]

Watershed Area	=	3.28 (ac)
Curve Number	=	96

[RAINFALL DESCRIPTION]

Distribution Type	=	SCS IA
Total Precipitation	=	4.50 (in)
Return Period	=	100 (yr)
Storm Duration	=	24.00 (hr)

[TIME CONCENTRATION -- USER DEFINED]

Time of Concentration	=	5.00 (min)

[Hydrograph Flow Values Time vs. Flow]
(The time interval is 1.0 hr)

TIME (hr)	OUTFLOW (cfs)
1.0	0.01
2.0	0.19
3.0	0.30
4.0	0.42
5.0	0.55
6.0	0.73
7.0	0.92
8.0	3.08
9.0	1.02
10.0	0.78
11.0	0.65
12.0	0.55
13.0	0.53
14.0	0.50
15.0	0.48
16.0	0.46
17.0	0.44
18.0	0.41
19.0	0.39
20.0	0.37
21.0	0.35
22.0	0.32
23.0	0.30
24.0	0.28

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JOB 5393.00 - POULSBO VILLAGE MIDWEST
SHEET NO. 21 OF 74
CALCULATED BY P.F. DATE 11/12/99
CHECKED BY DATE
SCALE

D. OUTLET STRUCTURE DESIGN

1. UPON MULTIPLE ITERATIONS AND TRIAL AND ERROR, A STANDARD T-STRUCTURE WAS MATCHED TO AN APPROPRIATE LENGTH/SIZE OF UNDERGROUND DETENTION BARREL TO ACHIEVE THE DESIRED PERFORMANCE RESULTS:

   - BOTTOM ORIFICE = 1 3/4" (AT ASSUMED I.E. = 100.0)
   - 2 3/4" WIDE SLIT IN THE STANDPIPE FROM 2-YR HIGH-WATER MARK TO TOP OF THE STANDPIPE

SEE SHT.'s 22 - 25 FOR THE OUTLET STRUCTURE DEFINITION UTILIZED FOR THIS PRELIMINARY ANALYSIS.

E. DETENTION PIPE DEFINITION

1. COUPLED WITH THE ITERATIONS ABOVE, DIFFERENT COMBINATIONS OF UNDERGROUND DETENTION PIPE LENGTHS AND DIAMETERS WERE MODELED TO ACHIEVE THE REQUIRED STAGE/STORAGE/DISCHARGE PERFORMANCE CRITERIA.

   - 330 LF ~ 8' DIAMETER DETENTION BARREL WAS FOUND TO MEET THE STORAGE AND DISCHARGE CRITERIA

SEE SHT.'s 26 - 27 FOR THE DETENTION PIPE DEFINITION UTILIZED FOR THIS PRELIMINARY ANALYSIS.

F. LEVEL-POOL ROUTE DESIGN STORMS

1. ROUTING THE DEVELOPED SITE HYDROGRAPHS THROUGH THE DEFINED PIPE AND T-STRUCTURE, THE FOLLOWING RESULTS WERE ACHIEVED:

   Q_2 = 0.20 cfs (= ½ ~2 yr PRE-DEVELOPED FLOW) (SHT.'s 28 & 29)
   Q_{10} = 0.58 cfs (< 0.87 cfs) SHT.'s 30 & 31
   Q_{100} = 1.42 cfs (= 100-YR PRE-DEVELOPED FLOW) SHT.'s 32 & 33

(CONTINUED ON SHT. 34)

SHT. 22 OF 74

POULSBO VILLAGE MIDWEST
OUTLET STRUCTURE REPORT

NUMBER : 3
TYPE : STAND PIPE WEIR
DESCRIPTION : T-STRUCTURE FOR 8'DETENTION BARRELS
[OPEN WEIR INFORMATION]
DESCRIPTION : CIRCULAR CMP STAND PIPE
[OUTLET STRUCTURE INFORMATION]

Radius	=	0.63 (ft)
Crest Length	=	0.2292 (ft)
Crest Elevation	=	105.61 (ft)

[RATING CURVE LIMIT]

Minimum Elevation	=	100.00 (ft)
Maximum Elevation	=	108.00 (ft)
Elevation Increment	=	0.10 (ft)

[RECTANGULAR STAND PIPE EQUATION]
ORIFICE EQ: Q = Co*A(2gh)^0.5
WEIR EQ: Q = Cw*L*H^exp

Coefficient Co	=	0.620
Coefficient Cw	=	3.330
Exponential	=	1.500

[DEFINITIONS]
H = Headwater depth above inlet control section invert, (ft)
A = Wetted area, (ft2)
L = Crest length, (ft)
[ORIFICE INFORMATION]
SUBRECORD : 1
DESCRIPTION : 1-3/4" BOTTOM ORIFICE
[OUTLET STRUCTURE INFORMATION]

Radius	=	0.0729 (ft)
Invert Elevation	=	100.00 (ft)
# of Openings	=	1

[RATING CURVE LIMITS]

Minimum elevation	=	100.00 (ft)
Maximum elevation	=	108.00 (ft)
Elevation Increment	=	0.10 (ft)

[CIRCULAR ORIFICE EQUATION]
Q = Co*A*[2gh]/k]^0.5

Coefficient Co	=	0.620

[DEFINITIONS]
A = Wetted area, (ft2)
K = 1

[CULVERT INFORMATION]

DESCRIPTION : T-STRUCTURE OUTLET PIPE

[OUTLET STRUCTURE INFORMATION]

Circular Radius	=	0.63 (ft)
Culvert Invert Elevation	=	100.00 (ft)
Slope	=	0.01
Manning's N-value	=	0.01
Orifice Coefficient	=	0.90
Tailwater	=	99.60 (ft)
Number barrels	=	1

[UNSUBMERGED EQUATION]

H/Diam = Hc/Diam + K *(Q/A*Diam^0.5))^M - 0.5*S^2

Coefficient K	=	0.034
coefficient M	=	1.500

[SUBMERGED EQUATION]

H/Diam = c*(Q/(A*Diam^0.5))^Z + Y - 0.5*S^2

Coefficient c	=	0.055
Coefficient Y	=	0.540

[DEFINITIONS]

H = Headwater depth above inlet control section invert, (ft)
Diam = Interior height of culvert barrel, (ft)
Hc = Specific head at critical depth (dc + Vc2/2g), (ft)
Q = Discharge, (ft3/s)
A = Full cross sectional area of culvert barrel, (ft2)
S = Culvert barrel slope, (ft/ft)

[Stand Pipe Discharge Value vs. Stage]
(the elevation increment is 0.1)

STAGE	ELEVATION (ft)	ORIFICE (cfs)	WEIR (cfs)	STAND PIPE (cfs)	CULVERT (cfs)	TOTAL FLOW (cfs)
0.00	100.00	0.00	0.00	0.00	0.00	0.00
0.10	100.10	0.01	0.00	0.00	0.00	0.00
0.20	100.20	0.03	0.00	0.00	0.00	0.00
0.30	100.30	0.04	0.00	0.00	0.14	0.04
0.40	100.40	0.05	0.00	0.00	0.56	0.05
0.50	100.50	0.05	0.00	0.00	0.83	0.05
0.60	100.60	0.06	0.00	0.00	1.14	0.06
0.70	100.70	0.07	0.00	0.00	1.47	0.07
0.80	100.80	0.07	0.00	0.00	1.83	0.07
0.90	100.90	0.08	0.00	0.00	2.19	0.08
1.00	101.00	0.08	0.00	0.00	2.53	0.08
1.10	101.10	0.08	0.00	0.00	2.97	0.08
1.20	101.20	0.09	0.00	0.00	3.42	0.09
1.30	101.30	0.09	0.00	0.00	3.87	0.09

STAGE	ELEVATION (ft)	ORIFICE (cfs)	WEIR (cfs)	STAND PIPE (cfs)	CULVERT (cfs)	TOTAL FLOW (cfs)
1.40	101.40	0.10	0.00	0.00	4.31	0.10
1.50	101.50	0.10	0.00	0.00	4.76	0.10
1.60	101.60	0.10	0.00	0.00	5.04	0.10
1.70	101.70	0.11	0.00	0.00	5.30	0.11
1.80	101.80	0.11	0.00	0.00	5.55	0.11
1.90	101.90	0.11	0.00	0.00	5.79	0.11
2.00	102.00	0.12	0.00	0.00	6.02	0.12
2.10	102.10	0.12	0.00	0.00	6.24	0.12
2.20	102.20	0.12	0.00	0.00	6.46	0.12
2.30	102.30	0.12	0.00	0.00	6.67	0.12
2.40	102.40	0.13	0.00	0.00	6.87	0.13
2.50	102.50	0.13	0.00	0.00	7.06	0.13
2.60	102.60	0.13	0.00	0.00	7.25	0.13
2.70	102.70	0.13	0.00	0.00	7.44	0.13
2.80	102.80	0.14	0.00	0.00	7.62	0.14
2.90	102.90	0.14	0.00	0.00	7.79	0.14
3.00	103.00	0.14	0.00	0.00	7.97	0.14
3.10	103.10	0.14	0.00	0.00	8.14	0.14
3.20	103.20	0.15	0.00	0.00	8.30	0.15
3.30	103.30	0.15	0.00	0.00	8.46	0.15
3.40	103.40	0.15	0.00	0.00	8.62	0.15
3.50	103.50	0.15	0.00	0.00	8.78	0.15
3.60	103.60	0.16	0.00	0.00	8.93	0.16
3.70	103.70	0.16	0.00	0.00	9.09	0.16
3.80	103.80	0.16	0.00	0.00	9.23	0.16
3.90	103.90	0.16	0.00	0.00	9.38	0.16
4.00	104.00	0.16	0.00	0.00	9.53	0.16
4.10	104.10	0.17	0.00	0.00	9.67	0.17
4.20	104.20	0.17	0.00	0.00	9.81	0.17
4.30	104.30	0.17	0.00	0.00	9.95	0.17
4.40	104.40	0.17	0.00	0.00	10.08	0.17
4.50	104.50	0.17	0.00	0.00	10.21	0.17
4.60	104.60	0.18	0.00	0.00	10.35	0.18
4.70	104.70	0.18	0.00	0.00	10.48	0.18
4.80	104.80	0.18	0.00	0.00	10.61	0.18
4.90	104.90	0.18	0.00	0.00	10.73	0.18
5.00	105.00	0.18	0.00	0.00	10.86	0.18
5.10	105.10	0.19	0.00	0.00	10.99	0.19
5.20	105.20	0.19	0.00	0.00	11.11	0.19
5.30	105.30	0.19	0.00	0.00	11.23	0.19
5.40	105.40	0.19	0.00	0.00	11.35	0.19
5.50	105.50	0.19	0.00	0.00	11.47	0.19
5.60	105.60	0.20	0.00	0.00	11.59	0.20
5.70	105.70	0.20	0.00	0.02	11.71	0.22
5.80	105.80	0.20	0.00	0.06	11.82	0.26
5.90	105.90	0.20	0.00	0.12	11.94	0.32
6.00	106.00	0.20	0.00	0.19	12.05	0.39
6.10	106.10	0.20	0.00	0.26	12.16	0.47
6.20	106.20	0.21	0.00	0.35	12.27	0.55
6.30	106.30	0.21	0.00	0.44	12.38	0.64

STAGE	ELEVATION (ft)	ORIFICE (cfs)	WEIR (cfs)	STAND PIPE (cfs)	CULVERT (cfs)	TOTAL FLOW (cfs)
6.40	106.40	0.21	0.00	0.54	12.49	0.74
6.50	106.50	0.21	0.00	0.64	12.60	0.85
6.60	106.60	0.21	0.00	0.75	12.71	0.96
6.70	106.70	0.21	0.00	0.87	12.82	1.08
6.80	106.80	0.22	0.00	0.99	12.92	1.21
6.90	106.90	0.22	0.00	1.12	13.03	1.34
7.00	107.00	0.22	0.00	1.25	13.13	1.47
7.10	107.10	0.22	0.00	1.39	13.23	1.61
7.20	107.20	0.22	0.00	1.53	13.34	1.75
7.30	107.30	0.22	0.00	1.68	13.44	1.90
7.40	107.40	0.22	0.00	1.83	13.54	2.05
7.50	107.50	0.23	0.00	1.98	13.64	2.21
7.60	107.60	0.23	0.00	2.70	13.74	2.92
7.70	107.70	0.23	0.00	3.57	13.84	3.80
7.80	107.80	0.23	0.00	4.44	13.94	4.67
7.90	107.90	0.23	0.00	5.31	14.03	5.54

POULSBO VILLAGE MIDWEST
RESERVOIR REPORT

NUMBER : 2
STORAGE TYPE : UNDERGND PIPE
DISCHARGE TYPE : COMP STAGE/DISC
DESCRIPTION : 8' BARRELS

[RATING CURVE LIMIT]

Minimum Elevation..... = 100.00 (ft)
Maximum Elevation..... = 108.00 (ft)
Elevation Increment..... = 0.10 (ft)

[STAGE STORAGE INFORMATION]

RESERVOIR DESCRIPTION:
Length..... = 330.00 (ft)
Radius..... = 4.00 (ft)

[STAGE DISCHARGE INFORMATION]

OUTLET STRUCTURE:
STR # : 3
TYPE : STAND PIPE WEIR
DESCRIPTION : T-STRUCTURE FOR 8' BARRELS

[Reservoir Discharge Value vs. Stage]
(the elevation increment is 0.2)

STAGE (ft)	ELEVATION (ft)	CONTOUR AREA (sqft)	STORAGE (cuft)	DISCHARGE (cfs)
0.00	100.00	0.00	0.00	0.00
0.20	100.20	824.34	110.47	0.00
0.40	100.40	1150.75	310.07	0.05
0.60	100.60	1390.71	565.20	0.06
0.80	100.80	1584.00	863.29	0.07
1.00	101.00	1746.20	1196.74	0.08
1.20	101.20	1885.34	1560.23	0.09
1.40	101.40	2006.23	1949.67	0.10
1.60	101.60	2112.00	2361.72	0.10
1.80	101.80	2204.83	2793.60	0.11
2.00	102.00	2286.31	3242.90	0.12
2.20	102.20	2357.60	3707.45	0.12
2.40	102.40	2419.60	4185.32	0.13
2.60	102.60	2473.02	4674.71	0.13
2.80	102.80	2518.40	5173.99	0.14
3.00	103.00	2556.17	5681.57	0.14
3.20	103.20	2586.66	6195.97	0.15
3.40	103.40	2610.13	6715.76	0.15
3.60	103.60	2626.77	7239.56	0.16

[Reservoir Discharge Value vs. Stage]
(the elevation increment is 0.2)

STAGE (ft)	ELEVATION (ft)	CONTOUR AREA (sqft)	STORAGE (cuft)	DISCHARGE (cfs)
3.80	103.80	2636.70	7766.02	0.16
4.00	104.00	2640.00	8293.80	0.16
4.20	104.20	2636.70	8821.58	0.17
4.40	104.40	2626.77	9348.04	0.17
4.60	104.60	2610.13	9871.84	0.18
4.80	104.80	2586.66	10391.63	0.18
5.00	105.00	2556.17	10906.04	0.18
5.20	105.20	2518.40	11413.62	0.19
5.40	105.40	2473.02	11912.89	0.19
5.60	105.60	2419.60	12402.29	0.20
5.80	105.80	2357.60	12880.15	0.26
6.00	106.00	2286.31	13344.71	0.39
6.20	106.20	2204.84	13794.00	0.55
6.40	106.40	2112.00	14225.88	0.74
6.60	106.60	2006.23	14637.94	0.96
6.80	106.80	1885.34	15027.37	1.21
7.00	107.00	1746.20	15390.86	1.47
7.20	107.20	1584.00	15724.32	1.75
7.40	107.40	1390.71	16022.40	2.05
7.60	107.60	1150.76	16277.53	2.92
7.80	107.80	824.35	16477.13	4.67
8.00	108.00	4.28	16587.61	0.00

POULSBO VILLAGE MIDWEST
HYDROGRAPH REPORT

NUMBER : 7
TYPE : RESER STOR. IND
DESCRIPTION : LEVEL-POOL ROUTE 2-YR DEVELOPED ON-SITE

[HYDROGRAPH INFORMATION]

Peak Discharge	=	0.20 (cfs)
Volume	=	0.55 (acft)
Time Interval	=	0.03 (hr)
Time to Peak	=	20.47 (hr)
Time of Base	=	48.00 (hr)
Peak Elevation	=	105.60 (ft)

[INFLOW HYDROGRAPH INFORMATION]

Hydrograph #	=	4
Hydrograph Description	=	2-YR DEVELOPED ON-SITE

[Storage Indication Reservoir Routed Hydrograph Flow Values Time vs. Flow]
(The time interval is 0.5 hr)

ELEVATION (ft)	TIME (hr)	INFLOW (cfs)	OUTFLOW (cfs)
100.22	2.5	0.07	0.01
100.33	3.0	0.10	0.04
100.44	3.5	0.13	0.05
100.57	4.0	0.16	0.06
100.71	4.5	0.19	0.07
100.88	5.0	0.24	0.07
101.07	5.5	0.29	0.08
101.28	6.0	0.34	0.09
101.54	6.5	0.41	0.10
101.80	7.0	0.45	0.11
102.14	7.5	0.67	0.12
103.12	8.0	1.71	0.15
103.74	8.5	0.68	0.16
104.06	9.0	0.56	0.17
104.28	9.5	0.44	0.17
104.45	10.0	0.41	0.17
104.60	10.5	0.37	0.18
104.73	11.0	0.35	0.18
104.84	11.5	0.32	0.18
104.93	12.0	0.30	0.18
105.02	12.5	0.31	0.18
105.08	13.0	0.28	0.19
105.15	13.5	0.28	0.19
105.21	14.0	0.27	0.19
105.27	14.5	0.27	0.19
105.32	15.0	0.26	0.19
105.37	15.5	0.26	0.19
105.42	16.0	0.25	0.19
105.46	16.5	0.24	0.19
105.49	17.0	0.24	0.19
105.52	17.5	0.23	0.19
105.55	18.0	0.23	0.19
105.57	18.5	0.22	0.19

105.58	19.0	0.21	0.19
105.59	19.5	0.21	0.20
105.60	20.0	0.20	0.20
105.60	20.5	0.20	0.20
105.60	21.0	0.19	0.20
105.60	21.5	0.18	0.20
105.58	22.0	0.18	0.20
105.57	22.5	0.17	0.19
105.55	23.0	0.17	0.19
105.53	23.5	0.16	0.19
105.50	24.0	0.15	0.19
105.39	24.5	0.00	0.19
105.25	25.0	0.00	0.19
105.12	25.5	0.00	0.19
104.99	26.0	0.00	0.18
104.86	26.5	0.00	0.18
104.73	27.0	0.00	0.18
104.61	27.5	0.00	0.18
104.49	28.0	0.00	0.17
104.37	28.5	0.00	0.17
104.25	29.0	0.00	0.17
104.14	29.5	0.00	0.17
104.02	30.0	0.00	0.17
103.91	30.5	0.00	0.16
103.80	31.0	0.00	0.16
103.69	31.5	0.00	0.16
103.59	32.0	0.00	0.16
103.48	32.5	0.00	0.15
103.37	33.0	0.00	0.15
103.27	33.5	0.00	0.15
103.17	34.0	0.00	0.15
103.07	34.5	0.00	0.14
102.97	35.0	0.00	0.14
102.87	35.5	0.00	0.14
102.77	36.0	0.00	0.14
102.67	36.5	0.00	0.13
102.58	37.0	0.00	0.13
102.48	37.5	0.00	0.13
102.39	38.0	0.00	0.13
102.29	38.5	0.00	0.12
102.20	39.0	0.00	0.12
102.11	39.5	0.00	0.12
102.02	40.0	0.00	0.12
101.93	40.5	0.00	0.11
101.84	41.0	0.00	0.11
101.75	41.5	0.00	0.11
101.66	42.0	0.00	0.10
101.57	42.5	0.00	0.10
101.48	43.0	0.00	0.10
101.40	43.5	0.00	0.10
101.31	44.0	0.00	0.09
101.23	44.5	0.00	0.09
101.14	45.0	0.00	0.09
101.06	45.5	0.00	0.08

POULSBO VILLAGE MIDWEST
HYDROGRAPH REPORT

NUMBER : 8
TYPE : RESER STOR. IND
DESCRIPTION : LEVEL-POOL ROUTE DEVELOPED 10-YR ON-SITE

[HYDROGRAPH INFORMATION]

Peak Discharge	=	0.58 (cfs)
Volume	=	0.82 (acft)
Time Interval	=	0.03 (hr)
Time to Peak	=	10.10 (hr)
Time of Base	=	48.00 (hr)
Peak Elevation	=	106.23 (ft)

[INFLOW HYDROGRAPH INFORMATION]

Hydrograph #	=	5
Hydrograph Description	=	10-YR DEVELOPED ON-SITE

[Storage Indication Reservoir Routed Hydrograph Flow Values Time vs. Flow]
(The time interval is 0.5 hr)

ELEVATION (ft)	TIME (hr)	INFLOW (cfs)	OUTFLOW (cfs)
100.25	2.0	0.10	0.02
100.41	2.5	0.16	0.05
100.59	3.0	0.20	0.06
100.77	3.5	0.23	0.07
100.97	4.0	0.29	0.08
101.19	4.5	0.33	0.09
101.44	5.0	0.39	0.10
101.72	5.5	0.46	0.11
102.02	6.0	0.53	0.12
102.38	6.5	0.64	0.13
102.74	7.0	0.68	0.14
103.22	7.5	0.99	0.15
104.61	8.0	2.50	0.18
105.55	8.5	0.99	0.19
106.04	9.0	0.81	0.42
106.20	9.5	0.63	0.55
106.23	10.0	0.59	0.58
106.22	10.5	0.53	0.57
106.19	11.0	0.50	0.54
106.15	11.5	0.46	0.51
106.12	12.0	0.42	0.48
106.09	12.5	0.44	0.46
106.05	13.0	0.40	0.43
106.04	13.5	0.40	0.42
106.02	14.0	0.38	0.40
106.01	14.5	0.38	0.39
106.00	15.0	0.37	0.39
105.98	15.5	0.36	0.38
105.97	16.0	0.35	0.37
105.96	16.5	0.35	0.36
105.95	17.0	0.34	0.35
105.94	17.5	0.33	0.34
105.92	18.0	0.32	0.34

ELEVATION (ft)	TIME (hr)	INFLOW (cfs)	OUTFLOW (cfs)
105.91	18.5	0.31	0.33
105.90	19.0	0.30	0.32
105.89	19.5	0.29	0.31
105.87	20.0	0.29	0.30
105.86	20.5	0.28	0.30
105.84	21.0	0.27	0.29
105.83	21.5	0.26	0.28
105.82	22.0	0.25	0.27
105.80	22.5	0.24	0.26
105.79	23.0	0.23	0.26
105.77	23.5	0.23	0.25
105.75	24.0	0.22	0.24
105.63	24.5	0.00	0.20
105.48	25.0	0.00	0.19
105.34	25.5	0.00	0.19
105.21	26.0	0.00	0.19
105.07	26.5	0.00	0.19
104.94	27.0	0.00	0.18
104.82	27.5	0.00	0.18
104.69	28.0	0.00	0.18
104.57	28.5	0.00	0.18
104.45	29.0	0.00	0.17
104.33	29.5	0.00	0.17
104.21	30.0	0.00	0.17
104.10	30.5	0.00	0.17
103.99	31.0	0.00	0.16
103.88	31.5	0.00	0.16
103.77	32.0	0.00	0.16
103.66	32.5	0.00	0.16
103.55	33.0	0.00	0.15
103.45	33.5	0.00	0.15
103.34	34.0	0.00	0.15
103.24	34.5	0.00	0.15
103.14	35.0	0.00	0.15
103.03	35.5	0.00	0.14
102.93	36.0	0.00	0.14
102.84	36.5	0.00	0.14
102.74	37.0	0.00	0.14
102.64	37.5	0.00	0.13
102.54	38.0	0.00	0.13
102.45	38.5	0.00	0.13
102.36	39.0	0.00	0.13
102.26	39.5	0.00	0.12
102.17	40.0	0.00	0.12
102.08	40.5	0.00	0.12
101.99	41.0	0.00	0.11
101.90	41.5	0.00	0.11
101.81	42.0	0.00	0.11
101.72	42.5	0.00	0.11
101.63	43.0	0.00	0.10

POULSBO VILLAGE MIDWEST
HYDROGRAPH REPORT

NUMBER : 9
TYPE : RESER STOR. IND
DESCRIPTION : LEVEL-POOL 100-YR DEVELOPED ON-SITE

[HYDROGRAPH INFORMATION]

Peak Discharge	=	1.42 (cfs)
Volume	=	1.09 (acft)
Time Interval	=	0.03 (hr)
Time to Peak	=	8.43 (hr)
Time of Base	=	48.00 (hr)
Peak Elevation	=	106.97 (ft)

[INFLOW HYDROGRAPH INFORMATION]

Hydrograph #	=	6
Hydrograph Description	=	100-YR DEVELOPED ON-SITE

[Storage Indication Reservoir Routed Hydrograph Flow Values Time vs. Flow]
(The time interval is 0.5 hr)

ELEVATION (ft)	TIME (hr)	INFLOW (cfs)	OUTFLOW (cfs)
100.40	2.0	0.19	0.05
100.64	2.5	0.26	0.06
100.88	3.0	0.30	0.07
101.13	3.5	0.34	0.09
101.40	4.0	0.41	0.10
101.69	4.5	0.46	0.11
102.00	5.0	0.54	0.12
102.36	5.5	0.64	0.13
102.75	6.0	0.72	0.14
103.22	6.5	0.86	0.15
103.69	7.0	0.90	0.16
104.32	7.5	1.32	0.17
106.26	8.0	3.28	0.61
106.96	8.5	1.29	1.41
106.83	9.0	1.06	1.25
106.64	9.5	0.82	1.01
106.51	10.0	0.76	0.87
106.43	10.5	0.69	0.78
106.37	11.0	0.66	0.72
106.32	11.5	0.60	0.66
106.27	12.0	0.55	0.62
106.24	12.5	0.57	0.59
106.20	13.0	0.52	0.55
106.18	13.5	0.52	0.54
106.16	14.0	0.50	0.52
106.15	14.5	0.49	0.51
106.14	15.0	0.48	0.50
106.12	15.5	0.47	0.49
106.11	16.0	0.46	0.47
106.10	16.5	0.45	0.46
106.08	17.0	0.44	0.45
106.07	17.5	0.43	0.44
106.06	18.0	0.41	0.43

ELEVATION (ft)	TIME (hr)	INFLOW (cfs)	OUTFLOW (cfs)
106.04	18.5	0.40	0.42
106.03	19.0	0.39	0.41
106.01	19.5	0.38	0.40
106.00	20.0	0.37	0.39
105.98	20.5	0.36	0.38
105.97	21.0	0.35	0.37
105.95	21.5	0.34	0.36
105.94	22.0	0.33	0.35
105.92	22.5	0.31	0.33
105.91	23.0	0.30	0.32
105.89	23.5	0.29	0.31
105.87	24.0	0.28	0.30
105.72	24.5	0.00	0.23
105.57	25.0	0.00	0.19
105.43	25.5	0.00	0.19
105.29	26.0	0.00	0.19
105.15	26.5	0.00	0.19
105.02	27.0	0.00	0.18
104.89	27.5	0.00	0.18
104.77	28.0	0.00	0.18
104.64	28.5	0.00	0.18
104.52	29.0	0.00	0.18
104.40	29.5	0.00	0.17
104.28	30.0	0.00	0.17
104.17	30.5	0.00	0.17
104.05	31.0	0.00	0.17
103.94	31.5	0.00	0.16
103.83	32.0	0.00	0.16
103.72	32.5	0.00	0.16
103.61	33.0	0.00	0.16
103.51	33.5	0.00	0.15
103.40	34.0	0.00	0.15
103.30	34.5	0.00	0.15
103.20	35.0	0.00	0.15
103.09	35.5	0.00	0.14
102.99	36.0	0.00	0.14
102.89	36.5	0.00	0.14
102.80	37.0	0.00	0.14
102.70	37.5	0.00	0.13
102.60	38.0	0.00	0.13
102.51	38.5	0.00	0.13
102.41	39.0	0.00	0.13
102.32	39.5	0.00	0.12
102.22	40.0	0.00	0.12
102.13	40.5	0.00	0.12
102.04	41.0	0.00	0.12
101.95	41.5	0.00	0.11
101.86	42.0	0.00	0.11
101.77	42.5	0.00	0.11
101.68	43.0	0.00	0.11

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SHEET NO. 34 OF 74
CALCULATED BY P.F. DATE 11/22/99
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G. ADJUSTED STORAGE

1. PURSUANT TO THE KITSAP COUNTY DESIGN MANUAL, A CORRECTION FACTOR IS TO BE APPLIED TO THE DETENTION STORAGE VOLUME IN ACCORDANCE WITH FIGURE 5-8 (SHT. 35), BASED ON THE SITE IMPERVIOUS COVERAGE.

DISTURBED SITE AREA = 3.28 ACRES (SHT. 3)
IMPERVIOUS = ASPHALT (1.5214 Ac.) + BUILDINGS/WALKS (0.7703 Ac) - SHT. 17

$$\% \text{ IMPERVIOUS} = \frac{(1.5214) + (0.7703)}{3.28} = 70\%$$

∴ CORRECTION FACTOR = 38%

AS SUCH, APPROXIMATELY 330 (1.38) = 455 LF OF 8" DIAMETER DETENTION PIPING WILL BE PROVIDED.

H. WATER QUALITY

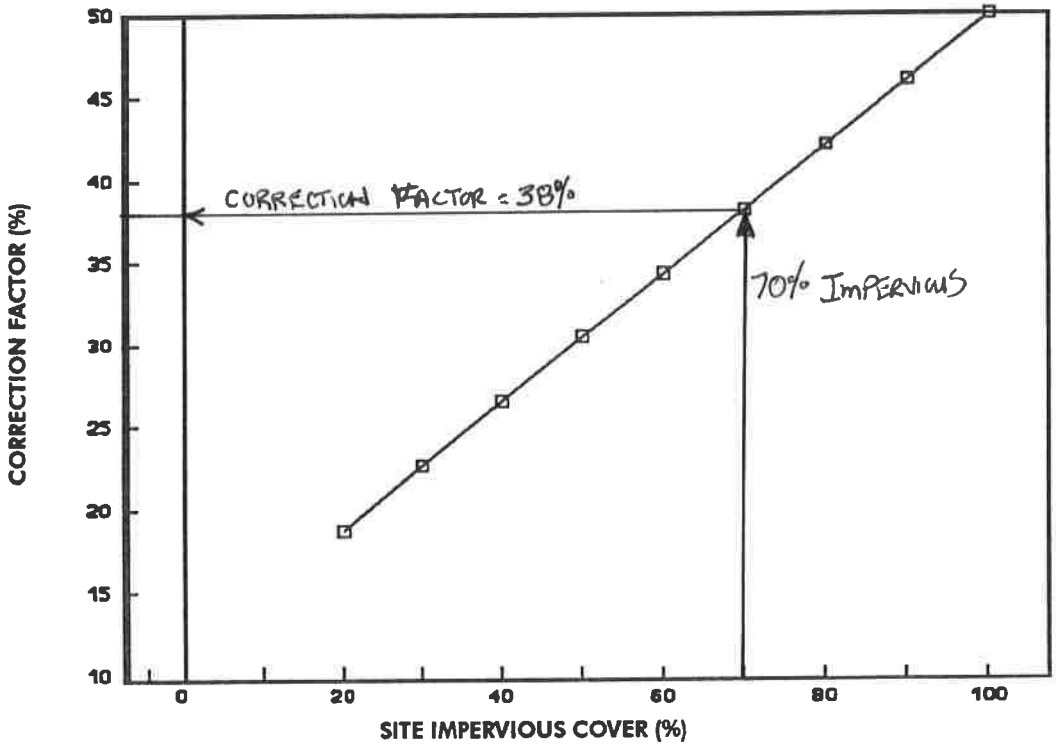
1. PURSUANT TO THE KITSAP COUNTY DESIGN MANUAL, 6" OF DEAD STORAGE WILL BE PROVIDED WITHIN THE DETENTION PIPING TO ALLOW FOR THE SETTLEMENT OF SEDIMENTS.

I. EROSION & SEDIMENTATION CONTROL

1. EROSION CONTROL MEASURES WILL BE IMPLEMENTED PRIOR TO LAND DISTURBING ACTIVITIES AND DURING CONSTRUCTION TO ENSURE THAT THE STORM WATER LEAVING THE SITE IS FREE OF SEDIMENTS AND TURBIDITY. AN ENGINEERED EROSION CONTROL PLAN WILL BE SUBMITTED AND APPROVED BY THE CITY OF POULSBO PRIOR TO GRADING & CLEARING, WHICH WILL SPECIFY APPROPRIATE BEST MANAGEMENT PRACTICES FOR THE PROJECT.

(CONTINUES ON SHT. 36)

Figure 5-8 VOLUME CORRECTION FACTOR



Hydrological Analysis for Poulsbo Village Midwest
(INSERT PROJECT NAME)

Submittal Requirements Checklist Pursuant to Kitsap County Ordinance #199-1996

DOWNSTREAM ANALYSIS

The Drainage Report submittal shall include a Level 1 downstream drainage analysis. This Level 1 analysis, as well as the location of the project in a drainage basin, will be reviewed by the City to determine whether a Level 2 and/or Level 3 downstream analysis will be required. Any further analysis of downstream conditions required beyond the Level 1 analysis shall become a part of the Drainage Report and must be submitted as part of the Drainage Report.

Level 1 Analysis: All proposed projects requiring a Site Development Activity Permit or City of Poulsbo Land Use Permit approval shall include at least this level of analysis with the permit application. The following steps should be completed for this level of analysis:

☒ Define and physically verify the study area. The upstream portion of the study area shall encompass the entire tributary drainage area (the area that drains to the proposed project site). The remaining portion of the study area shall extend downstream of the proposed project discharge location to a point on the drainage system where the proposed project site constitutes 15 percent or less of the total tributary area, but in no event less than ¼ mile.

Reference is made to the attached "Drainage Basin Study Area" sketch. An existing 18" outfall pipe conveys stormwater runoff from the 17.05 acre basin lying west of the Poulsbo Village Commercial Center from the low point behind the Albertson's Store to Harding Creek in the vicinity of Mitzel's Restaurant along S.R. 305.

☒ Review all available resource information regarding existing and potential water quality, runoff volumes and rates, flooding and streambank erosion problems within the study area.

Please refer to the attached runoff calculations and pipe capacity analysis. No flooding, streambank erosion, or water quality problems are known to the project engineer based upon discussions with City staff. There has been reported flooding during extreme rainfall events of the Valley View Apartment site.

☒ Physically inspect the existing on-site and off-site drainage system problems reported in the resources.

Inspection of the basin drainage characteristics has been accomplished by the Project Engineer. The flooding problem at the Valley View apartment site is caused by a lack of maintenance of the conveyance system along the east property line of the site. Several

catch basins near the northeast corner of the property were found to be plugged with sediments.

☒ On a map (minimum USGS 1:24000 Quadrangle Topographic Map) delineate the study area, together with the drainage system onto and from the proposed site.

Refer to the attached "Drainage Basin Study Area" sketch.

☒ Describe in a narrative form observations regarding the makeup and general condition of the drainage system.

Stormwater runoff from the 17.05 acre upstream basin originates at the high point in 4th Avenue as shown, and flows south in 4th Avenue with raised-edge of pavement, catch basins, and tightline piping to a catch basin located along the south line of the Valley View Apartments. A tightline pipe runs east along the south property line of the apartment site to the west line of the "Poulsbo Village S.W. Phase III" project, and runoff from the Norman parcel is also collected at this point as well. Runoff is then conveyed in an 18" CMP north to an existing 6' wide drainage ditch at the northeast corner of the apartment site. At this point, stormwater runoff from the apartment site is daylighted to the ditch in a 12" CMP, as well as the detained stormwater release from the Poulsbo Village S.W. Phase III project. The ditch flows in a northeasterly direction, picking up runoff from the proposed Poulsbo Village Midwest project, and flows to an 18" CMP located immediately west of Albertsons. This 18" pipe was installed under the existing buildings, with a minimum design slope specified as 0.5%. This water is then routed under the parking lots and discharged into an underground detention barrel located in 7th Avenue. After the detention pipe, the stormwater is conveyed to the outfall into Harding Creek near Mitzel's Restaurant.

☒ Include such information as pipe sizes, channel characteristics, and stormwater facilities.

See above discussion.

☒ Identify on the map and describe any evidence of the types of existing or predicted problems listed below in Table 2-1. Following the review of the Level 1 analysis, the City will determine whether a Level 2 analysis is required, based on the evidence of existing or predicted problems.

Please refer to the drainage basin Downstream analysis attached. None of the problems listed in Table 2-1 of the Kitsap County Design Manual are anticipated as a result of the construction of the proposed Poulsbo Village Midwest project.

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SHEET NO. 38 OF 74
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DOWNSTREAM ANALYSIS

A. UPSTREAM CONTRIBUTING AREAS (REFER TO SHT. 39)

1. 4th AVENUE DRAINAGE BASIN – 2.42 Acres
2. NORMAN PARCEL – 1.3 Acres
3. VALLEY VIEW APT.'s – 1.7 ACRES
4. POULSBO VILLAGE S.W. PHASE III – 2.33 Acres
5. CITY RESERVOIR – 0.11 Acres
6. RYAN WEST BASIN – 6.99 Acres
7. RYAN EAST BASIN – 2.20 Acres

TOTAL = 17.05 Acres

B. DETERMINE EXISTING RUNOFF CURVE NUMBERS

(GROUP "C" KITSAP" SERIES SOILS)

1. 4th AVENUE (50' R/W) :- ASSUME IMPERVIOUS $C_N = 98$

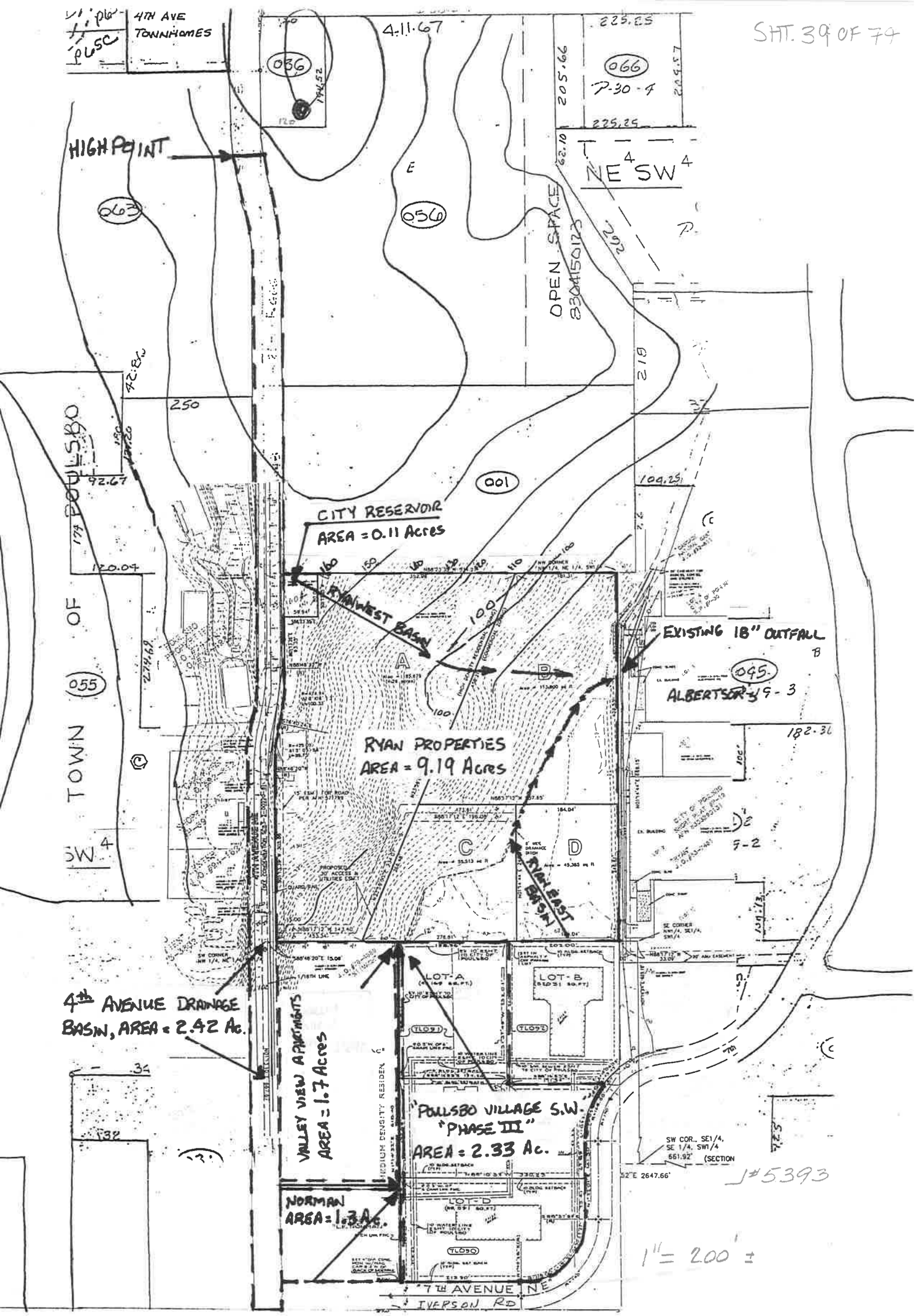
2. NORMAN PARCEL: "BRUSH" – $C_N = 81$

3. VALLEY VIEW APARTMENTS: NO TOPOGRAPHIC INFORMATION FOR % IMPERVIOUS AND % PERVIOUS IS AVAILABLE FOR ESTIMATING THE ACTUAL RUNOFF CURVE NUMBER. BASED ON OUR EXPERIENCE, A TYPICAL APARTMENT SITE COVERAGE IS 90% IMPERVIOUS AND 10% PERVIOUS

$$\therefore \text{ASSUME } C_N = \frac{(0.9)(1.7 \text{ Acres})(C_N=98) + (0.1)(1.7 \text{ Acres})(C_N=86)}{1.7 \text{ Acres}}$$

$$= 97$$

4. POULSBO VILLAGE S.W. PHASE III: REFERENCE IS MADE TO THE PREVIOUS STORM DRAINAGE COMPUTATIONS PERFORMED BY A.D.A. ENGINEERING FOR THE PROJECT,
IMPERVIOUS AREA = 2.04 Acres, $C_N = 98$
PERVIOUS AREA = 0.29 Acres, $C_N = 86$



DRAINAGE BASIN STUDY AREA

TOTAL AREA TO 18" OUTFALL

17.05 Acres

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B. DETERMINE EXISTING RUNOFF CURVE NUMBERS (CONTINUED)

5. CITY RESERVOIR SITE: ASSUME 50% IMPERVIOUS

$$\therefore \frac{(0.5)(0.11\ \text{Acres})(98) + (0.5)(0.11\ \text{Acres})(90)}{0.11}$$

$C_N = 94$

6. RYAN WEST BASIN: USE "ESTABLISHED SECOND GROWTH", $C_N = 78$

7. RYAN EAST BASN: USE "BRUSH", $C_N = 81$

C. TIME OF CONCENTRATION

1. 4th AVENUE a) SHEETFLOW ACROSS ROAD TO GUTTER

$$T_t = \frac{(0.42)[(0.011)(12^{-})]^{0.8}}{(2.5)^{0.5}(0.02)^{0.4}} = 0.25\ \text{min}$$

b) 300' PAVED GUTTER FLOW, AVG SLOPE = 3%, Avg. Velocity = $27\sqrt{0.03} = 4.7$ ft/sec

$$T_t = \frac{300}{(60)(4.7)} = 1.1\ \text{min}$$

c) 1500' PIPE FLOW TO WEST LINE "POULSBO VILLAGE S.W. PHASE III", AVG. SLOPE = 8%, ASSUME 12" PIPE, Avg. Velocity = 13.5 ft/sec.

$$T_t = \frac{1500}{(60)(13.5)} = 1.9\ \text{min}$$

$T_c = 0.25 + 1.1 + 1.9 = \underline{3.3\ \text{min}}$

2. NORMAN PARCEL

a) 300' SHEETFLOW, DENSE GRASSES, AVG SLOPE = 10%

$$T_t = \frac{0.42[(0.24)(300)]^{0.8}}{(2.5)^{0.5}(0.10)^{0.4}} = 20.4\ \text{min}$$

b) 40' SHALLOW CONCENTRATED FLOW, Avg. Slope = 10%

$V = K\sqrt{\text{SLOPE}} = 9\sqrt{0.10} = 2.8$ ft/sec

$$T_t = \frac{40}{(2.8)(60)} = 0.2\ \text{min}$$

$T_c = 20.4\ \text{min} + 0.2\ \text{min} = \underline{20.6\ \text{min}}$

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C. TIME OF CONCENTRATION (CONT.)

3. VALLEY VIEW APARTMENTS: ASSUME A CONSERVATIVE T_c OF 5 MINUTES. NOTE THAT THIS ONLY INCLUDES THE INITIAL COLLECTION TIME AT THE BEGINNING OF A STORM EVENT, AND DOES NOT INCLUDE ANY CONVEYANCE TIME. AS SUCH, THE PEAK RUNOFF ESTIMATE IS HIGHER THAN WHAT CURRENTLY EXISTS.

4. POULSBO VILLAGE S.W. PHASE III: A $T_c = 10$ min WAS UTILIZED IN THE DESIGN OF THE DETENTION SYSTEM FOR THIS PROJECT AND WILL BE UTILIZED IN THIS ANALYSIS FOR ROUTING THE 25-YEAR & 100-YEAR DEVELOPED PEAK STORMS THROUGH THE DETENTION SYSTEM.

5. COMBINE CITY RESERVOIR SITE WITH RYAN WEST BASIN FOR T_c AND PEAK RUNOFF ESTIMATION:

a) 300' OF SHEETFLOW, AVG. SLOPE = 20%
"WOODS OR FOREST WITH DENSE UNDERBRUSH", $n_s = 0.80$

$$T_t = \frac{0.42[(0.80)(300)]^{0.8}}{(2.5)^{0.5}(0.20)^{0.4}} = 40.6 \text{ min}$$

b) 350' OF SHALLOW CONCENTRATED FLOW, AVG. SLOPE = 13%
"FOREST WITH HEAVY GROUND LITTER", $K_s = 3$
$V = 3\sqrt{0.13} = 1.1$ ft/sec.

$$T_t = \frac{350}{(1.1)(60)} = 5.3 \text{ min}$$

$\therefore T_c = 40.6 + 5.3 = \underline{\underline{45.9 \text{ min}}}$

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C. TIME OF CONCENTRATION (CONT.)

6. RYAN EAST BASIN:

a) 200' SHEETFLOW, AVG. SLOPE = 3.1%
"DENSE GRASSES", $n_s = 0.24$

$$T_t = \frac{(0.42)[(0.24)(200)]^{0.8}}{(2.5)^{0.5}(0.031)^{0.4}} = 23.6 \text{ min}$$

b) 350' OF DITCH (CHANNEL) FLOW, Avg. SLOPE = 0.8%
USE $n = 0.030$, "CONSTRUCTED CHANNELS, EARTH BOTTOM & WEEDY BANKS"

$$K_c = \frac{0.807}{0.030} = 26.9$$

$$V = 26.9\sqrt{0.008} = 2.4 \text{ ft/sec}$$

$$T_t = \frac{350}{60(2.4)} = 2.4 \text{ min}$$

$\therefore T_c = 23.6 \text{ min} + 2.4 \text{ min} = \underline{26.0 \text{ min}}$

D. PRECIPITATION VALUES

USE $P_{25\text{-YR}} = 3.8$ in/24 HRS (SHT. 12)

$P_{100\text{-YR}} = 4.5$ in/24 HRS

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SHEET NO. 43 OF 74
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E. PEAK RUNOFF HYDROGRAPHS FROM INDIVIDUAL BASINS

a) HYDROGRAPH #10: 4th AVENUE 25-YR = 2.18 cfs (SHT. 44)
#11: 4th AVENUE 100-YR = 2.60 cfs (SHT. 45)

b) HYDROGRAPH #12: NORMAN PARCEL 25-YR = 0.47 cfs (SHT. 46)
#13: NORMAN PARCEL 100-YR = 0.63 cfs (SHT. 47)

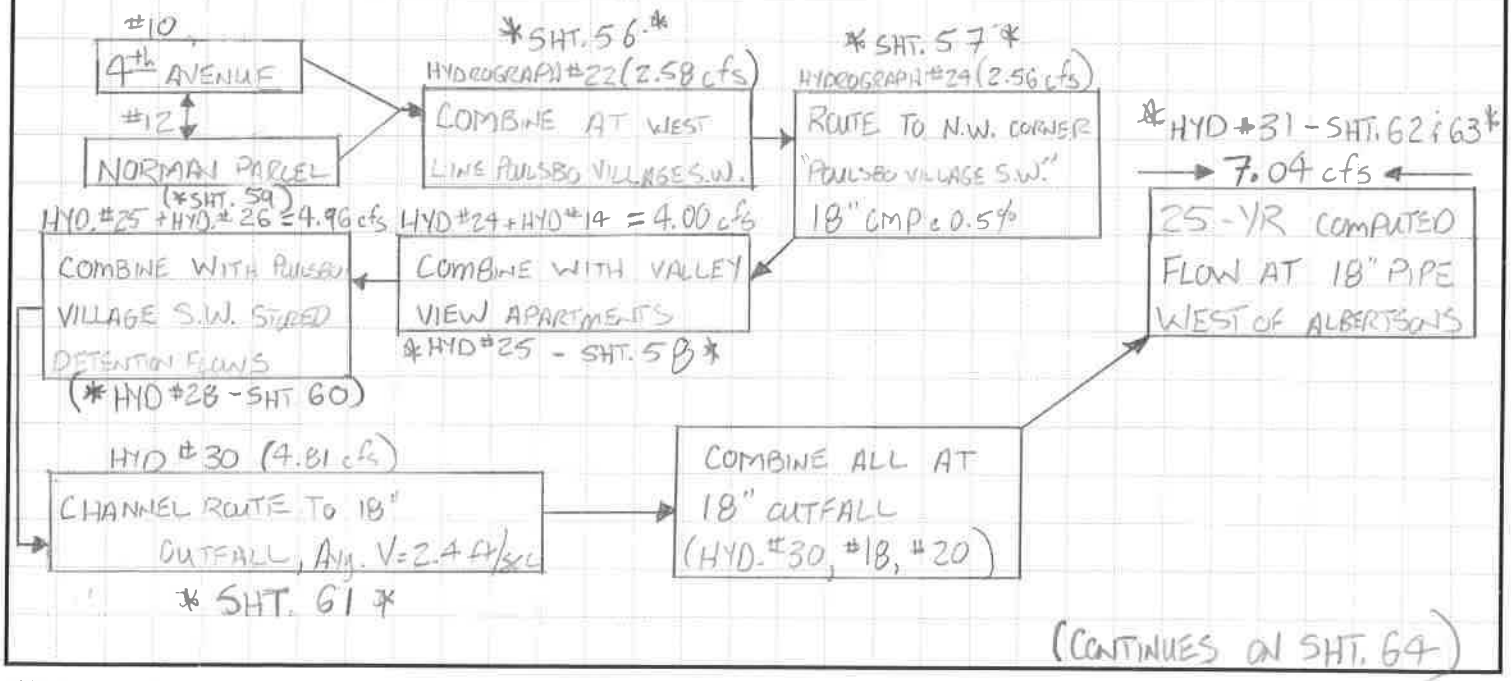
c) HYDROGRAPH #14: VALLEY VIEW APT.'s 25-YR = 1.49 cfs (SHT. 48)
#15: VALLEY VIEW APT.'s 100-YR = 1.78 cfs (SHT. 49)

d) HYDROGRAPH #16: POULSBO VILLAGE S.W. 25-YR = 1.93 cfs (BEFORE DETENTION) (SHT. 50)
#17: POULSBO VILLAGE S.W. 100-YR = 2.31 cfs (BEFORE DETENTION) (SHT. 51)

e) HYDROGRAPH #18: CITY RESERVOIR/RYAN WEST BASIN 25-YR = 1.54 cfs (SHT. 52)
#19: CITY RESERVOIR/RYAN WEST BASIN 100-YR = 2.17 cfs (SHT. 53)

f) HYDROGRAPH #20: RYAN EAST BASIN 25-YR = 0.73 cfs (SHT. 54)
#21: RYAN EAST BASIN 100-YR = 1.00 cfs (SHT. 55)

F. COMBINE/ROUTE 25-YR HYDROGRAPHS



(CONTINUES ON SHT. 64)

POULSBO VILLAGE MIDWEST
HYDROGRAPH REPORT

NUMBER : 10
TYPE : SANTA BARBARA
DESCRIPTION : 4th AVENUE 25-YR HYDROGRAPH

[HYDROGRAPH INFORMATION]

Peak Discharge	=	2.18 (cfs)
Volume	=	0.72 (acft)
Time Interval	=	0.03 (hr)
Time to Peak	=	7.87 (hr)
Time of Base	=	24.43 (hr)
Multiplication factor	=	1.00

[BASIN DESCRIPTION]

Watershed Area	=	2.42 (ac)
Curve Number	=	98

[RAINFALL DESCRIPTION]

Distribution Type	=	SCS IA
Total Precipitation	=	3.80 (in)
Return Period	=	25 (yr)
Storm Duration	=	24.00 (hr)

[TIME CONCENTRATION -- USER DEFINED]

Time of Concentration	=	3.30 (min)

[Hydrograph Flow Values Time vs. Flow]
(The time interval is 1.0 hr)

TIME (hr)	OUTFLOW (cfs)
1.0	0.06
2.0	0.19
3.0	0.24
4.0	0.30
5.0	0.38
6.0	0.49
7.0	0.61
8.0	1.90
9.0	0.63
10.0	0.49
11.0	0.41
12.0	0.34
13.0	0.33
14.0	0.31
15.0	0.30
16.0	0.29
17.0	0.27
18.0	0.26
19.0	0.24
20.0	0.23
21.0	0.22
22.0	0.20
23.0	0.19
24.0	0.17

POULSBO VILLAGE MIDWEST
HYDROGRAPH REPORT

NUMBER : 11
TYPE : SANTA BARBARA
DESCRIPTION : 4th AVENUE 100-YR HYDROGRAPH

[HYDROGRAPH INFORMATION]

Peak Discharge	=	2.60 (cfs)
Volume	=	0.86 (acft)
Time Interval	=	0.03 (hr)
Time to Peak	=	7.87 (hr)
Time of Base	=	24.43 (hr)
Multiplication factor	=	1.00

[BASIN DESCRIPTION]

Watershed Area	=	2.42 (ac)
Curve Number	=	98

[RAINFALL DESCRIPTION]

Distribution Type	=	SCS IA
Total Precipitation	=	4.50 (in)
Return Period	=	100 (yr)
Storm Duration	=	24.00 (hr)

[TIME CONCENTRATION -- USER DEFINED]

Time of Concentration	=	3.30 (min)

[Hydrograph Flow Values Time vs. Flow]
(The time interval is 1.0 hr)

TIME (hr)	OUTFLOW (cfs)
1.0	0.09
2.0	0.24
3.0	0.30
4.0	0.37
5.0	0.46
6.0	0.59
7.0	0.73
8.0	2.26
9.0	0.75
10.0	0.58
11.0	0.48
12.0	0.41
13.0	0.39
14.0	0.37
15.0	0.36
16.0	0.34
17.0	0.32
18.0	0.31
19.0	0.29
20.0	0.27
21.0	0.26
22.0	0.24
23.0	0.22
24.0	0.21

POULSBO VILLAGE MIDWEST
HYDROGRAPH REPORT

NUMBER : 12
TYPE : SANTA BARBARA
DESCRIPTION : NORMAN PARCEL 25-YR HYDROGRAPH

[HYDROGRAPH INFORMATION]

Peak Discharge	=	0.47 (cfs)
Volume	=	0.21 (acft)
Time Interval	=	0.08 (hr)
Time to Peak	=	8.08 (hr)
Time of Base	=	26.33 (hr)
Multiplication factor	=	1.00

[BASIN DESCRIPTION]

Watershed Area	=	1.30 (ac)
Curve Number	=	81

[RAINFALL DESCRIPTION]

Distribution Type	=	SCS IA
Total Precipitation	=	3.80 (in)
Return Period	=	25 (yr)
Storm Duration	=	24.00 (hr)

[TIME CONCENTRATION -- USER DEFINED]

Time of Concentration	=	20.60 (min)

[Hydrograph Flow Values Time vs. Flow]
(The time interval is 1.0 hr)

TIME (hr)	OUTFLOW (cfs)
5.1	0.01
6.1	0.05
7.1	0.10
8.1	0.47
9.1	0.25
10.1	0.18
11.1	0.16
12.1	0.14
13.1	0.13
14.1	0.13
15.1	0.12
16.1	0.12
17.1	0.12
18.1	0.11
19.1	0.11
20.1	0.10
21.1	0.10
22.1	0.09
23.1	0.09
24.1	0.08
25.1	0.00

POULSBO VILLAGE MIDWEST
HYDROGRAPH REPORT

NUMBER : 13
TYPE : SANTA BARBARA
DESCRIPTION : NORMAN PARCEL 100-YR HYDROGRAPH

[HYDROGRAPH INFORMATION]

Peak Discharge	=	0.63 (cfs)
Volume	=	0.28 (acft)
Time Interval	=	0.08 (hr)
Time to Peak	=	8.08 (hr)
Time of Base	=	26.42 (hr)
Multiplication factor	=	1.00

[BASIN DESCRIPTION]

Watershed Area	=	1.30 (ac)
Curve Number	=	81

[RAINFALL DESCRIPTION]

Distribution Type	=	SCS IA
Total Precipitation	=	4.50 (in)
Return Period	=	100 (yr)
Storm Duration	=	24.00 (hr)

[TIME CONCENTRATION -- USER DEFINED]

Time of Concentration	=	20.60 (min)

[Hydrograph Flow Values Time vs. Flow]
(The time interval is 1.0 hr)

TIME (hr)	OUTFLOW (cfs)
4.1	0.00
5.1	0.03
6.1	0.08
7.1	0.15
8.1	0.63
9.1	0.33
10.1	0.23
11.1	0.20
12.1	0.18
13.1	0.17
14.1	0.16
15.1	0.16
16.1	0.15
17.1	0.15
18.1	0.14
19.1	0.13
20.1	0.13
21.1	0.12
22.1	0.11
23.1	0.11
24.1	0.10
25.1	0.01

POULSBO VILLAGE MIDWEST
HYDROGRAPH REPORT

NUMBER : 14
TYPE : SANTA BARBARA
DESCRIPTION : VALLEY VIEW APT.'s 25-YR HYDROGRAPH

[HYDROGRAPH INFORMATION]

Peak Discharge	=	1.49 (cfs)
Volume	=	0.49 (acft)
Time Interval	=	0.03 (hr)
Time to Peak	=	7.90 (hr)
Time of Base	=	24.63 (hr)
Multiplication factor	=	1.00

[BASIN DESCRIPTION]

Watershed Area	=	1.70 (ac)
Curve Number	=	97

[RAINFALL DESCRIPTION]

Distribution Type	=	SCS IA
Total Precipitation	=	3.80 (in)
Return Period	=	25 (yr)
Storm Duration	=	24.00 (hr)

[TIME CONCENTRATION -- USER DEFINED]

Time of Concentration	=	5.00 (min)

[Hydrograph Flow Values Time vs. Flow]
(The time interval is 1.0 hr)

TIME (hr)	OUTFLOW (cfs)
1.0	0.01
2.0	0.10
3.0	0.14
4.0	0.19
5.0	0.25
6.0	0.33
7.0	0.41
8.0	1.35
9.0	0.45
10.0	0.34
11.0	0.29
12.0	0.24
13.0	0.23
14.0	0.22
15.0	0.21
16.0	0.20
17.0	0.19
18.0	0.18
19.0	0.17
20.0	0.16
21.0	0.15
22.0	0.14
23.0	0.13
24.0	0.12

POULSBO VILLAGE MIDWEST
HYDROGRAPH REPORT

NUMBER : 15
TYPE : SANTA BARBARA
DESCRIPTION : VALLEY VIEW APT.'s 100-YR HYDROGRAPH

[HYDROGRAPH INFORMATION]

Peak Discharge	=	1.78 (cfs)
Volume	=	0.59 (acft)
Time Interval	=	0.03 (hr)
Time to Peak	=	7.90 (hr)
Time of Base	=	24.63 (hr)
Multiplication factor	=	1.00

[BASIN DESCRIPTION]

Watershed Area	=	1.70 (ac)
Curve Number	=	97

[RAINFALL DESCRIPTION]

Distribution Type	=	SCS IA
Total Precipitation	=	4.50 (in)
Return Period	=	100 (yr)
Storm Duration	=	24.00 (hr)

[TIME CONCENTRATION -- USER DEFINED]

Time of Concentration	=	5.00 (min)

[Hydrograph Flow Values Time vs. Flow]
(The time interval is 1.0 hr)

TIME (hr)	OUTFLOW (cfs)
1.0	0.02
2.0	0.13
3.0	0.18
4.0	0.24
5.0	0.30
6.0	0.39
7.0	0.49
8.0	1.62
9.0	0.53
10.0	0.41
11.0	0.34
12.0	0.29
13.0	0.28
14.0	0.26
15.0	0.25
16.0	0.24
17.0	0.23
18.0	0.21
19.0	0.20
20.0	0.19
21.0	0.18
22.0	0.17
23.0	0.16
24.0	0.15

POULSBO VILLAGE MIDWEST
HYDROGRAPH REPORT

NUMBER : 16
TYPE : SANTA BARBARA
DESCRIPTION : POULSBO VILLAGE SW 25-YR(B-4 DETENTION)

[HYDROGRAPH INFORMATION]

Peak Discharge	=	1.93 (cfs)
Volume	=	0.67 (acft)
Time Interval	=	0.08 (hr)
Time to Peak	=	8.00 (hr)
Time of Base	=	25.33 (hr)
Multiplication factor	=	1.00

[BASIN DESCRIPTION]

Watershed Area	=	2.33 (ac)
Curve Number	=	97

[RAINFALL DESCRIPTION]

Distribution Type	=	SCS IA
Total Precipitation	=	3.80 (in)
Return Period	=	25 (yr)
Storm Duration	=	24.00 (hr)

[TIME CONCENTRATION -- USER DEFINED]

Time of Concentration	=	10.00 (min)

[Hydrograph Flow Values Time vs. Flow]
(The time interval is 1.0 hr)

TIME (hr)	OUTFLOW (cfs)
1.1	0.01
2.1	0.13
3.1	0.19
4.1	0.26
5.1	0.33
6.1	0.44
7.1	0.55
8.1	1.80
9.1	0.64
10.1	0.47
11.1	0.40
12.1	0.33
13.1	0.32
14.1	0.30
15.1	0.29
16.1	0.28
17.1	0.26
18.1	0.25
19.1	0.24
20.1	0.22
21.1	0.21
22.1	0.20
23.1	0.18
24.1	0.17

POULSBO VILLAGE MIDWEST
HYDROGRAPH REPORT

NUMBER : 17
TYPE : SANTA BARBARA
DESCRIPTION : POULSBO VILLAGE SW 100-YR(B-4 DETENTION)

[HYDROGRAPH INFORMATION]

Peak Discharge	=	2.31 (cfs)
Volume	=	0.81 (acft)
Time Interval	=	0.08 (hr)
Time to Peak	=	8.00 (hr)
Time of Base	=	25.33 (hr)
Multiplication factor	=	1.00

[BASIN DESCRIPTION]

Watershed Area	=	2.33 (ac)
Curve Number	=	97

[RAINFALL DESCRIPTION]

Distribution Type	=	SCS IA
Total Precipitation	=	4.50 (in)
Return Period	=	100 (yr)
Storm Duration	=	24.00 (hr)

[TIME CONCENTRATION -- USER DEFINED]

Time of Concentration	=	10.00 (min)

[Hydrograph Flow Values Time vs. Flow]
(The time interval is 1.0 hr)

TIME (hr)	OUTFLOW (cfs)
1.1	0.03
2.1	0.17
3.1	0.25
4.1	0.32
5.1	0.41
6.1	0.53
7.1	0.66
8.1	2.15
9.1	0.77
10.1	0.55
11.1	0.47
12.1	0.40
13.1	0.38
14.1	0.36
15.1	0.34
16.1	0.33
17.1	0.31
18.1	0.30
19.1	0.28
20.1	0.26
21.1	0.25
22.1	0.23
23.1	0.22
24.1	0.20

POULSBO VILLAGE MIDWEST
HYDROGRAPH REPORT

NUMBER : 18
TYPE : SANTA BARBARA
DESCRIPTION : CITY RES/RYAN WEST BASIN 25 YR HYDROGRAPH

[HYDROGRAPH INFORMATION]

Peak Discharge	=	1.54 (cfs)
Volume	=	1.03 (acft)
Time Interval	=	0.08 (hr)
Time to Peak	=	8.25 (hr)
Time of Base	=	30.50 (hr)
Multiplication factor	=	1.00

[BASIN DESCRIPTION]

Watershed Area	=	7.10 (ac)
Curve Number	=	78

[RAINFALL DESCRIPTION]

Distribution Type	=	SCS IA
Total Precipitation	=	3.80 (in)
Return Period	=	25 (yr)
Storm Duration	=	24.00 (hr)

[TIME CONCENTRATION -- USER DEFINED]

Time of Concentration	=	45.90 (min)

[Hydrograph Flow Values Time vs. Flow]
(The time interval is 1.0 hr)

TIME (hr)	OUTFLOW (cfs)
5.1	0.00
6.1	0.10
7.1	0.30
8.1	1.50
9.1	1.30
10.1	0.99
11.1	0.83
12.1	0.74
13.1	0.67
14.1	0.65
15.1	0.63
16.1	0.62
17.1	0.60
18.1	0.58
19.1	0.55
20.1	0.53
21.1	0.50
22.1	0.48
23.1	0.45
24.1	0.42
25.1	0.12
26.1	0.03
27.1	0.01
28.1	0.00

POULSBO VILLAGE MIDWEST
HYDROGRAPH REPORT

NUMBER : 20
TYPE : SANTA BARBARA
DESCRIPTION : RYAN EAST BASIN 25-YR

[HYDROGRAPH INFORMATION]

Peak Discharge	=	0.73 (cfs)
Volume	=	0.36 (acft)
Time Interval	=	0.08 (hr)
Time to Peak	=	8.08 (hr)
Time of Base	=	27.17 (hr)
Multiplication factor	=	1.00

[BASIN DESCRIPTION]

Watershed Area	=	2.20 (ac)
Curve Number	=	81

[RAINFALL DESCRIPTION]

Distribution Type	=	SCS IA
Total Precipitation	=	3.80 (in)
Return Period	=	25 (yr)
Storm Duration	=	24.00 (hr)

[TIME CONCENTRATION -- USER DEFINED]

Time of Concentration	=	26.00 (min)

[Hydrograph Flow Values Time vs. Flow]
(The time interval is 1.0 hr)

TIME (hr)	OUTFLOW (cfs)
5.1	0.02
6.1	0.08
7.1	0.16
8.1	0.73
9.1	0.45
10.1	0.32
11.1	0.27
12.1	0.24
13.1	0.22
14.1	0.22
15.1	0.21
16.1	0.20
17.1	0.20
18.1	0.19
19.1	0.18
20.1	0.17
21.1	0.16
22.1	0.15
23.1	0.15
24.1	0.14
25.1	0.01
26.1	0.00

POULSBO VILLAGE MIDWEST
HYDROGRAPH REPORT

NUMBER : 21
TYPE : SANTA BARBARA
DESCRIPTION : RYAN EAST BASIN 100-YR

[HYDROGRAPH INFORMATION]

Peak Discharge	=	1.00 (cfs)
Volume	=	0.47 (acft)
Time Interval	=	0.08 (hr)
Time to Peak	=	8.08 (hr)
Time of Base	=	27.25 (hr)
Multiplication factor	=	1.00

[BASIN DESCRIPTION]

Watershed Area	=	2.20 (ac)
Curve Number	=	81

[RAINFALL DESCRIPTION]

Distribution Type	=	SCS IA
Total Precipitation	=	4.50 (in)
Return Period	=	100 (yr)
Storm Duration	=	24.00 (hr)

[TIME CONCENTRATION -- USER DEFINED]

Time of Concentration	=	26.00 (min)

[Hydrograph Flow Values Time vs. Flow]
(The time interval is 1.0 hr)

TIME (hr)	OUTFLOW (cfs)
4.1	0.01
5.1	0.05
6.1	0.13
7.1	0.24
8.1	1.00
9.1	0.59
10.1	0.41
11.1	0.35
12.1	0.30
13.1	0.28
14.1	0.27
15.1	0.26
16.1	0.26
17.1	0.25
18.1	0.24
19.1	0.23
20.1	0.21
21.1	0.20
22.1	0.19
23.1	0.18
24.1	0.17
25.1	0.02
26.1	0.00

POULSBO VILLAGE MIDWEST
HYDROGRAPH REPORT

NUMBER : 22
TYPE : COMBINE
DESCRIPTION : COMBINE 4th & nORMAN PARCEL 25-YR

[HYDROGRAPH INFORMATION]

Peak Discharge	=	2.58 (cfs)
Volume	=	0.93 (acft)
Time Interval	=	0.08 (hr)
Time to Peak	=	7.92 (hr)
Time of Base	=	26.33 (hr)

[COMBINE HYDROGRAPH RECORD #]

HYDROGRAPH # 10 TYPE : SANTA BARBARA
DESCRIPTION : 4th AVENUE 25-YR HYDROGRAPH

Peak Discharge	=	2.18 (cfs)
Time to Peak	=	7.87 (hr)
Time Interval	=	0.03 (hr)

HYDROGRAPH # 12 TYPE : SANTA BARBARA
DESCRIPTION : NORMAN PARCEL 25-YR HYDROGRAPH

Peak Discharge	=	0.47 (cfs)
Time to Peak	=	8.08 (hr)
Time Interval	=	0.08 (hr)

[Combine Hydrograph Flow Values]
(The time interval is 1.0 hr)

TIME (hr)	OUTFLOW (cfs)
1.1	0.07
2.1	0.19
3.1	0.24
4.1	0.30
5.1	0.40
6.1	0.56
7.1	0.73
8.1	2.03
9.1	0.86
10.1	0.67
11.1	0.56
12.1	0.48
13.1	0.47
14.1	0.44
15.1	0.42
16.1	0.41
17.1	0.39
18.1	0.37
19.1	0.35
20.1	0.33
21.1	0.31
22.1	0.29
23.1	0.27
24.1	0.18
25.1	0.00

POULSBO VILLAGE MIDWEST
HYDROGRAPH REPORT

NUMBER : 24
TYPE : CHANNEL CONVEX
DESCRIPTION : ROUTE TO N.W. CORNER POULSBO VILLAGE SW

[HYDROGRAPH INFORMATION]

Peak Discharge	=	2.56 (cfs)
Volume	=	0.93 (acft)
Time Interval	=	0.08 (hr)
Time to Peak	=	8.00 (hr)
Time of Base	=	25.67 (hr)

[CHANNEL CONVEX INFORMATION]

Convex routing coef K	=	0.73

[INFLOW HYDROGRAPH INFORMATION]

Hydrograph #	=	22
Hydrograph Description	=	COMBINE 4th & nORMAN PARCEL 25-YR

[Convex Channel Routed Hydrograph Flow Values Time vs. Flow]
(The time interval is 1.0 hr)

TIME (hr)	INFLOW (cfs)	OUTFLOW O2(cfs)
1.1	0.07	0.04
2.1	0.19	0.18
3.1	0.24	0.24
4.1	0.30	0.30
5.1	0.40	0.38
6.1	0.56	0.52
7.1	0.73	0.68
8.1	2.03	2.54
9.1	0.86	0.94
10.1	0.67	0.66
11.1	0.56	0.57
12.1	0.48	0.49
13.1	0.47	0.46
14.1	0.44	0.44
15.1	0.42	0.43
16.1	0.41	0.41
17.1	0.39	0.39
18.1	0.37	0.37
19.1	0.35	0.35
20.1	0.33	0.33
21.1	0.31	0.31
22.1	0.29	0.29
23.1	0.27	0.28
24.1	0.18	0.26
25.1	0.00	0.01

POULSBO VILLAGE MIDWEST
HYDROGRAPH REPORT

NUMBER : 25
TYPE : COMBINE
DESCRIPTION : COMBINE 25-yr VALLEY VIEW APT.'s/4th&NORMAN
[HYDROGRAPH INFORMATION]
Peak Discharge..... = 4.00 (cfs)
Volume..... = 1.42 (acft)
Time Interval..... = 0.08 (hr)
Time to Peak..... = 8.00 (hr)
Time of Base..... = 25.67 (hr)
[COMBINE HYDROGRAPH RECORD #]
HYDROGRAPH # 24 TYPE : CHANNEL CONVEX
DESCRIPTION : ROUTE TO N.W. CORNER POULSBO VILLAGE SW
Peak Discharge..... = 2.56 (cfs)
Time to Peak..... = 8.00 (hr)
Time Interval..... = 0.08 (hr)
HYDROGRAPH # 14 TYPE : SANTA BARBARA
DESCRIPTION : VALLEY VIEW APT.'s 25-YR HYDROGRAPH
Peak Discharge..... = 1.49 (cfs)
Time to Peak..... = 7.90 (hr)
Time Interval..... = 0.03 (hr)

[Combine Hydrograph Flow Values]
(The time interval is 1.0 hr)

TIME (hr)	OUTFLOW (cfs)
1.1	0.06
2.1	0.28
3.1	0.38
4.1	0.49
5.1	0.64
6.1	0.86
7.1	1.10
8.1	3.70
9.1	1.37
10.1	1.00
11.1	0.86
12.1	0.73
13.1	0.69
14.1	0.66
15.1	0.64
16.1	0.61
17.1	0.58
18.1	0.55
19.1	0.52
20.1	0.49
21.1	0.47
22.1	0.44
23.1	0.41
24.1	0.34
25.1	0.01

POULSBO VILLAGE MIDWEST
HYDROGRAPH REPORT

NUMBER : 26
TYPE : RESER STOR. IND
DESCRIPTION : LEVEL-POOL ROUTE POULSBO VILL. SW 25 YR

[HYDROGRAPH INFORMATION]

Peak Discharge	=	1.09 (cfs)
Volume	=	0.67 (acft)
Time Interval	=	0.08 (hr)
Time to Peak	=	8.42 (hr)
Time of Base	=	31.67 (hr)
Peak Elevation	=	60.35 (ft)

[INFLOW HYDROGRAPH INFORMATION]

Hydrograph #	=	16
Hydrograph Description	=	POULSBO VILLAGE SW 25-YR(B-4 DETENTION)

[Storage Indication Reservoir Routed Hydrograph Flow Values Time vs. Flow]
(The time interval is 1.0 hr)

ELEVATION (ft)	TIME (hr)	INFLOW (cfs)	OUTFLOW (cfs)
56.02	2.0	0.12	0.06
56.42	3.0	0.19	0.09
56.85	4.0	0.25	0.11
57.36	5.0	0.32	0.13
58.02	6.0	0.42	0.16
58.70	7.0	0.53	0.41
59.87	8.0	1.93	0.95
59.99	9.0	0.68	0.99
59.18	10.0	0.47	0.70
58.78	11.0	0.40	0.48
58.66	12.0	0.34	0.37
58.61	13.0	0.31	0.32
58.60	14.0	0.30	0.31
58.58	15.0	0.29	0.29
58.57	16.0	0.28	0.28
58.56	17.0	0.26	0.27
58.54	18.0	0.25	0.26
58.53	19.0	0.24	0.24
58.51	20.0	0.22	0.23
58.49	21.0	0.21	0.22
58.47	22.0	0.20	0.20
58.45	23.0	0.18	0.19
58.42	24.0	0.17	0.18
58.11	25.0	0.00	0.16
57.69	26.0	0.00	0.14
57.29	27.0	0.00	0.13
56.90	28.0	0.00	0.11
56.53	29.0	0.00	0.09
56.18	30.0	0.00	0.07
55.92	31.0	0.00	0.01

*NOTE:
DETENTION BARREL AND OUTLET STRUCTURE MODELED BASED ON A.D.A. ENGINEERS "STORM DRAINAGE COMPUTATIONS FOR POULSBO VILLAGE S.W."

POULSBO VILLAGE MIDWEST
HYDROGRAPH REPORT

NUMBER : 28
TYPE : COMBINE
DESCRIPTION : COMBINE POULSBO VILLAGE/4th/NORMAN/VALLEY VIEW 25-YR
[HYDROGRAPH INFORMATION]
Peak Discharge..... = 4.96 (cfs)
Volume..... = 2.09 (acft)
Time Interval..... = 0.08 (hr)
Time to Peak..... = 8.00 (hr)
Time of Base..... = 31.67 (hr)
[COMBINE HYDROGRAPH RECORD #]
HYDROGRAPH # 25 TYPE : COMBINE
DESCRIPTION : COMBINE 25-yr VALLEY VIEW APT.'s/4th&NORMAN
Peak Discharge..... = 4.00 (cfs)
Time to Peak..... = 8.00 (hr)
Time Interval..... = 0.08 (hr)
HYDROGRAPH # 26 TYPE : RESER STOR. IND
DESCRIPTION : LEVEL-POOL ROUTE POULSBO VILL. SW 25 YR
Peak Discharge..... = 1.09 (cfs)
Time to Peak..... = 8.42 (hr)
Time Interval..... = 0.08 (hr)

[Combine Hydrograph Flow Values]
(The time interval is 1.0 hr)

TIME (hr)	OUTFLOW (cfs)
1.1	0.06
2.1	0.34
3.1	0.47
4.1	0.60
5.1	0.77
6.1	1.02
7.1	1.54
8.1	4.71
9.1	2.34
10.1	1.68
11.1	1.33
12.1	1.09
13.1	1.01
14.1	0.96
15.1	0.93
16.1	0.89
17.1	0.85
18.1	0.81
19.1	0.77
20.1	0.72
21.1	0.68
22.1	0.64
23.1	0.60
24.1	0.52
25.1	0.16
26.1	0.14

POULSBO VILLAGE MIDWEST
HYDROGRAPH REPORT

NUMBER : 30
TYPE : CHANNEL CONVEX
DESCRIPTION : CHANNEL ROUTE P.V./4th/NORMAN/APT.'s TO 18" OUTFALL

[HYDROGRAPH INFORMATION]

Peak Discharge	=	4.81 (cfs)
Volume	=	2.09 (acft)
Time Interval	=	0.08 (hr)
Time to Peak	=	8.08 (hr)
Time of Base	=	31.75 (hr)

[CHANNEL CONVEX INFORMATION]

Convex routing coef K	=	0.59

[INFLOW HYDROGRAPH INFORMATION]

Hydrograph #	=	28
Hydrograph Description	=	COMBINE POULSBO VILLAGE/4th/NORMAN/VALLEYVIEW 25-YR

[Convex Channel Routed Hydrograph Flow Values Time vs. Flow]
(The time interval is 1.0 hr)

TIME (hr)	INFLOW (cfs)	OUTFLOW O2(cfs)
1.1	0.06	0.03
2.1	0.34	0.31
3.1	0.47	0.46
4.1	0.60	0.59
5.1	0.77	0.74
6.1	1.02	0.96
7.1	1.54	1.42
8.1	4.71	4.81
9.1	2.34	2.50
10.1	1.68	1.74
11.1	1.33	1.37
12.1	1.09	1.12
13.1	1.01	1.01
14.1	0.96	0.97
15.1	0.93	0.94
16.1	0.89	0.89
17.1	0.85	0.85
18.1	0.81	0.81
19.1	0.77	0.77
20.1	0.72	0.73
21.1	0.68	0.69
22.1	0.64	0.65
23.1	0.60	0.60
24.1	0.52	0.56
25.1	0.16	0.17
26.1	0.14	0.15
27.1	0.13	0.13
28.1	0.11	0.11
29.1	0.09	0.09
30.1	0.07	0.07
31.1	0.01	0.01

POULSBO VILLAGE MIDWEST
HYDROGRAPH REPORT

NUMBER : 31
TYPE : COMBINE
DESCRIPTION : 25-YR HYDROGRAPH AT 18" OUTFALL

[HYDROGRAPH INFORMATION]

Peak Discharge	=	7.04 (cfs)
Volume	=	3.48 (acft)
Time Interval	=	0.08 (hr)
Time to Peak	=	8.08 (hr)
Time of Base	=	31.75 (hr)

[COMBINE HYDROGRAPH RECORD #]
HYDROGRAPH # 30 TYPE : CHANNEL CONVEX
DESCRIPTION : CHANNEL ROUTE P.V./4th/NORMAN/APT.'s TO 18" OUTFALL

Peak Discharge	=	4.81 (cfs)
Time to Peak	=	8.08 (hr)
Time Interval	=	0.08 (hr)

HYDROGRAPH # 18 TYPE : SANTA BARBARA
DESCRIPTION : CITY RES/RYAN WEST BASIN 25 YR HYDROGRAPH

Peak Discharge	=	1.54 (cfs)
Time to Peak	=	8.25 (hr)
Time Interval	=	0.08 (hr)

HYDROGRAPH # 20 TYPE : SANTA BARBARA
DESCRIPTION : RYAN EAST BASIN 25-YR

Peak Discharge	=	0.73 (cfs)
Time to Peak	=	8.08 (hr)
Time Interval	=	0.08 (hr)

[Combine Hydrograph Flow Values]
(The time interval is 1.0 hr)

TIME (hr)	OUTFLOW (cfs)
1.1	0.03
2.1	0.31
3.1	0.46
4.1	0.59
5.1	0.76
6.1	1.14
7.1	1.88
8.1	7.04
9.1	4.25
10.1	3.04
11.1	2.47
12.1	2.09
13.1	1.90
14.1	1.83
15.1	1.78
16.1	1.72
17.1	1.65
18.1	1.58
19.1	1.51
20.1	1.43
21.1	1.36

[Combine Hydrograph Flow Values]
(The time interval is 1.0 hr)

TIME (hr)	OUTFLOW (cfs)
22.1	1.28
23.1	1.20
24.1	1.12
25.1	0.31
26.1	0.18
27.1	0.14
28.1	0.12
29.1	0.10
30.1	0.07
31.1	0.01

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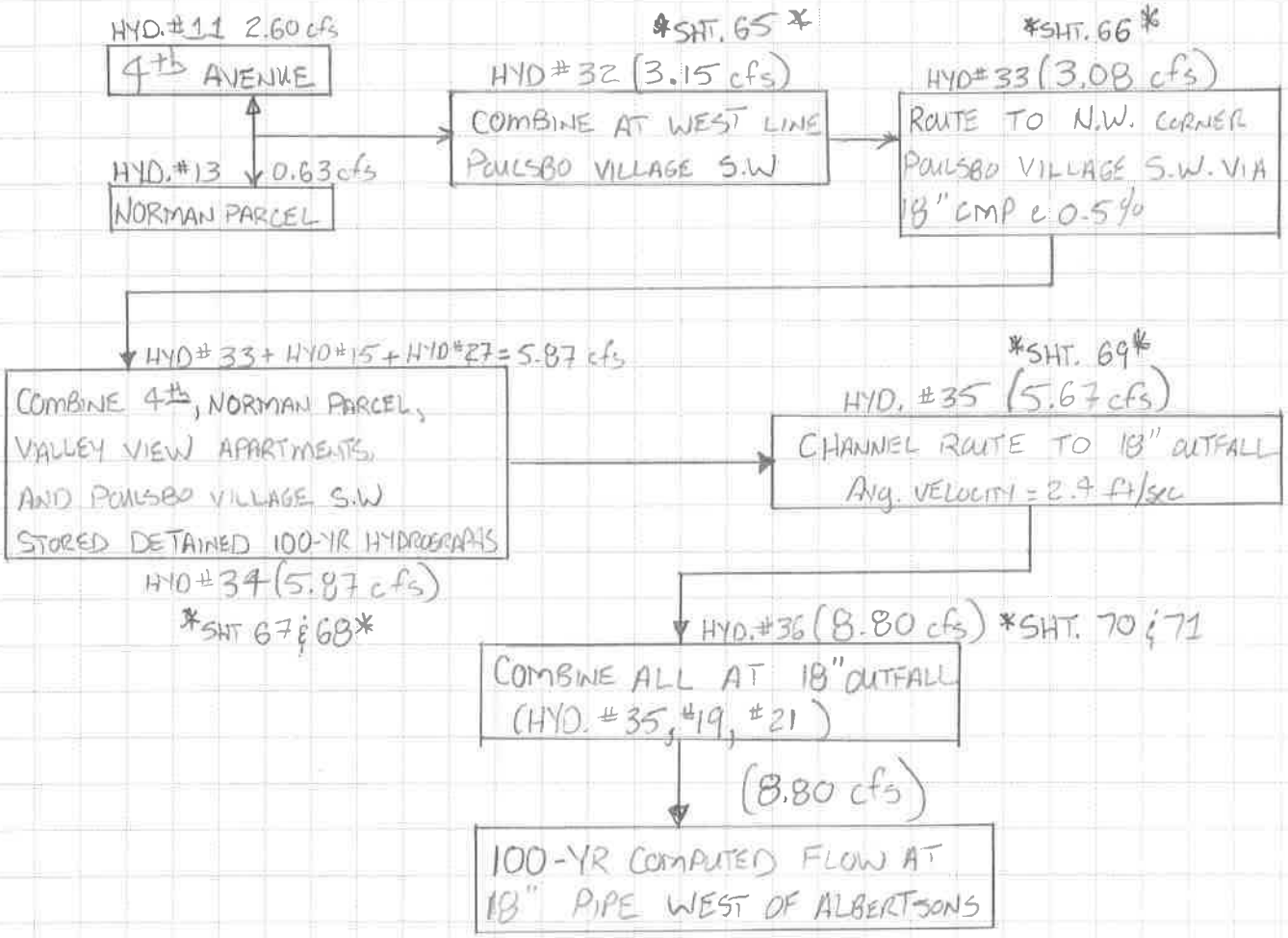
G. COMBINE & ROUTE 100-YR HYDROGRAPHS



H. CAPACITY OF DOWNSTREAM RECEIVING CONVEYANCE

THE ANALYSIS ILLUSTRATES THAT A 25-YR PEAK FLOW OF 7.04 cfs AND A 100-YR PEAK FLOW OF 8.80 cfs ARE CURRENTLY DIRECTED AT THE 18" PIPE OUTFALL.

ACCORDING TO THE DESIGN PLANS, 18" STORM PIPING WAS SPECIFIED AT A SLOPE OF 0.5% MINIMUM FROM THE INLET BEHIND ALBERTSONS (SHT. 72) THE CAPACITY OF 18" HELICAL CORRUGATED METAL PIPE, WITH $2\frac{2}{3}" \times \frac{1}{2}"$ CORRUGATIONS (MANNING'S $n = 0.014$), IS APPROXIMATELY 7.0 cfs (SEE SHT. 73).

(CONTINUES ON SHT 74)

POULSBO VILLAGE MIDWEST
HYDROGRAPH REPORT

NUMBER : 32
TYPE : COMBINE
DESCRIPTION : COMBINE 4th/NORMAN 100-YR

[HYDROGRAPH INFORMATION]

Peak Discharge	=	3.15 (cfs)
Volume	=	1.14 (acft)
Time Interval	=	0.08 (hr)
Time to Peak	=	7.92 (hr)
Time of Base	=	26.42 (hr)

[COMBINE HYDROGRAPH RECORD #]
HYDROGRAPH # 11 TYPE : SANTA BARBARA
DESCRIPTION : 4th AVENUE 100-YR HYDROGRAPH

Peak Discharge	=	2.60 (cfs)
Time to Peak	=	7.87 (hr)
Time Interval	=	0.03 (hr)

HYDROGRAPH # 13 TYPE : SANTA BARBARA
DESCRIPTION : NORMAN PARCEL 100-YR HYDROGRAPH

Peak Discharge	=	0.63 (cfs)
Time to Peak	=	8.08 (hr)
Time Interval	=	0.08 (hr)

[Combine Hydrograph Flow Values]
(The time interval is 1.0 hr)

TIME (hr)	OUTFLOW (cfs)
1.1	0.10
2.1	0.25
3.1	0.30
4.1	0.37
5.1	0.50
6.1	0.69
7.1	0.90
8.1	2.49
9.1	1.05
10.1	0.81
11.1	0.68
12.1	0.59
13.1	0.57
14.1	0.53
15.1	0.51
16.1	0.49
17.1	0.47
18.1	0.44
19.1	0.42
20.1	0.40
21.1	0.38
22.1	0.35
23.1	0.33
24.1	0.22
25.1	0.01

POULSBO VILLAGE MIDWEST
HYDROGRAPH REPORT

NUMBER : 33
TYPE : CHANNEL CONVEX
DESCRIPTION : ROUTE 4th/NORMAN TO N.W. CORNER P.V.S.W. VIA 18" CMP

[HYDROGRAPH INFORMATION]

Peak Discharge	=	3.08 (cfs)
Volume	=	1.14 (acft)
Time Interval	=	0.08 (hr)
Time to Peak	=	8.08 (hr)
Time of Base	=	25.83 (hr)

[CHANNEL CONVEX INFORMATION]

Convex routing coef K	=	0.59

[INFLOW HYDROGRAPH INFORMATION]

Hydrograph #	=	32
Hydrograph Description	=	COMBINE 4th/NORMAN 100-YR

[Convex Channel Routed Hydrograph Flow Values Time vs. Flow]
(The time interval is 1.0 hr)

TIME (hr)	INFLOW (cfs)	OUTFLOW O2(cfs)
1.1	0.10	0.07
2.1	0.25	0.23
3.1	0.30	0.30
4.1	0.37	0.37
5.1	0.50	0.47
6.1	0.69	0.64
7.1	0.90	0.83
8.1	2.49	3.08
9.1	1.05	1.17
10.1	0.81	0.81
11.1	0.68	0.70
12.1	0.59	0.59
13.1	0.57	0.55
14.1	0.53	0.53
15.1	0.51	0.51
16.1	0.49	0.49
17.1	0.47	0.47
18.1	0.44	0.45
19.1	0.42	0.43
20.1	0.40	0.40
21.1	0.38	0.38
22.1	0.35	0.35
23.1	0.33	0.33
24.1	0.22	0.31
25.1	0.01	0.01

POULSBO VILLAGE MIDWEST
HYDROGRAPH REPORT

NUMBER : 34
TYPE : COMBINE
DESCRIPTION : COMBINE 4th/NORMAN/APT.'S/P.V.S.W. 100YR HYDROGRAPHS

[HYDROGRAPH INFORMATION]

Peak Discharge	=	5.87 (cfs)
Volume	=	2.53 (acft)
Time Interval	=	0.08 (hr)
Time to Peak	=	8.00 (hr)
Time of Base	=	31.75 (hr)

[COMBINE HYDROGRAPH RECORD #]

HYDROGRAPH # 33 TYPE : CHANNEL CONVEX
DESCRIPTION : ROUTE 4th/NORMAN TO N.W. CORNER P.V.S.W. VIA 18" CMP

Peak Discharge	=	3.08 (cfs)
Time to Peak	=	8.08 (hr)
Time Interval	=	0.08 (hr)

HYDROGRAPH # 15 TYPE : SANTA BARBARA
DESCRIPTION : VALLEY VIEW APT.'s 100-YR HYDROGRAPH

Peak Discharge	=	1.78 (cfs)
Time to Peak	=	7.90 (hr)
Time Interval	=	0.03 (hr)

HYDROGRAPH # 27 TYPE : RESER STOR. IND
DESCRIPTION : LEVEL-POOL POULSBO VILLAGE SW 100-YR

Peak Discharge	=	1.25 (cfs)
Time to Peak	=	8.42 (hr)
Time Interval	=	0.08 (hr)

[Combine Hydrograph Flow Values]
(The time interval is 1.0 hr)

TIME (hr)	OUTFLOW (cfs)
1.1	0.10
2.1	0.44
3.1	0.58
4.1	0.73
5.1	0.93
6.1	1.39
7.1	1.91
8.1	5.62
9.1	2.82
10.1	2.06
11.1	1.64
12.1	1.34
13.1	1.22
14.1	1.15
15.1	1.11
16.1	1.06
17.1	1.01
18.1	0.96
19.1	0.91
20.1	0.86
21.1	0.81

[Combine Hydrograph Flow Values]
(The time interval is 1.0 hr)

TIME (hr)	OUTFLOW (cfs)
22.1	0.76
23.1	0.71
24.1	0.62
25.1	0.17
26.1	0.14
27.1	0.13
28.1	0.11
29.1	0.09
30.1	0.07
31.1	0.01

POULSBO VILLAGE MIDWEST
HYDROGRAPH REPORT

NUMBER : 35
TYPE : CHANNEL CONVEX
DESCRIPTION : CHANNEL ROUTE 4th,NORMAN,APT.'s,P.V.S.W. TO 18" OUTFALL

[HYDROGRAPH INFORMATION]

Peak Discharge	=	5.67 (cfs)
Volume	=	2.53 (acft)
Time Interval	=	0.08 (hr)
Time to Peak	=	8.08 (hr)
Time of Base	=	31.83 (hr)

[CHANNEL CONVEX INFORMATION]

Convex routing coef K	=	0.59

[INFLOW HYDROGRAPH INFORMATION]

Hydrograph #	=	34
Hydrograph Description	=	COMBINE 4th/NORMAN/APT.'S/P.V.S.W. 100YR HYDROGRAPHS

[Convex Channel Routed Hydrograph Flow Values Time vs. Flow]
(The time interval is 1.0 hr)

TIME (hr)	INFLOW (cfs)	OUTFLOW O2(cfs)
1.1	0.10	0.06
2.1	0.44	0.41
3.1	0.58	0.57
4.1	0.73	0.71
5.1	0.93	0.89
6.1	1.39	1.25
7.1	1.91	1.81
8.1	5.62	5.67
9.1	2.82	3.01
10.1	2.06	2.12
11.1	1.64	1.69
12.1	1.34	1.38
13.1	1.22	1.21
14.1	1.15	1.16
15.1	1.11	1.12
16.1	1.06	1.07
17.1	1.01	1.02
18.1	0.96	0.97
19.1	0.91	0.92
20.1	0.86	0.87
21.1	0.81	0.82
22.1	0.76	0.77
23.1	0.71	0.72
24.1	0.62	0.67
25.1	0.17	0.18
26.1	0.14	0.15
27.1	0.13	0.13
28.1	0.11	0.12
29.1	0.09	0.10
30.1	0.07	0.08
31.1	0.01	0.02

POULSBO VILLAGE MIDWEST
HYDROGRAPH REPORT

NUMBER : 36
TYPE : COMBINE
DESCRIPTION : COMBINE ALL 100 YR AT 18" OUTFALL

[HYDROGRAPH INFORMATION]

Peak Discharge	=	8.80 (cfs)
Volume	=	4.36 (acft)
Time Interval	=	0.08 (hr)
Time to Peak	=	8.08 (hr)
Time of Base	=	31.83 (hr)

[COMBINE HYDROGRAPH RECORD #]

HYDROGRAPH # 19 TYPE : SANTA BARBARA
DESCRIPTION : CITY RES/RYAN WEST BASIN 100 YR HYDROGRAPH

Peak Discharge	=	2.17 (cfs)
Time to Peak	=	8.25 (hr)
Time Interval	=	0.08 (hr)

HYDROGRAPH # 21 TYPE : SANTA BARBARA
DESCRIPTION : RYAN EAST BASIN 100-YR

Peak Discharge	=	1.00 (cfs)
Time to Peak	=	8.08 (hr)
Time Interval	=	0.08 (hr)

HYDROGRAPH # 35 TYPE : CHANNEL CONVEX
DESCRIPTION : CHANNEL ROUTE 4th,NORMAN,APT.'s,P.V.S.W. TO 18" OUTFALL

Peak Discharge	=	5.67 (cfs)
Time to Peak	=	8.08 (hr)
Time Interval	=	0.08 (hr)

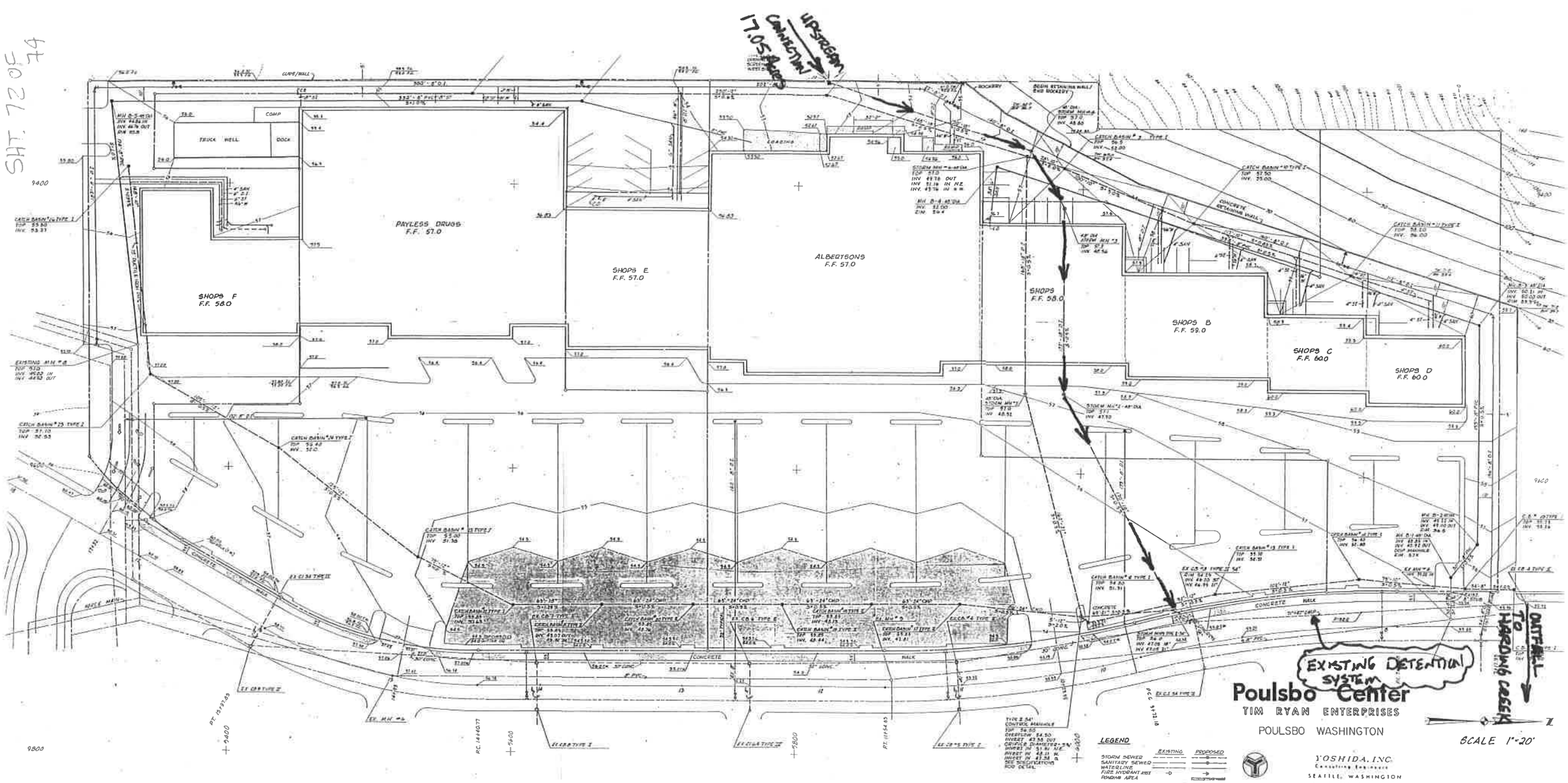
[Combine Hydrograph Flow Values]
(The time interval is 1.0 hr)

TIME (hr)	OUTFLOW (cfs)
1.1	0.06
2.1	0.41
3.1	0.57
4.1	0.72
5.1	1.00
6.1	1.61
7.1	2.55
8.1	8.80
9.1	5.38
10.1	3.84
11.1	3.13
12.1	2.64
13.1	2.36
14.1	2.27
15.1	2.19
16.1	2.11
17.1	2.03
18.1	1.94
19.1	1.85
20.1	1.75
21.1	1.66

[Combine Hydrograph Flow Values]
(The time interval is 1.0 hr)

TIME (hr)	OUTFLOW (cfs)
22.1	1.56
23.1	1.46
24.1	1.36
25.1	0.34
26.1	0.19
27.1	0.14
28.1	0.12
29.1	0.10
30.1	0.08
31.1	0.02

SHT. 72 OF 74



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GRADING AND UTILITY PLAN

DOWNSTREAM CONVEYANCE SYSTEM

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3			
2			
1	REVISION	DATE	BY

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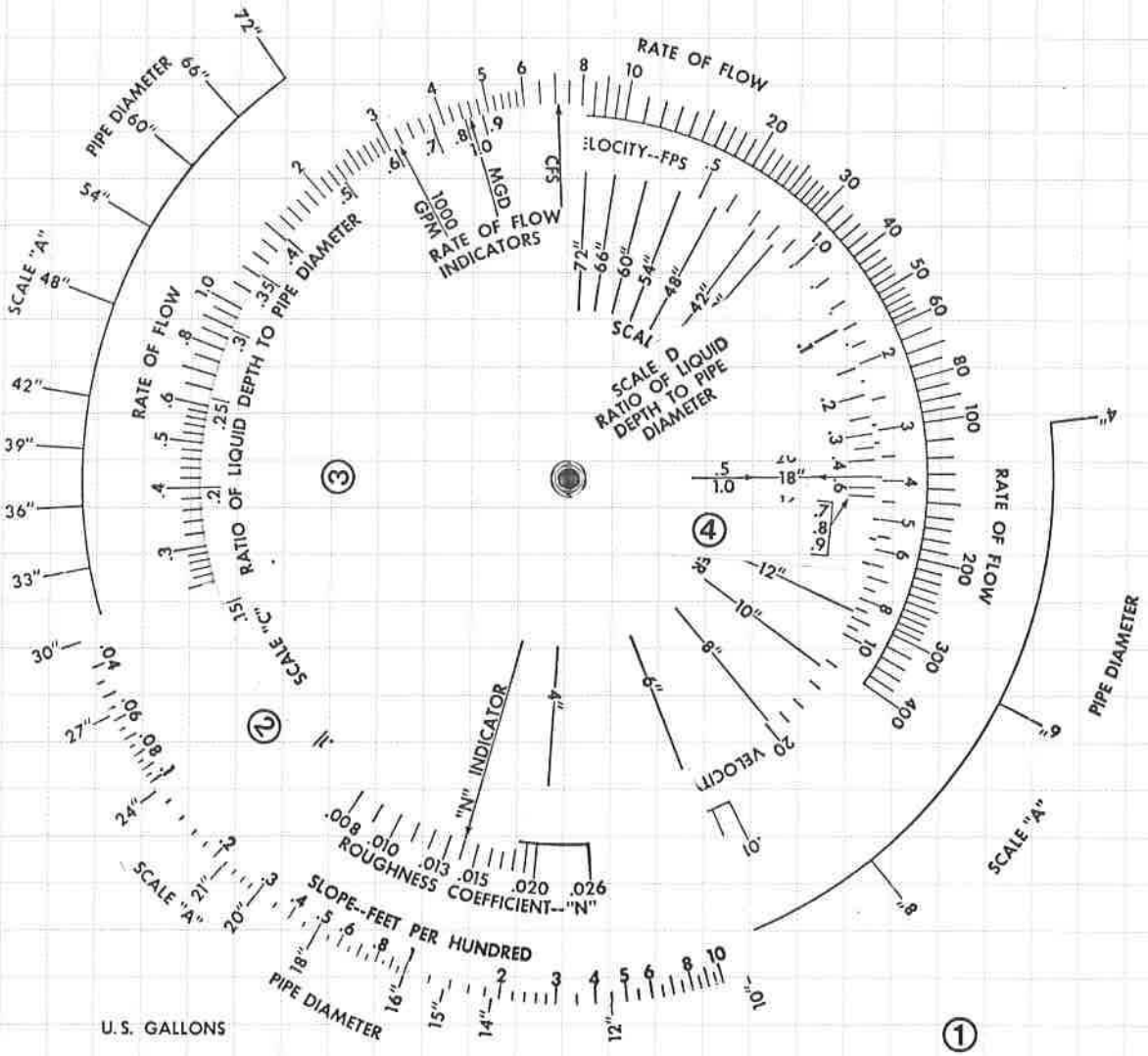

FEILD'S HYDRAULICS CALCULATOR FOR GRAVITY FLOW IN PIPES

Slide Chart by PERRYGRAF L.A. CA 91324

BASED ON THE MANNING FORMULA

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I. SUMMARY

BASED ON THE PRECEDING ANALYSIS, THE DOWNSTREAM RECEIVING PIPE UNDER THE POULSBO VILLAGE SHOPPING CENTER WAS SIZED FOR THE 25 YEAR PEAK RUNOFF FROM THE UPSTREAM CONTRIBUTING BASIN. THIS DESIGN PARAMETER IS CONSISTENT WITH THE CITY OF POULSBO REQUIREMENTS WHICH WERE IN PLACE AT THE TIME OF CONSTRUCTION OF POULSBO VILLAGE.

CURRENT CONVEYANCE REQUIREMENTS PER THE KITSAP COUNTY DESIGN MANUAL AND THE DEPT. OF ECOLOGY'S STORMWATER MANAGEMENT MANUAL FOR THE PUGET SOUND BASIN ARE THAT NEW CONVEYANCE FACILITIES BE SIZED FOR THE PEAK 100-YEAR, 24 HOUR DESIGN FLOW.

THE POULSBO VILLAGE MIDWEST PROJECT WILL BE DESIGNED TO STORE THE EXCESS RUNOFF FROM THE 2-YEAR, 10-YEAR, AND 100-YEAR DESIGN STORM EVENTS WHILE RELEASING RUNOFF AT THE PRE-DEVELOPED ONE-HALF OF THE 2-YEAR PEAK RUNOFF, THE PRE-DEVELOPED 10-YR PEAK RUNOFF, AND THE PRE-DEVELOPED 100-YR PEAK RUNOFF. UTILIZING THIS APPROACH, NO DOWNSTREAM CAPACITY PROBLEMS ARE ANTICIPATED. IT IS IMPORTANT TO NOTE THAT THE RELATIVELY SMALL DIFFERENCE BETWEEN THE EXISTING 25-YEAR PEAK FLOW (7.04 cfs) AND THE 100-YEAR PEAK FLOW (8.80 cfs) WILL CAUSE THE DOWNSTREAM CONVEYANCE SYSTEM TO FUNCTION IN A "PRESSURE-HEAD" SITUATION, HOWEVER THE ADDITIONAL 1.8 cfs WILL NOT CAUSE ENOUGH HEAD TO CAUSE LOCALIZED STANDING WATER IN THE VICINITY OF THE DOWNSTREAM CATCH BASINS.