SEPA File

FINAL
Technical Information Report
for
Lakepointe Development

(CONCEPTUAL MASTER PLAN)

Submitted by:

KPFF Consulting Engineers
1201 Third Avenue, Suite 900
Seattle, WA 98101
Phone: (206) 622-5822

Job No. 95379

May 30, 1997

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King County Building and Land Development Division

TECHNICAL INFORMATION REPORT (TIR) WORKSHEET

PART 1 PROJECT OWNER AND PROJECT ENGINEER

Project Owner: Pioneer Towing Company
Address:
Phone:
Project Engineer: John Eliason
Company: KPFF Consulting Engineers
Address Phone: (206)622-5822

PART 2 PROJECT LOCATION AND DESCRIPTION

Project Name: Lakepointe Development
Location
Township: 26N
Range: 4E
Section: 11
Project Size: 45 AC
Upstream Drainage Basin Size: 24 AC

PART 3 TYPE OF PERMIT APPLICATION

- [ ] Subdivision
- [ ] Short Subdivision
- [ ] Grading
- [ ] Commercial
- [X] Other: Commercial Site Development

PART 4 OTHER PERMITS

- [X] DOF/G HPA
- [X] COE 404
- [ ] DOE Dam Safety
- [ ] FEMA Floodplain
- [X] COE Wetlands
- [X] Shoreline Management
- [ ] Rockery
- [ ] Structural Vaults
- [ ] Other
- [X] HPA

PART 5 SITE COMMUNITY AND DRAINAGE BASIN

Community: Northshore Community Plan

Drainage Basin: Sammamish River and East Lake Washington

PART 6 SITE CHARACTERISTICS

- [X] River: Sammamish River
- [ ] Stream:
- [ ] Critical Stream Reach
- [ ] Depressions/Swales
- [X] Lake: Lake Washington
- [ ] Steep Slopes:
- [ ] Lakeside/Erosion Hazard
- [ ] Floodplain:
- [ ] Wetlands:
- [ ] Seeps/Springs
- [ ] High Groundwater Table
- [ ] Groundwater Recharge
- [X] Other: Lake Washington High Water Mark

PART 7 SOILS

Soil Type	Slopes	Erosion Potential	Erosive Velocities
Norma	10%	Low	

- [ ] Additional Sheets Attatched

King County Building and Land Development Division

TECHNICAL INFORMATION REPORT (TIR) WORKSHEET

PART 8 DEVELOPMENT LIMITATIONS

REFERENCE	LIMITATION/SITE CONSTRAINT
☐ Ch. 4 - Downstream Analysis	None found during Level 1 Analysis
☐	
☐	
☐	
☐	
☐	

☐ Additional Sheets Attatched

PART 9 ESC REQUIREMENTS

MINIMUM ESC REQUIREMENTS DURING CONSTRUCTION	MINIMUM ESC REQUIREMENTS FOLLOWING CONSTRUCTION
☒ Sedimentation Facilities	☒ Stabilize Exposed Surface
☒ Stabilized Construction Entrance	☒ Remove and Restore Temporary ESC Facilities
☒ Perimeter Runoff Control	☒ Clean and Remove All Silt and Debris
☒ Clearing and Grading Restrictions	☒ Ensure Operation of Permanent Facilities
☒ Cover Practices	☐ Flag Limits of NGPES
☒ Construction Sequence	☐ Other
☐ Other	

PART 10 SURFACE WATER SYSTEM

☒ Grass Lined Channel	☐ Tank	☐ Infiltration	Method of Analysis: KCRTS
☒ Pipe System	☐ Vault	☐ Depression	
☒ Open Channel	☒ Energy Dissapator	☒ Flow Dispersal	Compensation/Mitigation of Eliminated Site Storage: None
☐ Dry Pond	☐ Wetland	☐ Waiver	
☒ Wet Pond	☐ Stream	☐ Regional Detention	

Brief Description of System Operation: Consists of catch basins, main line pipe, manholes splitters, pump stations to wet pond or biofiltration swale combine with roof drainage in open swale which discharges to Lake Washington.

Facility Related Site Limitations ☐ Additional Sheets Attatched

Reference	Facility	Limitation

PART 11 STRUCTURAL ANALYSIS
(May require special structural review)

☐ Cast in Place Vault
☒ Retaining Wall
☐ Rockery > 4' High
☐ Structural on Steep Slope
☐ Other

PART 12 EASEMENTS/TRACTS

☒ Drainage Easement
☐ Access Easement
☐ Native Growth Protection Easement
☐ Tract
☐ Other

PART 14 SIGNATURE OF PROFESSIONAL ENGINEER

I or a civil engineer under my supervision have visited the site. Actual site conditions as observed were incorporated into this worksheet and the attatchments. To the best of my knowledge the information provided here is accurate.

Signed/Date

SECTION 1
PROJECT OVERVIEW

SECTION I
PROJECT OVERVIEW

GENERAL INFORMATION

This Technical Information Report (TIR) provides stormwater requirements for the Lakepointe development project. The project site is approximately 45 acres located in Kenmore, Washington. The site is north of the Sammamish Slough, east of Lake Washington, south of SR 522, and west of 68th Avenue NE. The majority of the site is relatively flat, sloping gently to Lake Washington and the Sammamish Slough.

The project will have several buildings to be used for parking, offices, retail and residential housing. An elevated deck will serve as a roadway to access the interior building areas. The project will be constructed in phases. This report is intended to cover the entire project development **through the Commercial Site Development Phase. Additional information will be provided during the Construction Document Phase of the project.**

DESIGN CRITERIA

Design criteria for storm drainage is based on the requirements outlined in the Draft King County Surface Water Design Manual, dated **February 1996. A variance to use the Draft Manual was submitted with the Commercial Site Development Permit in December of 1996.**

PROJECT APPROACH

Existing site conditions will be considered as industrial use and exposed pervious soil. Soil classification is till from the soil class charts; **however, soil borings show approximately 2 feet of silty sand over general wood and other debris.** The site will become **approximately 90 percent** impervious. The impervious area will **be a combination of buildings, roadways, parking areas, sidewalks and boardwalks. According to AGRA Earth & Environmental, approximately 90 percent of the site will be capped with impervious improvements or an impervious cap approved by the Department of Ecology for MTCA cleanup.** The remaining land will be landscaped. Detention facilities will not be required since direct drainage is allowed to Lake Washington. Water quality facilities will be provided for impervious areas subject to traffic-generated pollution.

The proposed drainage system will consist of catch basins, storm drainage pipe, **pump station, oil/water separator,** wet pond, open swales and biofiltration swales with sand filter underdrains.

RECENT SITE GRADING

The following is a copy of a May 22, 1997, memo from AGRA Earth & Environmental to provide information about recent site grading on the project site:

Note: Changes from the draft to the final report are shown in bold type.

AGRA EARTH & ENVIRONMENTAL, INC.

MEMORANDUM

11335 N.E. 122nd Way, Suite 100
Kirkland, Washington 98034-6918
Phone No. (206) 820-4669
Fax No. (206) 821-3914

TO: John Eliason, P.E.
KPFF

DATE: 22 May 1997

FROM: Deborah H. Gardner, R.P.G.
AGRA Earth & Environmental, Inc.

FILE: 6-91M-10459E

RE: Recent Grading Activities
Lakepointe
King County, Washington

Two tenant areas located in the southwest quadrant of the subject site have undergone recent grading activities that required submittal of a grading permit application and erosion control plan to King County in December 1996. These tenant areas are the former Stout Roofing Recycling operation and the former concrete washout pond.

Stout Roofing

Stout Roofing was permitted to grind roofing waste on-site in 1995 for recycling purposes. This operation resulted in the accumulation of approximately 8,000 cubic yards of roofing debris in the south central portion of the Lakepointe property by July 1996. The roofing debris included wood shakes, asphalt shingles, built-up roofing materials and unsegregated housing demolition debris. In August and September 1996, the majority of these materials were removed by order of the Seattle-King County Department of Public Health (SKCDPH) and the Puget Sound Air Pollution Control Authority (PSAPCA). An estimated 2,500 cubic yards of roofing material were not disposed and remain spread evenly across three acres of the tenant area. As a result, King County required that this area and the remaining volume of roofing debris be included in the December 1996 preliminary grading permit and erosion control plan submittal. The proposed erosion control measures had not been implemented in the former Stout Roofing tenant area as of the date of this memorandum.

Currently, soil conditions beneath the former Stout Roofing tenant area consist of an average of 0.5 feet of 1995 roofing debris over an average of three feet of silty sand fill material dating to the late 1960s, over an average of eleven feet of wood debris fill that was placed during the 1960s. Beneath the fill materials are organic peat and silt soils that formed the former lakebed.

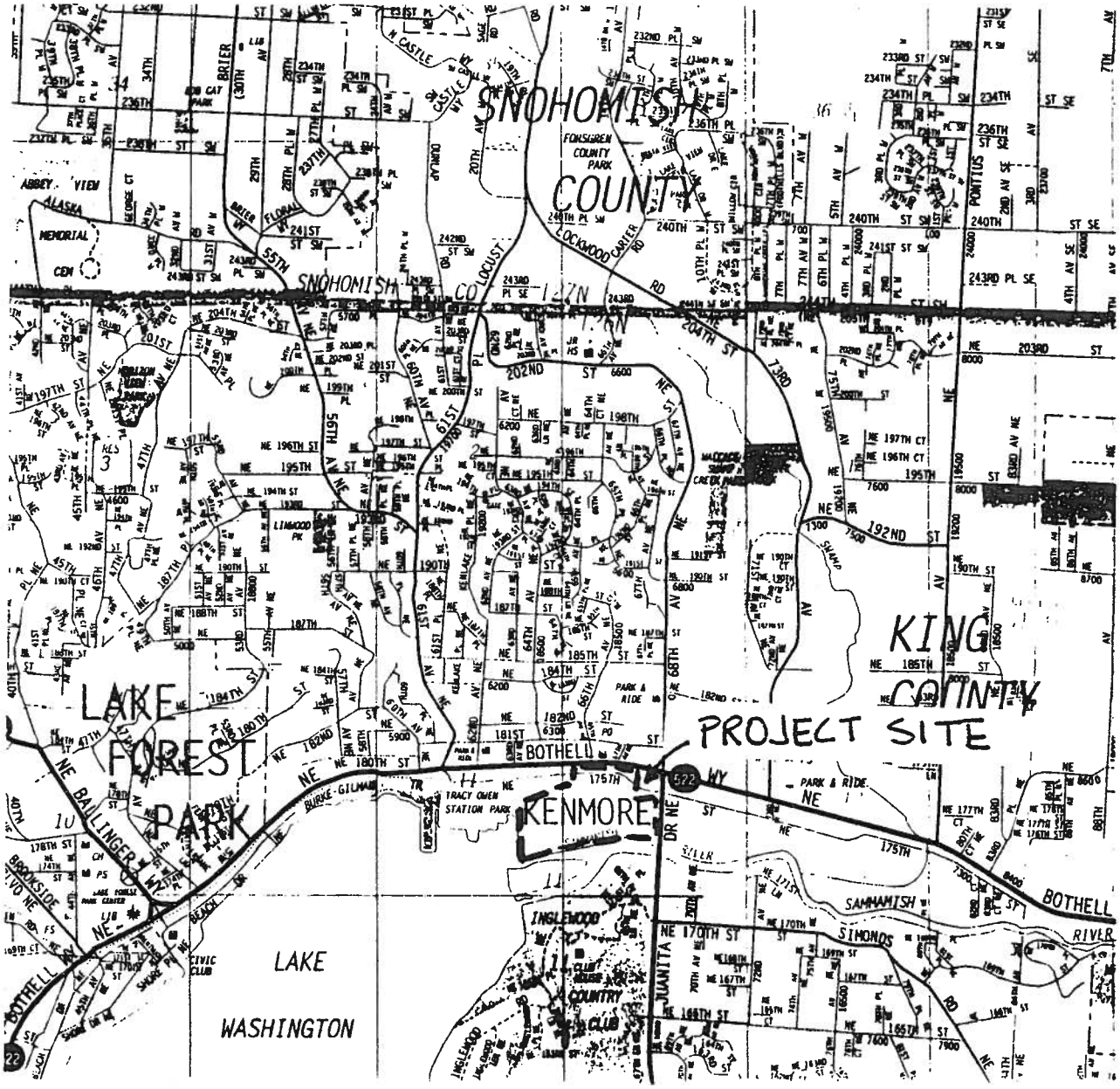
Concrete Washout Pond

A concrete plant has existed on-site since the 1970s, and a pond was maintained until mid 1996 in the southwest portion of the Lakepointe property to contain wastewater generated from rinsing concrete residue off of the concrete truck fleet. The pond measured approximately 450 feet long, 50 feet wide and 5 feet deep, relative to surrounding grades. Water was pumped from Lake Washington to a wash rack located at the north end of the pond where the trucks were rinsed. Sediment that accumulated in the pond was periodically dredged into piles adjacent to the pond. By 1996, an area of approximately 6.3 acres was occupied by pond dredgings, and dredge piles up to 15 feet tall encircled the pond.

Use of the washout pond was discontinued in spring 1996, and allowed to dry out during the summer. In summer 1996, approximately 6,800 cubic yards of the dredge piles were used to backfill the pond. The resulting graded area encompasses approximately 6.3 acres filled to an average height of three feet above surrounding grades. The filled area is sloped to shed runoff towards the north. The grading that occured in summer 1996 is the focus of the December 1996 grading permit requirements.

The filled area was hydroseeded in December 1996 and a thin cover of grass was established during the spring of 1997. Additional erosion control measures proposed in the preliminary grading plan had not been implemented by the date of this memorandum.

Currently, soil conditions beneath the former concrete washout pond area consist of an average of six feet of weakly to strongly cemented gravelly sand washout material generated since the 1970s, over an average of eleven feet of wood debris fill placed during the 1960s. Beneath the fill materials are organic peat and silt soils that formed the former lakebed.



Map Scale

0 660 1320 1980 2640 Feet

0 .125 .25 .375 .5 Miles

N

kpff Consulting Engineers 1201 Third Avenue, Suite 900 Seattle, Washington 98101 (206) 622-5822 Fax (206) 622-8130	SCALE : AS SHOWN SITE LOCATION	PROJ. NO. 95379 DATE 3/4/96 DWN. BY JNB

SECTION 2
CONDITIONS AND REQUIREMENTS SUMMARY

SECTION 2

CONDITIONS AND REQUIREMENTS SUMMARY

This section summarizes the requirements set forth by the King County Surface Water Management Design Manual, dated October 1995, for the Lakepointe project. Core and Special Requirements are listed in Chapter 1.

King County Surface Water Management Design Manual
Core Requirements

1. Discharge at the Natural Location (1.2.1): Storm drainage from the project site will be discharged to Lake Washington. This will not impact any downstream properties. Refer to Section 5 for additional information.

2. Off-site Analysis (1.2.2): This subject is addressed in Section 3. The upstream systems have been examined. A Level 1 Off-Site Analysis is included.

3. Flow Control (1.2.3): The project is exempt from flow control requirements because it discharges directly to Lake Washington.

4. Conveyance Facilities (1.2.4): This issue is discussed in Section 5.

5. Erosion/Sedimentation Control Plan (1.2.5): The project will construct a series of temporary erosion and sedimentation control measures to prevent transport of sediments. Refer to Section 8 for additional information.

6. Maintenance and Operation (1.2.6): This subject will be addressed when construction documents are complete.

7. Bonds and Liability (1.2.7): This subject will be addressed prior to starting construction of the project.

8. Water Quality (1.2.8): This subject is addressed in Section 4. The project will use water quality treatment facilities to protect receiving waters from pollution.

King County Surface Water Management Design Manual
Special Requirements

1. Other Adopted Area Specific Requirements (1.3.1): No special drainage requirements and conditions are needed for the project. The project is in the bounds of the Northshore Community Plan and the East Lake Washington Drainage Basin. Neither plan indicated special needs for the site. Renaldo Holsher, of DDES, confirmed there are no special requirements in the Northshore Community Plan for the project site. Refer to the attached confirmation.

2. Floodplain/Floodway Delineation (1.3.2): The Lake Washington shoreline and Sammamish riverbank are within a FEMA designated floodplain.

3. Flood Protection Facilities (1.3.3): There are no flood protection facilities on-site.

4. Source Control (1.3.4): During construction, a series of Best Management Practices will be employed to prevent contamination from associated pollutants. A wet pond facility will provide water quality for pavement drainage, subject to vehicular traffic.

5. Oil Control (1.3.5): Portions of the project site will be subject to high volumes of vehicular traffic. Oil control may be implemented to pretreat these areas before discharging to the wet pond or combined biofiltration swale and sand filter.

SECTION 3
OFF-SITE ANALYSIS

SECTION 3
OFF-SITE ANALYSIS

EXECUTIVE SUMMARY

The proposed project involves developing an approximately 45-acre site for mixed-use of retail, commercial and residential. The property is located at the north end of Lake Washington in Kenmore, Washington. The area is currently being used for industrial purposes. The majority of the land is used for a concrete sand and gravel business. The Level 1 Off-Site Analysis conducted includes a study area definition, a review of the existing drainage system and a field inspection.

A Downstream Analysis is not required for the project. The site drains or infiltrates into Lake Washington, a major receiving water. Upstream areas within 1/4-mile of the site and the contributing drainage basin were investigated.

OFF-SITE ANALYSIS

Study Area Definition and Maps

Preliminary review of the study area included the following maps:

- Master Plan - January 18, 1996
  - The site plan shows the project layout.
- Existing Neighborhood - January 18, 1996
  - The plan delineates property lines.
- Aerial Photos
  - Illustrates the industrial use of the site as a sand and gravel company.
- Sensitive Areas Folio Maps
  - Wetlands
  - Streams and 100-Year Floodplains
  - Erosion Hazard Areas
- FEMA Floodplain Map
  - Site is not in a floodplain area.
- Reconnaissance Map
  - Sammamish River Basin
  - Lake Washington Basin

FIELD INSPECTION AND DRAINAGE SYSTEM DESCRIPTION

General

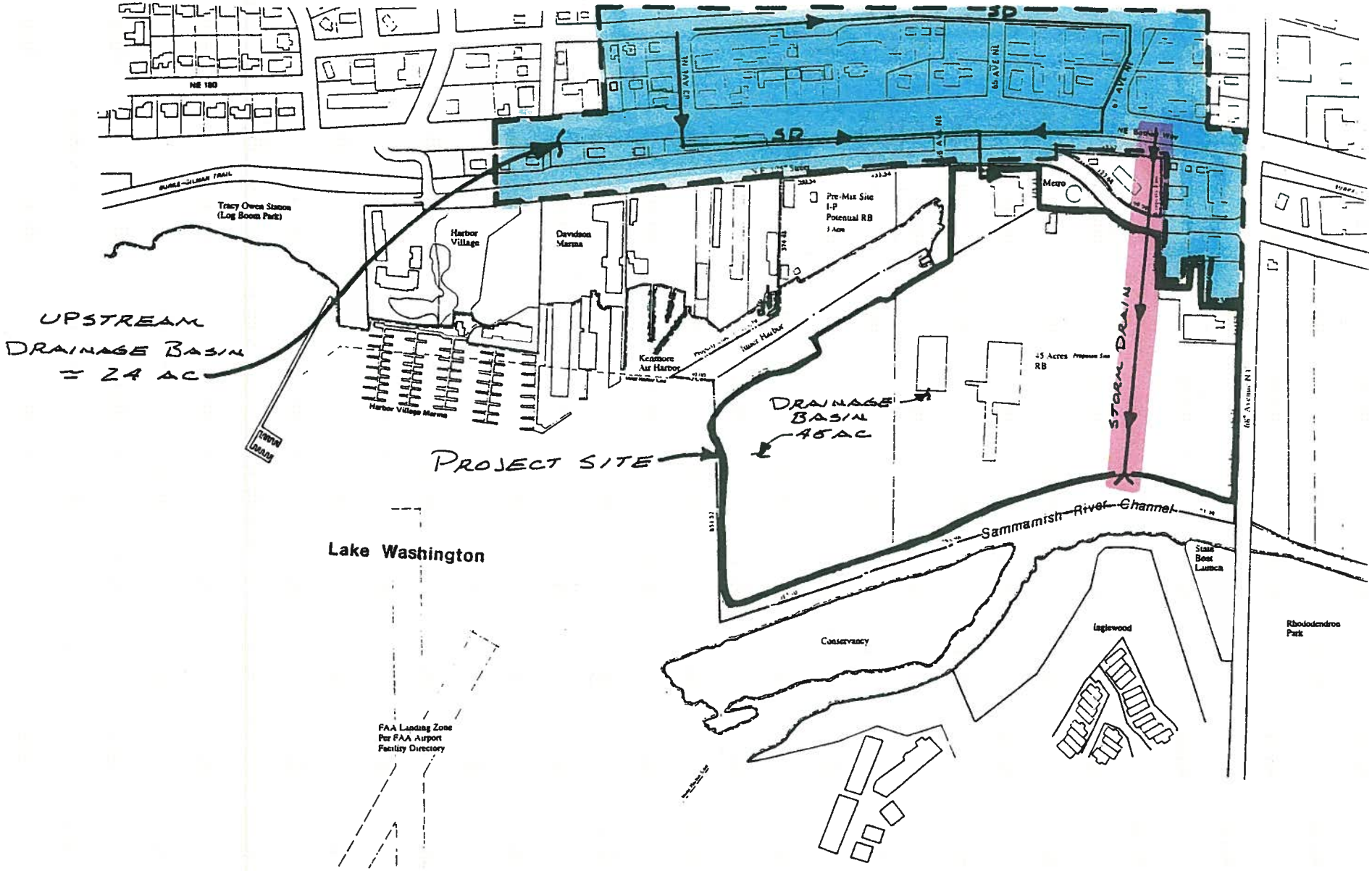
A site inspection was performed on February 23, 1996. The weather was cold and overcast. The objectives of the visit were to examine the project site and define upstream basins. The general area around the site is commercial/retail along SR 522 and 68th Avenue NE, and then residential areas to the north of SR 522. Drainage is accomplished with roadside ditches, catch basins and inlet structures, storm drain pipe and culverts.

The project receives stormwater drainage from an upstream basin. The basin is approximately 24 acres. Refer to the Project Site and Upstream Drainage Basin Plan. The basin drains to the project site where an additional 45 acres drains and discharges or infiltrates to Lake Washington.

OFF-SITE OBSERVATIONS

Upstream

Off-site flow from a residential area north of SR 522, east of 62nd Avenue NE, south of 181st Street and west of 68th Avenue NE drain to SR 522 to the south. The area is shown on the project site (Upstream Drainage Basin Plan). Runoff is collected in inlets and is conveyed downhill through storm drainage pipes to catch basins and downstream drainage pipes. At some locations, pipe daylights to grassy channels. The residential drainage takes two paths as it goes downhill—a crown in the middle of the basin on 64th Avenue NE sends water downhill to 63rd Avenue SE and SR 522, and the other sends water downhill to 66th Avenue SE and SR 522. A primary trunk line crosses south under SR 522 and goes through the ready-mix site to outfall in Lake Washington.



LAKEPOINTE DEVELOPMENT
PIONEER TOWING COMPANY

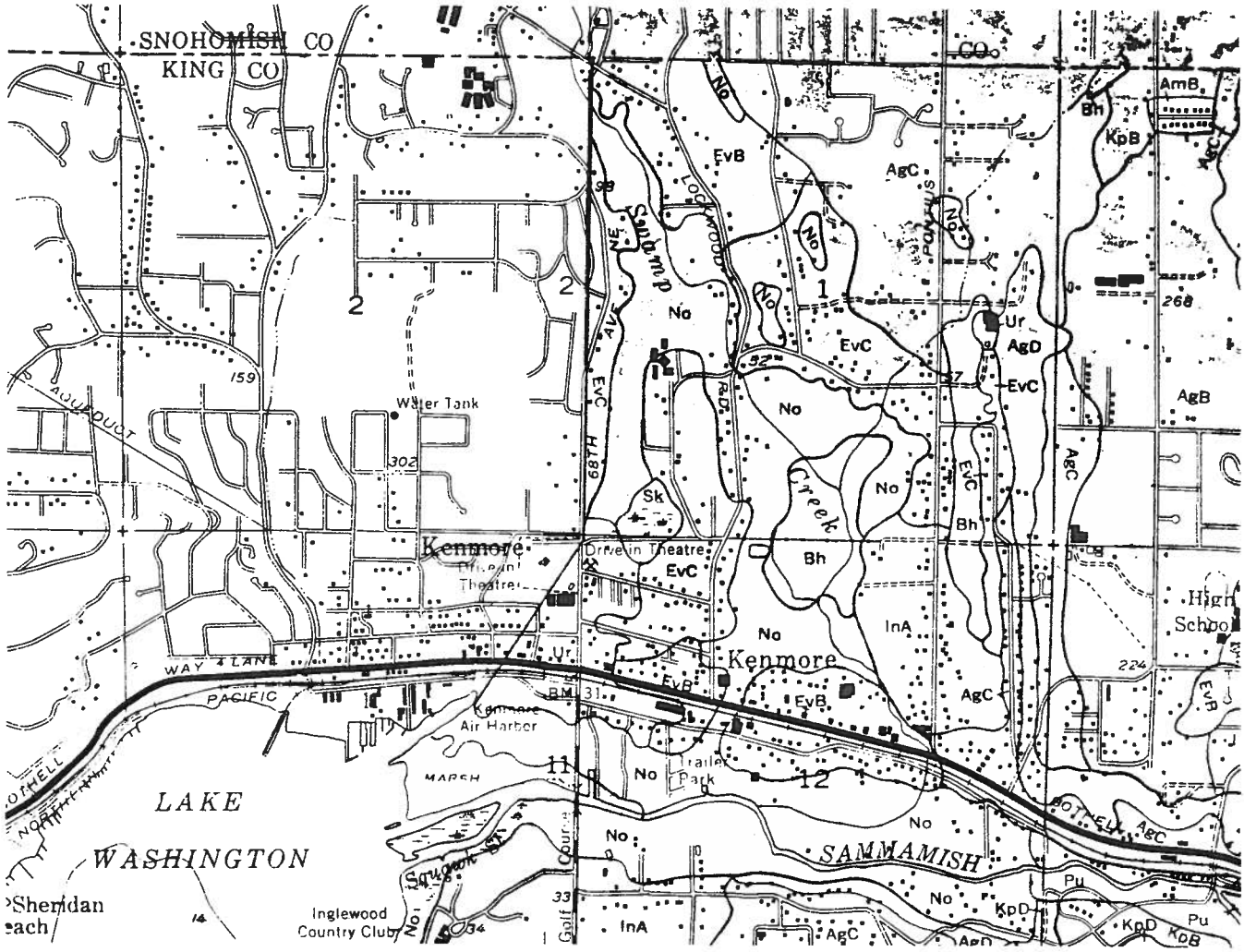
Callison Architecture, Inc.
1420 5th Ave., #2400
Seattle, WA 98101-2343
T 206-623-4646
F 206-623-4625

CALLISON ARCHITECTURE

First Submittal
March 26, 1996
Second Submittal
June 18, 1996
Third Submittal
December 23, 1996

DRAINAGE BASIN MAP
Project Number 95258.00

MP3



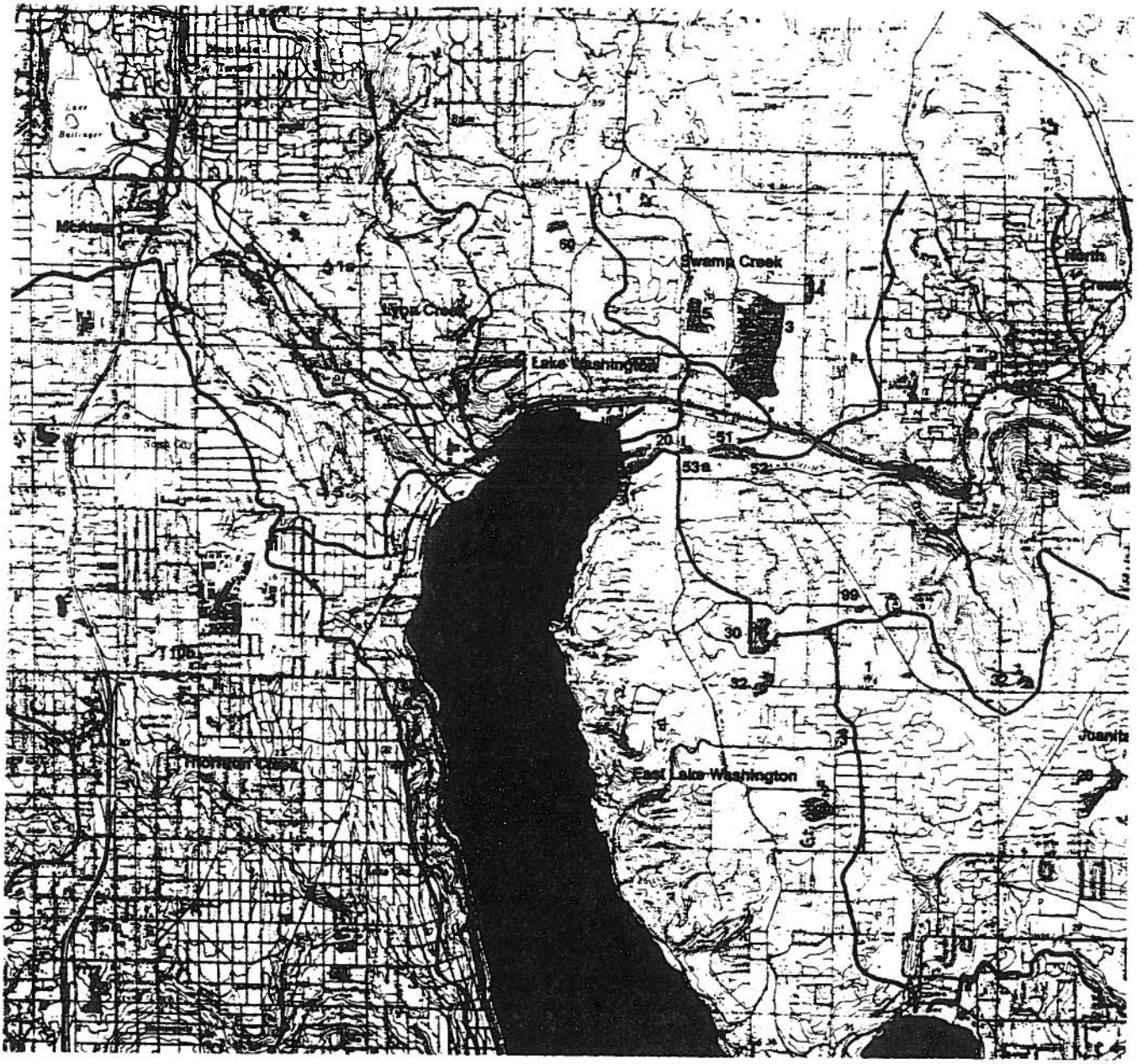
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NO. 4
KING COUNTY AREA, WASHINGTON
(PARTS OF BOTHELL
MALTBY AND MONROE QUADRANGLES)

No	Norma sandy loam
Ur	Urban land

N

kpff Consulting Engineers 1201 Third Avenue, Suite 900 Seattle, Washington 98101 (206) 622-5822 Fax (206) 622-8130	SCALE 1:24000 KING COUNTY SOIL MAP	PROJ. NO. 95379 DATE 3/9/96 DWN. BY



Wetlands

2

kpff Consulting Engineers
1201 Third Avenue, Suite 900
Seattle, Washington 98101
(206) 622-5822 Fax (206) 622-8130

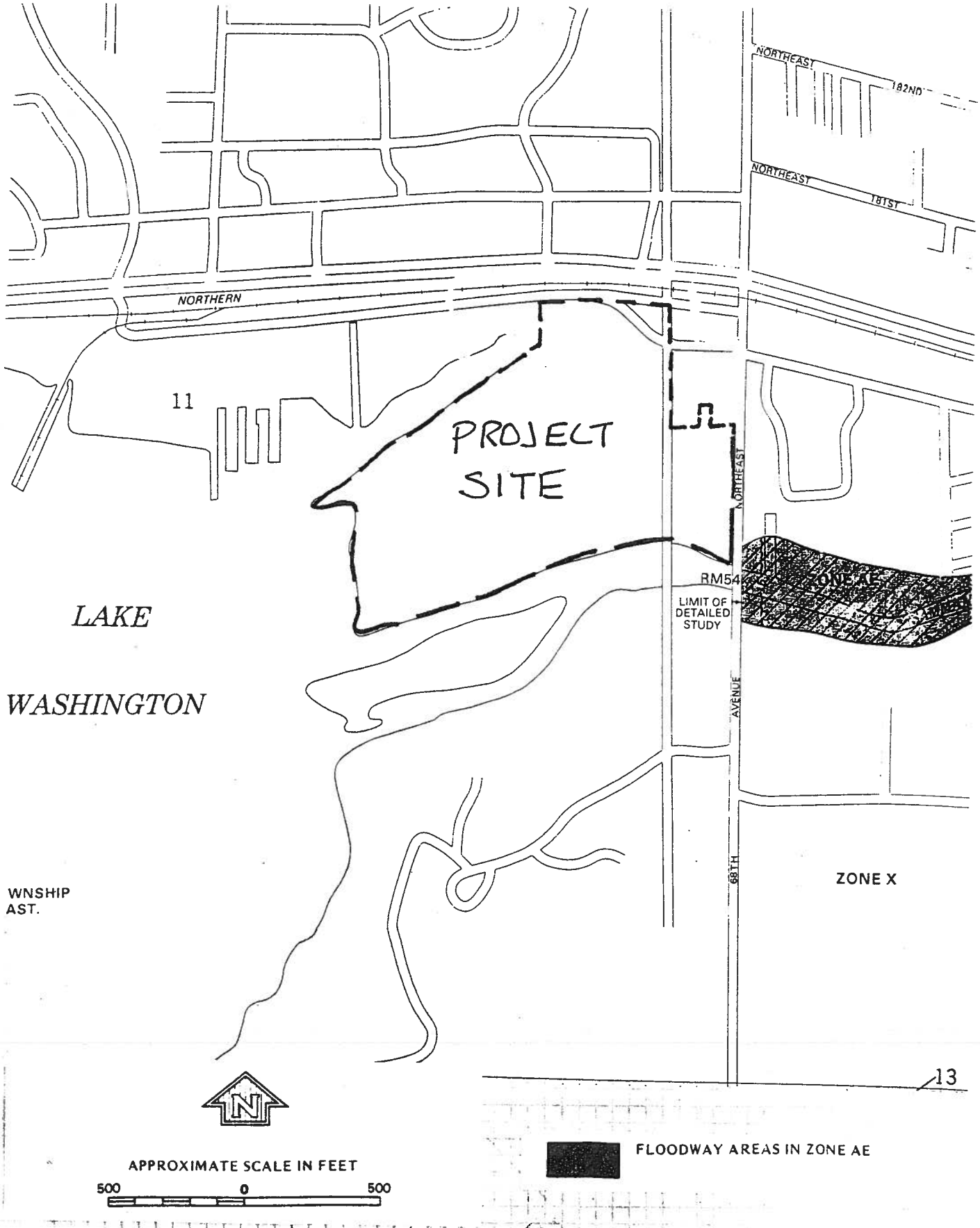
NTS

SENSITIVE AREAS FOLIO MAP

PROJ. NO. 95379

DATE 3/5/96

DSN. BY



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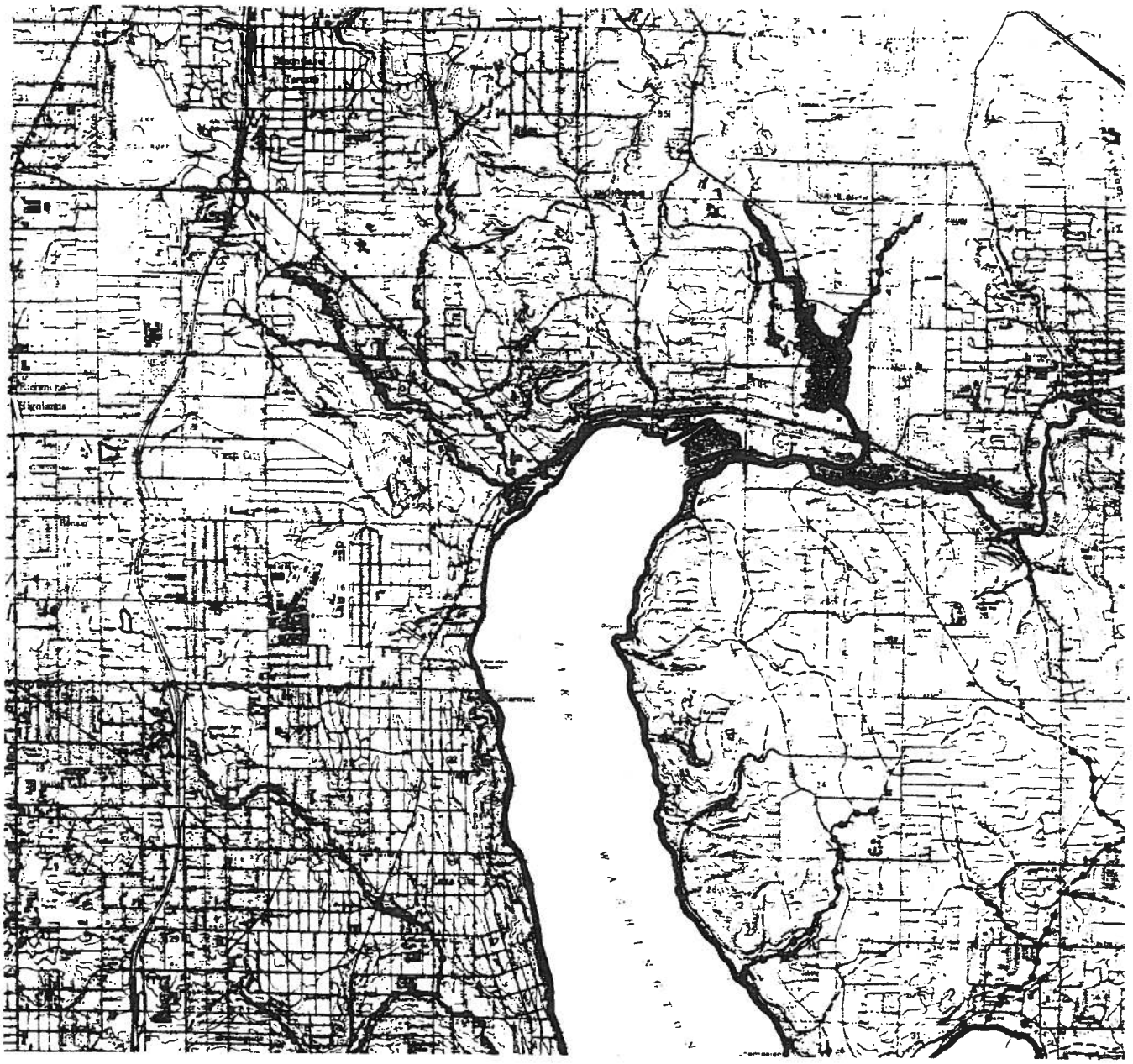
SCALE AS SHOWN

FEMA FLOOD MAP

PROJ. NO. 95379

DATE 3/6/96

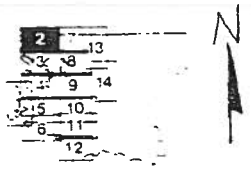
DWN. BY



Streams and 100-Year Floodplains

- Class 1
- Class 2 (with salmonids)
- Class 2 (perennial; salmonid use undetermined)
- Class 3
- Unclassified

Shoreline



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kpff Consulting Engineers
1201 Third Avenue, Suite 900
Seattle, Washington 98101
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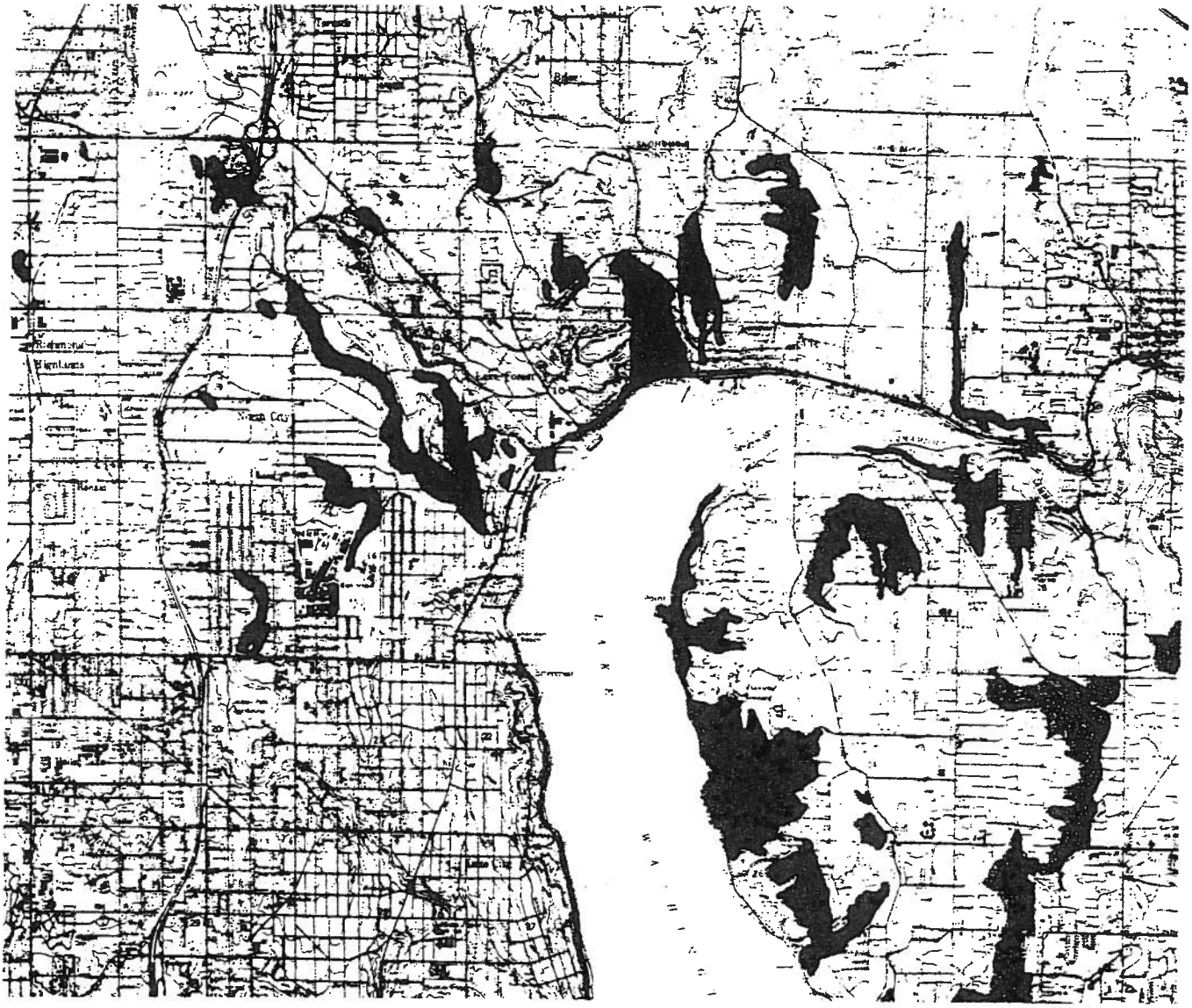
NTS

SENSITIVE AREAS FOLIO MAP

PROJ. NO. 95379

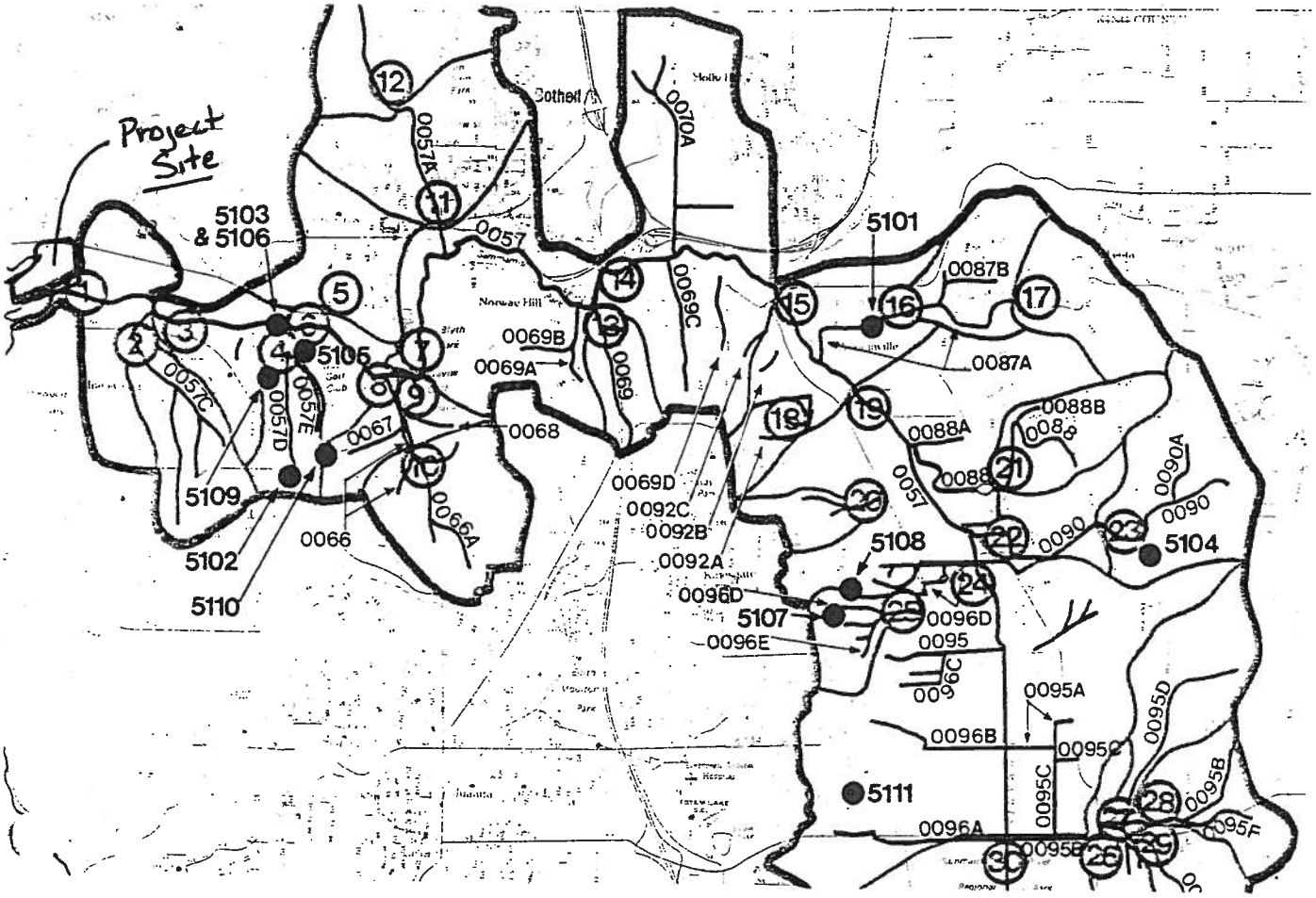
DATE 3/1/79

DWN. BY



Erosion Hazard Areas

kpff Consulting Engineers 1201 Third Avenue, Suite 900 Seattle, Washington 98101 (206) 622-5822 Fax (206) 622-8130	NTS SENSITIVE AREAS MAP FOLIO	PROJ. NO. 95379 DATE 3/4/96 DWN. BY



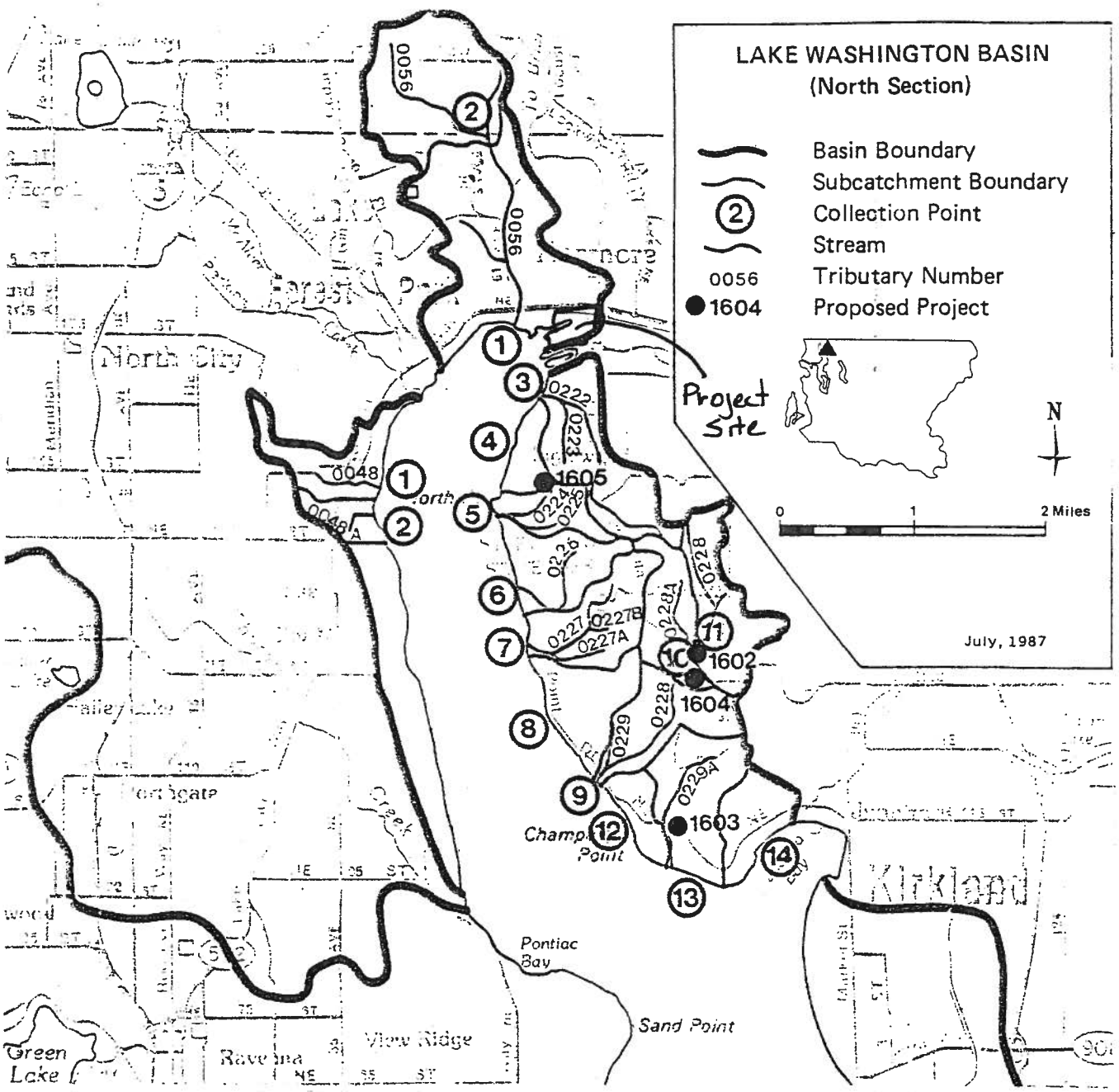
SAMMAMISH RIVER BASIN

- Basin Boundary
- Subcatchment Boundary
- (2) Collection Point
- Stream
- 0057 Tributary Number
- 5101 Proposed Project

N

July, 1987

kpff Consulting Engineers 1201 Third Avenue, Suite 900 Seattle, Washington 98101 (206) 622-5822 Fax (206) 622-8130	SCALE - AS SHOWN RECONAISSANCE MAP	PROJ. NO. 95379 DATE 3/6/96 DWN. BY



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Seattle, Washington 98101
(206) 622-5822 Fax (206) 622-8130

SCALE - AS SHOWN

RECONAISSANCE MAP

PROJ. NO. 95379

DATE 3/5/96

DRN. BY

FIELD INSPECTION AND DRAINAGE SYSTEM DESCRIPTION

General

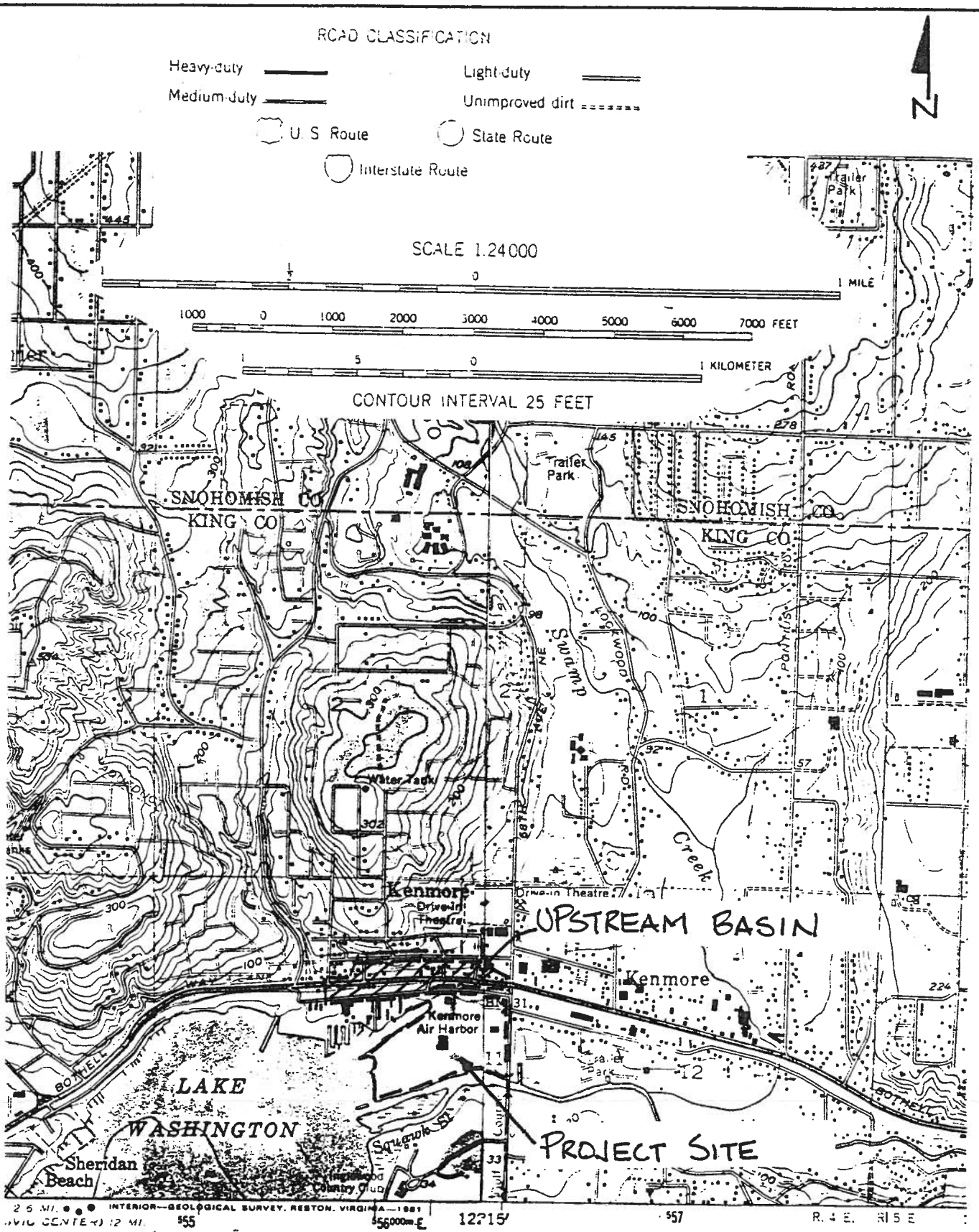
A site inspection was performed on February 23, 1996. The weather was cold and overcast. The objectives of the visit were to examine the project site and define upstream basins. The general area around the site is commercial/retail along SR 522 and 68th Avenue NE, and then residential areas to the north of SR 522. Drainage is accomplished with roadside ditches, catch basins and inlet structures, storm drain pipe and culverts.

The project receives stormwater drainage from an upstream basin. The basin is approximately 24 acres. Refer to the Project Site and Upstream Drainage Basin Plan. The basin drains to the project site where an additional 45 acres drains and discharges or infiltrates to Lake Washington.

OFF-SITE OBSERVATIONS

Upstream

Off-site flow from a residential area north of SR 522, east of 62nd Avenue NE, south of 181st Street and west of 68th Avenue NE drain to SR 522 to the south. The area is shown on the project site (Upstream Drainage Basin Plan). Runoff is collected in inlets and is conveyed downhill through storm drainage pipes to catch basins and downstream drainage pipes. At some locations, pipe daylights to grassy channels. The residential drainage takes two paths as it goes downhill—a crown in the middle of the basin on 64th Avenue NE sends water downhill to 63rd Avenue SE and SR 522, and the other sends water downhill to 66th Avenue SE and SR 522. A primary trunk line crosses south under SR 522 and goes through the ready-mix site to outfall in Lake Washington.



kpff Consulting Engineers
1201 Third Avenue, Suite 900
Seattle, Washington 98101
(206) 622-5822 Fax (206) 622-8130

SCALE AS NOTED

TOPOGRAPHIC MAP
PROJECT SITE &
UPSTREAM DRAINAGE BASINS

PROJ. NO. 95379
DATE 3/1/96
DWN. BY —

SECTION 4

FLOW CONTROL AND WATER QUALITY FACILITY ANALYSIS AND DESIGN

SECTION 4

FLOW CONTROL AND WATER QUALITY FACILITY ANALYSIS AND DESIGN

FLOW CONTROL SYSTEM

The proposed project will discharge storm drainage directly to Lake Washington. Since Lake Washington is a receiving water, detention will not be required for the project.

WATER QUALITY TREATMENT OVERVIEW

Separate drainage from traffic areas and split the water quality storm to a treatment facility. Drainage greater than the water quality storm discharges directly.

Roof area, plaza area, landscape area and maintenance fire access paths discharge directly.

The basis for water quality design provided in these calculations is the Draft King County Surface Water Design Manual, dated February 1996.

The project will be divided into three areas for water quality treatment:

1. **Phase 1 Area: this area includes Lakepointe Boulevard, the adjoining parking areas and the Phase 1 area that will be used for parking.**

2. **Access Road: This area includes the access road and landscaping for the south side of Building A.**

3. **Lakepointe Boulevard: This area includes the plaza area of Lakepointe Boulevard. These areas are shown on MP A1.**

The Phase 1 area is designated as a high use area because of anticipated heavy traffic. To satisfy requirements for pretreatment, a coalescing plate oil/water separator will be used to pretreat runoff before the stormwater enters the 2-cell wet pond. The oil/water separator will be located upstream of the 2-cell wet pond.

The Access Road and Lakepointe Boulevard are designated as low use areas. Water quality treatment will be provided by using combined biofiltration and sand filter swales. This combined water quality system will enhance pollutant treatment. The swales will be lined with grass on the sides and bottom. The sand filter element of the swale will have an underdrain. The swales are sized using the basic water quality menu to treat 60 percent of the 2-year storm.

MEAN ANNUAL STORM VOLUME

As requested by our environmental consultant, we calculated the mean annual storm volume to verify the storm drainage volume discharged from the Phase 1 area to the marina. The volume of runoff is approximately 1.7 million cubic feet. This volume of flow will flush in harbor area yearly.

LEGEND

WATER QUALITY AREA BOUNDARY

PHASE I BOUNDARY

2 CELL WET POND

TEMPORARY PHASE I PARKING TO CONTRIBUTE TO PHASE I AREA (INCLUDED IN 13AC)

VEHICULAR TRAFFIC AREA CONTRIBUTING TO PHASE I AREA
AREA ≅ 13 AC

VEHICULAR TRAFFIC AREA CONTRIBUTING TO ACCESS RD. SWALE
AREA ≅ 1.4 AC

VEHICULAR TRAFFIC AREA CONTRIBUTING TO LAKEPOINTE BLVD. SWALE
AREA ≅ 2.7 AC

Lake Washington

Slough

SCALE 1" = 400'

LAKEPOINTE DEVELOPMENT

PIONEER TOWING COMPANY

KENMORE · WASHINGTON

Callison Architecture, Inc.
1420 5th Ave., #2100
Seattle, WA 98101-2343
T 206-623-4646
F 206-623-4625

Callison ARCHITECTURE

WATER QUALITY TREATMENT FACILITIES AND CONTRIBUTING TRAFFIC AREAS

MP-2.1

PHASE I AREA

Calculations

kpff Consulting Engineers
1201 Third Avenue, Suite 900
Seattle, Washington 98101
(206) 622-5822 Fax (206) 622-8130

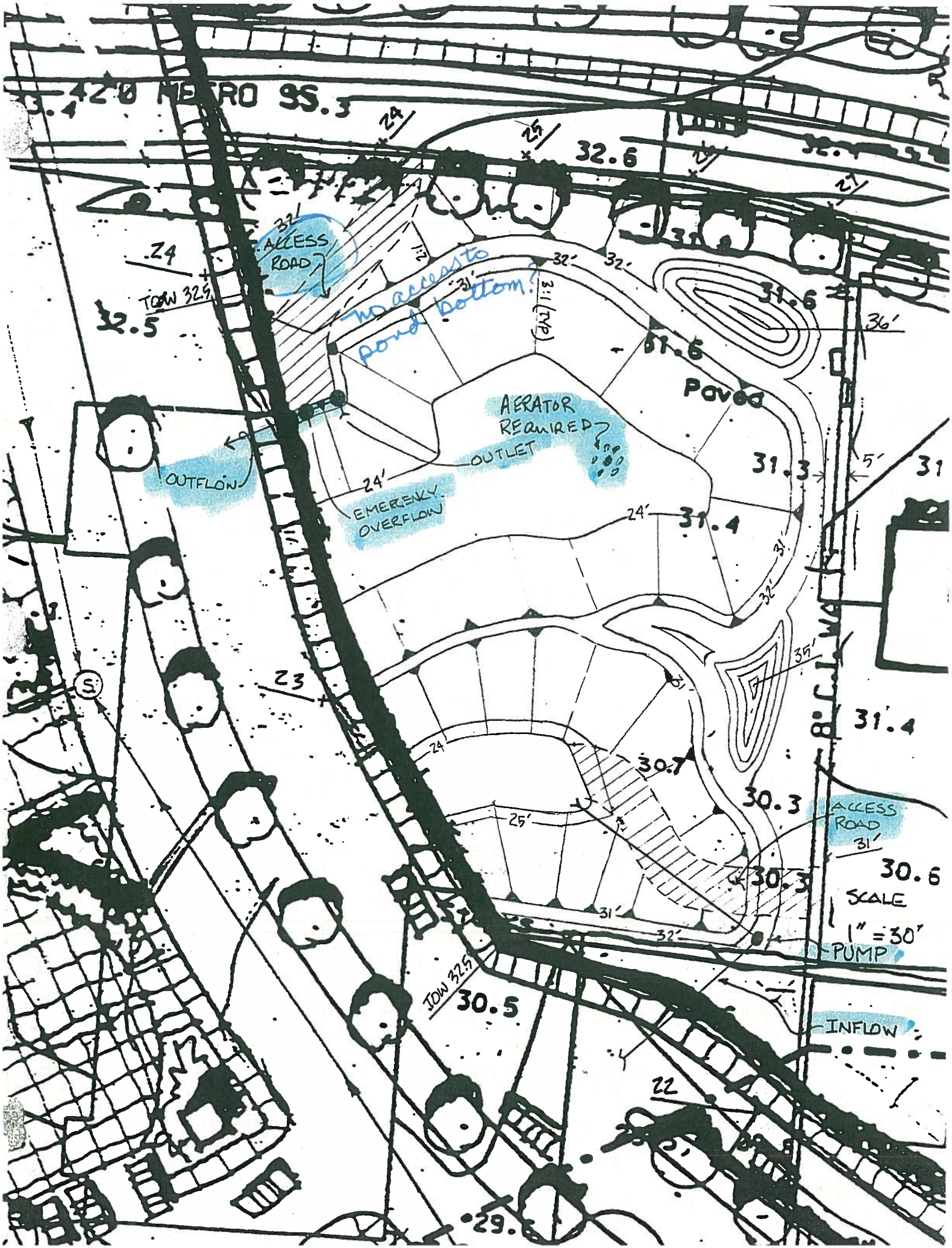
project	LAKE POINTE	by	NB	sheet no.
location	KENMORE, WA	date	2/26/96	1 /11
client				job no.

BASIC WETPOND REQUIREMENTS

- POND SIDE SLOPES: INSIDE 3:1 OUTSIDE 2:1
- ACCESS ROAD SLOPE 7:1
- PROVIDE FENCING IF INSIDE SLOPE IS LESS THAN 3:1
- SETBACKS SHALL BE 5 ft MINIMUM

DESIGN REQUIREMENTS HAVE BEEN REFERENCED FROM THE

K.C. SURFACE WATER DESIGN MANUAL
10/95 (DRAFT)


42" METRO SS.
32.6
ACCESS ROAD
32'
No access to pond bottom?
3:1 (TYP)
TOW 32.5
32.5
31.6
36'
Paved
AERATOR REQUIRED?
OUTLET
OUTFLOW
24'
EMERENCY OVERFLOW
31.3
5'
31
31.4
35'
30.7
30.3
ACCESS ROAD
31'
30.6
SCALE
1" = 30'
PUMP
INFLOW
IOW 32.5
30.5
29.6
22
23
24
25

kpff Consulting Engineers
1201 Third Avenue, Suite 900
Seattle, Washington 98101
(206) 622-5822 Fax (206) 622-8130

project LAKE POINTE	by WNB	sheet no.
location KENMORE, WA	date 2/22/96	2/11
client		job no.

WETPOND WQ FACILITY DESIGN

BASIC WETPOND:

Analysis –

1. ratio of wetpond vol. to runoff vol. $\left(\frac{V_b}{V_r}\right) = 3$
2. mean rainfall $(R) = 0.47''$ (see attached isopluvial)
3. tributary area $(A_d) = 12.472$ acres
4. runoff coefficient $(C) = \frac{0.9\, A_{impervious}}{A_d} = 0.9$

Calculate wetpond vol (V_b) base on 12.5 AC

$$V_b = \frac{V_b}{V_r} R A_d C \left(\frac{43{,}560}{12}\right)$$

$$V_b = (3)(0.47'')(12.472 AC)(0.9)\left(\frac{43{,}560'}{12'}\right)$$

$V_b = 57{,}451.89\ ft^3$ use $57{,}452\ ft^3$

Calculate required wetpond volume/acre

$$V_b = (3)(0.47'')(1\ AC)(0.9)\left(\frac{43{,}560}{12}\right) = 4606.5\ ft^3/AC$$

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project	by	sheet no.
location	date	3/11
client		job no.

Need to size pond for 13.ac

from previous calcs (sht 2/2 dated 2/22/96)

we need 4606.5 ft³/ac

4606.5 ft³/ac x 13 ac = 59884.5 ct

revised 1ST CELL $V_1 = (6')\left(\frac{1180+5090}{2}\right)$

$V_1 = 18{,}690.0$ ct

revised 2nd CELL $V_2 = (7')\left(\frac{3290+8980}{2}\right)$

$V_2 = 42{,}945.0$ ct

$V_T = 61{,}635.0$ ct

$V_T > V_{required}$ ✓

$\frac{V_1}{V_T} = 30\%$ ✓

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project	LAKE POINTE	by	VNB	sheet no.
location	PHASE I AREA	date	9/30/96	4/11
client				job no.

O/W SEPARATOR

High vehicle use in the Phase I area will generate surface oils that will need water quality treatment. That treatment will be accomplished by using coalescing plate oil/water (O/W) separators. The O/W separators will be located upstream of the 2-cell wet pond to pretreat the stormwater runoff.

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1201 Third Avenue, Suite 900
Seattle, Washington 98101
(206) 622-5822 Fax (206) 622-8130

project	LAKE POINTE	by	JNB	sheet no.
location	PHASE I AREA	date	9/12/96	5/11
client				job no.

DETERMINATION OF O/W SEPARATOR SIZING

1.) 2_{yr} = 6.19 cfs (see attached KCRTS output)

60% of 2_{yr} = 3.714 cfs

2.) $A_h = \dfrac{60\,Q}{0.00386\left[\dfrac{S_w - S_o}{\mu}\right]}$ (Eqn 6-28)

* based sec 6.6.3 Pg 1-138 -

$= \dfrac{60(3.714)}{.00386\left[\dfrac{1 - 0.85}{0.015674}\right]}$

= 6,032.5 sf is req'd effective separation to be treated.

3.) USE (2) - UV - VAULT CO. 818-3-CRS O/W SEPARATORS

A_h for each = 3552 sf, TOTAL A_H = 7104 sf > 6032.5 O.K.

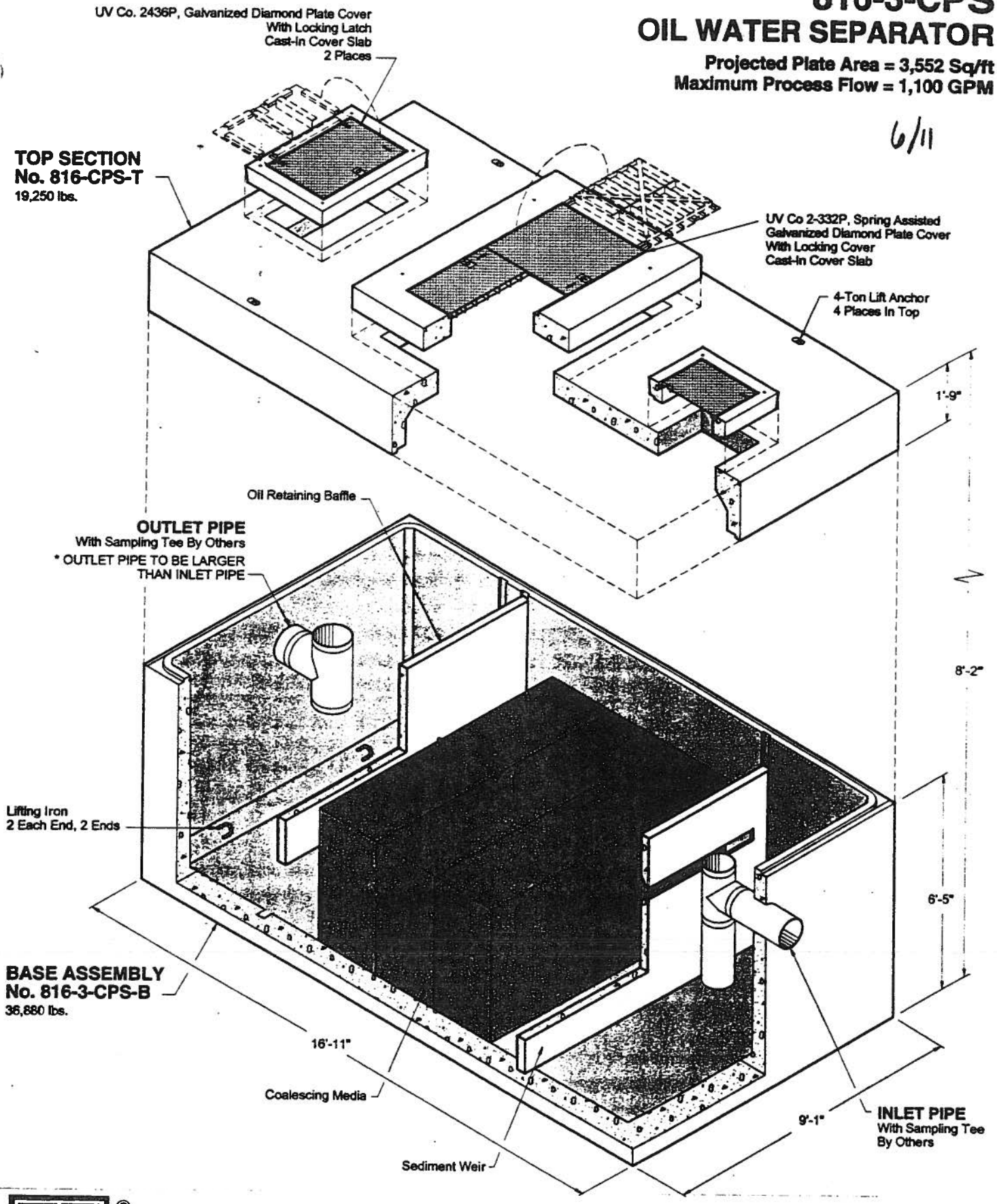
The Product satisfies the vault structure requirements, inlet/outlet pipe requirements, material requirement and access requirements (see attached)

Vault type will be confirmed during final design.

816-3-CPS
OIL WATER SEPARATOR

Projected Plate Area = 3,552 Sq/ft
Maximum Process Flow = 1,100 GPM

6/11



UV®

UTILITY VAULT COMPANY

P.O. BOX 588
Auburn, Washington 98071-0588

Phone (206) 839-3500
Fax (206) 735-4201

For Details Of Access Covers, See COVER Section.

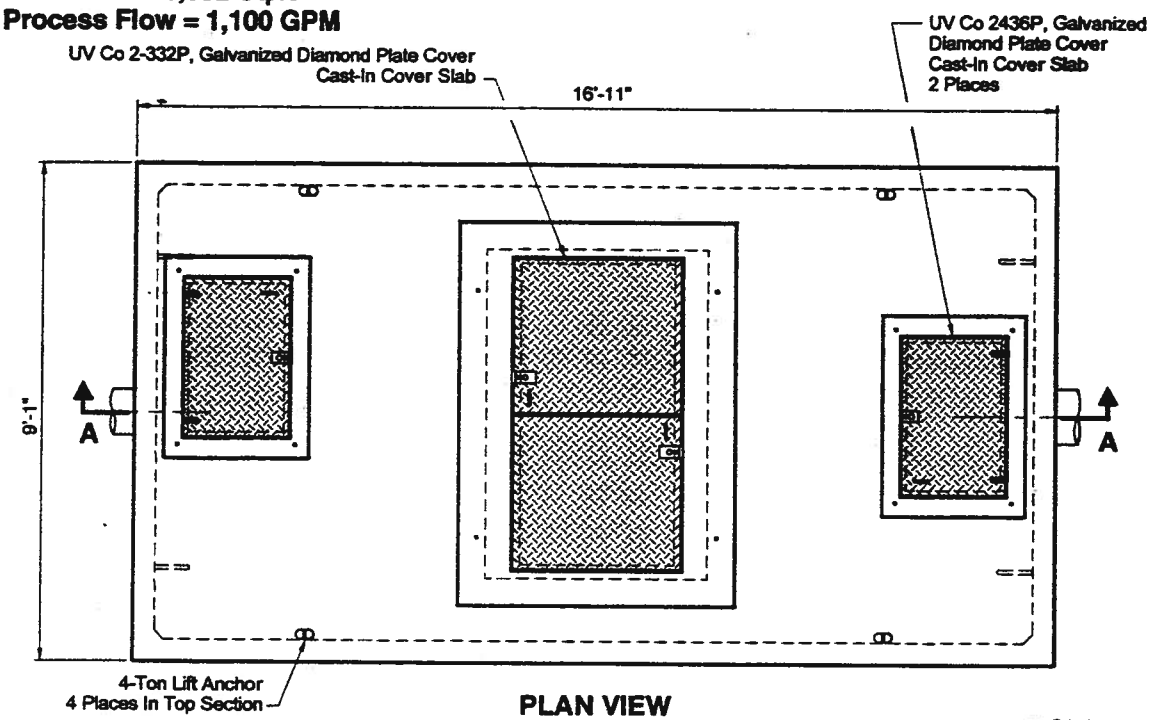
*** ITEMS SHOWN ARE SUBJECT TO CHANGE WITHOUT NOTICE.**

FOR DETAILS SEE REVERSE SIDE

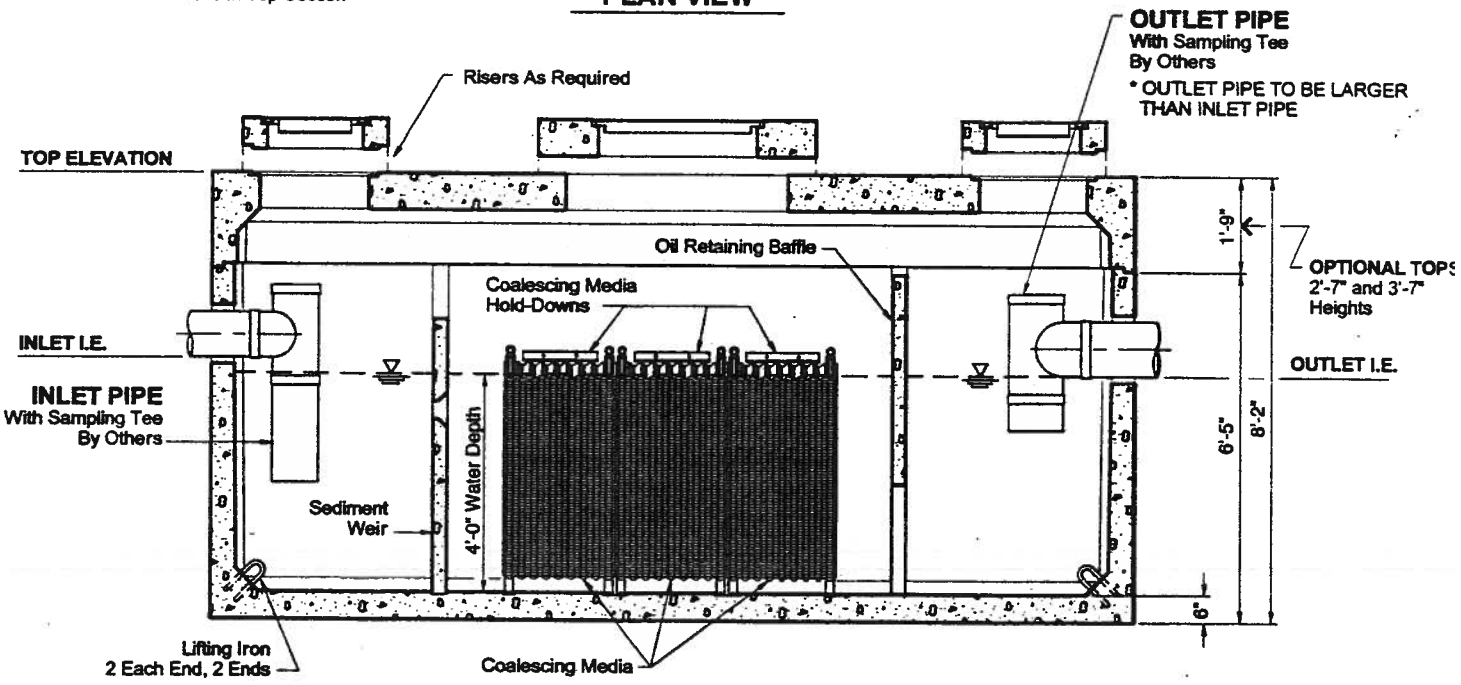
816-3-CPS
OIL WATER SEPARATOR

7/11

Projected Plate Area = 3,552 Sq/ft
Maximum Process Flow = 1,100 GPM



PLAN VIEW



SECTION AA

STRUCTURAL NOTES:

1. Concrete: 28 Day Compressive Strength f'c = 6000 psi
2. Rebar: ASTM A-615 Grade 60
3. Mesh: ASTM A-185 Grade 65
4. Design: ACI-318-89 Building Code
   ASTM C-857 "Minimum Structural Design Loading For Underground Precast Concrete Utility Structures"
5. Loads: H-20 Truck Wheel w/ 30% Impact Per AASHTO

GENERAL NOTES:

1. All Baffles and Weirs To Be Precast Concrete
2. Static Water Depth = 4'-0"
3. Contractor To:
   Supply and Install All Piping & Sampling Tees
   Grout In All Pipes
   Fill w/ CLean Water Prior To "Start-Up" Of System

INFORMATION NEEDED:

- Top Of Separator Elevation _____
- Inlet Pipe Size _____
- Inlet Pipe Elevation _____
- Outlet Pipe Size _____
- Outlet Pipe Elevation _____

BASIC DESIGN INFORMATION:

INFLUENT CHARACTERISTICS -
Oil Specific Gravity = 0.88
Operating Temperature = 50°
Influent Oil Concentration = 100 ppm
Mean Oil Droplet Size = 130 micron
0.033 ft/min Oil Rise Rate
Designed Per Washington State Department Of Ecology

FLOW	EFFLUENT	100%

LPWET

Flow Frequency Analysis

Time Series File:lpwet.tsf
Project Location:Sea-Tac

8/11

---Annual Peak Flow Rates---

Flow Rate (CFS)	Rank	Time of Peak
6.19	6	8/27/ 1 18:00
4.32	8	9/17/ 2 17:45
11.69	2	12/ 8/ 2 17:15
4.98	7	8/23/ 4 14:30
6.56	5	10/28/ 4 16:00
6.92	4	10/27/ 5 10:45
8.40	3	10/25/ 6 22:45
15.32	1	1/ 9/ 8 6:30

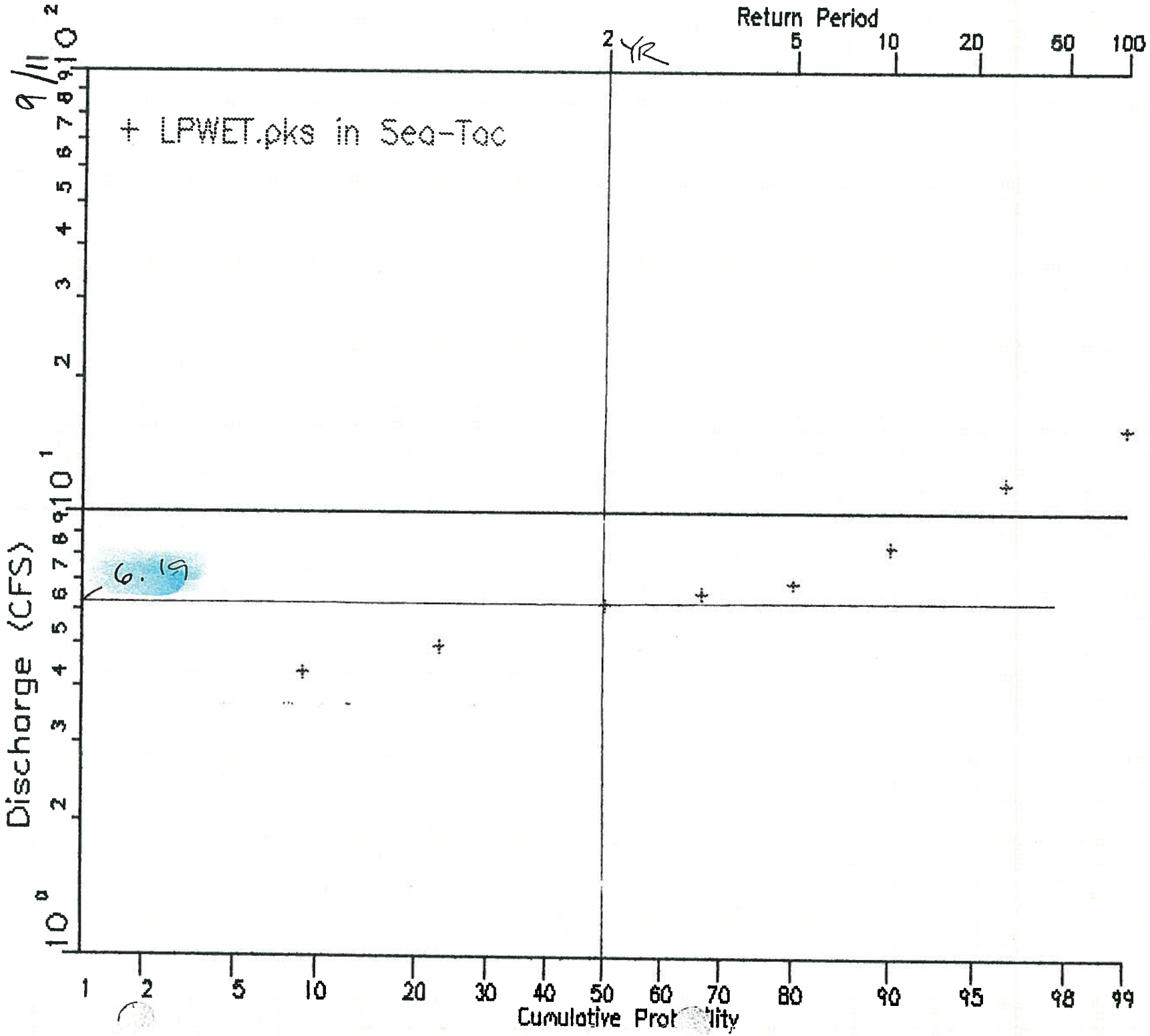
Computed Peaks

-----Flow Frequency Analysis-------

- - Peaks - - (CFS)	Rank	Return Period	Prob
15.32	1	100.00	0.990
11.69	2	25.00	0.960
8.40	3	10.00	0.900
6.92	4	5.00	0.800
6.56	5	3.00	0.667
6.19	6	2.00	0.500
4.98	7	1.30	0.231
4.32	8	1.10	0.091
14.11		50.00	0.980

Peak Values and Return Periods
Press Enter to Continue

* print out data from KCRTS


Return Period
2 YR
5
10
20
50
100
9/11
+ LPWET.pks in Sea-Tac
6.15
Discharge (CFS)
10^2
10^1
10^0
1
2
5
10
20
30
40
50
60
70
80
90
95
98
99
Cumulative Prob lity

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1201 Third Avenue, Suite 900
Seattle, Washington 98101
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project Lakepointe		by Eliason	sheet no. 10/11
location Kenmore, WA		date 10/16/96	
client Pioneer Towing Company			job no. 95379

Mean annual Storm Volume Calculations

Provide a rough calculation of the mean annual storm volume that will enter the harbor area for the developed project. The Phase1 area drains to the harbor at the eastern limit. The Phase 2 and Phase 3 areas overflow to the harbor but water quality for these areas drains through the South swales to the Sammamish River. Use the Phase 1 water quality area for calculation of the mean annual storm volume.* Use the US Weather Bureau (1965) map of the mean annual precipitation in Washington to determine precipitation in inches for the Kenmore area.

Calculate the rough volume

Phase1 water quality area = 13 Acres = 566,280 SF

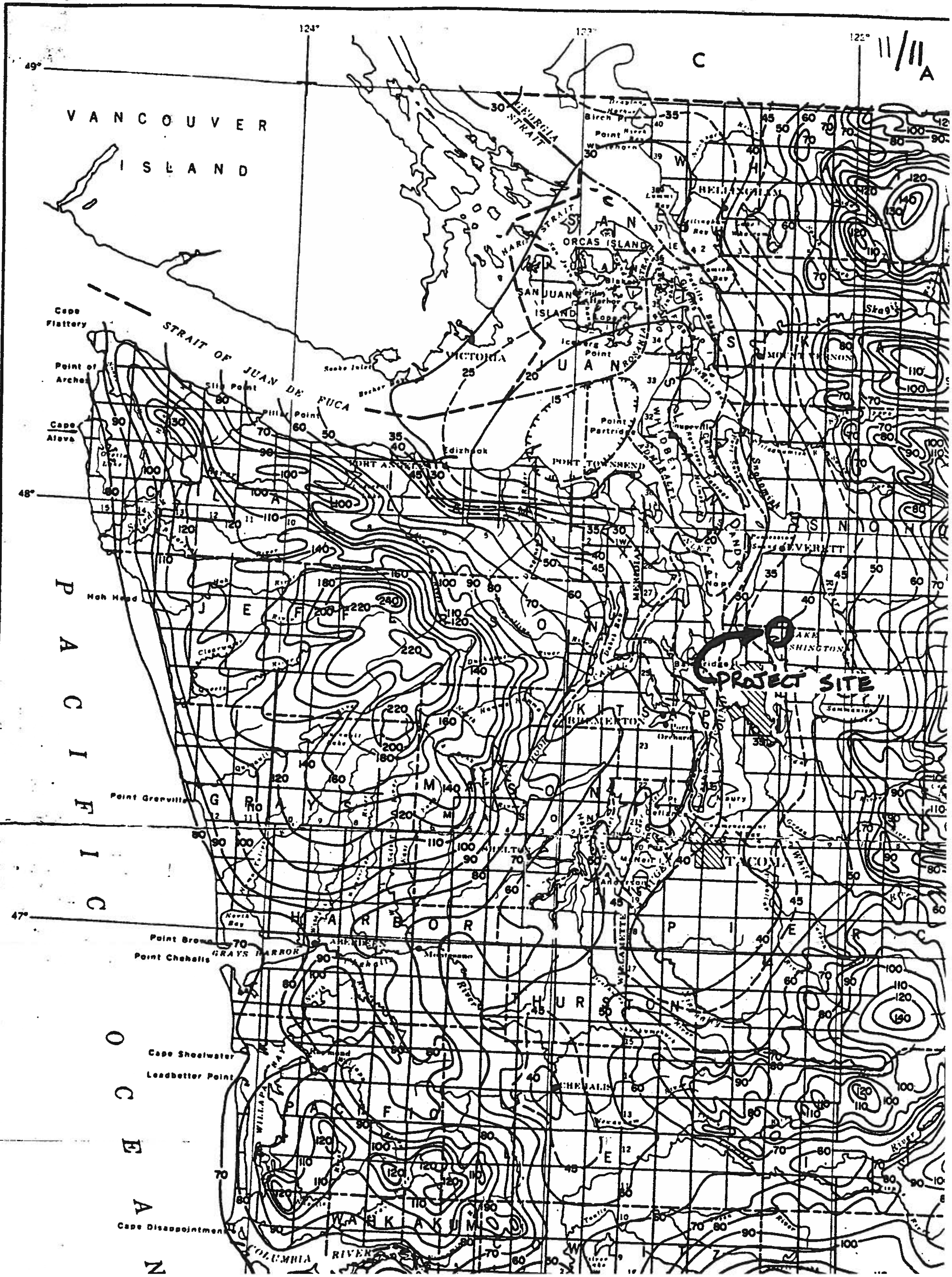
Mean annual precipitation = 39 inches = 3.3 Ft

Volume of precipitation = 1,887,600

Assume that 10% infiltrates in areas which are not capped.

Total rough mean annual volume discharging to the harbor:

1.7 million cubic feet



11/11 A
C
VANCOUVER
ISLAND
STRAIT OF JUAN DE FUCA
GEORGIA STRAIT
HARO STRAIT
ORCAS ISLAND
SAN JUAN ISLAND
VICTORIA
BELLINGHAM
MOUNT VERNON
PORT TOWNSEND
PORT ANGELES
EVERETT
BREMERTON
TACOMA
ABERDEEN
CHEHALIS
Cape Flattery
Point of Arches
Cape Alava
Hoh Head
Point Grenville
Point Brown
Point Chehalis
GRAYS HARBOR
Cape Shoalwater
Leadbetter Point
Cape Disappointment
COLUMBIA RIVER
PACIFIC OCEAN
CLALLAM
JEFFERSON
GRAYS HARBOR
MASON
KITSAP
PIERCE
THURSTON
PACIFIC
LEWIS
WAHKIAKUM
SNOHOMISH
SKAGIT
SAN JUAN
ISLAND
WHATCOM
PROJECT SITE

ACCESS ROAD
&
LAKE POINTE BOULEVARD

Calculations

kpff Consulting Engineers
1201 Third Avenue, Suite 900
Seattle, Washington 98101
(206) 622-5822 Fax (206) 622-8130

project LAKEPOINTE	by JNB	sheet no. 1/7
location	date 3/29/96	
client		job no.

BIOSWALE NARRATIVE

Two bioswales will be used for the site;

One swale will collect drainage from the access road. The area is 1.4 ac

One swale will collect drainage from the boulevard

The area is 2.7 ac

The KCRTS input is based on developed conditions To be conservative, the areas were considered to be 100% impervious

The Project is located in the Sea-Tac region with a scale factor of 1.00.

The grass height is 4" or 0.33$\bar{3}$'

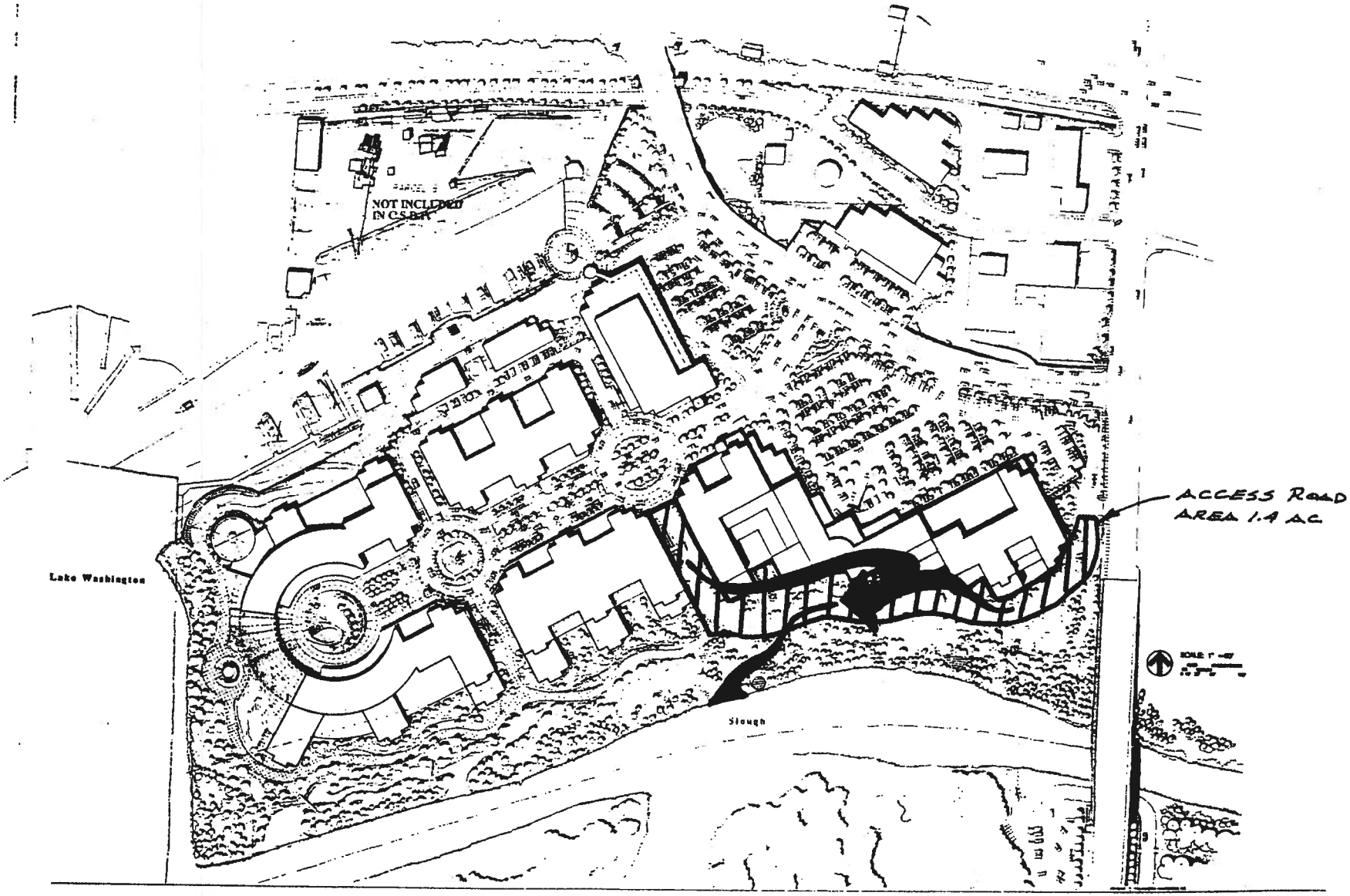
SAND FILTERS

SAND FILTERS HAVE BEEN SIZED TO TREAT THE CONTRIBUTING DRAINAGE AREA AS IMPERVIOUS.

The height of hydraulic head over the sand bottom will be 1 foot.

1' of freeboard will be maintained throughout the swale.

The swale will be a combined wetswale for suspended solid removal as well as a sand filter to remove chemical pollutants



LAKEPOINTE DEVELOPMENT

PIONEER TOWING COMPANY

KENMORE, WASHINGTON

Collison Architecture, Inc.

Collison ARCHITECTURE

First Submittal:
March 26, 1996

Second Submittal:
July 15, 1996

Third Submittal:
December 23, 1996

Commercial Site Development Permit
Master Plan
Working Model

MP1

Project Number 95253.00

kpff Consulting Engineers
1201 Third Avenue, Suite 900
Seattle, Washington 98101
(206) 622-5822 Fax (206) 622-8130

project LAKEPOINTE	by	sheet no. 2/7
location ACCESS ROAD	date	
client		job no.

Biofiltration Swale Design FOR ACCESS ROAD

Flows were generated by KCRTS

25yr peak flow = 1.25 cfs

100 yr peak flow = 1.64 cfs

2 yr peak flow = 0.662 cfs

60% of 2yr peak flow = 0.397 cfs

AREA = 1.39 ac

CALCULATE SWALE BOTTOM WIDTH

$$b = \frac{Q_{wq}\, n_{wq}}{1.49\, y^{1.67}\, s^{0.5}}$$

(Eqn 6-2, Pg 6-36)

$Q_{wq} = 0.397$ cfs

$n_{wq} = 0.20$

$y = 0.333$ ft

$s = 0.02$

$$b = \frac{(0.397)(0.20)}{(1.49)(0.333)^{1.67}(0.02)^{0.5}}$$

$b = 2.364$ ft

say 2.5 ft.

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project	LAKE POINTE	by	sheet no.
location	ACCESS RD	date	3/7
client			job no.

BIOFILTRATION SWALE DESIGN FOR ACCESS ROAD (cont.)

DETERMINE DESIGN FLOW: VELOCITY

$$V_{wq} = \frac{Q_{wq}}{A_{wq}} \qquad \text{(Eqn 6-4)}$$

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

$$(2.5)(0.333) + 3(0.333)^2$$

$$V_{wq} = \frac{0.397}{1.165}$$

$V_{wq} = 0.341$ fps

CALCULATE SWALE LENGTH

$$L = 540\, V_{wq} \qquad \text{(Eqn 6-5)}$$

$$= 540\,(0.341)$$

$L = 183.9$ L.F

Use 200 L.F.

FOR WET BIO SWALE (Sec 6.3.2.2.)

increase width (b) by 2

$2(b) = 2(2.364) = 4.73' \rightarrow$ width now is 5'

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project LAKEPOINTE | by JNB | sheet no. 4/7
location ACCESS RD | date 9/4/96 | job no.
client

CHECK ACCESS RD BIOSWALE ACTUAL CONDITIONS

$$y = \left[\frac{Q_{wq}\, n_{wq}}{1.49\, S^{0.5}\, b}\right]^{3/5} \qquad \text{(Eqn 6-3)}$$

$$\left[\frac{0.78 \quad 0.03}{1.49 \quad 0.005^{0.5} \quad 10}\right]^{3/5}$$

$y = 0.11'$

SIZE SAND FILTER

- basic sand filter (Sec 6.5.1 pg 6-91)
- Seafac region, scale factor $C_s = 1.0$
- depth of water over filter = 1.0'
- site = 1.39 AC (impervious)
- $A_{sf} = 0.7\, C_s\, (T, A_c)$ (Eqn 6-15)

$= 0.7\,(1.0)\,(1.39 \times 1711/AC) \cong 1665 sf$

for $b = 15'$ $L = 111$ LF

for $b = 10'$ $L = 167$ LF SAY 170 ★ determines sizing.

ACCESS RD WQ FACILITY DESIGN CRITERIA

SIZING THE SWALE WILL BE BASED ON SAND FILTER GEOMETRY. BY INCREASING THE WIDTH FROM 5' (REQUIRED WETSWALE DIMENSION) TO 10', ALLOWS TO REDUCE THE SWALE LENGTH FROM 200 LF TO 170 LF

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Seattle, Washington 98101
(206) 622-5822 Fax (206) 622-8130

project	LAKE POINTE	by	JNB	sheet no.
location	ALLEGS RD	date	9/30/96	5/7
client				job no.

TEST SAND FILTER DIMENSIONS TO SWALE SIZING REQUIREMENTS

- SWALE BOTTOM WIDTH $10' > 5'$ O.K.
- SWALE VELOCITY

$$V_{wq} = \frac{Q_{wq}}{A_{wq}}, \quad A_{wq} = by + zy^2 \quad \text{(eqn 6-4)}$$

$$A_{wq} = 10'(1') + 3(1)^2 \doteq 13$$

$1'$ = depth over sand filter

$$V_{wq} = \frac{0.397}{13} = 0.031 \text{ fps} < 1 \text{ fps} \quad \text{O.K}$$

- CALCULATE SWALE LENGTH

$$L = 540\, V_{wq} \quad \text{(eqn 6-5)}$$

$$L = 540(.031) = 16.75' \ll 170' \quad \text{O.K}$$

SIZING SUMMARY

The combined biofilter/sand filter swale was initially sized by swale requirements. Then sand filter requirements were sized to meet both criteria and site constraints. The sand filter dimensions of

width (b) = 10' & length (L) = 170'

were used. These values were tested to swale sizing requirements and are acceptable.

OPEN CHANNEL DESIGN FORM

6/1

PROJECT: LAKE POINTE

DESCRIPTION: BIOSWALE FOR ACCESS ROAD
BASED ON DESIGN CRITERIA

BEGIN LOCATION:
END LOCATION:

LENGTH 200 LF

	Input		Output	
FREEBOARD DEPTH (FT)	f =	1		
WATER DEPTH (FT)	y =	0.333	Velocity =	0.45
SIDE SLOPE 1 = (1/H)	H1 =	3	Flow, CFS =	0.86
SIDE SLOPE 2 = (1/H)	H2 =	3	Top Width =	12.75
BOTTOM WIDTH IN FEET	b =	4.75		
MANNINGS VALUE	n =	0.2		
SLOPE OF CHANNEL FT/FT	s =	0.02		

TYPICAL SECTION

OPEN CHANNEL DESIGN FORM

7/1

PROJECT: LAKE POINTE

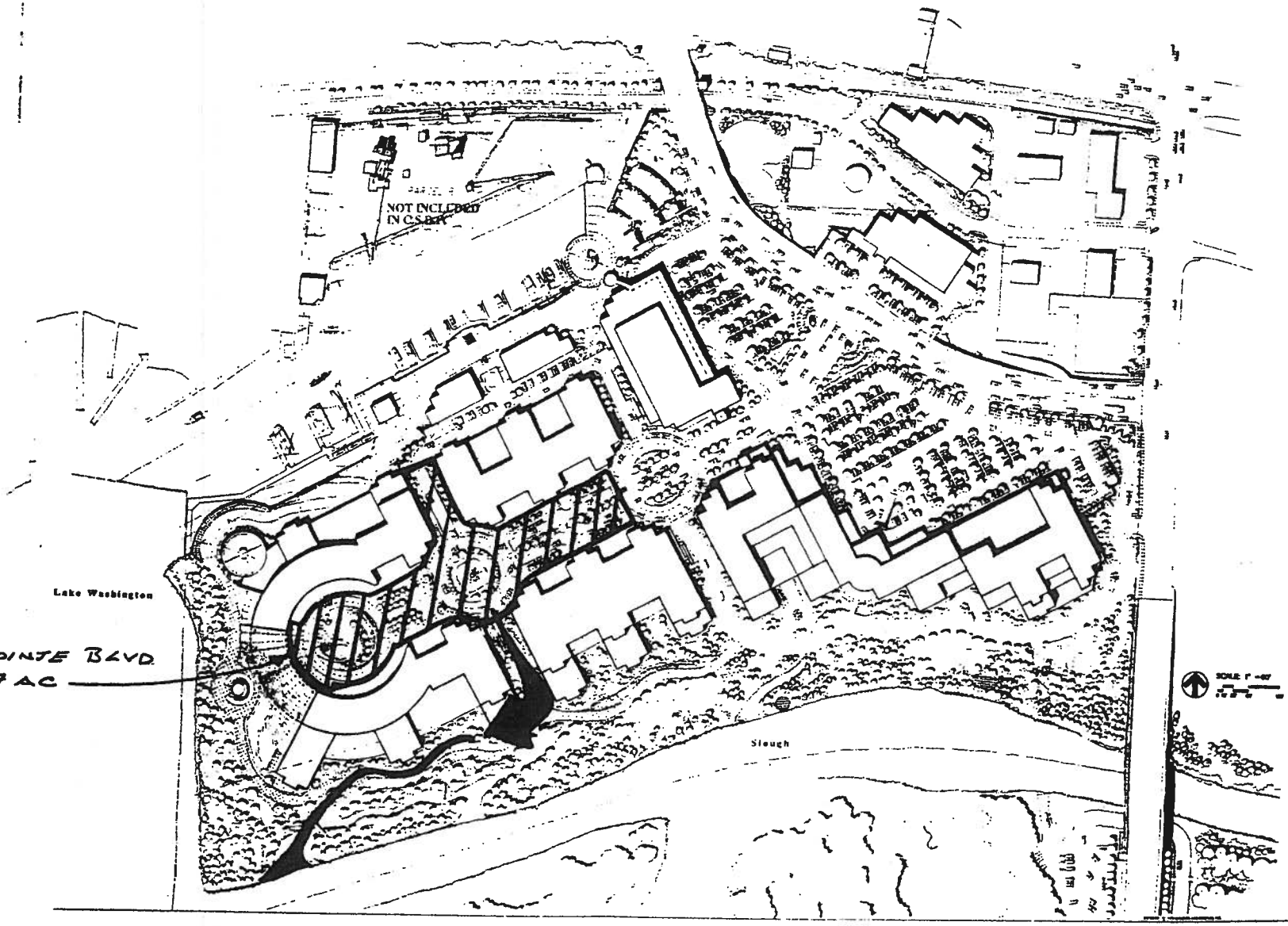
DESCRIPTION: BIOSWALE FOR ACCESS ROAD
ACTUAL SWALE LAYOUT

BEGIN LOCATION:
END LOCATION:

LENGTH 200 LF

	Input		Output	
FREEBOARD DEPTH (FT)	f =	1		
WATER DEPTH (FT)	y =	1	Velocity =	0.35
SIDE SLOPE 1 = (1/H)	H1 =	3	Flow, CFS =	0.40
SIDE SLOPE 2 = (1/H)	H2 =	3	Top Width =	22.00
BOTTOM WIDTH IN FEET	b =	10		
MANNINGS VALUE	n =	0.03		
SLOPE OF CHANNEL FT/FT	s =	0.005		

TYPICAL SECTION



NE LAKEPOINTE BLVD.
AREA = 2.7 AC

LAKEPOINTE DEVELOPMENT

PIONEER TOWING COMPANY

KENMORE, WASHINGTON

Callison ARCHITECTURE

Commercial Site Development Permit
Master Plan
Working Model

MP2

kpff Consulting Engineers
1201 Third Avenue, Suite 900
Seattle, Washington 98101
(206) 622-5822 Fax (206) 622-8130

project	LAKE POINTE	by	JNB	sheet no.
location	LAKEPOINTE BLVD	date	3/29/96	1/10
client				job no.

BIOFILTRATION SWALE DESIGN FOR LAKEPOINT BLVD

DESIGN FLOWS

Flows were generated by KCRTS

100yr peak flow = 3.22 cfs

25 yr peak flow = 2.46 cfs

2 yr peak flow = 1.30 cfs

60% of 2yr peak flow = 0.78 cfs

AREA = 2.73ac

CALCULATE SWALE BOTTOM WIDTH

$$b = \frac{Q_{wq}\, r_{wq}}{1.49\, y^{1.67}\, s^{0.5}}$$

(Eqn 6-2, pg 6-36)

Q_{wq} = 0.78 cfs

r_{wq} = 0.20

y = 0.333 ft

s = 0.02

$$b = \frac{(0.78)(0.20)}{1.49\,(0.333)^{1.67}(0.02)^{0.5}}$$

b = 4.645 ft

say 5 ft

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1201 Third Avenue, Suite 900
Seattle, Washington 98101
(206) 622-5822 Fax (206) 622-8130

project LAKE POINTE	by JNB	sheet no. 2/10
location LAKEPOINTE BLVD	date 3/29/96	
client		job no.

BIOFILTRATION SWALE DESIGN FOR LAKEPOINTE BLVD

DETERMINE FLOW VELOCITY

$$V_{wq} = \frac{Q_{wq}}{A_{wq}} \qquad \text{(Eqn 6-4)}$$

$$A_{wq} = (4.667)(0.333) + 3(0.333)^2$$

$$V_{wq} = \frac{0.78}{1.887}$$

$V_{wq} = 0.413$ fps < 1 fps okay

CALCULATE SWALE LENGTH

$$L = 540\, V_{wq} \qquad \text{(Eqn 6-5)}$$

$$= 540\,(0.413)$$

$L = 223.2$ LF

USE 225 L.F

FOR WET BIOSWALE

Increase width (b) by 2 (Sec. 6.3.2.2.)

$2(b) = 2(5) = 10'$ $\quad 10' = b$

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1201 Third Avenue, Suite 900
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project LAKEPOINTE	by JNB	sheet no. 3/10
location LAKEPOINTE BLVD	date 9/4/96	
client		job no.

CHECK LAKEPOINTE BIOSWALE ACTUAL CONDITIONS

$$y = \left[\frac{Q_{wq}\, n_{wq}}{1.49\, s^{0.5}\, b}\right]^{3/5} \qquad \text{(Eqn 6-3)}$$

$$\left[\frac{0.78 \quad 0.03}{1.49 \quad 0.005^{0.5} \quad 15}\right]^{3/5}$$

$y = 0.08'$

SIZE SAND FILTERS

(Sec. 6.5.1 pg 6-91)

- use basic sand filter
- use SeaTac region and scale factor (C_s) = 1.0
- use depth of water over filter = 1.0'
- site 2.73 AC (impervious)
- A_{sf} (req'd sand filter area) $= 0.7 C_s (T_i A_i)$
  $= 0.7 (1.0)(2.73\text{AC} \times 1711/\text{AC}) \cong 3270$ sf

for $b = 10'$ $L = 327$ LF

for $b = 15'$ $L = 218$ LF ★ determines sizing

LAKEPOINT BLVD WQ FACILITY DESIGN CRITERIA

SWALE SIZED BY SAND FILTER GEOMETRY REQUIREMENTS. WIDTH = 15', LENGTH = 220'

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1201 Third Avenue, Suite 900
Seattle, Washington 98101
(206) 622-5822 Fax (206) 622-8130

project	LAKEPOINTE	by	LNR	sheet no.
location	LAKE POINTE BLVD	date	9/30/96	4/10
client				job no.

TEST SAND FILTER DIMENSIONS TO SWALE SIZING REQUIREMENT

- SWALE BOTTOM WIDTH $15' > 10'$ O.K.
- SWALE VELOCITY

$$V_{wq} = \frac{Q_{wq}}{A_{wq}}, \quad A_{wq} = by + zy^2 \qquad \text{(eqn 6-4)}$$

$$A_{wq} = 15(1) + 3(1)^2 = 18$$

$$V_{wq} = \frac{0.78}{18} = .043 \text{ fps} < 1 \text{ fps} \quad \text{O.K}$$

- CALC SWALE LENGTH

$$L = 540\, V_{wq}$$

$$L = 540\,(0.043) = 23.40' < 220' \quad \text{O.K.}$$

SIZING SUMMARY

SWALE WAS SIZED USING THE SAME PROCESS AS THE ALLESS RD SWALE. THE SAND FILTER DIMENSIONS CONTROLLED AND WERE TESTED INTO THE SWALE REQUIREMENTS AND FOUND ACCEPTABLE.

WIDTH (b) = 15' & LENGTH (L) = 220'

OPEN CHANNEL DESIGN FORM

5/10

PROJECT: LAKE POINTE

DESCRIPTION: BIOSWALE FOR BOULEVARD
BASED ON DESIGN CRITERIA

BEGIN LOCATION:
END LOCATION:

LENGTH 225 LF

	Input		Output	
FREEBOARD DEPTH (FT)	f =	1		
WATER DEPTH (FT)	y =	0.333	Velocity =	0.47
SIDE SLOPE 1 = (1/H)	H1 =	3	Flow, CFS =	1.62
SIDE SLOPE 2 = (1/H)	H2 =	3	Top Width =	17.30
BOTTOM WIDTH IN FEET	b =	9.3		
MANNINGS VALUE	n =	0.2		
SLOPE OF CHANNEL FT/FT	s =	0.02		

TYPICAL SECTION

OPEN CHANNEL DESIGN FORM

6/10

PROJECT: LAKE POINTE

DESCRIPTION: BIOSWALE FOR BOULEVARD
ACTUAL SWALE LAYOUT

BEGIN LOCATION:
END LOCATION:

LENGTH 225 LF

	Input		Output	
FREEBOARD DEPTH (FT)	f =	1		
WATER DEPTH (FT)	y =	1	Velocity =	0.64
SIDE SLOPE 1 = (1/H)	H1 =	3	Flow, CFS =	0.78
SIDE SLOPE 2 = (1/H)	H2 =	3	Top Width =	27.00
BOTTOM WIDTH IN FEET	b =	15		
MANNINGS VALUE	n =	0.03		
SLOPE OF CHANNEL FT/FT	s =	0.005		

TYPICAL SECTION

LP LP BLVD LAKEPOINTE BLVD

7/10

Land Use Area

Till Forest	0.00 acres	
Till Pasture	0.00 acres	
Till Grass	0.00 acres	
Outwash Forest	0.00 acres	
Outwash Pasture	0.00 acres	
Outwash Grass	0.00 acres	
Wetland	0.00 acres	
Impervious	2.73 acres	L: 300.00 S: 0.02000

Total Area :	2.73 acres		
Scale Factor :	1.00	15-Min	Reduced

Edit Flow Paths

Time Series File lplpblvd

Compute Time Series

Modify User Input

Retrieve runoff files and compute Time Series

LP ACC RD ACCESS RD

Land Use Area

Till Forest	0.00 acres	
Till Pasture	0.00 acres	
Till Grass	0.00 acres	
Outwash Forest	0.00 acres	
Outwash Pasture	0.00 acres	
Outwash Grass	0.00 acres	
Wetland	0.00 acres	
Impervious	1.39 acres	L: 300.00 S: 0.02000

Total Area :	1.39 acres		
Scale Factor :	1.00	15-Min	Reduced

Edit Flow Paths

Time Series File (filename)

Compute Time Series

Modify User Input

Retrieve runoff files and compute Time Series

LAKEPOINTE BLVD

8/10

Flow Frequency Analysis

Time Series File:lplpblvd.tsf
Project Location:Sea-Tac

---Annual Peak Flow Rates---			-----Flow Frequency Analysis-------			
Flow Rate (CFS)	Rank	Time of Peak	- - Peaks - - (CFS)	Rank	Return Period	Prob
1.30	6	8/27/ 1 18:00	3.22	1	100.00	0.990
0.908	8	9/17/ 2 17:45	2.46	2	25.00	0.960
2.46	2	12/ 8/ 2 17:15	1.76	3	10.00	0.900
1.04	7	8/23/ 4 14:30	1.45	4	5.00	0.800
1.38	5	10/28/ 4 16:00	1.38	5	3.00	0.667
1.45	4	10/27/ 5 10:45	1.30	6	2.00	0.500
1.76	3	10/25/ 6 22:45	1.04	7	1.30	0.231
3.22	1	1/ 9/ 8 6:30	0.908	8	1.10	0.091
Computed Peaks			2.96		50.00	0.980

Peak Values and Return Periods
Press Enter to Continue

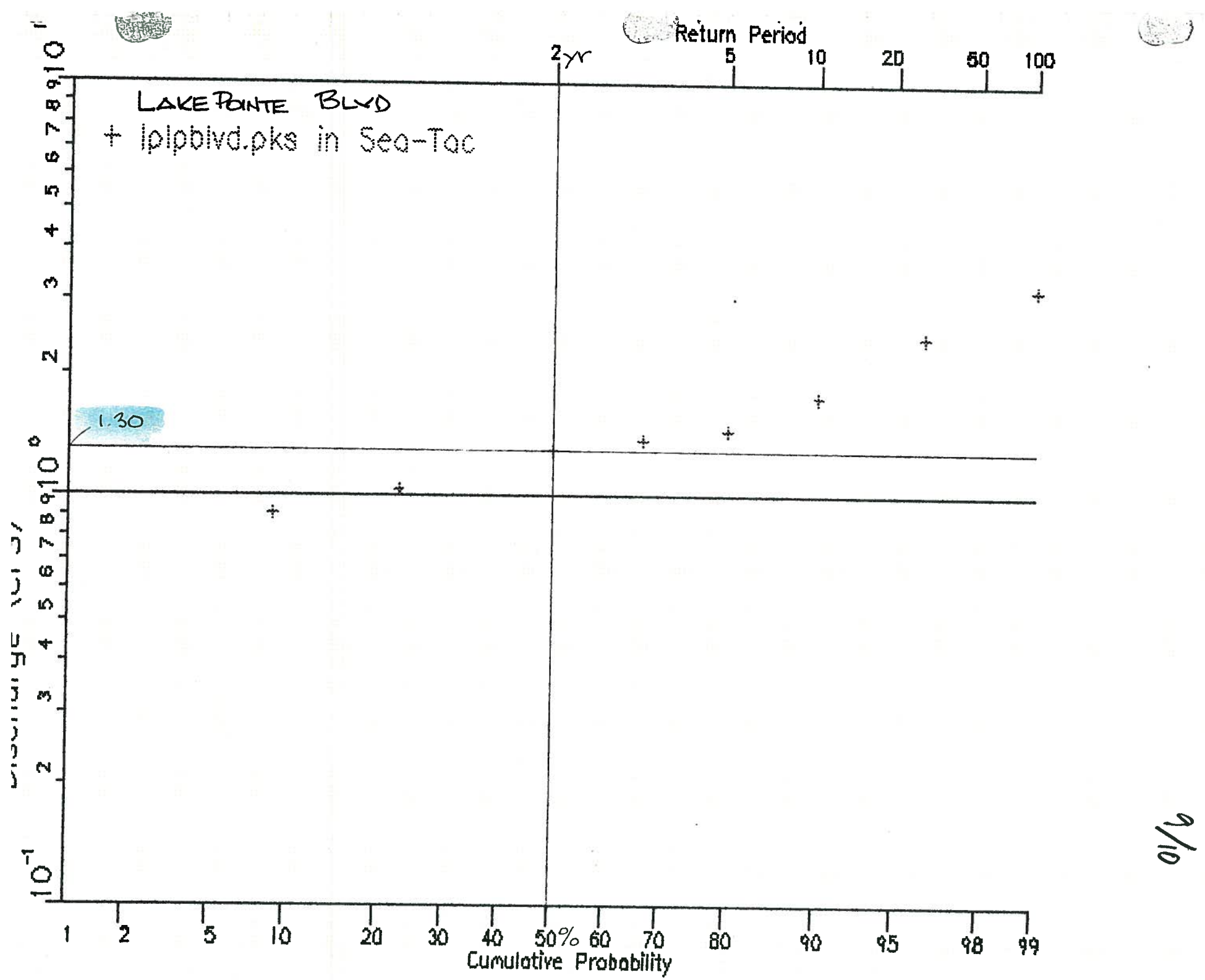
ACCESS RD

Flow Frequency Analysis

Time Series File:lpaccrd.tsf
Project Location:Sea-Tac

---Annual Peak Flow Rates---			-----Flow Frequency Analysis-------			
Flow Rate (CFS)	Rank	Time of Peak	- - Peaks - - (CFS)	Rank	Return Period	Prob
0.662	6	8/27/ 1 18:00	1.64	1	100.00	0.990
0.462	8	9/17/ 2 17:45	1.25	2	25.00	0.960
1.25	2	12/ 8/ 2 17:15	0.899	3	10.00	0.900
0.533	7	8/23/ 4 14:30	0.740	4	5.00	0.800
0.701	5	10/28/ 4 16:00	0.701	5	3.00	0.667
0.740	4	10/27/ 5 10:45	0.662	6	2.00	0.500
0.899	3	10/25/ 6 22:45	0.533	7	1.30	0.231
1.64	1	1/ 9/ 8 6:30	0.462	8	1.10	0.091
Computed Peaks			1.51		50.00	0.980

Peak Values and Return Periods
Press Enter to Continue


Return Period
2yr
5
10
20
50
100
LAKE POINTE BLVD
+ lplpblvd.pks in Sea-Tac
1.30
Cumulative Probability
1
2
5
10
20
30
40
50%
60
70
80
90
95
98
99

01/6

FIGURE 3.2.2.A RAINFALL REGIONS AND REGIONAL SCALE FACTORS

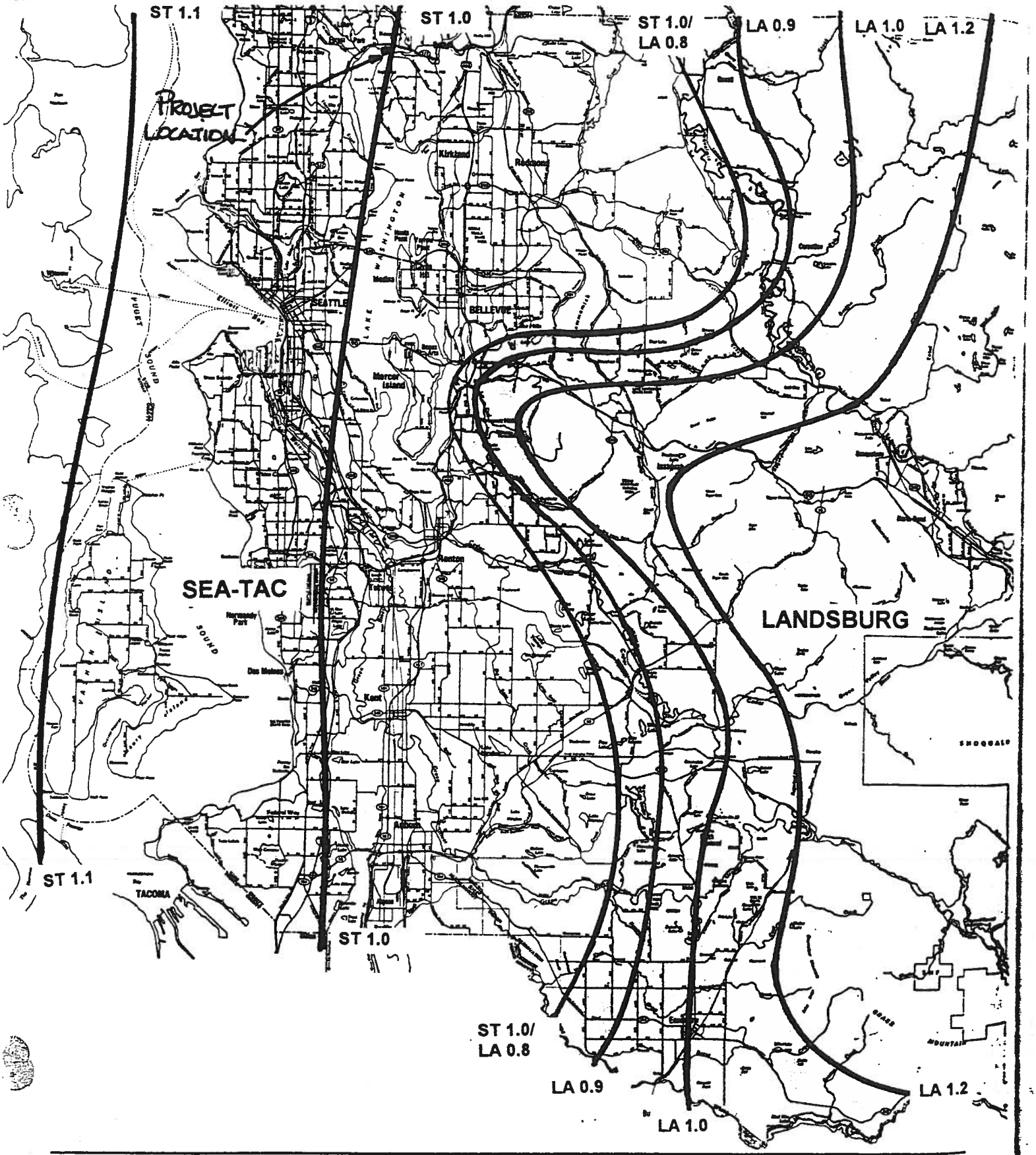


TABLE 3.2.2.C KCRTS COVER GROUPS AND AREAS OF APPLICATION

KCRTS Cover Group	APPLICATION	
	Pre-Development	Post-Development
Forest	All forest/shrub cover irrespective of age.	All permanent (e.g. protected by covenant or SAO designation) onsite forest/shrub cover irrespective of age planted at densities sufficient to ensure 80%+ canopy cover within 5 years.
Pasture	All grass land, pasture land, lawns, cultivated or cleared areas, except for lawns in redevelopment areas with pre-development densities in excess of 4 DU/GA.	Unprotected forest in rural residential development may be considered half pasture, half grass.
Grass	Lawns in re-development areas with pre-development densities in excess of 4 DU/GA.	All post-development grass land, all onsite forested land not protected by covenant or NGPE designation (except in rural areas as noted above).
Wetland	All delineated wetland areas except cultivated/drained farmland.	All delineated wetland areas except cultivated/drained farmland.
Impervious[1]	All impervious surfaces including heavily compacted gravel and dirt roads, parking areas, etc.	All impervious surfaces including heavily compacted gravel and dirt roads, parking areas, etc.

POST

Notes:

[1] Impervious acreage used in KCRTS computations should be the **effective impervious area (EIA)**. This is the gross impervious area multiplied by the **effective impervious fraction** (see Table 3.2.2.D, p. 3-24).

TABLE 3.2.2.D EFFECTIVE IMPERVIOUS FRACTION[1]

Land Use	Pre-Development	Post-Development
Commercial/Industrial/Roadways	0.95	1.00
Multi-Family or High Density Single Family[2] (>4 DU/GA)	0.80	1.00[3]
Medium Density Single-Family[2] (4 DU/GA)	0.66	1.00[3]
Low Density Single-Family[2] (1 DU/GA)	0.50	---
Rural[2] (< 1 DU/GA)	0.40	1.00[3][4]
Gravel/Dirt Roads and Parking Lots	0.50	0.50

Notes:

(1) The effective impervious fraction is the fraction of actual total impervious area directly connected to the drainage system. These figures should be used in the absence of detailed surveys or physical inspection.

(2) Figures for residential areas are inclusive of roadways.

(3) Where downspout infiltration is used, roofs are not counted as impervious area when sizing the R/D facility.

(4) Roofs are considered grass where downspouts are dispersed in rural residential development.

3.2.2.2 TIME SERIES STATISTICAL ANALYSIS

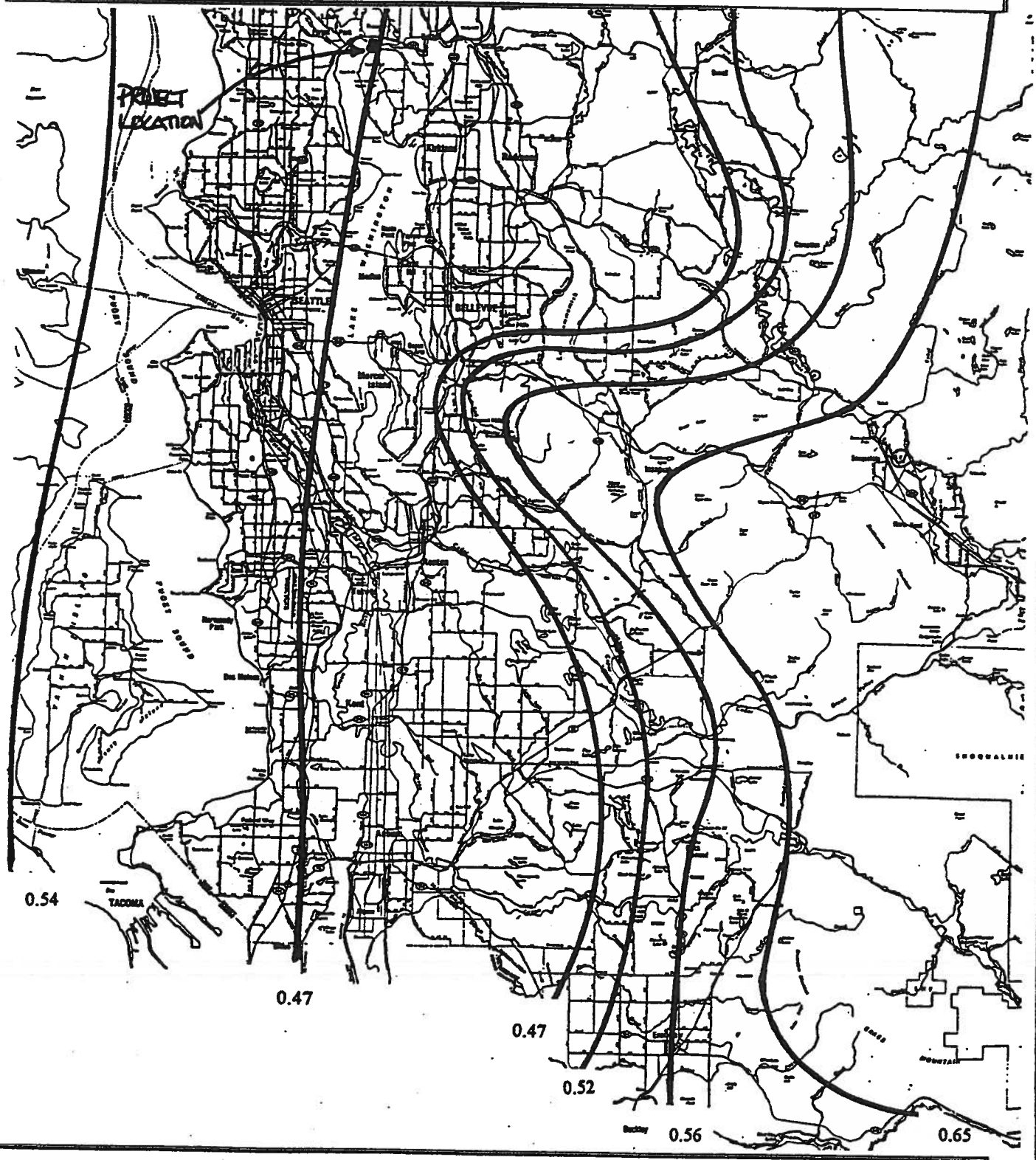
When using KCRTS to size flow control, water quality and conveyance facilities, design flows and durations must be determined through statistical analysis of time series data generated by KCRTS. KCRTS provides for statistical analysis of both **flow frequency** and **flow duration** as described in this section. **Flow frequency analysis** is used for determining design peak flows while **flow duration analysis** is used for determining durations of design peak flows.

❑ FLOW FREQUENCY ESTIMATES

Flow frequency is a commonly used but often misunderstood concept. **The frequency of a given flow** is the average return interval for flows equal to or greater than the given flow. The flow frequency is actually the inverse of the probability that the flow will be equaled or exceeded in any given year (the **exceedance probability**). For example, if the exceedance probability is 0.01, or 1 in 100, that flow is referred to as the 100-year flow. Assuming no underlying changes in local climate, one would expect to see about 10 peak annual flows equal to or greater than the 100-year flow in a 1,000 year period. Similarly, the 2-year flow is the flow with a probability of 0.5, or 1 in 2, of being equaled or exceeded in any given year. In a 100-year period, one would expect to observe 50 peak annual flows greater than or equal to the 2-year flow. The number of peak annual flows actually equal to the 2-year flow may be zero, since peak annual flows come from a continuous spectrum.

There are many **methods for estimating exceedance probabilities** and therefore flow frequencies. The *USGS Bulletin 17B* methods are commonly used, as are graphical methods using either the Gringorten, Cunane, or Weibull plotting schemes (Maidment, 1993). Graphical methods for flow frequency estimation involve assigning exceedance probabilities and therefore return intervals to each annual peak in a series of annual peak observations and then plotting the peak flows against their assigned return intervals. This is known as a **flow-frequency curve**, and it is a very useful tool for analyzing flood probabilities. Examples of flow-frequency curves for a small basin under various conditions are shown in Figure 3.2.2.B (p. 3-26).

FIGURE 6.4.1.A PRECIPITATION FOR MEAN ANNUAL STORM (INCHES)[12]



Note: Areas east of the easternmost isopluvial should use 0.65 inches unless rainfall data is available for the location of interest.

[12] The mean annual storm is a conceptual storm found by dividing the annual precipitation by the total number of storm events per year

FIGURE 6.3.1.B BIOFILTRATION SWALE UNDERDRAIN DETAIL

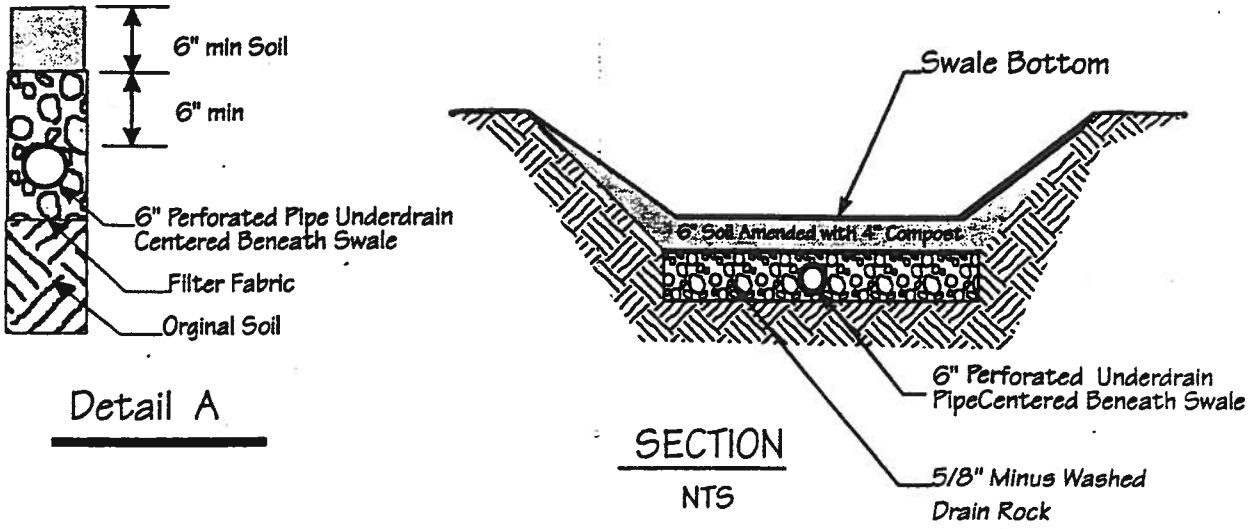
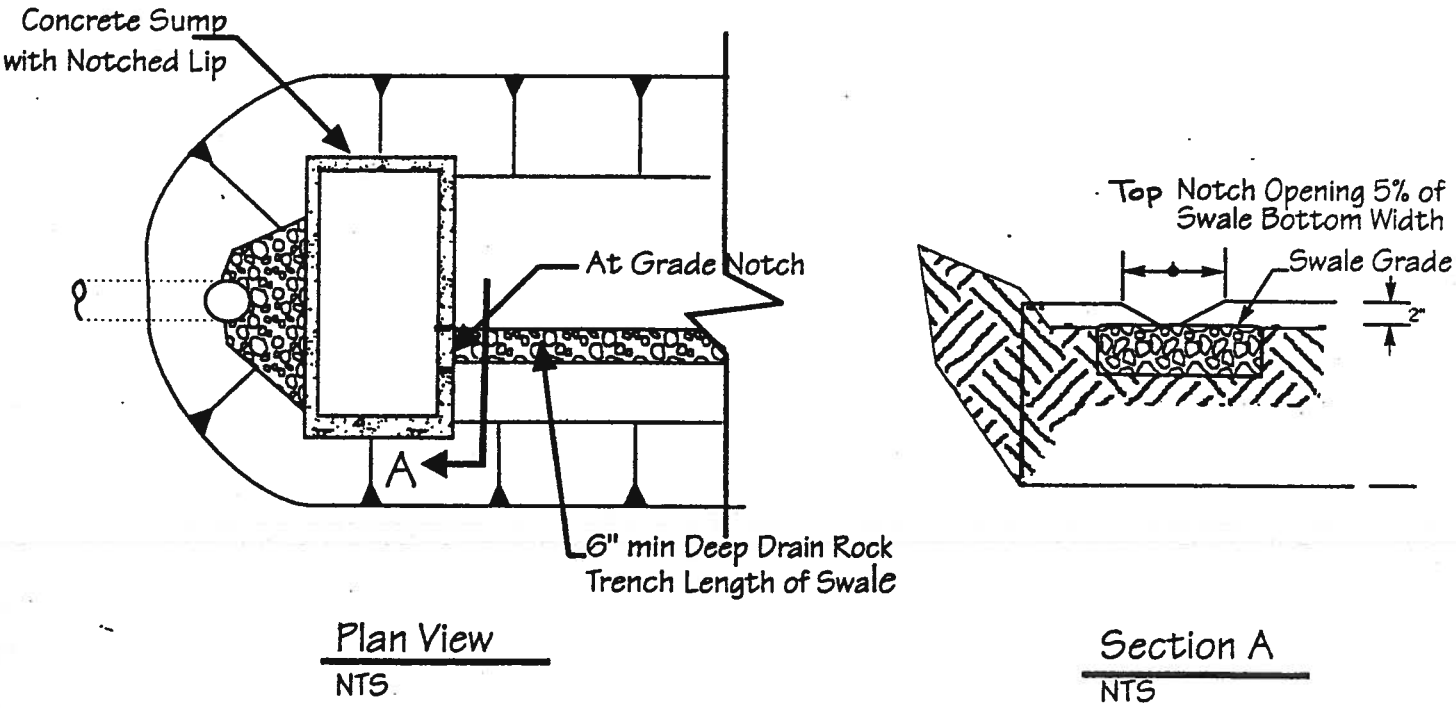


FIGURE 6.3.1.C BIOFILTRATION SWALE LOW-FLOW DRAIN DETAIL



SECTION 5
CONVEYANCE SYSTEM ANALYSIS AND DESIGN

SECTION 5

CONVEYANCE SYSTEM ANALYSIS AND DESIGN

OFF-SITE CONVEYANCE

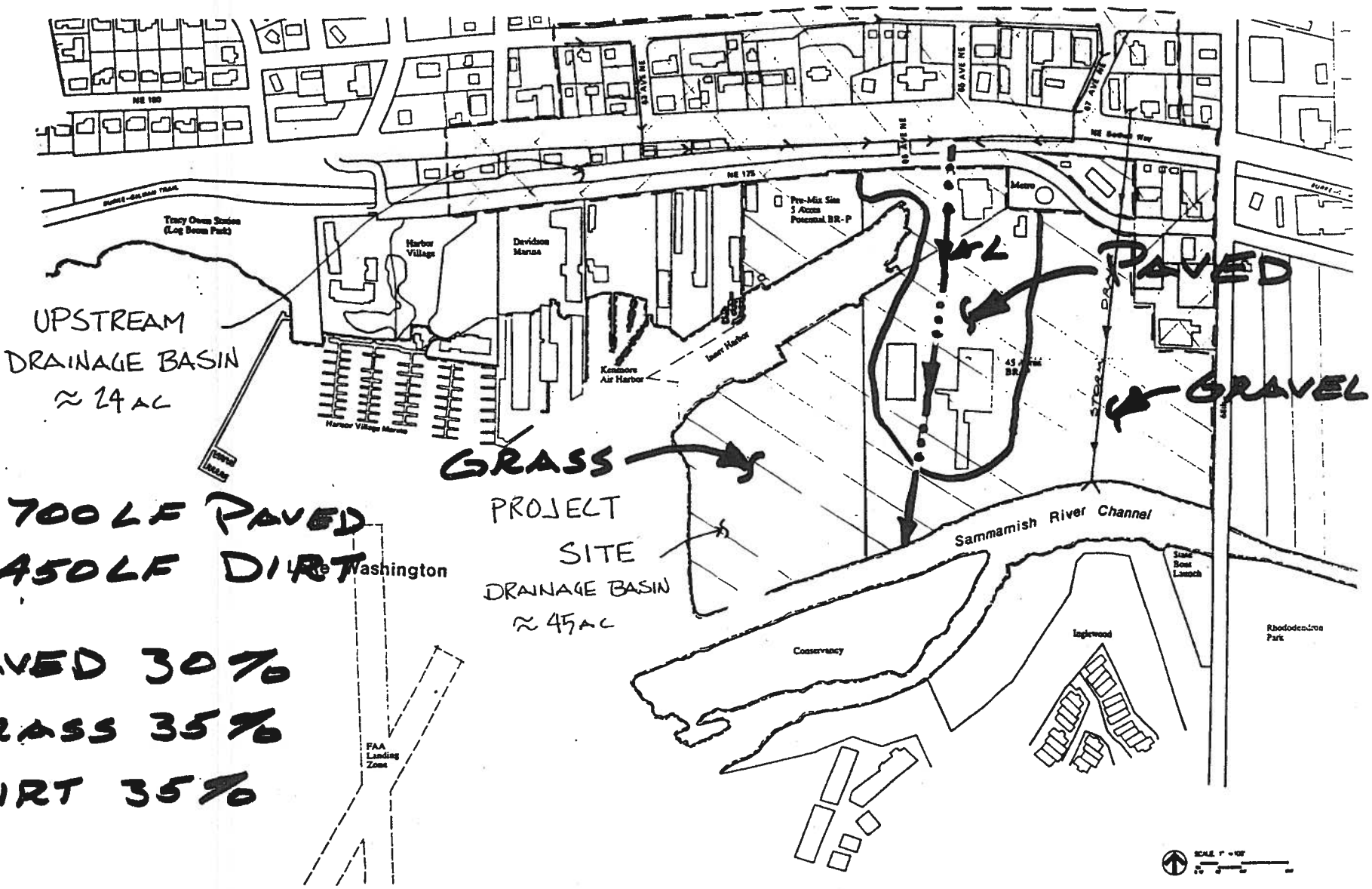
Off-site conveyance will not be considered for this storm drainage report. During design development, the conveyance systems will be analyzed in accordance with Core Requirement number 4 and sized to convey the 25-year peak developed flows.

ON-SITE CONVEYANCE

Peak flows for the entire project site were calculated for the existing and developed 25-and-100year 24 hour storm events using Water Works computer model Version 4.11g at a schematic level. Flows were calculated using the Type 1A Rainfall with the SCS methodology. Soil conditions were categorized as Type C Hydrological Soil Group per AGRA Earth & Environmental recommendation. Curve numbers were 86 for the exposed areas and 98 for the paved areas. Areas for the different site conditions were calculated from an existing survey. Ninety percent of the site was assumed to be capped per current MTCA conditions and 10% landscaped.

Based on this information, the peak flows for the 25-and-100-year existing storm events were 18-and 24cubic feet per second. The developed peak flows for the 25-and 100-year storm events were 26-and 32-cubic feet per second. Refer to page 6 for a calculated table of developed flows for each outfall labeled 1 to 5 as shown on the attached plan MP.A1.

PREDEVELOPED SITE



LAKEPOINTE DEVELOPMENT
PIONEER TOWING COMPANY
KENMORE, WASHINGTON

Callison Architecture, Inc.
1420 5th Ave., #2400
Seattle, WA 98101-2343
T 206-623-4646
F 206-623-4625

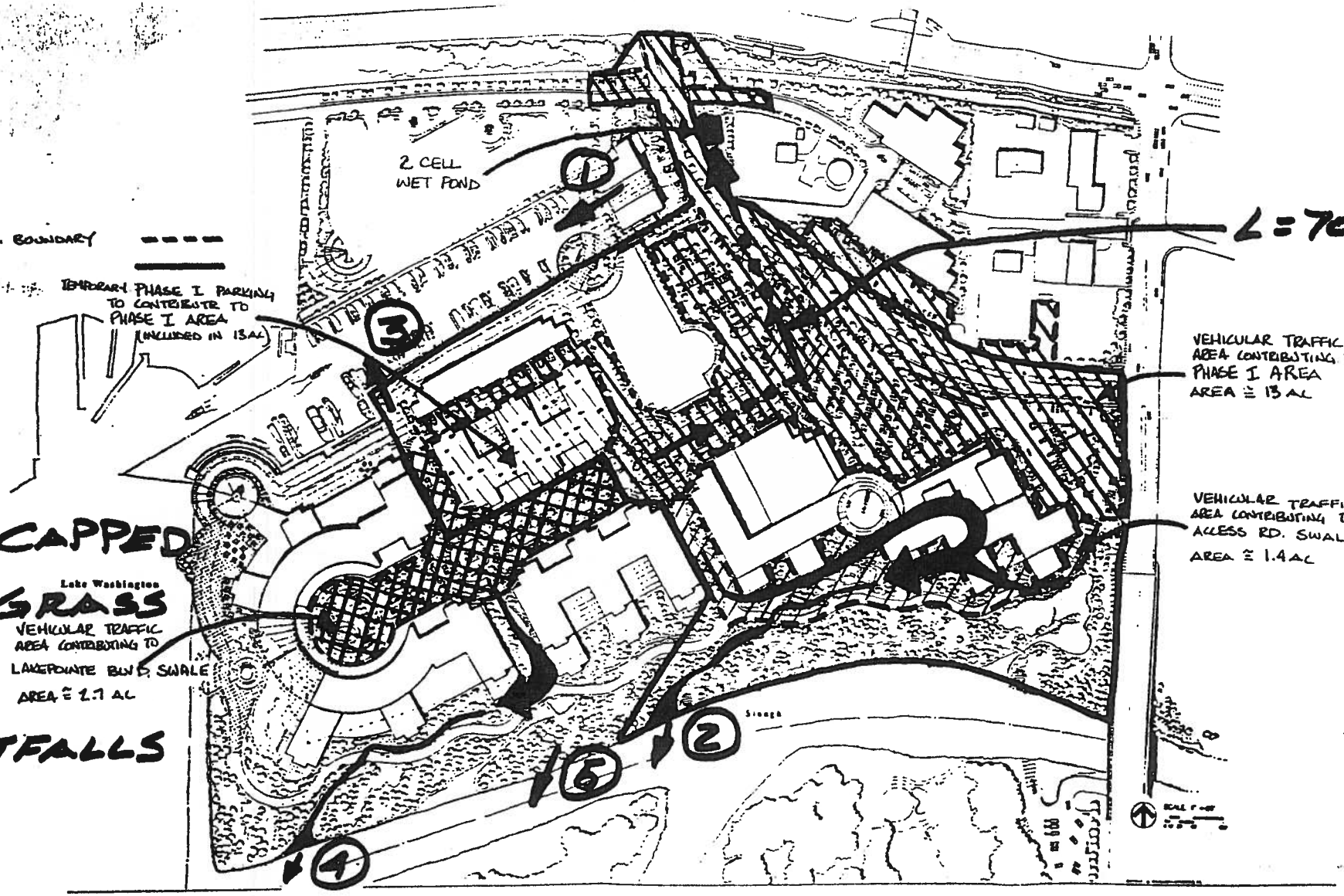
CALLISON ARCHITECTURE

DRAINAGE BASIN MAP

Project Number 92253.00
January 18, 1996

MP-3

DEVELOPED SITE



LAKEPOINTE DEVELOPMENT
PIONEER TOWING COMPANY
KENMORE, WASHINGTON

Callison ARCHITECTURE

WATER QUALITY
TREATMENT FACILITIES
AND CONTRIBUTING TRAFFIC AREAS

MP. A1

kpff Consulting Engineers
1201 Third Avenue, Suite 900
Seattle, Washington 98101
(206) 622-5822 Fax (206) 622-8130

project	by	sheet no.
LAKEPOINTE	D.S.B	1/11
location KENMORE	date 5/22/07	
client		job no. 95379
EXISTING SITE CONDITIONS		

DETERMINE APPROXIMATE AREAS OF BUILDINGS AND PAVED AREAS OF EXISTING SITE FROM SURVEY INFORMATION

1) BUILDINGS ON SURVEY

FF 26.04 = 155 x 100 = 15,500 SF
26.25 = 120 x 200 = 24,000 SF
28.40 = 125 x 60 + 50 x 50 = 10,000 SF
32.36 = 205 x 100 = 20,500 SF
32.04 = 100 x 80 = 8,000 SF
26.40 = 70 x 130 + 50 x 20 = 10,100 SF

TOTAL 88,100 SF
= 2.02 ACRES

2) PAVED AREA
= 420 x 600 + 650 x 400 + 80 x 400
= 544,000 SF
= 12.48 ACRES

TOTAL IMPERVIOUS AREA = 14.5 ACRES
OR 30%

3) SOIL CONDITIONS / CURVE NUMBER

- ASSUME HYDROLOGIC SOIL GROUP "C" SOIL CONDITIONS PER AGRA EARTH & ENVIRONMENTAL; SEE CONFIRMATION ATTACHED TO CALCULATIONS

(OVER)

kpff Consulting Engineers
1201 Third Avenue, Suite 900
Seattle, Washington 98101
(206) 622-5822 Fax (206) 622-8130

project	LAKEPOINTE	by	DSB	sheet no.
location	KENMORE	date	5/27/97	2 | 11
client				job no.
EXISTING SITE CONDITIONS				95379

3) SOIL CONDITIONS / CURVE NUMBER CONTINUED:
TOTAL AREA = 45 ACRES

a) PAVED AREA = 30%(45) = 13.5 ACRES

b) GRASS/LANDSCAPING = 50%(45-13.5) = 15.75

c) GRAVEL AREAS = 50%(45-13.5) = 15.75

CURVE NUMBERS

PAVED AREAS = 98
GRASS AREAS = 86
GRAVEL AREAS = 87
} USE 86

4) PRECIPITATION NUMBER

100 YR ⇒ P = 3.4

25 YR ⇒ P = 2.8

BASED ON KING COUNTY

kpff Consulting Engineers
1201 Third Avenue, Suite 900
Seattle, Washington 98101
(206) 622-5822 Fax (206) 622-8130

project LAKEPOINTE		by DJB	sheet no. 3/11
location KENMORE		date 5/27/97	
client			job no. 95379
PROPOSED SITE CONDITIONS			

TOTAL SITE AREA = 45 ACRES

PER AGRA EARTH & ENVIRONMENTAL, 90% OF SITE WILL BE CAPPED.

IMPERVIOUS AREA

$0.90(45) = 40.5$ ACRES

CN = 98

P = 3.4; 100-YR

P = 2.8; 25-YR

PERVIOUS AREA

$45 - 40.5 = 4.5$ ACRES

CN = 86

4/11

BASIN SUMMARY

BASIN ID: A1-25E NAME: 25-yr predeveloped condition
SCS METHODOLOGY
TOTAL AREA.....: 45.00 Acres BASEFLOWS: 0.00 cfs
RAINFALL TYPE....: TYPE1A PERV IMP
PRECIPITATION....: 2.80 inches AREA..: 30.50 Acres 14.50 Acres
TIME INTERVAL....: 10.00 min CN....: 86.00 98.00
TC....: 25.29 min 10.72 min
ABSTRACTION COEFF: 0.20
TcReach - Sheet L: 450.00 ns:0.0500 p2yr: 1.60 s:0.0100
impTcReach - Sheet L: 700.00 ns:0.0110 p2yr: 1.60 s:0.0100
PEAK RATE: 18.07 cfs VOL: 6.68 Ac-ft TIME: 510 min

BASIN ID: A2-100E NAME: 100-yr predeveloped condition
SCS METHODOLOGY
TOTAL AREA.....: 45.00 Acres BASEFLOWS: 0.00 cfs
RAINFALL TYPE....: TYPE1A PERV IMP
PRECIPITATION....: 3.40 inches AREA..: 30.50 Acres 14.50 Acres
TIME INTERVAL....: 10.00 min CN....: 86.00 98.00
TC....: 25.29 min 10.72 min
ABSTRACTION COEFF: 0.20
TcReach - Sheet L: 450.00 ns:0.0500 p2yr: 1.60 s:0.0100
impTcReach - Sheet L: 700.00 ns:0.0110 p2yr: 1.60 s:0.0100
PEAK RATE: 23.81 cfs VOL: 8.65 Ac-ft TIME: 510 min

BASIN ID: A3-25F NAME: 25-yr postdeveloped condition
SCS METHODOLOGY
TOTAL AREA.....: 45.00 Acres BASEFLOWS: 0.00 cfs
RAINFALL TYPE....: TYPE1A PERV IMP
PRECIPITATION....: 2.80 inches AREA..: 4.50 Acres 40.50 Acres
TIME INTERVAL....: 10.00 min CN....: 86.00 98.00
TC....: 27.95 min 10.72 min
ABSTRACTION COEFF: 0.20
TcReach - Sheet L: 170.00 ns:0.1500 p2yr: 1.60 s:0.0100
impTcReach - Sheet L: 700.00 ns:0.0110 p2yr: 1.60 s:0.0100
PEAK RATE: 26.22 cfs VOL: 8.96 Ac-ft TIME: 510 min

BASIN SUMMARY

BASIN ID: A4-100F NAME: 100-yr postdeveloped condition
SCS METHODOLOGY

TOTAL AREA.....:	45.00 Acres	BASEFLOWS:	0.00 cfs	
RAINFALL TYPE....:	TYPE1A		PERV	IMP
PRECIPITATION....:	3.40 inches	AREA..:	4.50 Acres	40.50 Acres
TIME INTERVAL....:	10.00 min	CN....:	86.00	98.00
		TC....:	27.95 min	10.72 min

ABSTRACTION COEFF: 0.20
TcReach - Sheet L: 170.00 ns:0.1500 p2yr: 1.60 s:0.0100
impTcReach - Sheet L: 700.00 ns:0.0110 p2yr: 1.60 s:0.0100
PEAK RATE: 32.35 cfs VOL: 11.10 Ac-ft TIME: 510 min

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1201 Third Avenue, Suite 900
Seattle, Washington 98101
(206) 622-5822 Fax (206) 622-8130

project	LAKE POINTE	by	DJR	sheet no.
location	KENMORE	date	5/27/97	6/11
client				job no.
				95379

CONTRIBUTING OUTFALL AREAS

NOTES: 1) TOTAL SITE = 45 ACRES
90% SITE CAPPED. THEREFORE, ASSUME CONTRIBUTING AREAS TO OUTFALL = 0.90 (45) = 40.5 ACRES.
4.5 ACRES DRAIN DIRECTLY TO LAKE WASHINGTON.

2) SEE DEVELOPED SITE SKETCH FOR APPROXIMATE LOCATIONS OF OUTFALLS

FLOWS:

25Y/100YEAR DEVELOPED DESIGN FLOWS PER WATERWORKS = 26.2 & 32.4 cfs

OUTFALL	CONTRIBUTING AREA	PERCENT	25YR FLOW (cfs)	100YR FLOW (cfs)
1	17.5	43	11.3	13.9
2	7	17	4.5	5.5
3	6	15	3.9	4.9
4	6	15	3.9	4.9
5	4	10	2.6	3.2
			26.2	32.4

kpff Consulting Engineers

1201 Third Avenue, Suite 900 Seattle, WA 98101
(206) 622-5822 Fax (206) 622-8130

Date 5/27/97 Job No. 95379 1/11

Project LAKEPOINT

Discussion With DEE GARDNER

Company AGRA

By DAVID BAUMAN

☒ Telephone ☐ Direct

Confirmation Record

DEE SAID THE LAKEPOINT SITE HAS 2-FEET SILTY SANDS OVER ABOUT 15-FEET OF WOOD DEBRIS. BASED ON THEIR SOIL LOGS, DEE RECOMMENDED HYDROLOGIC SOIL CLASSIFICATION "C" TO DEVELOP CURVE NUMBERS FOR RUNOFF CALCULATIONS.

TABLE 3.5.2B SCS WESTERN WASHINGTON RUNOFF CURVE NUMBERS

SCS WESTERN WASHINGTON RUNOFF CURVE NUMBERS (Published by SCS in 1982)					
Runoff curve numbers for selected agricultural, suburban and urban land use for Type 1A rainfall distribution, 24-hour storm duration.					
LAND USE DESCRIPTION		CURVE NUMBERS BY HYDROLOGIC SOIL GROUP A	B	C	D
Cultivated land(1):	winter condition	86	91	94	95
Mountain open areas:	low growing brush and grasslands	74	82	89	92
Meadow or pasture:		65	78	85	89
Wood or forest land:	undisturbed or older second growth	42	64	76	81
Wood or forest land:	young second growth or brush	55	72	81	86
Orchard:	with cover crop	81	88	92	94
Open spaces, lawns, parks, golf courses, cemeteries, landscaping.					
good condition:	grass cover on 75% or more of the area	68	80	86	90
fair condition:	grass cover on 50% to 75% of the area	77	85	90	92
Gravel roads and parking lots		76	85	89	91
Dirt roads and 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				
Planned unit developments, condominiums, apartments, commercial business and industrial areas.	% impervious must be computed				

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

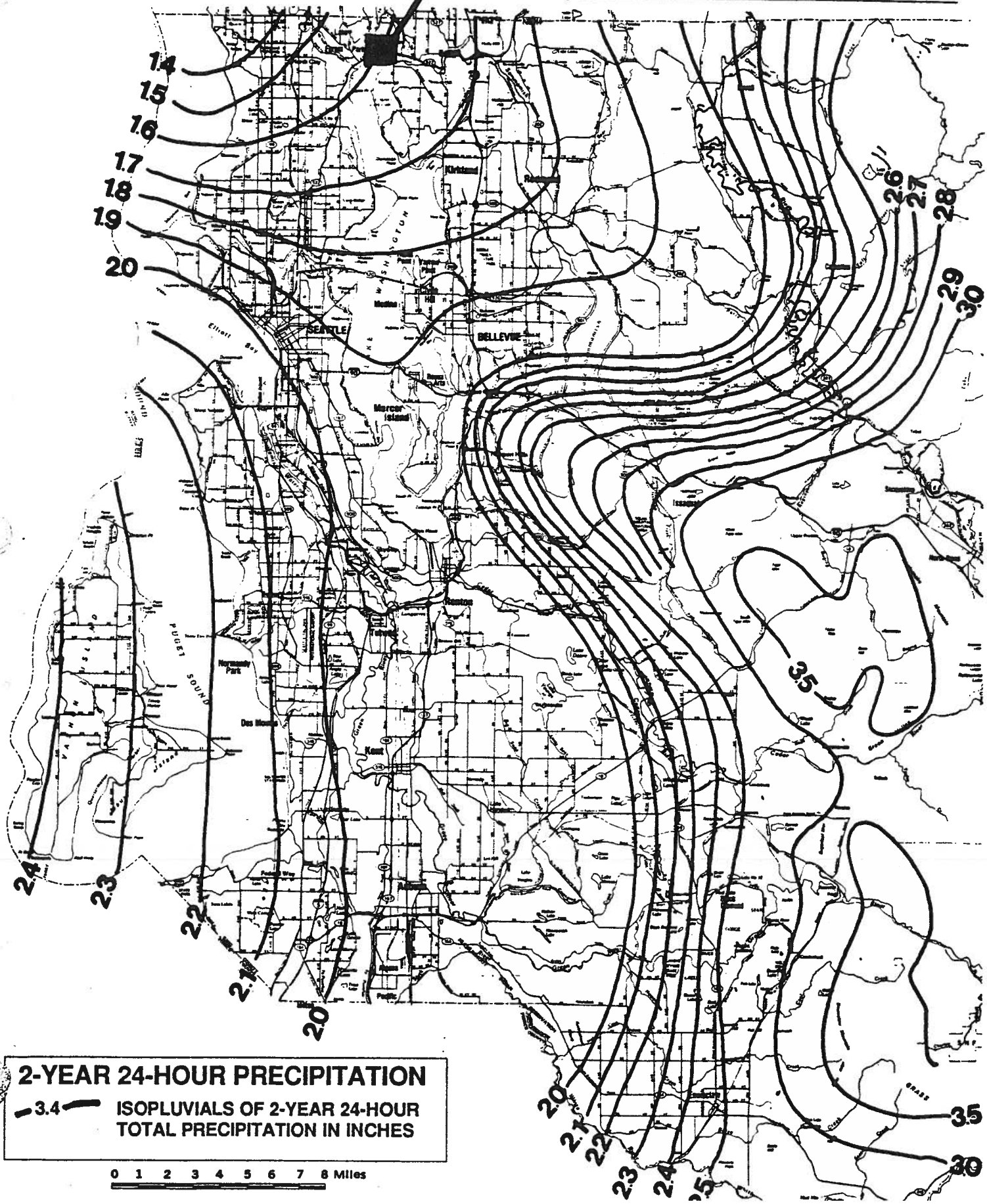
(1) For a more detailed description of agricultural land use curve numbers refer to National Engineering Handbook, Section 4, Hydrology, Chapter 9, August 1972.
(2) Assumes roof and driveway runoff is directed into street/storm system.
(3) The remaining pervious areas (lawn) are considered to be in good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

9/11

PROJECT SITE

P = 1.6

FIGURE 3.5.1C 2-YEAR 24-HOUR ISOPLUVIALS



2-YEAR 24-HOUR PRECIPITATION

3.4 ISOPLUVIALS OF 2-YEAR 24-HOUR TOTAL PRECIPITATION IN INCHES

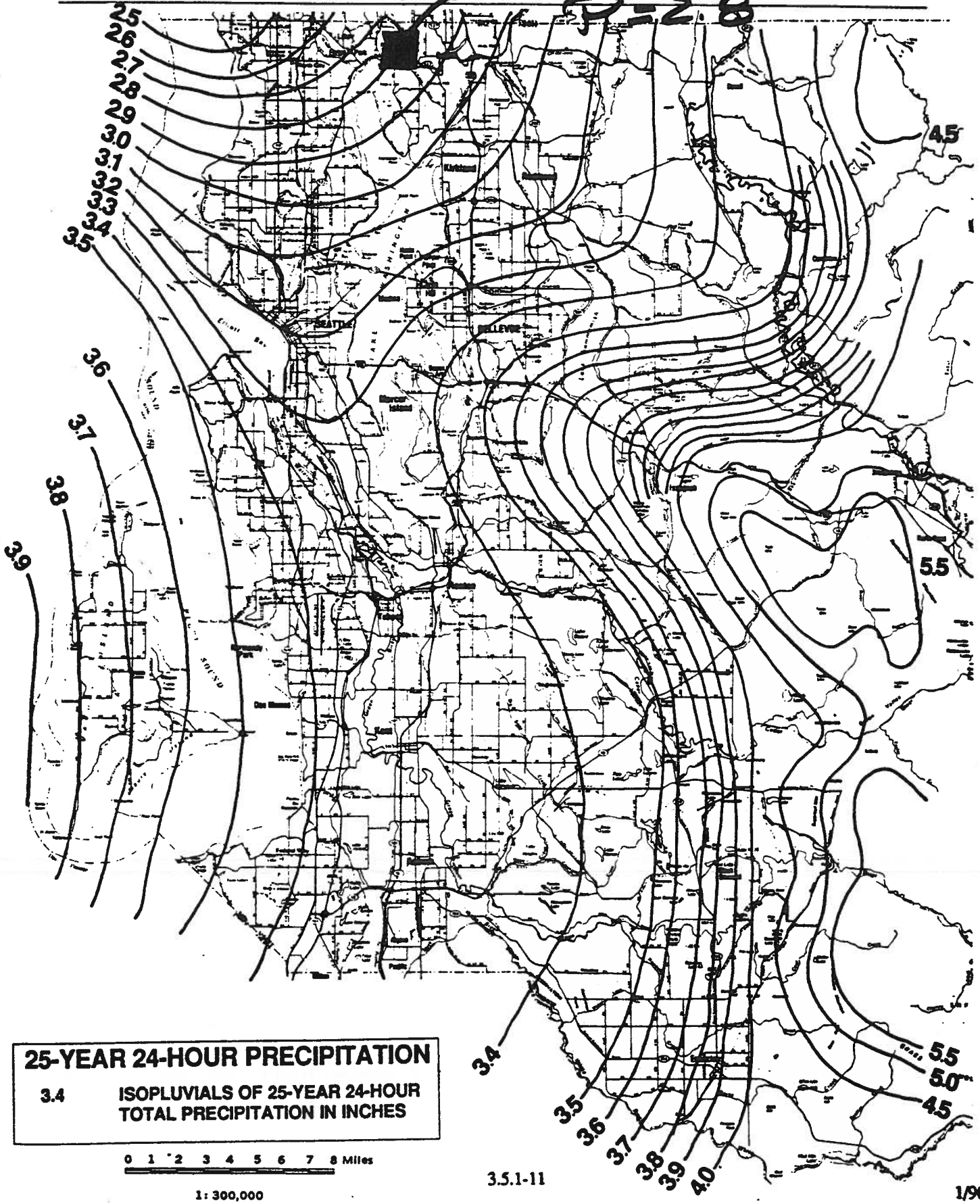
0 1 2 3 4 5 6 7 8 Miles

10/11

PROJECT SITE

P=2.8

FIGURE 3.5.1F 25-YEAR 24-HOUR ISOPLUVIALS



25-YEAR 24-HOUR PRECIPITATION

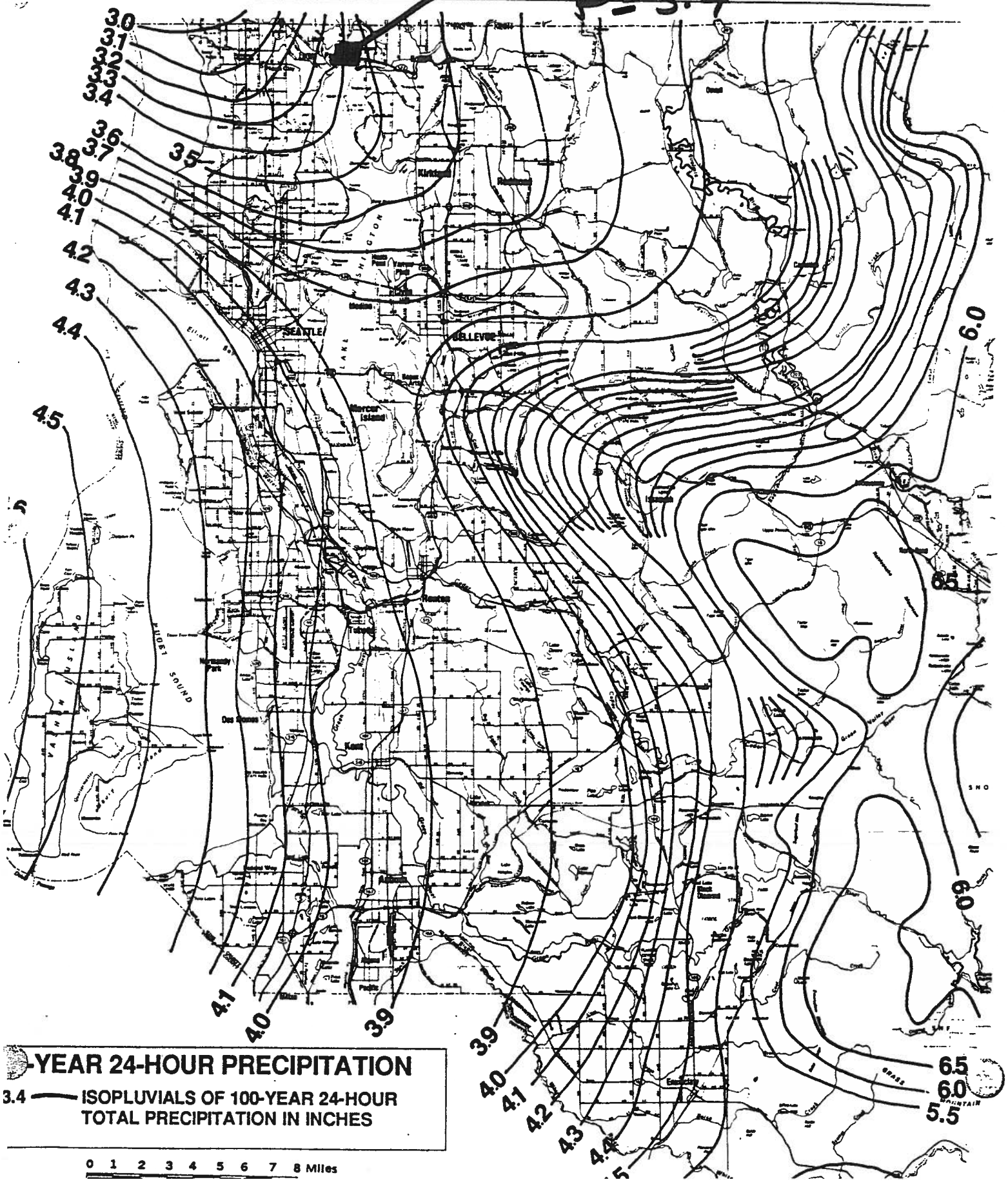
3.4 ISOPLUVIALS OF 25-YEAR 24-HOUR TOTAL PRECIPITATION IN INCHES

0 1 2 3 4 5 6 7 8 Miles

1: 300,000

PROJECT SITE
P=3.4

FIGURE 3.5.1H 100-YEAR 24-HOUR ISOPLUVIALS



100-YEAR 24-HOUR PRECIPITATION

3.4 —— ISOPLUVIALS OF 100-YEAR 24-HOUR TOTAL PRECIPITATION IN INCHES

0 1 2 3 4 5 6 7 8 Miles

SECTION 6
SPECIAL REPORTS AND STUDES

SECTION 6

SPECIAL REPORTS AND STUDIES

The project site lies within the Northshore Community Planning area. The Northshore Community Plan does not have storm drainage impacts for the proposed project.

AGRA Earth & Environmental will submit a report that will have information on geotechnical/soils, groundwater, geotechnical design, information for foundations, geology and structural fill.

An environmental consultant will submit a report containing information on water quality and fisheries impacts.

SECTION 7
OTHER PERMITS

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OTHER PERMITS

Permits expected for this project include:

- Washington State Department of Transportation
  - Developer/Local Agency Agreement

    For traffic impacts to SR 522.
- Washington State Department of Fish and Wildlife
  - Hydraulic Project Approval

    For the proximity of the Sammamish Slough and Lake Washington which is a salmon habitat.
- Washington Department of Ecology
  - NPDES Stormwater Permit
- United States Army Corps of Engineers
  - Section Permits for the Sammamish Slough, Lake Washington and Wetlands

SECTION 8

TEMPORARY EROSION AND SEDIMENTATION CONTROL (TESC) ANALYSIS AND DESIGN

SECTION 8
TEMPORARY EROSION AND SEDIMENTATION CONTROL (TESC) ANALYSIS AND DESIGN

TEMPORARY EROSION AND SEDIMENTATION CONTROL (TESC)

TESC measures will be required during construction of the project. TESC measures implemented will be in accordance to the King County Erosion and Sedimentation Control (ESC) Standards described in the Surface Water Management Manual. The construction documents will include TESC plans and notes.

The existing project site consists of sand and gravel stockpiles on native soil. The native soil descriptions from soil boring logs consists of silt, sand and some peat. The site topography is generally flat. The project will be constructed in phases. As the site is cleared and graded, TESC measures will be installed to contain sediment transport.

CLEARING LIMITS

Prior to construction, the contractor will stake the clearing and grading limits as defined on the contract plans. Plastic construction fence or silt fence will be used to delineate the limits. Sensitive area buffers will be protected.

COVER MEASURES

Areas that have been cleared and graded and will be left exposed for a longer duration will be seeded with grass. Temporary exposed areas will be mulched with straw if sediment runoff is observed.

PERIMETER PROTECTION

Silt fence will be placed at the toe of drainage slope at the clearing and grading limits. The Sammamish Slough, Lake Washington and the Kenmore Marina will be protected with silt fence.

TRAFFIC AREA STABILIZATION

Stabilized construction entrances will be placed at points of egress from the site to prevent sediment tracking to adjacent roads.

SEDIMENT RETENTION

Sediment ponds will be used to collect and store sediments suspended in stormwater runoff. Straw bale barriers placed in conveyance swales will filter sediments.

SURFACE WATER CONTROLS

Swales will convey stormwater overflow from sediment ponds to receiving waters. Straw bale barriers or silt fence placed in the swale will filter sediments.

DUST CONTROL

During the dry months when dust is prevalent, areas will be sprayed with water to minimize dust.