STORMWATER SITE PLAN
FOR
THE MURRAY RESIDENCE

APRIL 14, 2023

STORMWATER SITE PLAN

FOR

THE MURRAY RESIDENCE

A portion of the Southeast Quarter of Section 13, Township 24 North, Range 4 East of the Willamette Meridian, City of Mercer Island, King County, Washington

Prepared for:

Frank Ross Murray
4803 Forest Avenue SE
Mercer Island, Washington 98040

Prepared by:

Apex Engineering PLLC
2601 South 35th, Suite 200
Tacoma, Washington 98409
(253) 473-4494
File #34578
April 14, 2023

Design Engineer: ____________________
Riggin Thorniley, EIT

Project Engineer: ____________________
Felix Jacobs, PE

ENGINEER'S CERTIFICATION:

"I hereby state that this Construction Stormwater Site Plan for the Murray Residence 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 for professional engineers. I understand that the City of Mercer Island does not and will not assume liability for the sufficiency, suitability, or performance of the Construction Stormwater Site Plan prepared by me."

FELIX R. JACOBS
STATE OF WASHINGTON
42244
REGISTERED
PROFESSIONAL ENGINEER
04-14-2023

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SECTION 1 - PROJECT OVERVIEW

This stormwater site plan report provides the technical and background information for design of the stormwater facilities for the Murray Residence project. This report is intended to meet the requirements of the City of Mercer Island and the 2014 Department of Ecology Stormwater Management Manual for Western Washington (SWMMWW).

The project site is in a portion of the southeast quarter of Section 13, Township 24 North, Range 4 East, W.M., City of Mercer Island, King County, Washington. The site parcel number is 2577300021 and address is 4803 Forest Ave SE Mercer Island, WA 98040.

The existing site is approximately 0.40-acres (ac). Currently, there is an existing single-family home, driveway, garage, associated walkway, and small sheds on the parcel. There is an existing storm sewer line along the southern boundary that discharges to Lake Washington via a 12-inch CMP at the southwest corner of the site.

Development of the project consists of removing the existing house and associated driveway, walkway, and garage structure and constructing a new single-family structure with a new garage, walkway, driveway, loggia, and associated utility connections.

Runoff from the predeveloped site is collected and conveyed to Lake Washington. Runoff from the developed site will to be collected and conveyed to the existing conveyance system and then to Lake Washington. Existing drainage patterns are to remain, and no new drainage patterns are proposed. Bypass flows are not proposed.

The existing conveyance begins at the eastern property line, continues westerly, along the south property line, and continues to Lake Washington.

See Appendix A for Vicinity Map.

1.1 - Minimum Requirements

The project is required to meet All Minimum Requirements for the new and replaced hard surfaces and the land disturbed (see Appendix B). The minimum requirements are listed below with a short narrative of how each is being met.

1. *Minimum Requirement #1: Preparation of Stormwater Site Plans:*

   Preparation of this stormwater site plan is intended to meet Minimum Requirement #1.

2. *Minimum Requirement #2: Construction Stormwater Pollution Prevention (SWPPP):*

   Preparation of a construction SWPPP is intended to meet Minimum Requirement #2.

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3. *Minimum Requirement #3: Source Control of Pollution:*

   The project will implement measures to prevent stormwater from encountering pollutants, including silt fence and inlet protection. See SWPPP for details.

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

   Existing drainage patterns are utilized, and no new drainage patterns or outfalls are proposed.

5. *Minimum Requirement: #5: On-Site Stormwater Management*

   The project is flow control exempt and is not required to achieve the LID performance standard nor consider bioretention, rain gardens, permeable pavement, and full dispersion. Per the City of Mercer Island LID feasibility map, infiltration is not feasible on-site. See Appendix B for details.

6. *Minimum Requirement: #6: Runoff Treatment:*

   The only PGIS proposed for the site is a 1,852-sf driveway, which is less than the 5,000-sf threshold requirement treatment, so runoff treatment is not required.

7. *Minimum Requirement: #7: Flow Control:*

   The site drains to flow control exempt waters (Lake Washington).

8. *Minimum Requirement: #8: Wetlands Protection:*

   There are no known wetlands on-site or downstream of the site.

9. *Minimum Requirement: #9: Operation and Maintenance:*

   Preparation of an Operation and Maintenance manual is intended to meet Minimum Requirement #9.

SECTION 2 – EXISTING CONDITIONS SUMMARY

The existing conditions consist of:

- Single family residence home
- A garage structure
- Concrete driveway
- Landscaping
- Storm sewer line along the southern property line

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The project site generally slopes moderately to steep down towards the west with an average slope of approximately 21-percent. There is a portion of steeper slope at the western portion of the site of approximately 32-percent.

The existing conveyance begins near the southeastern boundary and flows westerly through a series of pipes where it outlets into Lake Washington. See Section 1 for details.

The project site is situated in the City of Mercer Island's Storm Drainage Basin 25A. Refer to Section 4, Part A for details regarding the existing site hydrology.

On-site soils consist of Kitsap silt loam, per the NRCS web soil survey (see Appendix D). Table III-2.3.1 of the 2014 SWMMWW classifies the Kitsap soil type as hydrologic soil group C.

Per the City of Mercer Island's GIS information, the project site is located within a Wind Exposure 'C' with a Wind Speed-Up Factor of 1.0. All or portions of the site are also within potential slide, seismic, and erosion hazard areas. Steep slope hazard areas are identified off-site to the north, south and east. Per King County's GIS information, the project site is within the Tacoma Smelter Plume and has been identified as having lead and arsenic levels up to 40-ppm. No additional critical conditions, difficult site parameters or flood plains are known to exist at this time.

The City of Mercer Island recently determined that a watercourse does not exist in the southern portion of the Murray property, but there may be a wetland present in that vicinity. Currently, outlet flow from an existing lined pond in the adjacent parcel east of the site is conveyed in a pipe system on the Murray property, meanders to the southwest and into the adjacent parcel for approximately 110-feet, crosses back into the Murray property, and is then conveyed to the shore.

SECTION 3 – OFF-SITE ANALYSIS

This project does not propose to add 5,000-sf or more of new hard surface. Therefore, per Section 3.1.3 of the SWMMWW, an off-site analysis should not be required for the project. Additionally, the stormwater runoff from the site is proposed to directly discharge through approximately 200-ft of pipes into Lake Washington and should have a minimal adverse impact to the downstream system. All existing drainage patterns and existing outfalls are proposed to be maintained.

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SECTION 4 – PERMANENT STORMWATER CONTROL PLAN

Part A - Summary

The site is currently developed and graded to slope down to the west. The stormwater run-off for the site is conveyed to an existing system along the southern boundary of the site, then discharges through a 12-inch storm pipe to Lake Washington. The existing system was verified for conveyance capacity from the adjacent parcel east of the project.

The following table summarizes the pre-developed and developed site conditions:

	Land Use	Acreage	Soil Group
PRE	Pervious (lawn, landscape)	0.26	C
	Impervious	0.14	C
	Total	**0.40**	C
DEV	Pervious (lawn, landscape)	0.22	C
	Impervious	0.18	C
	Total	**0.40**	C

The effective impervious surfaces in the pre-developed conditions consist of the house and its associated driveway, walkways, and garage are approximately 0.14-ac in size. The effective impervious surfaces in the developed conditions consist of the new residence and its associated driveway, walkways, loggia, and garage and are approximately 0.179-ac in size.

Part B - Performance Standards and Goals

The storm system is to conform to the City of Mercer Island and 2014 SWMMWW standards.

Runoff treatment is not required since the project creates less than the 5,000-sf of total pollution generating impervious surfaces threshold requiring treatment.

Flow control is not required. The project discharges stormwater to Lake Washington, which is a Flow Control Exempt Receiving Water.

The proposed conveyance system is modeled and has been verified to have capacity sufficient to contain the 100-year storm event (SBUH Methodology). Refer to Section 4, Part F for further information.

Part C – Low Impact Development Features

For lawn and landscaped areas, post-construction soil quality and depth will be utilized. Raingardens, bioretention, downspout dispersion, and sheet flow dispersion are considered infeasible due to existing site slopes. Detention is not required as the project is within a flow control exempt discharge area. Furthermore, per the City of Mercer Island's Infiltration Feasibility Map included in Appendix C, the site is located in an area where infiltrating LID facilities are not permitted.

Part D – Flow Control System

Not required. The project discharges to Lake Washington, which is a flow control exempt receiving water.

Part E – Water Quality System

Not required. The project creates less than the 5,000-sf of pollution generating impervious surface threshold requiring treatment.

Part F – Conveyance System Analysis and Design

Refer to Appendix C for engineering calculations.

Runoff from the proposed 3,504-sf roof area and 4,278-sf associated improvements (drive, walk, and loggia) is proposed to be conveyed into the existing 12-inch private storm system south of the proposed residence via 4-inch roof drains and 6-inch storm drain lines. The private storm system conveys runoff through an existing catchbasin to the south of the site, where it continues to the west for approximately 200-ft through 8- and 12-inch pipe that outlets into Lake Washington.

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The conveyance system was analyzed using StormShed 2G software and Flowmaster software, using Manning's Equation, and the SBUH Method. A Manning's roughness coefficient (n) of 0.014 and precipitation values as shown in Isopluvial Maps from the 2014 ECY SWMMWW were used.

StormShed 2G was used to model the site as impervious surface as a factor of safety to ensure the storm system can adequately convey the proposed improvements, although the project is proposing only 0.179-ac. of impervious area. The peak flow from the StormShed analysis is 0.3703-cfs from the 100-year storm.

The minimum pipe slope for the on-site conveyance system is 2.33-percent. A 2.0-percent slope was assumed for the conveyance analysis, as a factor of safety. Flowmaster results show that a 6-inch (0.5-ft) diameter pipe at a minimum slope of 2.0-percent and a discharge of 0.3705-cfs, would have a flow depth of 0.24-ft. Therefore, the proposed conveyance system should adequately handle stormwater runoff from the proposed rooftop area.

There is an existing stormwater system that conveys runoff from the project site and upstream Cropp residence (parcel 4045000145). The existing 12-inch stormwater pipe that discharges stormwater from the site has a minimum slope of 2.38-percent. The pipe can convey 5.10-cfs with a manning's roughness coefficient of 0.014, according to Flowmaster calculations. The proposed project (0.40-ac.) and run-on from existing upstream areas (0.38-ac) totals 0.75-ac. and creates a peak flow of 0.7178-cfs, per StormShed calculations. The existing 12-inch stormwater pipe will be able to convey runoff adequately. See Appendix C for detailed calculations.

SECTION 5 – CONSTRUCTION STORMWATER POLLUTION PREVENTION PLAN

See the associated SWPPP for the project. The project has considered the 13 Elements of Construction Stormwater Pollution outlined in the 2014 ECY SWMMWW.

SECTION 6 – SPECIAL REPORTS AND STUDIES

An NRCS Soil Report was obtained for the site and is included in Appendix D.

SECTION 7 – OTHER PERMITS

Anticipated permits:

- Building permits

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SECTION 8 – OPERATION AND MAINTENANCE MANUAL

See the associated Operation and Maintenance (O&M) Manual for the project.

SECTION 9 – DECLARATION OF COVENANT FOR PRIVATELY MAINTAINED FLOW CONTROL AND TREATMENT FACILITIES

Not applicable.

SECTION 10 – DECLARATION OF COVENANT FOR PRIVATELY MAINTAINED ON-SITE STORMWATER MANAGEMENT BMPs

The onsite storm drainage system will be privately maintained by the property owner after acceptance of the improvements.

SECTION 11 – BOND QUANTITIES WORKSHEET

To be provided upon request.

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Appendix A

Vicinity Map

MURRAY RESIDENCE

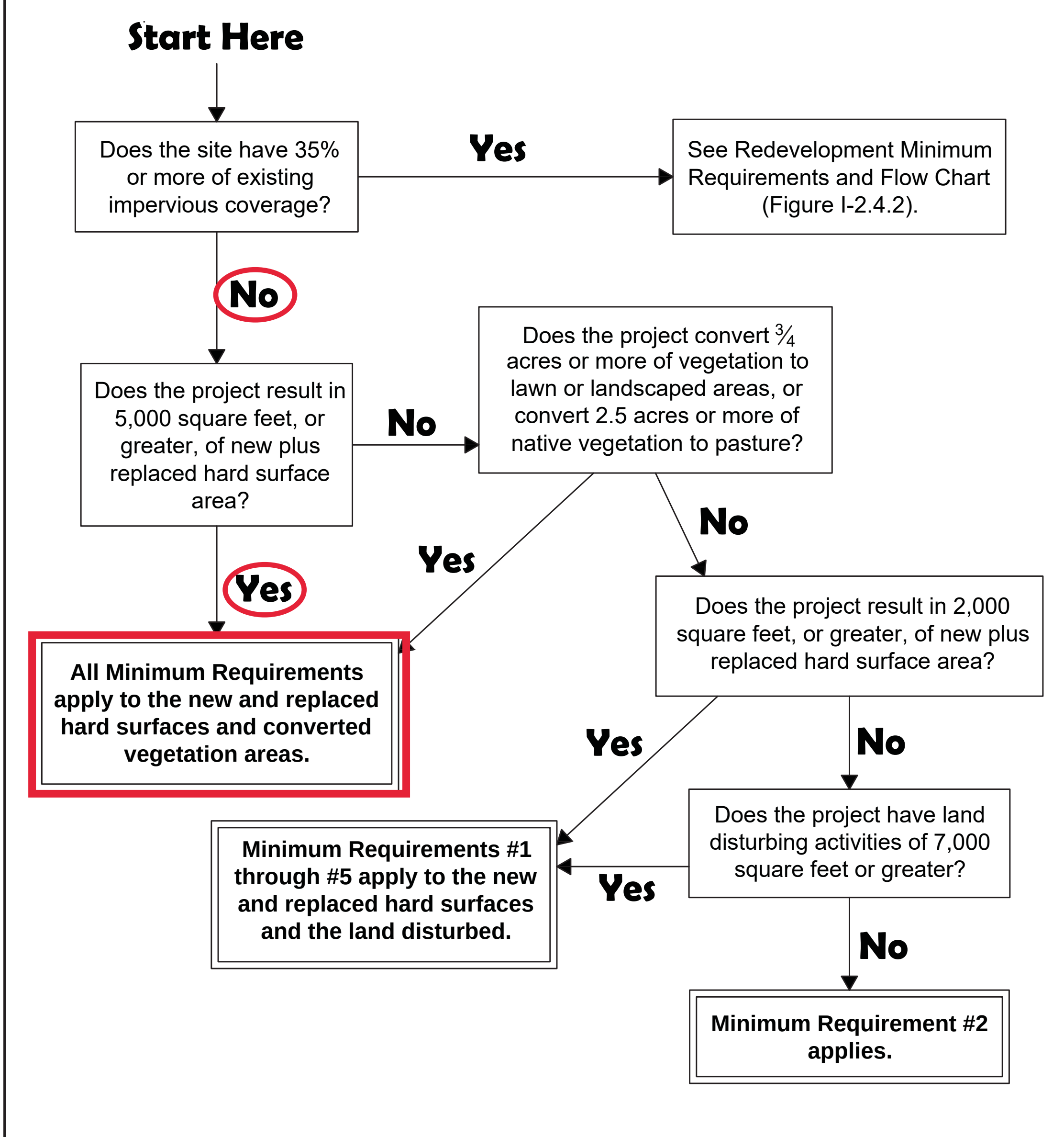
VICINITY MAP

N.T.S

Appendix B

Minimum Requirement Flow Charts / City Maps

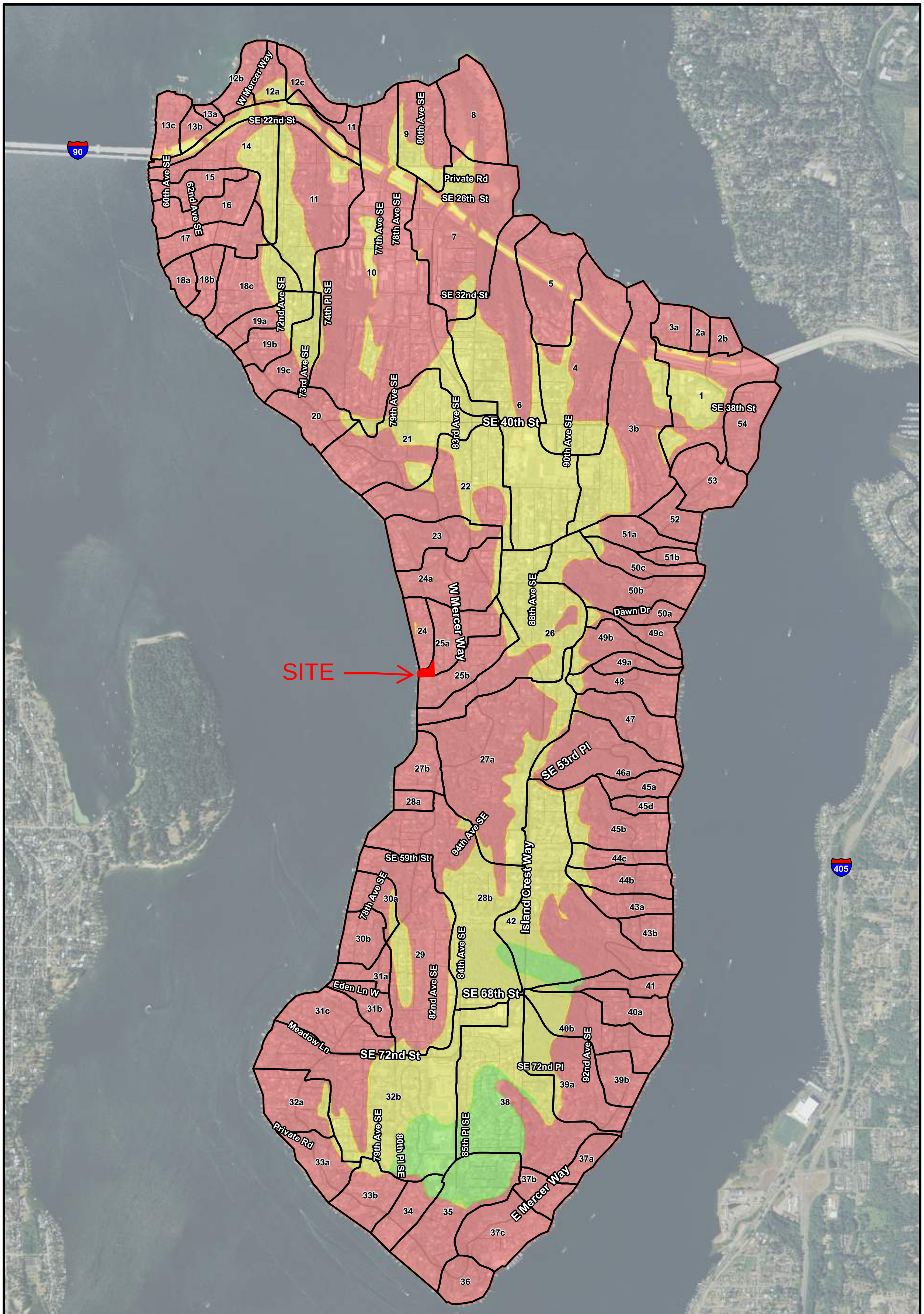
Figure I-2.4.1 Flow Chart for Determining Requirements for New Development



DEPARTMENT OF ECOLOGY
State of Washington

Figure I-2.4.1
Flow Chart for Determining Requirements for New Development

Revised June 2015



Legend

Infiltrating LID facilities may be feasible, and soil has high infiltration potential

Infiltrating LID facilities may be feasible, and soil has moderate infiltration potential

Infiltrating LID facilities are not permitted

36 Storm drainage basin

* Map is intended to be used for planning purposes only. Site-specific analysis is required prior to design and construction of LID facilities.

Figure 3. Low impact development infiltration feasibility on Mercer Island.

N

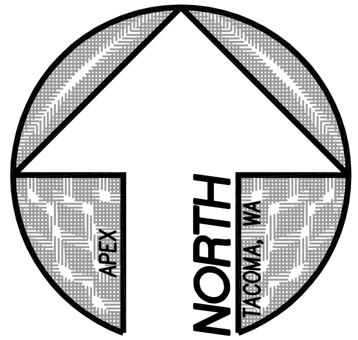
0 950 1,900 3,800 Feet

HERRERA

Aerial photography: USDA (2009)

Appendix C

Engineering Calculations



GRAPHIC SCALE

30	0	15	30	60

(IN FEET)
1 inch = 30 ft.

LEGEND

- PROPERTY LINE (0.40± AC)
- EXISTING EFFECTIVE IMPERVIOUS SURFACE (0.14± ACRES)
- EXISTING CONCRETE DRIVEWAY/SIDEWALK
- EXISTING HARD SURFACE TO BE REMOVED

PRE-DEVELOPED TDA MAP

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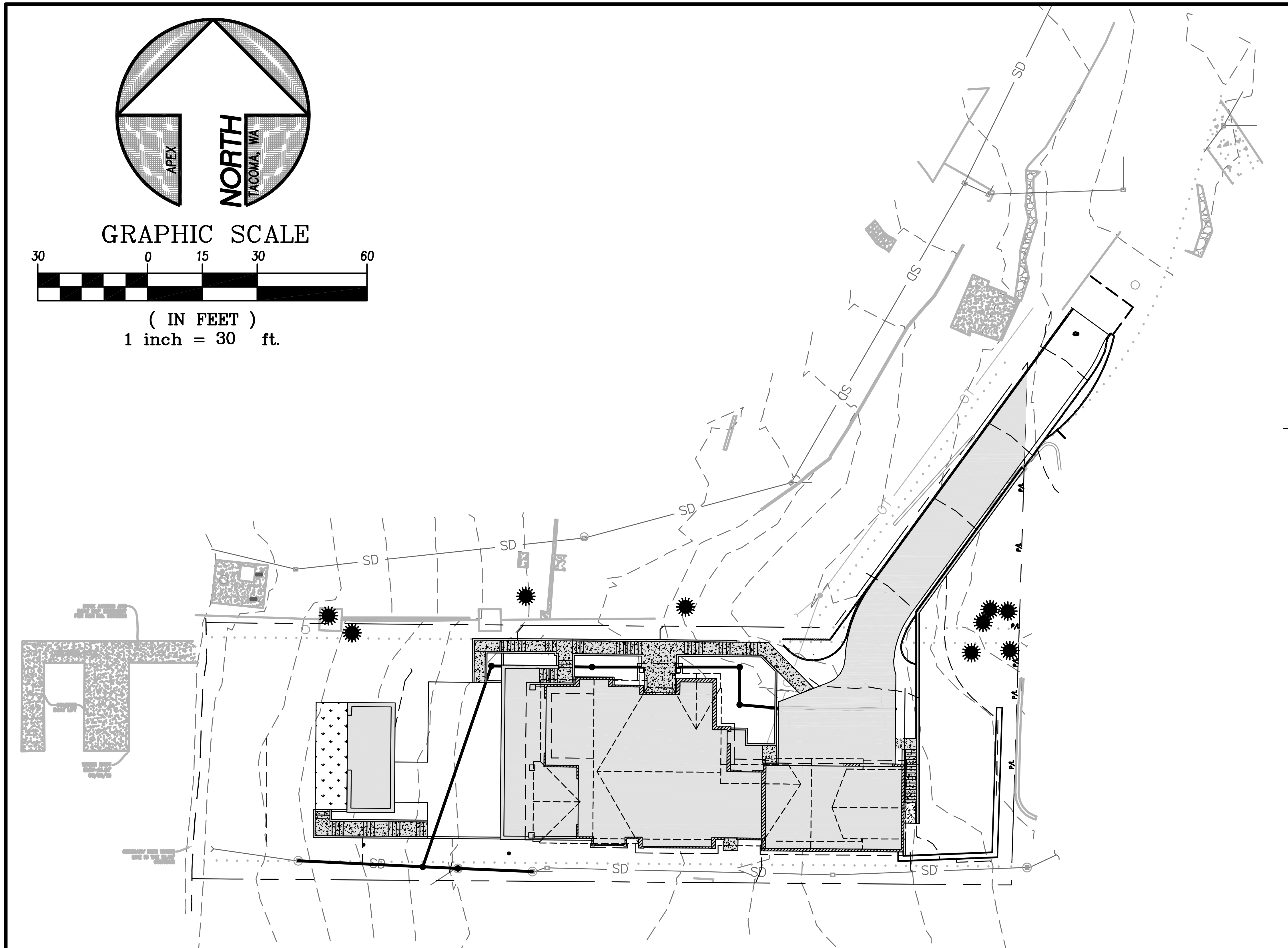

LEGEND

PROPERTY LINE (0.40± AC)

PROPOSED EFFECTIVE IMPERVIOUS SURFACE (0.179± ACRES)

DEVELOPED TDA MAP

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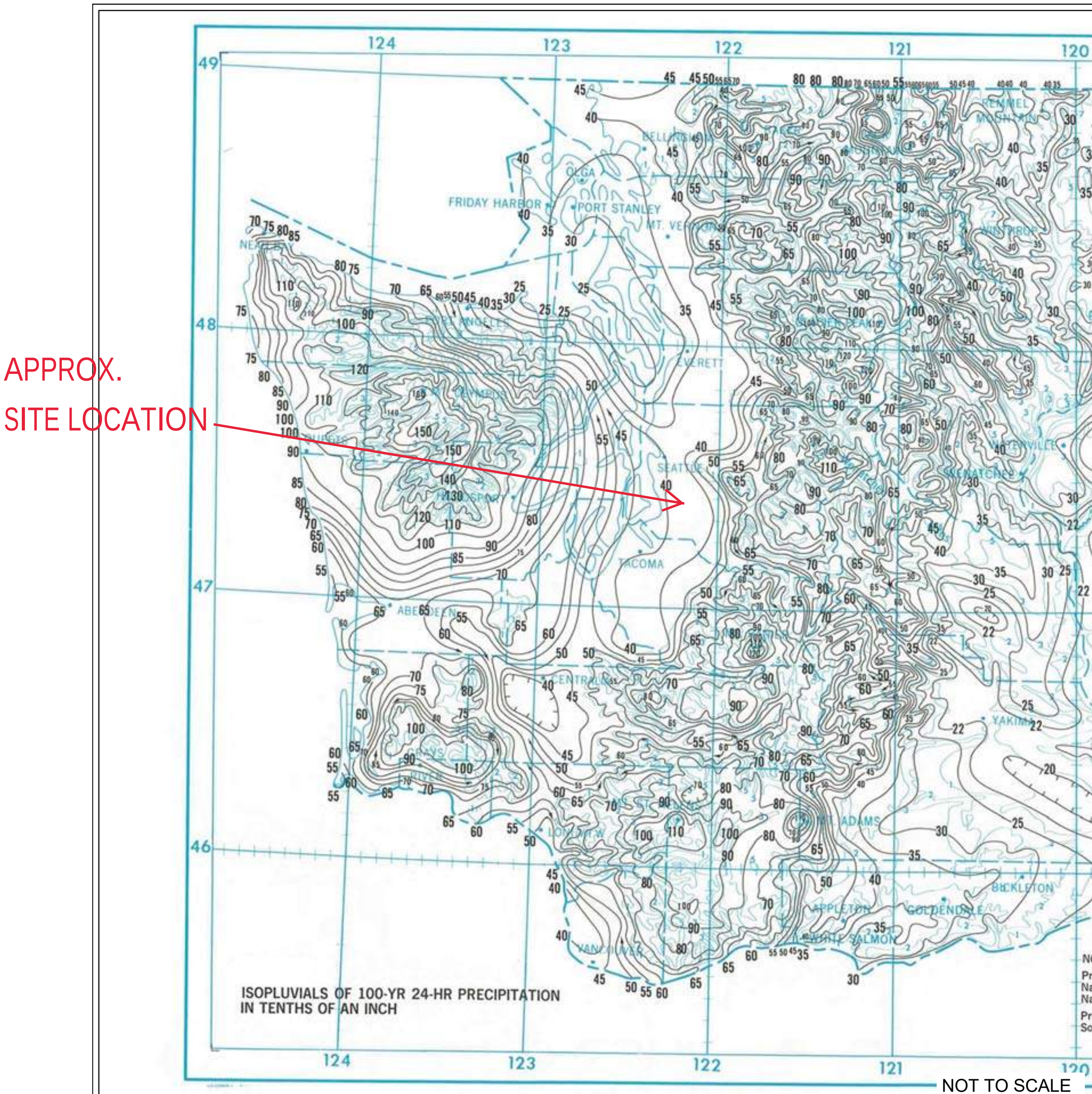
CONVEYANCE SYSTEM ANALYSIS

Figure III-A.3 Western Washington Isopluvial 100-year, 24 hour



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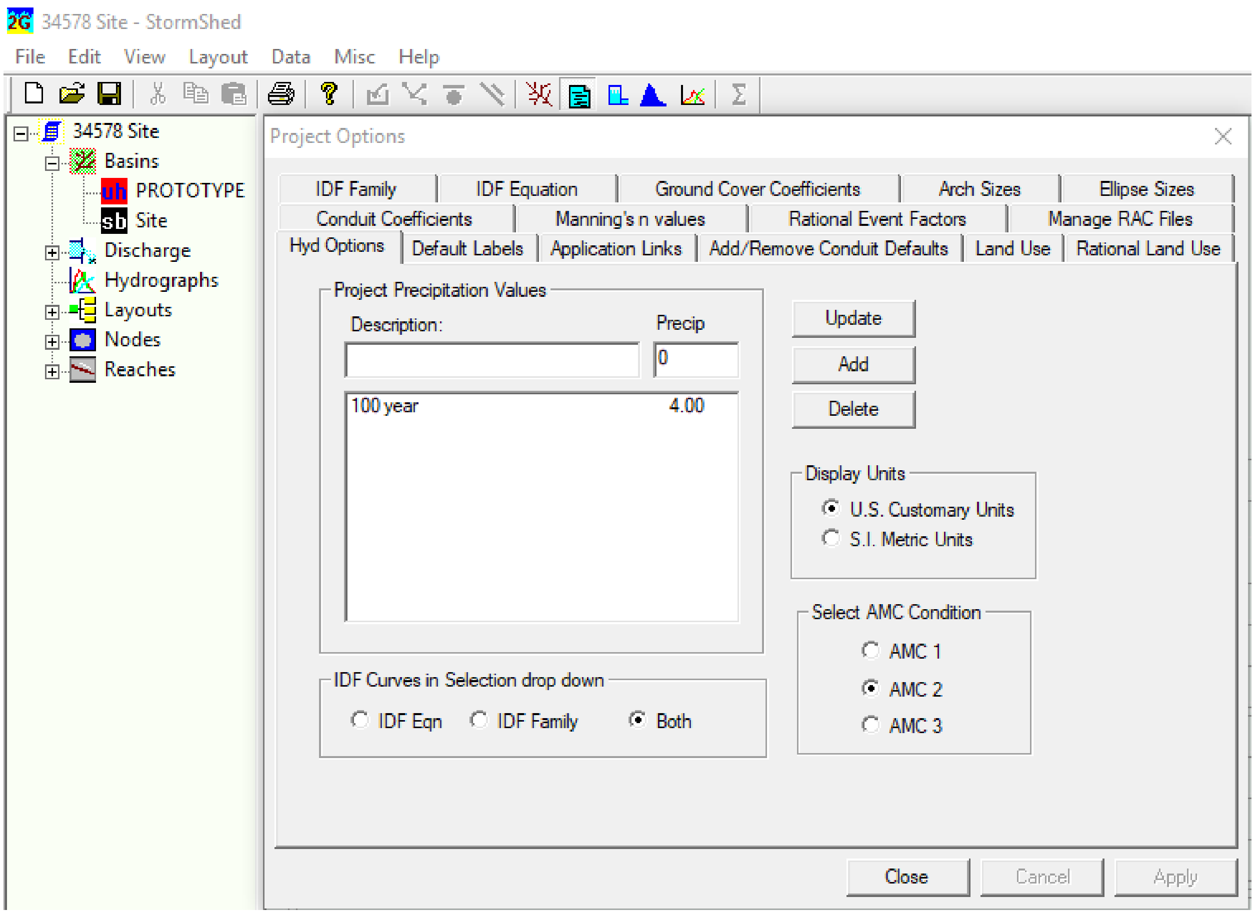
State of Washington

Figure III-A.3
Western Washington Isopluvial
100-year, 24 hour

Revised January 2016

Murray Residence
Job #34578



Site Event Summary

Event	Peak Q (cfs)	Peak T (hrs)	Hyd Vol (acft)	Area (ac)	Method	Raintype
100 year	0.3703	8.00	0.1271	0.4050	SBUH	TYPE1A

Record Id: Site

Design Method	SBUH	**Rainfall type**	TYPE1A
Hyd Intv	10.00 min	**Peaking Factor**	484.00
		Abstraction Coeff	0.20
Pervious Area (AMC 2)	0.00 ac	**DCIA**	0.41 ac
Pervious CN	0.00	**DC CN**	98.00
Pervious TC	5.00 min	**DC TC**	5.00 min

Pervious TC Calc

Type	Description	Length	Slope	Coeff	Misc	TT
Fixed	Assumed					5.00 min

Pervious TC	5.00 min

Directly Connected CN Calc		
Description	**SubArea**	**Sub cn**
Impervious surfaces (pavements, roofs, etc)	0.41 ac	98.00
DC Composited CN (AMC 2)		98.00

Directly Connected TC Calc						
Type	**Description**	**Length**	**Slope**	**Coeff**	**Misc**	**TT**
Fixed	Assumed					5.00 min
Directly Connected TC						5.00min

Haestad Method's Flowmaster 1 (Version 3.16) Results:

PIPE FLOW (MINIMUM SLOPE):

Solve For......Depth

Diameter	0.50 ft	Velocity	4.01 fps
Slope	0.0200 (ft/ft)	Flow Area	0.09 sf
Manning's n	0.014	Critical Slope	0.0102 ft/ft
Discharge	0.3703 (cfs)	Critical Depth	0.31 ft
Depth	**0.24 ft**	Percent Full	47.67 %
		Froude Number	1.64
		Full Capacity	0.80 cfs
		Q(max) @.94D	0.86 cfs

CONVEYANCE SYSTEM ANALYSIS:
Upstream Contributions and Existing 12" Pipe Capacity

Tributary Basin Event Summary

Event	Peak Q (cfs)	Peak T (hrs)	Hyd Vol (acft)	Area (ac)	Method	Raintype
100 year	0.7178	8.00	0.2463	0.7850	SBUH	TYPE1A

Record Id: Tributary Basin

Design Method	SBUH	**Rainfall type**	TYPE1A
Hyd Intv	10.00 min	**Peaking Factor**	484.00
		Abstraction Coeff	0.20
Pervious Area (AMC 2)	0.00 ac	**DCIA**	0.79 ac
Pervious CN	0.00	**DC CN**	98.00
Pervious TC	5.00 min	**DC TC**	5.00 min

Pervious TC Calc

Type	Description	Length	Slope	Coeff	Misc	TT
Fixed	Assumed					5.00 min
Pervious TC						5.00 min

Directly Connected CN Calc

Description	SubArea	Sub cn
Impervious surfaces (pavements, roofs, etc)	0.79 ac	98.00
DC Composited CN (AMC 2)		98.00

Directly Connected TC Calc

Type	Description	Length	Slope	Coeff	Misc	TT
Fixed	Assumed					5.00 min
Directly Connected TC						5.00min

Haestad Method's Flowmaster 1 (Version 3.16) Results:

PIPE FLOW (MINIMUM SLOPE):

Solve For......Actual Discharge

Diameter	1.00 ft	Velocity	6.50 fps
Slope	0.0238 (ft/ft)	Flow Area	0.79 sf
Manning's n	0.014	Critical Slope	0.0206 ft/ft
Discharge	5.10 (cfs)	Critical Depth	0.92 ft
Depth	1.00 ft	Percent Full	100.00 %
		Froude Number	Full
		Full Capacity	5.10 cfs
		Q(max) @.94D	5.49 cfs

Appendix D

Soils Report

United States Department of Agriculture

NRCS

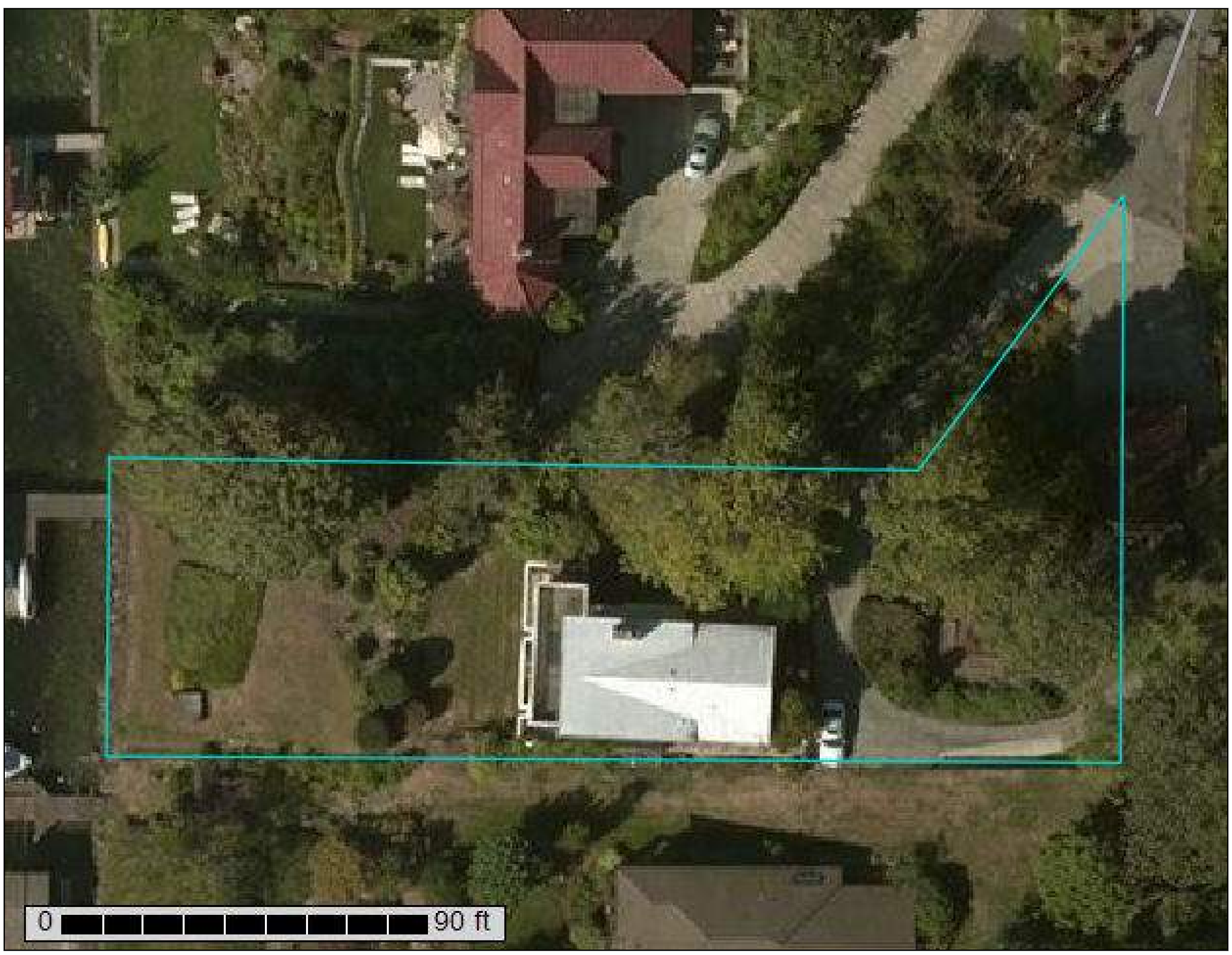
Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for

King County Area, Washington

Murray Residence



July 31, 2019

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map (Murray Residence)

Map Scale: 1:419 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0, 5, 10, 20, 30

Feet: 0, 20, 40, 80, 120

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

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

Soils
Soil Map Unit Polygons
Soil Map Unit Lines
Soil Map Unit Points

Special Point Features
Blowout
Borrow Pit
Clay Spot
Closed Depression
Gravel Pit
Gravelly Spot
Landfill
Lava Flow
Marsh or swamp
Mine or Quarry
Miscellaneous Water
Perennial Water
Rock Outcrop
Saline Spot
Sandy Spot
Severely Eroded Spot
Sinkhole
Slide or Slip
Sodic Spot

Spoil Area
Stony Spot
Very Stony Spot
Wet Spot
Other
Special Line Features

Water Features
Streams and Canals

Transportation
Rails
Interstate Highways
US Routes
Major Roads
Local Roads

Background
Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

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

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

Date(s) aerial images were photographed: Aug 31, 2013—Oct 6, 2013

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

Map Unit Legend (Murray Residence)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
KpB	Kitsap silt loam, 2 to 8 percent slopes	0.4	97.9%
Totals for Area of Interest		**0.5**	**100.0%**

Map Unit Descriptions (Murray Residence)

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

King County Area, Washington

KpB—Kitsap silt loam, 2 to 8 percent slopes

Map Unit Setting

National map unit symbol: 1hmt9
Elevation: 0 to 590 feet
Mean annual precipitation: 37 inches
Mean annual air temperature: 50 degrees F
Frost-free period: 160 to 200 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Kitsap and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kitsap

Setting

Landform: Terraces
Parent material: Lacustrine deposits with a minor amount of volcanic ash

Typical profile

H1 - 0 to 5 inches: silt loam
H2 - 5 to 24 inches: silt loam
H3 - 24 to 60 inches: stratified silt to silty clay loam

Properties and qualities

Slope: 2 to 8 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 36 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): 3w
Hydrologic Soil Group: C
Forage suitability group: Soils with Few Limitations (G002XN502WA)
Hydric soil rating: No

Minor Components

Alderwood

Percent of map unit: 10 percent
Hydric soil rating: No

Bellingham

Percent of map unit: 3 percent
Landform: Depressions
Hydric soil rating: Yes

Seattle

Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

Tukwila

Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

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