

## **CHAPTER 2.**

# **METHODS AND DATA INVENTORY**

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### **2.1 Data Sources**

The Ecology 2003 shoreline master program (SMP) guidelines state that shoreline inventory and characterizations that support local SMP amendments should be based on best available technical information. Inventories should use existing sources of information that are both relevant and reasonably available (WAC 173-26-201(3)(c)). Aside from reconnaissance-level field visits, no new field-based data collection efforts were performed to develop the summaries and characterization included in this document.

This report incorporates and builds on past work Mason County has undertaken relevant to its SMP. Key sources of information include County planning documents and technical studies (including comprehensive plans and basin plans), and watershed planning documents for Hood Canal and Water Resource Inventory Areas (WRIA) 14, 15, 16, and 22. Mapping information and other studies from state agencies (including Washington Department of Fish and Wildlife, Department of Ecology, and Department of Natural Resources) were also used. To analyze spatial patterns and visually display data, numerous cartographic resources were consulted and used in ArcGIS (ArcMap 10).

A complete list of technical and scientific references is included in Chapter 12 of this report. The Geographic Information System (GIS) map folio prepared for this SMP update is provided in Appendix A. In addition, a complete list of GIS/mapping data sources is included in Appendix B.

### **2.2 Establishing Shoreline Planning Area**

Mason County contains approximately 492 miles of freshwater shoreline and 217 miles of marine shoreline. The total mileage of potential shoreline jurisdiction within the county is based on lake perimeter data and on centerline distance for rivers and streams, not counting each river bank separately. Shorelines of the state within the county include 708.5 miles.

Except as it pertains to characterizing ecosystem-wide processes, this inventory and characterization does not directly address waterbodies outside the county

jurisdiction. Waterbodies within Olympic National Park, Mount Skokomish Wilderness, Wonder Mountain Wilderness, the Skokomish Indian Reservation, the Squaxin Island Indian Reservation, and Shelton city limits are not included in this report.

## 2.2.1 Potential Shorelines Not Designated by WAC 173-18 or 173-20

Following the passage of the Shoreline Management Act (SMA) in 1971, Ecology developed a list of all known streams and lakes meeting the criteria for shorelines of the state. The lists, which were codified in WAC 173-18 and 173-20, had not been updated since their initial development. Recently, Ecology revised the list of shoreline streams using data from several regional flow studies conducted by the U.S. Geological Survey (Kresch, 1998). The results of the USGS study showed that numerous streams that are not currently designated as shorelines of the state meet the 20 cubic feet per second (cfs) mean annual flow criterion and should be regulated as state shorelines. In other cases, the USGS study relocated the upstream boundary of the 20 cfs point further upstream or downstream from its WAC-designated location. The streams and rivers addressed in this inventory and characterization include all those identified by the USGS study which are located outside federal or Tribal lands.

Bahls et al. (2006) conducted a study to assess potential errors in state shoreline designation for lakes in Washington. The study attempted to estimate the error rate in current lake designation and develop a reliable and cost-effective method for local governments to use in identifying lakes that meet the 20-acre size threshold. The investigators used a three-phased approach to identify lakes equal to or greater than 20 acres throughout the state. The first phase of the Bahls study involved GIS analysis, the second phase involved aerial photo interpretation, and the third phase included field assessment of a small subset of the lakes analyzed.

An Ecology GIS data layer based on the Bahls study identified several lakes in Mason County that appear to meet the criteria for shorelines of the state but are currently undesignated. Ecology staff conducted further GIS review and field investigations to make final determinations on which lakes meet the 20-acre threshold.

## 2.2.3 Lateral Extent of Shoreline Planning Area

The approximate extent of shoreline jurisdiction within Mason County is shown on Map 2, and referred to throughout this report as the “shoreline planning area.” In general, the shoreline planning area includes:

- The regulated waterbody;
- 200 feet of adjacent “shorelands” extending landward from the mapped edge of the approximate Ordinary High Water Mark (OHWM);
- an area having 1 percent chance of flooding in any given year (also referred to as the 100-year floodplain); and
- any bordering, neighboring, or contiguous mapped wetlands.

This approximate extent of shoreline jurisdiction should be considered useful for planning purposes only since its resolution is based on relatively coarse-scale mapping. Site-specific delineation of wetlands, floodplains and/or OHWM is always necessary to determine the actual extent of regulated shoreline areas. It is likely that wetlands are present in some portions of the shoreline planning area but have not yet been mapped. As described in Chapter 1 (Section 1.3, Shoreline Jurisdiction) local governments can choose to regulate the entire floodplain under its SMP, or a smaller area. For this study, the entire mapped floodplain was included as it represents the maximum potential shoreline jurisdiction.

## **2.3 Approach to Characterizing Ecosystem-wide Process and Shoreline Functions**

For purposes of this report, ecosystem-wide processes (or landscape processes) are described at the watershed scale according to WRIA boundaries. In this document, the term ecosystem-wide processes refer to the dynamic physical and chemical interactions that form and maintain the landscape at the geographic scales of watersheds to basins (hundreds to thousands of square miles). These processes include the movement of water, sediment, nutrients, pathogens, toxins, and wood as they enter into, pass through, and eventually leave the watershed.

## **2.4 Approach to Inventory and Characterization of Regulated Shorelines**

The inventory of shorelines of the state in Mason County is intended to characterize conditions in and adjacent to each shoreline waterbody within the County's jurisdiction. The shoreline planning area roughly approximates the regulatory limits of the County's SMP as described above. GIS data were used to inventory and characterize conditions at the reach scale (discussed in more detail below). In addition, aerial photography and review of existing reports were used to qualitatively describe conditions in the shoreline planning area.

## 2.4.1 GIS Analysis and Mapping

GIS data, analysis and mapping were used to characterize shoreline conditions at the waterbody and reach scale. GIS overlay analysis was used to quantify certain conditions (e.g., spatial extent of wetlands, land use designations) in the shoreline planning areas. GIS mapping was used to develop the Working Map Folio that is found in Appendix A.

## 2.4.2 Determining Reach Breaks

To facilitate this shoreline characterization, shoreline planning areas were divided into reaches based on shoreline type (marine, river/stream, or lake system). The overall goal of this approach is to select reach breaks that primarily capture the hydro-geomorphic conditions or biophysical criteria in the landscape that will impact shoreline form and function. The reach breaks also form a basis for the scale of inventory, and provide a mechanism for developing and applying shoreline environment designations in later phases. Reach breaks can also be used to calculate linear shoreline lengths and areas (e.g., area of associated wetlands, floodplains, etc.).

The number of reaches by shoreline type is summarized below in Table 2-2.

**Table 2-2. Shoreline Summary by Type - Mason County, Washington**

<b>Waterbody Type</b>	<b>Number of Waterbodies</b>	<b>Number of Reaches</b>	<b>Total Miles</b>
Marine	2 (Hood Canal, Puget Sound)	48	217
Rivers and Streams	64	100	343
Lakes	44	45	149
<b>TOTAL</b>	<b>109</b>	<b>195</b>	<b>709</b>

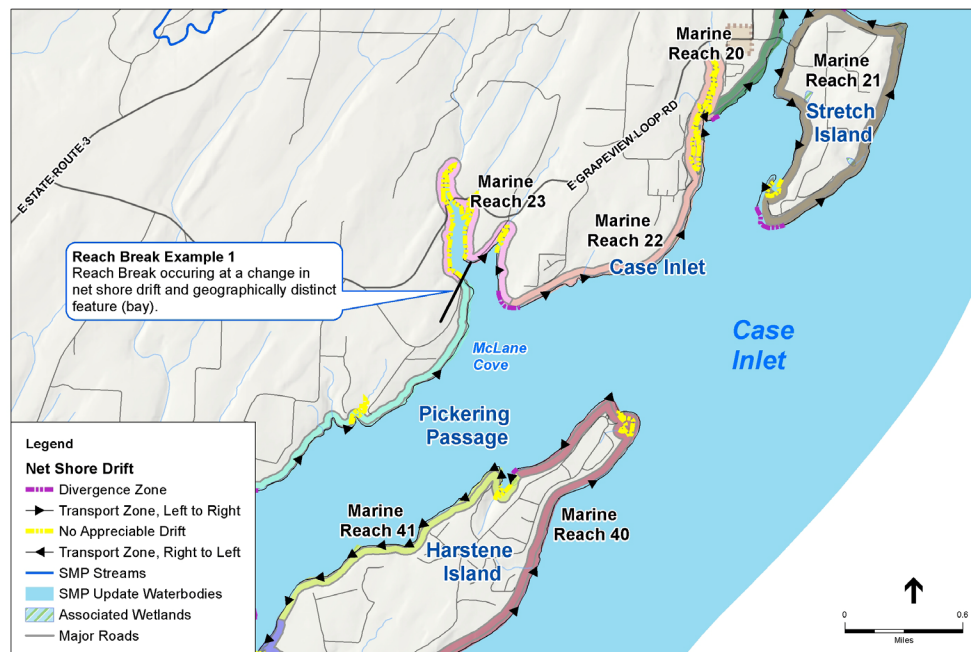
### *Nearshore Marine Reach Breaks*

For purposes of inventorying marine shorelines, the shoreline planning area was delineated for unincorporated portions of Mason County using GIS. The area included marine waters extending 200 feet offshore; 200 feet of adjacent upland; and any bordering, neighboring, or contiguous mapped wetlands. The source data depicting the marine “shoreline” was developed by the Washington State

Department of Natural Resources (WDNR) ShoreZone line file approximating the OHWM.

In addition to the analysis described above, GIS analysis and mapping were used to characterize conditions at the reach scale. Reach breaks along the marine shoreline of Mason County were developed, considering changes in predominant drift direction, wave and tidal current exposure, nearshore geology, geomorphic shoreform type (e.g., Shipman typology mapping from Change Analysis: bluffs, embayments, bedrock shores); and in some cases where there were substantial changes in predominant upland or nearshore development patterns. In many cases shorter, converging drift cells were grouped to form one longer shoreline reach that supports/maintains a larger shoreform, such as an embayment. All groupings occurred within a geographically distinct feature (bay, cove) where significant land cover variations do not suggest maintaining ungrouped reaches. Consideration of land cover for reach breaks focused on broad patterns (not at a parcel scale) and occurred only where broad patterns associated with physical processes are less apparent. In addition, discussion of marine shorelines is organized around larger management units, representing different watershed areas of Hood Canal and South Puget Sound. There are 48 unique marine reaches totaling approximately 217 miles of marine shoreline in Mason County. An example marine reach break is shown in Figure 2.1.

**Figure 2-1. Marine Reach Break Example**





## Freshwater Reach Breaks

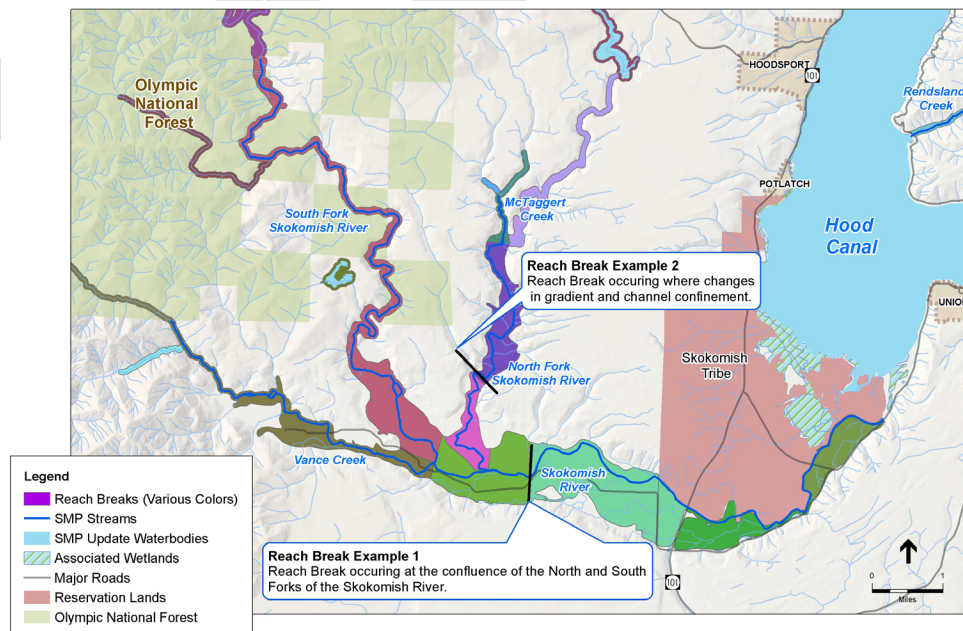
### Rivers and Streams

Based upon an overview of the watersheds and the landscape setting in Mason County, the following criteria were used to determine reach breaks within rivers and streams:

- Breaks at the confluence of two SMP jurisdictional shoreline rivers. The rationale here is that major changes in geomorphology and landscape often occur downstream of major river confluences.
- Breaks at significant changes in channel morphology. These changes can include: gradient, width of floodplain, width or type of channel migration zone, and/or transition in channel form. This will often include the transition from the upper watershed to lower alluvial valley.
- Breaks occur at jurisdictional boundaries. Shoreline jurisdictional streams that extend into Federal Lands (Olympic National Forest) lands, for example, will be included in the inventory and have reach breaks. Tribal reservation lands, however, are analyzed in the inventory, but will not be designated as reaches for the reach analysis since these areas lie outside of the county's jurisdiction. Reach breaks will also occur at Shelton UGA and city limit boundaries.
- Breaks where significant shifts in the pattern of land use development occur.

An example stream reach break is shown in Figure 2-2.

**Figure 2-2. Rivers and Streams Reach Break Example**



After applying the reach break criteria to all of the rivers/streams in the County, there were a few cases where additional changes were made based upon site specific issues:

- The Skokomish River was further divided into three reaches based on additional information provided by the Joint Technical Advisory Committee on the actual location of the confluence with the North Fork Skokomish River.

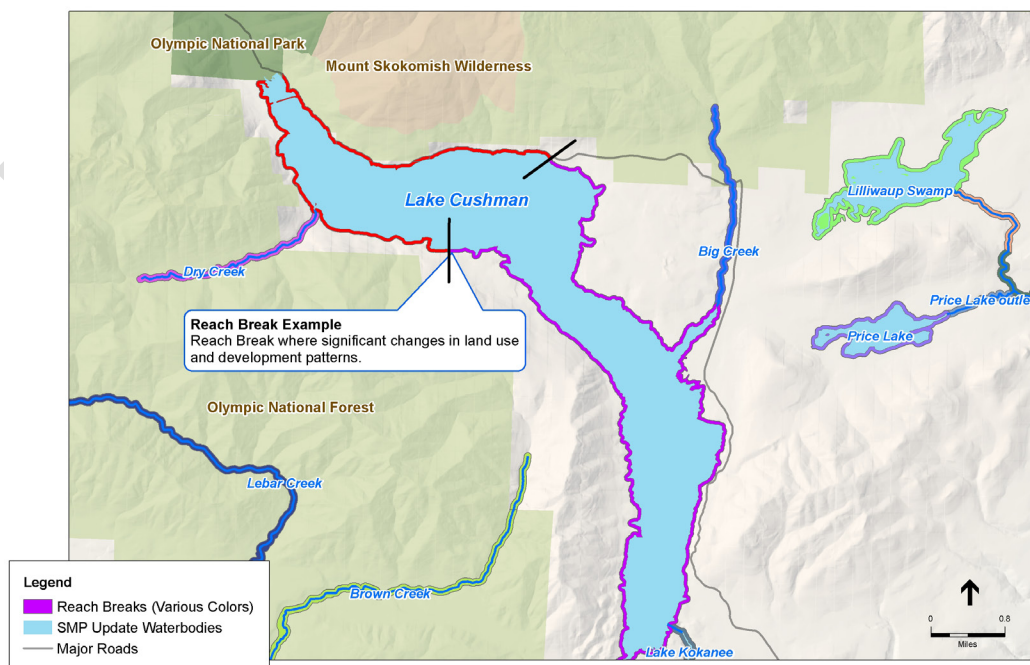
## Lakes

The following criteria were used to determine reach breaks along lakes:

- Lakes and reservoirs formed wholly within river channels are separate reaches from the river reach.
- Lakes classified as “shorelines of the state” are typically considered one reach - unless significant changes in the pattern of land use development occur.
- Lakes classified as “shorelines of statewide significance” (Lake Cushman) may have several reaches due to significant changes in the pattern of land use development.
- Breaks at Shelton UGA and city limit boundaries.

An example lake reach break is shown in Figure 2-3.

**Figure 2-3. Lake Reach Break Example**



### 2.4.3 Comparison to Other Methods

We compared our reach break methods to several other studies conducted in the County and found that the size and extent of our SMP Update reach breaks are appropriate for inventorying and characterizing shoreline ecological functions and processes and form the basis for determining no net loss of ecological functions. Many of the other studies in the County have focused on either the freshwater or marine shoreline environments or a characterization of ecosystem function at a watershed scale. A comparison of some of the other recent studies conducted in Mason County can be found below in Table 2.3.

**Table 2.3 Comparison of Other Studies Conducted in Mason County, Washington**

Report/Study	Date	Extent	# Reaches in Mason County	Focus of Study
SMP Update Reach Breaks	2011	Mason County Shorelines of the State	185 ( 137 freshwater/48 marine)	Shoreline Management Act
PSNERP - Change Analysis (V3)	2010	Marine Shoreline (Entire Puget Sound)	112 process units	Nearshore process and functions and alterations (change analysis from historic to current conditions)
WRIA Plans	XX	XX	XX	Basin Planning/Management actions and potential restoration
Nearshore Assessment	2004	South Puget Sound (Case Inlet)	56 units	Nearshore processes and alterations
EDT Reach Breaks	2002	WRIA 22 – Lower Chehalis only	213 reaches	Salmon protection/restoration



## 2.5 GIS Data Sources for Reach Sheets

Description of each shoreline reach is provided in a two-page 'reach sheet' and included in Chapters 4-9 of this report. The information contained in the reach sheets are primarily based on GIS data sources, as shown in the examples below. If information is obtained from a non-GIS data source, a citation is provided in the reach sheets in Chapters 4-9.

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## MARINE REACH SHEET – GIS DATA SOURCES

SHORELINE LENGTH	PSNERP PROCESS UNITS	REACH AREA
WDNR, 2007 (Reach length)	PSNERP, 2010	ESA, 2011
Ecology, 2007 (Oblique Imagery)		

## PHYSICAL AND ECOLOGICAL FEATURES

<b>HYDROLOGY</b> FEMA, 1998 (Floodplain)	<b>HAZARD AREAS</b> USDA, 2010 (Erosion); Ecology Shoreline Slope Stability, 2004 (Landslide)
<b>SHOREFORM AND NET SHORE DRIFT</b> PSNERP, 2010 (Shoreform)	<b>NEARSHORE PROCESS DEGRADATION</b> PSNERP, 2010 (Strategic Needs Assessment Report); WDNR, 2005 (Shorezone)
<b>LAND COVER</b> GAP Land Cover Analysis, 2009 (Land cover types); PNPTC, 2011 (Riparian vegetation cover types)	<b>HABITATS AND SPECIES</b> WDFW, 2010 (Bald Eagle, Fish Distribution, and Wildlife Occurrence, Herring, Rocksole, Sand Lance Spawning, Shellfish, Shorebirds, Smelt Spawning); WDNR, 2008 (Eelgrass and Kelp); USFWS, 2010 (Critical Habitat); NWI, 1989 (wetlands)
<b>WATER QUALITY (MAP 13)</b> Department of Ecology, 2008 (303 (d) list); Herrera, 2011 (Hood Canal and Oakland Bay)	

## HUMAN ENVIRONMENT AND LAND USE

<b>EXISTING LAND USES AND OWNERSHIP</b> Mason County Assessor Parcel Information, 2010 (Existing land uses); PSNERP, 2010 (ownership)	<b>SHORELINE MODIFICATIONS</b> PSNERP, 2010 (Tidal barriers); PSNERP, 2010 (Armoring); PSNERP, 2010 (Overwater nearshore fill)
<b>ZONING AND COMPREHENSIVE PLAN DESIGNATIONS</b> Mason County, 2010 (Zoning designations and existing shoreline environment designations); Mason County, 2000 (Comprehensive Plan designations)	<b>PUBLIC ACCESS</b> Ecology, 2010 (Shoreline Public Access)
<b>IMPERVIOUS SURFACES</b> NOAA (CCAP), 2006 (Area of impervious surface)	<b>AREAS OF SPECIAL INTEREST</b> Ecology, 2011 (Ecology Facility Sites); CGS, 2003 (Priority sediment supply [medium, high, and exceptional] and nearshore connectivity)
<b>CULTURAL AND ARCHAEOLOGICAL RESOURCES</b> DAHP, 2011; DAHP, 2006 (Hood Canal Probability Model)	

## OPPORTUNITY AREAS

Various Sources

## KEY MANAGEMENT ISSUES

Various Sources

## FRESHWATER REACH SHEET– GIS DATA SOURCES

### SHORELINE LENGTH:

WDNR, 2007

### REACH AREA:

ESA, 2011

NAIP, 2009 and Google Earth, 2006 and 2009 (air photos)

## PHYSICAL AND ECOLOGICAL FEATURES

### HYDROLOGY

FEMA, 1998 (Floodplain area); Geoengineers, 2006 (CMZ)

### HAZARD AREAS

Mason County, 2010 (Erosion); Mason County, 2010 (Landslide)

### LAND COVER

GAP Land Cover Analysis (Land cover types), 2009; PNPTC, 2011 (Riparian vegetation land cover types)

### HABITATS AND SPECIES

WDFW, 2010 (bald eagle, fish distribution, and wildlife occurrence); USFWS, 2010 (bull trout critical habitat); USFWS, 2005 (Chinook and Chum critical habitat); USFWS, 2009 and WDFW, 2010 (Marbled Murrelet and spotted owl); ; NWI, 1989(wetlands); WDNR, 2009 (rare plant species populations and endangered ecosystems)

### WATER QUALITY

Department of Ecology, 2008 (303 (d) list); Herrera, 2011 (Lake water quality)

## BUILT ENVIRONMENT AND LAND USE

### EXISTING LAND USES AND OWNERSHIP

Mason County Assessor Parcel Information, 2010 (Existing land uses); PSNERP, 2010 (Ownership)  
NOTE: Ownership data is derived from a broad-scale regional dataset designed to identify large public lands. Discrepancies might exist with smaller public lands such as parks.

### SHORELINE MODIFICATIONS

DNR, 2010 (Overwater structures); WDFW, 2008 (Road crossings); WDFW, 2008 (Dams); WDFW, 2008 (Miscellaneous barriers)

### ZONING AND COMPREHENSIVE PLAN DESIGNATIONS

Mason County, 2010 (Zoning designations and existing shoreline environment designations); Mason County, 2000 (Comprehensive Plan designations)

### PUBLIC ACCESS

No GIS data sources used

### IMPERVIOUS SURFACES

HCCC, 2006; NOAA CCAP, 2006 (Area of impervious surface)

### AREAS OF SPECIAL INTEREST

Ecology, 2011 (Ecology Facility Sites)

### CULTURAL AND ARCHAEOLOGICAL RESOURCES

DAHP, 2011; DAHP, 2006 (Hood Canal Probability Model)

## OPPORTUNITY AREAS

Various sources

## KEY MANAGEMENT ISSUES

Various sources