

Water-flow processes addressed by management objectives: "DE" = Delivery, "SS" = Surface Storage, "RD" = Recharge/Discharge.

Management Objective	Management Recommendations	Regulatory Driver(s)	Applicable Land Use(s)				Water Flow Assessment - Overall Protection & Restoration Result				Water Flow Processes Addressed		
			Forest Lands	Rural Lands	Agricultural	Urban and Suburban	Higher Protection	Higher Restoration	Lower Protection	Lower Development	Delivery	Surface Storage	Recharge / Discharge
Maintain stream and wetland physical structure and ecological functions (DE, SS, RD).	<p>Review and update (as needed) Critical Areas Ordinance based on Best Available Science to provide protection for wetlands and streams, and to require buffers sufficient to protect riparian zones.</p> <p>Use current use property tax incentive programs to encourage conservation.</p> <p>Acquire property or easements to provide permanent protection.</p>	Local: Critical Areas Ordinance, Shoreline Master Program	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
Protect and restore floodplains (reconnect streams, reduce channelization) (SS, RD)	<p>Consider implementing all or portions of FEMA's model land use ordinance to protect floodplain functions.</p> <p>Update local regulations including critical areas ordinances, drainage, grading and filling regulations, zoning regulations and land use regulations to restore floodplain functions for new and redevelopment.</p> <p>Use current use property tax incentive programs to limit floodplain development and encourage restoration.</p> <p>Acquire property or easements to restore and provide permanent protection.</p>	<p>Local: Shoreline Master Program, Critical Areas Ordinances, drainage, grading and filling regulations, zoning regulations and other land use controls.</p> <p>State: Ecology manages floodplains through Chapter 86.16 RCW (floodplain management). Ecology has the authority to "examine, approve or reject designs and plans for any structure or works, public or private, to be erected or built or to be reconstructed or modified upon the banks or in the channel or over and across the floodway of any stream or body of water in the State. (RCW 86.16.025). Ecology has authority to influence federal actions that occur in floodplain wetlands via Section 401 of the Federal Clean Water Act, and authority to approve or disapprove a local government's Shoreline Master Program. The Department of Fish and Wildlife regulates activities that could impair fish life through the State's Hydraulic Code (Ch. 77.55 RCW).</p> <p>Federal: NFIP administered by FEMA is a potential regulatory tool for controlling land use actions that negatively affect floodplain functions. FEMA issued a model land use ordinance for adoption by local governments in response to NMFS Biological Opinion (BiOp) pursuant to Section 7 of the Endangered Species Act in January 2012. New land use standards for flood plains set by FEMA will be required elements of continuing in the NFIP for local governments.</p>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
Reduce surface-water diversions (RD)			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
Protect and restore depressional wetlands and their adjacent riparian zones	<p>Prepare or update a Watershed Management Plan that includes restoration and enhancement projects.</p> <p>Update Shoreline Master Program Restoration Plan to include wetland and riparian restoration that would benefit the shoreline jurisdiction.</p> <p>Institute a mitigation program as part of local Critical Areas Ordinance with suggested prioritized projects.</p>	Local: Critical Areas Ordinance Shoreline Master Program Watershed Management plan	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	

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Protect and restore/replant riparian zones (RD)	<p>Prepare or update a Watershed Management Plan that includes riparian restoration and enhancement projects.</p> <p>Update Shoreline Master Program Restoration Plan to include riparian restoration in the shoreline jurisdiction.</p> <p>Institute a mitigation program as part of local Critical Areas Ordinance with suggested prioritized projects.</p>	<p>Local: Critical Areas Ordinance Shoreline Master Program Watershed Management plan</p>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>
Identify and protect aquifer recharge areas (DE, RD)	<p>Update Critical Areas Ordinance based on Best Available Science to protect aquifer recharge areas.</p> <p>Institute a septic training and inspection program.</p> <p>Institute a pollutant source tracking program.</p> <p>Update stormwater regulations to avoid infiltrating stormwater where it could adversely impact aquifer recharge.</p>	<p>Local: Critical Areas Ordinance Stormwater Management Regulations</p>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>
Reduce number of stream crossings by roads (SS)		<p>Local: Critical Areas Ordinance Shoreline Master Program State: Forest Practices Act Ch. 76.09, RCW</p>	<input checked="" type="checkbox"/>				<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	
Reduce interception of shallow GW in channels and road ditches (RD)			<input checked="" type="checkbox"/>				<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>
Replant deforested areas (DE)		State: Forest Practices Act Ch. 76.09, RCW	<input checked="" type="checkbox"/>				<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>		
Ensure zoning is consistent with long-term protection of resources (e.g., large parcel size; stable urban growth boundary) (DE, SS, RD)	Update Comprehensive Plan	Local: Comprehensive Plan	<input checked="" type="checkbox"/>				<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Decommission and remove unneeded forest roads (SS, RD)			<input checked="" type="checkbox"/>				<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>				<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Increase size of protected areas around streams/wetlands (DE, SS, RD)	<p>Update Critical Areas Ordinance to meet Best Available Science recommendations.</p> <p>Acquire property or conservation easements.</p> <p>Allow for native growth protection easements in local land use regulations.</p>	Local: Critical Areas Ordinance	<input checked="" type="checkbox"/>				<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Require [properly functioning] septic systems (RD)				<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>

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Emphasize dispersive/infiltrative stormwater management (DE, RD)	Update Stormwater Management Plans to include low impact development measures Encourage and/or require use of LID approaches and techniques to better manage stormwater for new development, redevelopment and retrofit projects. This includes: limit land clearing, retain and, where necessary, restore native vegetation and soils, minimize site disturbance and development footprints, limit impervious surfaces through use of permeable pavement or other techniques, create graded swales and rain gardens to disperse and infiltrate stormwater runoff on site, and utilize rainwater catchment for landscaping irrigation.	Local: Stormwater Management Regulations		<input checked="" type="checkbox"/>				<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Ensure zoning is consistent with long-term protection of resources (e.g., clustered development, stable urban growth boundary) (DE, SS, RD)	Update Comprehensive Plan	Local: Comprehensive Plan		<input checked="" type="checkbox"/>				<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Increase size of protected areas around streams/wetlands, as needed to meet Best Available Science (DE, SS, RD)	Update Critical Areas Ordinance to meet Best Available Science recommendations. Acquire property or conservation easements. Allow for and incentivize native growth protection easements in local land use regulations.	Local: Critical Areas Ordinance, Development / Zoning regulations		<input checked="" type="checkbox"/>				<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Reduce drainage density of artificial channels (SS, RD)				<input checked="" type="checkbox"/>				<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Revegetate upland areas (DE, SS)		Local: Critical Areas Ordinance State: Forest Practices Act Ch. 76.09, RCW		<input checked="" type="checkbox"/>				<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Reduce GW withdrawals (RD)				<input checked="" type="checkbox"/>				<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>				<input checked="" type="checkbox"/>
Reduce interception of shallow GW in channels and road ditches (RD)				<input checked="" type="checkbox"/>				<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>				<input checked="" type="checkbox"/>
Replant deforested areas (DE)		Local: Critical Areas Ordinance State: Forest Practices Act Ch. 76.09, RCW		<input checked="" type="checkbox"/>				<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>		
Set back dikes/levees in key areas to restore overbank flooding (SS)		Local:		<input checked="" type="checkbox"/>				<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>		

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Restore stream reaches, floodplains, or wetlands to recover lost processes and functions (SS, RD)	<p>Prepare or update a Watershed Management Plan that includes restoration and enhancement projects.</p> <p>Update Shoreline Master Program Restoration Plan to include such projects that would benefit the shoreline jurisdiction.</p> <p>Institute a mitigation program as part of local Critical Areas Ordinance with suggested prioritized projects.</p>	<p>Local: Critical Areas Ordinance Shoreline Master Program Watershed Management plan</p>		<input checked="" type="checkbox"/>				<input checked="" type="checkbox"/>				<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Apply source controls for nitrogen and pathogens (SS)				<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	
Allow greater residence time of water on fields and ditches outside of growing season (SS, RD)				<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Encourage [properly functioning] septic systems (RD)				<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>
Ensure zoning is consistent with long-term protection of agriculture and resources (e.g., large parcel size; stable urban growth boundary) (DE, SS, RD)	<p>Update Comprehensive Plan</p> <p>Provide property tax incentives for protection of farmland.</p> <p>Obtain farmland protection grants for acquisition of property and easements.</p>	<p>Local: Comprehensive Plan, Land Use Regulations, Current Use Taxation Programs</p>		<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Reduce GW withdrawals (RD)				<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>					<input checked="" type="checkbox"/>
Reduce drainage density of artificial channels (SS, RD)				<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>				<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Establish buffers for water-quality improvement in strategic areas (DE, RD)	<p>Update Critical Areas Ordinance to meet Best Available Science recommendations.</p> <p>Acquire property or conservation easements.</p> <p>Allow for native growth protection easements in local land use regulations.</p>			<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>
Reduce interception of shallow GW in channels and road ditches (RD)				<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>					<input checked="" type="checkbox"/>
Revegetate upland areas (DE, SS)				<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
Set back dikes/levees in key areas to restore overbank flooding (SS)		<p>Local and Regional: Flood authorities, County flood control districts, Public Works</p>		<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		

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Construct stream reaches or constructed wetlands to recover lost processes and functions if/as feasible (SS, RD)	<p>Prepare or update a Watershed Management Plan that includes restoration and enhancement projects.</p> <p>Update Shoreline Master Program Restoration Plan to include such projects that would benefit the shoreline jurisdiction.</p> <p>Institute a mitigation program as part of local Critical Areas Ordinance with suggested prioritized projects.</p>	Local: Critical Areas Ordinance, Shoreline Master Program			<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Recommendations from Volume 1: Water Resources Assessment (Water Flow and Water Quality), April 2012 - available:
<http://www.ecy.wa.gov/services/gis/data/pugetsound/characterization.htm>

Content from Volume 1 'Solutions Templates' tables not included in EXCEL MATRIX

ALL LANDS - For relevant literature see: <http://www.ecy.wa.gov/biblio/wetlands.html>

FOREST LANDS - Common issues: widespread loss of vegetative cover, particularly in high-elevation snow and rain-on-snow areas, high in watersheds and so affecting many reaches downstream. Creation of new impervious surfaces rare, although a dense forest road network can greatly alter flow paths and sediment production.

RURAL LANDS - Common issues: Rural land use can drain key headwater wetlands, with potentially great effect on downstream flooding and erosion. Septic systems can be a source of nutrients and pathogens. Forest clearing increases overland flows, affecting stream/wetland structure and function. Groundwater withdrawal in rural residential areas can affect downstream discharge areas.

RURAL LANDS - For relevant literature see: <http://www.ecy.wa.gov/biblio/wq.html>

AGRICULTURAL LANDS - Common issues: Extensive drainage system reduces residence time of water on landscape and increases downstream delivery of water; also compromises water-quality functions of wetlands and floodplains. Potential source of nutrients, pathogens and sediment that impact downstream aquatic area; lack of vegetated buffers increases delivery and transport. Floodplains disconnected from overbank flooding and tidal processes. Groundwater withdrawals and diversions can significantly affect low-flow regimes and wetland hydrology.

URBAN AND SUBURBAN LANDS - Common issues: Areas of impervious surface impair multiple water-flow processes, resulting in simplification of habitat structure and functions, and compromising effective restoration of structure and function of aquatic habitat. Significant transport of pollutants generated by urban uses to aquatic areas. Note that development regulations will preempt/supersede some of these recommendations.