Envision Puget Sound - Scenario Descriptions

Three scenarios were developed for this study: 1) **Status Quo** (SQ), 2) **Managed Growth** (SG), and 3) **Unconstrained Growth** (UG). Primary characteristics of each scenario are defined below.

Scenario Quality	Status Quo (SQ)	Managed Growth (MG)	Unconstrained Growth (GT)
Population Allocation	Maintain existing allocation distributions	Greater allocation to UGA's; greater emphasis on concentrating growth around Regional Growth Centers	Greater allocation to areas outside UGA's; less emphasis on concentrating growth around Regional Growth Centers
Urban Growth Pattern	Maintain existing development pattern, mix of densities, uses	Emphasize higher densities; mix of residential/commercial/industrial; primarily urban form in residential development; floodplain avoidance	Emphasize commercial/industrial; lower residential densities, primarily suburban form in residential development
Rural Growth Pattern	Maintain existing development pattern, mix of densities, uses	Resource lands protected: Where conversion occurs, growth concentrated near existing density, away from resource uses, sensitive habitats, viewsheds	Distribute growth relatively uniformly, without consideration of resource uses, sensitive habitats
Nearshore /Coastline Development	Maintain existing development pattern, mix of uses	Restrict development in nearshore areas, particularly in areas near sensitive lands, certain shoreform types, away from wetlands, sensitive lands, unstable areas, viewsheds	Unrestricted development in nearshore areas
Shoreline Modifications	Maintain existing relationship between modification amounts/densities, population densities	Reduce amounts/densities of nearshore modifications relative to existing conditions	Increase amounts/densities of nearshore modifications relative to existing conditions
Sensitive Areas/Open Space	Maintain moderate level of protection of wetlands, some restoration of historic wetlands; Moderate level of new park/open spaces	High level of protection of existing, undeveloped historic wetlands; aggressive restoration of historic wetlands, protections of sites with high conservation/ restoration potential;	Low level of wetlands protection; no restoration of historic wetlands; no new parks/open space

		Aggressive levels of park/open space acquisition, both within and outside UGA's	

Model and Process Descriptions

Population Growth and Allocation

Population growth and development is modeled as a two step process involving interplay between policies setting up development opportunities and an autonomous process, *PopulationTarget*, that allocates new population. *PopulationTarget* works by creating and examining two surfaces: 1) a current population density surface, and 2) a population capacity surface. The population capacity surface represents the potential of the IDU's to contain population density. It is defined in spatially-dependent and scenario-specific terms in the input file to the target.dll process. Total population targets were computed for each sub-basin based on medium growth projection provided by the Washington State Office of Financial Management Allocation through 2030. Annual growth estimates for this period were extrapolated throughout the analysis period used to generate the scenarios. Sub-basin estimates were developed by area-weighting the county level estimates within each sub-basin. Summaries of these estimates are provided in Appendix 4. Estimates were spatialized to the IDU level using current IDU population density estimates disaggregated by DEV_CODE class. Population capacity estimates were computed dynamically during scenario runs using these DEV_CODE and sub-basin-specific capacity estimates and scenario-specific scalars based on proximity to regional growth centers. Representations of population input files for each sub-basin are available at http://envision/bioe.orst.edu/StudyAreas/PugetSound/PS_Population.html

Policies

In Envision, *policies* are the basic decision rules that guide and constrain actor behavior. The contain a number of attributes, most importantly a set of *site attributes,* expresses as a spatial query on the underlying IDU coverage, that determine where on the landscape the policy is potentially applicable, and zero or more *outcomes,* expressed in Envisions outcome specification language, that determines what happens, in terms of changes to the underlying IDU coverage, if an actor chooses to adopt a specific policy.

Policies were developed based on discussions with PSNERP and reflect several broad categories of policies, including 1) urbanization, 2) shoreline modifications, 3) preservation/conservation/restoration

of sensitive lands, and 4) miscellaneous additional policies. In most cases, general policies were developed with variations specific to each scenario. These are described below.

Many policies and scenarios are responsive to landscape feedbacks of various types. Examples include scarcity of resource lands and availability of residential capacity. These are described in more detail in the "Model and Process Descriptions" above.

Urban/Rural Growth and Resource Lands Conversion

Conversion of resource lands. Policies reflecting conversion of private agricultural and forested lands to developed uses were developed. The varied based on scenario, spatial location, and additional spatial attributes including location in floodplain, proximity to sensitive lands (defined as wetlands, eelgrass beds, herring spawning areas, and areas with good/very good conservation potential), proximity to major roads, and location of UGAs.   Only lands outside of the nearshore zone were considered; nearshore conversions are addressed below. In all cases, policies are applicable only to those IDUs outside the 1 km neashore area. IDUs in a protected status (those set aside for conservation purposes) are excluded from development in all scenarios. Development rules and scenario-specific modifications are summarized below:

Policy Intention	Site Attribute(s)	Policy Outcomes	Scenario-specific Modifications
Conversion of Agricultural Lands within UGAs	DEV_CODE =Ag and OWNER=Private and UGA=1	DEV_CODE, LULC converts to Urban or Suburban with associated probability	SQ: equal probability of transition across all development classes. Moderately responsive to scarcity of residential lands.
Conversion of Agricultural Lands outside UGAs	DEV_CODE=Ag and OWNER=Private and UGA=0	DEV_CODE, LULC converts to Rural Residential or Suburban with associated probability	MG: limited conversion; where conversion occurs, probabilities biased to higher-density development patterns, limited to areas near regional growth centers (DIST_RGC), and away from sensitive lands, areas with high conservation potential, floodplains, and near streams.
Conversion of Forested Lands within UGAs	DEV_CODE=Forest and OWNER=Private and UGA=1	DEV_CODE, LULC converts to Urban or Suburban with associated probability	
Conversion of Forested Lands outside UGAs	DEV_CODE=Forest and OWNER= Private and UGA=0	DEV_CODE, LULC converts to Rural Residential or Suburban with associated probability	UG: probabilities biased to lower-density development patterns; less sensitivity to scarcity of residential capacity

Infill and Densification. Infill involves the conversion of underdeveloped, private residential lands within UGA's to higher densities. Underdeveloped lands are defined as those areas where available population density capacity exceeds 50 percent of total capacity. Details varied by scenario, with the SQ scenario

having moderate conversion rates, SG emphasizing conversion to higher-density uses as well as parks, and UG emphasizing conversion to commercial/industrial uses.

Policy Intention	Site Attribute(s)	Policy Outcomes	Scenario-specific Modifications
Infill of Commercial/ Industrial	UGA=1 and OWNER=1 and P_POP_AVAIL > 0.50 and DEV_CODE = Commercial	DEV_CODE/LULC converts to Comm/Ind/Urban/ Parks with associated probability	SQ: Moderately responsive to scarcity of commercial development.

MG: limited conversion; where conversion occurs, probabilities biased to higher-density development patterns, limited to areas near regional growth centers. Strongly responsive to scarcity in commercial development; |
| Infill/ Densification to Residential Uses | UGA=1 and OWNER=1 and P_POP_AVAIL > 0.50 and DEV_CODE = Urban/Suburban Low Density | DEV_CODE/LULC converts to Urban/Suburban Med/High Density and Parks with associated probability | UG: probabilities biased to lower-density development patterns; Insensitive to level of existing commercial development |

Conversion of Barren Land. Barren Lands are defined as undeveloped, unvegetated lands that have typically been cleared of vegetation via human modification, for example brownfield areas. Conversion of barren land occurs both within and outside UGAs.   Development to both Commercial, Urban and Park uses occurs within UGAs; outside UGAs conversion to Residential and Park uses occurs.

Policy Intention	Site Attribute(s)	Policy Outcomes	Scenario-specific Modifications
Within UGA Conversion	LULC_B=Barren and OWNER = 1 and UGA = 1	DEV_CODE, LULC converts to Comm/Urban/Parks with associated probability	SQ: equal probability of transition across all development classes.

MG: probabilities biased to higher-density development patterns; sensitive lands converted to protected vegetated lands (outside UGAs) and Parks (within UGAs) |
| Outside UGA Conversion | | DEV_CODE, LULC converts to Rural Residential/Parks with associated probability | Unconstrained Growth: probabilities biased to lower-density development patterns |

Nearshore/Shoreline Development

Nearshore development is treated separately from other development. Nearshore development is defined as development occurring in one of two regions: 1) within 200 ft of a shoreline (shoreline development), and 2) beyond 200 ft but within 1 km of a coastline (nearshore development). Nearshore development processes are impacted by proximity to existing road network, location in a viewshed, and development opportunity expressed via IDU proximity to sensitive lands, shoreforms, and similar attributes. Because scenarios differ widely in their treatment of nearshore/coastline development, we provide policy descriptors for each scenario below. In all cases, policies are constrained to those parcels within 1 km of the coastline.

Status Quo: Allows moderate levels of development in most areas. No development is allowed on deltas, within floodplains, or in areas with unstable slopes; development on existing wetlands is limited. Development pattern emphasizes moderate density uses.

Policy Intention	Site Attribute(s)	Policy Outcomes
Conversion of undeveloped lands to commercial/ residential development	DEV_CODE = Ag or DEV_CODE = Forest and OWNER=1 and CURR_SHORE != Delta and FLOOD != 1 and SLOPE_STAB != unstable • IDU's near roads have an increased likelihood of development; • Those containing wetlands (P_CURRWET > 0.20) have a reduced likelihood of development; • Those with a water view have an increased likelihood of development; • Those in an existing UGA have a higher probability of development	DEV_CODE/LULC converts to Comm/Urban/ Suburban/Parks with associated probability, emphasizing a mix of densities
Infill/Densification of Residential Development	DEV_CODE = Urban/Suburban/Rural Residential and OWNER=1 and CURR_SHORE != Delta and FLOOD != 1 and SLOPE_STAB != unstable • IDU's near roads have an increased likelihood of development; • Those containing wetlands (P_CURRWET > 0.20) have a reduced likelihood of development; • Those with a water view have an increased likelihood of development; • Those in an existing UGA have a higher probability of development	DEV_CODE/LULC converts to higher-density Urban/ Suburban/ Rural Residential with associated probability, emphasizing a mix of densities

Managed Growth: No new development is allowed within 200 ft of the shoreline. Outside the 200 ft zone development is severely restricted in areas near sensitive lands, including current and historic

wetlands, lands with significant conservation opportunities, or lands adjacent to streams. Water views are protected. In existing developed areas, focus is on increasing density.

Policy Intention	Site Attribute(s)	Policy Outcomes
Conversion of undeveloped lands to commercial/ residential development	DEV_CODE = Ag or DEV_CODE = Forest and OWNER=1 and CURR_SHORE != Delta and FLOOD != 1 and SLOPE_STAB != unstable and DIST_COAST > 200 and P_CURRWET < 0.10 and CONSERV < good/very good and DIST_STR > 20 • IDU's near roads have an increased likelihood of development; • Those with a water view have an decreased likelihood of development; • Those in an existing UGA have a higher likelihood of development; • Those near regional growth centers have an increased likelihood of development; • Those occupying historic wetlands are less likely to be developed.	DEV_CODE converts to Comm/Urban/ Suburban/Parks with associated probability, higher density classes; parks emphasized

Unconstrained growth: The Unconstrained Growth scenario allows significant new development in the nearshore. No development is allowed on deltas or on unstable slopes, but other shoreforms are developable. Development pattern emphasizes low-density uses.

Policy Intention	Site Attribute(s)	Policy Outcomes
Conversion of undeveloped lands to commercial/ residential development	DEV_CODE = Ag or DEV_CODE = Forest and OWNER=1 and CURR_SHORE != Delta and FLOOD != 1 and SLOPE_STAB != unstable • IDU's near roads have an increased likelihood of development; • those with a water view have an increased likelihood of development; • those in an existing UGA have a higher probability of development	DEV_CODE/LULC converts to Comm/Urban/ Suburban/Parks with associated probability, emphasizing lower density uses
Infill/Densification of Residential Development	DEV_CODE = Urban/Suburban/Rural Residential and OWNER=1 and CURR_SHORE != Delta and FLOOD != 1 and SLOPE_STAB != unstable • IDU's near roads have an increased likelihood of development; • those containing wetlands (P_CURRWET > 0.20) have a reduced likelihood of development; • those with a water view have an increased likelihood of development;	DEV_CODE/LULC converts to higher-density Urban/ Suburban/ Rural Residential with associated probability, emphasizing lower-density uses

	• those in an existing UGA have a higher probability of development	

Shoreline Modifications.

Shoreline modifications considered include tidal barriers, shoreline fill, armoring, overwater structures (OWS), breakwaters/jetties. Modifications follow development and allocation of new population at fixed ratios that vary by scenario. These ratios are derived from current conditions in each sub-basin.

For example, the following table summarizes the amount of armoring for each geomorphic type on Bainbridge Island. As new development occurs, associated armoring is applied consistent with these values.

Percent Shoreline Armored	Artificial	Barrier Beach	Barrier Estuary	Barrier Lagoon	Bluff Backed Beach	Open Coastal Inlet	Plunging Bluff	Rocky Platform
0	2	117	26	35	238	44	0	14
0 To 20	1	11	1	3	36	11	0	6
20 To 40	1	4	7	4	29	10	0	3
40 To 60	0	13	3	3	40	10	1	4
60 To 80	1	13	2	5	52	11	0	5
80 To 100	6	91	26	15	641	111	3	114
Total	11	249	65	65	1036	197	4	146

A similar approach is taken with other nearshore modifications.

Sensitive Areas/Conservation Lands/Open Space

Policies for protection of sensitive areas and open spaces are included in the scenarios. Sensitive areas are defined as wetlands, eelgrass beds, herring spawning areas, and areas with good/very good conservation potential. Generally scenarios vary in terms of their overall level of protection of sensitive areas.

Status Quo: Maintain moderate level of protection of wetlands, some restoration of historic wetlands; Moderate level of protection of existing open space areas. Moderate level of protection of IDUs adjacent to eelgrass beds, herring spawning areas.

Policy Intention	Site Attribute(s)	Policy Outcomes
Protection of existing wetlands	LULC_B = wetlands and P_CURR_WET > 0.1 • those outside an existing UGA have a lower probability of protection	STATUS = protected
Restoration of historic wetlands	DEV_CODE = Ag or Forestry, P_CURR_WET < 0.1, P_HIST_WET > 0.50 • those outside an existing UGA have a lower probability of protection	LULC_B=wetlands, STATUS = protected
Protection of Eelgrass/Herring Spawning areas	NextTo(EELCONT > 10 or EELPATCH > 20) and DEV_CODE = Ag or Forestry	STATUS = protected

Open Space Protection	DEV_CODE = open space	STATUS = protected

Managed Growth: This scenario reflective a high level of protection of existing and undeveloped historic wetlands; aggressive restoration of historic wetlands, protections of sites with high conservation/ restoration potential. No development is allowed next to Eelgrass/Herring Spawning areas. Existing open space is precluded from development.

Policy Intention	Site Attribute(s)	Policy Outcomes
Protection of existing wetlands	LULC_B = wetlands and P_CURR_WET > 0.1 • All IDUs outside an existing UGA are protected. Within UGAs, a higher probability of protection is specified	STATUS = protected
Restoration of historic wetlands	DEV_CODE = Ag or Forestry, P_CURR_WET < 0.1, P_HIST_WET > 0.50 • those outside an existing UGA have a lower probability of protection	LULC_B=wetlands, P_CURR_WET= P_HIST_WET, STATUS = protected
Protection of Eelgrass/Herring Spawning areas	NextTo(EELCONT > 10 or EELPATCH > 20) and DEV_CODE = Ag or Forestry • Applies to all undeveloped IDUs	STATUS = protected
Open Space Protection	DEV_CODE = open space	STATUS = protected