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| **DATE** | JUNE 28, 2022 |
| **TO** | WASHINGTON DEPARTMENT OF ECOLOGY, SW REGIONAL OFFICE, WATER QUALITY PROGRAM |
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# CITY OF PORT ANGELES | STORMWATER MANAGEMENT ACTION PLANNING

## FINAL RECEIVING WATER PRIORITIZATION MEMO

GRANT AGREEMENT #WQC-2022-POANPW-00164 | DELIVERABLE 4.5

## INTRODUCTION

Over the past several decades, urbanization has altered the natural environment; including habitat structure, flow regime, and the water quality of downstream waterbodies (Booth 2005). To accommodate growth and development while taking measures to minimize or preventing water quality degradation, the Western Washington Phase II Municipal Stormwater Permit (the Permit) has required all Phase II Permitees, including the City of Port Angeles (the City), to develop a Stormwater Management Action Plan (SMAP) for one high-priority basin located within the City's jurisdiction. The SMAP process is a planning approach that emphasizes the protection of designated waters and improvements to receiving water quality and its habitat through strategic retrofits, land management strategies, and Stormwater Management Plan (SWMP) enhancements. The first step of the SMAP process, the Receiving Water Conditions Assessment (Osborn Consulting 2022), delineated the City's basins and identified the receiving waters, gathered data to assess the receiving water conditions, and evaluated the stormwater management influence. Building on the Receiving Waters Conditions Assessment, a prioritization method was developed and implemented to determine which receiving water will receive the most benefit from strategic retrofits and land management actions.

This technical memorandum describes the prioritization methodology, the results of the City's receiving water prioritization process, and identifies a high priority catchment area that will be focused on in the upcoming final phase of this effort – development of an SMAP.

## METHODOLOGY OVERVIEW

This receiving water prioritization method follows the process outlined in the Stormwater Management Action Planning Guidance (SMAP Guidance) document, which was developed by Washington State Department of Ecology (Ecology), as well as Chapter 4 of the Building Cities in the Rain (BCitR). BCitR is a guidance document developed by the Washington State Department of Commerce to provide tools for local governments to target investment in stormwater retrofits that leverage the restoration of salmonid habitat while facilitating redevelopment in urban centers (Ballash 2006). To determine the highest-priority receiving water basin for a SMAP, each basin was scored relative to other basins within the City's jurisdictional limits. Scoring was conducted using various metrics to determine the level of importance assigned to natural processes and aquatic species, as well as the current relative level of degradation for each basin.

Metrics used to measure level of importance for natural processes and aquatic species included the following:

- Documented fish presence
- Forested land cover
- Total stream length within the City
- Forested land cover in stream corridor
- Wetland land cover
- Infiltration potential

Metrics used to measure level of degradation from development included the following:

- Water quality impairment
- Impervious surface land cover
- Stream crossings
- Miles of major corridors

Each metric was scored on a scale from zero to three and the scores were averaged to produce a final basin score for importance and degradation. The scores for each metric were assigned based on the basin characteristic information that was collected during the Receiving Water Conditions Assessment (Osborn Conuslting 2022). Using the final scores for level of importance and level of degradation, each basin fell into one of the four categories described below and illustrated on Figure 1:

- **Restoration** – Highest importance for restoring water resource functions, but greatest degradation. These basins will likely benefit the most from a regional retrofit project and may require the most intensive management strategies.

- **Conservation** – Low importance, but also low degradation. These basins should require a lower level of management attention.

- **Protection** – High importance and low existing degradation. These basins will likely benefit the most from stormwater management and regulated development (appropriate zoning or protective easements) and may need little or no active intervention to maintain high functional conditions.

- **Development** – Low importance and significant existing human impact. These basins are the most appropriate areas for development.

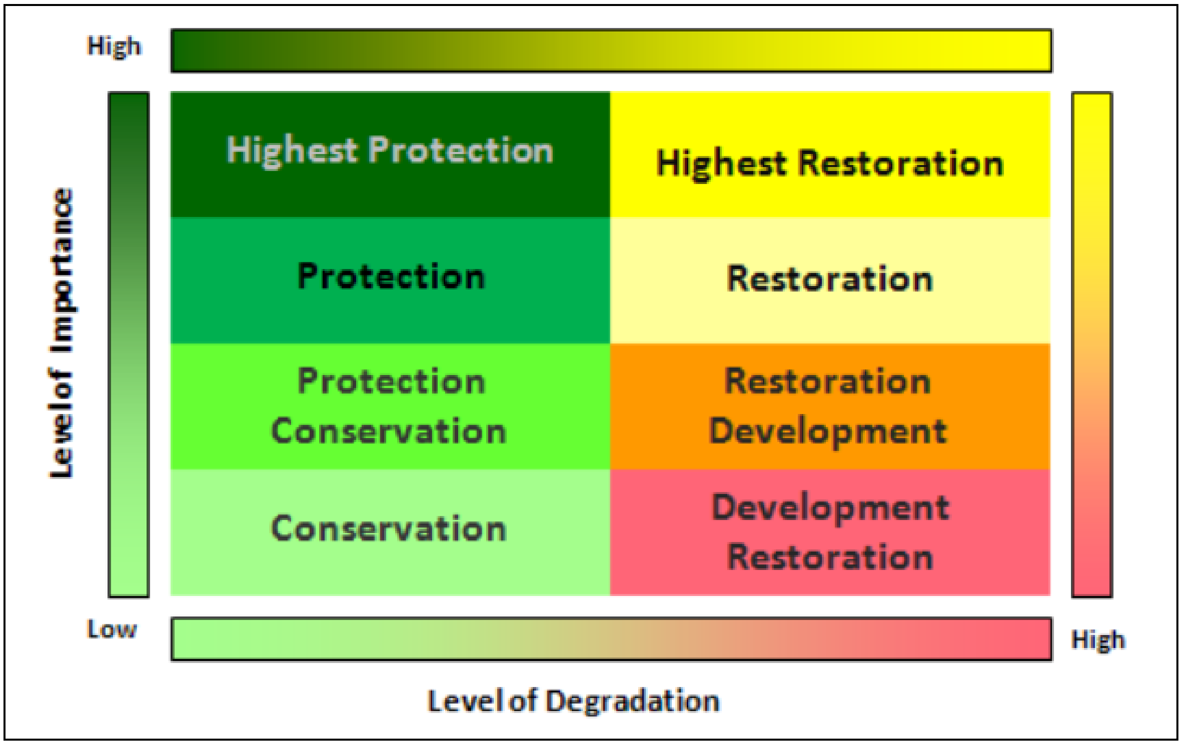



**Figure 1: Puget Sound Watershed Characterization Management Strategy Matrix**

Both the SMAP Guidance and BCitR suggest that basins falling into the *Protection* and *Restoration* categories should be prioritized for strategic retrofits and land management activities (Ballash 2006). Basins that fell into these categories during the Receiving Water Conditions Assessment were further assessed and evaluated based on the following criteria:

- Extent of municipality's influence
- Opportunity for retrofits
- Water quality treatment and stormwater infrastructure
- Pre-existing local or regional projects planned within the basin
- Overburdened communities

Using the criteria above, one high-priority basin was selected from those that fell into the Protection or Restoration category to move forward with the development of the SMAP document. The following sections discuss in greater detail the different metrics, scoring systems, and results for determining the level of importance for natural processes and aquatic species, level of degradation from development, and selection of the high-priority basin for the SMAP.

# Importance For Natural Processes and Aquatic Species

## Documented Fish Presence

Using the Washington Department of Fish and Wildlife (WDFW) SalmonScape online mapping tool, documented fish presence was scored based on the number of observed species within each basin and in their downstream receiving waters (Port Angeles Harbor and the Strait of Juan de Fuca). Basins with multiple observed species scored higher than those with limited or no fish presence. Scoring criteria is provided in Table 1 and results for each basin are provided in Table 2.

**TABLE 1 | DOCUMENTED FISH PRESENCE**

| Document Fish Presence | Score |
|---|---|
| No Known or Observed Fish Species | 0 |
| Single Documented Species within Basin or >3 number of Species in Downstream RW | 1 |
| Two Documented Species within Basin and >3 number of Species in Downstream RW | 2 |
| Three or More Documented Species within Basin and >3 number in Downstream RW | 3 |

**TABLE 2 | DOCUMENTED FISH PRESENCE RESULTS**

| Basin Name | Number of Fish Species within Basin (Freshwater) | Number of Fish Species in Downstream Receiving Waters (Saltwater) | Total Number of Fish Species | Score |
|---|---|---|---|---|
| Dry Creek | 4 | > 3 | > 3 | 3 |
| Tumwater Creek | 4 | > 3 | > 3 | 3 |
| Valley Creek | 4 | > 3 | > 3 | 3 |
| Peabody Creek | 2 | > 3 | > 3 | 2 |
| White Creek | 2 | > 3 | > 3 | 2 |
| Ennis Creek | 6 | > 3 | > 3 | 3 |
| Ocean 7 | 0(1) | > 3 | > 3 | 1 |
| Ocean 8 | 0(1) | > 3 | > 3 | 1 |
| Ocean 9 | 0(1) | > 3 | > 3 | 1 |
| Ocean 10 | 0(1) | > 3 | > 3 | 1 |
| Ocean 11 | 0(1) | > 3 | > 3 | 1 |
| Ocean 12 | 0(1) | > 3 | > 3 | 1 |
| Ocean 13 | 0(1) | > 3 | > 3 | 1 |
| Ocean 14 | 0(1) | > 3 | > 3 | 1 |
| Ocean 15 | 0(1) | > 3 | > 3 | 1 |

Note:
(1) No freshwater stream exists in these basins.

## FORESTED LAND COVER

Receiving water health is often dependent on land cover within the overall basin. Receiving water health can be managed by minimizing impervious surface and maximizing preservation of native forest cover. Forested land cover produces less stormwater runoff and does not typically generate pollutants commonly associated with impervious surfaces, such as suspended solids, petroleum hydrocarbons, and heavy metals. It is suggested that stream quality is best maintained when impervious surface is limited to less than 10 percent and at least 65 percent of forested cover is retained (Schueler 2003). Forested land cover was scored based on the percent of forested land cover in each basin. Scoring criteria is provided in Table 3 and results for each basin are provided in Table 4.

**TABLE 3 | FORESTED LAND COVER**

| Forest Land Cover (%) | Score |
|---|---|
| 0 – 10 | 0 |
| 10 – 25 | 1 |
| 25 – 65 | 2 |
| > 65 | 3 |

**TABLE 4 | FORESTED LAND COVER RESULTS**

| Basin Name | Percent Forest Land Cover (%) | Score |
|---|---|---|
| Dry Creek | 19 | 1 |
| Tumwater Creek | 16 | 1 |
| Valley Creek | 24 | 1 |
| Peabody Creek | 15 | 1 |
| White Creek | 26 | 2 |
| Ennis Creek | 28 | 2 |
| Ocean 7 | 23 | 1 |
| Ocean 8 | 9 | 0 |
| Ocean 9 | 25 | 1 |
| Ocean 10 | 8 | 0 |
| Ocean 11 | 0 | 0 |
| Ocean 12 | 2 | 0 |
| Ocean 13 | 10 | 0 |
| Ocean 14 | 17 | 1 |
| Ocean 15 | 1 | 0 |

## TOTAL IN-CITY STREAM LENGTH

The length of stream within City limits corresponds to the extent of the receiving water that the City can directly influence through strategic retrofits and land management strategies. Stream length also indicates the potential for fish and other aquatic habitat. Total stream length in the City was scored based on the miles of stream in each basin that lies within City limits. Scoring criteria is provided in Table 5 and results for each basin are provided in Table 6.

**TABLE 5 | TOTAL STREAM LENGTH IN CITY**

| Miles of Stream within City | Score |
|---|---|
| 0 – 1 | 0 |
| 1 – 2 | 1 |
| 2 – 3 | 2 |
| >3 | 3 |

**TABLE 6 | TOTAL STREAM LENGTH IN CITY RESULTS**

| Basin Name | Freshwater Stream within City Limits (miles) | Score |
|---|---|---|
| Dry Creek | 2.41 | 2 |
| Tumwater Creek | 1.69 | 1 |
| Valley Creek | 3.43 | 3 |
| Peabody Creek | 2.46 | 2 |
| White Creek | 1.38 | 1 |
| Ennis Creek | 1.32 | 1 |
| Ocean 7 | 0 | 0 |
| Ocean 8 | 0 | 0 |
| Ocean 9 | 0 | 0 |
| Ocean 10 | 0 | 0 |
| Ocean 11 | 0 | 0 |
| Ocean 12 | 0 | 0 |
| Ocean 13 | 0 | 0 |
| Ocean 14 | 0 | 0 |
| Ocean 15 | 0 | 0 |

## FORESTED LAND COVER WITHIN STREAM CORRIDOR

In addition to the total forested land cover within the basin, forested land cover specifically within the stream corridor is also important because it provides benefits such as stabilizing eroding banks; providing shade, shelter, and food for fish and other aquatic organisms; providing other critical wildlife habitat; and recreational space for the community (USDA 2022).

Port Angeles Municipal Code (PAMC) defines the stream corridor width dimension for Type 3 and Type 4 streams as 150 feet and 100 feet, respectively, as measured from the seasonal high-water mark or elevation of the stream. Forested land cover within the stream corridor was scored based on the percent of forested land cover within the stream corridor in each basin. Scoring criteria is provided in Table 7 and results for each basin are provided in Table 8.

**TABLE 7 | FOREST IN STREAM CORRIDOR**

| Percent Forest in Stream Corridor | Score |
|---|---|
| 0 – 10 | 0 |
| 10 – 25 | 1 |
| 25 – 65 | 2 |
| > 65 | 3 |

| TABLE 8 \| FORESTED LAND COVER IN STREAM CORRIDOR RESULTS | | |
|---|---|---|
| **Basin Name** | **Percent Forested Land Cover in Stream Corridor** | **Score** |
| Dry Creek | 54 | 2 |
| Tumwater Creek | 56 | 2 |
| Valley Creek | 53 | 2 |
| Peabody Creek | 65 | 3 |
| White Creek | 76 | 3 |
| Ennis Creek | 66 | 3 |
| Ocean 7 | 0(1) | 0 |
| Ocean 8 | 0(1) | 0 |
| Ocean 9 | 0(1) | 0 |
| Ocean 10 | 0(1) | 0 |
| Ocean 11 | 0(1) | 0 |
| Ocean 12 | 0(1) | 0 |
| Ocean 13 | 0(1) | 0 |
| Ocean 14 | 0(1) | 0 |
| Ocean 15 | 0(1) | 0 |

Note:
(1) No freshwater stream exists in these basins.

## WETLAND LAND COVER

Research has shown manmade and natural wetlands are effective at reducing nutrients, sediment, organic carbon, and heavy metals from stormwater runoff in urbanized areas (Tilley and Brown 1998). Wetlands also provide habitat for several aquatic species. The percent wetland land cover score was derived from the percentage of each basin that is occupied by wetlands. Wetland land cover data was provided by the City from the City's GIS database; however, the wetland in Ocean Basin 14 was removed, as it represented an industrial settling pond that no longer exists. Scoring criteria is provided in Table 9 and results for each basin are provided in Table 10.

| TABLE 9 \| PERCENT WETLAND LAND COVER | |
|---|---|
| **Percent Wetland Land Cover** | **Score** |
| 0 – 1 | 0 |
| 1 – 2 | 1 |
| 2 – 3 | 2 |
| > 3 | 3 |

TABLE 10 | PERCENT WETLAND LAND COVER RESULTS

| Basin Name | Percent Wetland Land Cover | Score |
|---|---|---|
| Dry Creek | 16.3 | 3 |
| Tumwater Creek | 1.8 | 1 |
| Valley Creek | 0.0 | 0 |
| Peabody Creek | 0.3 | 0 |
| White Creek | 0.0 | 0 |
| Ennis Creek | 0.1 | 0 |
| Ocean 7 | 1.2 | 1 |
| Ocean 8 | 0.7 | 0 |
| Ocean 9 | 0.0 | 0 |
| Ocean 10 | 9.1 | 3 |
| Ocean 11 | 0.3 | 0 |
| Ocean 12 | 0.0 | 0 |
| Ocean 13 | 2.4 | 2 |
| Ocean 14 | 0.0 | 0 |
| Ocean 15 | 0.0 | 0 |

## INFILTRATION POTENTIAL – SOILS

Using the US Department of Agriculture (USDA) soil classification system, soils in hydrologic soil group "A" have the greatest potential for infiltration. A basin's greater potential to infiltrate runoff is presumed to correspond to improved water quality (via filtration and adsorption) and reduced peak flow in the downstream receiving water. Additionally, basins with group A soils are more feasible for applying low impact development (LID) practices. Infiltration potential was scored by the precent of each basin with soils in hydrologic group A. Including hydrologic group  B and B/D soils was considered for this evaluation, however, adding the additional soil criteria did not produce different results. Scoring criteria is provided in Table 11 and results for each basin are provided in Table 12.

TABLE 11| INFILTRATION POTENTIAL

| Percent of Basin with Type A Soils | Score |
|---|---|
| 0 – 10 | 0 |
| 10 – 20 | 1 |
| 20 – 30 | 2 |
| >30 | 3 |

TABLE 12 | INFILTRATION POTENTIAL RESULTS

| Basin Name | Percent of Basin with Type A Soils | Score |
|---|---|---|
| Dry Creek | 4.2 | 0 |
| Tumwater Creek | 9.5 | 0 |
| Valley Creek | 25.9 | 2 |
| Peabody Creek | 11.3 | 1 |
| White Creek | 25.4 | 2 |
| Ennis Creek | 25.7 | 2 |
| Ocean 7 | 44.0 | 3 |
| Ocean 8 | 7.4 | 0 |
| Ocean 9 | 17.0 | 1 |
| Ocean 10 | 11.9 | 1 |
| Ocean 11 | 0.3 | 0 |
| Ocean 12 | 2.7 | 0 |
| Ocean 13 | 19.5 | 1 |
| Ocean 14 | 37.2 | 3 |
| Ocean 15 | 0.2 | 0 |

## IMPORTANCE FOR NATURAL PROCESSES AND AQUATIC SPECIES SUMMARY

Table 13 includes a summary by basin of the scores for each metric measuring the level of importance for natural processes and aquatic species. The scores for individual metrics were averaged to determine the final basin scores. The final level of importance score for each basin was then placed along the Importance axis of the prioritization matrix, ranging from low to high, which correlates to the categories "Conservation" to "Highest Protection." It is important to note these designations are relative only to the metrics chosen for this assessment and to each other. Figure 2 provides a map that shows the relative importance of each basin.

TABLE 13| FINAL BASIN IMPORTANCE SCORES

| Basin Number and Name | Documented Fish Presence[1] | Forested Land Cover[2] | Total In-City Stream Length[3] | Forest Riparian Buffer[2,4] | Wetland Land Cover[5] | Infiltration Potential[6] | **TOTAL AVERAGED SCORE** |
|---|---|---|---|---|---|---|---|
| 1 Dry Creek | 3 | 1 | 2 | 2 | 3 | 0 | **1.83** |
| 2 Tumwater Creek | 3 | 1 | 1 | 2 | 1 | 0 | **1.33** |
| 3 Valley Creek | 3 | 1 | 3 | 2 | 0 | 2 | **1.83** |
| 4 Peabody Creek | 2 | 1 | 2 | 3 | 0 | 1 | **1.50** |
| 5 White Creek | 2 | 2 | 1 | 3 | 0 | 2 | **1.67** |
| 6 Ennis Creek | 3 | 2 | 1 | 3 | 0 | 2 | **1.83** |
| 7 Ocean 7 | 1 | 1 | 0 | 0 | 1 | 3 | **1.00** |
| 8 Ocean 8 | 1 | 0 | 0 | 0 | 0 | 0 | **0.17** |
| 9 Ocean 9 | 1 | 1 | 0 | 0 | 0 | 1 | **0.50** |
| 10 Ocean 10 | 1 | 0 | 0 | 0 | 3 | 1 | **0.83** |
| 11 Ocean 11 | 1 | 0 | 0 | 0 | 0 | 0 | **0.17** |
| 12 Ocean 12 | 1 | 0 | 0 | 0 | 0 | 0 | **0.17** |
| 13 Ocean 13 | 1 | 0 | 0 | 0 | 2 | 1 | **0.67** |
| 14 Ocean 14 | 1 | 1 | 0 | 0 | 0 | 3 | **0.83** |
| 15 Ocean 15 | 1 | 0 | 0 | 0 | 0 | 0 | **0.17** |

Notes and Assumptions:

1. Fish Presence data was collected from Washington Department of Fish & Wildlife's (WDFW) SalmonScape online mapping tool.
2. Forested Land Cover data was collected from the Multi-Resolution Land Characteristics Consortium, National Land Cover Database (2019). Data provided in raster form with 100'x100' resolution. Land Cover Data was updated using aerial imagery.
3. Stream Length data was provided by the City of Port Angeles from the City's GIS database.
4. Stream Corridor dimensions outlined in Port Angeles Municipal Code were identified based on Stream Type.
5. Wetland Land Cover data was provided by the City of Port Angeles and from the City's GIS database.
6. Infiltration Potential Data was collected from the NRCS Web Soil Survey tool.

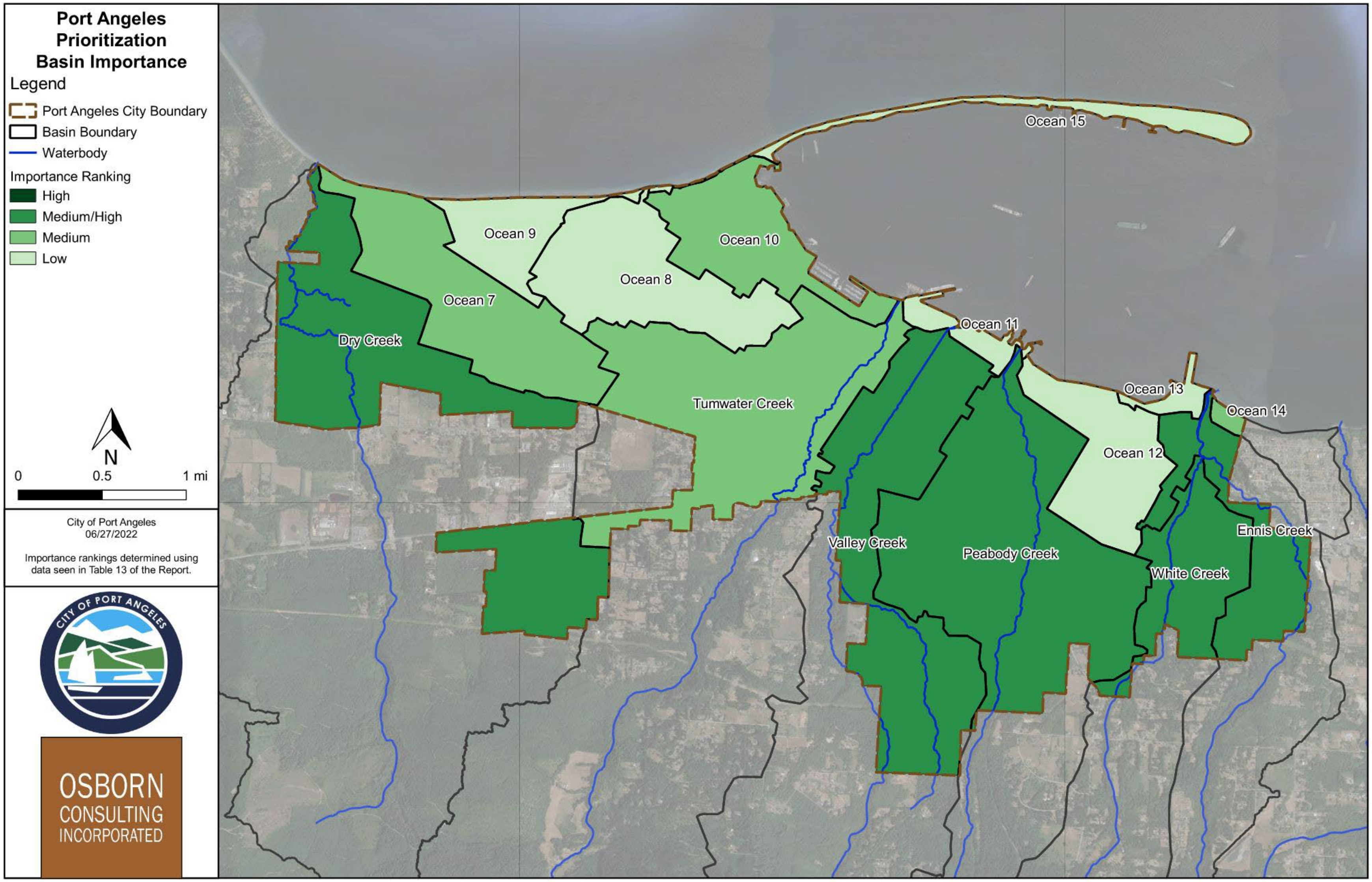



**Figure 2: Basin Importance Rankings**

# DEGRADATION

## WATER QUALITY IMPAIRMENT

The Federal Clean Water Act requires each state to perform a water quality assessment on rivers, lakes, and marine water bodies every 2 years. Assessed water bodies get placed into categories that describe the quality of the water and status of any needed cleanup (Ecology 2022). This assessment is used to better allocate state resources by focusing limited resources on the water bodies with greatest impairment. Water quality impairment was scored based on the number of Category 5 constituents in the freshwater creek for creek basins and the number of Category 5 constituents in the downstream receiving waters for ocean basins, according to Ecology's Water Quality Atlas Online Mapping Tool for Assessed Water/Sediment Impairments and Water Quality Standards. Category 5 indicates the water body has one or more constituents that require a water quality improvement project. Basins with multiple Category 5 constituents scored higher than basins with limited to no Category 5 impairments. Scoring criteria is provided in Table 14 and results for each basin are provided in Table 15.

TABLE 14 | WATER QUALITY IMPAIRMENT

| Number of Category 5 Constituents | Score |
|---|---|
| 0 | 0 |
| 1 | 1 |
| 2 | 2 |
| >2 | 3 |

TABLE 15 | WATER QUALITY IMPAIRMENT RESULTS

| Basin Name | Number of Category 5 Constituents | Score |
|---|---|---|
| Dry Creek | 3 | 3 |
| Tumwater Creek | 1 | 1 |
| Valley Creek | 1 | 1 |
| Peabody Creek | 4 | 3 |
| White Creek | 0 | 0 |
| Ennis Creek | 2 | 2 |
| Ocean 7 | 0 | 0 |
| Ocean 8 | 0 | 0 |
| Ocean 9 | 0 | 0 |
| Ocean 10 | 0 | 0 |
| Ocean 11 | 0 | 0 |
| Ocean 12 | 1 | 1 |
| Ocean 13 | 4 | 3 |
| Ocean 14 | 0 | 0 |
| Ocean 15 | 2 | 2 |

## IMPERVIOUS SURFACE LAND COVER

In general, impervious surfaces within a tributary basin have known adverse impacts on receiving waters. The natural hydrologic cycle is disrupted, runoff volume and peak flow are known to increase, and water quality is degraded through increased stormwater pollutants. An Impervious Cover Model (ICM) was developed by the Center for Watershed Protection (CWP) to predict the behavior of urban stream indicators, such as increased runoff volume or increased peak discharge, based on the percent impervious cover in the contributing watershed. The model was originally developed with more than two dozen research studies that documented a reasonably strong relationship between watershed impervious cover and various indicators of stream quality. Since model development, the model has been tested by more than 250 research studies and is applicable in the Pacific Northwest; one of the locations where it has been tested. The results of the model indicated that impervious cover in the 1 to 10-percent range has the least influence on stormwater runoff. The influence of impervious cover on stormwater becomes more pronounced within the 10 to 25-percent range and water quality degradation is almost inevitable once basin coverage exceeds 25 percent (Schueler 2003). Stream quality compared to watershed impervious cover as predicted by the ICM is shown on Figure 3.

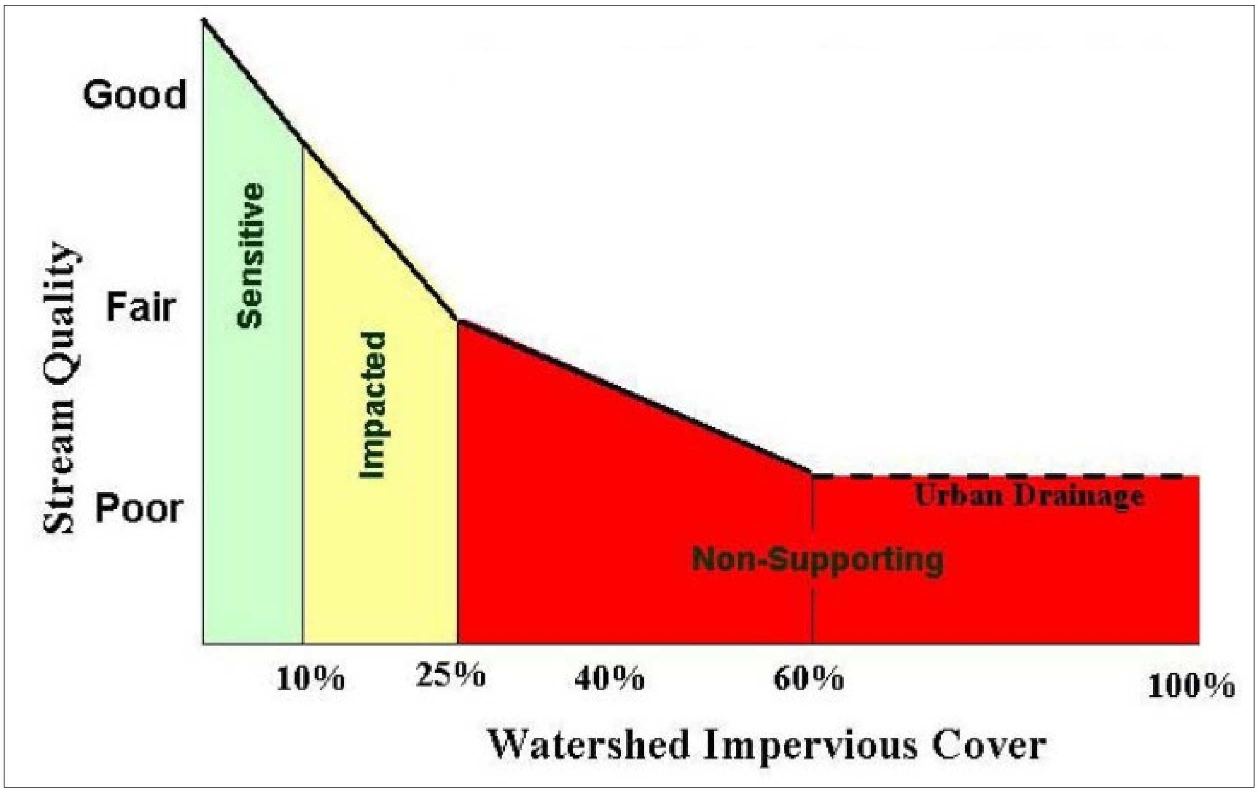



**Figure 3: Stream Quality as Predicted by the Impervious Cover Model**

Percent impervious surface land cover was scored based on the percent impervious surface in each basin using the percent ranges produced by the ICM. Scoring criteria is provided in Table 16 and results for each basin are provided in Table 17.

TABLE 16| IMPERVIOUS LAND COVER

| Percent Impervious Surface Land Cover | Score |
|---|---|
| 0 – 10 | 0 |
| 10 – 25 | 1 |
| 25 – 60 | 2 |
| > 60 | 3 |

| TABLE 17 \| IMPERVIOUS LAND COVER RESULTS | | |
|---|---|---|
| **Basin Name** | **Percent Impervious Surface Land Cover** | **Score** |
| Dry Creek | 32 | 2 |
| Tumwater Creek | 53 | 2 |
| Valley Creek | 48 | 2 |
| Peabody Creek | 51 | 2 |
| White Creek | 43 | 2 |
| Ennis Creek | 38 | 2 |
| Ocean 7 | 50 | 2 |
| Ocean 8 | 56 | 2 |
| Ocean 9 | 44 | 2 |
| Ocean 10 | 54 | 2 |
| Ocean 11 | 85 | 3 |
| Ocean 12 | 73 | 3 |
| Ocean 13 | 41 | 2 |
| Ocean 14 | 52 | 2 |
| Ocean 15 | 30 | 2 |

## MILES OF MAJOR CORRIDORS

Roadway corridors, especially those with high traffic volume, contain impervious surfaces that are associated with increased levels of pollutants, such as suspended solids and heavy metals (Schmidt and Michaud 2020). The City has defined principal arterials in their municipal code as consisting of 40 to 60 percent of travel volume throughout the City. The following streets, or sections of streets, are listed in the PAMC as being principal arterial roadways:

- Front Street from Golf Course Road to Lincoln Street
- First Street from Lincoln Street to east City limits
- Lincoln Street from Front Street to Lauridsen Boulevard
- Lauridsen Boulevard from Lincoln Street to Cherry Street
- State Highway 101 from Cherry Street to west City Limits
- Race Street from Front Street to Mt. Angeles Road

In addition, the City has identified the Tumwater Truck Route, a portion of State Route 117 between State Highway 101 and South Lincoln Street, as a major corridor with high traffic volume. The Tumwater Truck Route was included in this analysis.

The metric of miles of major corridors were scored based on miles of principal arterial and truck route within each basin divided by the total area in acres of each basin within the City limits. Scoring criteria is provided in Table 18 and results for each basin are provided in Table 19.

| TABLE 18 \| MILES OF MAJOR CORRIDORS | |
|---|---|
| **Miles of Major Corridors per Acre** | **Score** |
| 0 – 0.1 | 0 |
| 0.1 – 0.3 | 1 |
| 0.3 – 0.5 | 2 |
| >0.5 | 3 |

| TABLE 19 \| MILES OF MAJOR CORRIDORS RESULTS | | |
|---|---|---|
| **Basin Name** | **Miles of Major Corridor per Acre** | **Score** |
| Dry Creek | 0.08 | 0 |
| Tumwater Creek | 0.33 | 2 |
| Valley Creek | 0.12 | 1 |
| Peabody Creek | 0.14 | 1 |
| White Creek | 0.24 | 1 |
| Ennis Creek | 0.09 | 0 |
| Ocean 7 | 0.00 | 0 |
| Ocean 8 | 0.00 | 0 |
| Ocean 9 | 0.00 | 0 |
| Ocean 10 | 0.00 | 0 |
| Ocean 11 | 0.66 | 3 |
| Ocean 12 | 0.80 | 3 |
| Ocean 13 | 0.00 | 0 |
| Ocean 14 | 0.00 | 0 |
| Ocean 15 | 0.00 | 0 |

## STREAM CROSSINGS

As mentioned for the miles of major corridors metric, roadway corridors are associated with increased pollutant loads (Schmidt and Michaud 2020). Road crossings disrupt a stream's riparian corridor and increase efficiency of runoff delivery to the stream, which increases peak flows. Culverts at stream crossings may also be undersized, creating fish passage barriers. Stream crossings were scored based on number of stream crossings per mile in each basin within the City. Scoring criteria is provided in Table 20 and results for each basin are provided in Table 21.

| TABLE 20 \| STREAM CROSSINGS PER MILE | |
|---|---|
| **Number of Stream Crossings per Mile** | **Score** |
| 0 – 1 | 0 |
| 1 – 2 | 1 |
| 2 – 3 | 2 |
| > 3 | 3 |

| TABLE 21 \| STREAM CROSSINGS PER MILE RESULTS | | |
|---|---|---|
| **Basin Name** | **Number of Stream Crossings per Mile** | **Score** |
| Dry Creek | 1.2 | 1 |
| Tumwater Creek | 3.0 | 2 |
| Valley Creek | 3.2 | 3 |
| Peabody Creek | 2.8 | 2 |
| White Creek | 2.2 | 2 |
| Ennis Creek | 2.3 | 2 |
| Ocean 7 | 0 | 0 |
| Ocean 8 | 0 | 0 |
| Ocean 9 | 0 | 0 |
| Ocean 10 | 0 | 0 |
| Ocean 11 | 0 | 0 |
| Ocean 12 | 0 | 0 |
| Ocean 13 | 0 | 0 |
| Ocean 14 | 0 | 0 |
| Ocean 15 | 0 | 0 |

## DEGRADATION SUMMARY

Table 22 includes a summary of the scores for each degradation metric in each basin. The individual metric scores were averaged to determine the final basin scores. The final degradation score for each basin was then placed along the Level of Degradation axis of the prioritization matrix, ranging from low to high, which correlates to the categories Conservation to Development Restoration. It is important to note these designations are relative only to the metrics chosen for this assessment and to each other. Figure 4 provides a map that shows the relative degradation of each basin.

TABLE 22 | FINAL BASIN DEGRADATION SCORES

| Basin Number and Name | Number of Category 5 Constituents[1] | Miles of Major Corridors /Acre[2] | Number of Stream Crossings/Mile[3] | Impervious Land Cover[4] | **TOTAL AVERAGED SCORE** |
|---|---|---|---|---|---|
| 1 Dry Creek | 3 | 0 | 1 | 2 | **1.50** |
| 2 Tumwater Creek | 1 | 2 | 2 | 2 | **1.75** |
| 3 Valley Creek | 1 | 1 | 3 | 2 | **1.75** |
| 4 Peabody Creek | 3 | 1 | 2 | 2 | **2.00** |
| 5 White Creek | 0 | 1 | 2 | 2 | **1.25** |
| 6 Ennis Creek | 2 | 0 | 2 | 2 | **1.50** |
| 7 Ocean 7 | 0 | 0 | 0 | 2 | **0.50** |
| 8 Ocean 8 | 0 | 0 | 0 | 2 | **0.50** |
| 9 Ocean 9 | 0 | 0 | 0 | 2 | **0.50** |
| 10 Ocean 10 | 0 | 0 | 0 | 2 | **0.50** |
| 11 Ocean 11 | 0 | 3 | 0 | 3 | **1.50** |
| 12 Ocean 12 | 1 | 3 | 0 | 3 | **1.75** |
| 13 Ocean 13 | 3 | 0 | 0 | 2 | **1.25** |
| 14 Ocean 14 | 0 | 0 | 0 | 2 | **0.50** |
| 15 Ocean 15 | 2 | 0 | 0 | 2 | **1.00** |

Notes and Assumptions:

1. Category 5 Constituents identified in Ecology's 303(d) listings and do include the downstream waterbody (Puget Sound/Port Angeles Harbor), if applicable.
2. Major Corridors include roads identified as Principal Arterials in the Port Angeles Municipal Code and the Tumwater Truck Route identified by City Staff.
3. Stream Crossings counted crossings trafficked by pollution generating vehicles and data was verified using WDFWs Fish Passage Database.
4. Impervious Land Cover Data was collected from Multi-Resolution Land Characteristics Consortium, National Land Cover Database (2019). Percentages were calculated predicated on literature values (Alley & Veenhuis, 1984) for percent impervious for the overlapping Land Zoning designation.

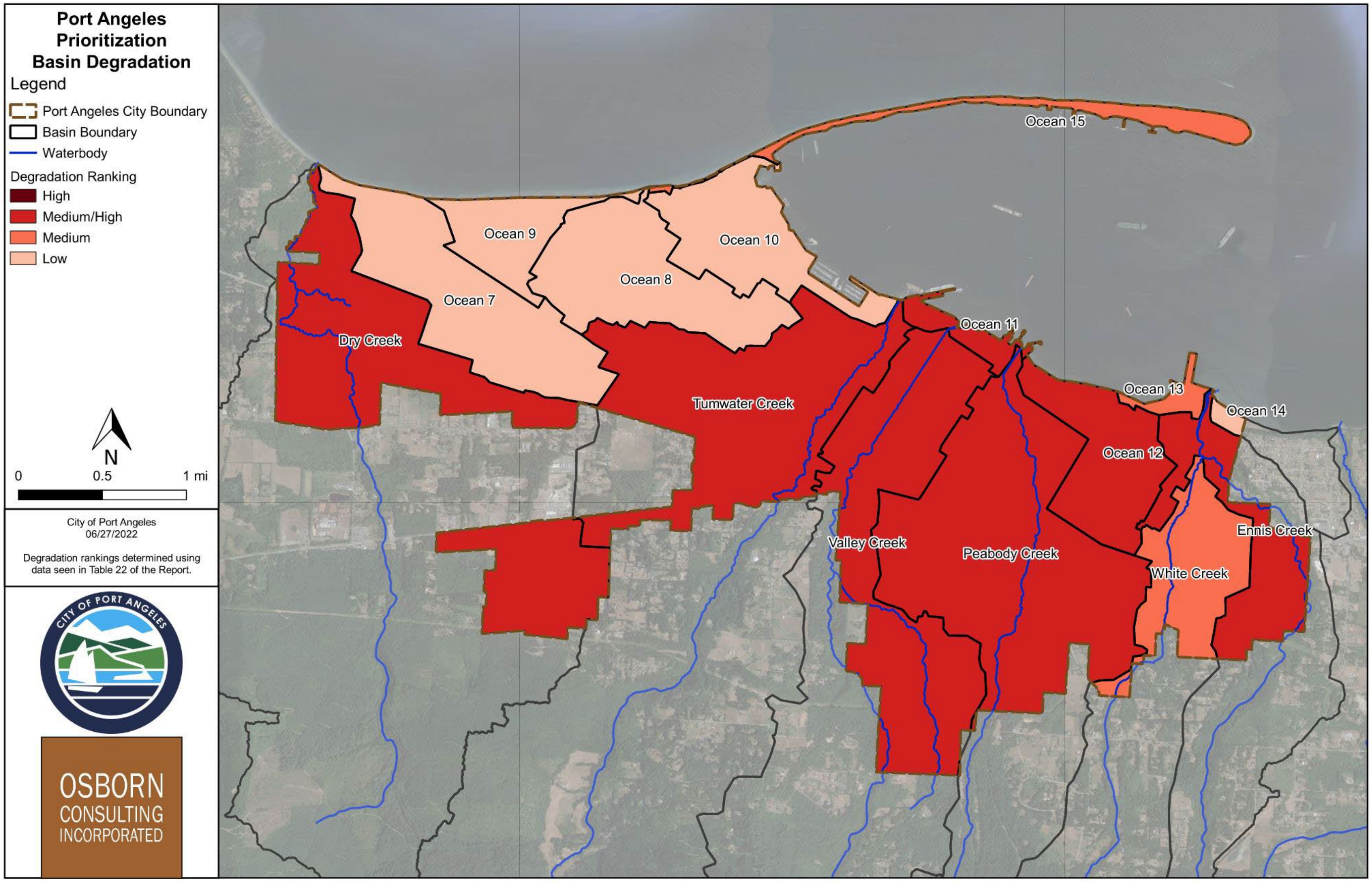
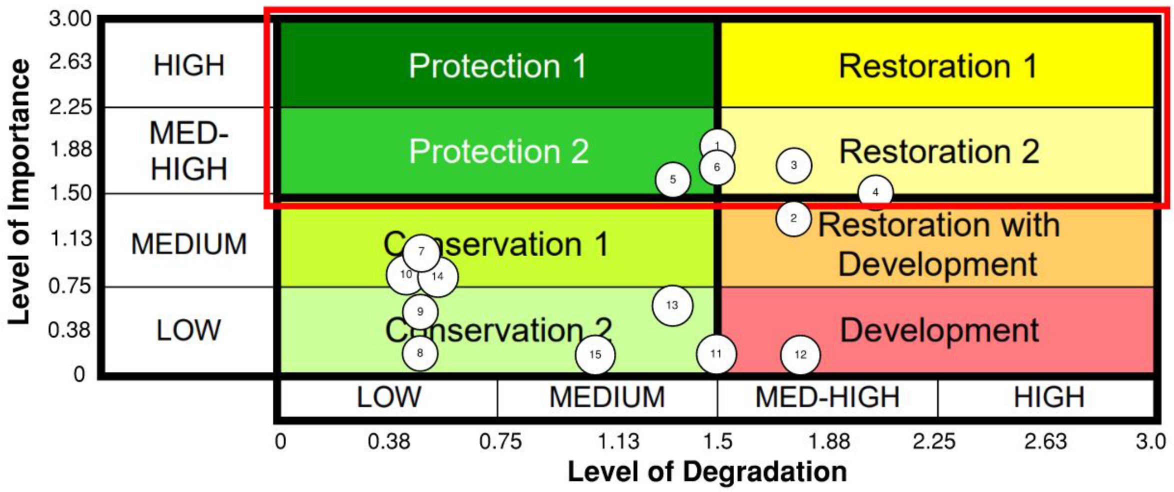



**Figure 4: Basin Degradation Rankings**

# Basin Prioritization

## Results

The final importance for natural processes and aquatic species scores and degradation from development scores for each basin were used to place the basins on the Prioritization Matrix. Each basin was scored relative to other basins in the City. The results are presented in Figure 5.




Basin names and numbers

| | | |
|---|---|---|
| 1 – Dry Creek | 6 – Ennis Creek | 11 – Ocean 11 |
| 2 – Tumwater Creek | 7 – Ocean 7 | 12 – Ocean 12 |
| 3 – Valley Creek | 8 – Ocean 8 | 13 – Ocean 13 |
| 4 – Peabody Creek | 9 – Ocean 9 | 14 – Ocean 14 |
| 5 – White Creek | 10 – Ocean 10 | 15 – Ocean 15 |

**Figure 5: Prioritization Matrix**

As stated in the Methodology Overview, both the SMAP Guidance and BCitR suggest prioritizing basins that fall into the *Protection* and *Restoration* categories for strategic retrofits and land management activities. While the level of importance dictates which basins are ultimately selected for further review, the level of degradation dictates land management and retrofit strategies for the SMAP. For example, protection strategies focus on land management and policy actions, and restoration strategies focus on retrofit projects and education and outreach (E&O) programs.

As shown above, the following drainage basins landed in the *Protection* and *Restoration* quadrants and therefore will be further evaluated for final selection of the high-priority basin:

- Dry Creek (Basin no. 1)
- Valley Creek (Basin no. 3)
- Peabody Creek (Basin no. 4)
- White Creek (Basin no. 5)
- Ennis Creek (Basin no. 6)

## Basin Selection

The basins that fall into the *Protection* and *Restoration* quadrants were evaluated in further detail based on the following criteria:

- Extent of the municipality's influence
- Existing water quality treatment and stormwater infrastructure
- Opportunity for retrofits
- Other local or regional projects planned within the basin
- Overburdened communities

Extent of the municipality's influence (percent of total watershed within permittee's jurisdiction) was evaluated in the Receiving Water Conditions Assessment using geographic information systems (GIS) data. Higher priority was given to basins with greater municipality influence.

Existing water quality treatment and stormwater infrastructure were evaluated by interviewing City staff and reviewing City GIS data. The City does not currently have contributing basins mapped for public or privately owned water quality treatment and detention facilities; however, publicly managed facilities are mapped and tracked within the City's asset management system (ArcGIS) and City staff were interviewed to provide insight on the level of treatment and detention occurring within each basin. A rough measurement of contributing area was measured using the City's online stormwater utility map for a basin-to-basin comparison. Higher priority was given to basins that currently have less water quality treatment or detention.

Opportunity for retrofit projects was evaluated using GIS, Google Maps, and historical knowledge from City staff to identify available right-of-way and vacant or City-owned parcels suitable for retrofit projects. Existing water quality treatment and detention facilities were also evaluated in these basins for opportunities to expand contributing area or upgrade the infrastructure for increased level of treatment or detention. Higher priority was given to basins with opportunities for retrofit projects.

Other local or regional projects planned within the basin were identified during City staff interviews. Basins in which there is the potential for leveraging partnerships with other planned projects were prioritized.

Overburdened communities were evaluated in the Receiving Water Conditions Assessment (Osborn Conuslting 2022) using the Environmental Justice Screening and Mapping Tool. Demographic and environmental parameters, such as low-income population, people of color population, demographic index, proximity to hazardous waste, proximity to superfund sites, and proximity to traffic were reviewed. Ideally, higher priority would be given to basins with overburdened communities where water quality issues and human health impacts overlap and can, at least in part, be addressed through stormwater management improvements. The demographic and environmental parameters for Port Angeles are fairly consistent across the City; therefore, no basins were prioritized based on overburdened communities.

## DRY CREEK

Dry Creek is a seasonal creek that does not flow above ground during the summer months. The City determined that resources would be better spent developing strategic retrofits and land management activities in a basin with a perennial stream where retrofits would provide year-round benefits; therefore, Dry Creek was removed from the remaining portion of the additional analysis and will not be selected as the high-priority basin.

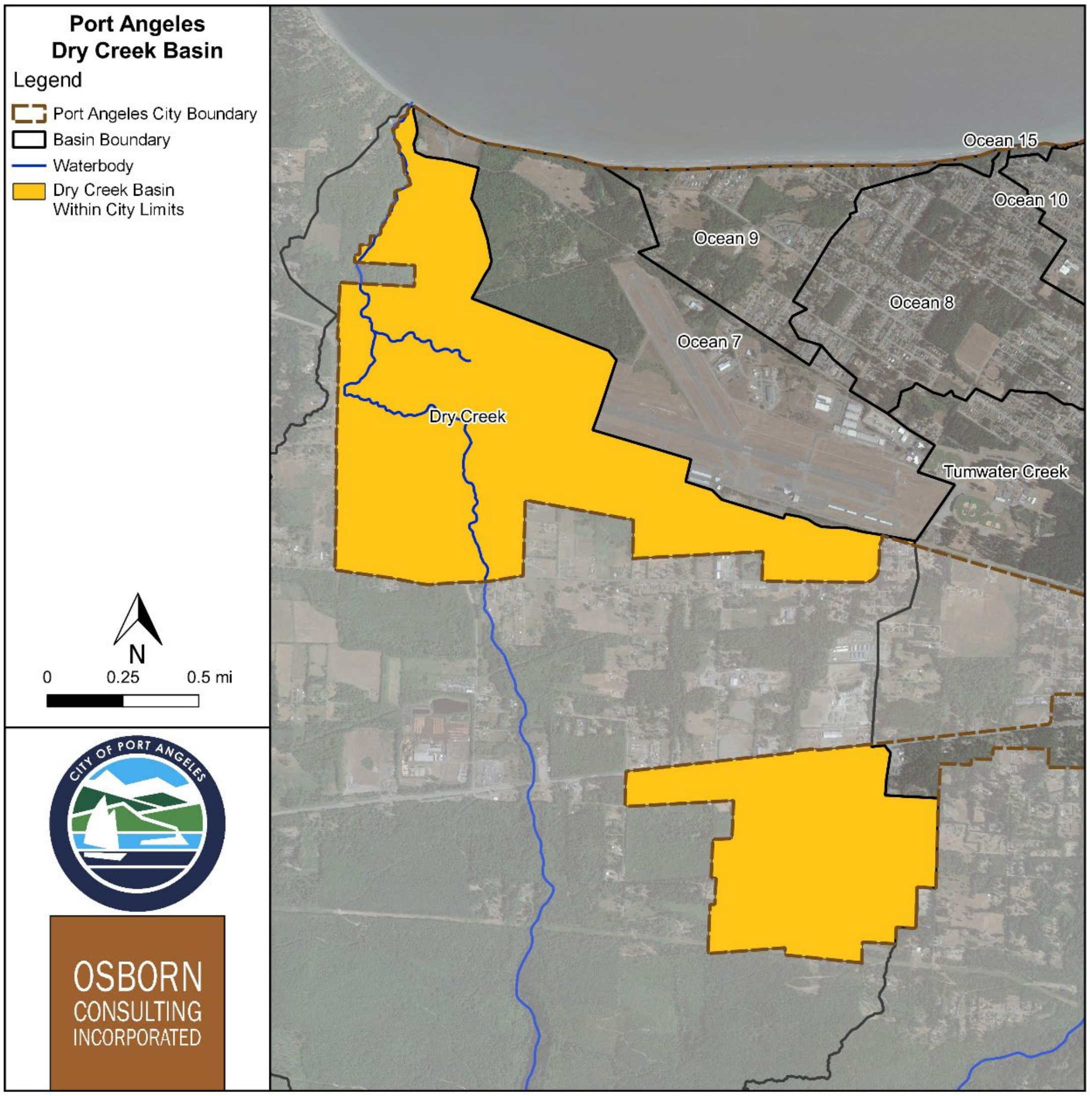



**Figure 6. Port Angeles Dry Creek Basin**

## VALLEY CREEK

With almost one-third (31 percent) of the basin within the City limits, the Valley Creek basin provides the second highest extent of municipality influence among the five basins undergoing further analysis. The majority of runoff from this basin is collected into the MS4 and does not receive water quality treatment nor any measure of flow control. Detention and water quality treatment are provided via a 72-inch detention pipe and a Filterra unit for a small contributing basin of roadway runoff from W 8th St between S Pine St and S Cherry St. Water quality treatment is also provided along W 1st St at S Valley St via a filtration unit.

The Valley Creek basin lends itself naturally to potential stormwater retrofit projects. This basin is largely developed and is predominantly zoned residential south of W 2nd St. A few multifamily and commercial sections exist along W 8th St. As future development or redevelopment occurs, it will most likely be as single-family residential, which is unlikely to exceed Ecology's current thresholds requiring onsite water quality treatment or flow control. Therefore, a down-stream regional water quality retrofit project would arguably carry more benefit in this basin as opposed to a similar basin with more commercial zoning and room for development under current standards. Additionally, runoff from 200 acres is collected, conveyed, and discharged via two outfalls that are located a block away from each other. In this location, between 2nd and 3rd Streets, there are available City-controlled properties that may be conducive for future retrofit project use. Installing water quality treatment and/or detention in this area would provide the opportunity to treat and detain runoff from a large portion of the basin with only one or two proposed projects.

Currently, the City has several planned improvement projects pertaining to Valley Creek. The City's Capital Facilities Plan (CFP), along with other local and regional planning efforts were reviewed to consider other potential conflicting or complimentary work proposed in this basin. The current 2023 to 2028 Preliminary CFP (Port Angeles 2022) reports that the City proposes to replace the lower reach of the Valley Creek culvert; a 300 foot section from the abandoned industrial waterline to the Valley Creek saltwater estuary (Project # DR0112). The CFP also lists a project to improve a channelized and culverted portion of Valley Creek located adjacent to and under Valley Street between 2nd Street and 9th Street (Project # GG0916). The CFP lists a third project to address a road crossing near 9$^{th}$ Street that has effectively reached the end of its service life (Project # TR0421). If replacement is warranted, the project will replace the Valley Creek Bridge with a new box culvert designed to meet modern fish passage requirements. While all three of these projects are currently unfunded, they attest to the City's attention and concern for this valuable waterway and a desire to make improvements.

Also in the planning phase; Futurewise, the City, and Herrera Environmental Consultants (Herrera) have coordinated *GreenLink Port Angeles* – a watershed-scale planning process for developing an integrated network of multi-benefit green stormwater infrastructure (GSI) projects within the City. The program has received sufficient funding to include development and implementation of the GSI projects identified and recommended in Phase 1 of the program. During Phase 1 of the program, Valley Creek was selected as the focus and Phase 2 of the design work is currently being executed. This may result in an opportunity for the City to partner with the *GreenLink* program to help achieve shared goals as they move forward in the SMAP process.

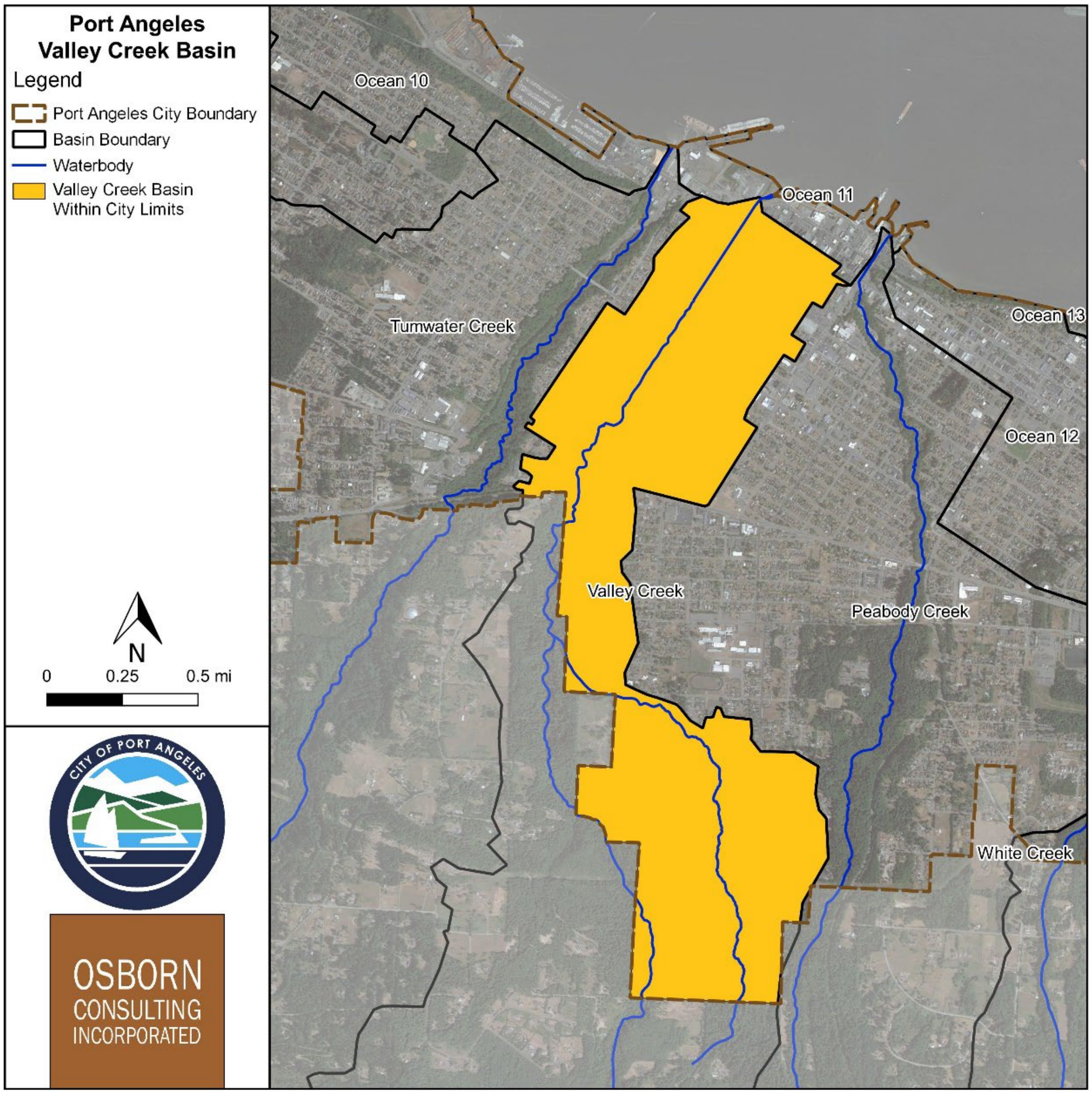



**Figure 7. Port Angeles Valley Creek Basin**

## Peabody Creek

With just over half (51 percent) of the basin within the City limits, the Peabody Creek basin provides the highest extent of municipality influence among the five basins undergoing further analysis. The majority of the runoff in the Peabody Creek basin is collected into the MS4, does not receive flow control, and does not receive water quality treatment. Where they do exist, water quality and flow control facilities consist of multiple Filterra units, in-line detention pipes, and engineered outfalls that serve small subbasins scattered throughout the basin.

Retrofit opportunities in the Peabody Creek basin exist but would require a dispersed approach rather than a centralized facility, due to existing infrastructure. Compared to Valley Creek with two main outfalls that serve the majority of the developed basin, the Peabody Creek basin has several smaller discharge points distributed throughout, which discharge to Peabody Creek. Because the basin has several outfalls discharging to the creek, water quality treatment and/or detention retrofit projects would most likely be additional small facilities scattered throughout the basin. No City-owned parcels were identified as feasible potential retrofit sites.

The City's CFP, along with other local and regional planning efforts were reviewed to consider other potential conflicting or complimentary work proposed in this basin. Per the 2023 to 2028 Preliminary CFP, (Port Angeles 2022) there are two proposed and funded projects (at least, in part) that will directly improve the conditions of Peabody Creek. The Park Avenue Outfall to Peabody Creek project will design and construct a new stormwater outfall to replace the failed existing outfall (Project # DR0322) and the Peabody Street Water Quality Project proposes to install water quality facilities in existing stormwater conveyance to Peabody Street (Project # DR0117). The Peabody Street Water Quality Project is contingent upon being awarded an Ecology grant and is part of a larger ongoing effort to improve downstream water quality in the Peabody Creek basin. Additionally, the City and the WA Dept. of Transportation are working together to improve upon the historical Peabody Creek Culvert which extends from 2nd Street north to the mouth near Hollywood Beach (Project # TR0414)

Similar to the Valley Creek basin, the Peabody Creek basin is predominately residential, and most future development or redevelopment will be below Ecology's thresholds requiring onsite stormwater treatment or flow control.

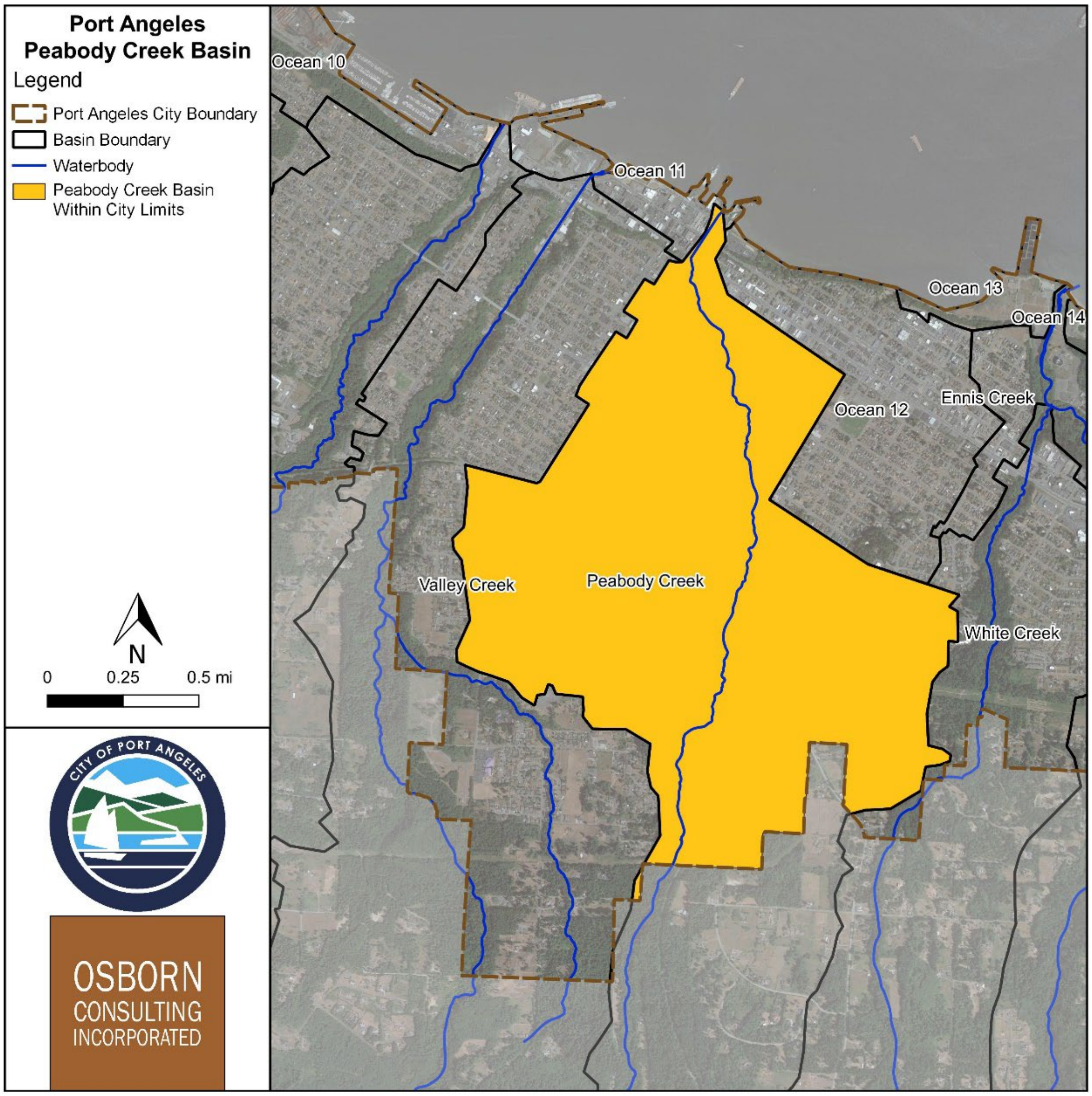



**Figure 8. Port Angeles Peabody Creek Basin**

## WHITE CREEK

With almost a quarter (23 percent) of the basin within the City limits, the White Creek basin provides the third highest extent of municipality influence among the five basins undergoing further analysis. The majority of runoff within the White Creek basin is not detained and does not receive water quality treatment. Compared to the Valley Creek Basin and Peabody Creek Basin, White Creek Basin is less developed. Large parcels within the basin are owned by the Bonneville Power Administration for their transmission lines as well as a privately owned golf course. Because of this, the stormwater system is comparatively more disconnected, already experiences more runoff dispersion through vegetation, and has fewer direct discharges to the creek. Some existing water quality treatment and detention facilities are present in a private housing development along E. Melody Lane.

Opportunities for strategic retrofits are less in this basin than in the Valley Creek or Peabody Creek basins. The few City-owned parcels that could be potential sites for retrofits are on steep slopes and in environmentally sensitive areas. Peninsula College has potential for expansion and, at that time, will be required to meet current water quality treatment and flow-control standards. The 2023 to 2028 Preliminary CFP does not include any proposed projects to improve the conditions of White Creek and other local or regional projects with partnership opportunities to help achieve potential SMAP goals are unlikely. For these reasons, White Creek Basin is not a strong candidate for a SMAP.

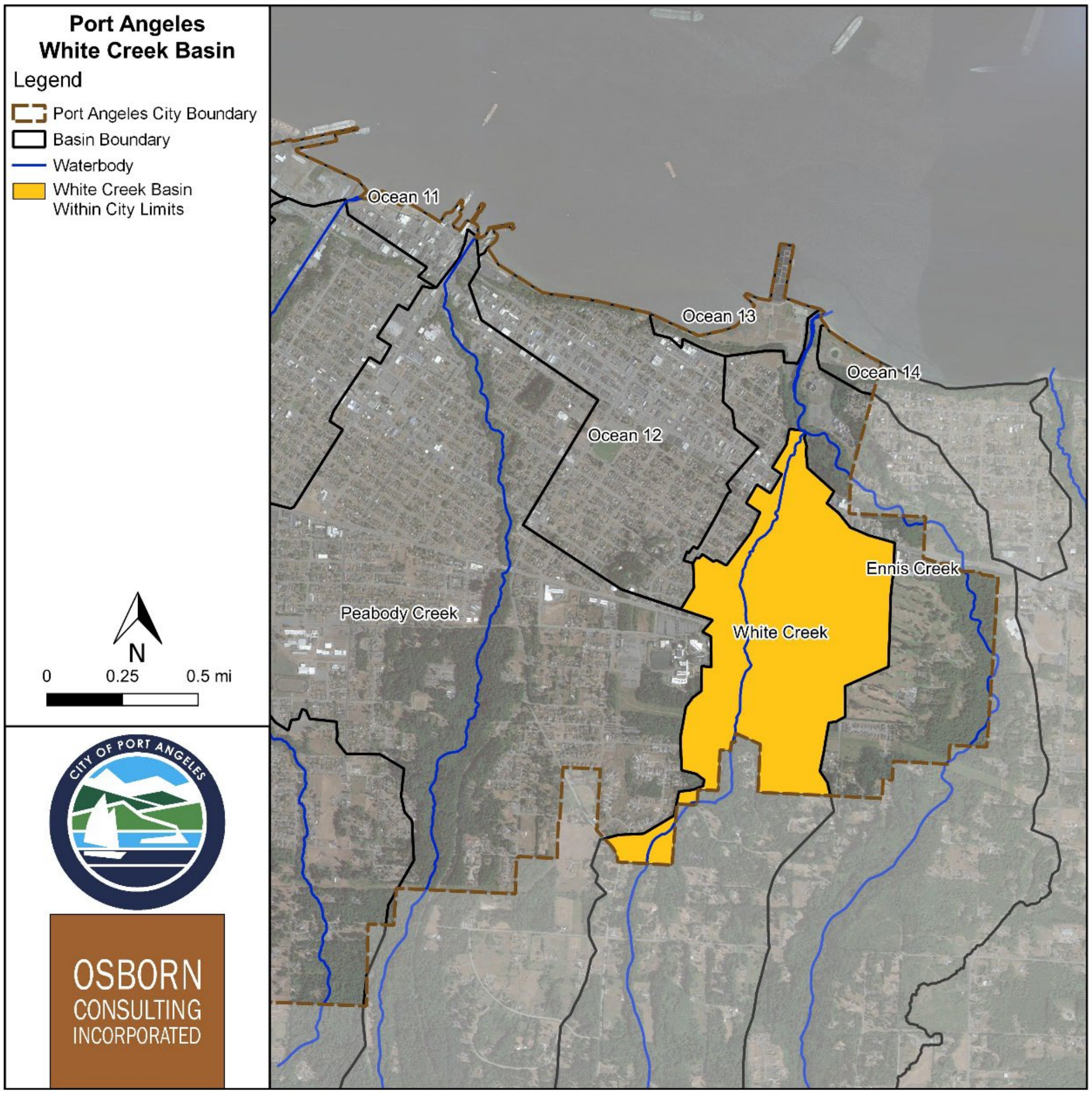



**Figure 9. Port Angeles White Creek Basin**

## ENNIS CREEK

With only six percent of the basin within the City limits, the Ennis Creek basin provides the lowest extent of municipality influence among the five basins undergoing further analysis. The City determined that resources would be better spent developing strategic retrofits and land management activities in a basin with greater municipality influence; therefore, Ennis Creek was removed from the remaining portion of the additional analysis and will not be selected as the high-priority basin.

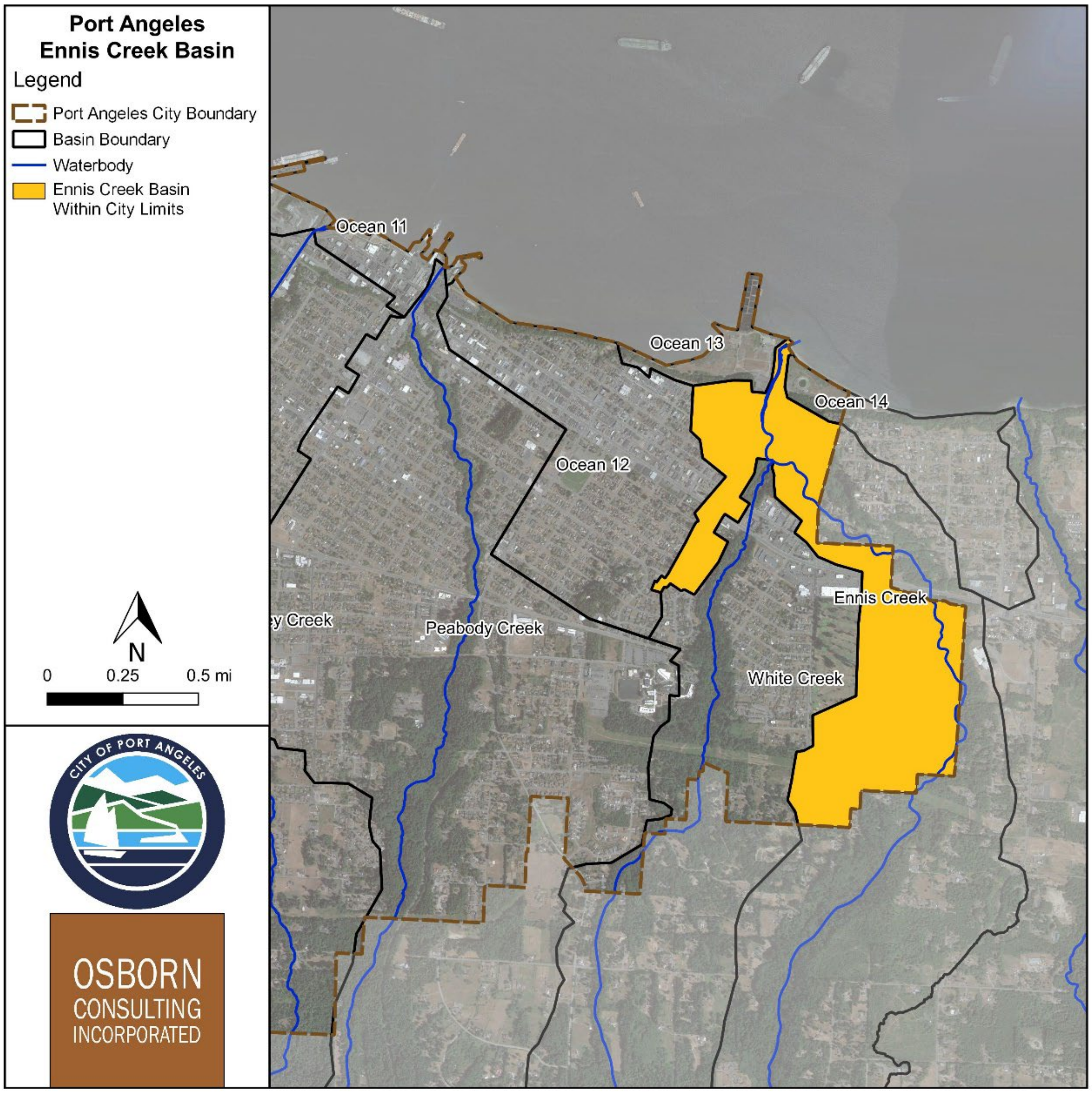



**Figure 10. Port Angeles Ennis Creek Basin**

## Detailed Analysis Summary

Table 23 is a tabulated summary of the detailed analysis discussed above.

Table 23 | High Priority Basin Selection Summary

| Basin Name | Notes | Status |
|---|---|---|
| Dry Creek | • Creek runs dry in the summer | Eliminated |
| Valley Creek | • Large portion of basin in City limits<br>• Minimal existing water quality and detention facilities<br>• Good opportunities for large scale retrofit projects<br>• Multiple partnership opportunities | Top Candidate for High-Priority Basin |
| Peabody Creek | • Large portion of basin in City limits<br>• Minimal existing water quality and detention facilities<br>• Possible opportunities for small scale retrofit projects<br>• No known partnership opportunities | Alternate Candidate for High-Priority Basin |
| White Creek | • Small portion of basin in City limits<br>• Minimal existing water quality and detention facilities<br>• Less opportunities for small scale retrofit projects<br>• No known partnership opportunities | Eliminated |
| Ennis Creek | • Only 6 percent of the basin is within City limits | Eliminated |

The detailed analysis of the five basins that fall into the *Protection* and *Restoration* quadrants of the prioritization matrix identified the Valley Creek basin and the Peabody Creek basin as potential high-priority basins. In contrast to Peabody Creek, Valley Creek has apparent opportunities for retrofits that have the potential to treat and detain stormwater from a large portion of the basin, proposed complimentary CFP projects, as well as partnership opportunities with other local stakeholders. For these reasons, this analysis concludes that the Valley Creek basin will experience the greatest benefit from strategic retrofits and land management activities and has been selected as the high-priority basin moving forward to the third phase of this effort: SMAP development.

## Next Steps

The Valley Creek Basin has been selected as the high-priority basin in the City of Port Angeles. The next step is to publish this document, along with interactive GIS maps on the City's website for public review and comment. Any feedback received regarding the prioritization process and results will be incorporated into the next and final step of the SMAP process; the creation of a Stormwater Management Action Plan for the Valley Creek Basin.

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