Sea Level Rise Exposure Inventory for Oregon's Estuaries

Oregon Coastal Management Program
Department of Land Conservation and Development
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Introduction

The Estuary Sea Level Rise Exposure Inventory identified infrastructure and other assets within six scenarios that represent future flooding along Oregon's estuaries. The project objective was to identify the assets and geographies most likely to be impacted by sea-level rise in 21 of Oregon's estuaries, and prioritize areas to focus future resources and further study. The project included 21 major estuaries and the surrounding low-lying shorelands (less than 25 feet in elevation), excluding the Columbia River. The Columbia River was excluded due a lack of funding and time, but we recommend that a follow-up project cover the Columbia River when resources are available. An online map and webpage where the future flooding scenarios are available for download complement this written report[1].

The inventory results are presented by estuary and within each estuary section there are subsections for each of the eleven 'assets' inventoried. Preceding those sections, there is a comparative summary of impacts across the estuaries.

Methods

Sea-Level Rise Scenarios

Sea-level rise scenario polygons (future flooding scenarios) were created using sea-level rise projections coupled with coastal flood event water levels. The sea-level rise projections were from the National Research Council of the National Academies "Sea-Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future" (2012, pg 96). The report gave a range of sea-level rise projections for 2030, 2050, and 2100 from a 2000 baseline. The upper end of the range for each year projected was used to take a precautionary approach and to provide a large range of possible water levels. The 2030 (short-term), 2050 (mid-term), and 2100 (long-term) sea-level rise (SLR) estimates were 0.75 feet, 1.5 feet, and 4.6 feet, respectively.

The coastal flood event water levels were taken from NOAA's extreme water level calculations at the Crescent City, Charleston, South Beach, and Astoria tide stations. The flood event water levels used were the 1% and 50% annual exceedance probability values. For example, the 50% exceedance elevation is 2.6 ft above Mean Higher High Water (MHHW) at South Beach, Oregon. This means there is a 50% chance that the tidal water level will exceed 2.6 ft above MHHW in a given year, or on average, once every two year period.

The water surface models are based on the combined flood event water level and sea-level rise projections. See Appendix A for a table of water levels used for each estuary; note that the water level for the 2030 sea-level rise + 1% chance flood is higher than the water level for the 2050 SLR + 50% chance flood scenario. The water surfaces were created using the National Oceanic and Atmospheric Administration (NOAA) VDatum tool. The land surface model is based on lidar elevation measurements collected in 2008 and 2009 and supplied by the Oregon Lidar Consortium. The scenario areas were generated through a GIS intersection of the modeled water surface and the land surface digital elevation model. The following six future flooding scenarios were created (shown graphically in Figure 1):

- 2030 sea-level rise + 50% annual chance coastal flood,
- 2030 sea-level rise + 1% annual chance coastal flood,

[1] coastalatlas.net/sealevelrise

- 2050 sea-level rise +50% annual chance coastal flood,
- 2050 sea-level rise + 1% annual chance coastal flood,
- 2100 sea-level rise + 50% annual chance coastal flood,
- 2100 sea-level rise + 1% annual chance coastal flood.

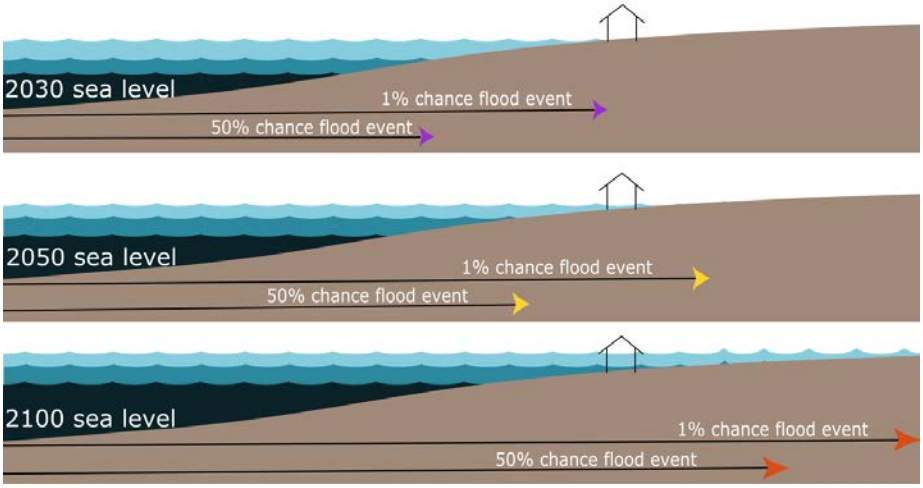

Figure 1 Six Future Flooding Scenarios

It is important to note that the flooding scenarios do not account for artificial (man-made) hydrologic barriers such as dikes, flood gates, restrictive culverts, and road and railroad embankments. Areas behind these barriers at an elevation lower than the modeled water level are shown as flooded in the scenarios. This conservative approach was taken because the effectiveness of hydrologic barriers in the future cannot be guaranteed. Dikes and tide gates will certainly change over time; for example, increasing storm intensity and peak flows generally lead to dike erosion and dike breaches. Maintenance of dikes and tide gates is often dependent on the economic value of the land uses behind them; and that value may change over time.

Lastly, all flood modeling has uncertainties. These scenarios are intended to be used as planning-level tools that illustrate the potential for flooding under future sea level rise and flood events. Although this information is appropriate for conducting vulnerability and risk assessments, more detailed modeling is needed for site-specific engineering design. The maps depict possible future flooding that could occur if nothing is done to adapt or prepare for sea-level rise over the next century. Because the scenario modeling relied on a digital elevation model created from lidar data collected in 2008 and 2009, if development has occurred along the estuaries after 2009 (i.e., if a project was completed that raised or modified ground elevations), these changes are not captured. In addition, the scenarios are based on 'bath-tub' model outputs and do not account for all of the complex and dynamic estuarine and riverine processes, or future conditions such as erosion, subsidence, shoreline protection structure construction or upgrades, and other changes to the region that may occur in response to sea level rise.

Exposure Inventory

The exposure inventory analysis was a spatial intersection between each of the future flooding scenarios and location data of assets. The assets chosen for the analysis were based on concerns of coastal planners and the availability of data. The following were the assets analyzed:

- state highways,
- county/local roads,
- railways,
- critical facilities,
- municipal use drinking water,
- wastewater treatment plants,
- electric substations,
- potential contaminant sources,
- buildings, and
- land use zones.

The exposure inventory is only one piece of determining overall vulnerability. Vulnerability consists of the exposure of the asset to the hazard, the sensitivity of the asset, and the adaptive capacity of the asset. If an asset is exposed to flooding, it must also have a high sensitivity and a low adaptive capacity to flooding to have a high vulnerability. **The exposure inventory is designed to be a first level screening tool in identifying our communities with a high vulnerability to sea-level rise.**

Asset Data Sources

The following list provides the data source for each asset inventoried and the details of any source data modification made in the process of the analysis.

State Highways

The analysis of state highways within each of the scenarios used a dataset from the Oregon Department of Transportation (ODOT) (2014) which includes all state owned or maintained highways, spurs, connections, frontage roads, temporary traveled routes (TTR) and located centerlines. Bridges were not included in the analysis. As they were not accurately represented in the land surface model produced, the flooding scenarios imply that the deck of the bridge is flooded when only the foundation of the bridge would actually experience higher water levels. Determining the vulnerability of the bridge foundation and abutments is outside of the scope of this assessment. They were removed from the dataset using the water polygon from the Coastal and Marine Ecological Classification Standard (CMECS) geoform layer.
url: ftp://ftp.odot.state.or.us/tdb/trandata/GIS_data/Transportation_Network/hwynet.zip

County/Local Roads

The analysis of county and local roads within each of the scenarios used two datasets. The first was the OR-Trans Framework data layer from ODOT (2014). OR-Trans is a GIS road centerline dataset compiled from numerous sources of data throughout the state. Each dataset is from the road authority responsible for (or assigned data maintenance for) the road data each dataset contains. OR-Trans does not include roads for the city of Reedsport, so the US Census Bureau TIGER Roads/Line shapefile was used to do the analysis for the Umpqua system. As described under state highways, bridges were not included in the analysis.
url: http://spatialdata.oregonexplorer.info/geoportal/details;id=2dadde8695464b88a7937d15f86c08ab

Airports

The analysis of airports within each of the scenarios used the 'Trans_AirportRunway' shapefile which is part of a larger Transportation dataset from the United States Geological Survey (USGS).
url: http://prd-tnm.s3.amazonaws.com/index.html?prefix=StagedProducts/Tran/GDB/

Railways

The analysis of railways within each of the scenarios used the ODOT Oregon Railroads Framework dataset (2015). Bridges were removed from the analysis using the water polygon from the Coastal and Marine Ecological Classification Standard (CMECS) geoform layer.
url: http://spatialdata.oregonexplorer.info/geoportal/details;id=cfa08d7ace6a446789c2acb987967549

Critical Facilities

The analysis of critical facilities within each of the scenarios used a dataset originating from the Oregon Department of Geology and Mineral Industries (DOGAMI) (2013). The dataset includes the following facilities: public school, hospital, airport, fire station, police station, city hall, bridge, sheriff office, and tsunami siren. The tsunami siren and bridge categories were not used in the analysis.
url: http://spatialdata.oregonexplorer.info/geoportal/details;id=cc7454e2e6f9447ba90310a8e5140ec4

Municipal Use Drinking Water

The analysis of municipal use drinking water sources within each of the scenarios used the 'Water_Rights' dataset from the Oregon Water Resources Department (WRD) (2008). The dataset depicts the location of each water right diversion point and information about the associated water right. Only entries categorized as "Municipal Use' were used in the analysis.
url: http://spatialdata.oregonexplorer.info/geoportal/details;id=14fac385d20c4c1f8ce2dd3da297b781

Wastewater Treatment Plant

The analysis of wastewater treatment plants within each of the scenarios used a dataset from Oregon Department of Environmental Quality (DEQ) on the location of sewage/wastewater treatment plant outfalls. The location of the outfall was used to identify the vicinity of the plant, and the plant was then manually located using aerial imagery.
url: http://spatialdata.oregonexplorer.info/geoportal/details;id=fe7bda8ee57843c79c1514e36643ea9d

Energy Infrastructure

There are no power plants in the coastal zone, and therefore only electric substation locations were used in the analysis of energy infrastructure with the scenarios. Electric substation locations were from a Bonneville Power Administration (2009) dataset identifying BPA and non-BPA transmission facilities for which BPA has an interest. Facilities include substations, switchyards, compensation stations and other related facilities.
url:
http://coastalatlas.net/index.php/search?kw=bpa&src=Originator&scl=Scale&option=com_jumi&view=application&fileid=5

Potential Contaminant Sources

The analysis of hazardous materials within each of the scenarios used four datasets from DEQ. The first was a Hazardous Waste dataset (HazWaste), and only the 'Large Quantity Generators' records were used. The second was a Confined Animal Feeding Operations dataset. The third dataset was the Solid Waste Information Facility Tracking (SWIFT) database which contains the locations of municipal and industrial solid waste facilities. And lastly, a potential drinking water contaminant dataset that identifies significant potential contaminant sources identified in watershed and recharge areas that supply

drinking water to wells, springs or intakes (the "drinking water source area") for Public Water Systems (PWSs) was used.
urls: http://spatialdata.oregonexplorer.info/geoportal/details;id=8ef273f7a0be4acd9827bf16b2dd6346; http://spatialdata.oregonexplorer.info/geoportal/details;id=fad9f14fa3264c3d8ba20802b14cacd6; http://spatialdata.oregonexplorer.info/geoportal/details;id=9de6d3e9a8cf4545a2e7ab9327d69d4b; http://spatialdata.oregonexplorer.info/geoportal/details;id=ba4bdeece4524a9f8830ebf161c60f62

Buildings

The analysis of buildings within each of the scenarios used a draft building footprint database (unpublished as of December 2017) from DOGAMI. The building footprints were digitized from lidar collected in 2009, 2010, and 2012.

Land Use Zones

The analysis of land use zones within each of the scenarios used the Oregon statewide zoning geodatabase from the Oregon Department of Land Conservation and Development (DLCD). The database contains a statewide zoning layer compiled from multiple jurisdictions. The zoning classifications were generalized further for this analysis into: Beaches and Dunes, Coastal Estuarine, Coastal Shorelands, Commercial, Farm Use, Federal Forest/Range, Residential, Indian Reservation/Tribal Trust, Industrial, Mineral and Aggregate, Mixed-Use, Farm/Forest, Parks/Open Space, Public Use, Rural Residential, and Forest. This layer does not include data for Waldport, Depoe Bay, and Toledo and thus those jurisdictions were not included in the analysis. The land use zone analysis was only done for estuaries with significant areas of flooding and as such does not include estuaries south of the Coquille River.
url: http://spatialdata.oregonexplorer.info/geoportal/details;id=49bfb86d4e594a3c8fa8d968aaaa45e9

Overall Relative Exposure

In order to provide an overall look at exposure to sea-level across the study area, a relative exposure index was created using the results from roads, buildings, and critical facilities. The results were normalized by estuary size to accommodate the large variance across the study area. The normalized results were then ranked relative the range of results across all scenarios and all estuaries and assigned a value between 1 (least exposure) and 4 (highest exposure). The ranking for roads, building, and critical facilities were then combined into a single ranking. The results (Figure 2) can be used to make decisions on where to focus further resources and study depending on the timeframe being considered.

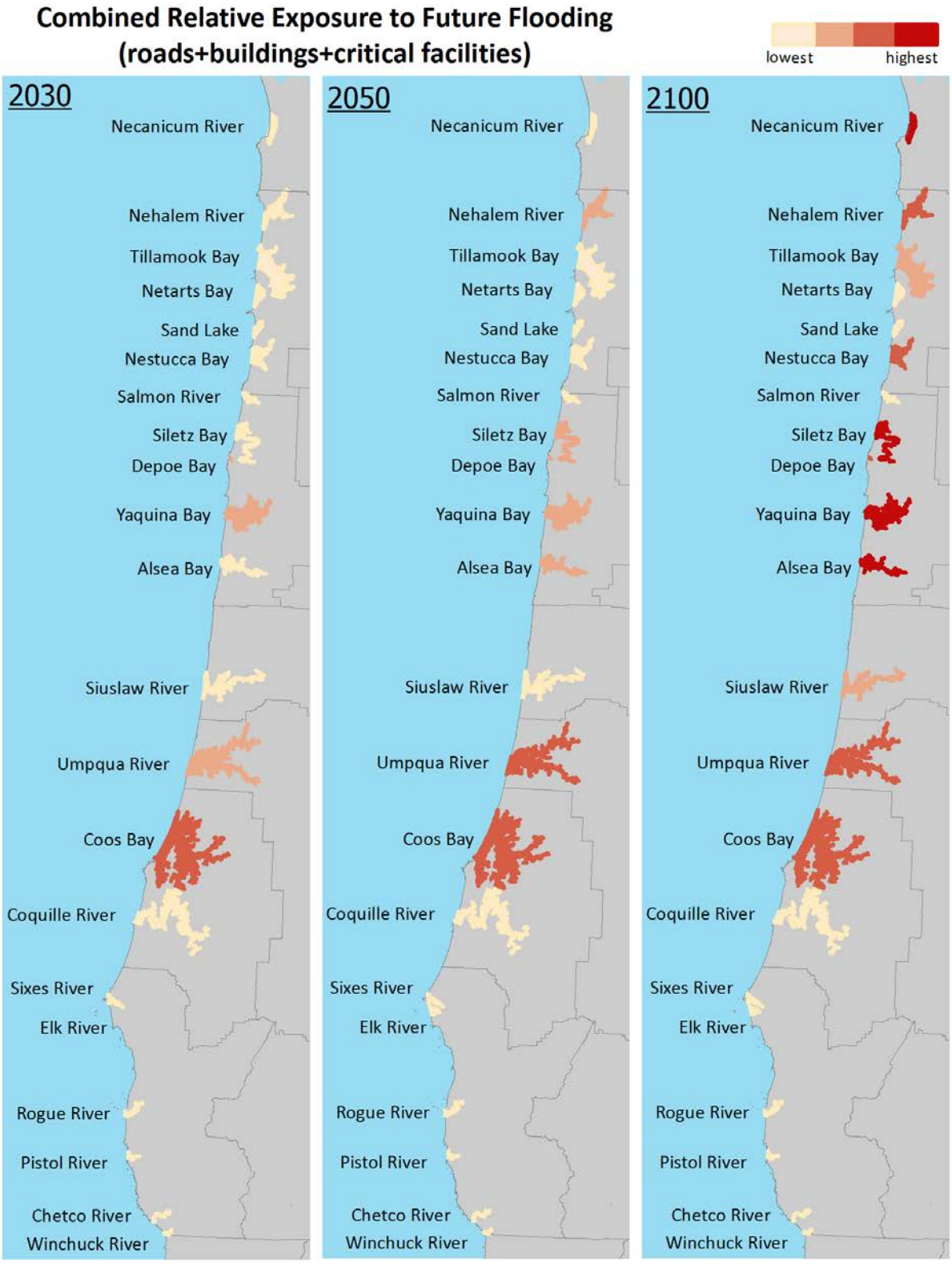

Figure 2. Relative Exposure Index Maps

Necanicum River Estuary

This section presents the results of the exposure inventory by asset in the Necanicum River system. Overall, in the near- and mid-term (2030-2050), little impact is observed to development in Seaside and Gearhart. However, there is a threshold between the water levels of the 2050 and 2100 projections where impact increases significantly. The range of buildings exposed to flooding goes from 12 for the lowest water level to over 1,400 buildings in the highest water level scenario.

State Highways

The Oregon Coast Highway (US-101) is inundated under the six future flood scenarios, Figure 3 provides the total number of miles impacted.

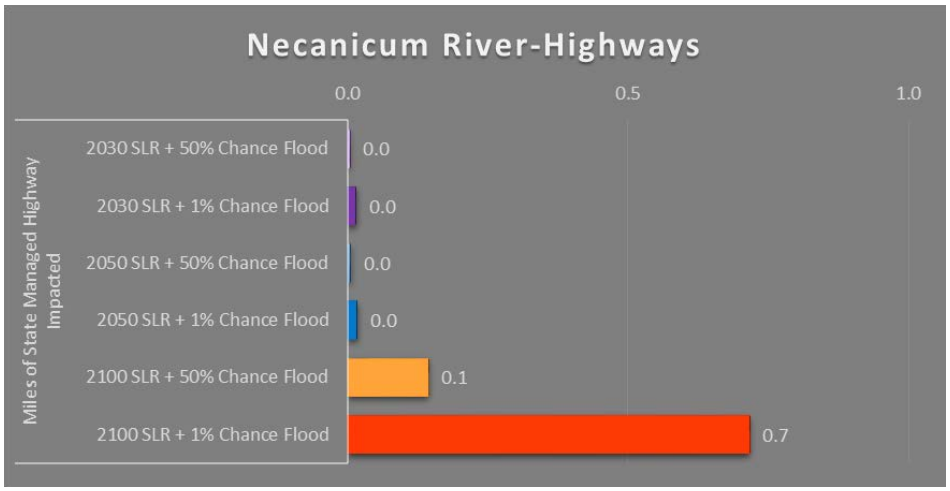

Figure 3. Miles of State Managed Highway Impacted in Necanicum River Future Flooding Scenarios

Roads

In addition to the highways impacted, county and local roads also may see flooding under the six flood scenarios. Figure 4 displays the total number of state, county, and local road miles impacted per scenario.

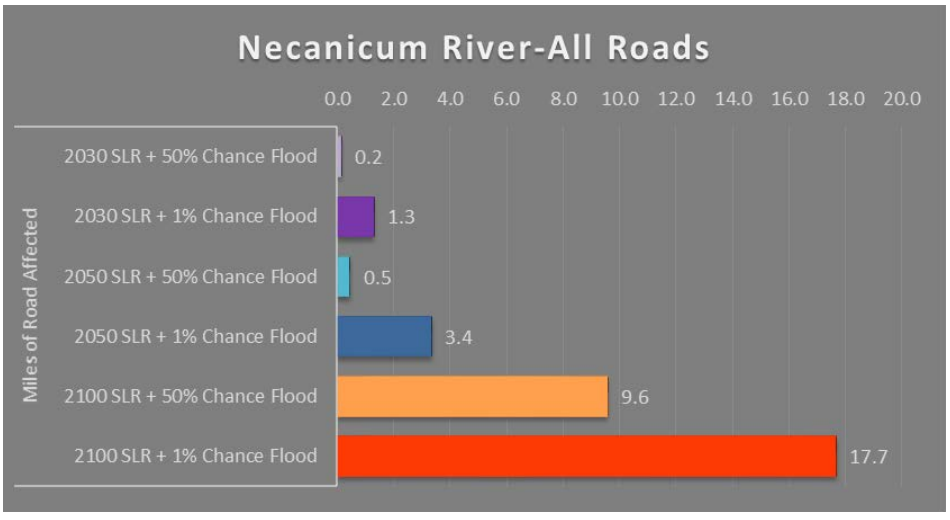

Figure 4. Miles of Road Impacted in the Necanicum River Future Flooding Scenarios

Airports

The Seaside Municipal Airport (FAA code 56S) is partially flooded in the 2030 SLR + 50% chance flood and the 2050 SLR + 50% chance flood scenarios and completely flooded in the remaining scenarios (see Figure 6).

Railway

There are no railroads affected in the future flood scenarios.

Critical Facilities

There are no fire stations, police stations, sheriff's offices, schools, hospitals, or city halls in the future flood scenarios within the Necanicum River system.

Municipal Use Drinking Water

There are no municipal drinking water sources that are within the future flood scenarios.

Wastewater Treatment Plant

The City of Seaside Sewage Treatment Plant is within both of the 2100 future flood scenarios.

Electric Substations

There are no substations within the six future flooding scenarios.

Potential Contaminant Sources

There are no large contaminant sources within the six future flooding scenarios.

Buildings

The number of buildings impacted under each scenario is shown in Figure 5; the city of Seaside sees a large increase in the number of buildings impacted under the 2100 scenario water levels.

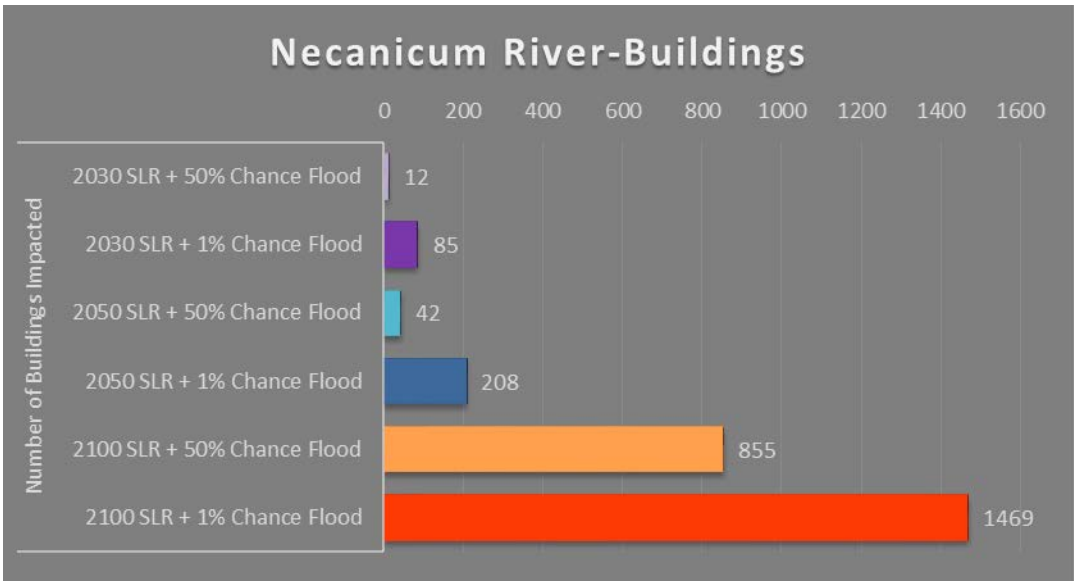

Figure 5. Number of Buildings Exposed to the Future Flooding Scenarios in the Necanicum River System

Overview Map

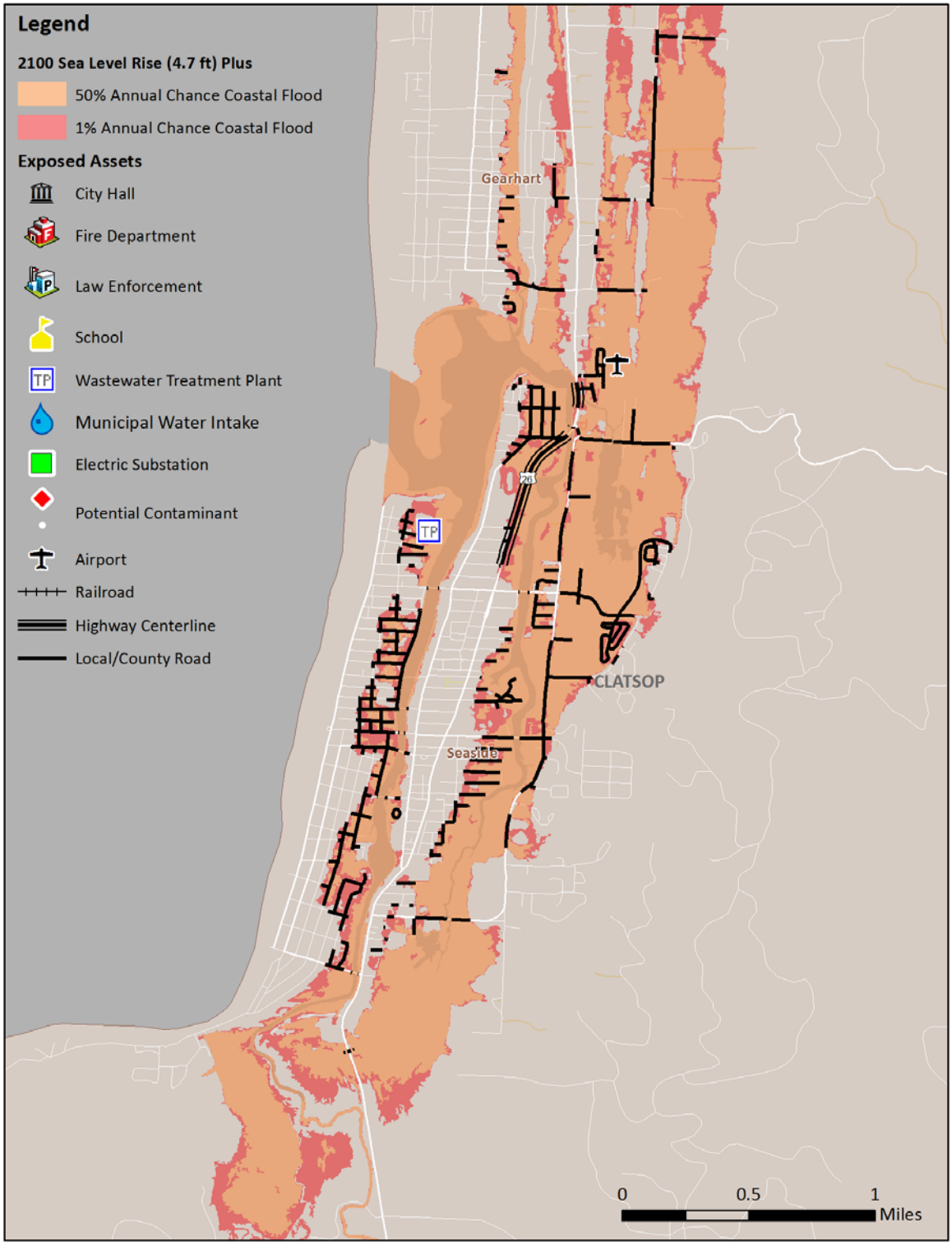

Figure 6. Necanicum River 2100 Flood Scenarios and Assets Map (for the 2030 and 2050 scenario map, please visit http://coastalatlas.net/sealevelriseviewer/).

Land Use Zones

The land use zones within each future flooding scenario are provided as a percentage of the zoning type within a jurisdiction. Parks/Open Space may be considered an appropriate use for land that is subject to flooding, whereas residential may not be. A community can use these results to identify areas for improvements in their zoning. The results for city of Gearhart are provided in Figure 7, and the city of Seaside are provided in Figure 8. Maps of the results are shown in Figures 9, 10, and 11.

The city of Gearhart has rural residential and residential zones in the near-term flooding scenarios, and in the long-term, commercial, mixed-use, and public-use zones also see flooding.

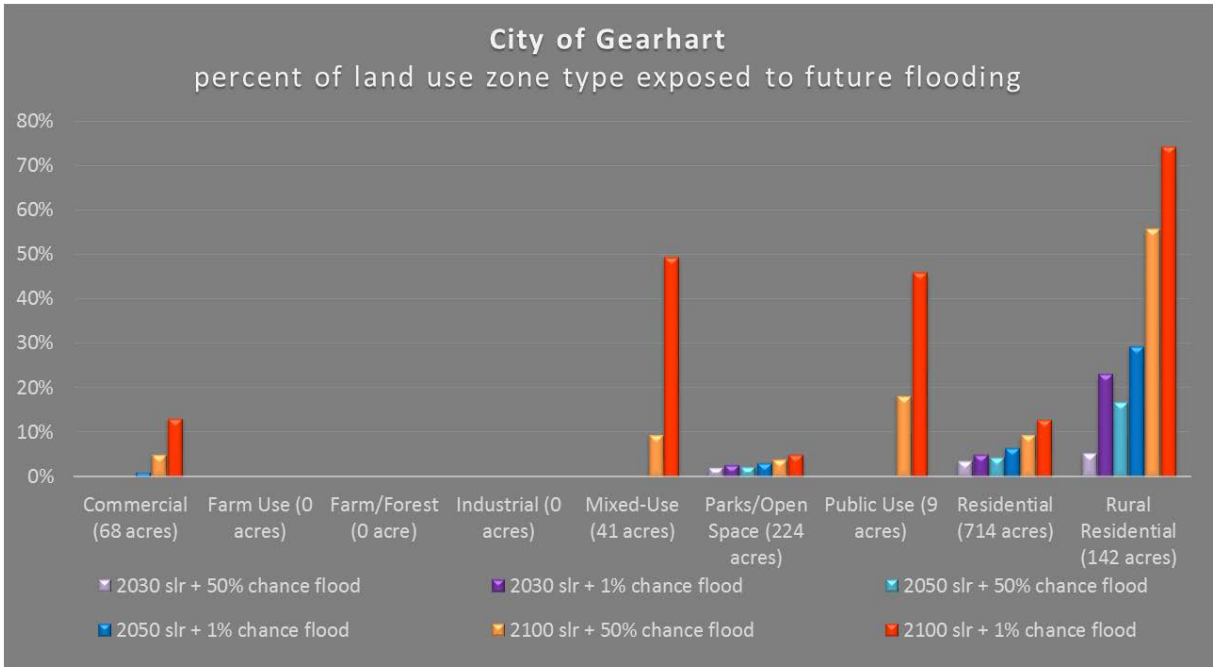

Figure 7. City of Gearhart percent of land use zone types exposed to future flooding

In the near-term, Seaside may see the greatest impacts to its industrial zoned land, but in the long-term impacts occurs across nearly all zones.

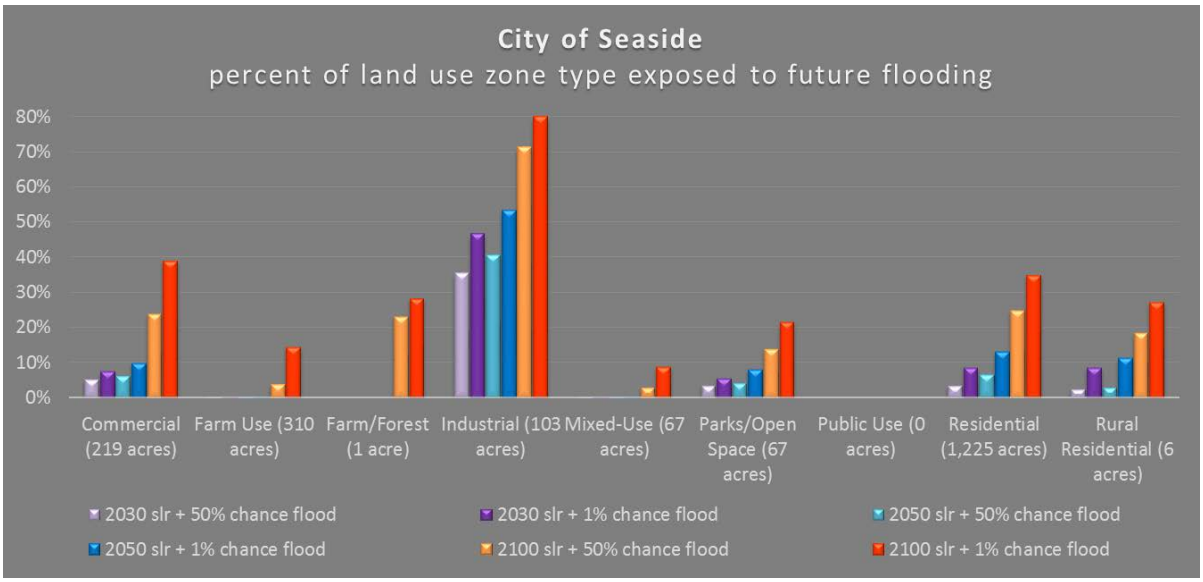

Figure 8. City of Seaside percent of land use zone type exposed to future flooding

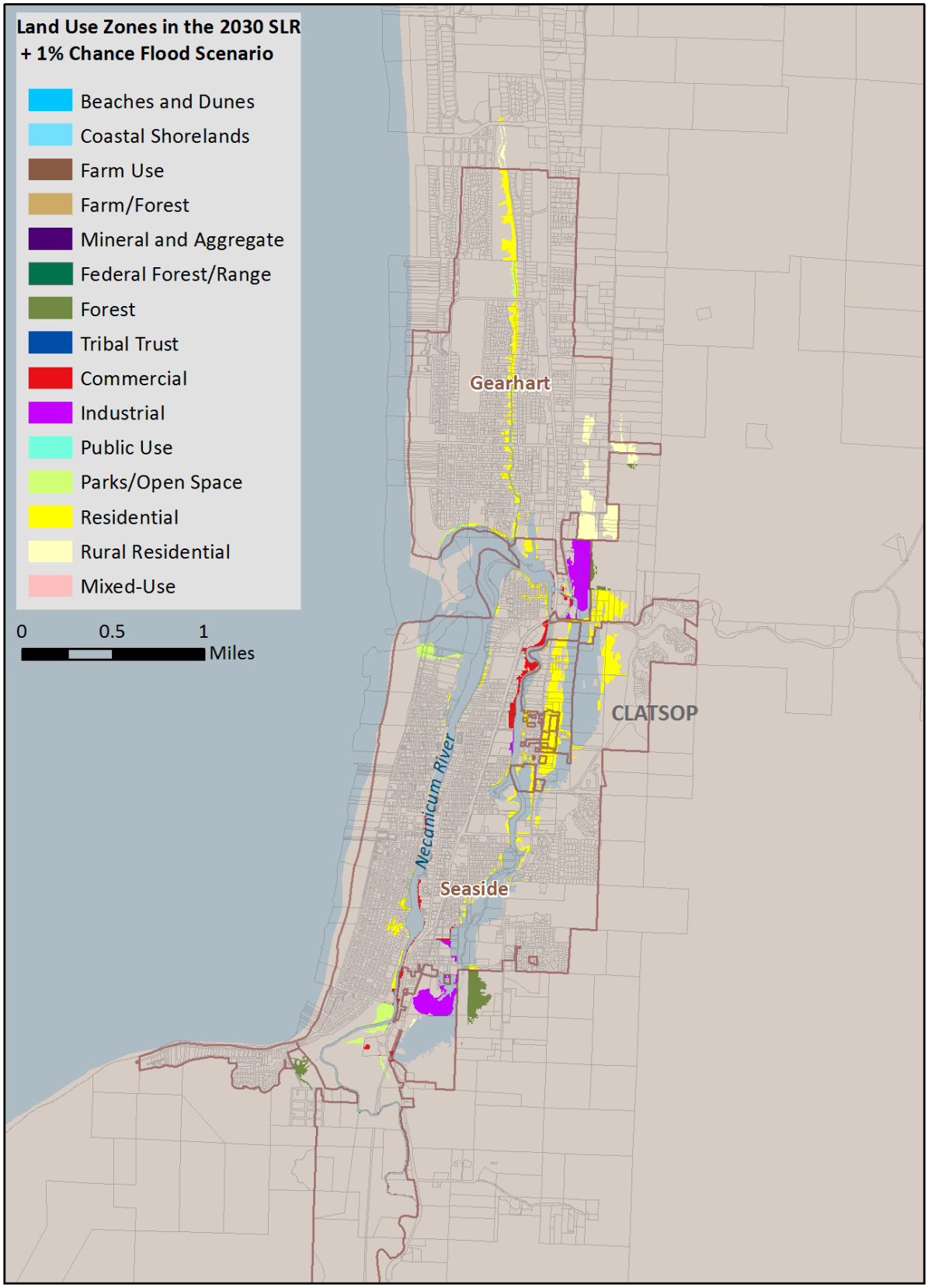

Figure 9. Land Use Zones within the Necanicum River 2030 SLR + 1% chance flood scenario

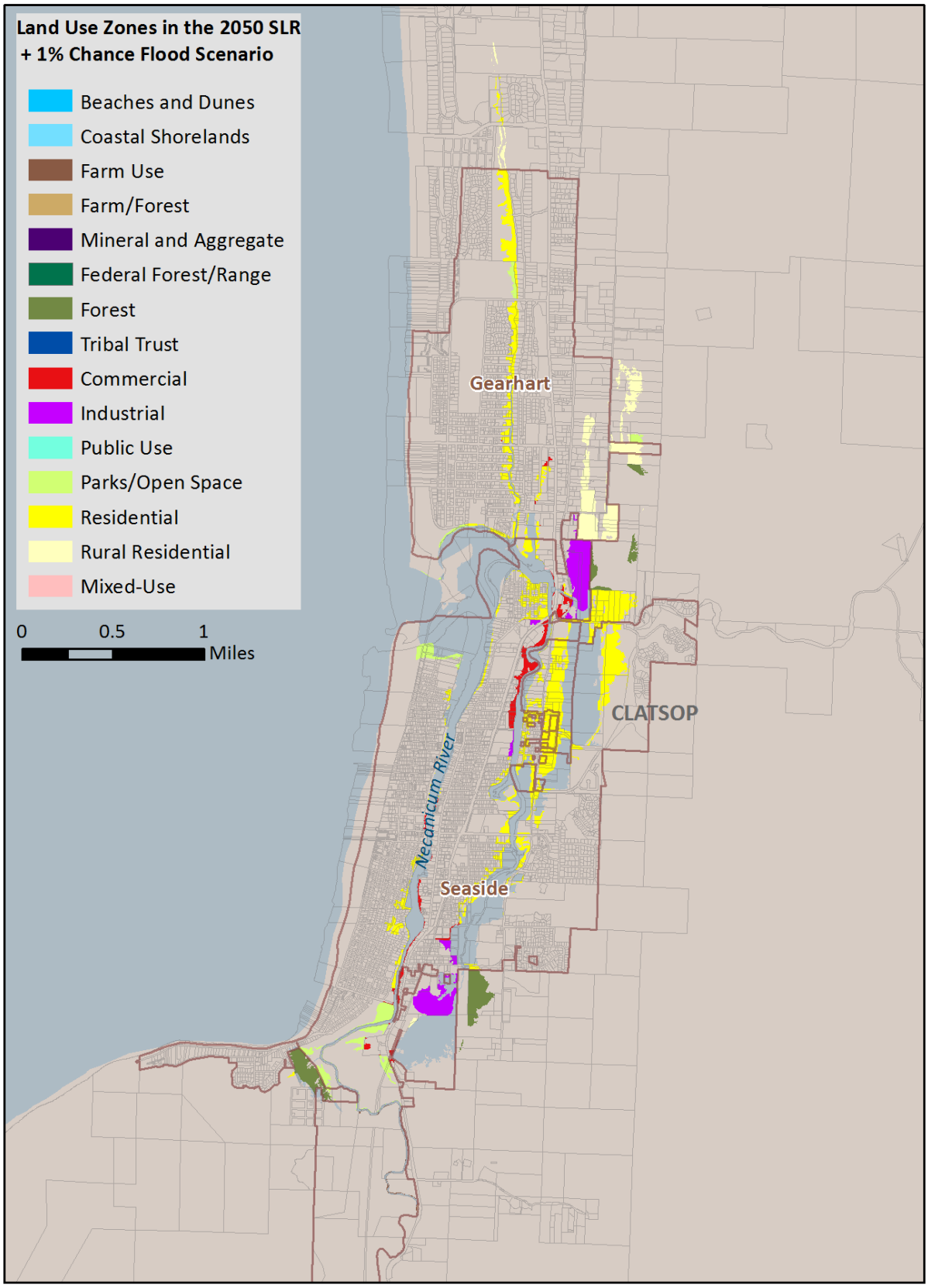

Figure 10. Land Use Zones within the Necanicum River 2050 SLR + 1% chance flood scenario

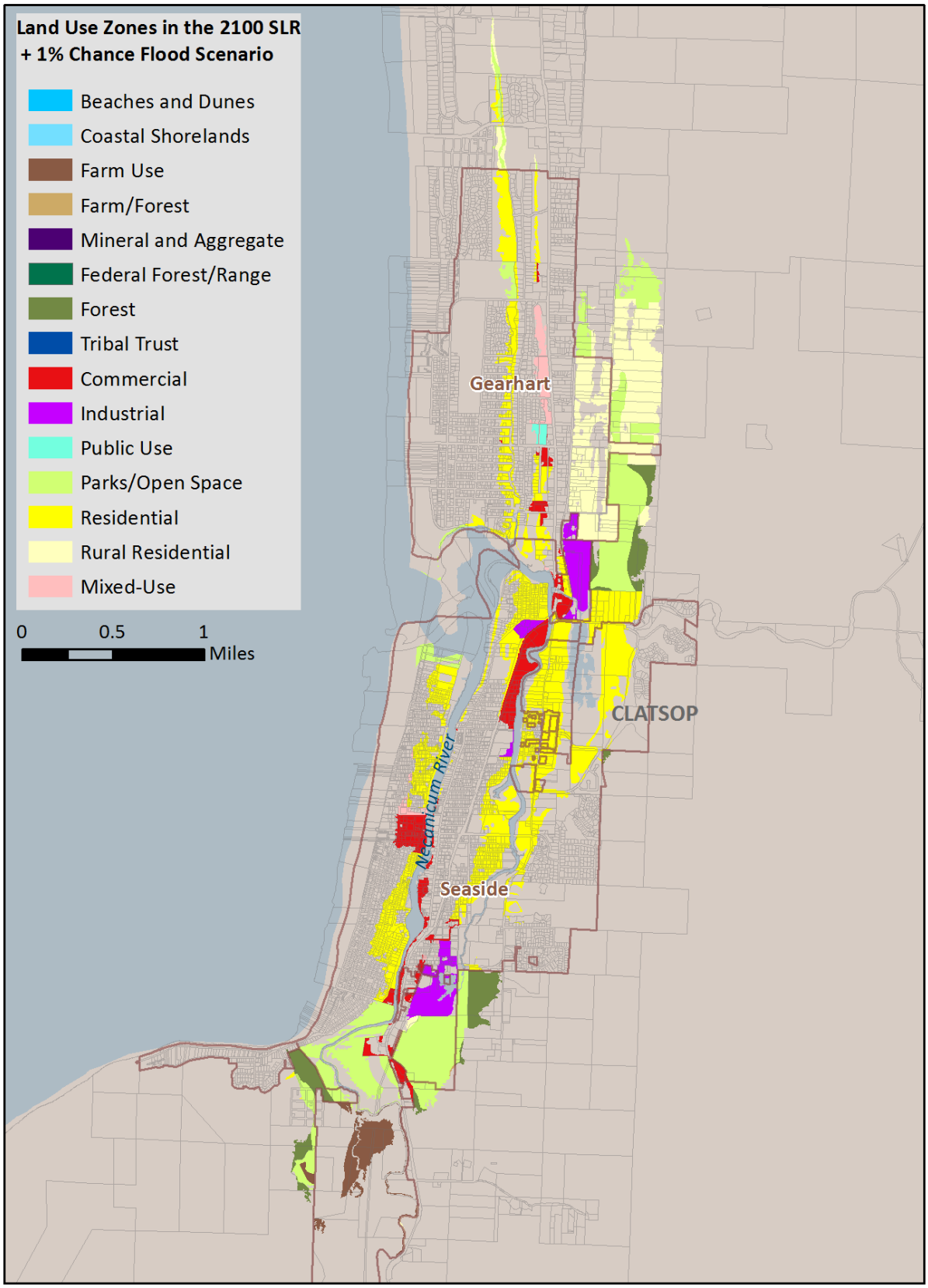

Figure 11. Land Use Zones within the Necanicum River 2100 SLR + 1% chance flood scenario

Nehalem Bay Estuary

This section presents the results of the exposure inventory by asset in the Nehalem Bay system. Flooding from Nehalem Bay already impacts the city of Nehalem, with the frequency and severity of these events increasing into the future. US-101 may experience more frequent flooding, increasing the need for detours. In the long-term (2100), Rockaway Beach may also experience flooding from the estuary. There are two groundwater wells that serve as the community's drinking water source, and further research may be needed to assess the vulnerability of that groundwater to saltwater intrusion.

State Highways

Portions of two state highways are inundated under the six future flood scenarios, Figure 12 provides the total number of miles impacted and Table 1 provides a breakdown of impacted miles per highway.

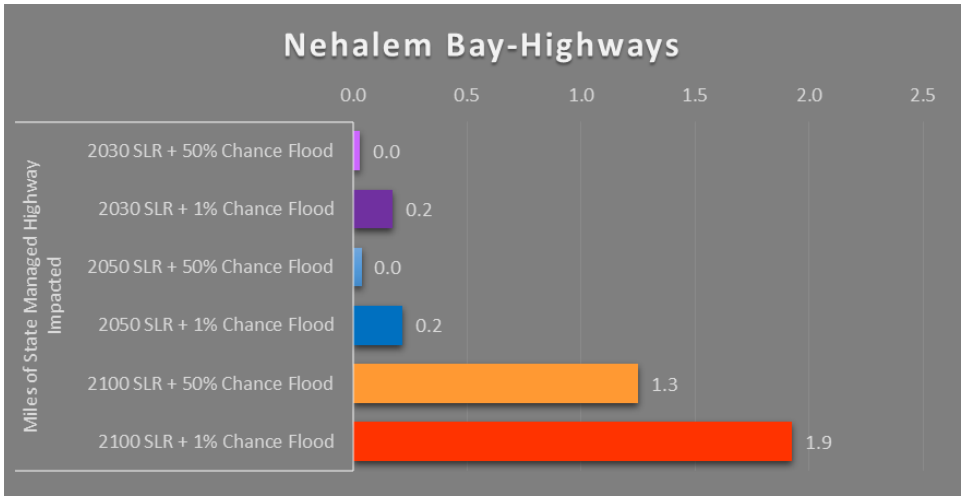

Figure 12. Miles of State Managed Highway Impacted in Nehalem Bay Future Flooding Scenarios

Table 1 Impacted miles per highway

	2030 SLR + 50% Chance Flood	2030 SLR + 1% Chance Flood	2050 SLR + 50% Chance Flood	2050 SLR + 1% Chance Flood	2100 SLR + 50% Chance Flood	2100 SLR + 1% Chance Flood
Necanicum Hwy (OR-53)		0.04	0.03	0.04	0.82	0.99
Oregon Coast Hwy (US-101)	0.03	0.14	0.10	0.18	0.43	0.94

Roads

In addition to the highways impacted, county and local roads also may see flooding under the six flood scenarios. Figure 13 displays the total number of state, county, and local road miles impacted per scenario.

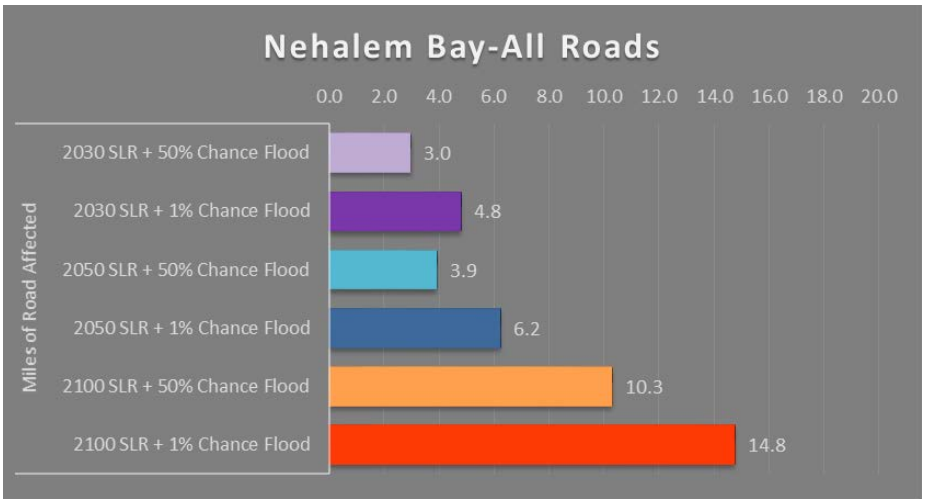

Figure 13. Miles of Road Impacted in Nehalem Bay Future Flooding Scenarios

Airports

The Nehalem Bay State Airport (FAA code 3S7) is partially flooded in the 2050 SLR + 1% chance flood, and both 2100 flood event scenarios.

Railway

A small portion of the Oregon Coast Scenic Railroad in Wheeler is impacted in each of the flooding scenarios. Figure 14 displays the number of miles impacted under each scenario.

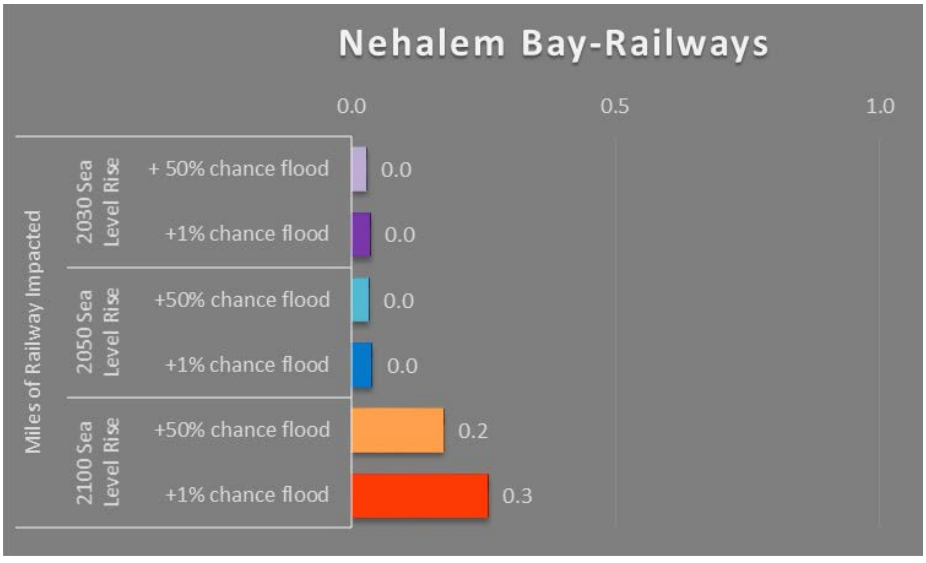

Figure 14. Miles of Railway Impacted in Nehalem Bay Future Flooding Scenarios

Critical Facilities

Table 2 provides the number of critical facilities exposed under the six future flooding scenarios in the Nehalem Bay system.

Table 2

Type of Critical Facility	2030 SLR + 50% Chance Flood	2030 SLR + 1% Chance Flood	2050 SLR + 50% Chance Flood	2050 SLR + 1% Chance Flood	2100 SLR + 50% Chance Flood	2100 SLR + 1% Chance Flood
Fire Station	0	0	0	0	0	0
Police Station/ Sheriff's Office	0	0	0	0	0	0
School	0	0	0	0	0	0
Hospital	0	0	0	0	0	0
City Hall • **Nehalem City Hall**	0	0	0	1	1	1
Total	**0**	**0**	**0**	**1**	**1**	**1**

Municipal Use Drinking Water

Rockaway Beach Water District has two ground water wells within the future flooding scenarios, one is within the 2050 SLR + 1% chance flood area, and one is within the 2100 SLR + 50% chance flood area.

Wastewater Treatment Plant

The Nehalem Bay Sewage Treatment Plant is within both of the 2100 future flood scenarios.

Electric Substations

There are no substations within the six future flooding scenarios.

Potential Contaminant Sources

There are large contaminant sources in the scenario areas for Nehalem Bay (Table 3); 3 in the 2050 SLR + 1% chance flood, and 7 in both of the 2100 future flooding scenarios.

Table 3

Potential Contaminant Sources	2030 SLR + 50% Chance Flood	2030 SLR + 1% Chance Flood	2050 SLR + 50% Chance Flood	2050 SLR + 1% Chance Flood	2100 SLR + 50% Chance Flood	2100 SLR + 1% Chance Flood
High Density Septic Systems	-	-	-	2	2	2
Large Capacity Septic Systems	-	-	-	-	2	2
Confined Animal Feeding Operations (CAFOs)	-	-	-	1	3	3

Buildings

The number of buildings impacted under each scenario is shown in Figure 15. Buildings in Nehalem and Wheeler are impacted in the near-term scenario, while buildings in Nedonna Beach see a large increase in impacts in the 2100 scenarios.

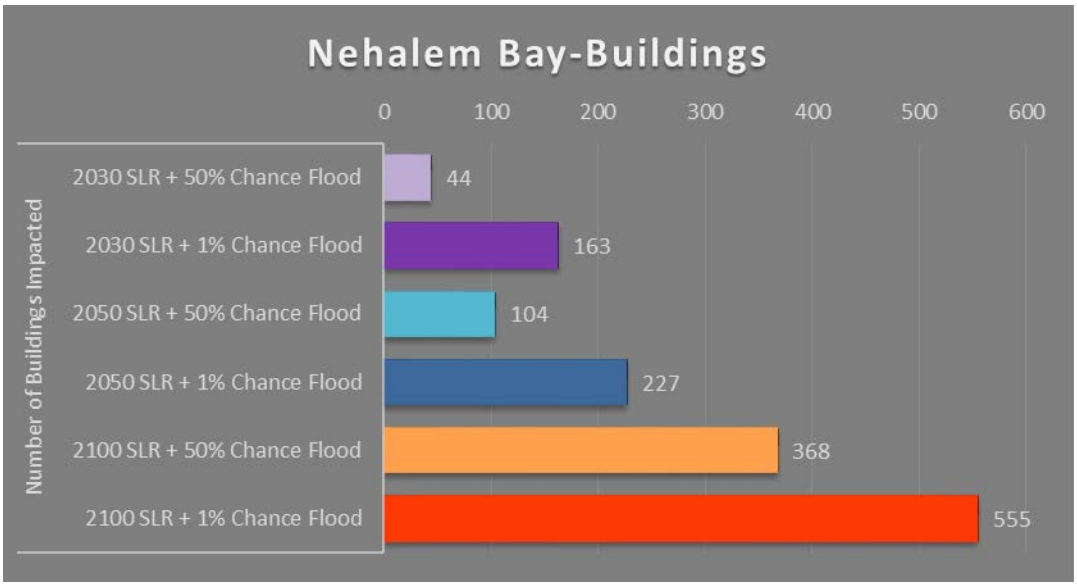

Figure 15. Number of Building Exposed to the Future Flooding Scenarios in the Nehalem Bay System

Overview Map

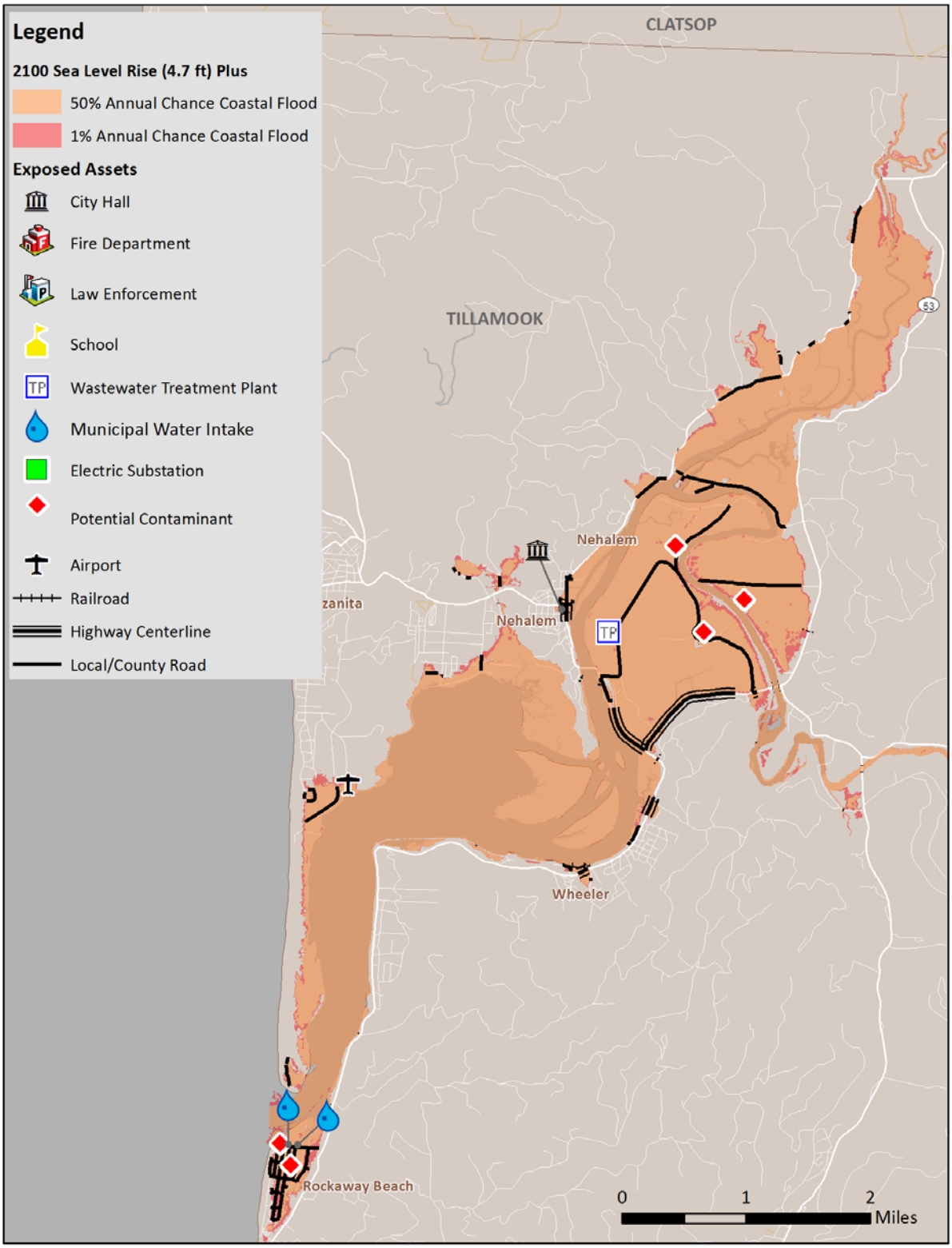

Figure 16. Nehalem Bay 2100 Flood Scenario and Assets Map (for the 2030 and 2050 scenario maps, please visit http://coastalatlas.net/sealevelriseviewer/)

Land Use Zones

The land use zones within each future flooding scenarios are provided as a percentage of the zoning type within a jurisdiction. Parks/Open Space may be considered an appropriate use for land that is subject to flooding, whereas residential may not be. A community can use these results to identify areas for improvements in their zoning. The results for Tillamook County are provided in Figure 17, City of Nehalem are provided in Figure 18, City of Wheeler in Figure 19, and Rockaway Beach in Figure 21. Maps of the results are shown in Figures 22, 23, and 24.

Nehalem Bay will flood areas zoned for commercial, farm use, parks/open space, and a small percent of rural residential in Tillamook County; there are not large jumps in percentages as the flood height increases.

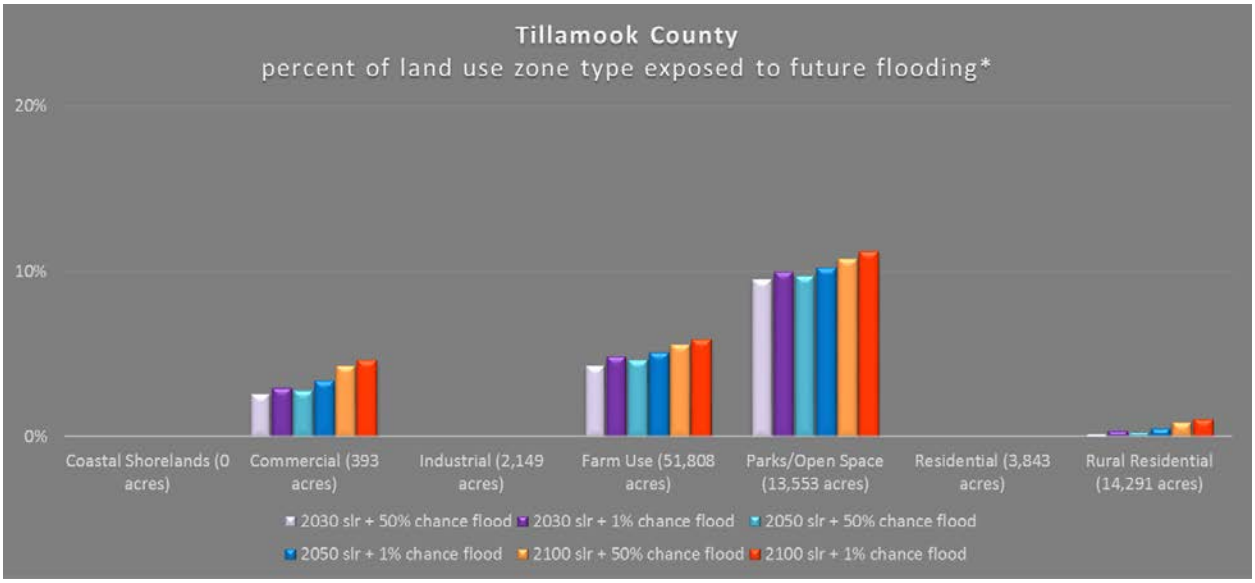

Figure 17. Tillamook County percent of land use zone types exposed to future flooding

**Only includes flooding from Nehalem Bay. Percent of land use zone types flooded from the other estuaries in Tillamook County are presented separately.*

In the City of Nehalem, appropriately, areas zoned as coastal shorelands and parks/open space are within the flooding scenarios. Nehalem also has commercial, residential, and rural residential zones with the future flooding scenarios.

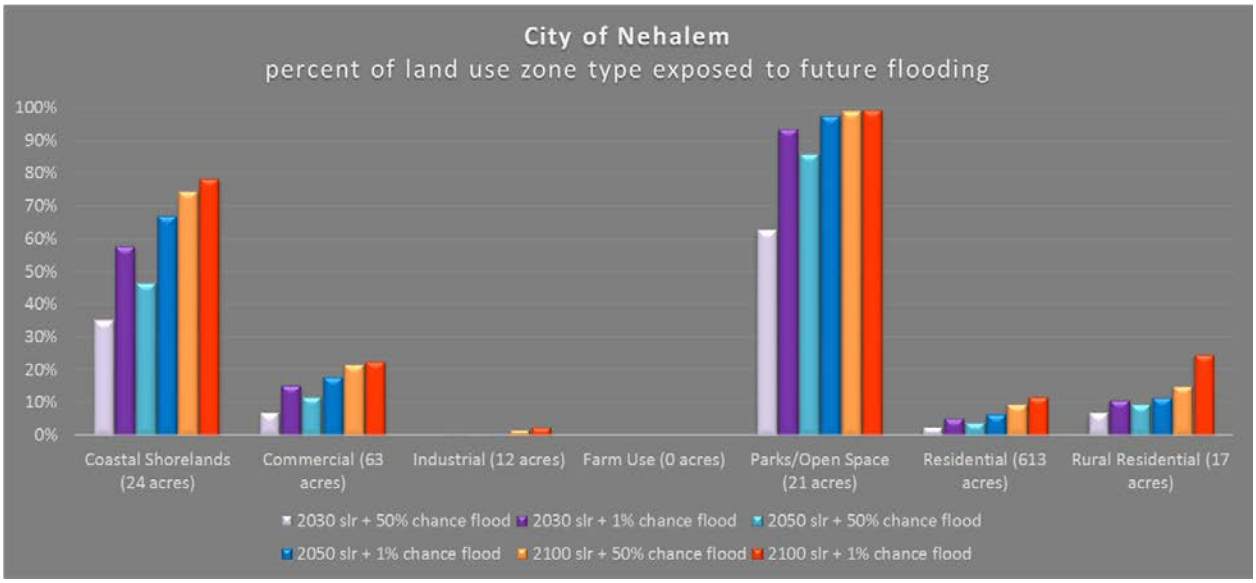

Figure 18. City of Nehalem percent of land use zone type exposed to future flooding

In the City of Wheeler, commercial, industrial, and park/open space zoned areas are within the future flooding scenarios. There is a large increase in industrial zoned land that is flooded from 2030 to 2100.

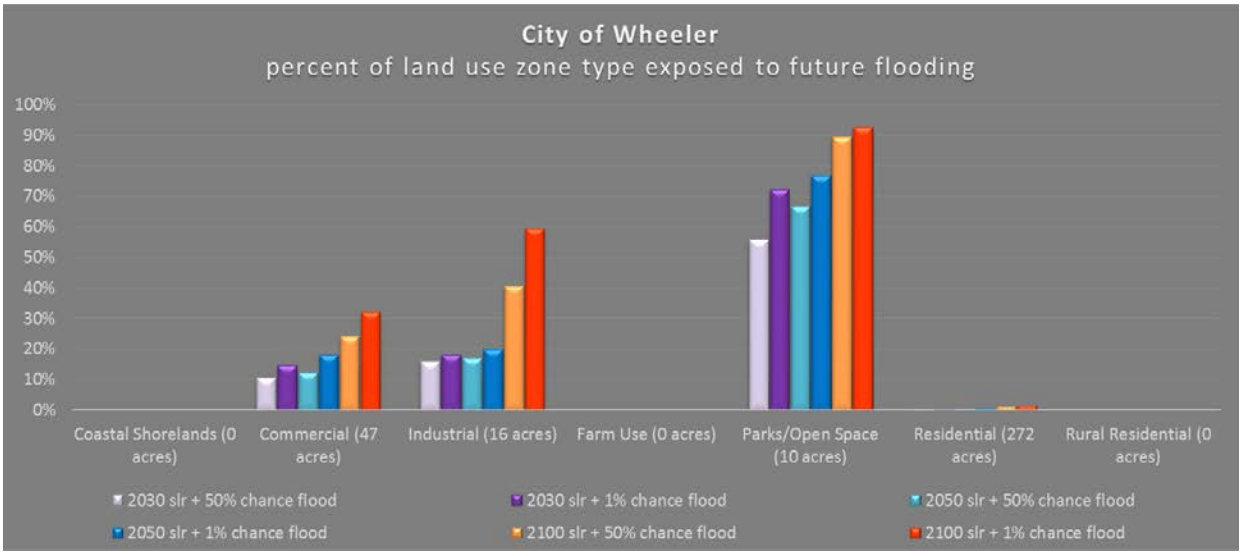

Figure 19. City of Wheeler percent of land use zone type exposed to future flooding

Rockaway Beach sees minimal impacts, but with a greater percentage of residential zoned land flooded in the year 2100.

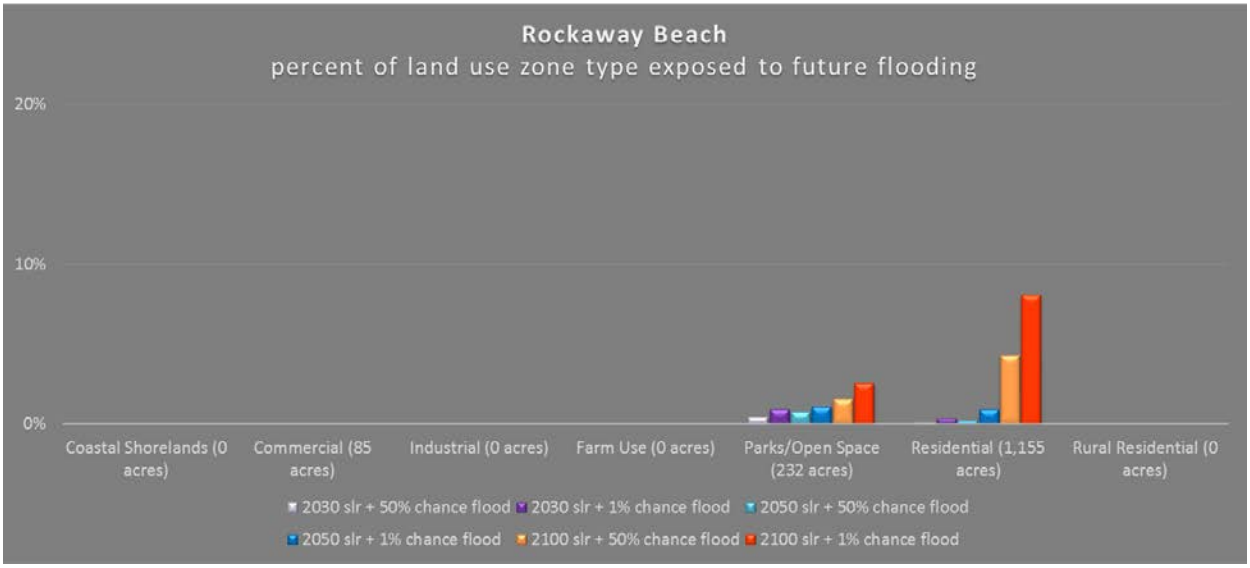

Figure 20. Rockaway Beach percent of land use zone type exposed to future flooding

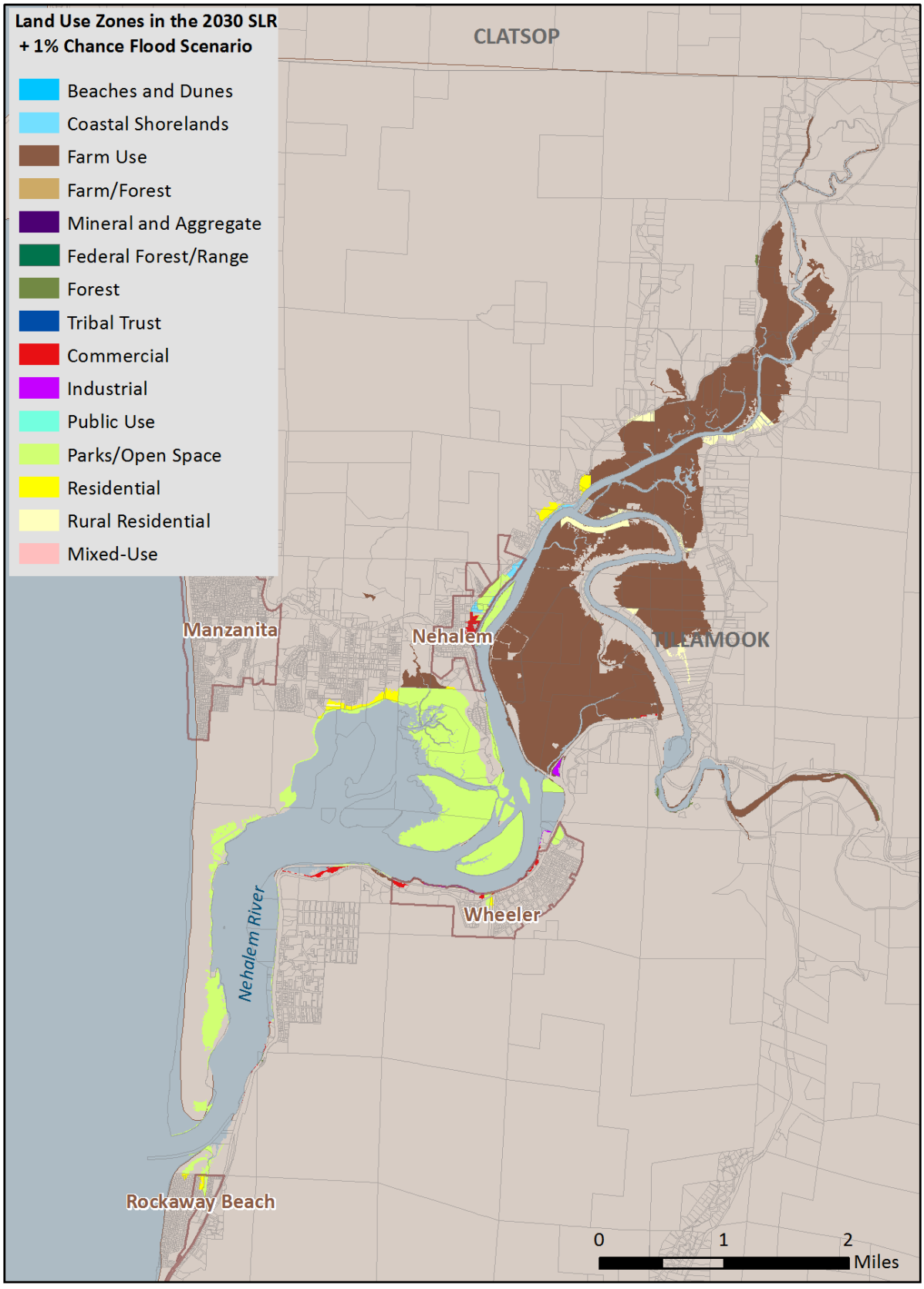

Figure 21. Land Use Zones within the Nehalem Bay 2030 SLR + 1% chance flood scenario

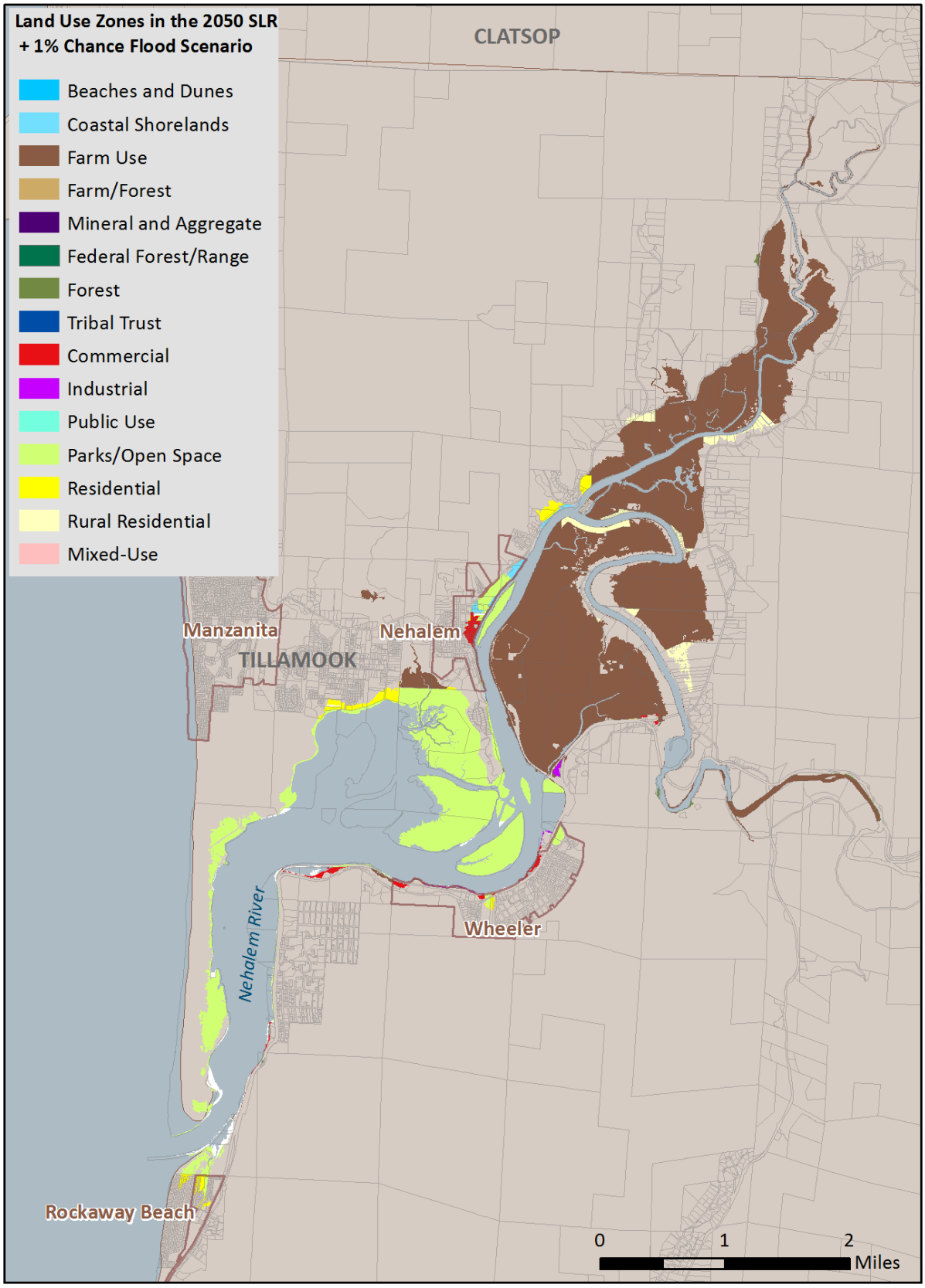

Figure 22. Land Use Zones within the Nehalem Bay 2050 SLR + 1% chance flood scenario

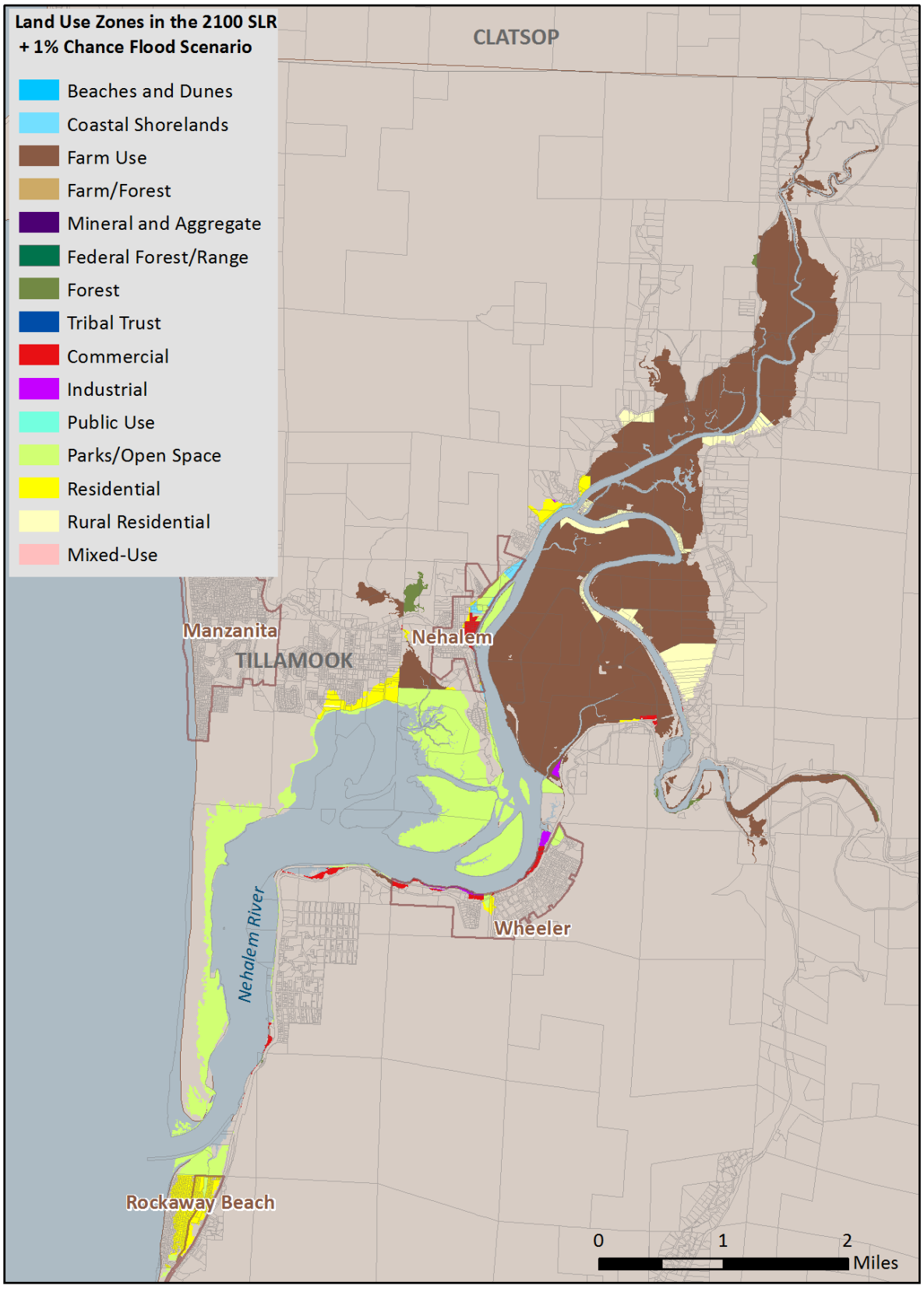

Figure 23. Land Use Zones within the Nehalem Bay 2100 SLR + 1% chance flood scenario

Tillamook Bay Estuary

This section presents the results of the exposure inventory by asset in the Tillamook Bay system. Tillamook Bay has an expansive floodplain of primarily agricultural land that will be flooded more frequently with sea-level rise. Much of the city of Tillamook sits at a higher elevation and will be unaffected by sea-level rise. Although, US-101 and Netarts Highway connecting the city to the north and west are highly vulnerable as early as 2030. Additionally, Tillamook Bay has the largest number of potential contaminant sources across all of the estuaries, so water quality will be an issue to monitor as these areas flood more frequently.

State Highways

A number of state highways are inundated under the six future flooding scenarios, Figure 23 provides the total number of miles impacted and Table 4 provides a breakdown of impacted miles per highway.

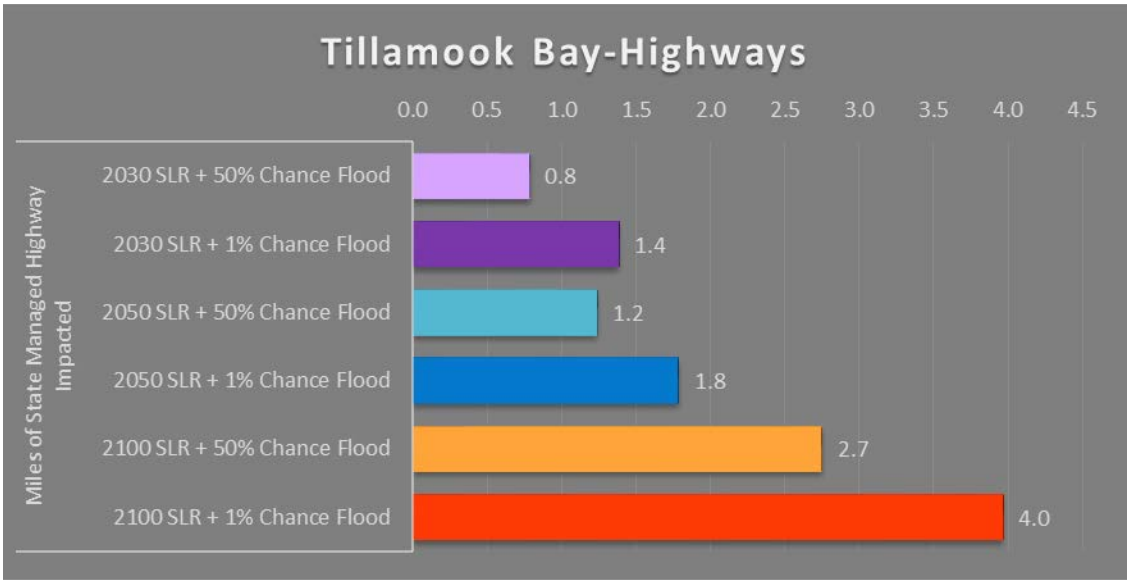

Figure 24. Miles of State Managed Highway Impacted in the Tillamook Bay Future Flooding Scenarios

Table 4 Impacted miles per highway

	2030 SLR + 50% Chance Flood	2030 SLR + 1% Chance Flood	2050 SLR + 50% Chance Flood	2050 SLR + 1% Chance Flood	2100 SLR + 50% Chance Flood	2100 SLR + 1% Chance Flood
Netarts Hwy (OR-131)	0.62	0.71	0.67	0.87	1.17	1.31
Oregon Coast Hwy (US-101)	0.16	0.67	0.56	0.82	1.45	2.49
Wilson River Hwy (OR-6)				0.09	0.13	0.17

Roads

In addition to the highways impacted, county and local roads also may see flooding under the six flood scenarios. Figure 24 displays the total number of state, county, and local road miles impacted per scenario.

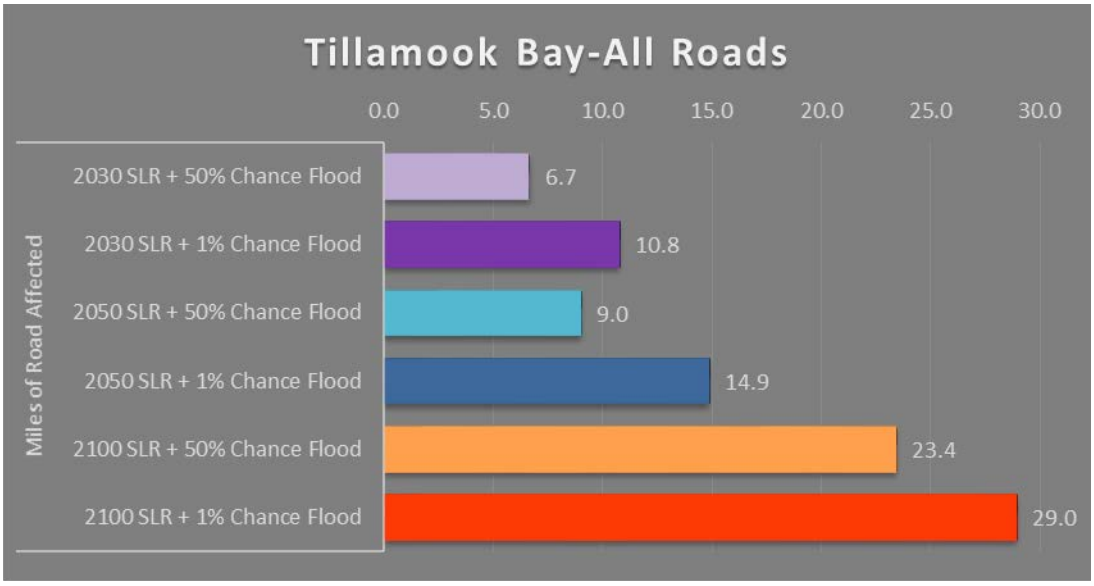

Figure 25. Miles of Road Impacted in the Tillamook Bay Future Flooding Scenarios

Airports

There are no airports that are within the future flood scenarios.

Railway

A portion of the Oregon Coast Scenic Railroad near Hathaway Slough is impacted in each of the flooding scenarios, but primarily in the highest scenario. Figure 25 displays the number of miles impacted under each scenario.

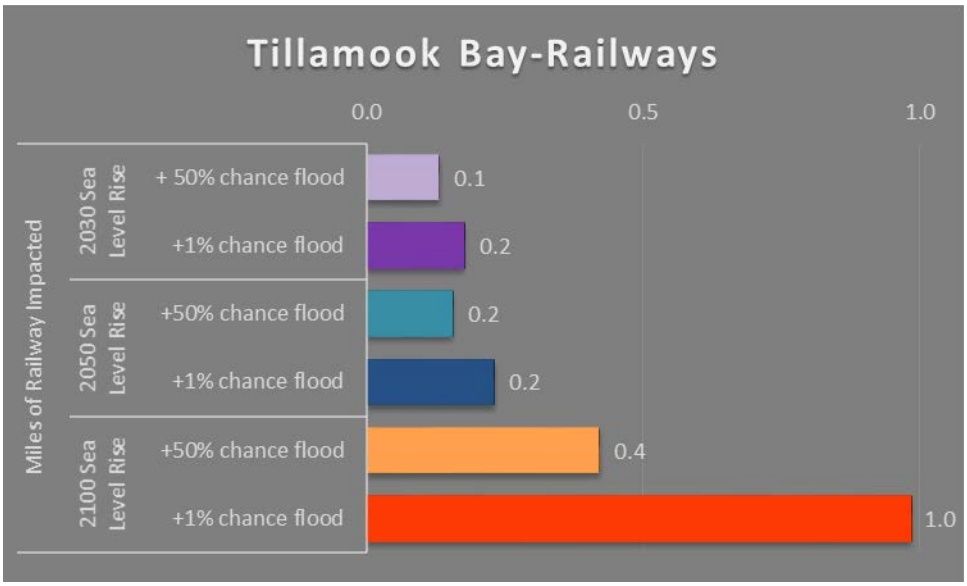

Figure 26. Miles of Railway Impacted in the Tillamook Bay Future Flooding Scenarios

Critical Facilities

There are no fire stations, police stations, sheriff's offices, schools, hospitals, or city halls in the future flood scenarios within the Tillamook Bay system.

Municipal Use Drinking Water

There are no municipal drinking water sources that are within the future flood scenarios.

Wastewater Treatment Plant

The Tillamook Sewage Treatment Plant along the Trask River is within the 2100 SLR + 1% chance flood scenario. The Bay City Sewage Treatment Plant is within the 2050 SLR + 1% chance flood scenario, the 2100 SLR + 50% chance flood scenario, and the 2100 SLR + 1% chance flood scenarios.

Electric Substations

There are no substations within the six future flooding scenarios.

Potential Contaminant Sources

There are large contaminant sources in the scenario areas for Tillamook Bay (Table 5); 4 in the 2030 SLR + 50% chance flood; 20 in the 2030 SLR + 1% chance flood; 12 in the 2050 SLR + 50% chance flood; 23 in the 2050 SLR + 1% chance flood; 30 in the 2100 SLR + 50% chance flood; and 37 in the 2100 SLR + 1% chance flood.

Table 5

Potential Contaminant Sources	2030 SLR + 50% Chance Flood	2030 SLR + 1% Chance Flood	2050 SLR + 50% Chance Flood	2050 SLR + 1% Chance Flood	2100 SLR + 50% Chance Flood	2100 SLR + 1% Chance Flood
Confined Animal Feeding Operations (CAFOs)	4	7	7	8	12	16
Gas Station		1		1	1	1
Automobile Repair Shop		5	1	6	7	8
Fleet/Trucking/Bus Terminal		1	-	1	1	1
Known Contamination Sites/Plumes/Spills		2	2	2	2	2
Parking Lots/Malls (>50 spaces)		1		1	1	1
Solid Waste Facility		2	2	2	2	2
Underground Storage Tank-Leaking		1		1	1	1
Underground Storage Tank-Status Unknown				1	1	1
Chemical/Petroleum Processing/Storage						2
Lagoons/Liquid Wastes					2	2

Buildings

The number of buildings impacted under each scenario is shown in Figure 26. Impacted buildings are distributed across the developed areas of the Tillamook Bay shorelands including Garibaldi, Bay City, and Tillamook.

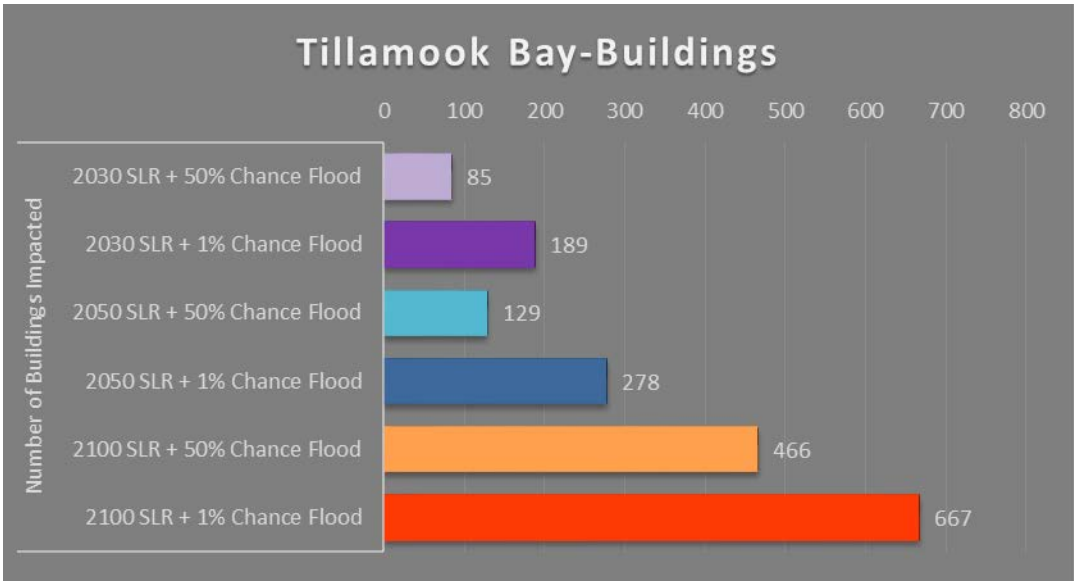

Figure 27. Number of Buildings Exposed to the Future Flooding Scenarios in the Tillamook Bay System

Overview Map

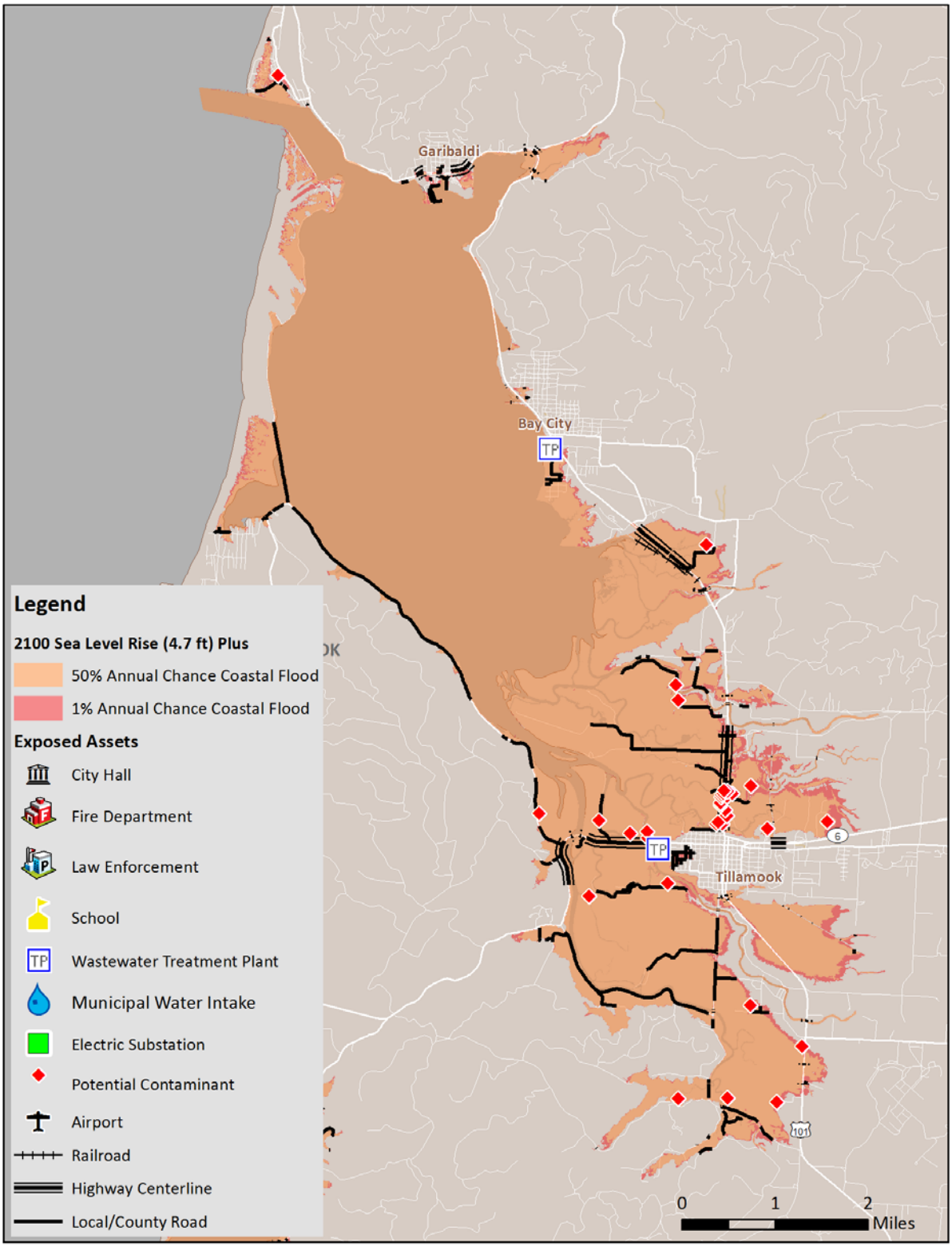

Figure 28. Tillamook Bay 2100 Flood Scenarios and Assets Map (for the 2030 and 2050 scenario maps, please visit http://coastalatlas.net/sealevelriseviewer/)

Land Use Zones

The land use zones within each future flooding scenarios are provided as a percentage of the zoning type within a jurisdiction. Parks/Open Space may be considered an appropriate use for land that is subject to flooding, whereas residential may not be. A community can use these results to identify areas for improvements in their zoning. The results for Tillamook County are provided in Figure 29, Bay City are provided in Figure 30, Garibaldi in Figure 31, and City of Tillamook in Figure 32. Maps of the results are shown in Figures 33, 34, and 35.

Portions of commercial, farm use, industrial, parks/open space, and rural residential zoned land in Tillamook County will be flooded by the Tillamook Bay system.

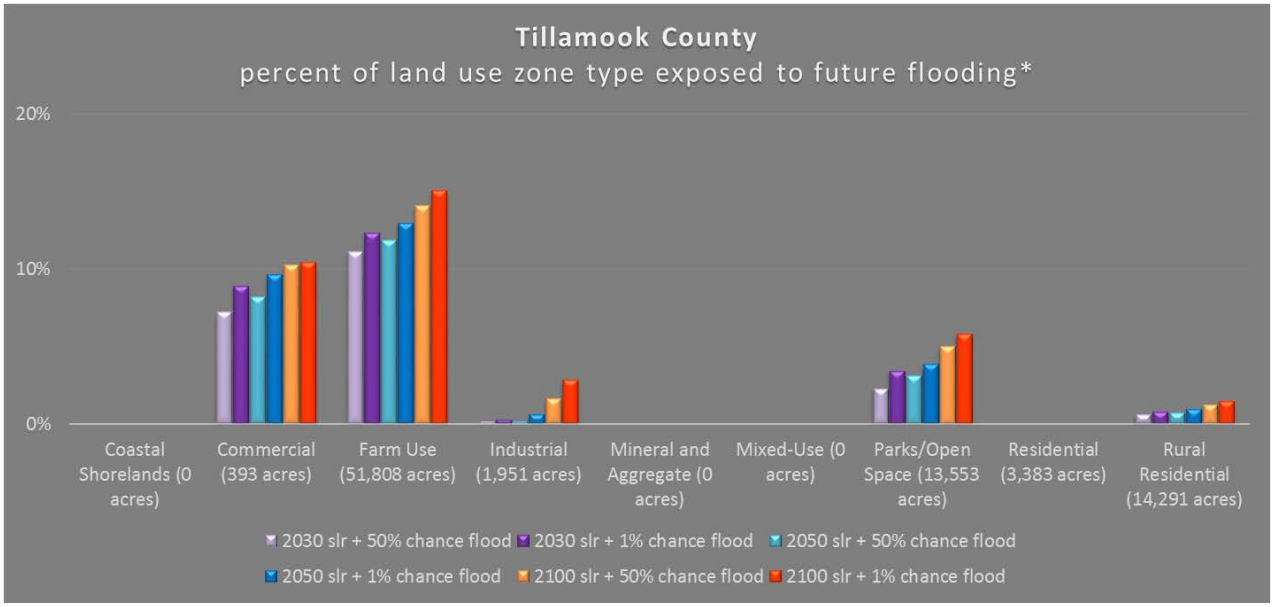

Figure 29. Tillamook County percent of land use zone types exposed to future flooding

**Only includes flooding from Tillamook Bay. Percent of land use zone types flooded from the other estuaries in Tillamook County are presented separately.*

A small percentage of residential zoned land is within the future flooding scenarios in Bay City. Other zones within the flooding scenarios are coastal shorelands, and mineral and aggregate; and are likely appropriate zoning types for a floodplain.

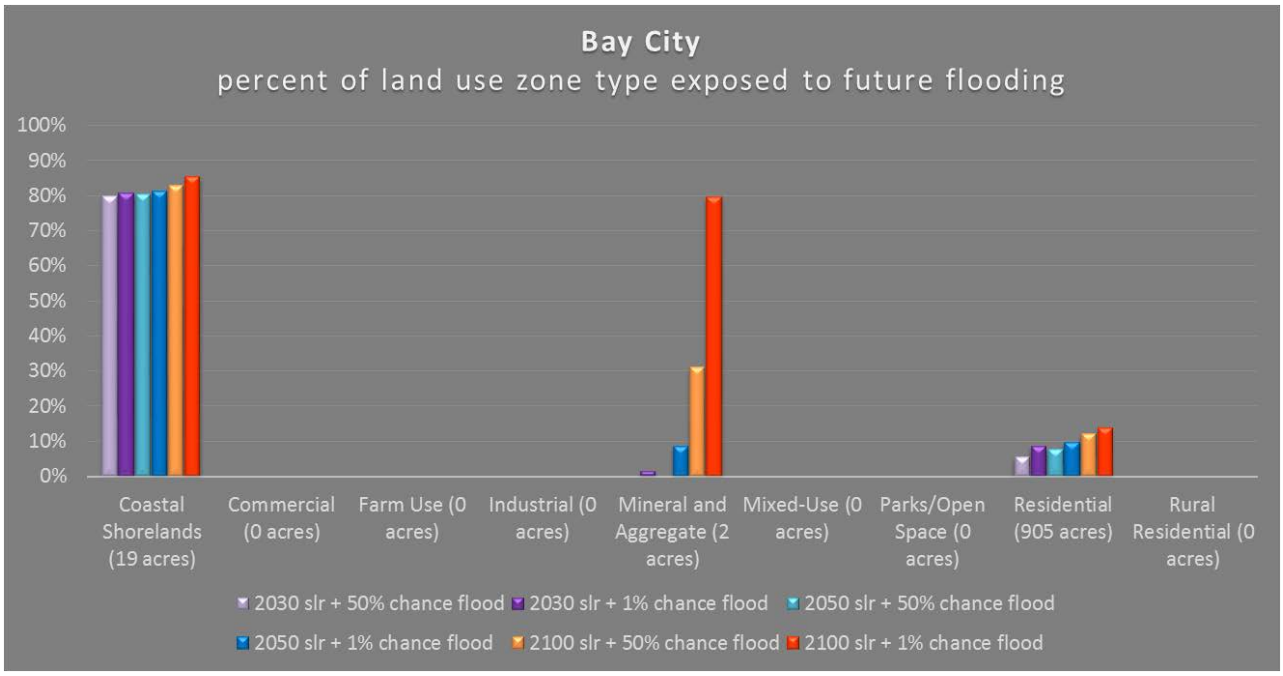

Figure 30. Bay City percent of land use zone type exposed to future flooding

In Garibaldi, commercial, industrial, mineral and aggregate, mixed-use, and residential zoned land is within the future flooding scenarios. There are large increase in the percentages of impacted industrial, mineral and aggregate, and mixed-use zone in the long-term scenarios.

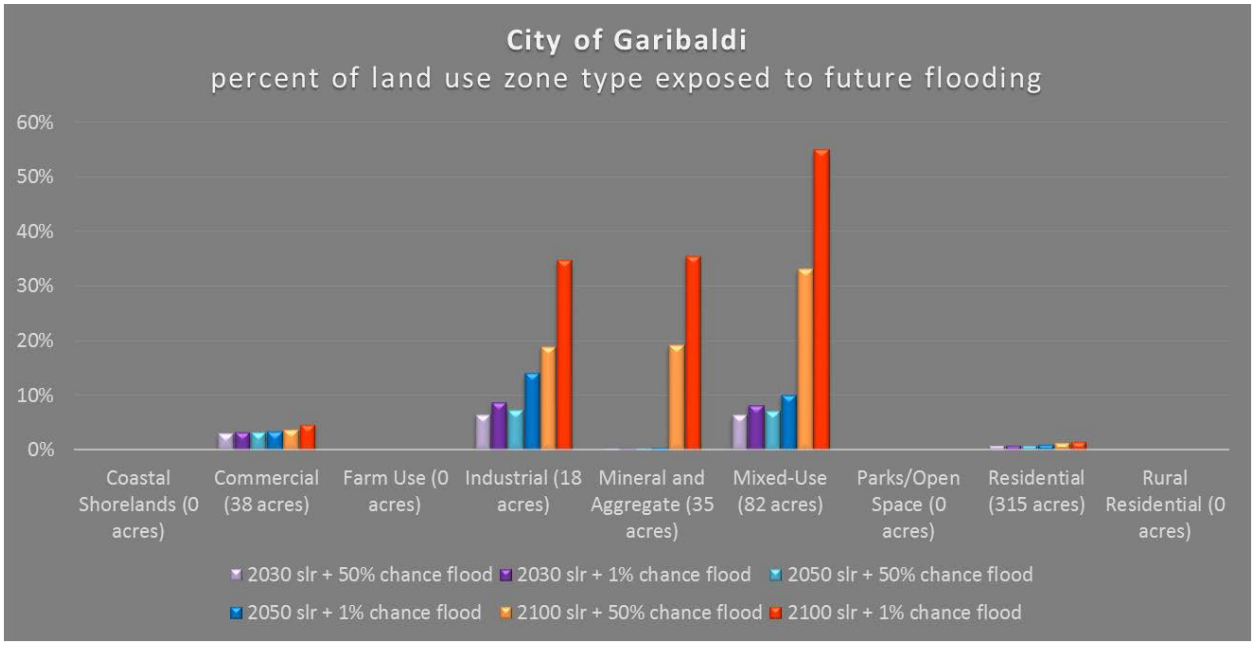

Figure 31. Garibaldi percent of land use zone type exposed to future flooding

In the City of Tillamook, commercial, industrial, mixed-use, parks/open space, and residential zoned land is within the future flooding scenarios. With each increase in flood height in the scenarios, there is a large increase in commercial zoned land impacted; going from less than 10% to over 50%.

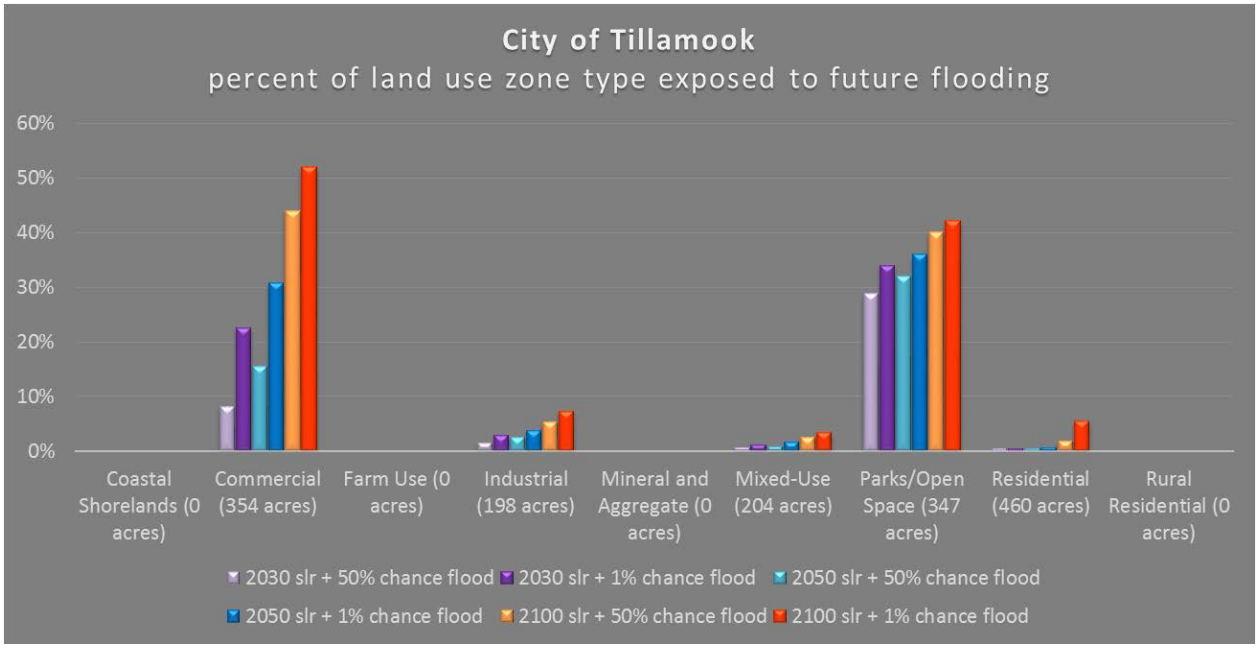

Figure 32. City of Tillamook percent of land use zone type exposed to future flooding

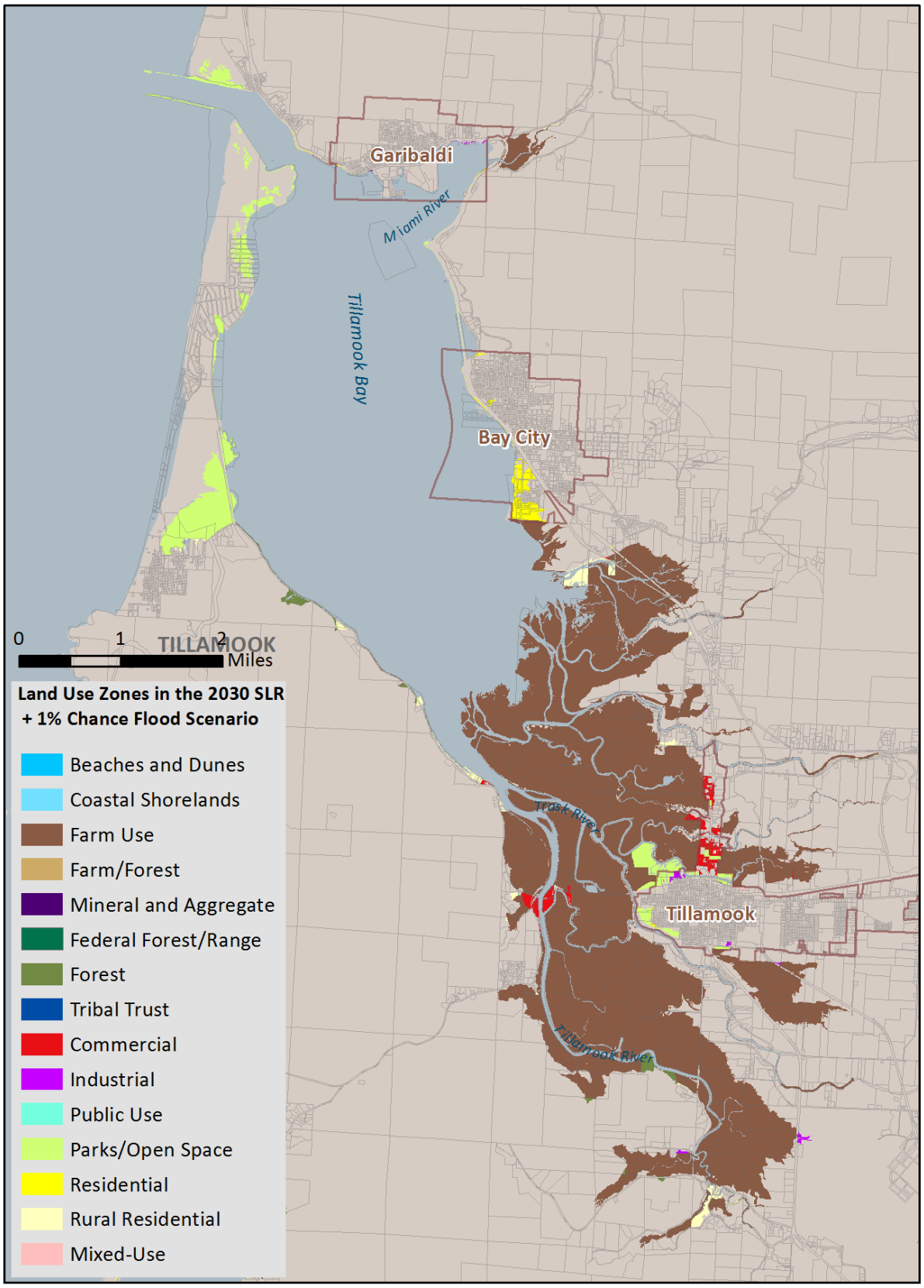

Figure 33. Land Use Zones within the Tillamook Bay 2030 SLR + 1% chance flood scenario

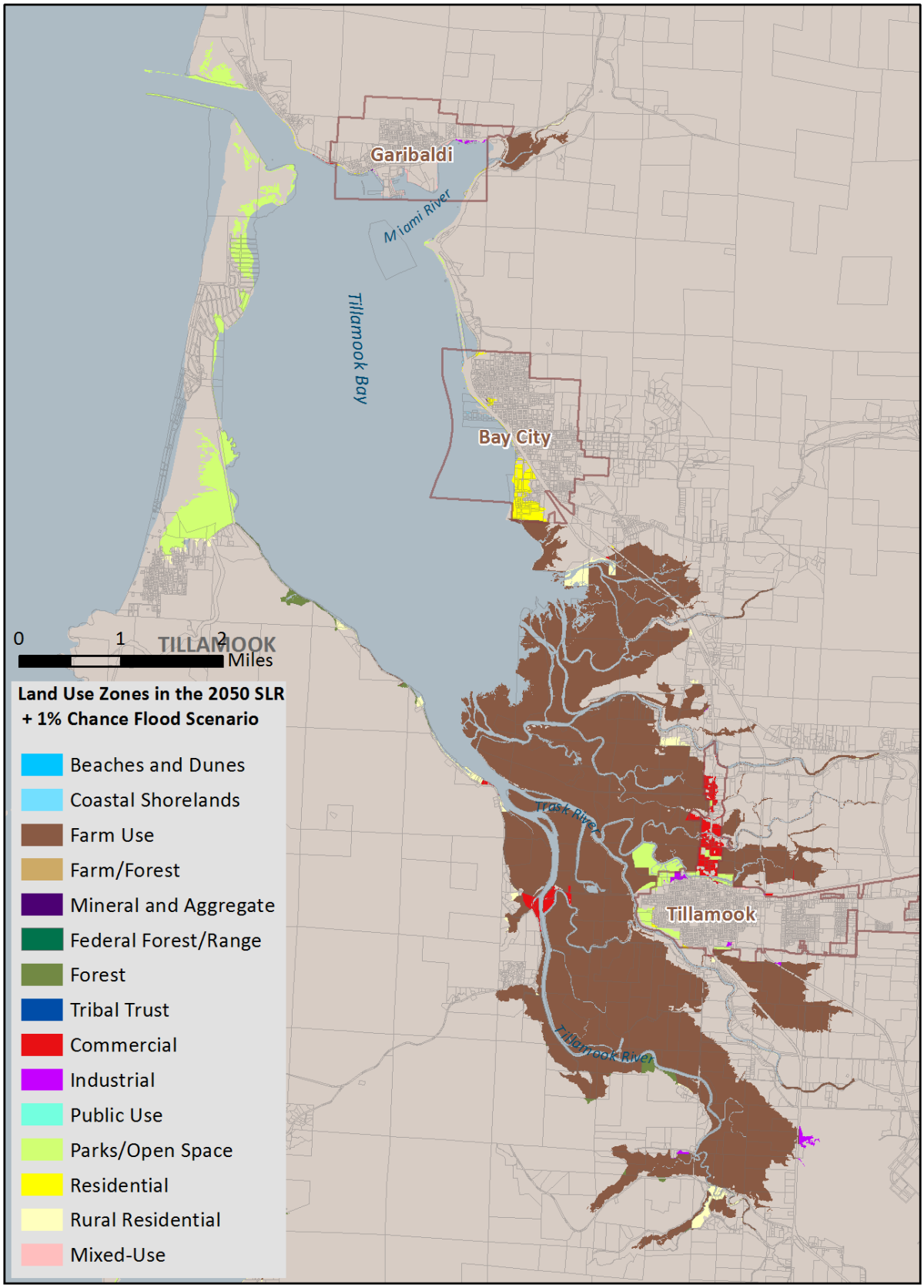

Figure 34. Land Use Zones within the Tillamook Bay 2050 SLR + 1% chance flood scenario

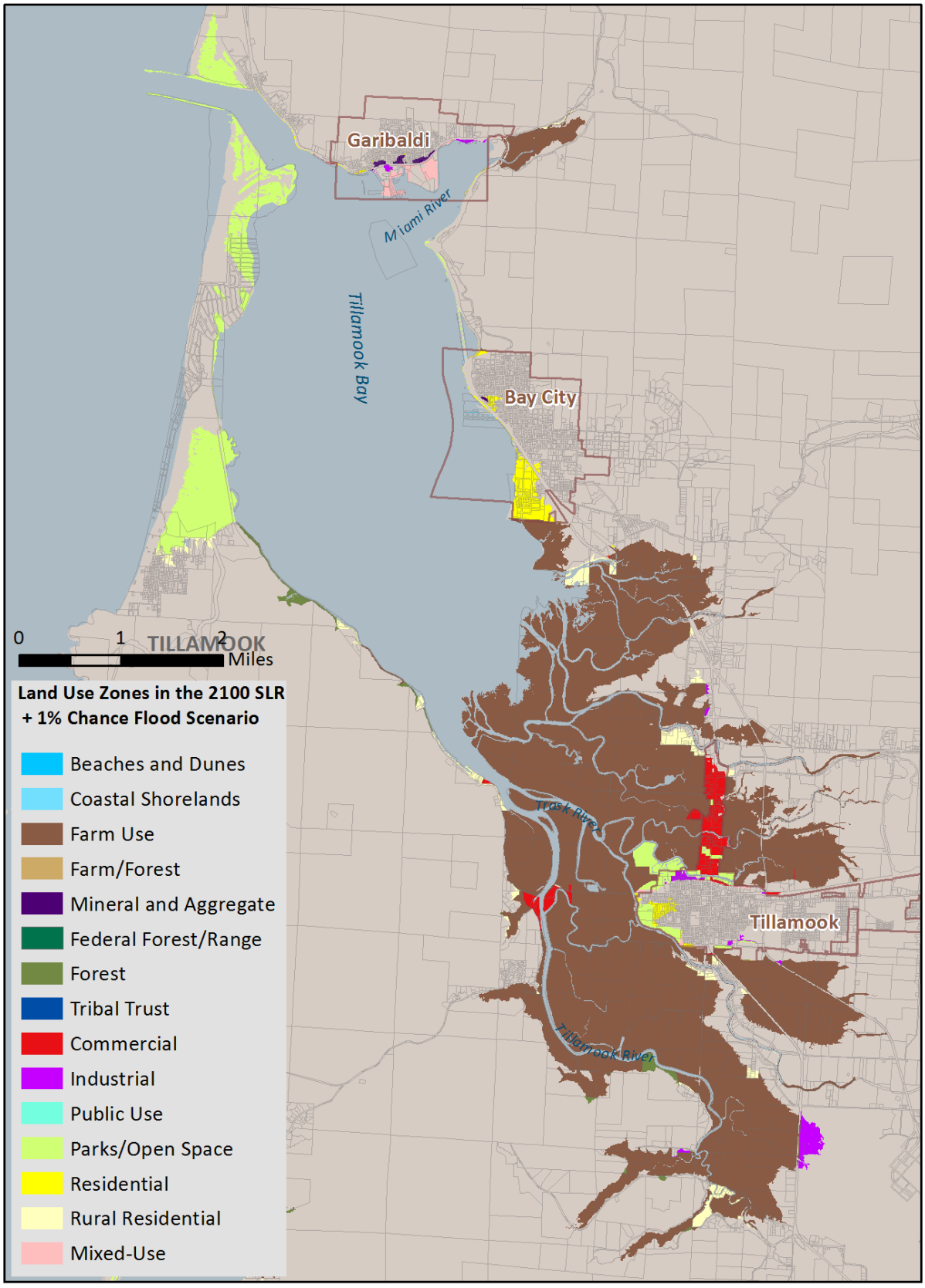

Figure 35. Land Use Zones within the Tillamook Bay 2100 SLR + 1% chance flood scenario

Netarts Bay Estuary

This section presents the results of the exposure inventory by asset in the Netarts Bay system. Netarts Bay is a small system with very little development and a narrow floodplain. These characteristics lead to few major impacts from sea-level rise. In the long-term, flooding impacts would be primarily to Netarts Bay Dr.

State Highways

There are no state highways impacted by the six future flood scenarios.

Roads

However, county and local roads may see flooding under the six flood scenarios. Figure 36 displays the total number of county and local road miles impacted per scenario.

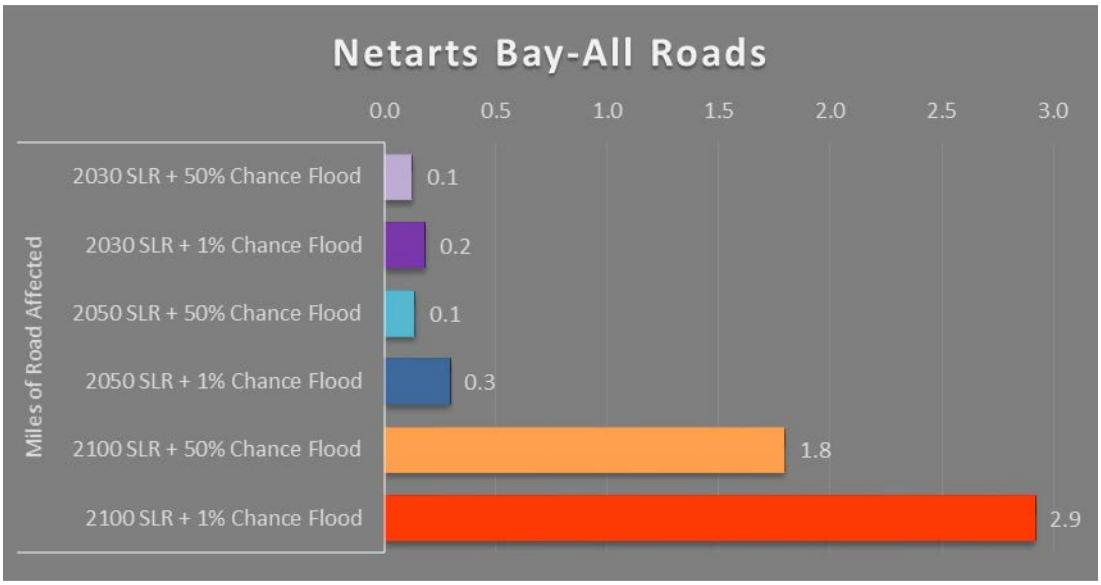

Figure 36. Miles of Road Impacted in the Netarts Bay Future Flooding Scenarios

Airports

There are no airports that are within the future flood scenarios.

Railway

There are no railroads affected in the future flood scenarios.

Critical Facilities

There are no fire stations, police stations, sheriff's offices, schools, hospitals, or city halls in the future flood scenarios within the Netarts Bay system.

Municipal Use Drinking Water

There are no municipal drinking water sources that are within the future flood scenarios.

Wastewater Treatment Plant

There are no wastewater treatment plants that are within the future flood scenarios.

Electric Substation

There are no substations within the six future flooding scenarios.

Potential Contaminant Sources

There are no large contaminant sources within the six future flooding scenarios.

Buildings

A small number of buildings flood in the scenarios along Netarts Bay. The number of buildings impacted under each scenario is shown in Figure 37.

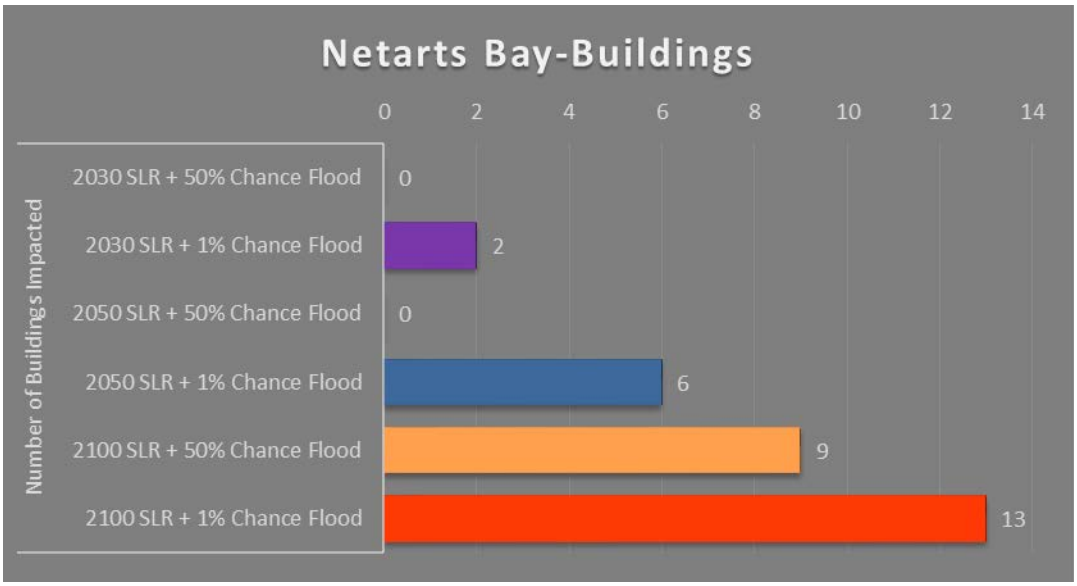

Figure 37. Number of Buildings Exposed to the Future Flooding Scenarios in the Netarts Bay System

Overview Map

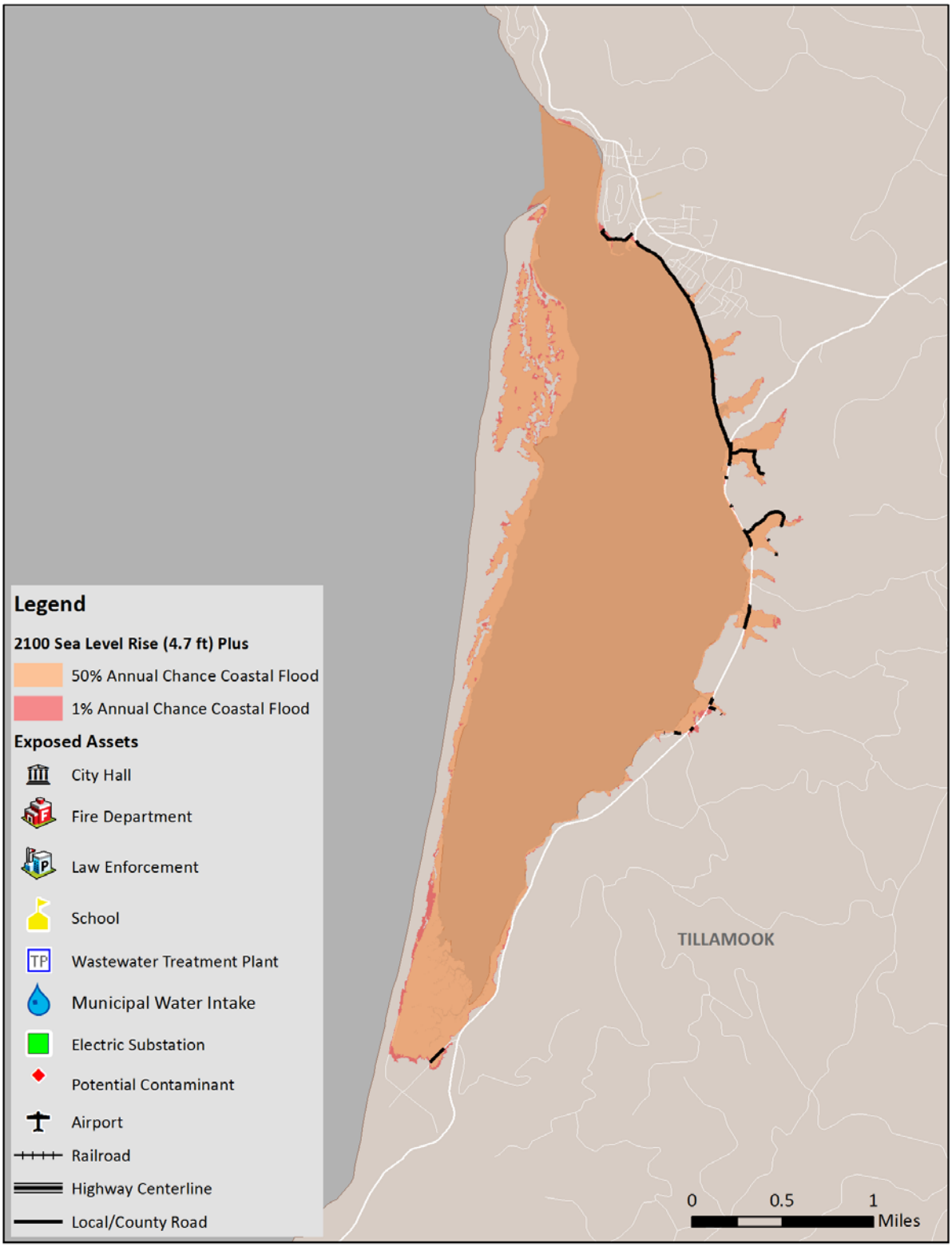

Figure 38. Netarts Bay 2100 Flood Scenarios and Assets Map (for the 2030 and 2050 scenario maps, please visit http://coastalatlas.net/sealevelriseviewer/)

Land Use Zones

The land use zones within each future flooding scenarios are provided as a percentage of the zoning type within a jurisdiction. Parks/Open Space may be considered an appropriate use for land that is subject to flooding, whereas residential may not be. A community can use these results to identify areas for improvements in their zoning. The results for Tillamook County are provided in Figure 39. Maps of the results are shown in Figures 40, 41, and 42.

A small portion of commercial and rural residential zoned land in Tillamook County could flood from Netarts Bay; whereas the majority of the land in the future flood scenarios is park/open space zoning.

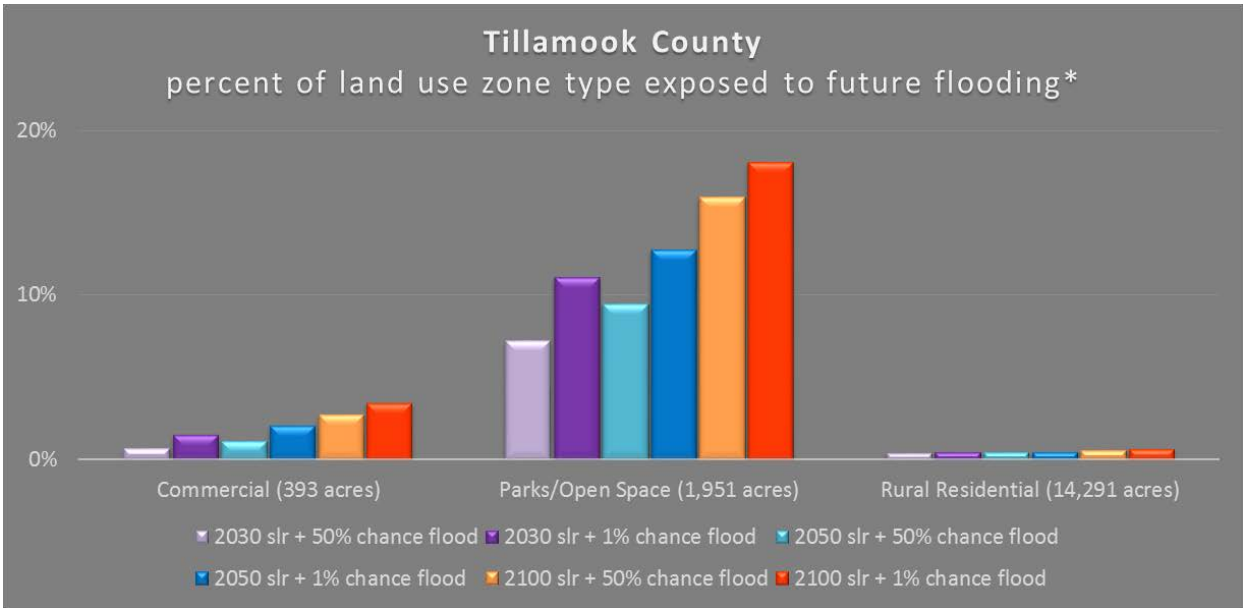

Figure 39. Tillamook County percent of land use zone types exposed to future flooding

**Only includes flooding from Netarts Bay. Percent of land use zone types flooded from the other estuaries in Tillamook County are presented separately.*

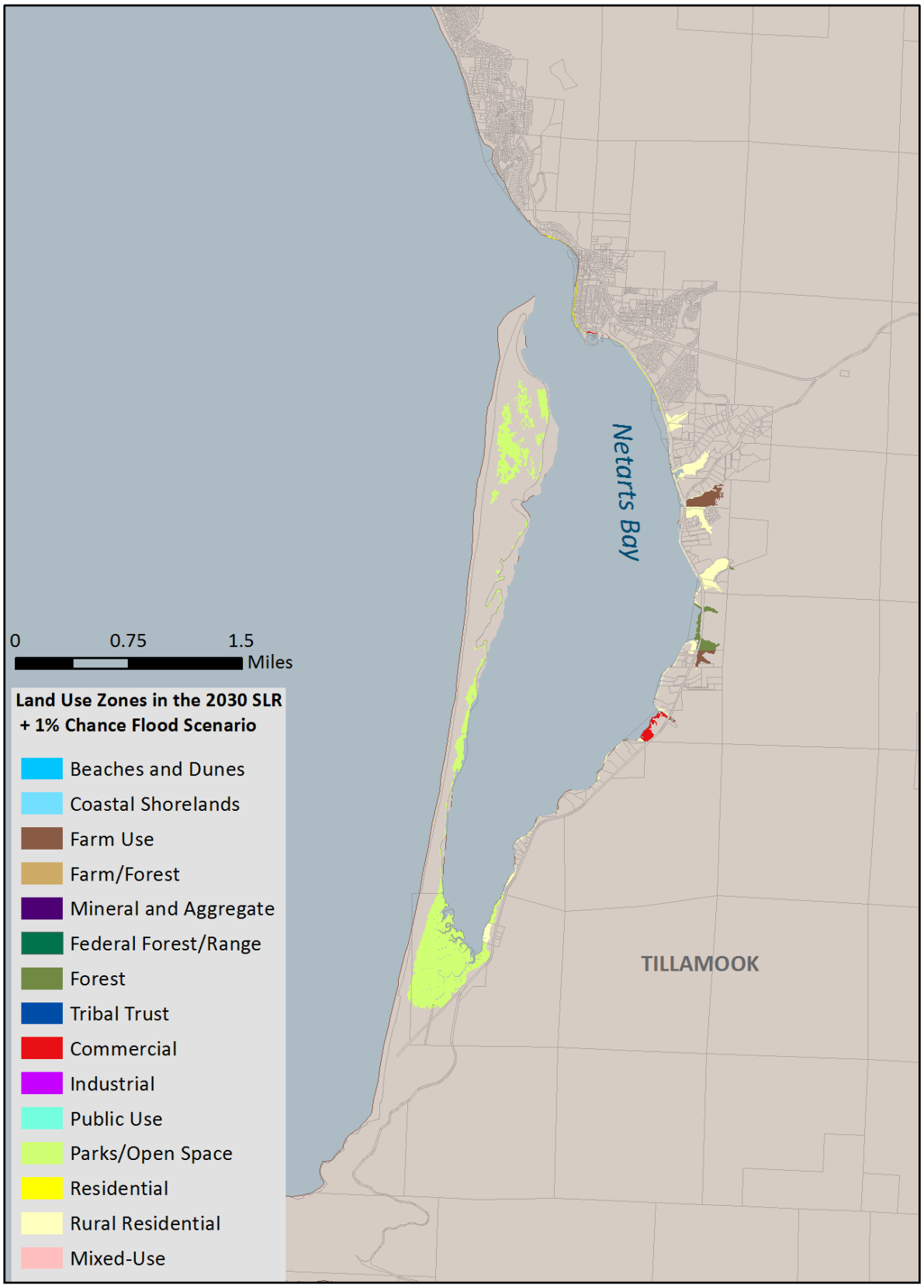

Figure 40. Land Use Zones within the Netarts Bay 2030 SLR + 1% chance flood scenario

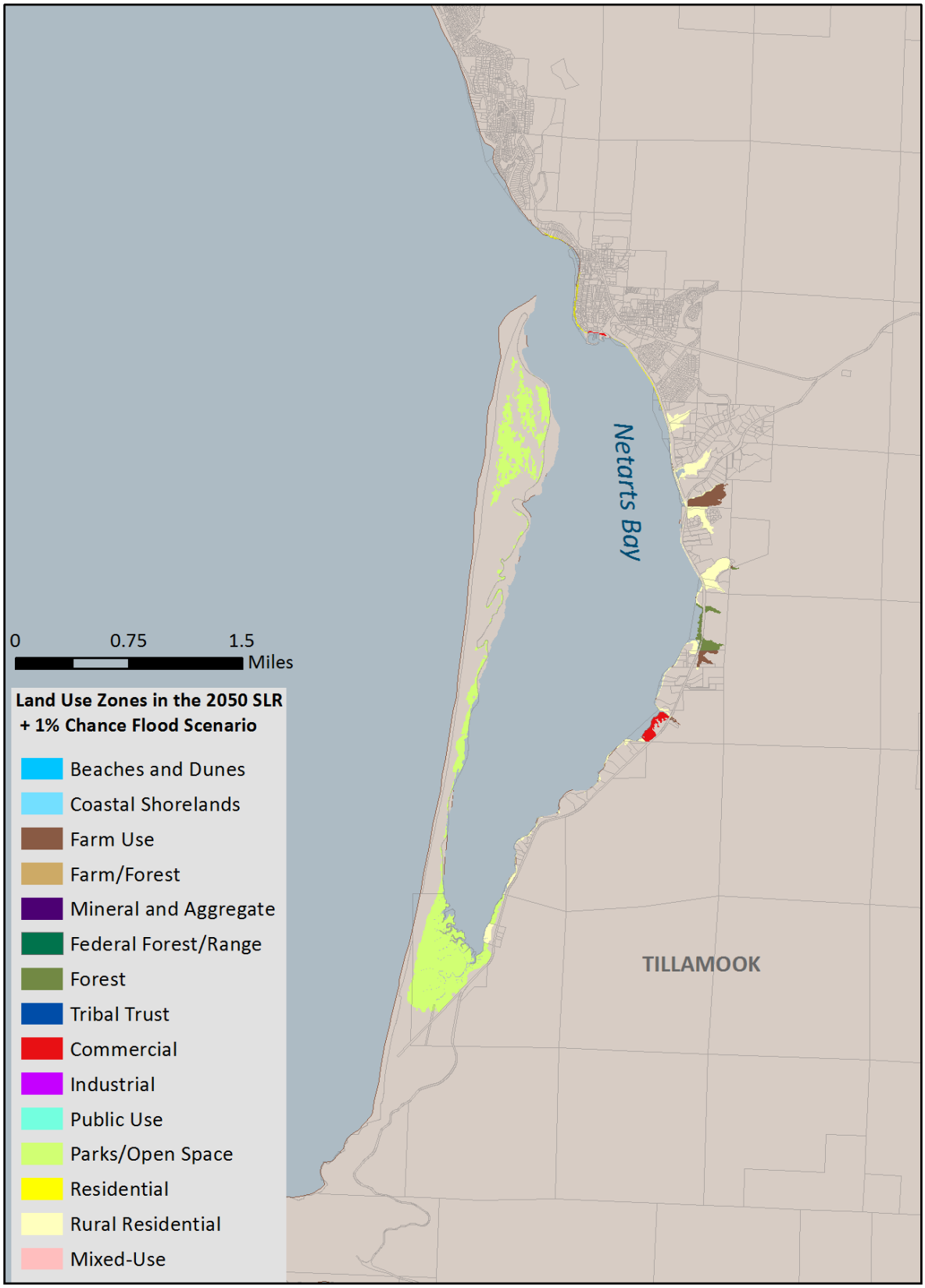

Figure 41. Land Use Zones within the Netarts Bay 2050 SLR + 1% chance flood scenario

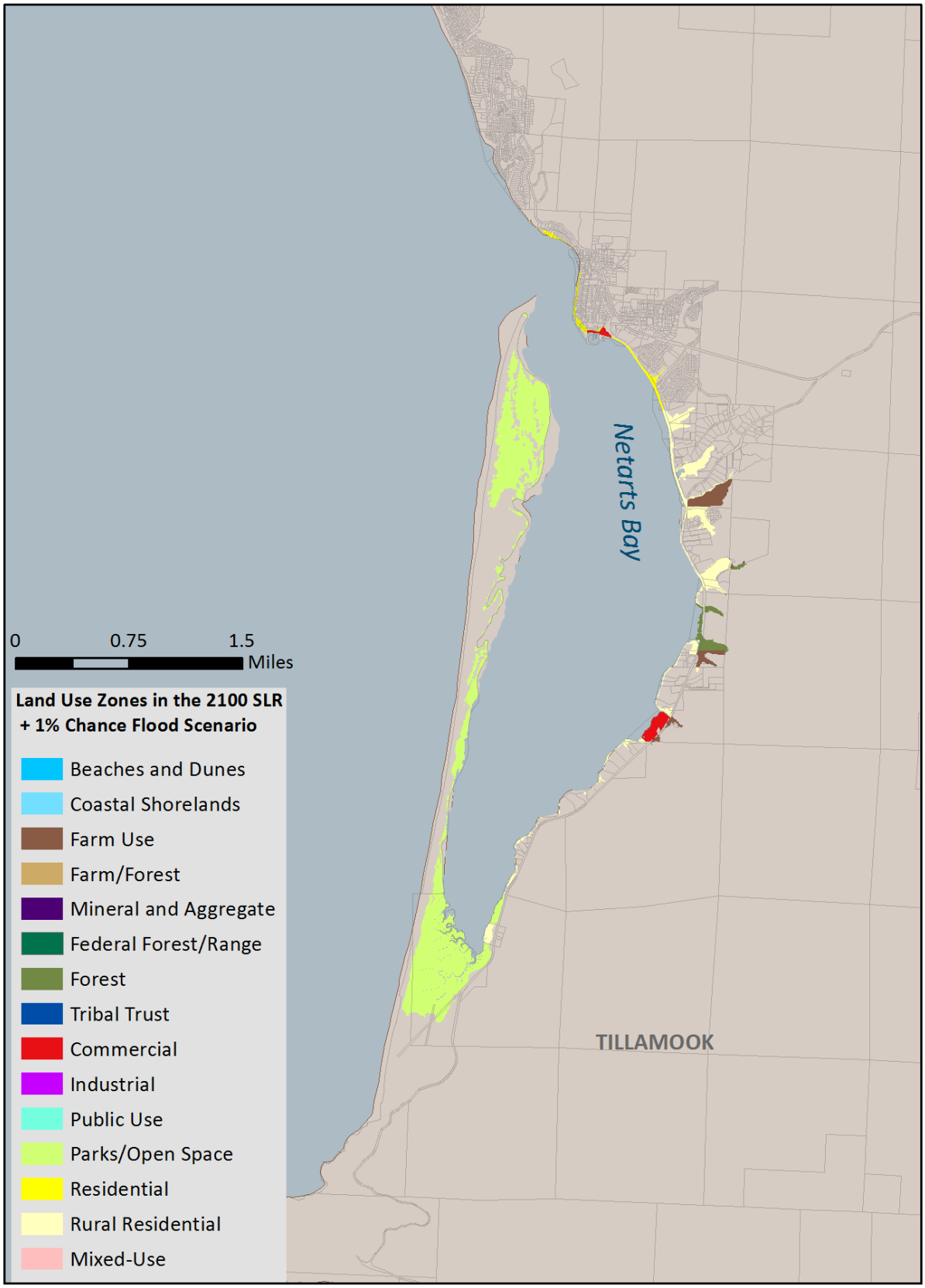

Figure 42. Land Use Zones within the Netarts Bay 2100 SLR + 1% chance flood scenario

Sand Lake Estuary

This section presents the results of the exposure inventory by asset in the Sand Lake system. Sand Lake is designated as a 'Natural Estuary' under the Oregon Estuary Classification system, and thus does not have significant shoreland development. There are few impacts from sea-level rise in the system.

State Highways

There are no state highways impacted by the six future flood scenarios.

Roads

However, county and local roads may see flooding under the six flood scenarios. Figure 43 displays the total number of county and local road miles impacted per scenario.

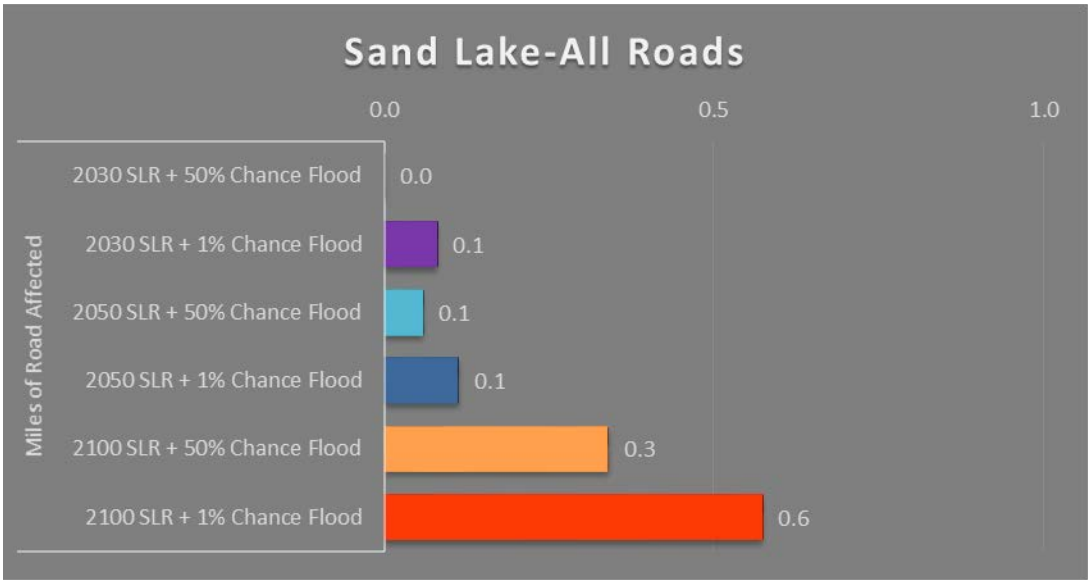

Figure 43. Miles of Road Impacted in the Sand Lake Future Flooding Scenarios

Airports

There are no airports that are within the future flood scenarios.

Railway

There are no railroads affected in the future flood scenarios.

Critical Facilities

There are no fire stations, police stations, sheriff's offices, schools, hospitals, or city halls in the future flood scenarios within the Sand Lake system.

Municipal Use Drinking Water

There are no municipal drinking water sources that are within the future flood scenarios.

Wastewater Treatment Plant

There are no wastewater treatment plants within the future flood scenarios.

Electric Substation

There are no substations within the six future flooding scenarios.

Potential Contaminant Sources

There are no large contaminant sources within the six future flooding scenarios.

Buildings

A small number of buildings are impacted under the 2100 future flooding scenarios. In the 1% chance flood, 5 buildings are impacted and in the 50% chance flood, 24 buildings are impacted.

Overview Map

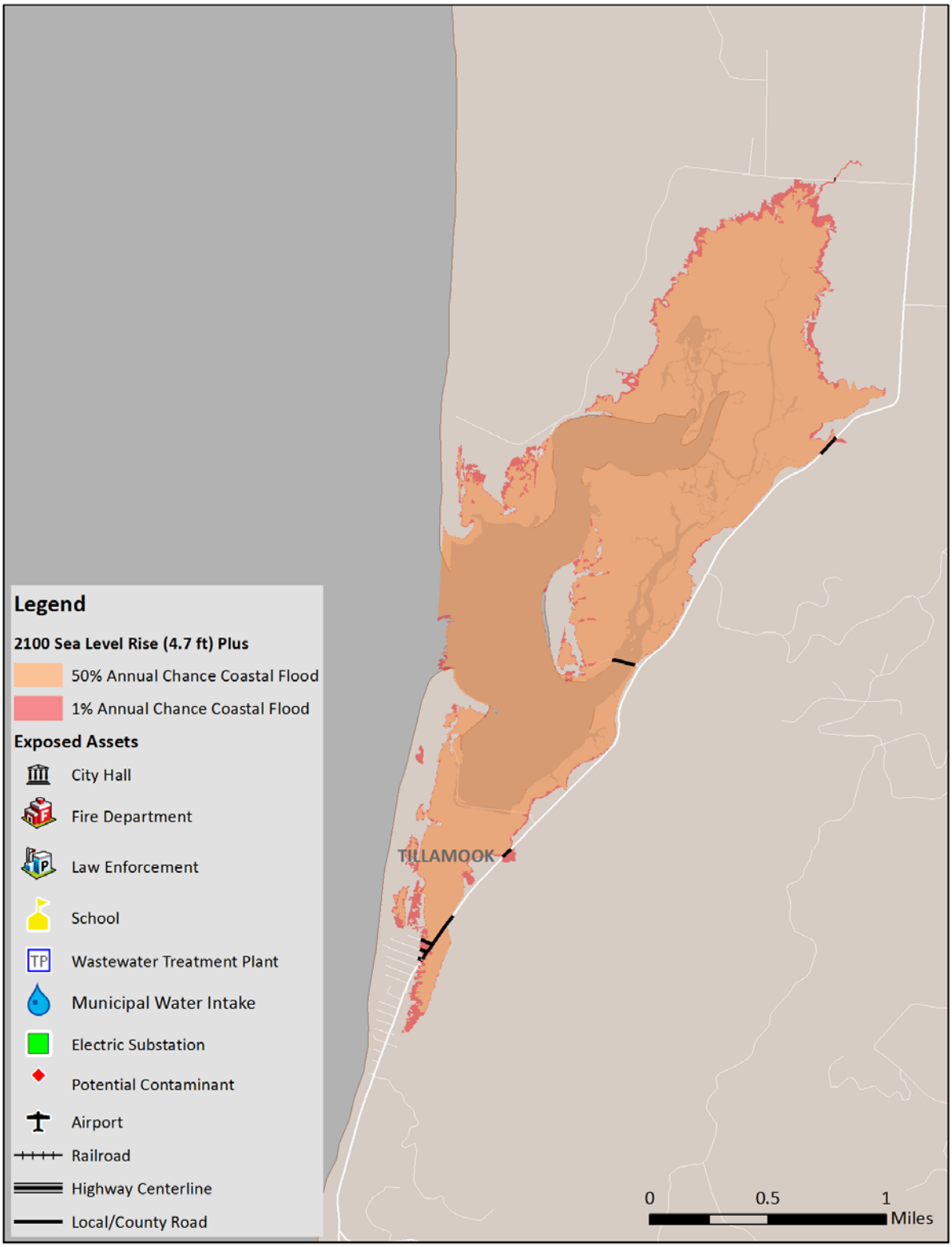

Figure 44. Sand Lake 2100 Flooding Scenarios and Assets Map (for the 2030 and 2050 scenario maps, please visit http://coastalatlas.net/sealevelriseviewer/)

Land Use Zones

The land use zones within each future flooding scenarios are provided as a percentage of the zoning type within a jurisdiction. Parks/Open Space may be considered an appropriate use for land that is subject to flooding, whereas residential may not be. A community can use these results to identify areas for improvements in their zoning. The results for Tillamook County are provided in Figure 45. Maps of the results are shown in Figures 46, 47, and 48.

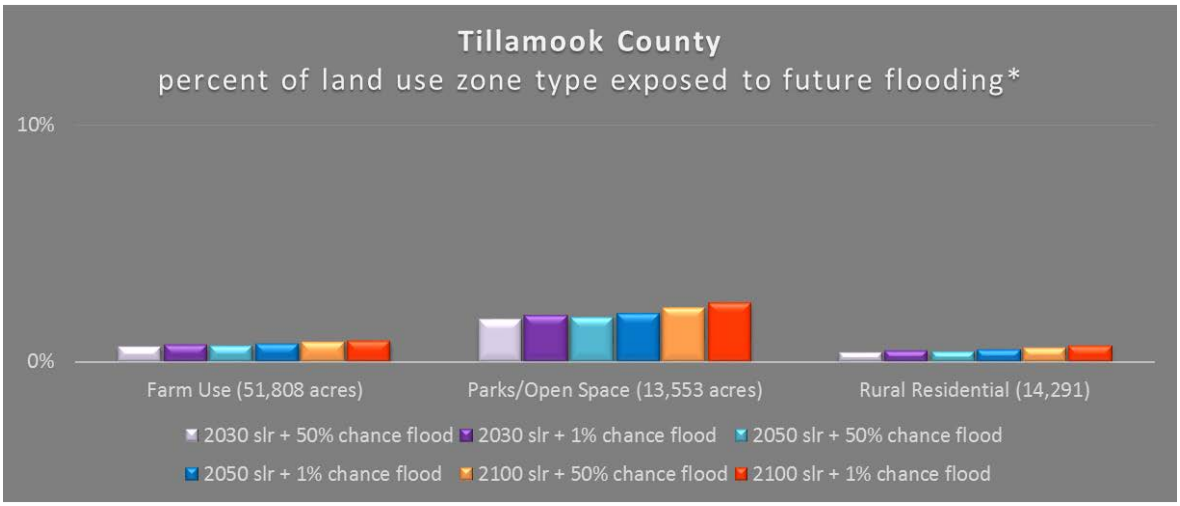

Figure 45. Tillamook County percent of land use zone types exposed to future flooding

**Only includes flooding from Sand Lake. Percent of land use zone types flooded from the other estuaries in Tillamook County are presented separately.*

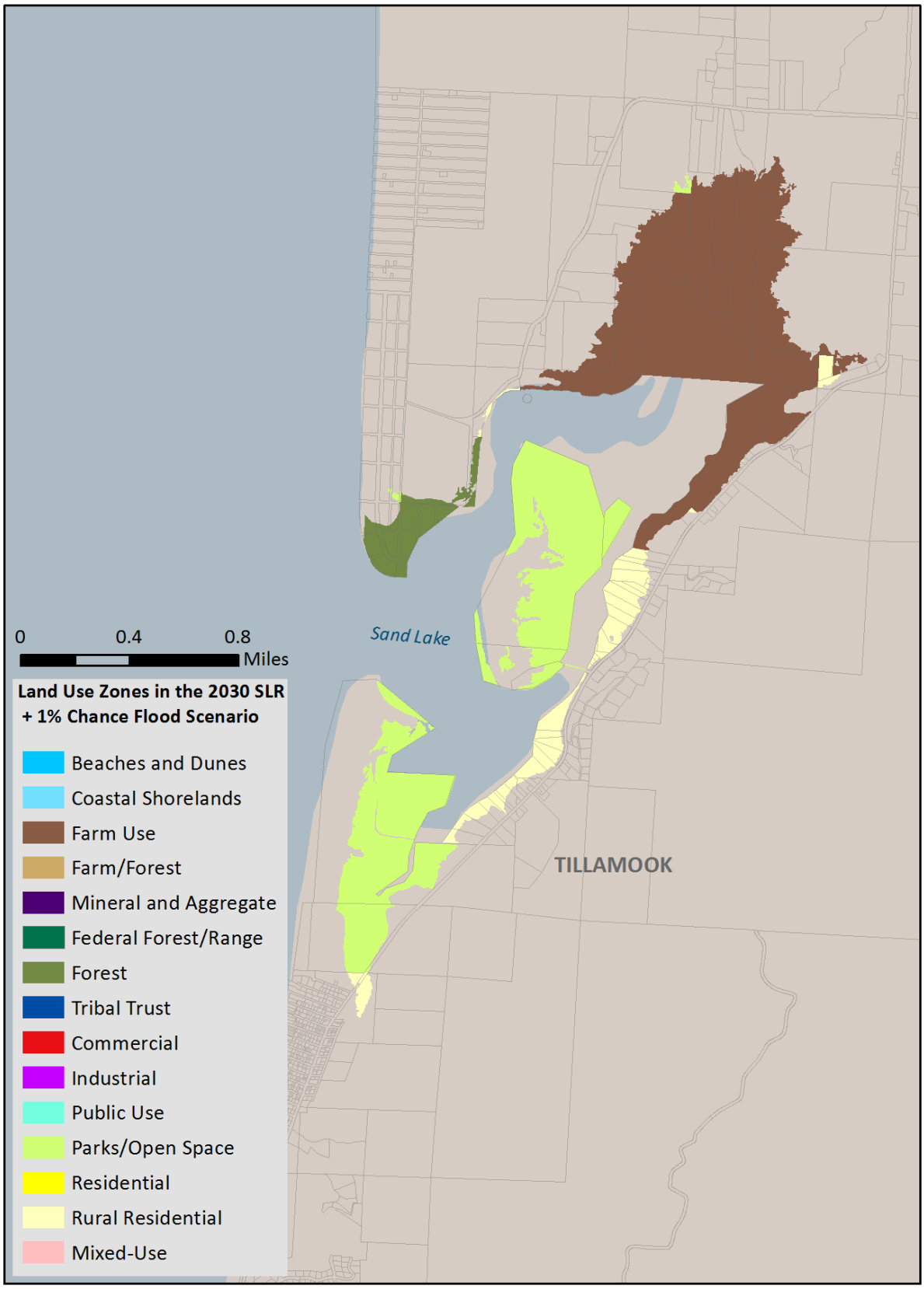

Figure 46. Land Use Zones within the Netarts Bay 2030 SLR + 1% chance flood scenario

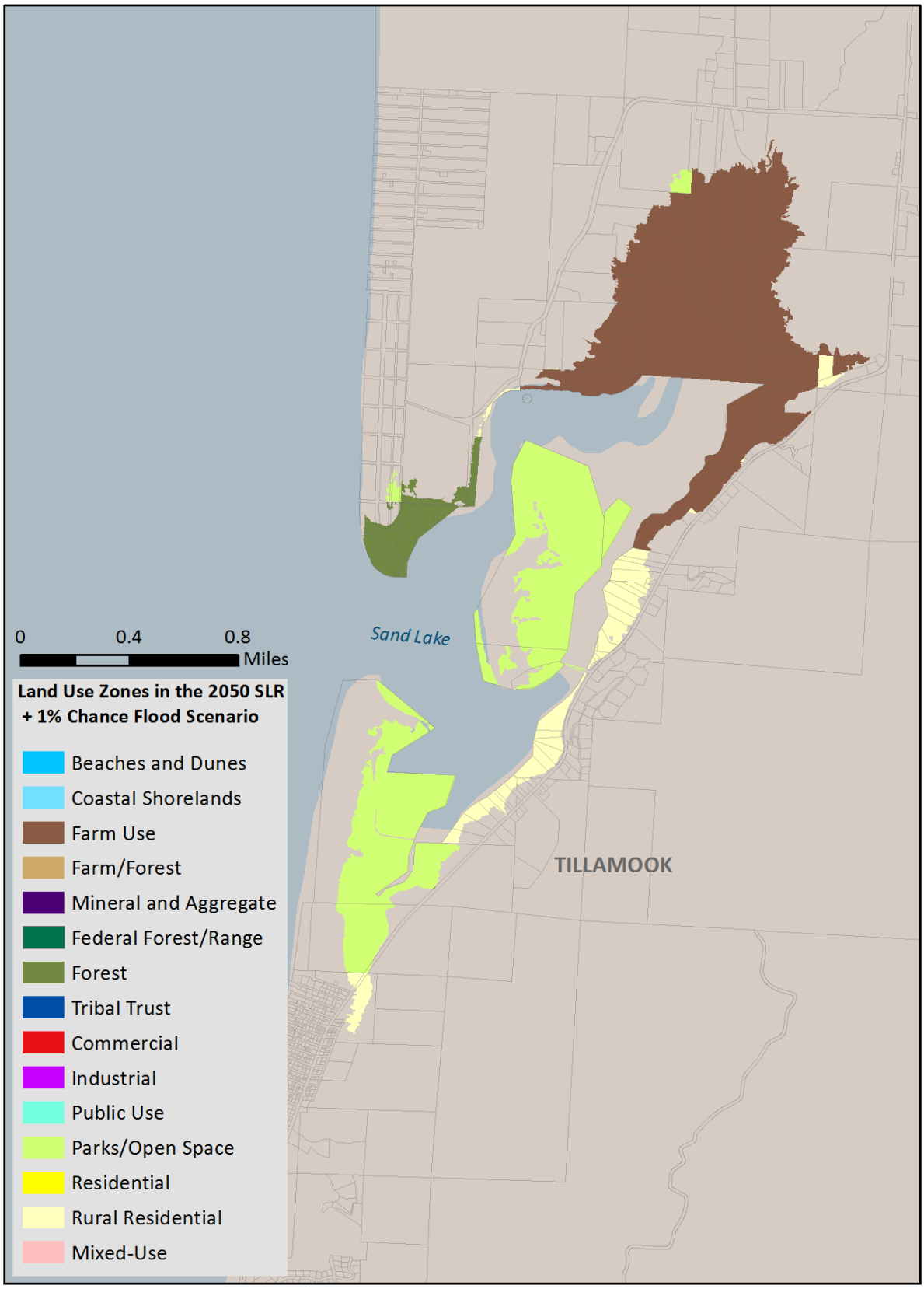

Figure 47. Land Use Zones within the Netarts Bay 2050 SLR + 1% chance flood scenario

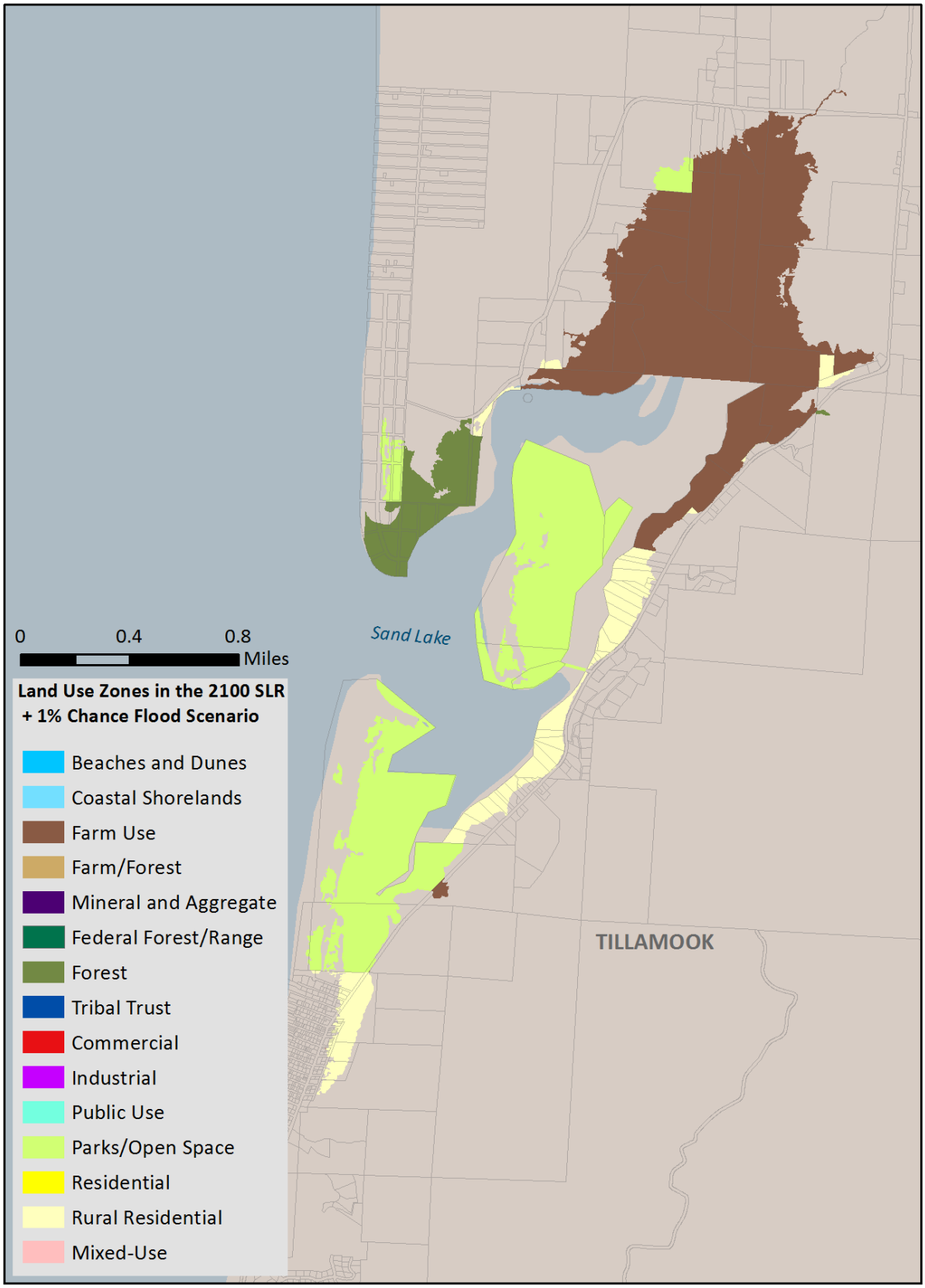

Figure 48. Land Use Zones within the Sand Lake 2100 SLR + 1% chance flood scenario

Nestucca River Estuary

This section presents the results of the exposure inventory by asset in the Nestucca River system. In the near-term (2030), impacts to development include US-101 and the Pacific City airport. In the mid-(2050) and long-term (2100) buildings in Pacific City will see an increase in flood events.

State Highways

Two state highways are inundated under the six future flooding scenarios, Figure 49 provides the total number of miles impacted and Table 6 provides a breakdown of impacted miles per highway.

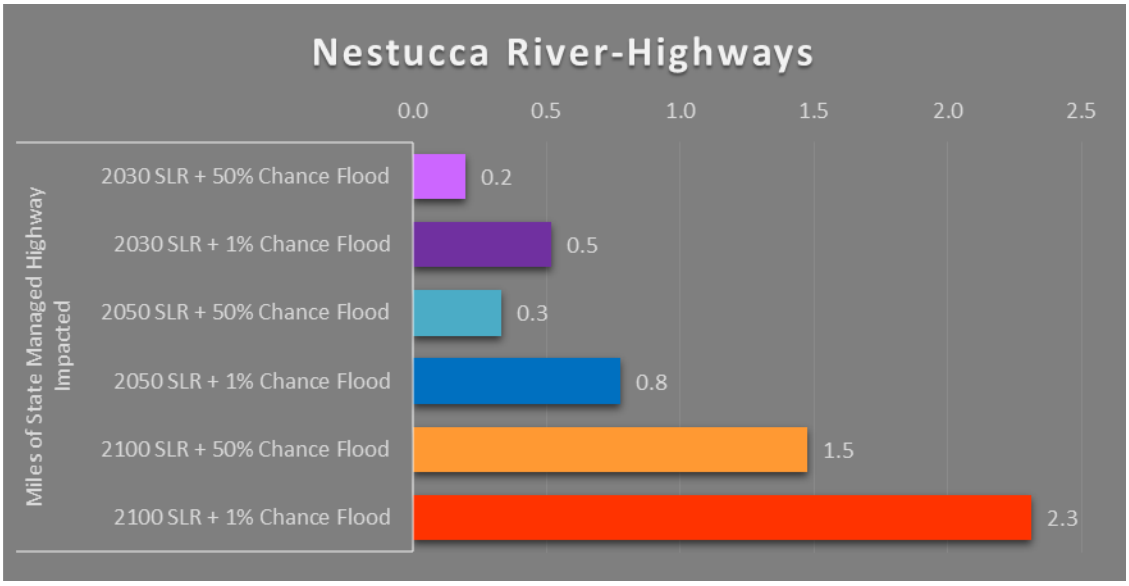

Figure 49. Miles of State Managed Highway Impacted in the Nestucca River Future Flooding Scenarios

Table 6 Impacted miles per highway

	2030 SLR + 50% Chance Flood	2030 SLR + 1% Chance Flood	2050 SLR + 50% Chance Flood	2050 SLR + 1% Chance Flood	2100 SLR + 50% Chance Flood	2100 SLR + 1% Chance Flood
Little Nestucca Hwy (OR-130)	0.01	0.07	0.04	0.11	0.36	0.79
Oregon Coast Hwy (US-101)	0.19	0.45	0.29	0.67	1.11	1.52

Roads

In addition to the highways impacted, county and local roads also may see flooding under the six flood scenarios. Figure 50 displays the total number of state, county, and local road miles impacted per scenario.

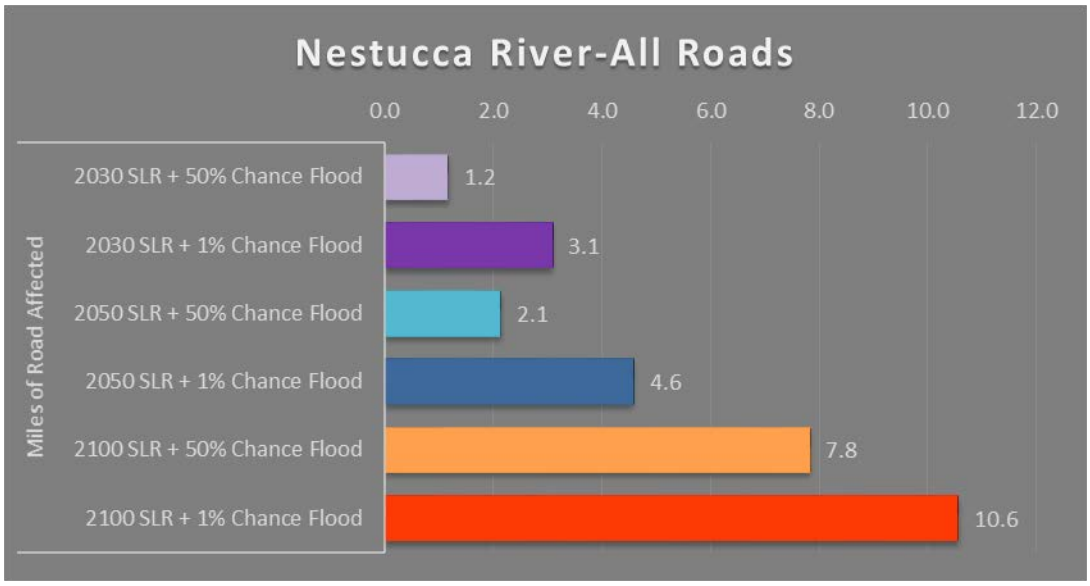

Figure 50. Miles of Road Impacted in the Nestucca River Future Flooding Scenarios

Airports

The Pacific City State Airport (FAA code PFC) floods completely in each of the six scenarios.

Railway

There are no railroads affected in the future flood scenarios.

Critical Facilities

Table 7 provides the number of critical facilities exposed under the six future flooding scenarios.

Table 7

Type of Critical Facility	2030 SLR + 50% Chance Flood	2030 SLR + 1% Chance Flood	2050 SLR + 50% Chance Flood	2050 SLR + 1% Chance Flood	2100 SLR + 50% Chance Flood	2100 SLR + 1% Chance Flood
Fire Station • Nestucca RFPD Pacific City #82	0	0	0	0	0	1
Police Station/ Sheriff's Office	0	0	0	0	0	0
School	0	0	0	0	0	0
Hospital	0	0	0	0	0	0
City Hall	0	0	0	0	0	0
Total	**0**	**0**	**0**	**0**	**0**	**1**

Municipal Use Drinking Water

There are no municipal drinking water sources that are within the future flood scenarios.

Wastewater Treatment Plant

There are no wastewater treatment plants that are within the future flood scenarios.

Electric Substation

There are no substations within the six future flooding scenarios.

Potential Contaminant Sources

There are a couple large contaminant sources in the scenario areas for Nestucca Bay; one CAFO in the 2100 SLR + 50% chance flood and two CAFOs in the 2100 SLR + 1% chance flood.

Buildings

A number of buildings in Pacific City are impacted; primarily on the east side of the river. The number of buildings impacted under each scenario is shown in Figure 51.

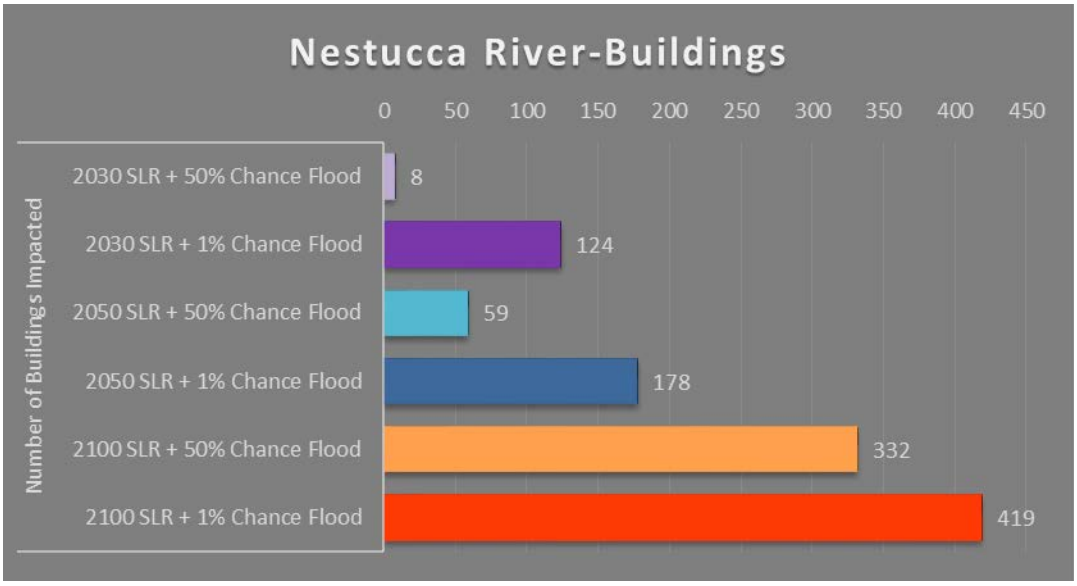

Figure 51. Number of Buildings Exposed to the Future Flooding Scenarios in the Nestucca River System

Overview Map

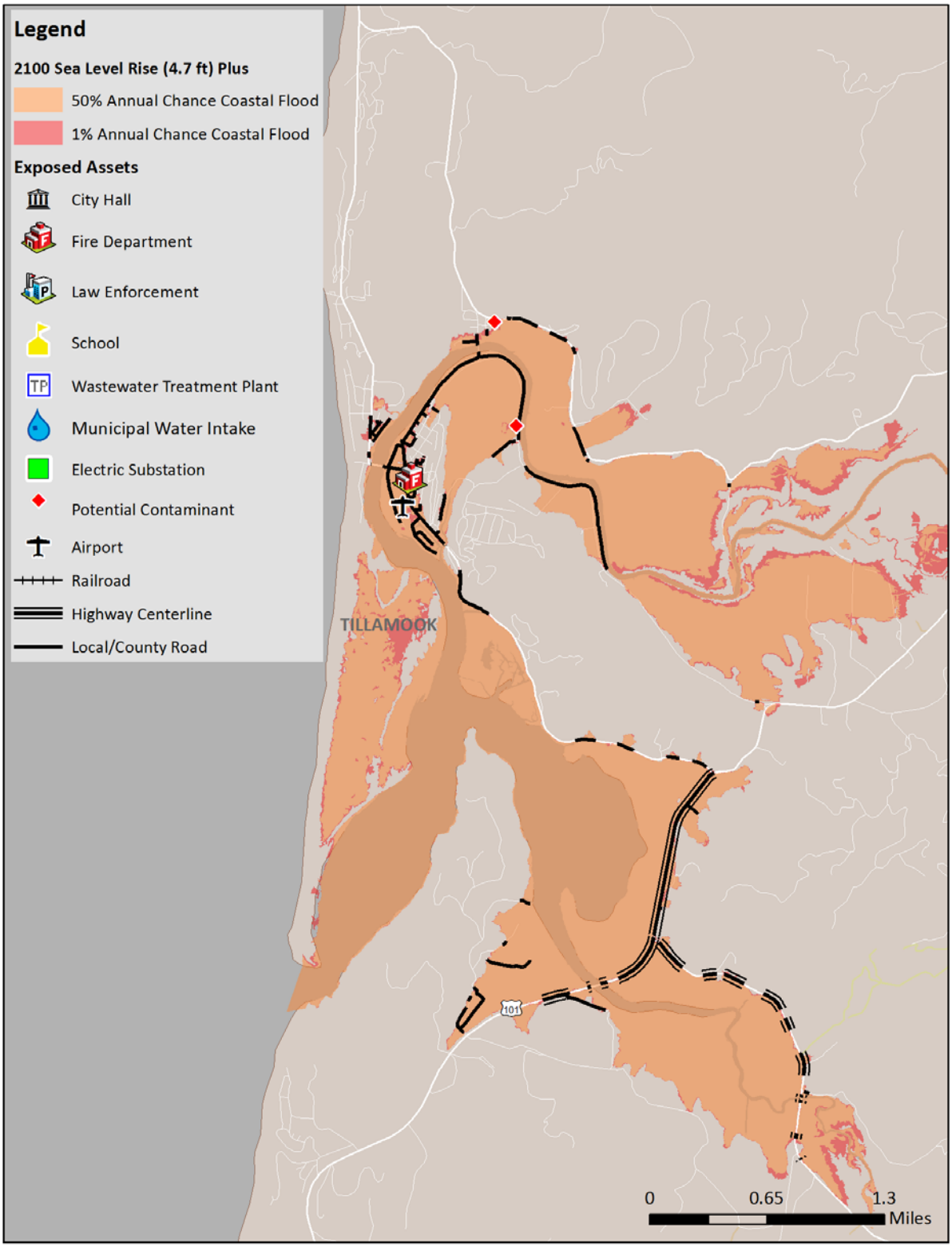

Figure 52. Nestucca River 2100 Flood Scenarios and Assets Map (for the 2030 and 2050 scenario maps, please visit http://coastalatlas.net/sealevelriseviewer/)

Land Use Zones

The land use zones within each future flooding scenarios are provided as a percentage of the zoning type within a jurisdiction. Parks/Open Space may be considered an appropriate use for land that is subject to flooding, whereas residential may not be. A community can use these results to identify areas for improvements in their zoning. The results for Tillamook County are provided in Figure 53. Maps of the results are shown in Figures 54, 55, and 56.

Impacts to land zoned for commercial use increases in the long-term scenarios; and impacts to a small portion of farm use, parks/open space, residential zones occur across all scenarios from flooding from the Nestucca River system in Tillamook County.

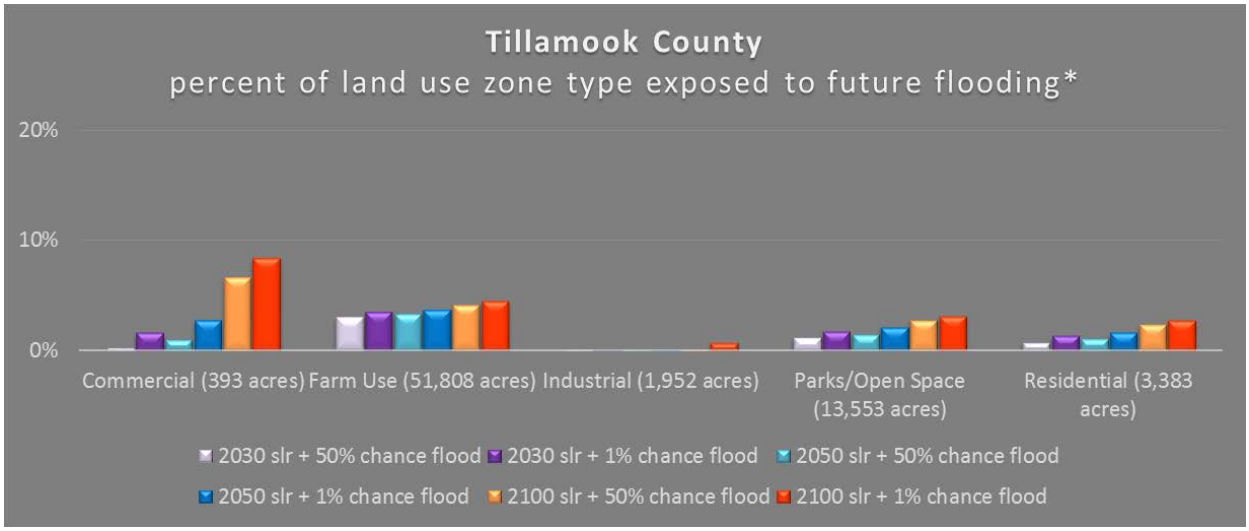

Figure 53. Tillamook County percent of land use zone types exposed to future flooding

**Only includes flooding from the Nestucca River. Percent of land use zone types flooded from the other estuaries in Tillamook County are presented separately.*

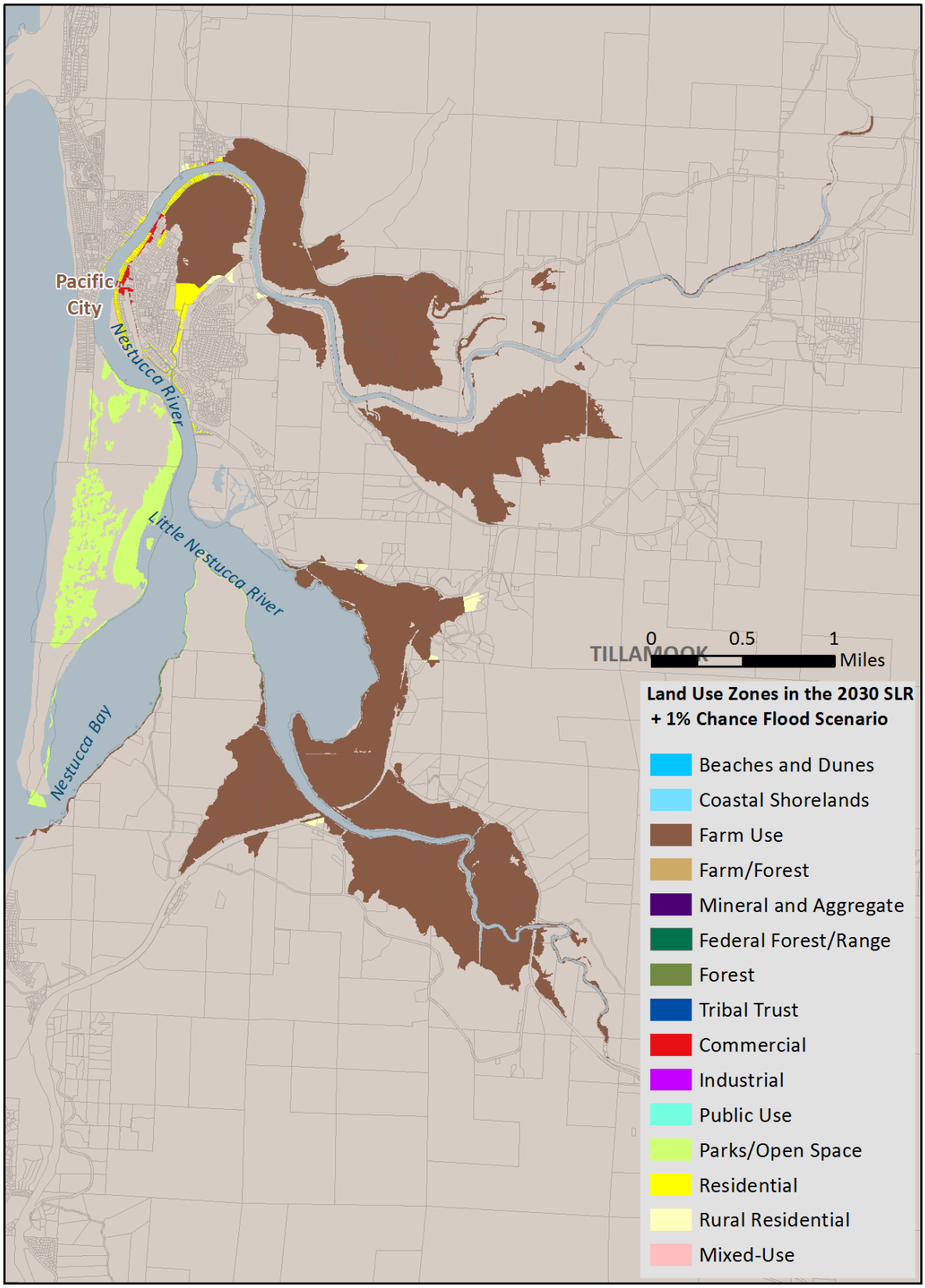

Figure 54. Land Use Zones within the Nestucca River 2030 SLR + 1% chance flood scenario

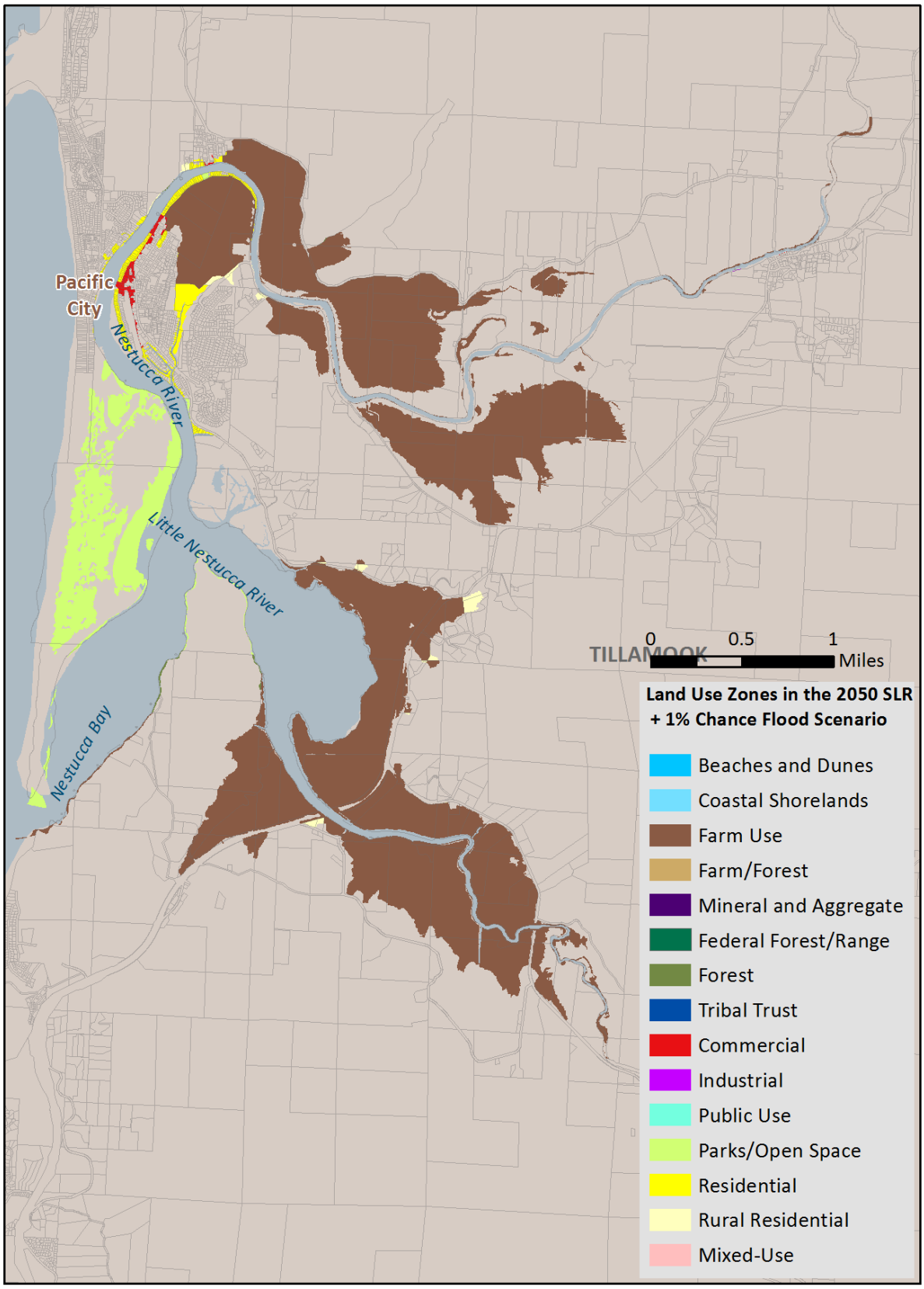

Figure 55. Land Use Zones within the Nestucca River 2050 SLR + 1% chance flood scenario

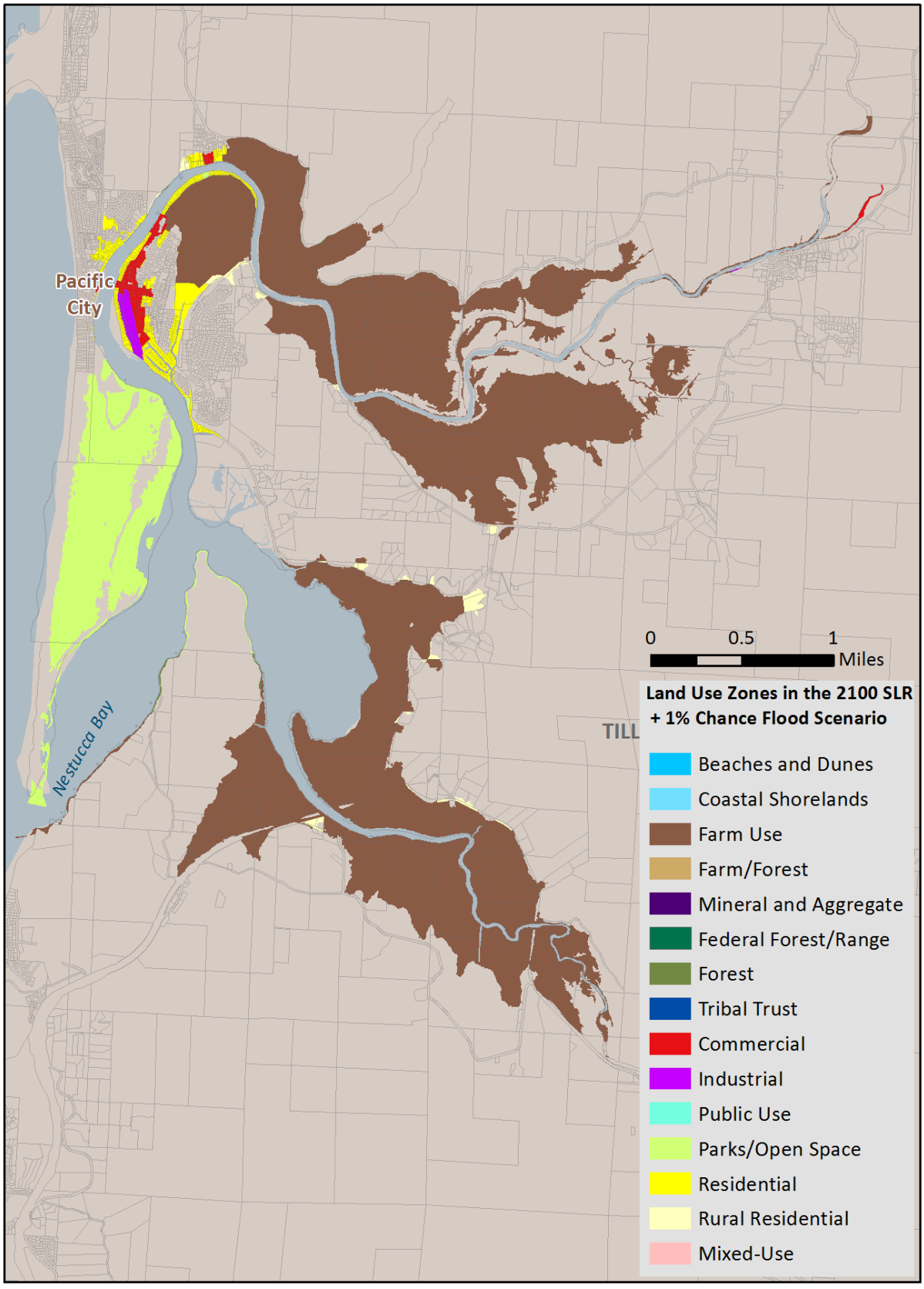

Figure 56. Land Use Zones within the Nestucca River 2100 SLR + 1% chance flood scenario

Salmon River Estuary

This section presents the results of the exposure inventory by asset in the Salmon River system. The Salmon River is designated as a 'Natural Estuary' under the Oregon Estuary Classification system, and thus does not have significant shoreland development. There are relatively few impacts from sea-level rise in the system, but in the long-term (2100), state highways will be impacted by increased flood events.

State Highways

A number of state highways are inundated under the six future flooding scenarios, Figure 56 provides the total number of miles impacted and Table 8 provides a breakdown of impacted miles per highway.

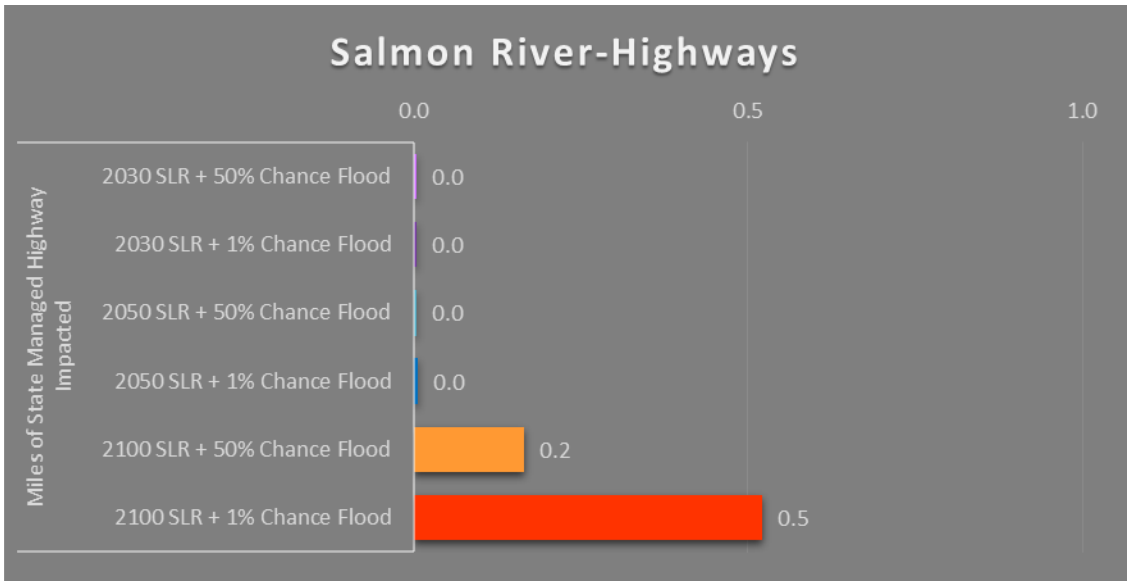

Figure 57. Miles of State Managed Highway Impacted in the Salmon River Future Flooding Scenarios

Table 8 Impacted miles per highway

	2030 SLR + 50% Chance Flood	2030 SLR + 1% Chance Flood	2050 SLR + 50% Chance Flood	2050 SLR + 1% Chance Flood	2100 SLR + 50% Chance Flood	2100 SLR + 1% Chance Flood
Oregon Coast Hwy (US-101)	-	-	-	0.01	0.06	0.27
Oregon Coast Hwy Conn.	-	-	-	-	-	0.03
Otis Jct. Frontage Rd. #1	-	-	-	-	0.11	0.14
Salmon River Hwy (OR-18)	-	-	-	-	-	0.08

Roads

In addition to the highways impacted, county and local roads also may see flooding under the six flood scenarios. Figure 58 displays the total number of state, county, and local road miles impacted per scenario.

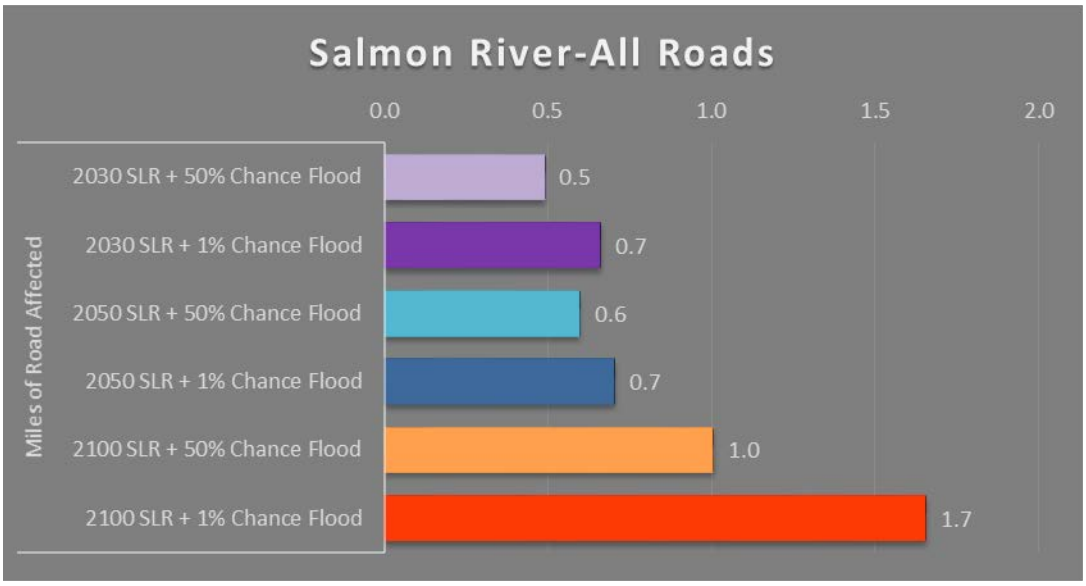

Figure 58. Miles of Road Impacted in the Salmon River Future Flooding Scenarios

Airports

There are no airports that are within the future flood scenarios.

Railway

There are no railroads affected in the future flood scenarios.

Critical Facilities

There are no fire stations, police stations, sheriff's offices, schools, hospitals, or city halls in the future flood scenarios within the Salmon River system.

Municipal Use Drinking Water

There are no municipal drinking water sources that are within the future flood scenarios.

Wastewater Treatment Plant

There are no wastewater treatment plants that are within the future flood scenarios.

Electric Substation

There are no substations within the six future flooding scenarios.

Potential Contaminant Sources

There are no large contaminant sources within the six future flooding scenarios.

Buildings

A small number of buildings are impacted under the highest three future flooding scenarios. In the 2050 SLR + 1% chance flood, 1 building is impacted; in the 2100 SLR + 50% chance flood, 4 buildings are impacted; and in the 2100 SLR + 1% chance flood, 5 buildings are impacted.

Overview Map

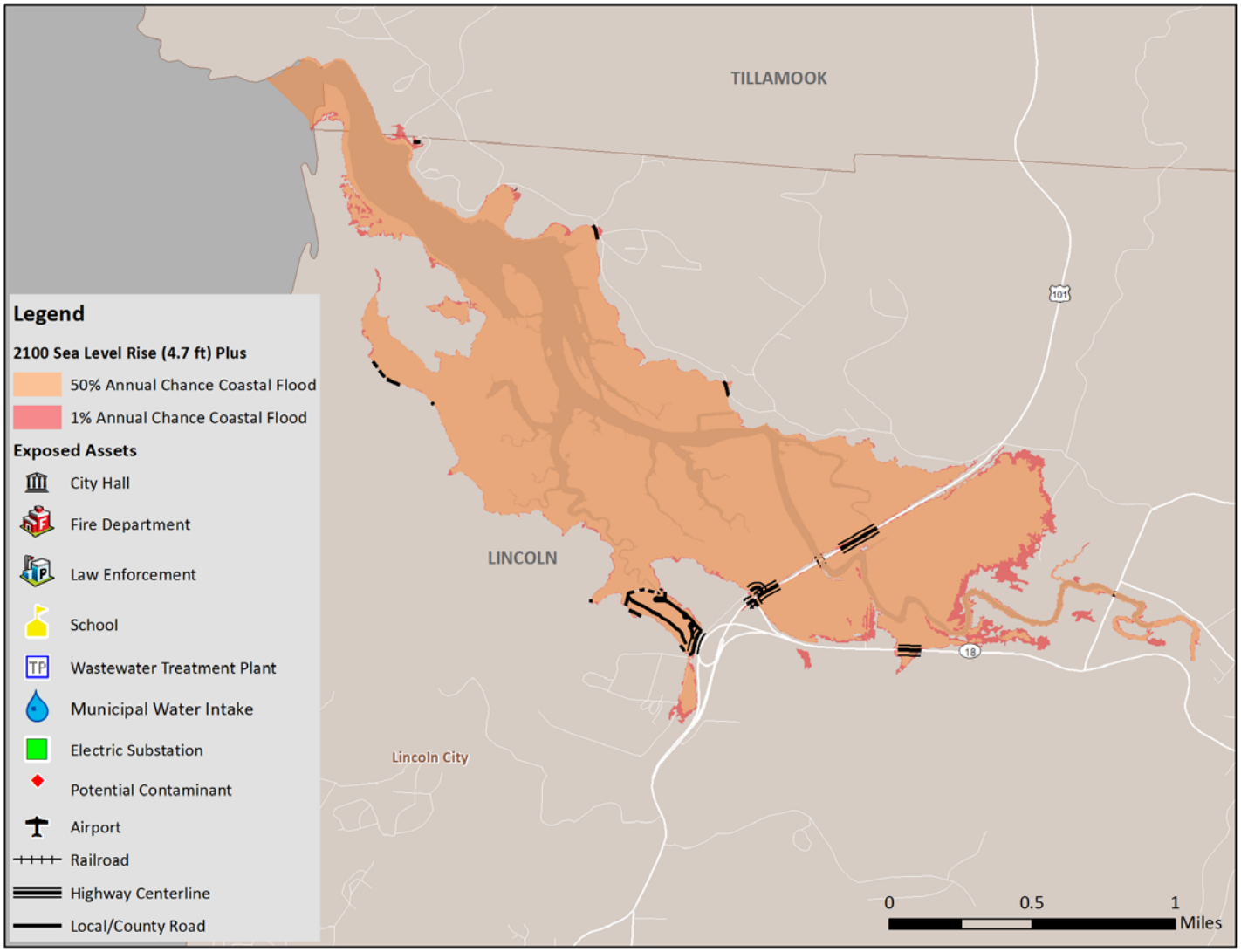

Figure 59. Salmon River 2100 Flood Scenarios and Assets Map (for the 2030 and 2050 scenario maps, please visit http://coastalatlas.net/sealevelriseviewer/)

Land Use Zones

The land use zones within each future flooding scenarios are provided as a percentage of the zoning type within a jurisdiction. Parks/Open Space may be considered an appropriate use for land that is subject to flooding, whereas residential may not be. A community can use these results to identify areas for improvements in their zoning. The results for Lincoln County are provided in Figure 60. Maps of the results are shown in Figures 61, 62, and 63.

Impacts to land zoned for commercial use increases in the long-term scenarios; and impacts to a small portion of farm use and rural residential zones occur across all scenarios in Lincoln County from Salmon River flooding.

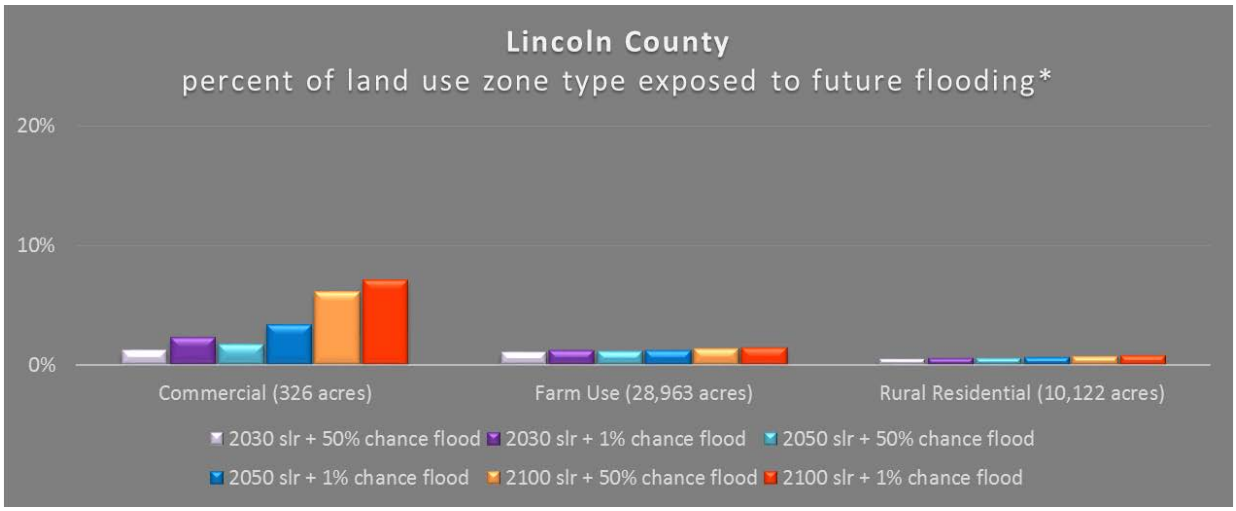

Figure 60. Lincoln County percent of land use zone types exposed to future flooding

**Only includes flooding from the Salmon River system. Percent of land use zone types flooded from the other estuaries in Lincoln County are presented separately.*

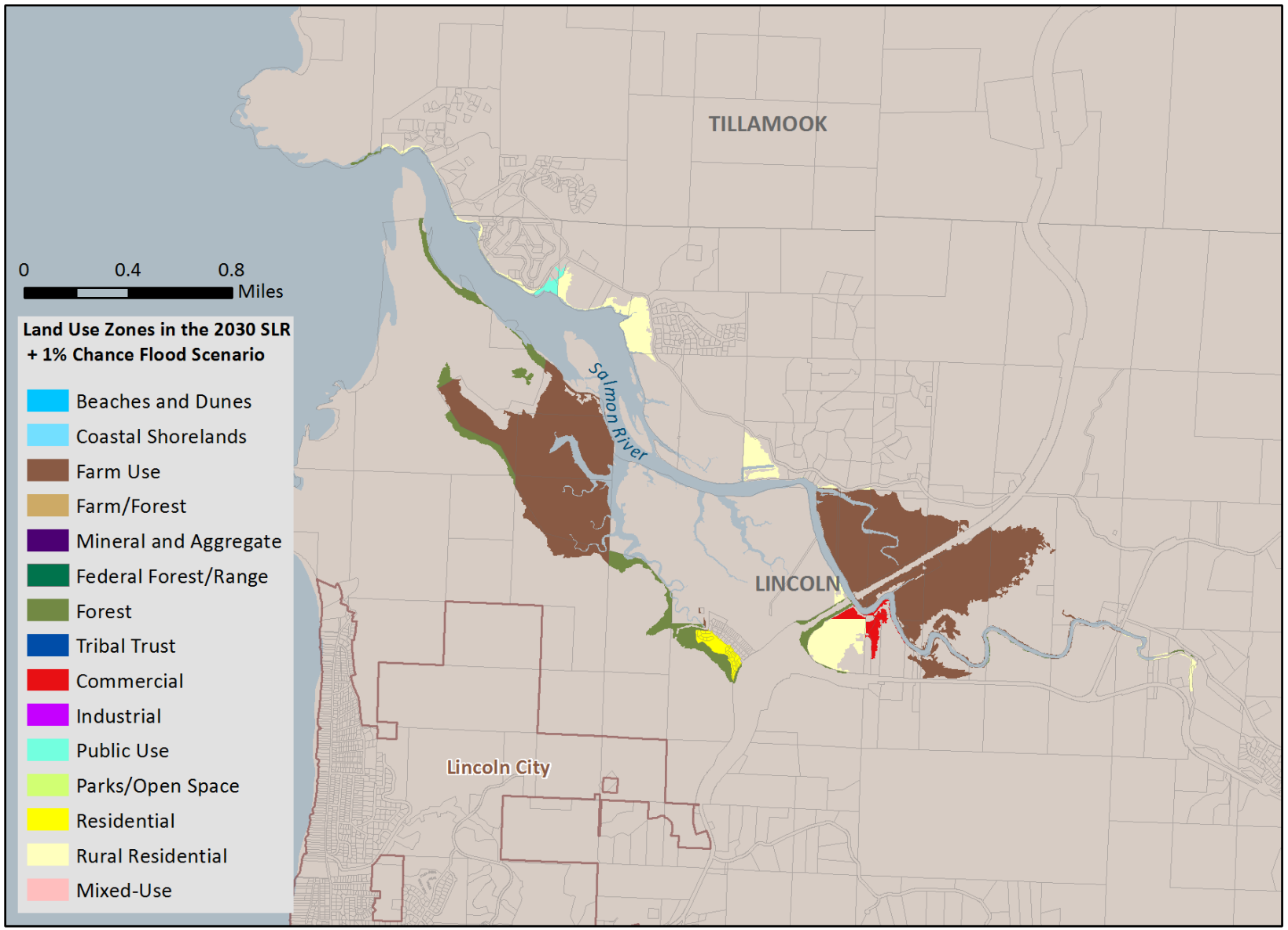

Figure 61. Land Use Zones within the Salmon River 2030 SLR + 1% chance flood scenario

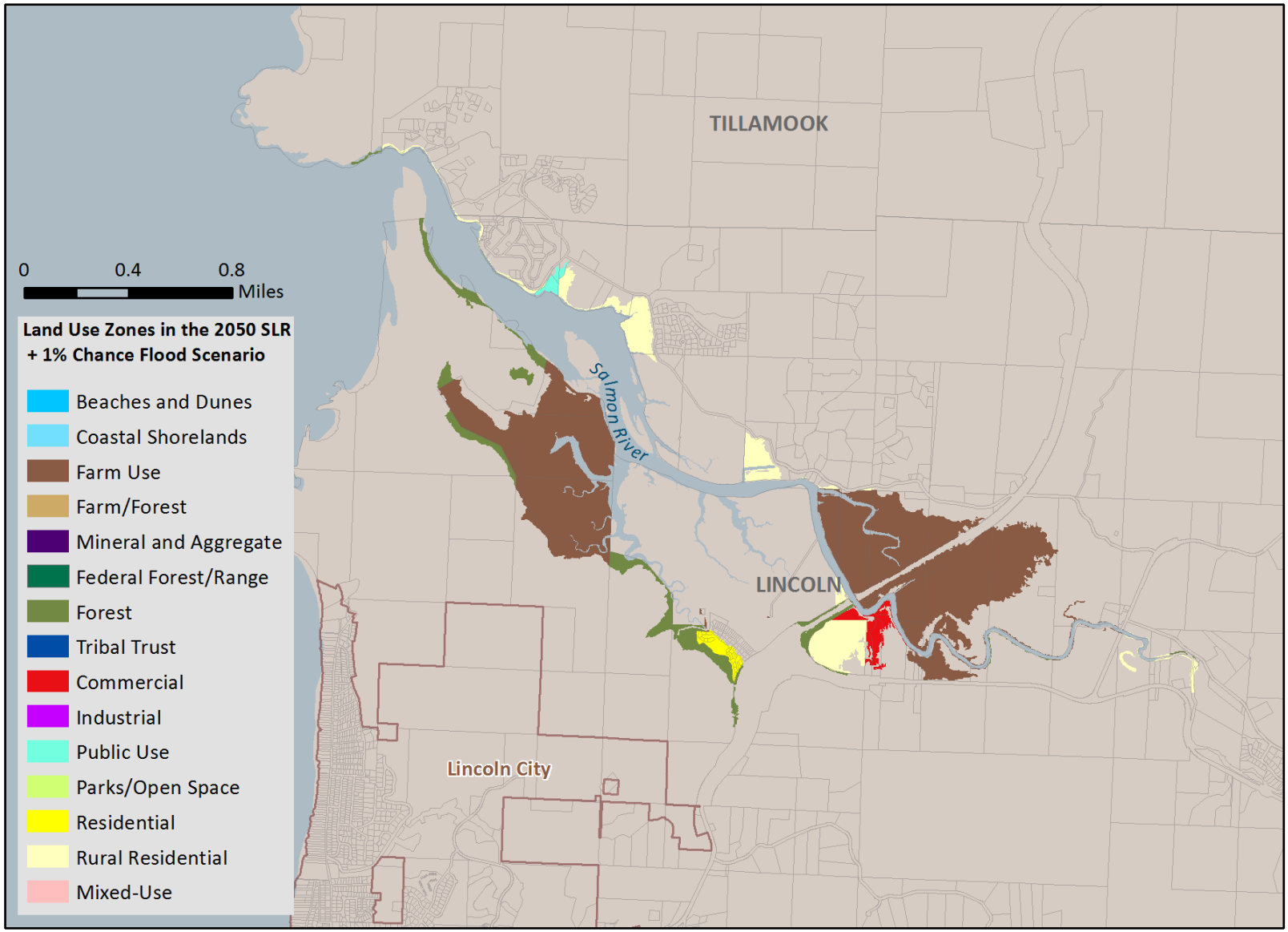

Figure 62. Land Use Zones within the Salmon River 2050 SLR + 1% chance flood scenario

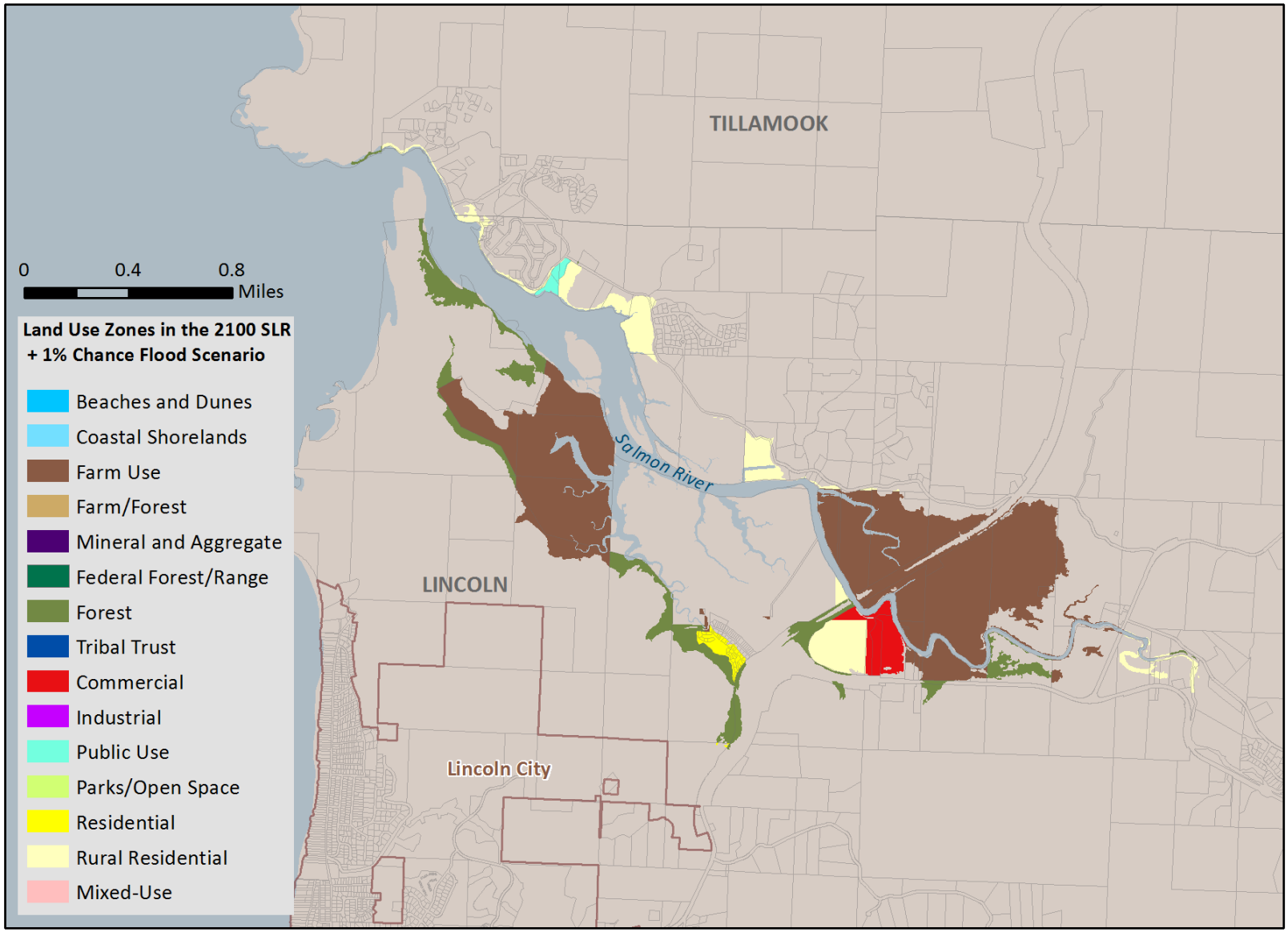

Figure 63. Land Use Zones within the Salmon River 2100 SLR + 1% chance flood scenario

Siletz Bay Estuary

This section presents the results of the exposure inventory by asset in the Siletz Bay system. Siletz Bay has development along it's shorelands that will be increasingly vulnerable to sea-level rise over time. US-101, along with local roads and buildings in the Taft area of Lincoln City and Culver City will see an increase in flood events.

State Highways

Two state highways are inundated under the six future flooding scenarios, Figure 64 provides the total number of miles impacted and Table 9 provides a breakdown of impacted miles per highway.

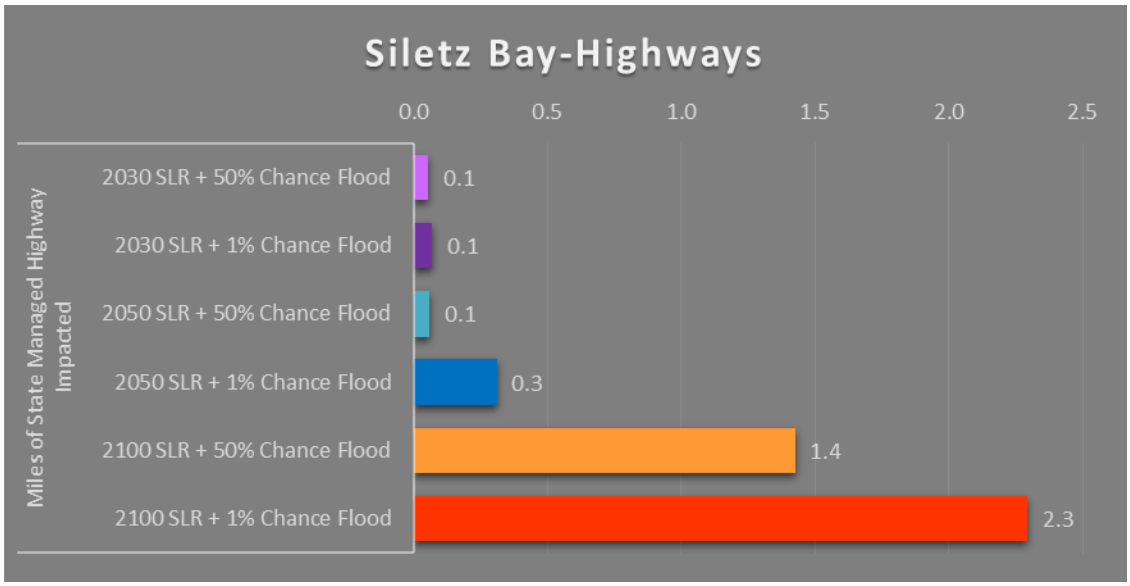

Figure 64. Miles of State Managed Highway Impacted in the Siletz Bay Future Flooding Scenarios

Table 9 Impacted miles per highway

	2030 SLR + 50% Chance Flood	2030 SLR + 1% Chance Flood	2050 SLR + 50% Chance Flood	2050 SLR + 1% Chance Flood	2100 SLR + 50% Chance Flood	2100 SLR + 1% Chance Flood
Oregon Coast Hwy (US-101)	0.05	0.07	0.06	0.08	0.66	1.41
Siletz Hwy (OR-229)	-	-	-	0.23	0.77	0.88

Roads

In addition to the highways impacted, county and local roads also may see flooding under the six flood scenarios. Figure 65 displays the total number of state, county, and local road miles impacted per scenario.

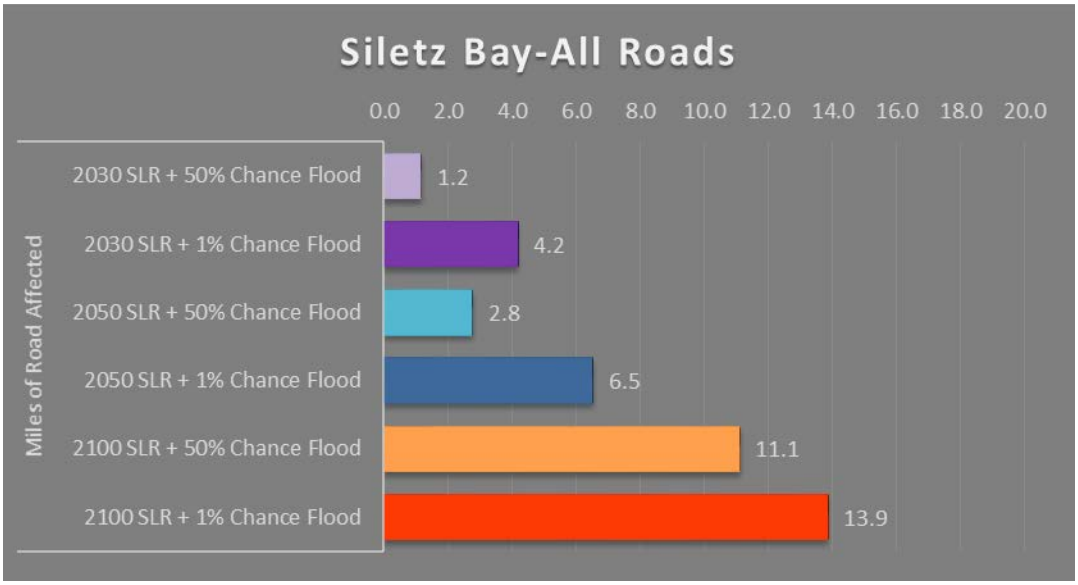

Figure 65. Miles of Road Impacted in the Siletz Bay Future Flooding Scenarios

Airports

There are no airports that are within the future flood scenarios.

Railway

There are no railroads affected in the future flood scenarios.

Critical Facilities

Table 10 provides the number of critical facilities exposed under the six future flooding scenarios.

Table 10

Type of Critical Facility	2030 SLR + 50% Chance Flood	2030 SLR + 1% Chance Flood	2050 SLR + 50% Chance Flood	2050 SLR + 1% Chance Flood	2100 SLR + 50% Chance Flood	2100 SLR + 1% Chance Flood
Fire Station	0	0	0	0	0	0
Police Station/ Sheriff's Office	0	0	0	0	0	0
School • Taft Elementary School	0	0	0	0	1	1
Hospital	0	0	0	0	0	0
City Hall	0	0	0	0	0	0
Total	**0**	**0**	**0**	**0**	**1**	**1**

Municipal Use Drinking Water

There are no municipal drinking water sources within the future flood scenarios.

Wastewater Treatment Plant

The Lincoln City Sewage Treatment Plant and the Salishan Sewage Treatment Plant are within both of the 2100 future flood scenarios.

Electric Substation

There are no substations within the six future flooding scenarios.

Potential Contaminant Sources

There are no large contaminant sources within the six future flooding scenarios.

Buildings

The number of buildings impacted under each scenario is shown in Figure 66. Buildings impacted are primarily in the Taft and Cutler City areas of Lincoln City.

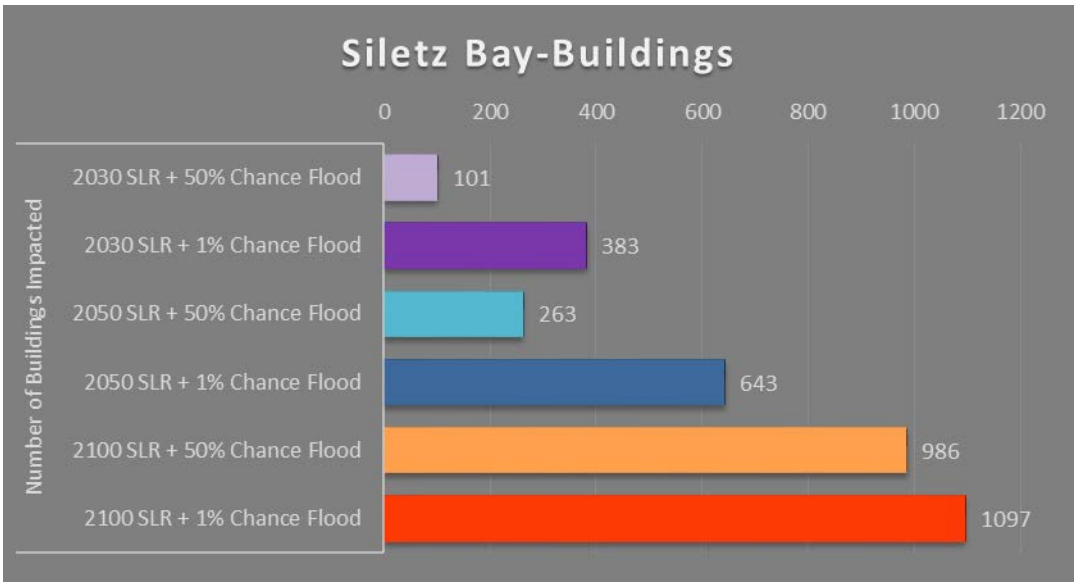

Figure 66. Number of Building Exposed to the Future Flooding Scenarios in the Siletz Bay System

Overview Map

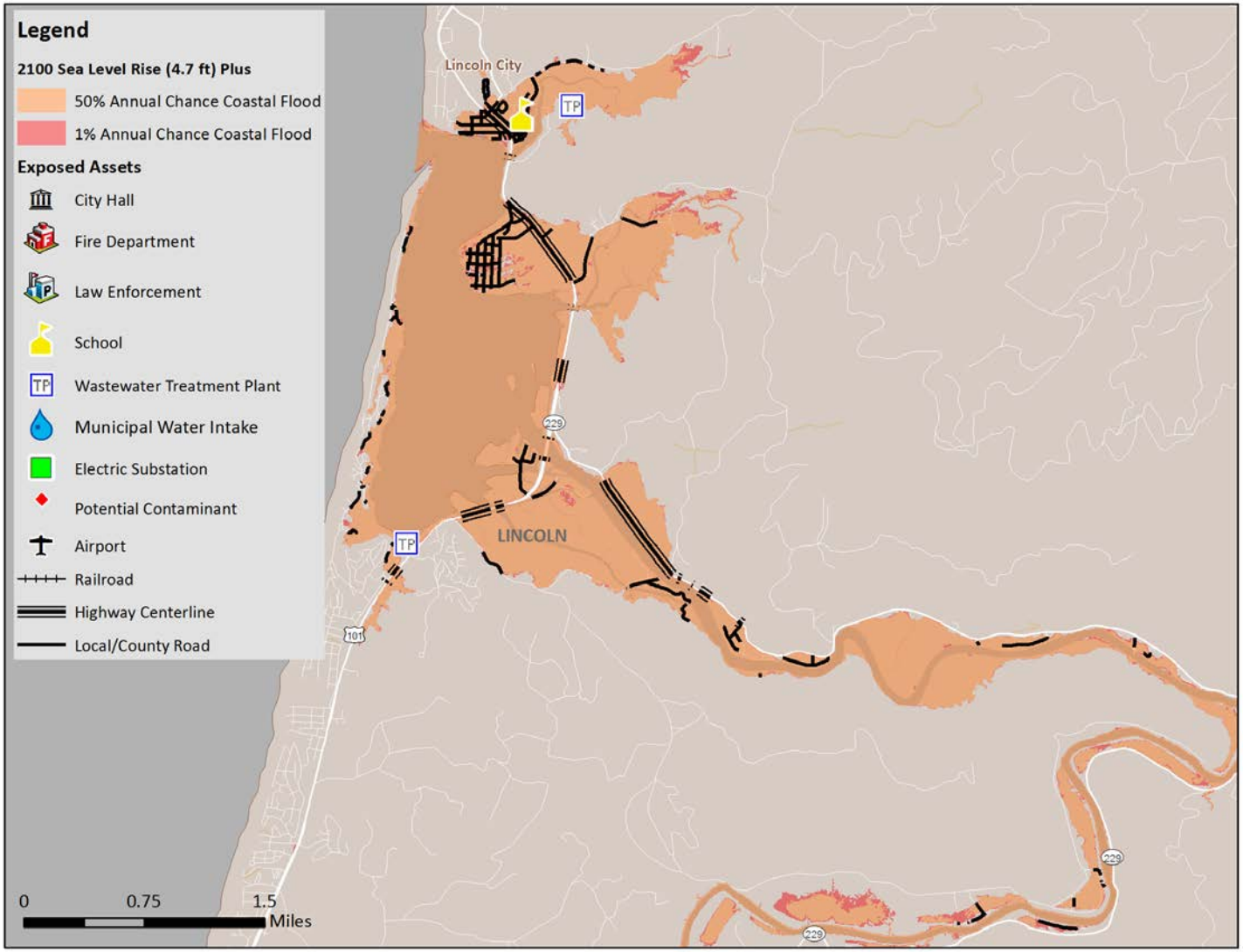

Figure 67. Siletz River 2100 Scenarios and Assets Map (for the 2030 and 2050 scenario maps, please visit http://coastalatlas.net/sealevelriseviewer/)

Land Use Zones

The land use zones within each future flooding scenarios are provided as a percentage of the zoning type within a jurisdiction. Parks/Open Space may be considered an appropriate use for land that is subject to flooding, whereas residential may not be. A community can use these results to identify areas for improvements in their zoning. The results for Lincoln County are provided in Figure 68, and Lincoln City are provided in Figure 69. Maps of the results are shown in Figures 70, 77, and 72.

For the scenario areas in Lincoln County surrounding the Siletz, appropriately, areas zoned as coastal shorelands are impacted. There are also farm use, residential, and rural residential zones with the future flooding scenarios.

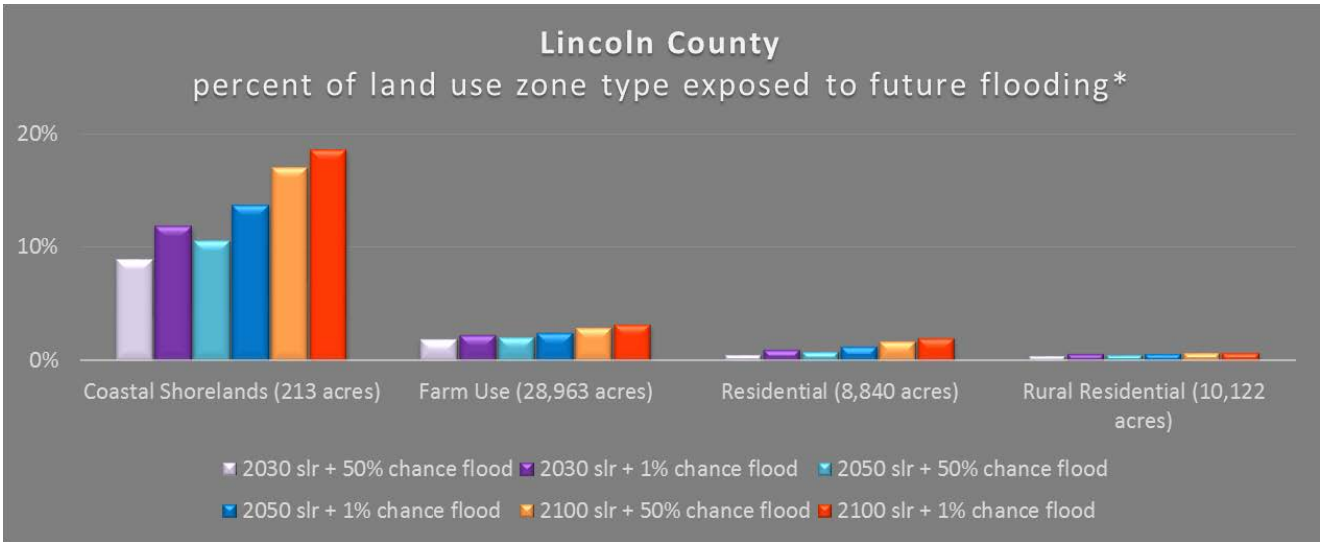

Figure 68. Lincoln County percent of land use zone types exposed to future flooding

**Only includes flooding from the Siletz Bay system. Percent of land use zone types flooded from the other estuaries in Lincoln County are presented separately.*

Small percentages of the commercial, parks/open space, and residential zones in Lincoln City are within the future flooding scenarios.

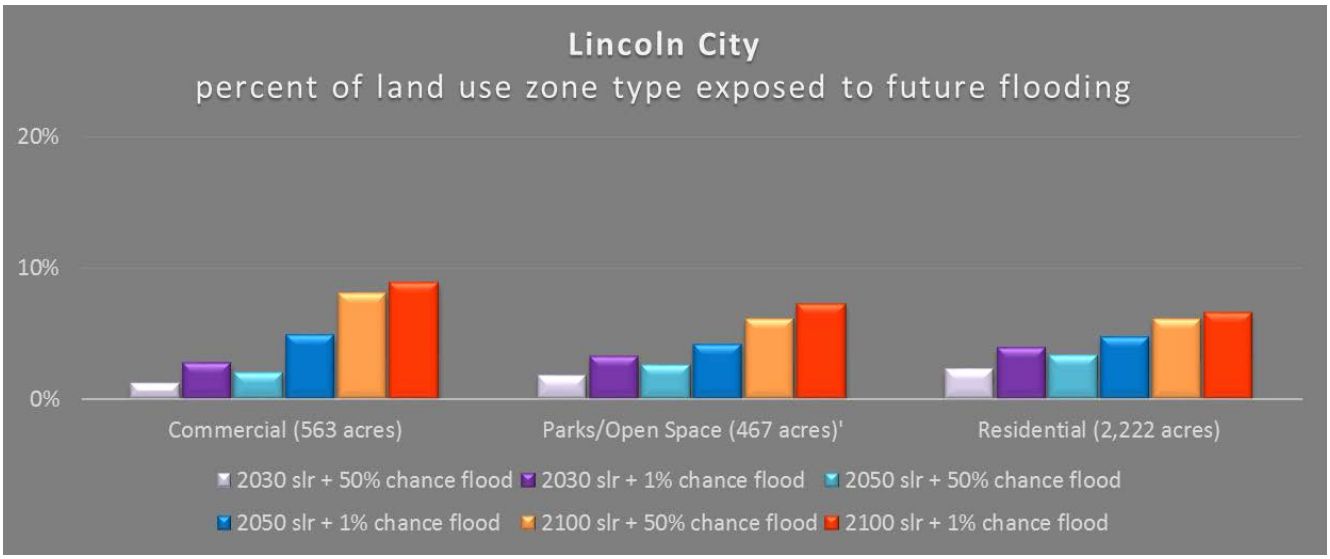

Figure 69. Lincoln City percent of land use zone type exposed to future flooding

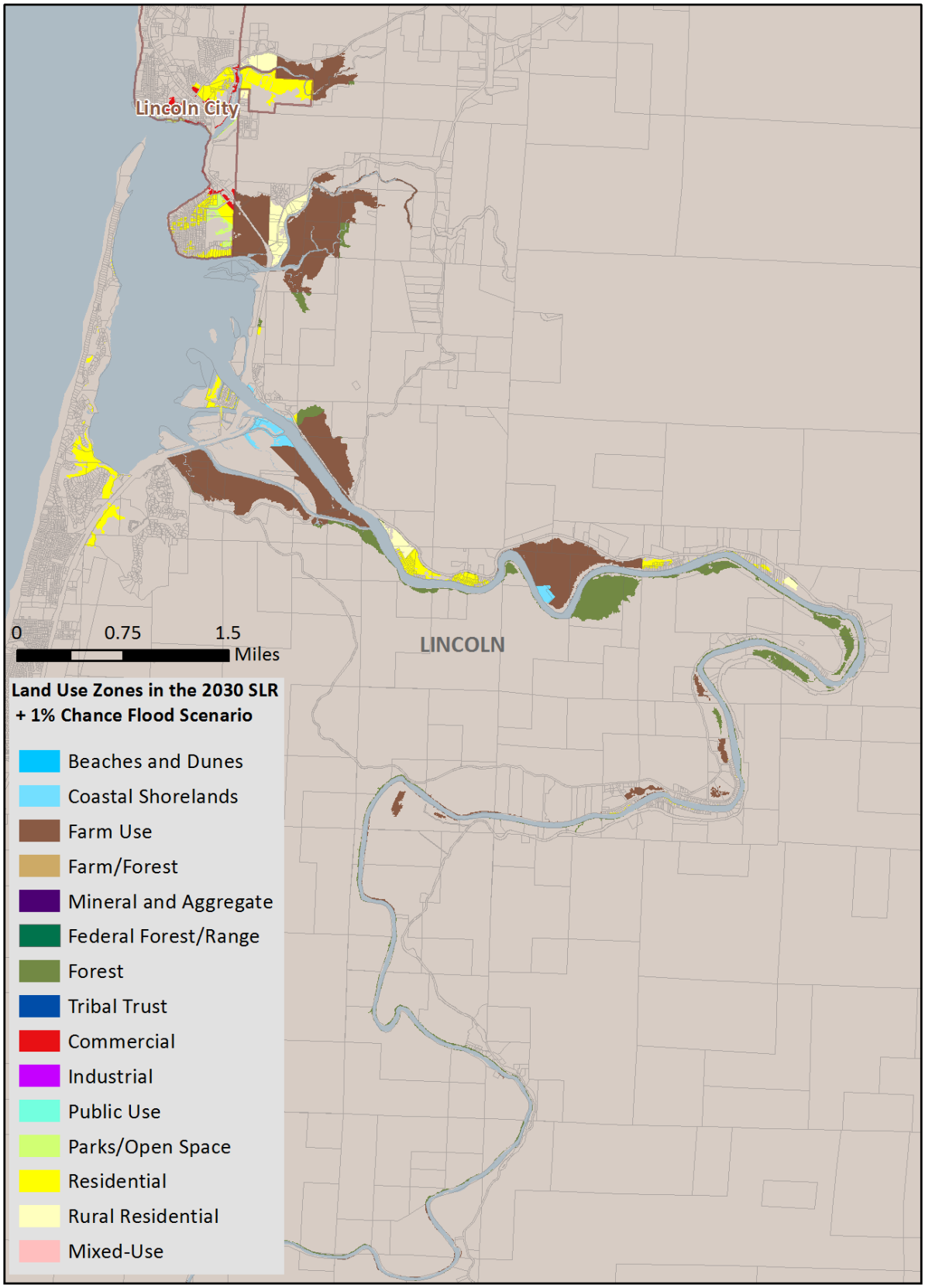

Figure 70. Land Use Zones within the Siletz Bay 2030 SLR + 1% chance flood scenario

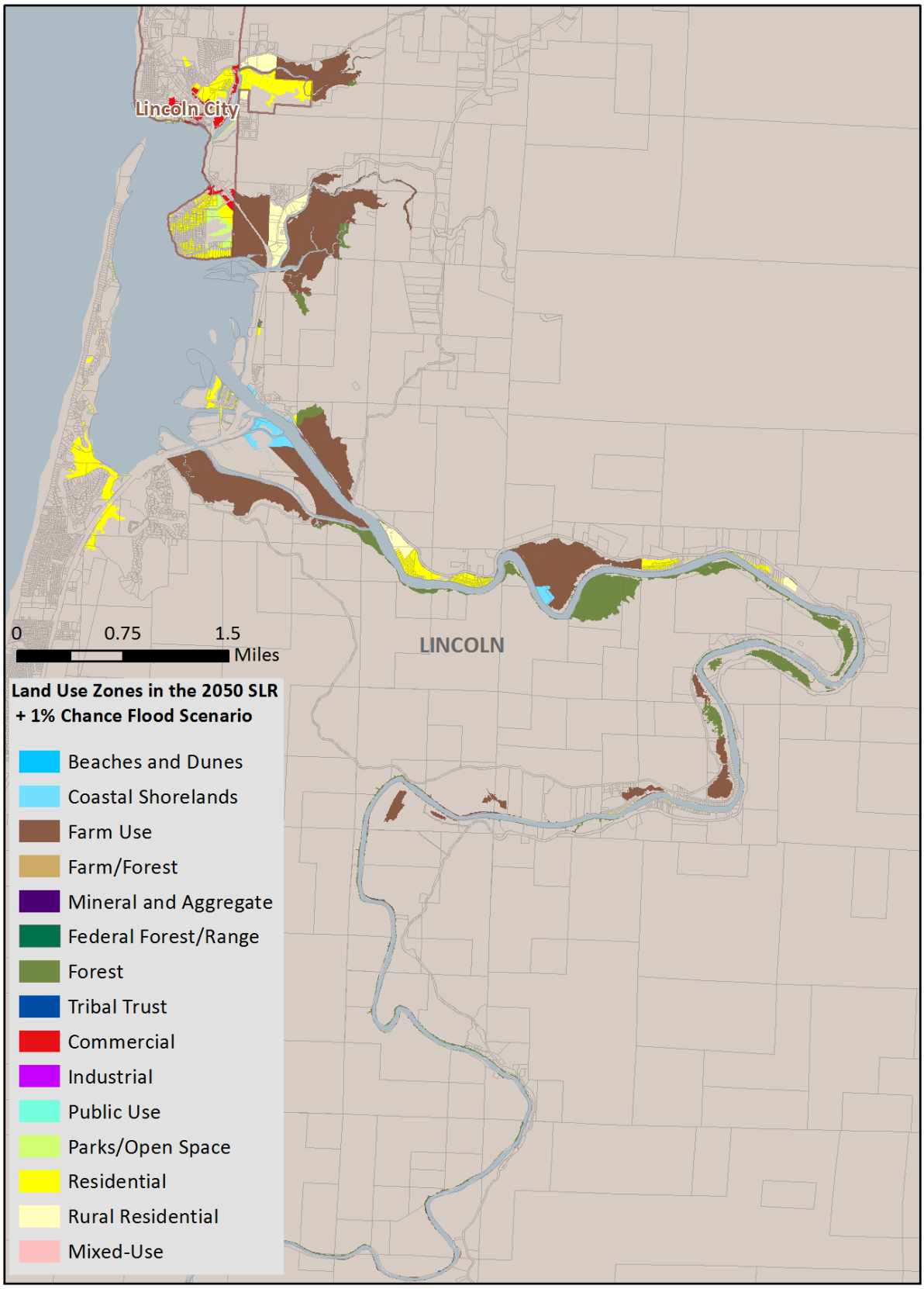

Figure 71. Land Use Zones within the Siletz Bay 2050 SLR + 1% chance flood scenario

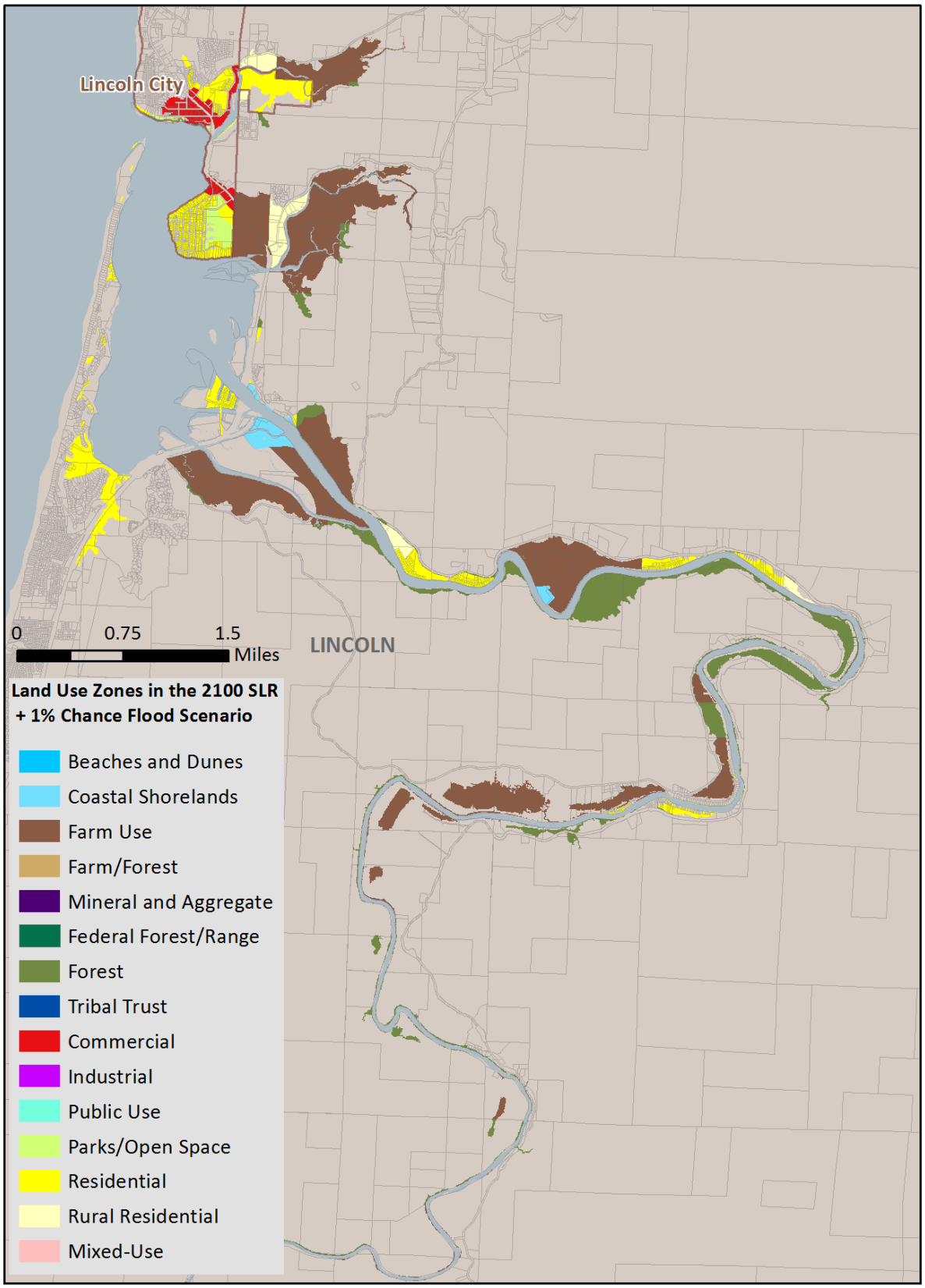

Figure 72. Land Use Zones within the Siletz Bay 2100 SLR + 1% chance flood scenario

Depoe Bay Estuary

This section presents the results of the exposure inventory by asset in the Depoe Bay system. Depoe Bay is a very small estuary. While there is significant development along its shorelands, it is mostly outside of the floodplain and will see minimal impacts from sea-level rise.

State Highways

There are no state highways impacted by the six future flood scenarios.

Roads

However, county and local roads may see flooding under the six flood scenarios. Figure 72 displays the total number of county and local road miles impacted per scenario.

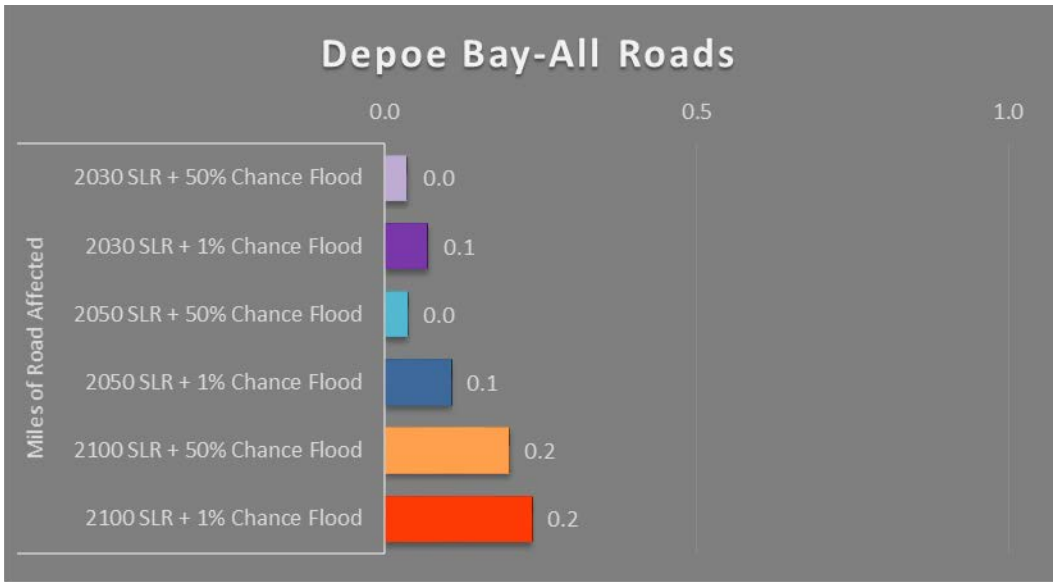

Figure 73. Miles of Road Impacted in the Depoe Bay Future Flooding Scenarios

Airports

There are no airports that are within the future flood scenarios.

Railway

There are no railroads affected in the future flood scenarios.

Critical Facilities

There are no fire stations, police stations, sheriff's offices, schools, hospitals, or city halls in the future flood scenarios within the Depoe Bay system.

Municipal Use Drinking Water

The City of Depoe Bay has water rights to a point of diversion which falls within all six future flooding scenarios.

Wastewater Treatment Plant

There are no wastewater treatment plants that are within the future flood scenarios.

Electric Substation

There are no substations within the six future flooding scenarios.

Potential Contaminant Sources

There is a marina that is considered a potential contaminant source in all of the future flooding scenario areas for Depoe Bay.

Buildings

A small number of buildings are impacted under most of the future flooding scenarios. In the 2030 SLR + 1% chance flood, 2050 SLR + 1% chance flood, and 2100 SLR + 50% chance flood, one building is impacted. Three buildings are impacted in the 2100 SLR + 1% chance flood.

Overview Map

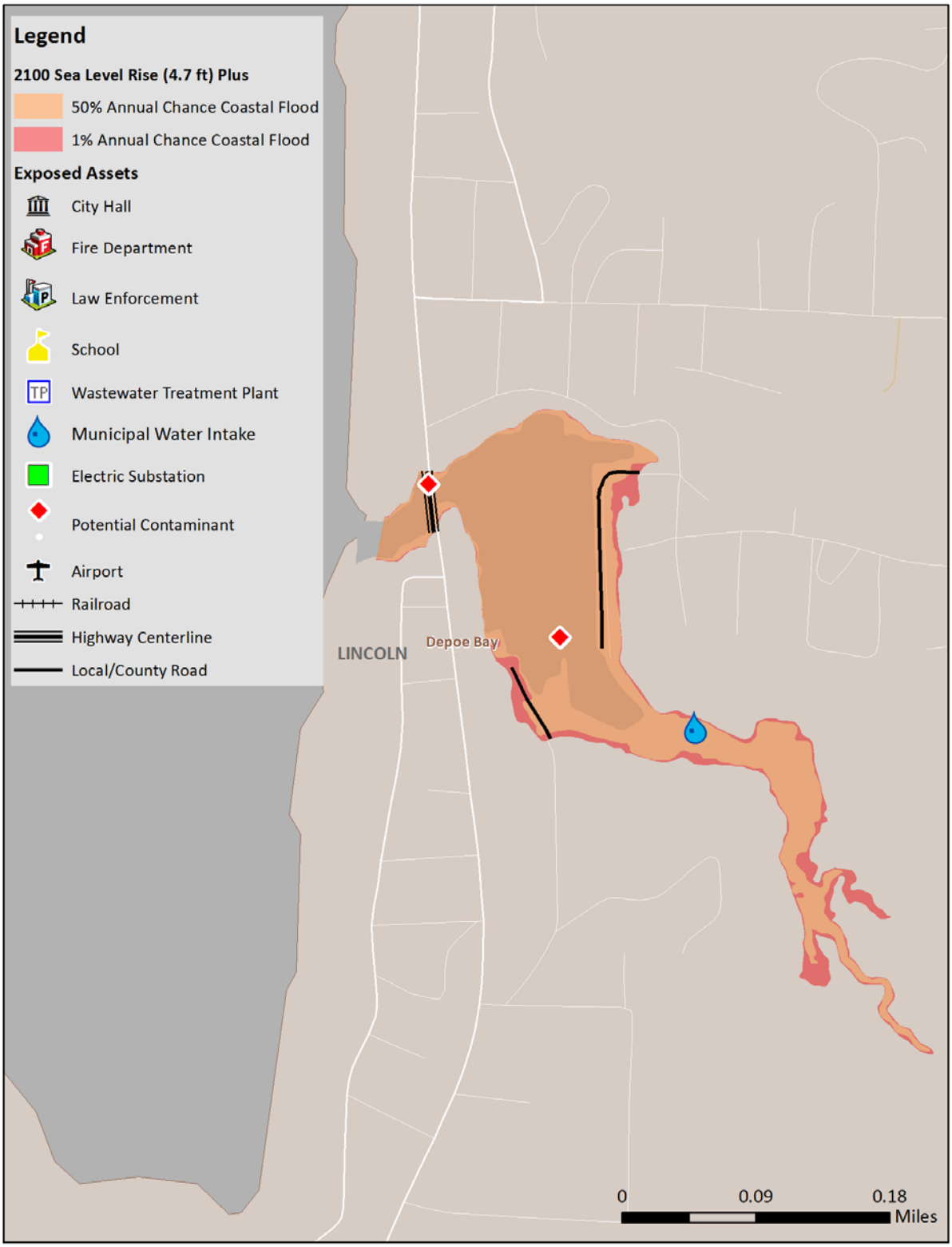

Figure 74. Depoe Bay 2100 Flood Scenarios and Assets Map (for the 2030 and 2050 scenario maps, please visit http://coastalatlas.net/sealevelriseviewer/)

Land Use Zones

The land use zone analysis was not completed for Depoe Bay due to minimal flooded area.

Yaquina Bay Estuary

This section presents the results of the exposure inventory by asset in the Yaquina Bay system. In the near-term (2030), flooding in the Yaquina Bay system will mainly impact a small number of buildings and local roads. However, in the long-term (2100), impacts increase significantly to include some critical facilities and state highways.

State Highways

A number of state highways are inundated under the six future flooding scenarios, Figure 75 provides the total number of miles impacted and Table 11 provides a breakdown of impacted miles per highway.

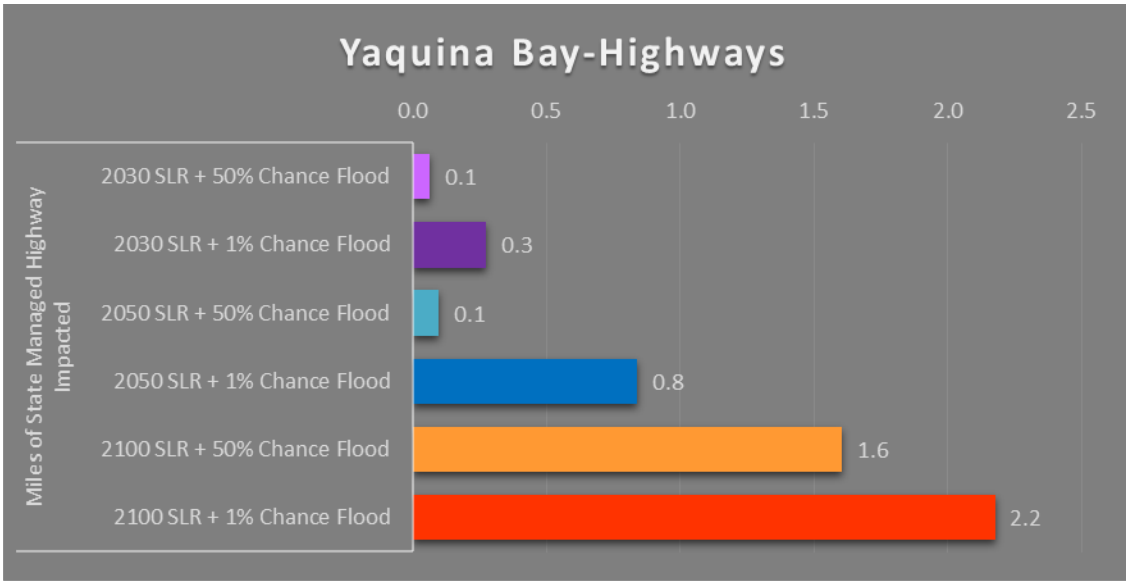

Figure 75. Miles of State Managed Highway Impacted in the Yaquina Bay Future Flooding Scenarios

Table 11 Impacted miles per highway

	2030 SLR + 50% Chance Flood	2030 SLR + 1% Chance Flood	2050 SLR + 50% Chance Flood	2050 SLR + 1% Chance Flood	2100 SLR + 50% Chance Flood	2100 SLR + 1% Chance Flood
Corvallis-Newport Hwy (US-20)	0.02	0.02	0.02	0.14	0.25	0.54
Oregon Coast Hwy (US-101)	0.02	0.02	0.02	0.02	0.02	0.02
Siletz Hwy (OR-229)	0.03	0.24	0.06	0.69	1.34	1.62

Roads

In addition to the highways impacted, county and local roads also may see flooding under the six flood scenarios. Figure 76 displays the total number of state, county, and local road miles impacted per scenario.

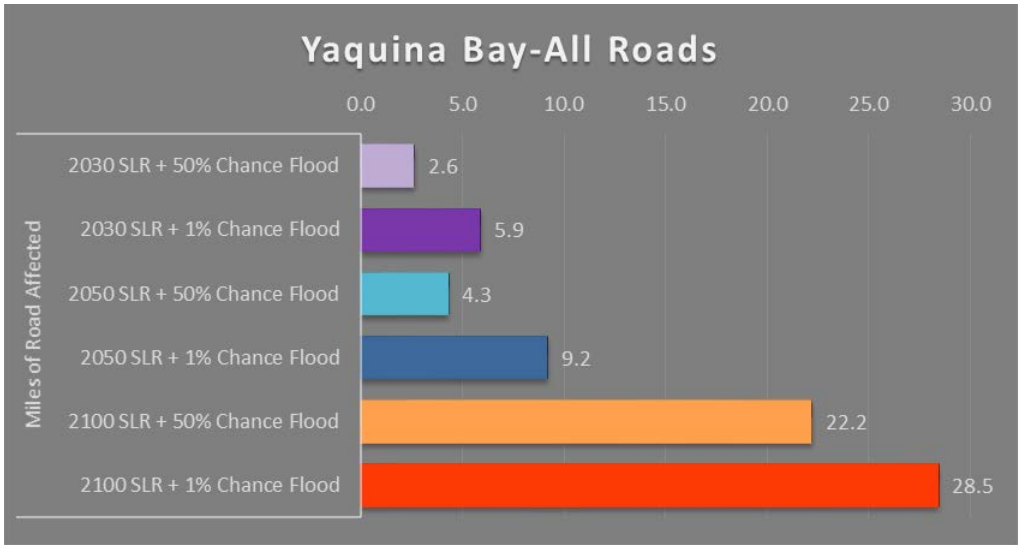

Figure 76. Miles of Road Impacted in the Yaquina Bay Future Flooding Scenarios

Airports

The Toledo State Airport (FAA code 5S4) is completely within in each of the six scenarios.

Railway

A portion of the Portland & Western Railroad in Toledo is impacted in each of the flooding scenarios. Figure 77 displays the number of miles impacted under each scenario.

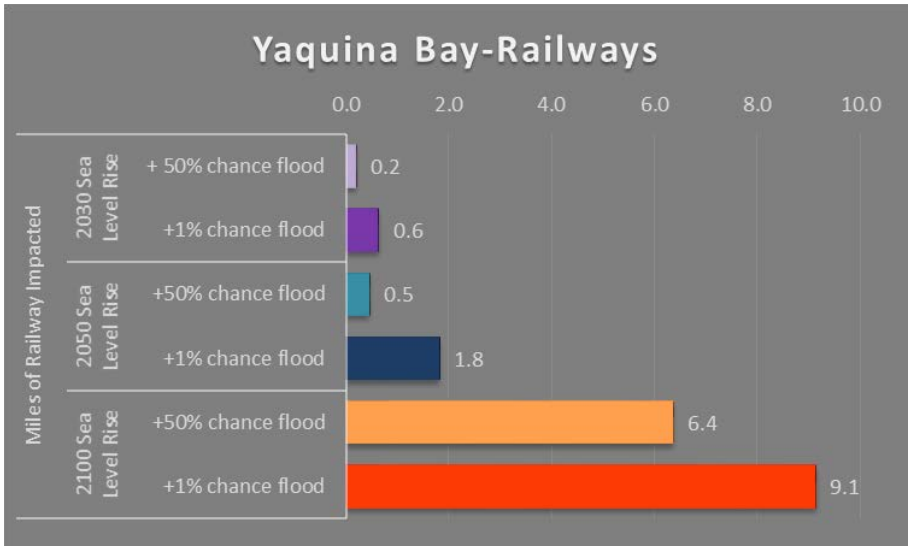

Figure 77. Miles of Railway Impacted in the Yaquina Bay Future Flooding Scenarios

Critical Facilities

Table 12 provides the number of critical facilities exposed under the six future flooding scenarios.

Table 12

Type of Critical Facility	2030 SLR + 50% Chance Flood	2030 SLR + 1% Chance Flood	2050 SLR + 50% Chance Flood	2050 SLR + 1% Chance Flood	2100 SLR + 50% Chance Flood	2100 SLR + 1% Chance Flood
Fire Station	0	0	0	0	0	0
Police Station/Sheriff's Office • Toledo Police Department, US Customs and Border Protection	0	0	0	0	2	2
School • Oregon State University Marine Science Center	0	0	0	0	0	1
Hospital	0	0	0	0	0	0
City Hall	0	0	0	0	0	0
Total	**0**	**0**	**0**	**0**	**2**	**3**

Municipal Use Drinking Water

There are no municipal water intakes or wells described in the Water Rights Information Database that will be affected by the future flood scenarios in the Yaquina Bay system.

Wastewater Treatment Plant

There are no wastewater treatment plants within the future flood scenarios.

Electric Substation

There are no substations within the six future flooding scenarios.

Potential Contaminant Sources

There are no large contaminant sources within the six future flooding scenarios.

Buildings

The number of buildings impacted under each scenario is shown in Figure 78. Buildings impacted are primarily in South Beach and Toledo.

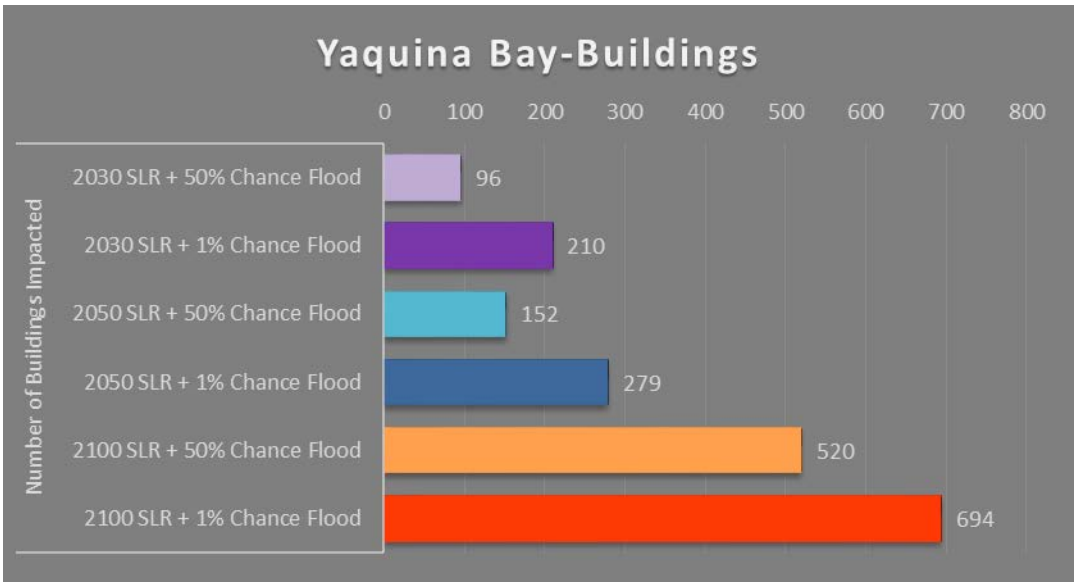

Figure 78. Number of Buildings Exposed to the Future Flooding Scenarios in the Yaquina Bay System

Overview Map

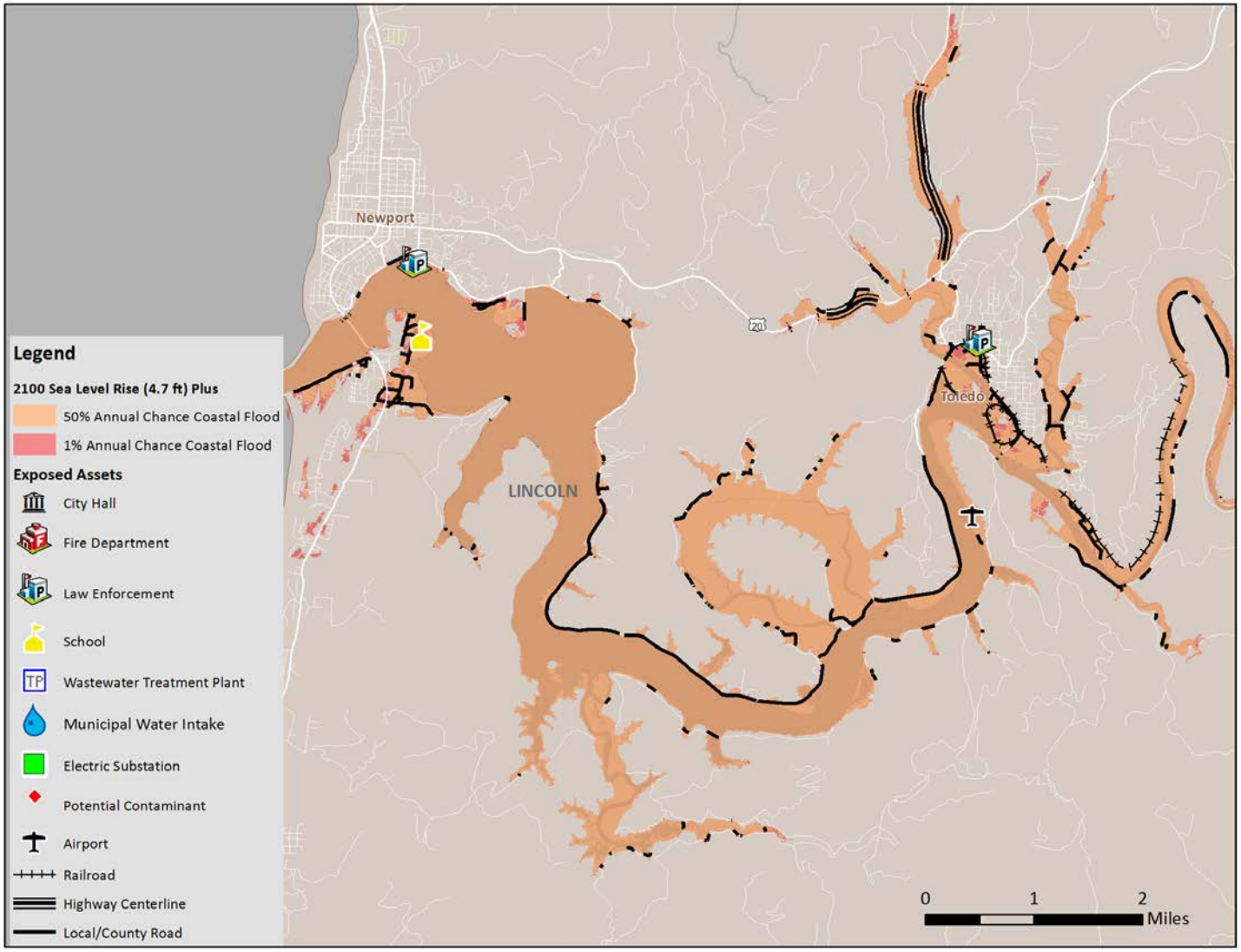

Figure 79. Yaquina Bay 2100 Flooding Scenarios and Assets Map (for the 2030 and 2050 scenario maps, please visit http://coastalatlas.net/sealevelriseviewer/)

Land Use Zones

The land use zones within each future flooding scenarios are provided as a percentage of the zoning type within a jurisdiction. Parks/Open Space may be considered an appropriate use for land that is subject to flooding, whereas residential may not be. A community can use these results to identify areas for improvements in their zoning. The results for Lincoln County are provided in Figure 80, and the city of Newport are provided in Figure 81. Maps of the results are shown in Figures 82, 83, and 84.

For the scenario areas in Lincoln County surrounding the Yaquina, appropriately, areas zoned as coastal shorelands are impacted. There are also commercial, farm use, industrial, mineral and aggregate, residential, and rural residential zones within the future flooding scenarios.

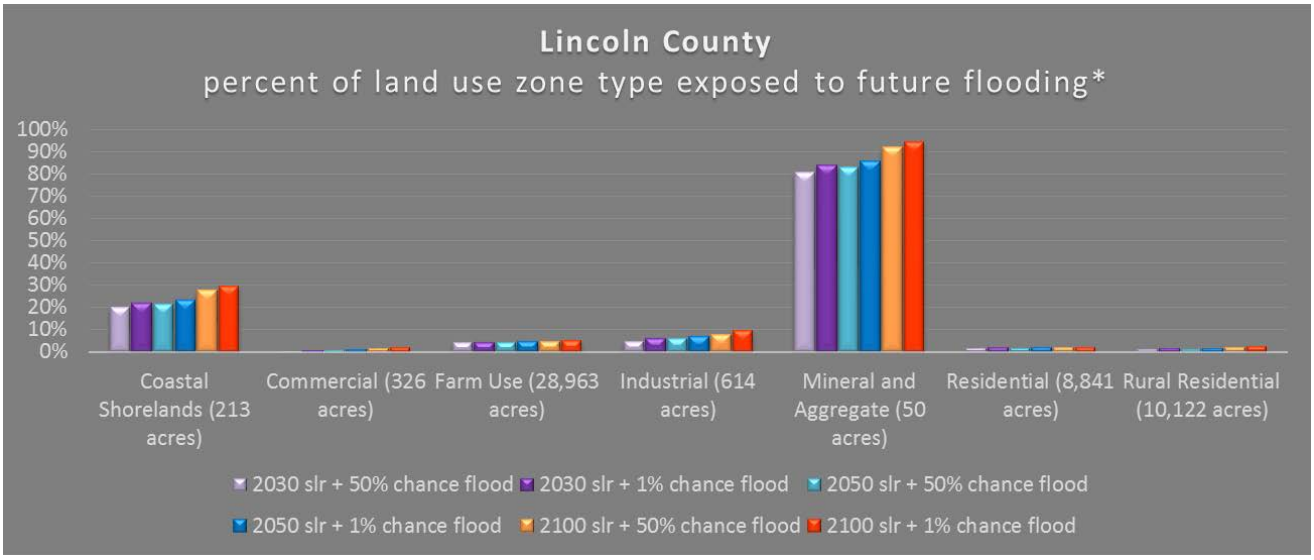

Figure 80. Lincoln County percent of land use zone types exposed to future flooding

**Only includes flooding from the Yaquina Bay system. Percent of land use zone types flooded from the other estuaries in Lincoln County are presented separately.*

For the scenario areas in Newport surrounding the Yaquina, appropriately, areas zoned as coastal shorelands and parks/open space are impacted. There are also commercial, industrial, and residential zones within the future flooding scenarios. The impact to industrial lands increases in the long-term scenarios.

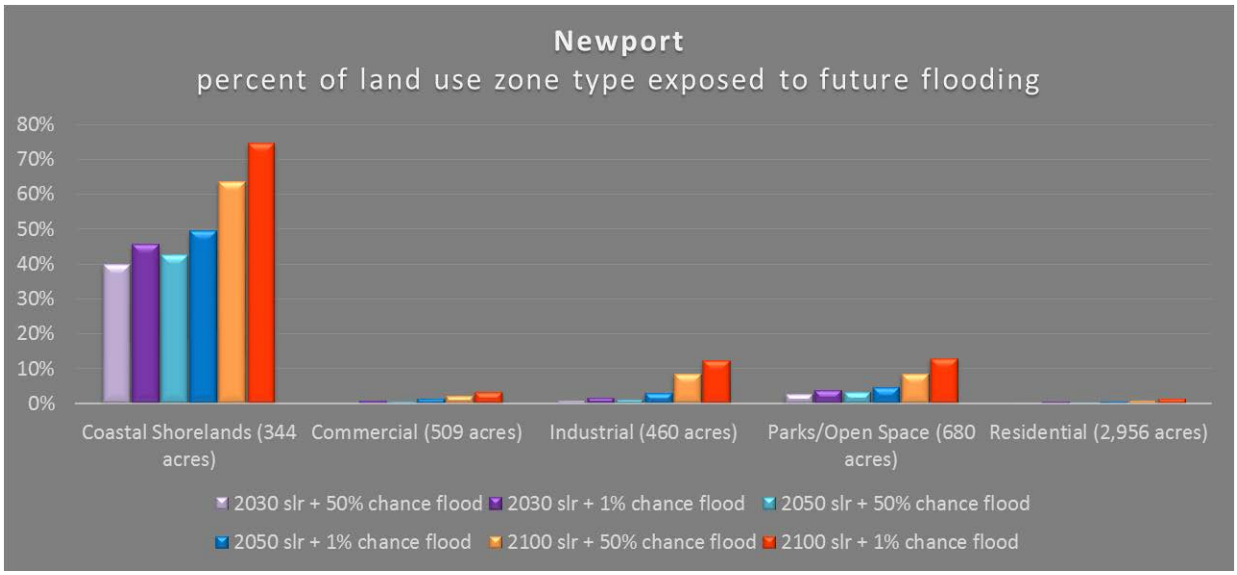

Figure 81. City of Newport percent of land use zone type exposed to future flooding

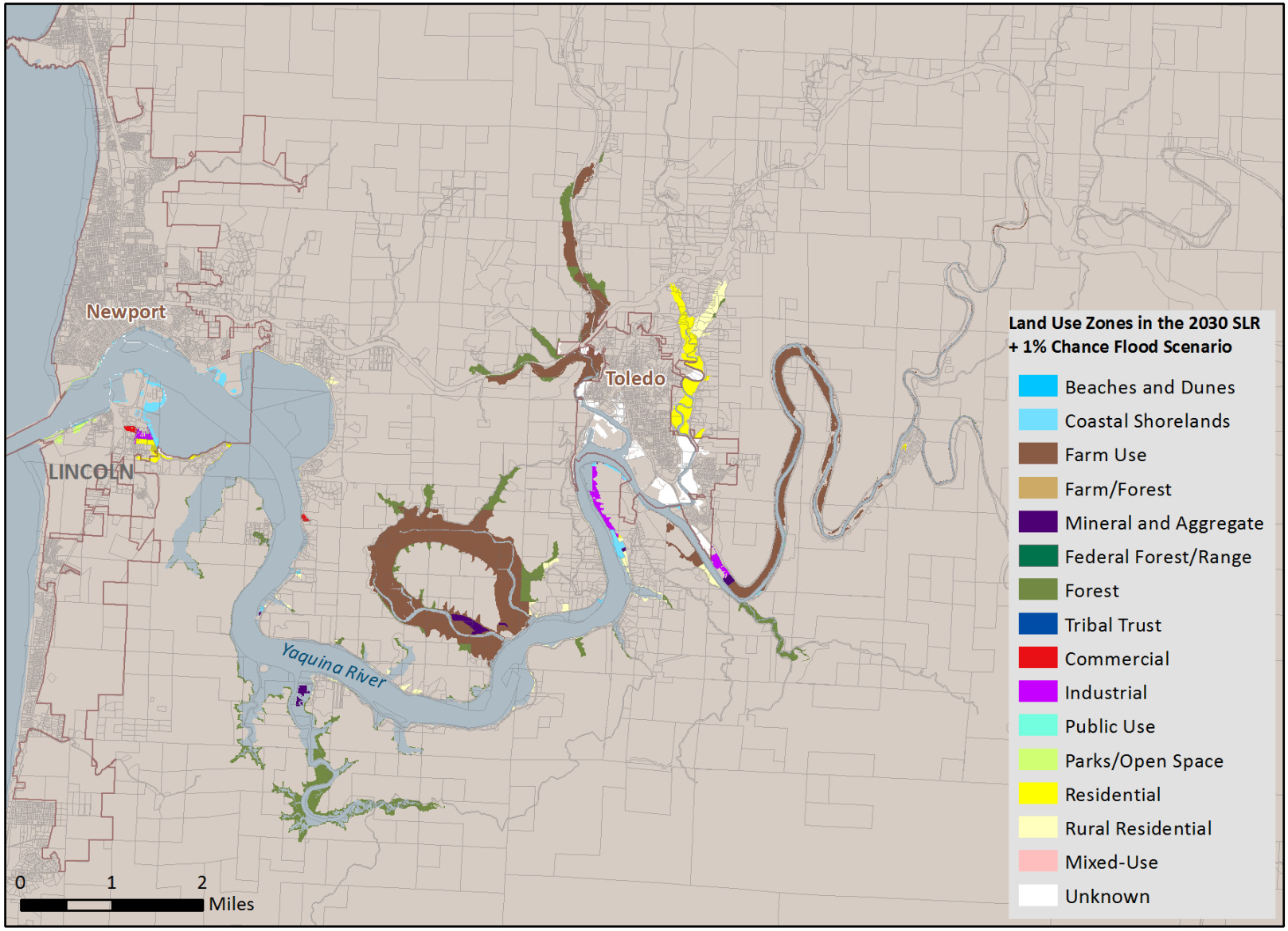

Figure 82. Land Use Zones within the Yaquina Bay 2030 SLR + 1% chance flood scenario

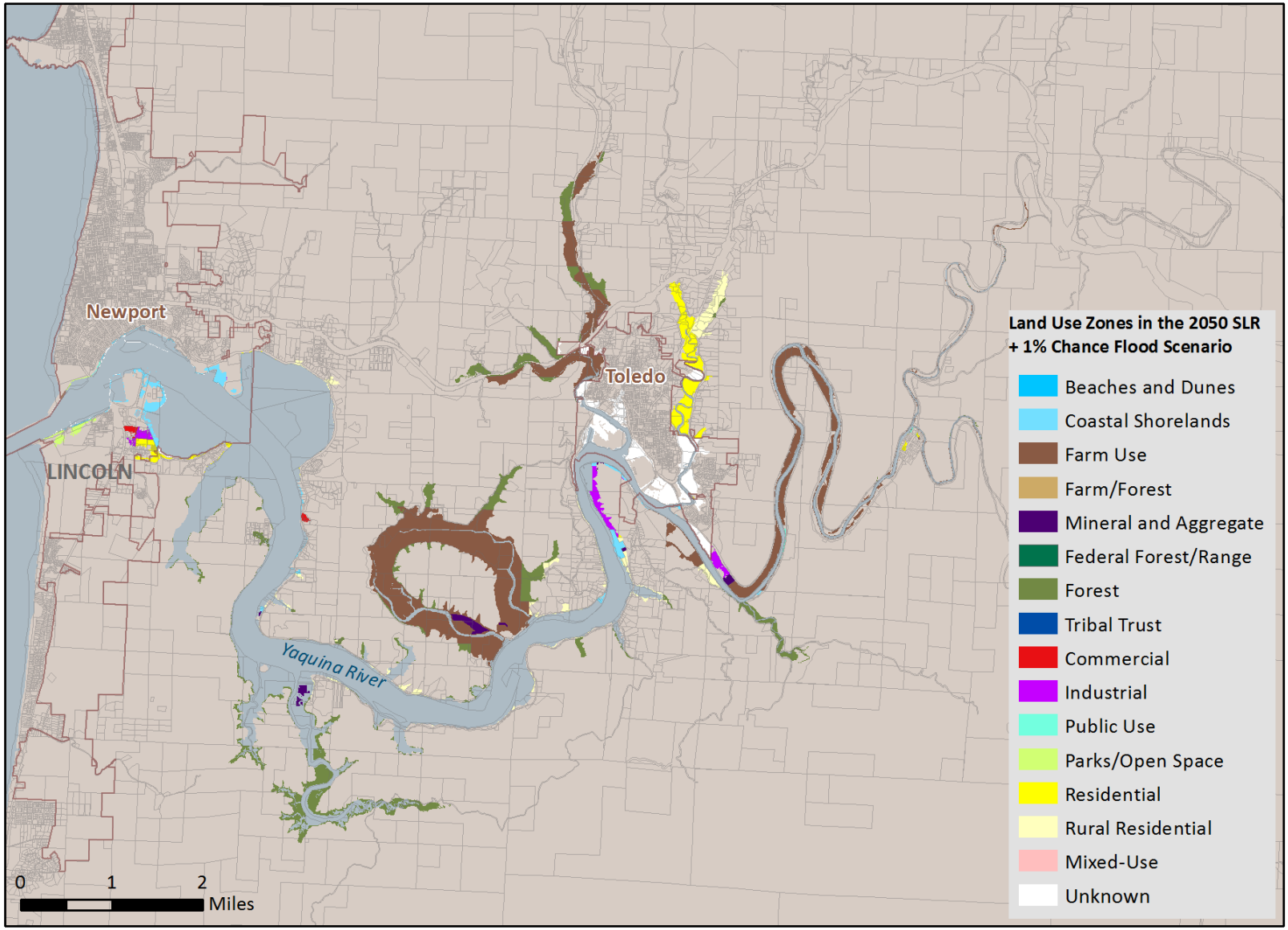

Figure 83. Land Use Zones within the Yaquina Bay 2050 SLR + 1% chance flood scenario

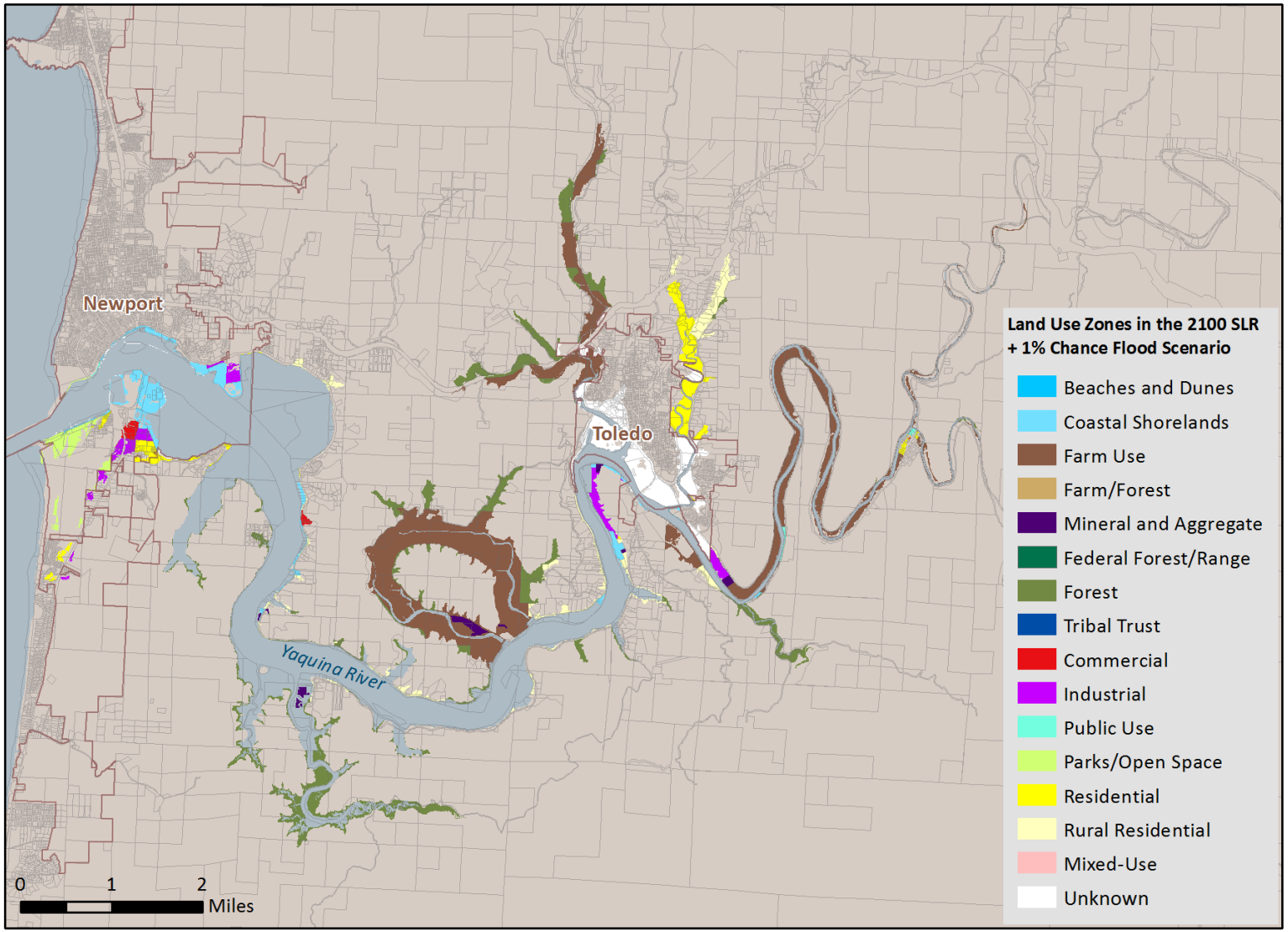

Figure 84. Land Use Zones within the Yaquina Bay 2100 SLR + 1% chance flood scenario

Alsea Bay Estuary

This section presents the results of the exposure inventory by asset in the Alsea Bay system. Flooding from the Alsea Bay impacts the city of Waldport in the near-term (2030), and becomes more significant in the mid-(2050) and long-term (2100); much of the downtown development and its high school will see an increase in flood events.

State Highways

Two state highways are inundated under the six future flooding scenarios, Figure 85 provides the total number of miles impacted and Table 13 provides a breakdown of impacted miles per highway.

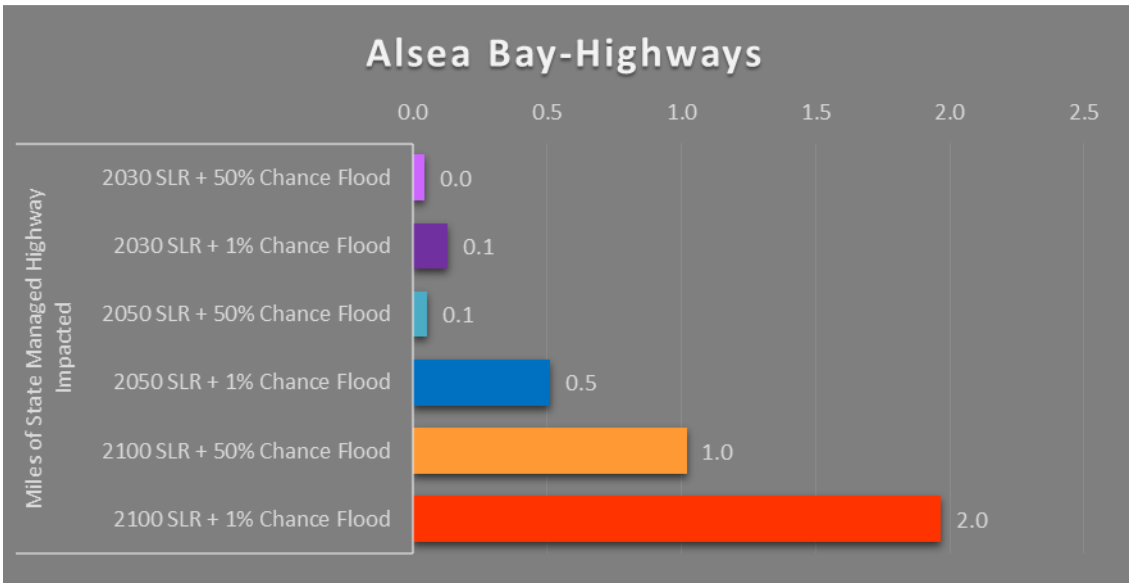

Figure 85. Miles of State Managed Highway Impacted in the Alsea Bay Future Flooding Scenarios

Table 13 Impacted miles per highway

	2030 SLR + 50% Chance Flood	2030 SLR + 1% Chance Flood	2050 SLR + 50% Chance Flood	2050 SLR + 1% Chance Flood	2100 SLR + 50% Chance Flood	2100 SLR + 1% Chance Flood
Alsea Hwy (OR-34)	0.04	0.12	0.04	0.50	0.96	1.43
Oregon Coast Hwy (US-101)	0.01	0.01	0.01	0.01	0.06	0.54

Roads

In addition to the highways impacted, county and local roads also may see flooding under the six flood scenarios. Figure 86 displays the total number of state, county, and local road miles impacted per scenario.

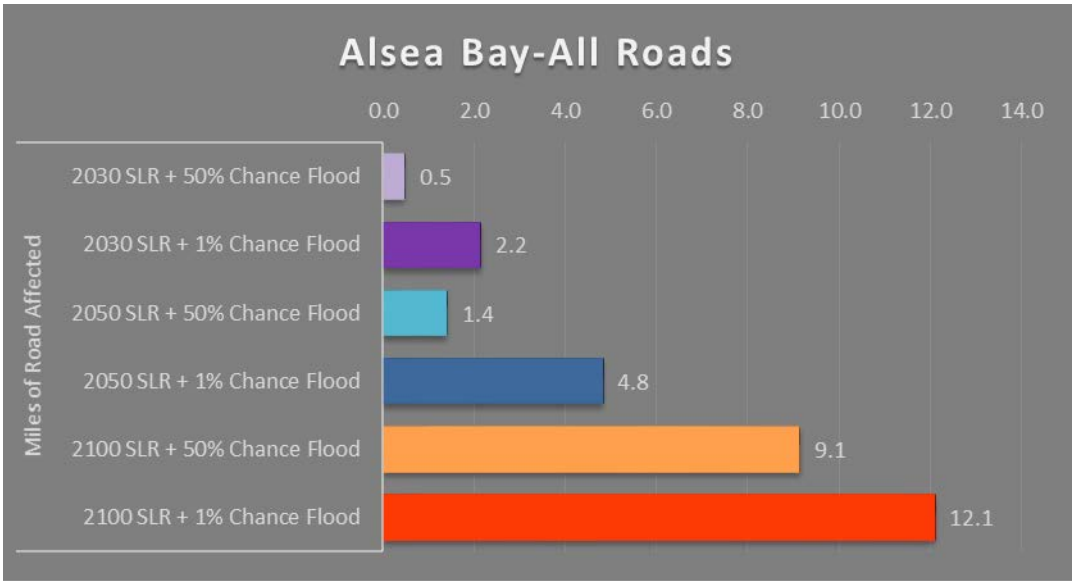

Figure 86. Miles of Road Impacted in the Alsea Bay Future Flooding Scenarios

Airports

There are no airports that are within the future flood scenarios.

Railway

There are no railroads affected in the future flood scenarios.

Critical Facilities

Table 14 provides the number of critical facilities exposed under the six future flooding scenarios.

Table 14

Type of Critical Facility	2030 SLR + 50% Chance Flood	2030 SLR + 1% Chance Flood	2050 SLR + 50% Chance Flood	2050 SLR + 1% Chance Flood	2100 SLR + 50% Chance Flood	2100 SLR + 1% Chance Flood
Fire Station • Central Oregon Coast F&R Dist	0	0	0	0	1	1
Police Station/ Sheriff's Office	0	0	0	0	0	0
School • Waldport High School	0	0	0	1	1	1
Hospital	0	0	0	0	0	0
City Hall	0	0	0	0	0	0
Total	**0**	**0**	**0**	**1**	**2**	**2**

Municipal Use Drinking Water

There are no municipal drinking water sources that are within the future flood scenarios.

Wastewater Treatment Plant

There are no wastewater treatment plants that are within the future flood scenarios.

Electric Substation

There are no substations within the six future flooding scenarios.

Potential Contaminant Sources

There is a large capacity septic system (serving greater than 20 people) in the 2050 SLR + 1% chance flood and both of the 2100 flood scenario areas for Alsea Bay.

Buildings

The number of buildings impacted under each scenario is shown in Figure 87. Buildings impacted are in Bayshore, Waldport, and continuing upstream.

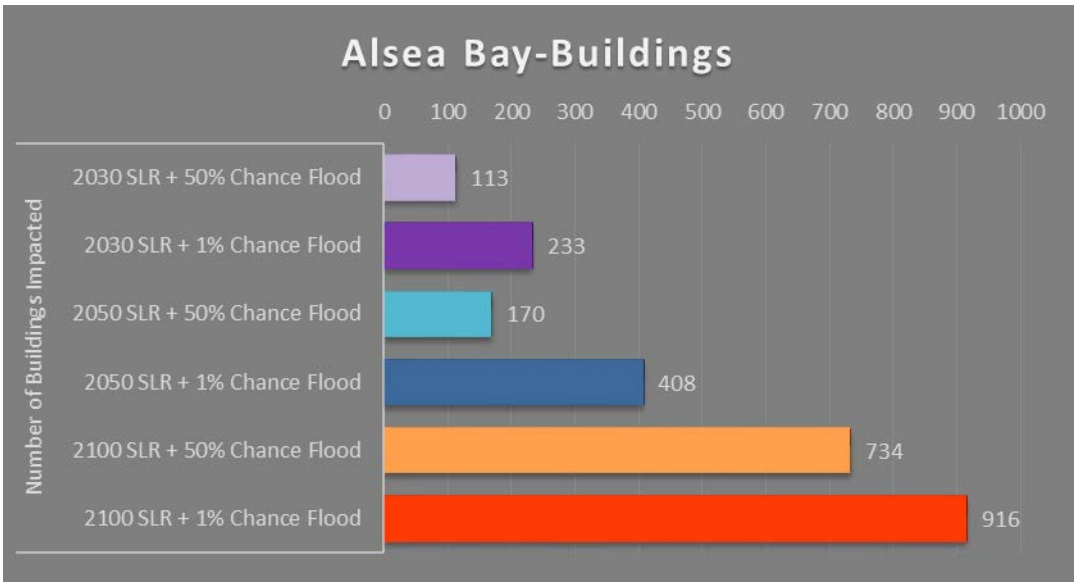

Figure 87. Number of Building Exposed to the Future Flooding Scenarios in the Alsea Bay System

Overview Map

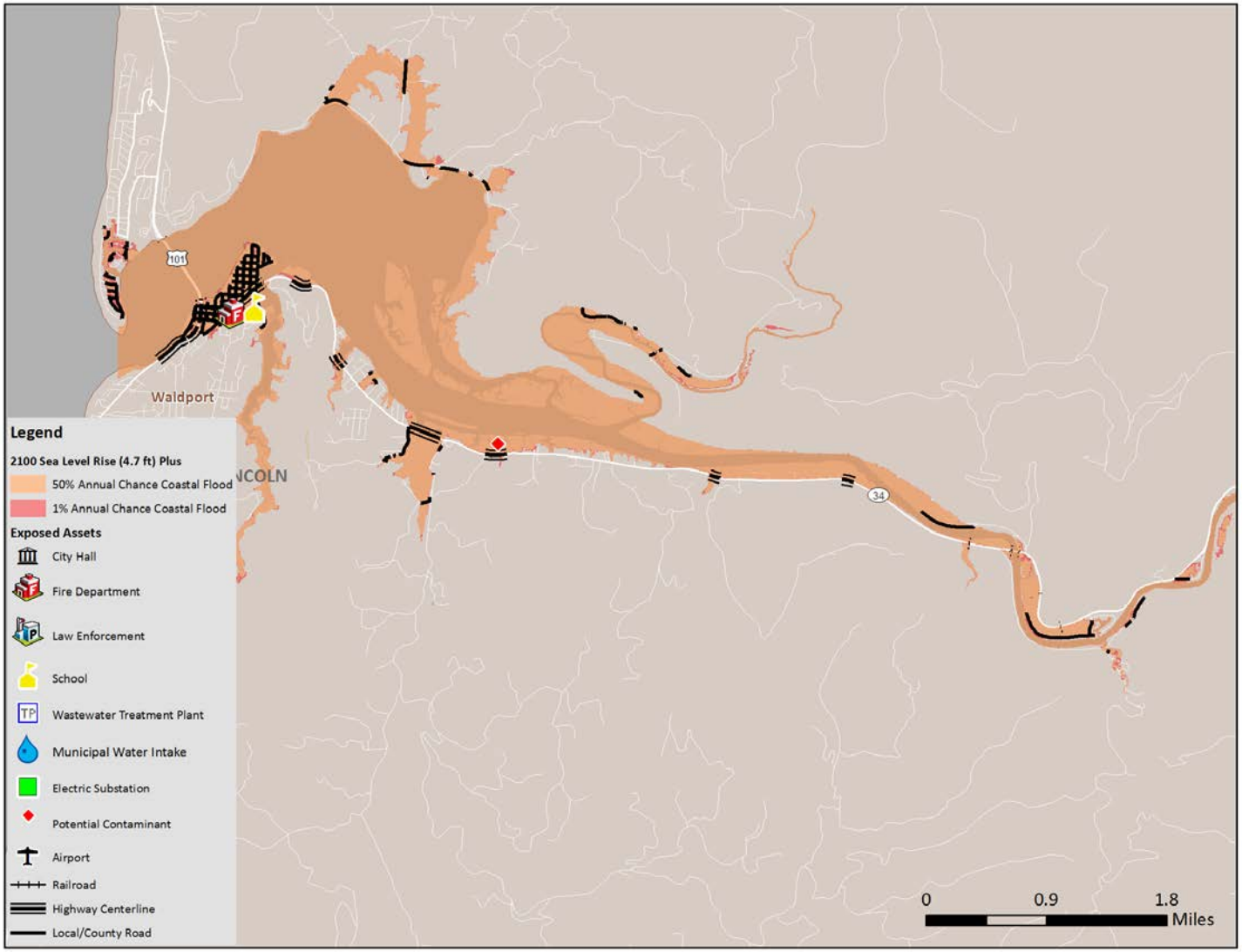

Figure 88. Alsea Bay 2100 Flooding Scenarios and Asset Map (for the 2030 and 2050 scenario maps, please visit http://coastalatlas.net/sealevelriseviewer/)

Land Use Zones

The land use zones within each future flooding scenarios are provided as a percentage of the zoning type within a jurisdiction. Parks/Open Space may be considered an appropriate use for land that is subject to flooding, whereas residential may not be. A community can use these results to identify areas for improvements in their zoning. The results for Lincoln County are provided in Figure 89. Maps of the results are shown in Figures 90, 91, and 92.

For the scenario areas in Lincoln County surrounding Alsea Bay, appropriately, areas zoned as coastal shorelands are impacted. There are also commercial, farm use, residential, rural residential, forest, and public use zones with the future flooding scenarios.

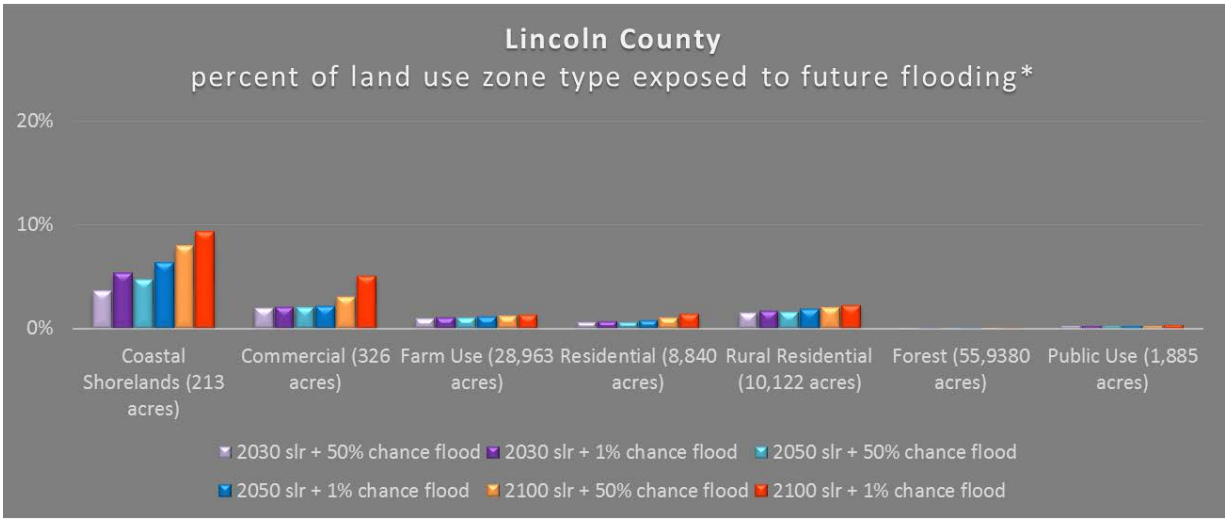

Figure 89. Lincoln County percent of land use zone types exposed to future flooding

**Only includes flooding from the Alsea Bay system. Percent of land use zone types flooded from the other estuaries in Lincoln County are presented separately.*

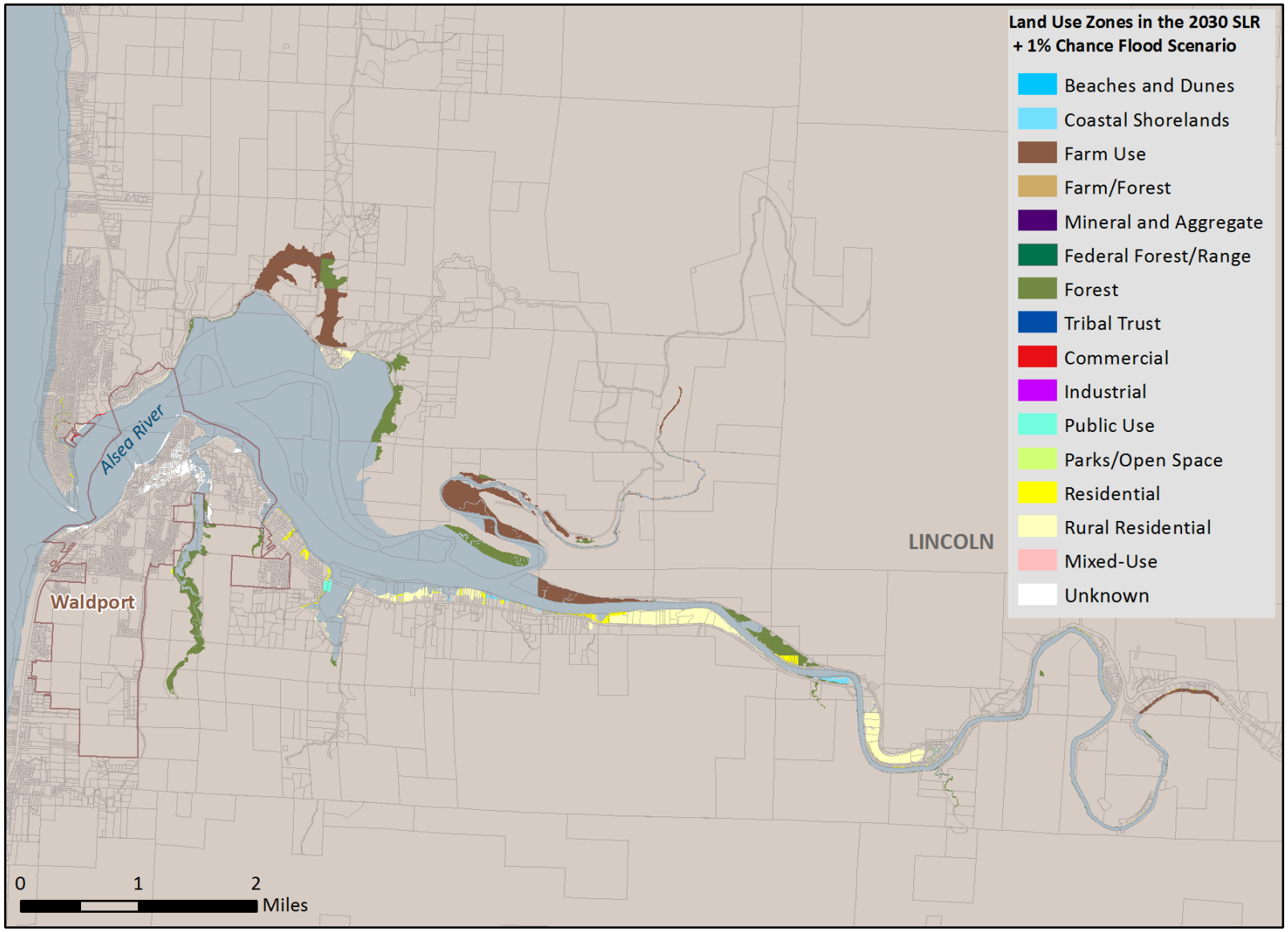

Figure 90. Land Use Zones within the Alsea Bay 2030 SLR + 1% chance flood scenario

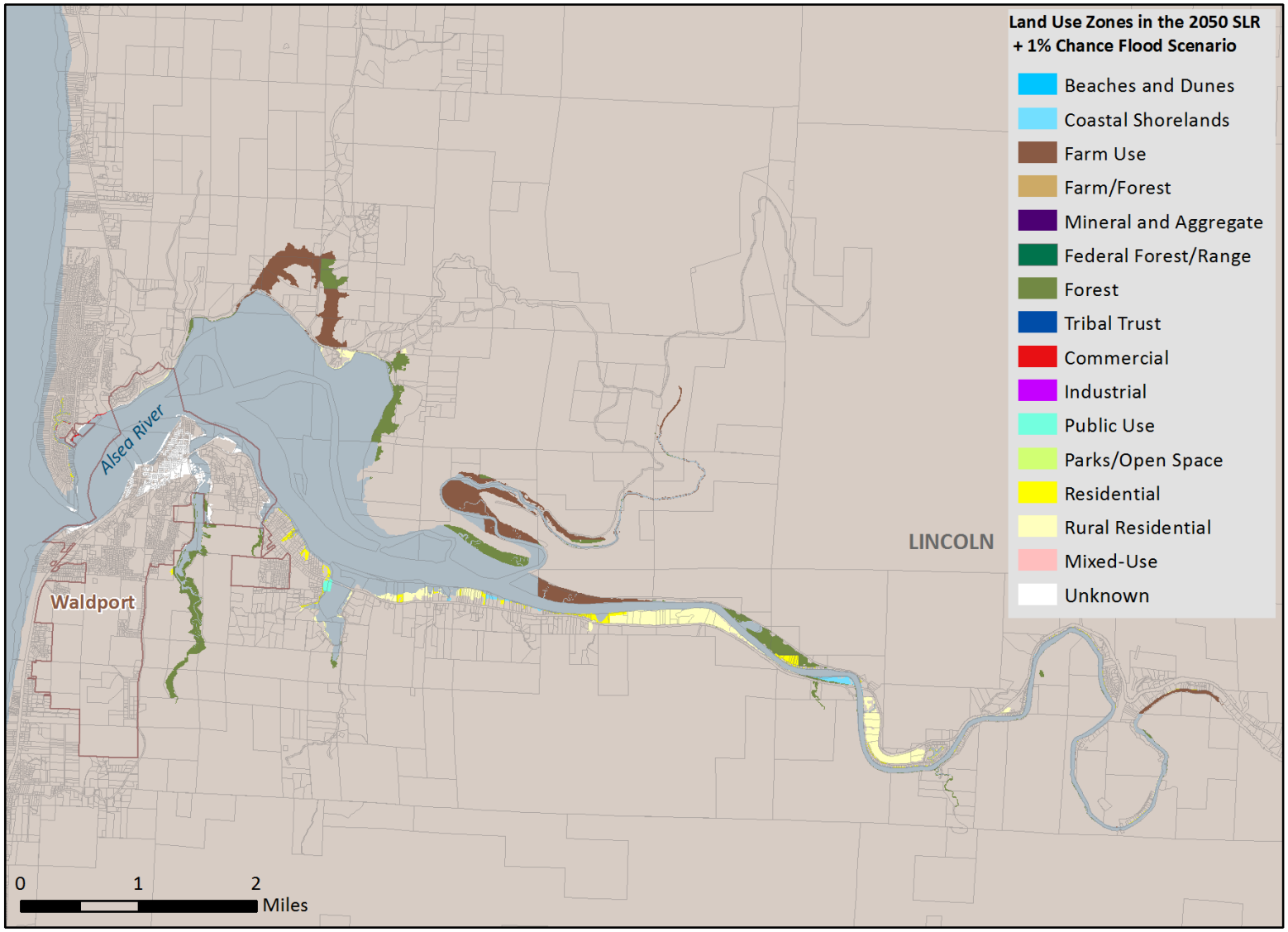

Figure 91. Land Use Zones within the Alsea Bay 2050 SLR + 1% chance flood scenario

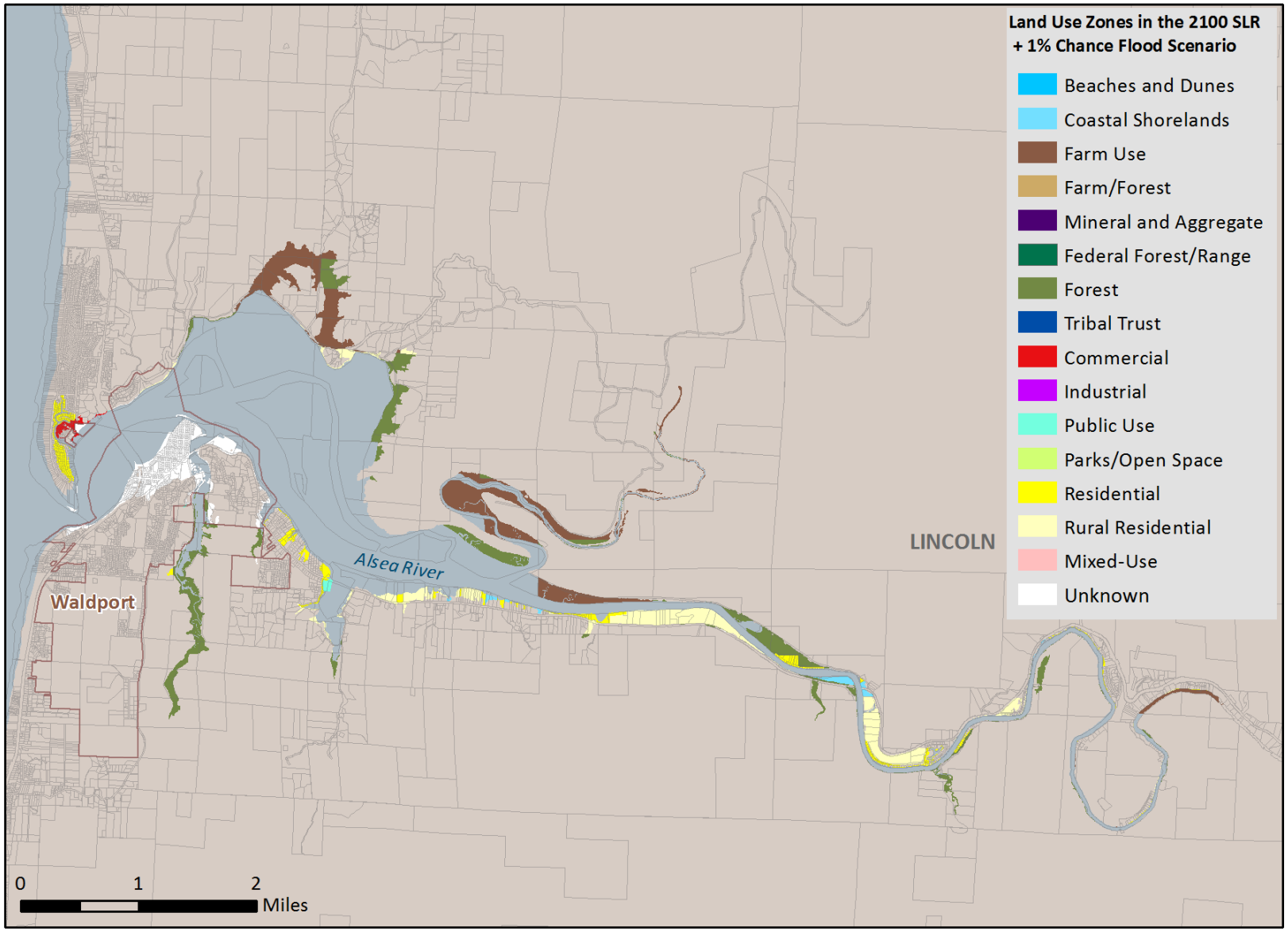

Figure 92. Land Use Zones within the Alsea Bay 2100 SLR + 1% chance flood scenario

Siuslaw River Estuary

This section presents the results of the exposure inventory by asset in the Siuslaw River system. The major impact within the Siuslaw system is to State Highway 26 which is flooded in the near-term (2030) and the extent of impact continues to increase over time. The route provides an important connection from the City of Florence to Eugene.

State Highways

A number of state highways are inundated under the six future flooding scenarios, Figure 93 provides the total number of miles impacted and Table 15 provides a breakdown of impacted miles per highway.

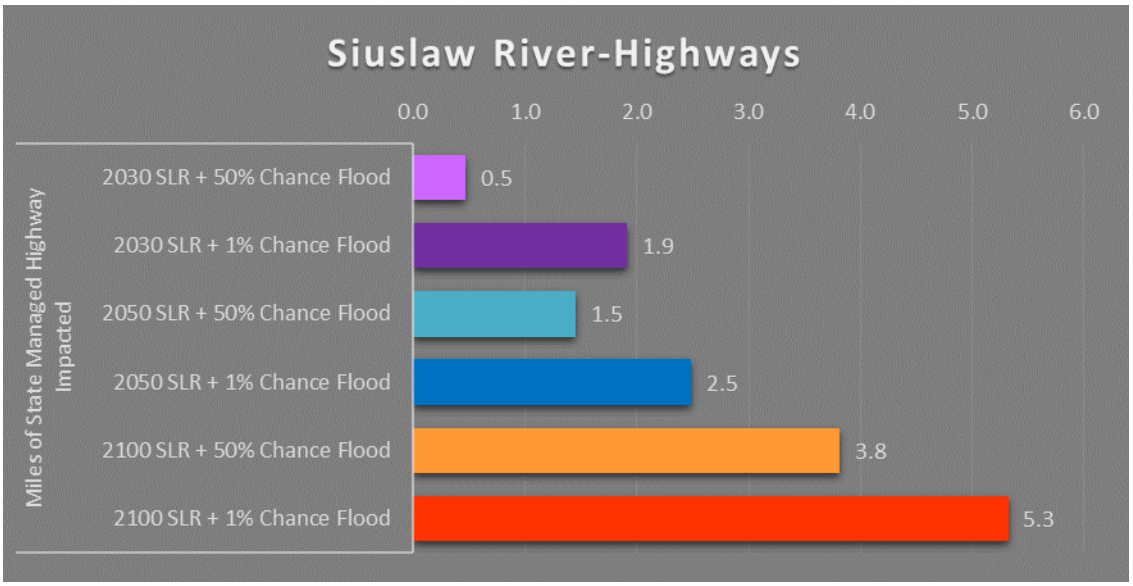

Figure 93. Miles of State Managed Highway Impacted in the Siuslaw River Future Flooding Scenarios

Table 15 Impacted miles per highway

	2030 SLR + 50% Chance Flood	2030 SLR + 1% Chance Flood	2050 SLR + 50% Chance Flood	2050 SLR + 1% Chance Flood	2100 SLR + 50% Chance Flood	2100 SLR + 1% Chance Flood
Florence-Eugene Hwy (OR-126)	0.42	1.87	1.41	2.43	3.64	5.15
Oregon Coast Hwy (US-101)	0.04	0.05	0.05	0.05	0.08	0.08
Tiernan Frontage Rd.	-	-	-	0.01	0.09	0.09

Roads

In addition to the highways impacted, county and local roads also may see flooding under the six flood scenarios. Figure 94 displays the total number of state, county, and local road miles impacted per scenario.

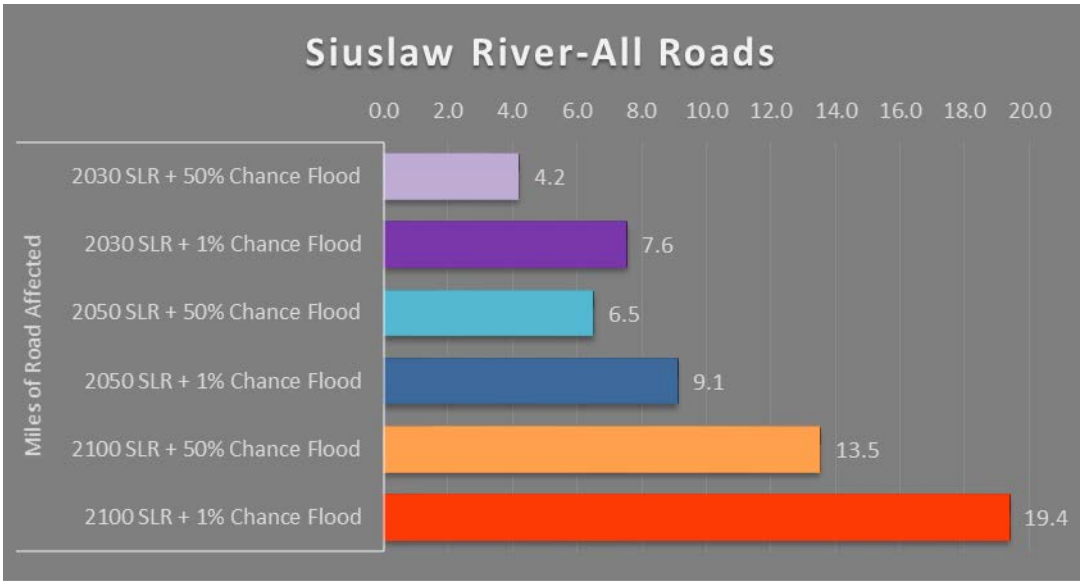

Figure 94. Miles of Road Impacted in the Siuslaw Future Flooding Scenarios

Airports

There are no airports within the future flood scenarios.

Railway

A portion of the Coos Bay Rail Link from Cushman to the South Inlet is impacted in each of the flooding scenarios. Figure 95 displays the number of miles impacted under each scenario.

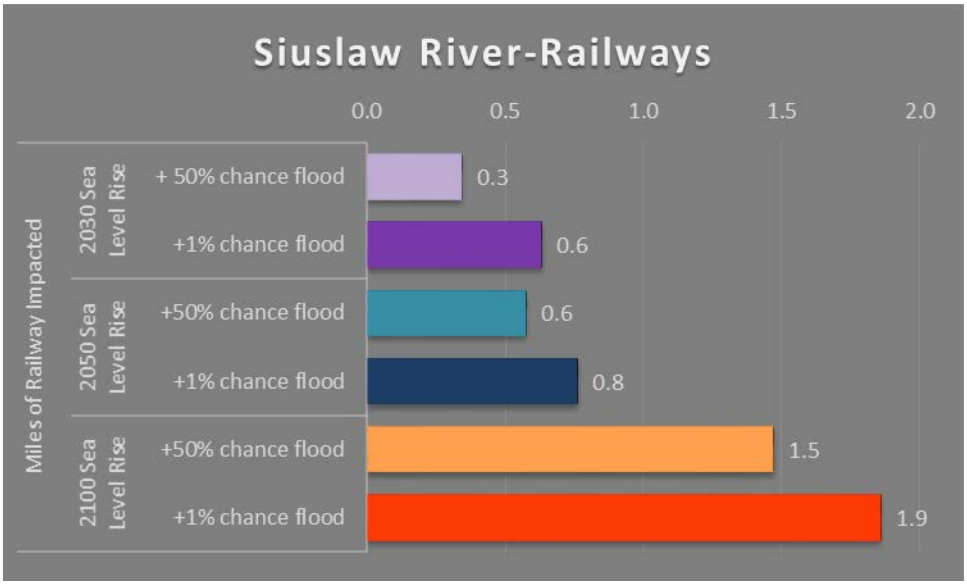

Figure 95. Miles of Railway Impacted in the Siuslaw Future Flooding Scenarios

Critical Facilities

There are no fire stations, police stations, sheriff's offices, schools, hospitals, or city halls in the future flood scenarios within the Siuslaw River system.

Municipal Use Drinking Water

There are no municipal drinking water sources that are within the future flood scenarios.

Wastewater Treatment Plant

There are no wastewater treatment plants that are within the future flood scenarios.

Electric Substations

There are no substations within the six future flooding scenarios.

Potential Contaminant Sources

There are no large contaminant sources within the six future flooding scenarios.

Buildings

The number of buildings impacted under each scenario is shown in Figure 96. In the near-term scenarios impacts are primarily to buildings along the river upstream from Florence. Buildings in the old town part of Florence see a jump in impacts in the 2100 flooding scenarios.

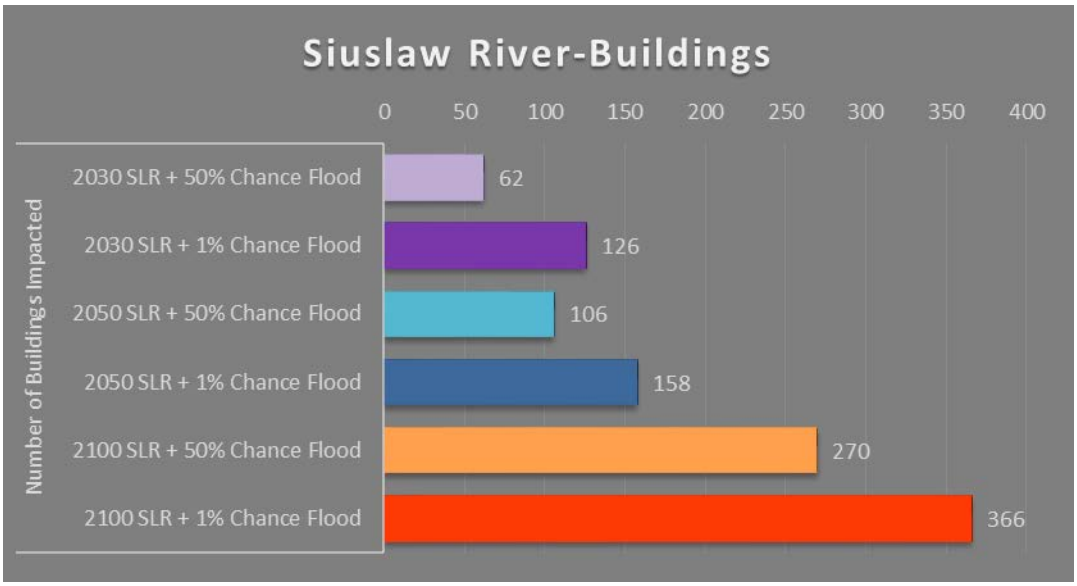

Figure 96. Number of Building Exposed to the Future Flooding Scenarios in the Siuslaw River System

Overview Map

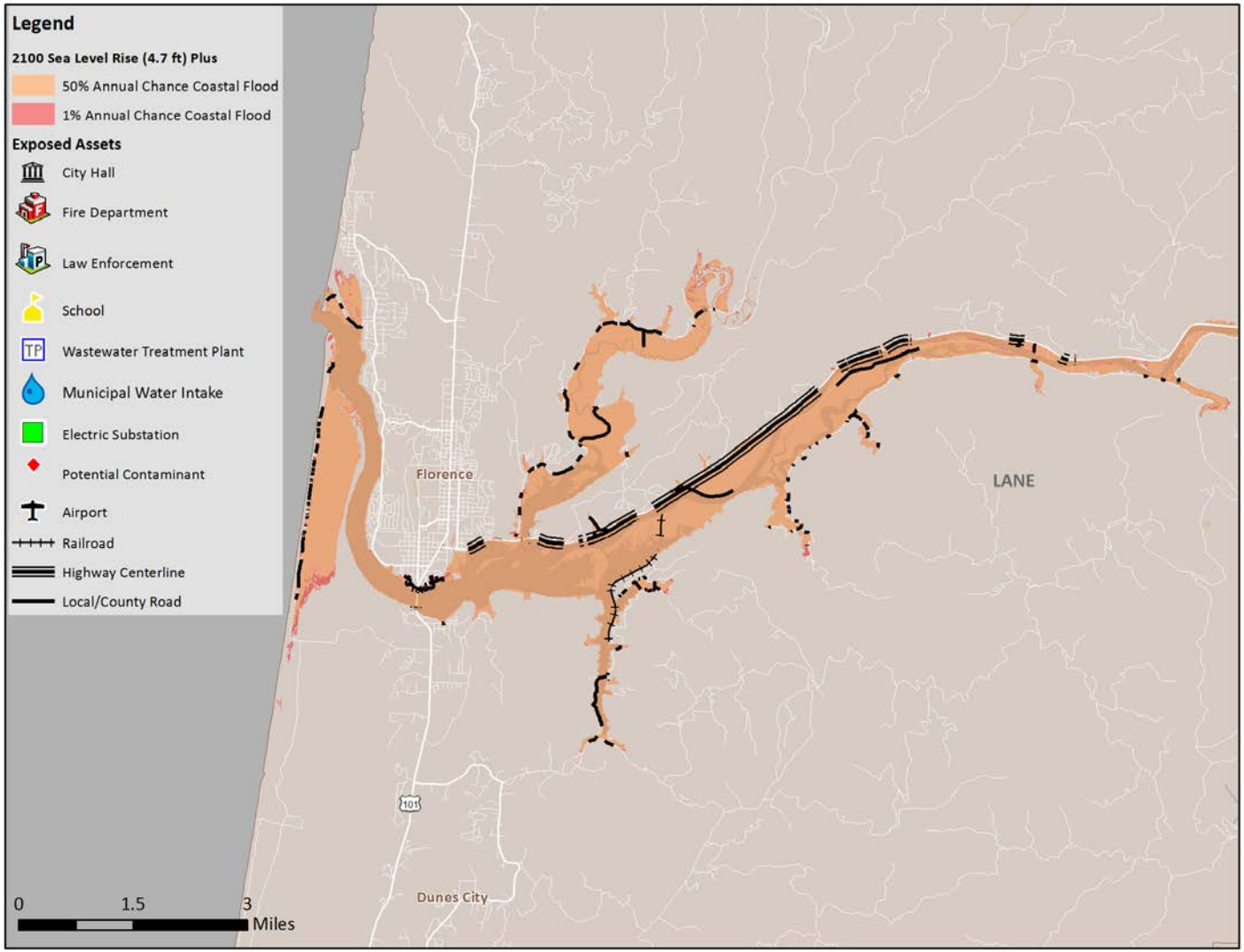

Figure 97. Siuslaw River 2100 Flood Scenarios and Assets Map (for the 2030 and 2050 scenario maps, please visit http://coastalatlas.net/sealevelriseviewer/)

Land Use Zones

The land use zones within each future flooding scenarios are provided as a percentage of the zoning type within a jurisdiction. Parks/Open Space may be considered an appropriate use for land that is subject to flooding, whereas residential may not be. A community can use these results to identify areas for improvements in their zoning. The results for Lane County are provided in Figure 98, and the City of Florence are provided in Figure 99. Maps of the results are shown in Figures 100, 101, and 102.

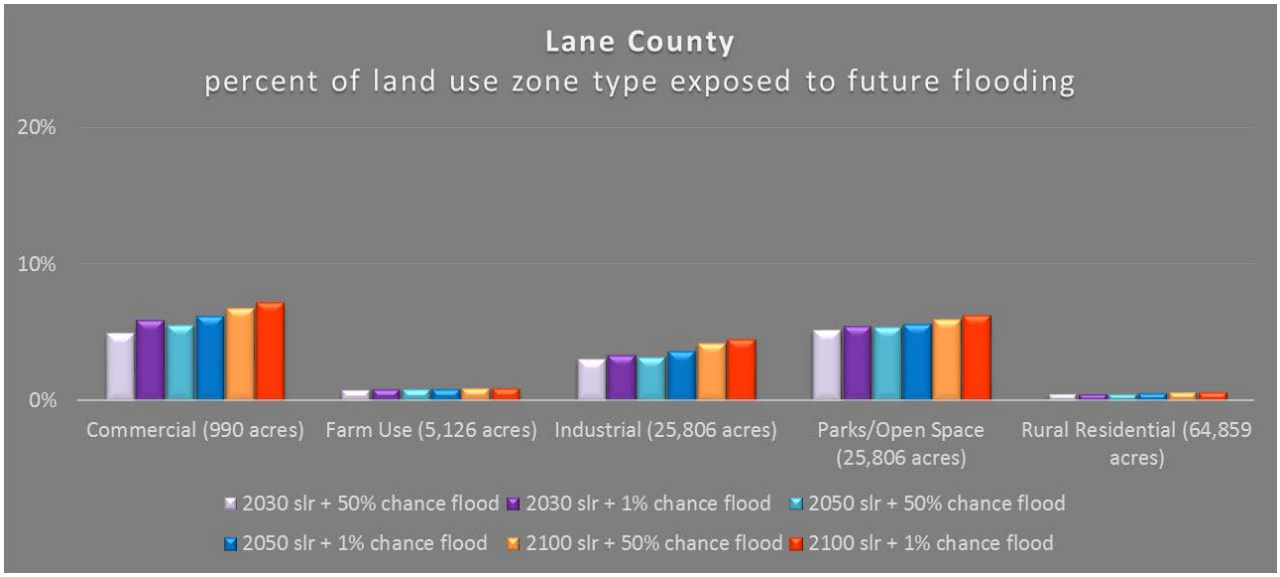

Figure 98. Lane County percent of land use zone types exposed to future flooding

For the scenario areas in Florence surrounding the Siuslaw, appropriately, areas zoned as coastal shorelands and parks/open space are impacted. There are also commercial, mixed-use, and residential zones within the future flooding scenarios. The impact to mixed-use lands increases from 10% in the near-term to over 40% in the long-term scenario.

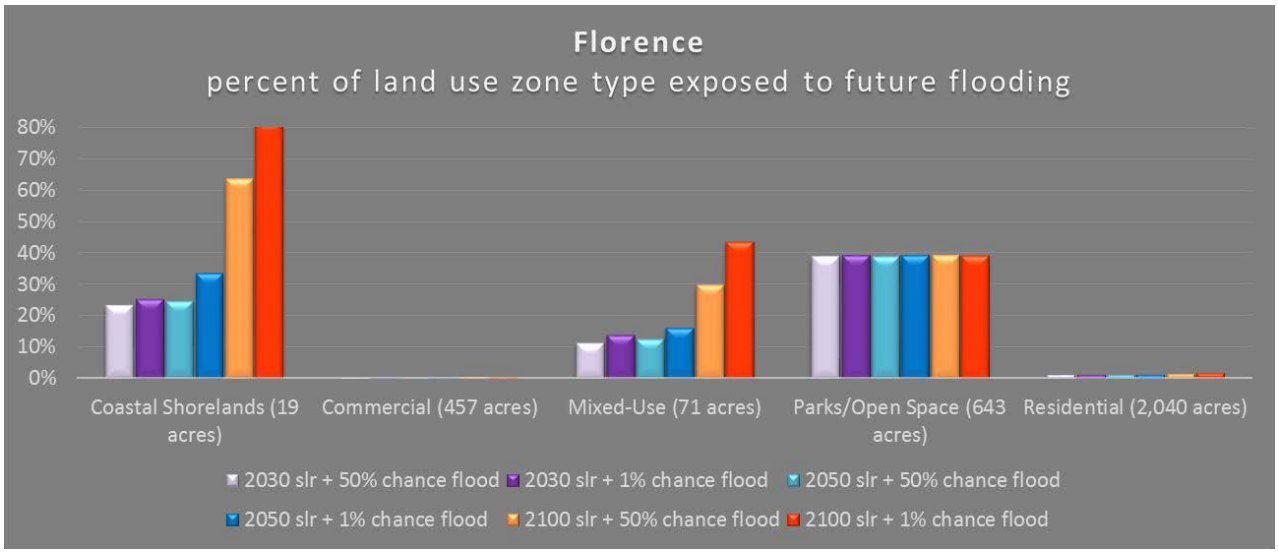

Figure 99. City of Florence percent of land use zone type exposed to future flooding

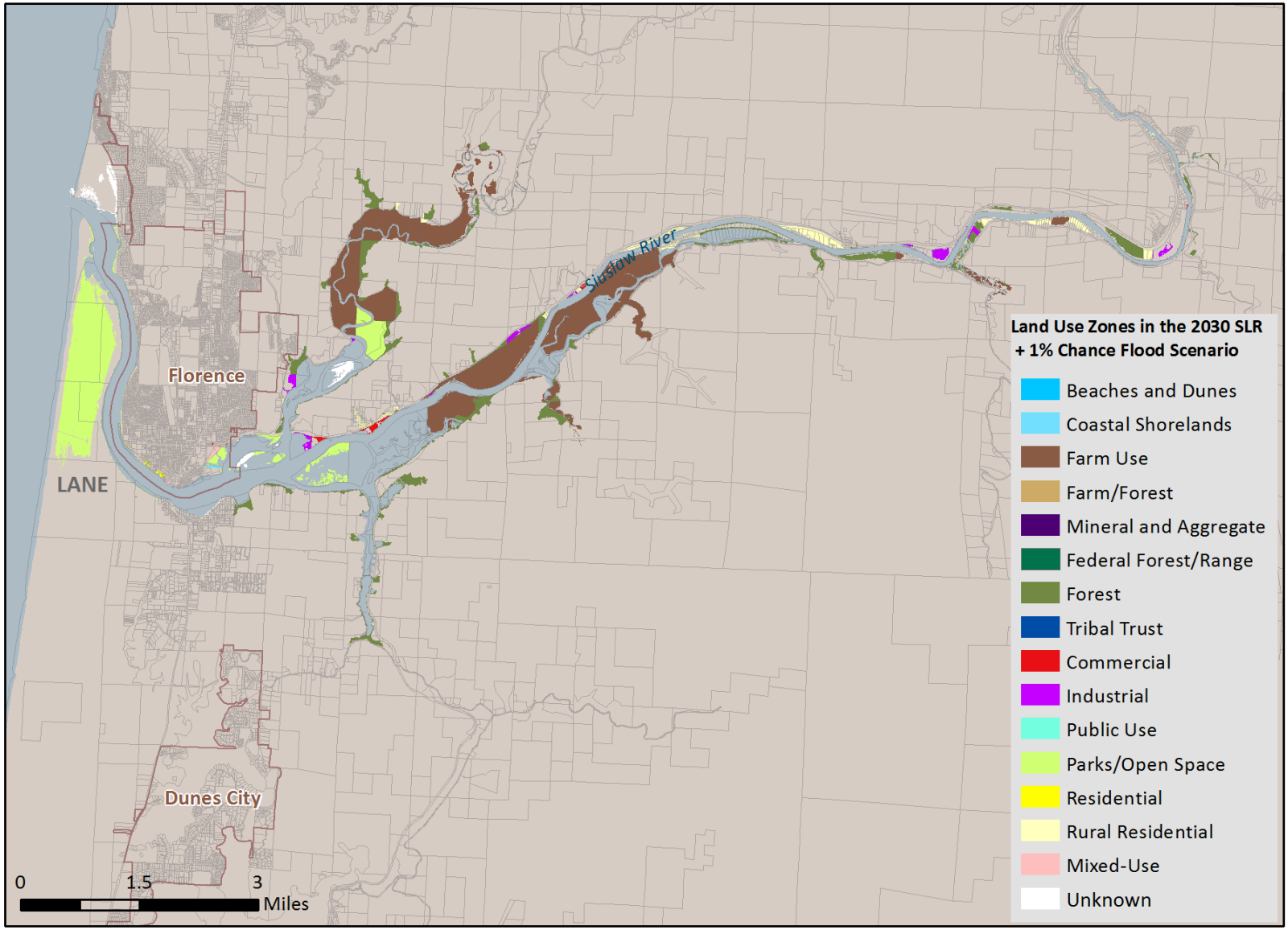

Figure 100. Land Use Zones within the Siuslaw River 2030 SLR + 1% chance flood scenario

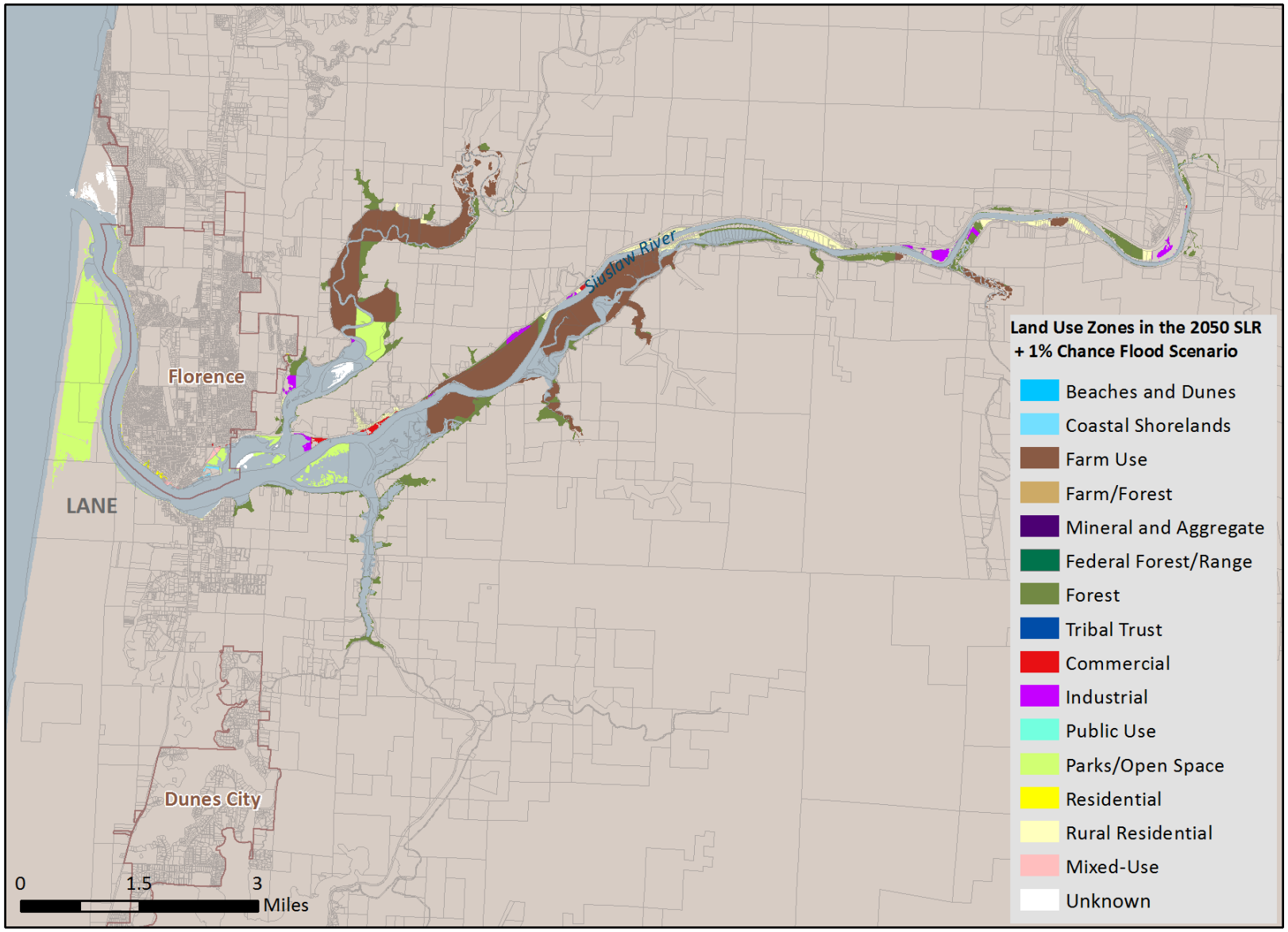

Figure 101. Land Use Zones within the Siuslaw River 2050 SLR + 1% chance flood scenario

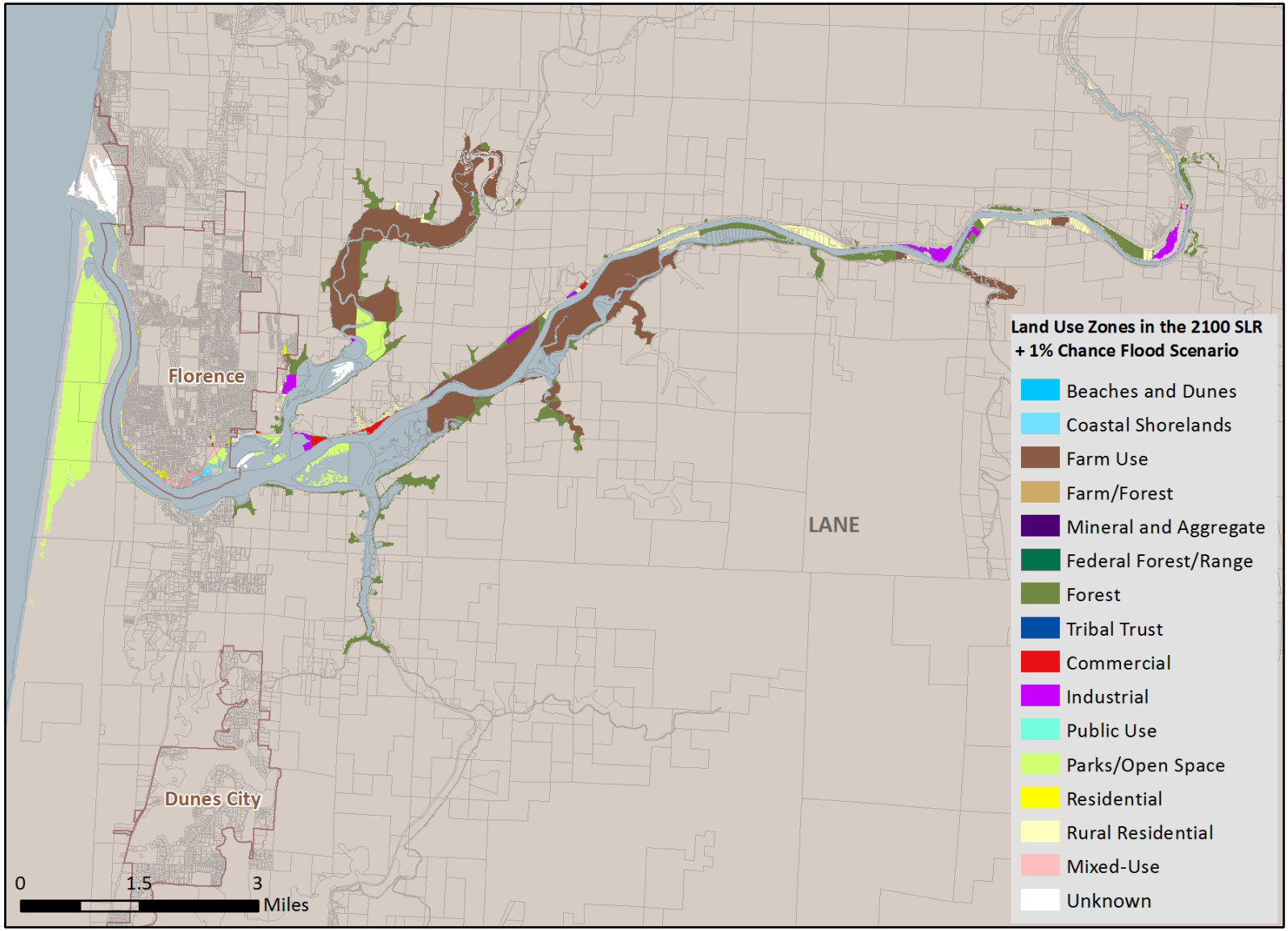

Figure 102. Land Use Zones within the Siuslaw River 2100 SLR + 1% chance flood scenario

Umpqua River Estuary

This section presents the results of the exposure inventory by asset in the Umpqua River system. It's important to note that the City of Reedsport has a levee system that is not incorporated into the flooding model. Assets within the levee system (green cross-hatch in Figure 107) will likely be protected as long as the levee is maintained. But since they are at an elevation lower than the modeled water level they are included in the inventory. The results confirm how important flood protection is to the City of Reedsport; without this protection flood event impacts would be severe.

State Highways

A number of state highways are inundated under the six future flooding scenarios, Figure 103 provides the total number of miles impacted and Table 16 provides a breakdown of impacted miles per highway.

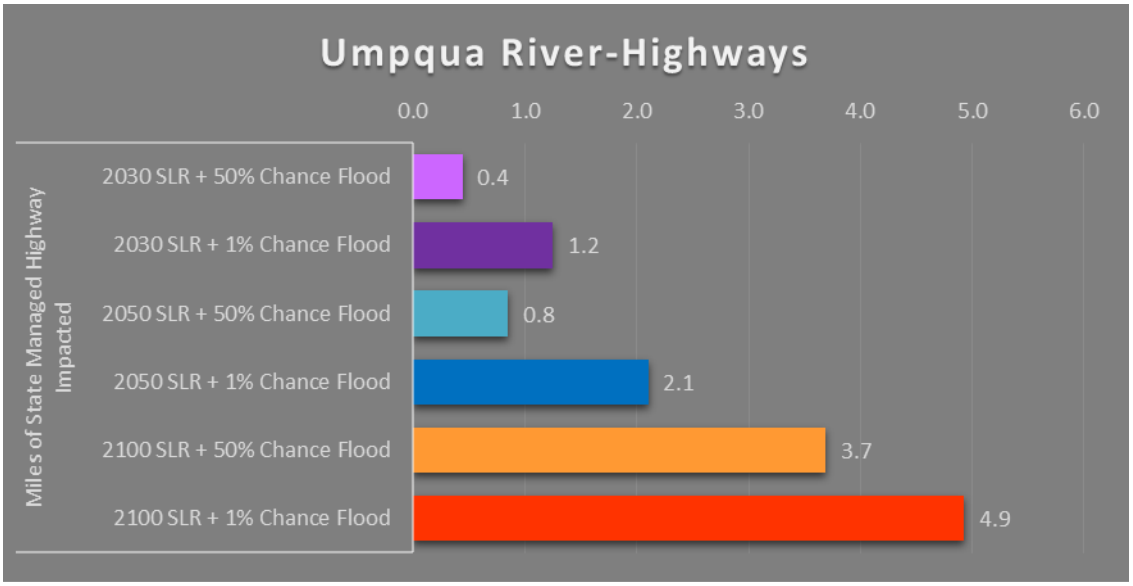

Figure 103. Miles of State Managed Highway Impacted in the Umpqua River Future Flooding Scenarios

Table 16 Impacted miles per highway

	2030 SLR + 50% Chance Flood	2030 SLR + 1% Chance Flood	2050 SLR + 50% Chance Flood	2050 SLR + 1% Chance Flood	2100 SLR + 50% Chance Flood	2100 SLR + 1% Chance Flood
Oregon Coast Hwy (US-101)	0.28	0.75	0.52	1.49	2.63	2.94
Oregon Coast Hwy Conn. Hwy	0.12	0.02	0.26	0.03	0.05	0.06
Umpqua Hwy (OR-38)	0.04	0.41	0.06	0.50	0.93	1.84
Umpqua Hwy. Conn. Hwy	-	0.07	-	0.08	0.08	0.08

Roads

In addition to the highways impacted, county and local roads also may see flooding under the six flood scenarios. Figure 104 displays the total number of state, county, and local road miles impacted per scenario.

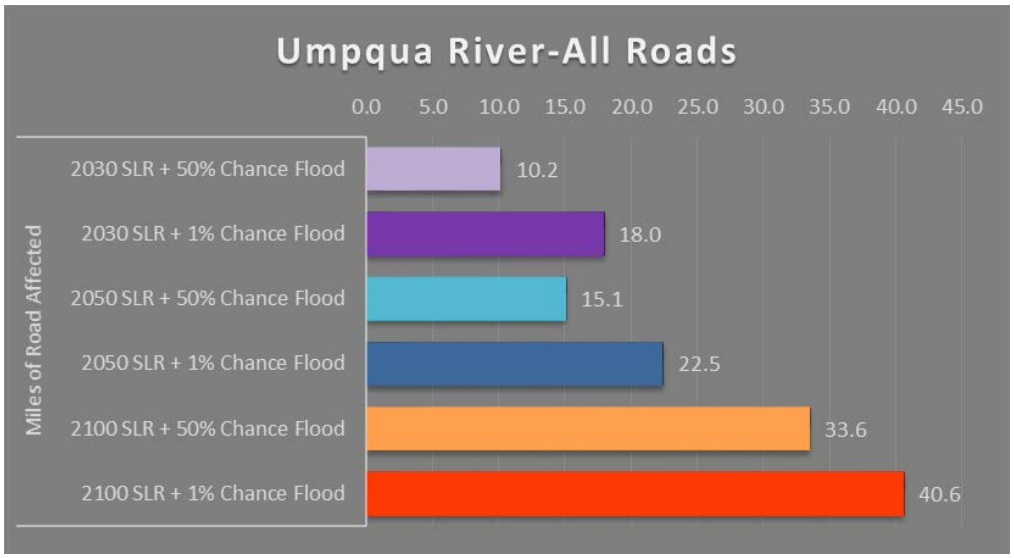

Figure 104. Miles of Road Impacted in the Umpqua River Future Flooding Scenarios

Airports

There are no airports that are within the future flood scenarios.

Railway

A portion of the Coos Bay Rail Link, and the Longview, Portland, and Northern Railway from Gardiner to East Gardiner is impacted in each of the flooding scenarios. Figure 105 displays the number of miles impacted under each scenario.

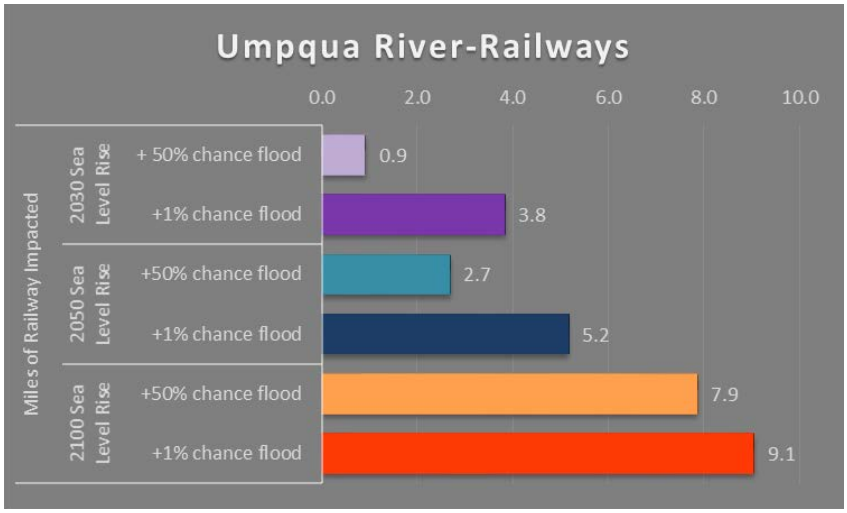

Figure 105. Miles of Railway Impacted in the Umpqua River Future Flooding Scenarios

Critical Facilities

Table 17 provides the number of critical facilities exposed under the six future flooding scenarios.

Table 17

Type of Critical Facility	2030 SLR + 50% Chance Flood	2030 SLR + 1% Chance Flood	2050 SLR + 50% Chance Flood	2050 SLR + 1% Chance Flood	2100 SLR + 50% Chance Flood	2100 SLR + 1% Chance Flood
Fire Station • Reedsport FD Station 1, Gardiner RFPD	0	1	1	1	2	2
Police Station/ Sheriff's Office • Douglas County Sheriff's Office, Reedsport Police Department	0	1	1	2	2	2
School	0	0	0	0	0	0
Hospital	0	0	0	0	0	0
City Hall	0	0	0	0	0	0
Total	**0**	**2**	**2**	**3**	**4**	**4**

Municipal Use Drinking Water

There are no municipal drinking water sources that are within the future flood scenarios.

Wastewater Treatment Plant

The Reedsport Sewage Treatment Plant is within the both of the 2100 future flood scenarios. The Winchester Bay Sewage Treatment Plant is within the 2100 SLR + 1% chance flood scenario.

Electric Substation

There is a Bonneville Power Administration owned substation within both of the 2100 flooding scenarios.

Potential Contaminant Sources

There are a couple of large contaminant sources in the scenario areas for the Umpqua River; one solid waste facility in the 2050 SLR + 1% chance flood and the 2100 SLR + 50% chance flood, and two solid waste facilities in the 2100 SLR + 1% chance flood area.

Buildings

The number of buildings impacted under each scenario is shown in Figure 106. Buildings impacted are primarily in Reedsport, and likely have reduced risk due to the levee system.

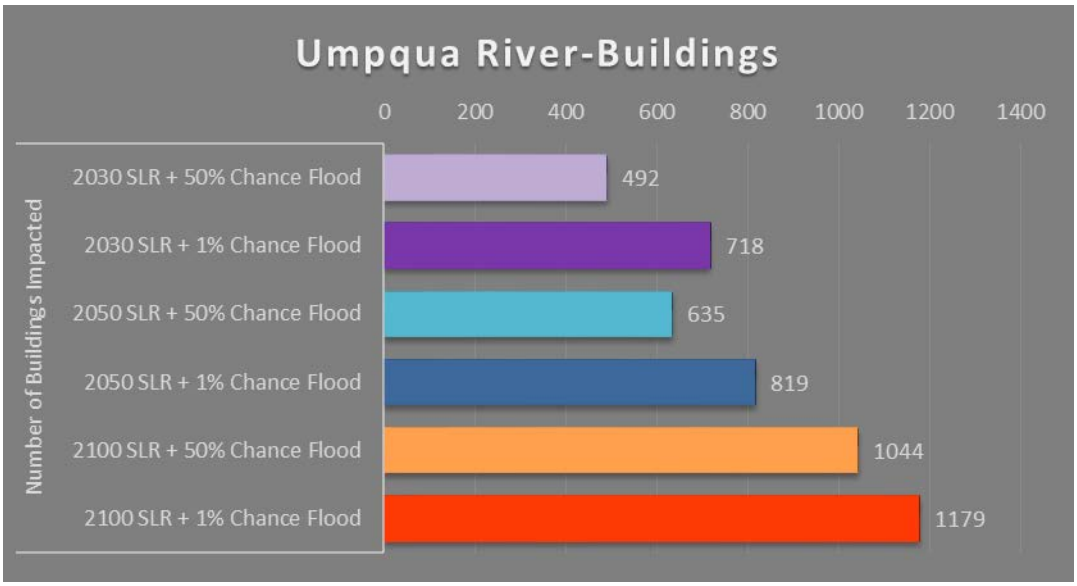

Figure 106. Number of Building Exposed to the Future Flooding Scenarios in the Umpqua River System

Overview Map

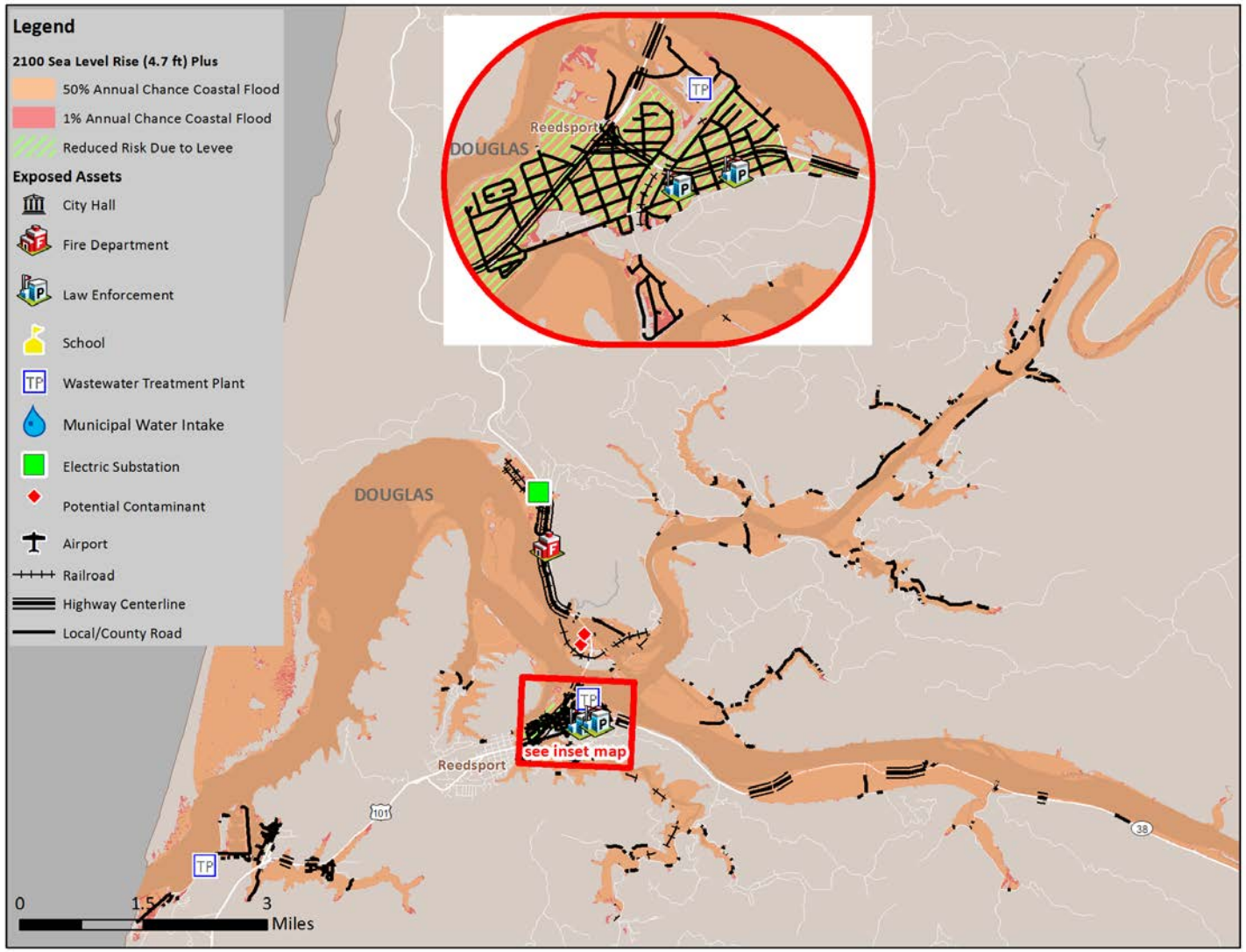

Figure 107. Siuslaw River 2100 Flood Scenarios and Assets Map (for the 2030 and 2050 scenario maps, please visit http://coastalatlas.net/sealevelriseviewer/)

Land Use Zones

The land use zones within each future flooding scenarios are provided as a percentage of the zoning type within a jurisdiction. Parks/Open Space may be considered an appropriate use for land that is subject to flooding, whereas residential may not be. A community can use these results to identify areas for improvements in their zoning. The results for Douglas County are provided in Figure 109, and the City of Reedsport are provided in Figure 108. Maps of the results are shown in Figures 110, 111, and 112.

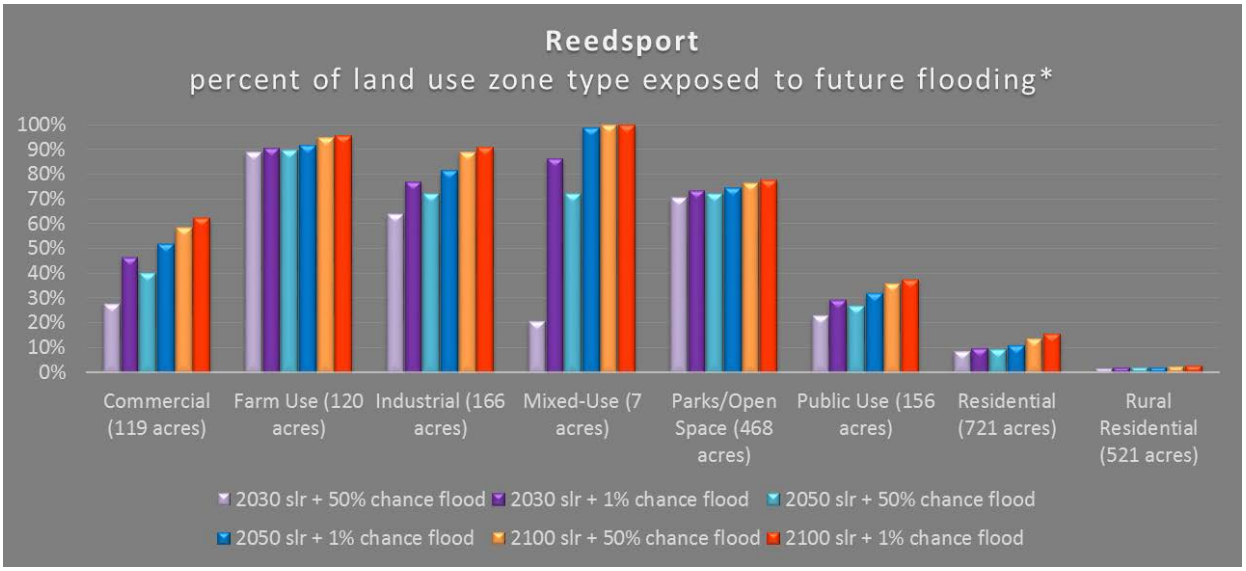

Figure 108. City of Reedsport percent of land use zone types exposed to future flooding

**does not incorporate reduced risk due to levee protection*

For the scenario areas in Douglas County surrounding the Umpqua, appropriately, areas zoned as coastal shorelands and parks/open spaces are impacted. There are also commercial, federal forest/range, industrial, mixed-use, public use, and residential zones within the future flooding scenarios.

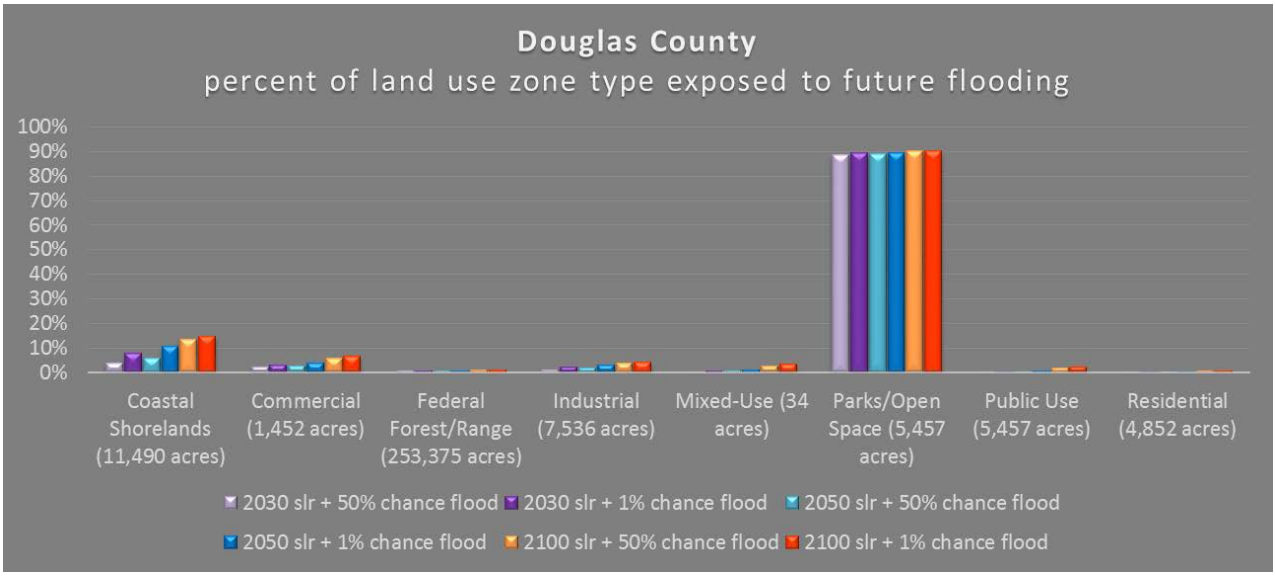

Figure 109. Douglas County percent of land use zone type exposed to future flooding

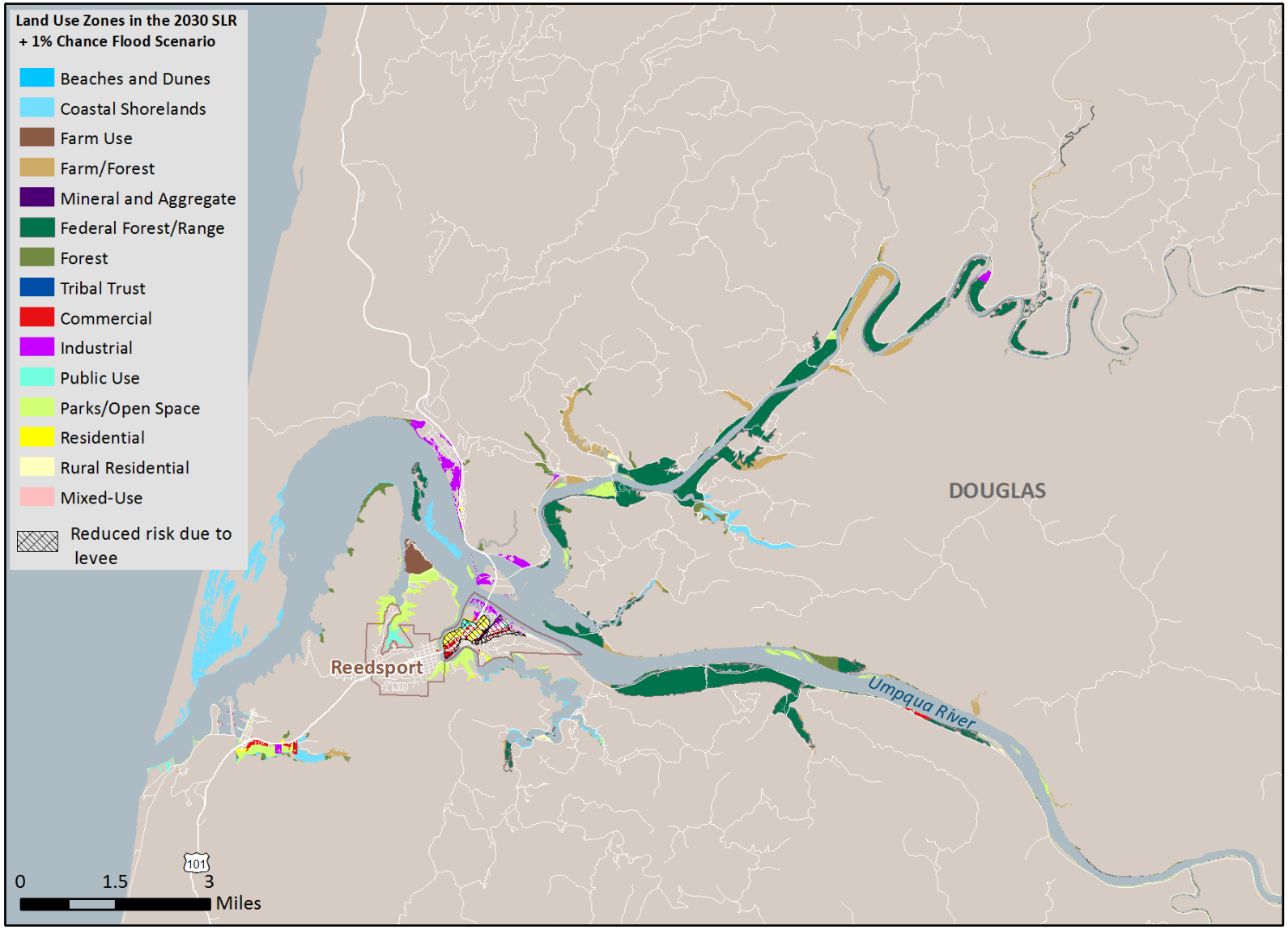

Figure 110. Land Use Zones within the Umpqua River 2030 SLR + 1% chance flood scenario

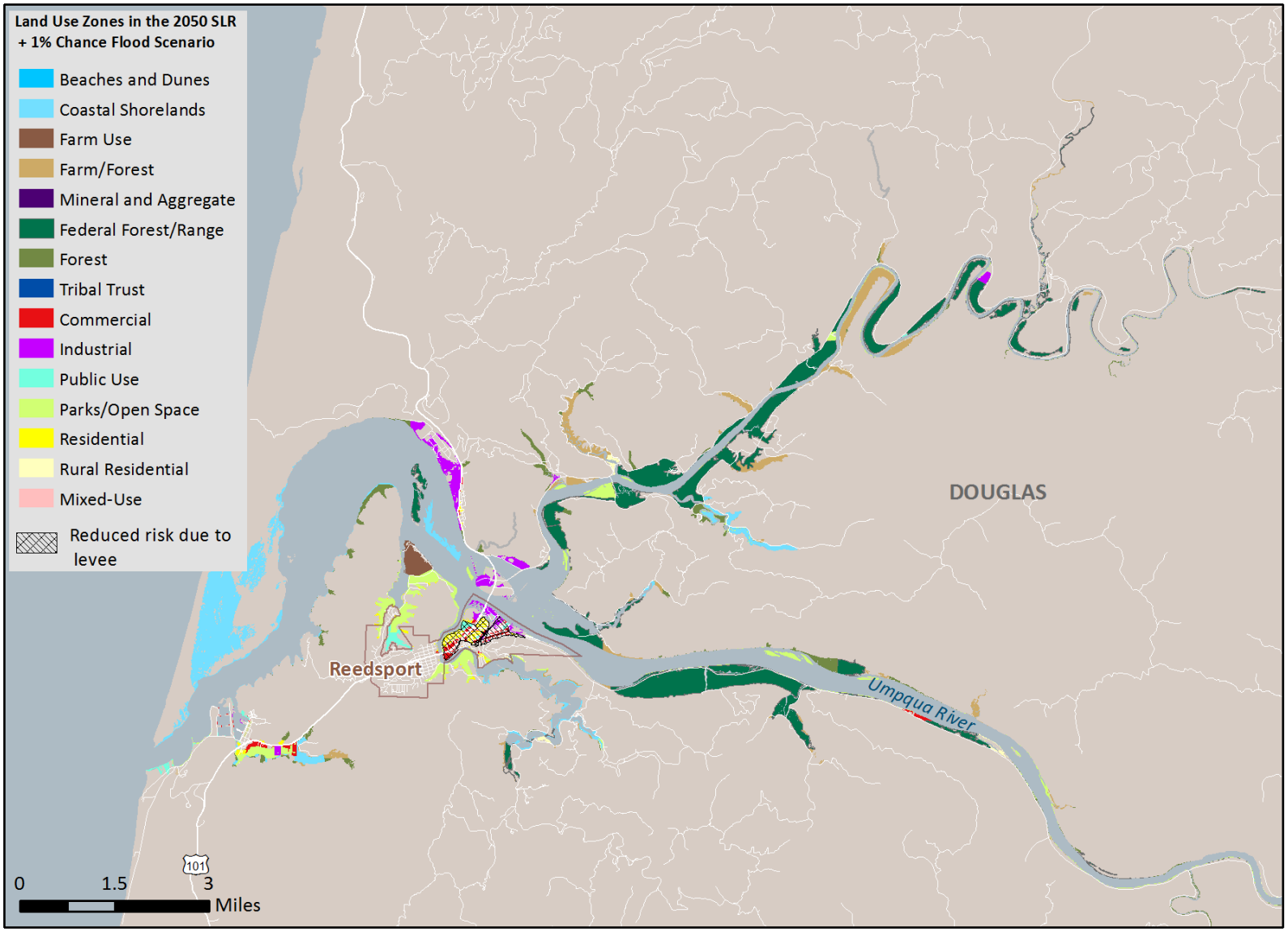

Figure 111. Land Use Zones within the Umpqua River 2050 SLR + 1% chance flood scenario

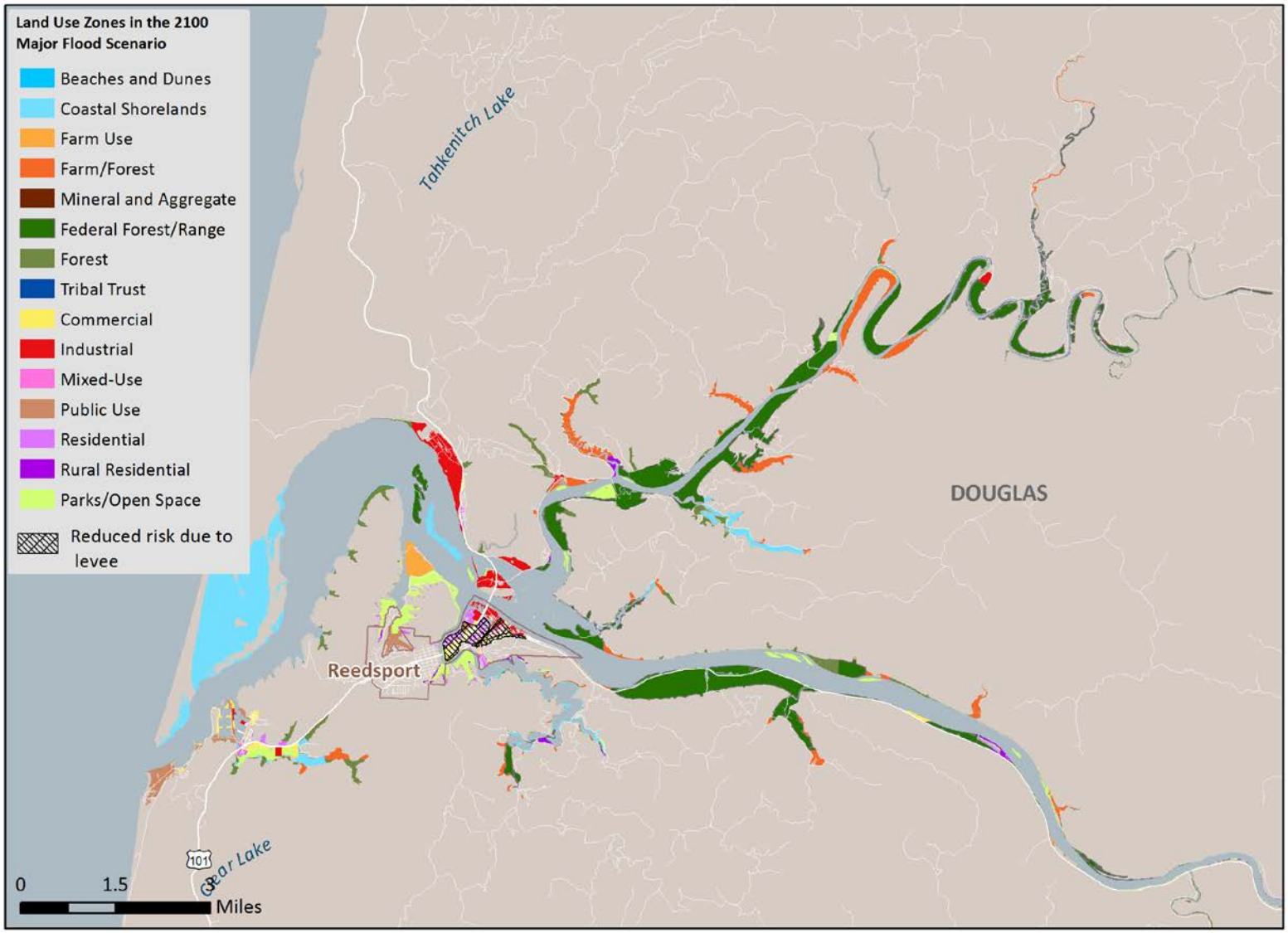

Figure 112. Land Use Zones within the Umpqua River 2100 SLR + 1% chance flood scenario

Coos Bay Estuary

This section presents the results of the exposure inventory by asset in the Coos Bay system. Coos Bay is a large system with an expansive floodplain. The shorelands of Coos Bay see the most impact of all of the estuaries from sea-level rise in the near-term. Highways, local roads, railways, and critical infrastructure across the system will experience increased flood events with the City of Coos Bay being particularly vulnerable.

State Highways

A number of state highways are inundated under the six future flood scenarios, Figure 113 provides the total number of miles impacted and Table 18 provides a breakdown of impacted miles per highway.

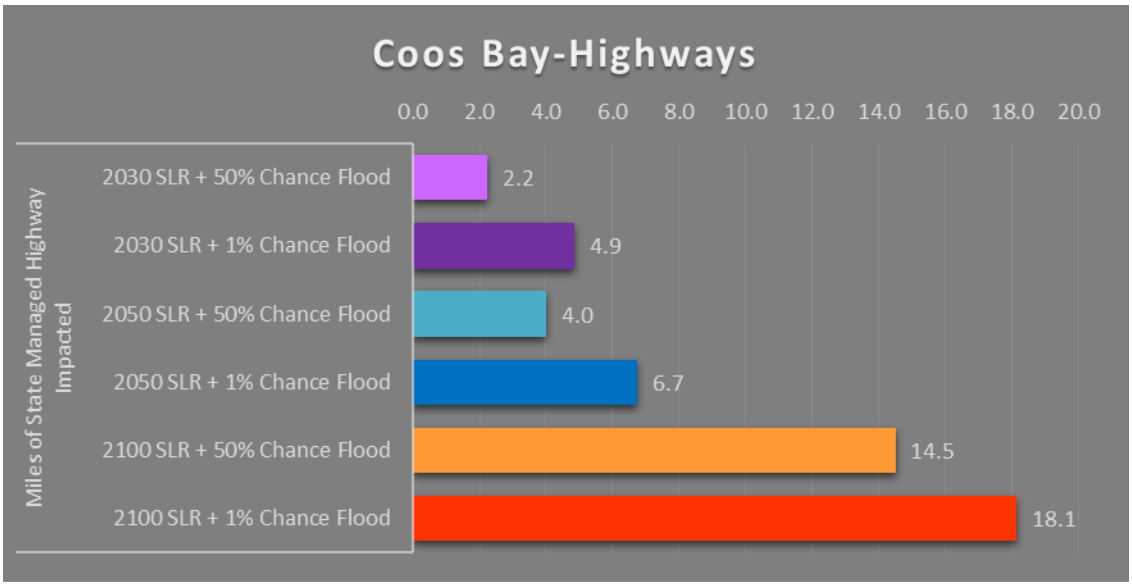

Figure 113 Miles of State Managed Highway Impacted in the Coos Bay Future Flooding Scenarios

Table 18 Impacted miles per highway

	2030 SLR + 50% Chance Flood	2030 SLR + 1% Chance Flood	2050 SLR + 50% Chance Flood	2050 SLR + 1% Chance Flood	2100 SLR + 50% Chance Flood	2100 SLR + 1% Chance Flood
Cape Arago Hwy (OR-540)	0.03	0.13	0.07	0.22	0.42	0.53
Coos Bay-Roseburg Hwy (OR-42)	0.05	0.43	0.27	0.76	2.23	2.77
Coos Bay-Roseburg Hwy Conn	-	-	-	0.07	0.21	0.21
Coos River Hwy (OR-241)	0.20	0.71	0.60	1.18	3.00	3.76
Millington Frontage Rd. Hwy	0.29	0.37	0.34	0.46	0.54	0.60
Oregon Coast Hwy (US-101)	1.67	3.22	2.73	4.05	8.13	10.28

Roads

In addition to the highways impacted, county and local roads also may see flooding under the six flood scenarios. Figure 114 displays the total number of state, county, and local road miles impacted per scenario.

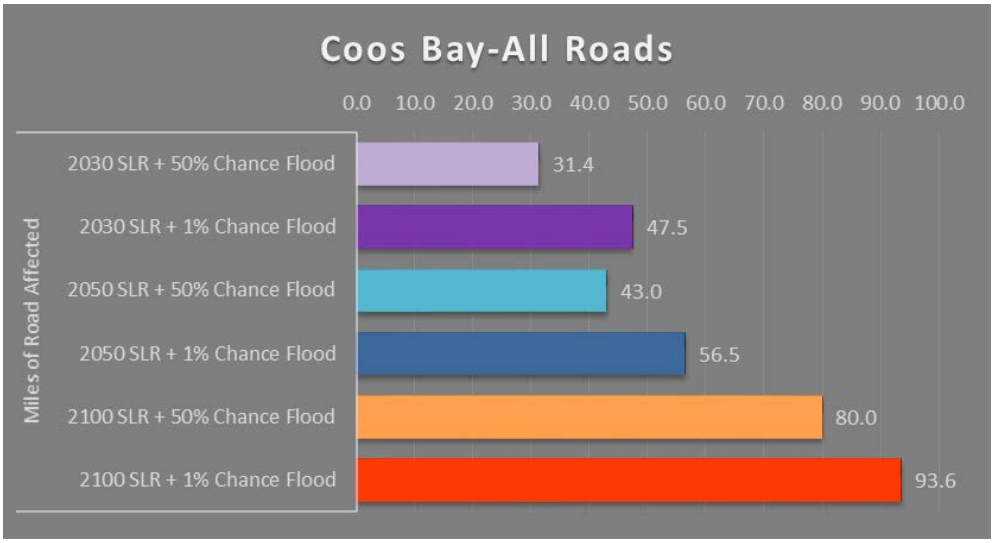

Figure 114 Miles of Road Impacted in the Coos Bay Future Flooding Scenarios

Airports

The Southwest Oregon Regional Airport (FAA code OTH) runways partially flood in the 2050 major flood scenario and almost completely flood in the 2100 moderate and major flood scenarios.

Railway

A number of railroad miles of the Coos Bay Rail Link are impacted along the Coos River and Isthmus Slough in the City of Coos Bay for each of the flooding scenarios. Figure 115 displays the number of miles impacted under each scenario.

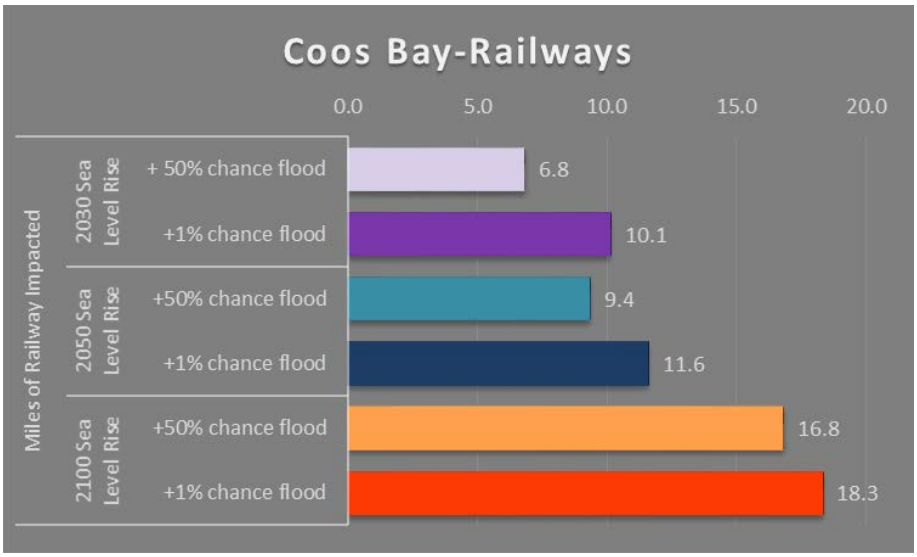

Figure 115 Miles of Railway Impacted in the Coos Bay Future Flooding Scenarios

Critical Facilities

Table 19 provides the number of critical facilities exposed under the six future flooding scenarios. The hospital and city hall are not within any of the six future flooding scenarios.Table 19

Type of Critical Facility	2030 SLR + 50% Chance Flood	2030 SLR + 1% Chance Flood	2050 SLR + 50% Chance Flood	2050 SLR + 1% Chance Flood	2100 SLR + 50% Chance Flood	2100 SLR + 1% Chance Flood
Fire Station • **Millington RFD #5, Coos Bay Fire Station-Central, Charleston RFPD**	2	2	2	3	3	3
Police Station/Sheriff's Office • **Coos Bay Police Department**	0	1	0	1	1	1
School • **Blossom Gulch Elementary School, Oregon Institute of Marine Biology**	0	1	1	1	1	2
Hospital	0	0	0	0	0	0
City Hall	0	0	0	0	0	0
Total	**2**	**4**	**3**	**5**	**5**	**6**

Municipal Use Drinking Water

Coos Bay-North Bend Water Board has a municipal use water right for the Joey Slough Reservoir which is within all six future flooding areas.

Wastewater Treatment Plant

The Coos Bay Sewage Treatment Plant No. 1 and No. 2 (Empire) are within the 2050 SLR + 1% chance flood scenario, and both of the 2100 future flood scenarios.

Electric Substation

There are no substations within the six future flooding scenarios.

Potential Contaminant Sources

The large contaminant sources in the scenario areas for Coos Bay are all solid waste facilities, 2 in the 2030 SLR + 50% chance flood; 3 in the 2030 SLR + 1% chance flood; 2 in the 2050 SLR + 50% chance flood; 3 in the 2050 SLR + 1% chance flood; 4 in the 2100 SLR + 50% chance flood; and 4 in the 2100 SLR + 1% chance flood.

Buildings

The number of buildings impacted under each scenario is shown in Figure 116. Impacted buildings are distributed across the developed areas of the Coos Bay shoreland including Charleston, North Bend, and Coos Bay.

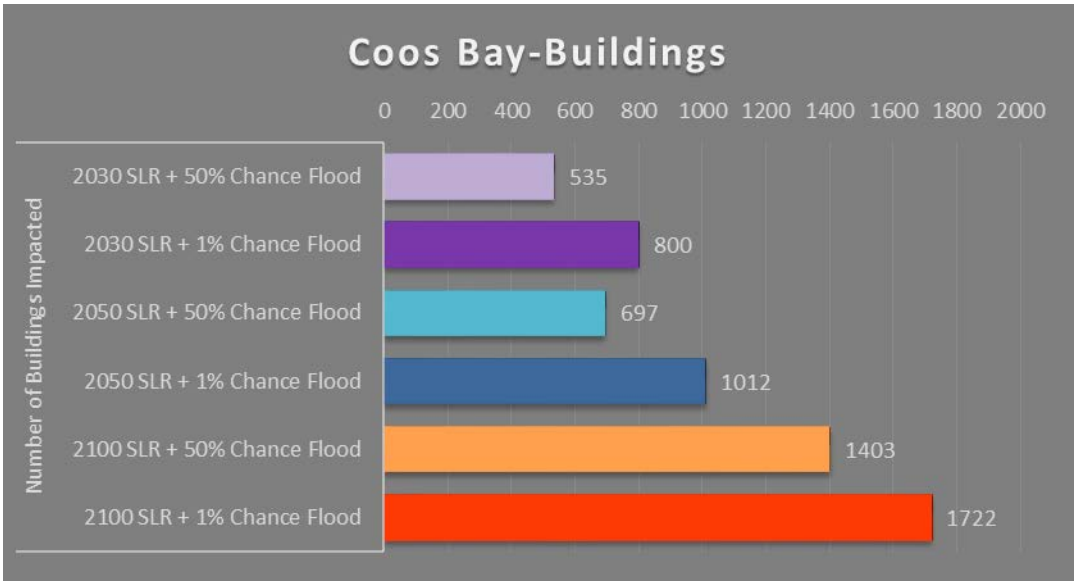

Figure 116. Number of Buildings Exposed to the Future Flooding Scenarios in the Coos Bay System

Overview Map

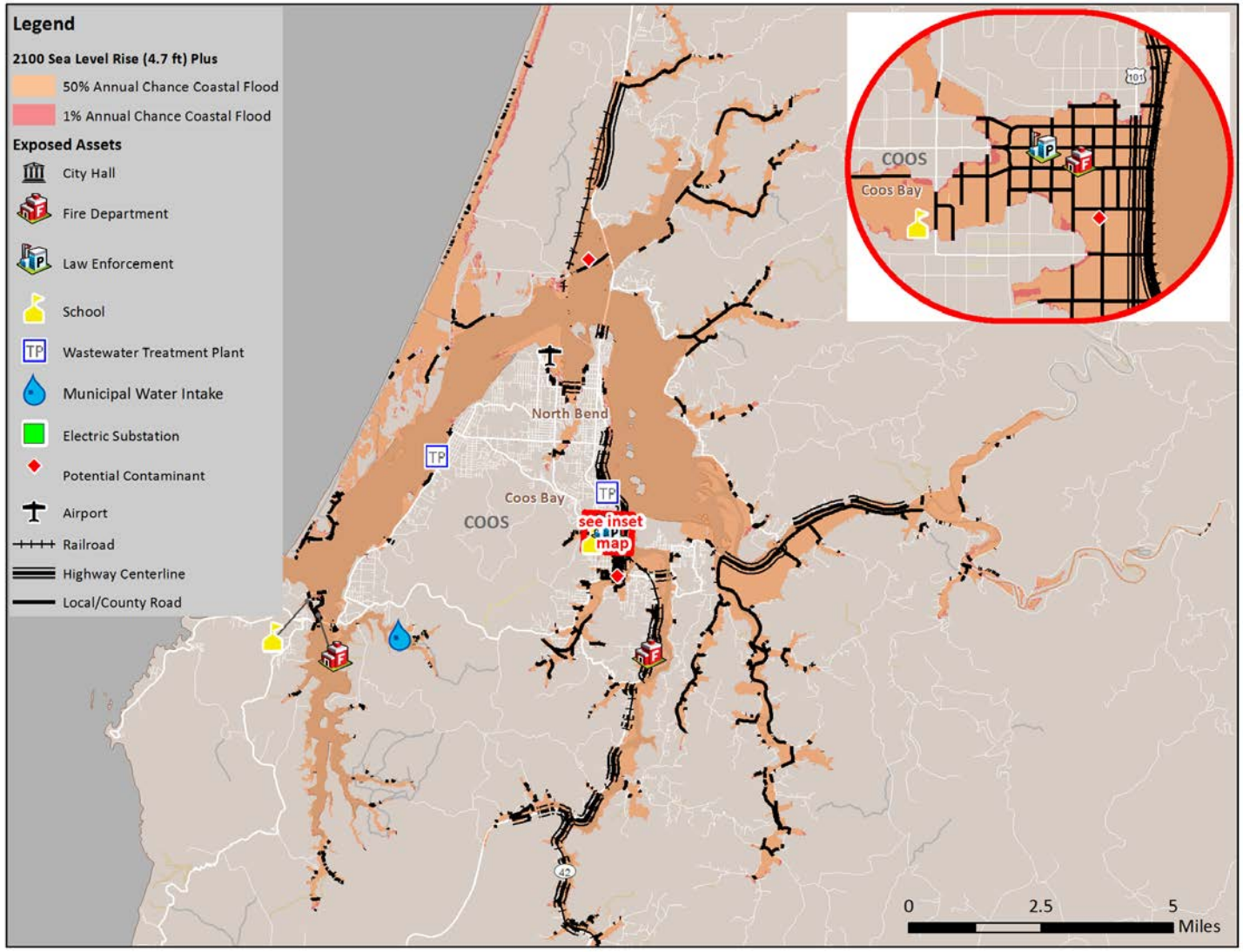

Figure 117. Coos Bay 2100 Flood Scenarios and Assets Map (for the 2030 and 2050 scenario maps, please visit http://coastalatlas.net/sealevelriseviewer/)

Land Use Zones

The land use zones within each future flooding scenarios are provided as a percentage of the zoning type within a jurisdiction. Parks/Open Space may be considered an appropriate use for land that is subject to flooding, whereas residential may not be. A community can use these results to identify areas for improvements in their zoning. The results for Coos County are provided in Figure 118, the City of North Bend are provided in Figure 119, and the City of Coos Bay in Figure 120. Maps of the results are shown in Figures 121, 122, and 123.

Small percentages of the commercial, farm use, industrial, parks/open space, and rural residential zones in Coos County are within the Coos Bay system future flooding scenarios.

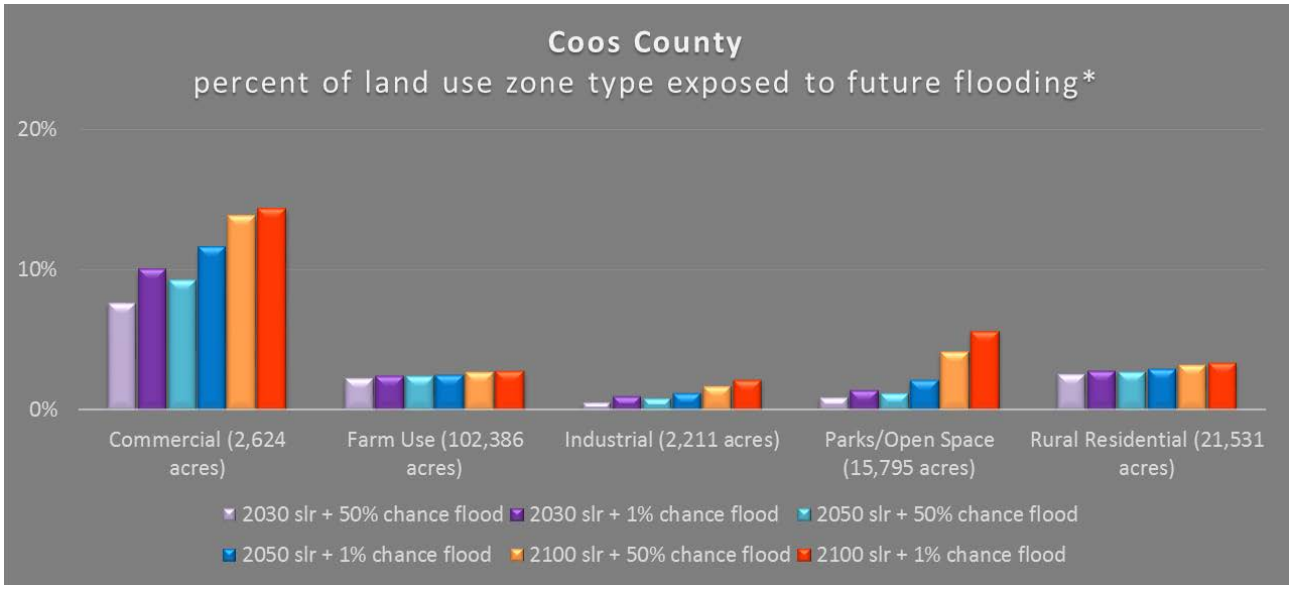

Figure 118. Coos County percent of land use zone types exposed to future flooding

**Only includes flooding from the Coos Bay system. Percent of land use zone types flooded from the other estuaries in Coos County are presented separately.*

North Bend may see the greatest impacts to its industrial zoned land, followed by commercial zoned land and residential zoned land.

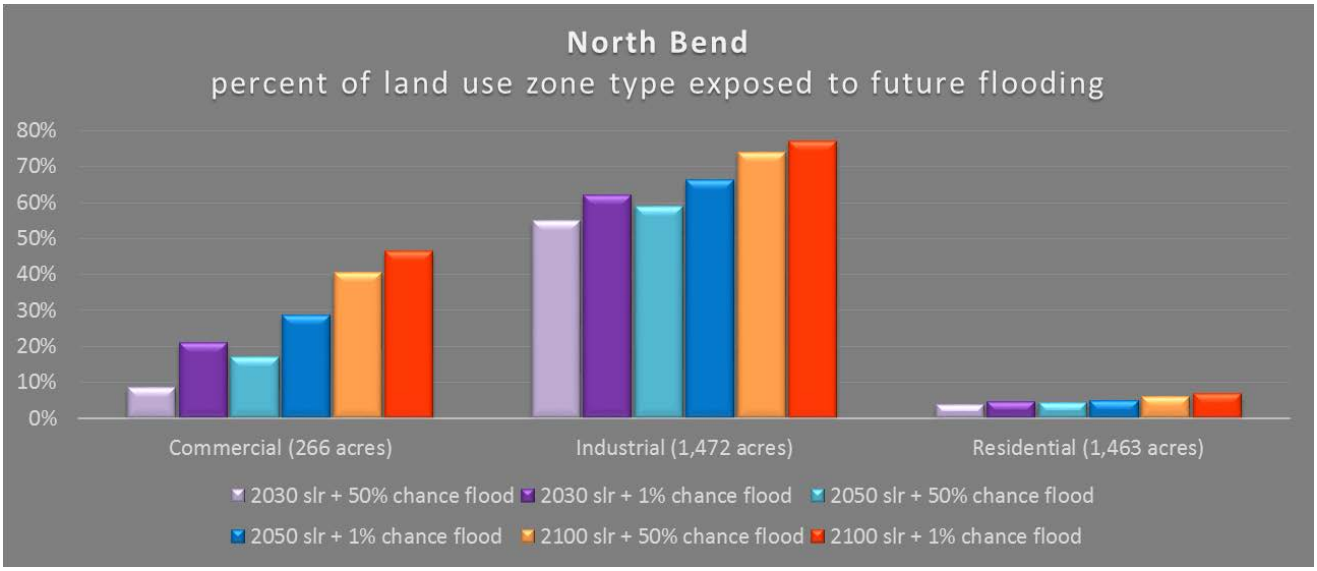

Figure 119. North Bend percent of land use zone type exposed to future flooding

North Bend may see the greatest impacts to its industrial zoned land, but impacts occur also to reservation/tribal trust, commercial, mixed-use, park/open space, and residential zoned land.

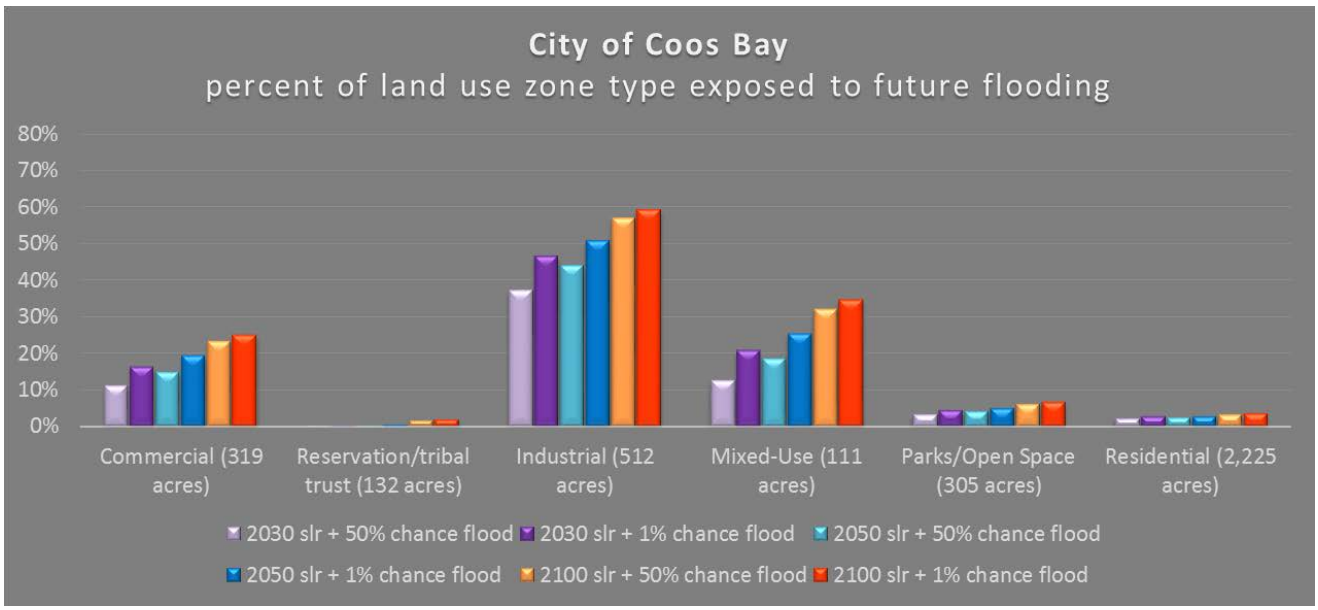

Figure 120. City of Coos Bay percent of land use zone type exposed to future flooding

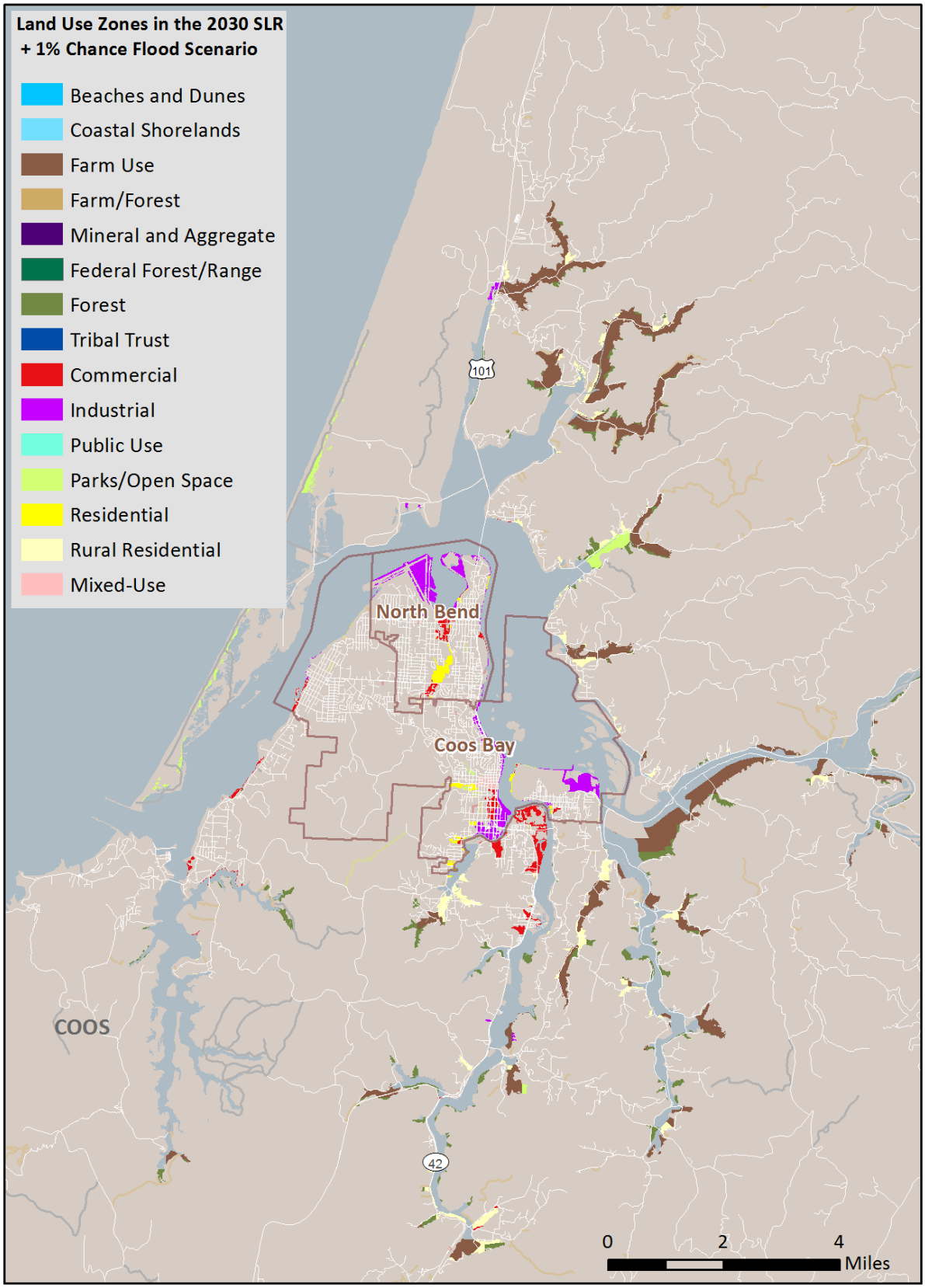

Figure 121. Land Use Zones within the Coos Bay 2030 SLR + 1% chance flood scenario

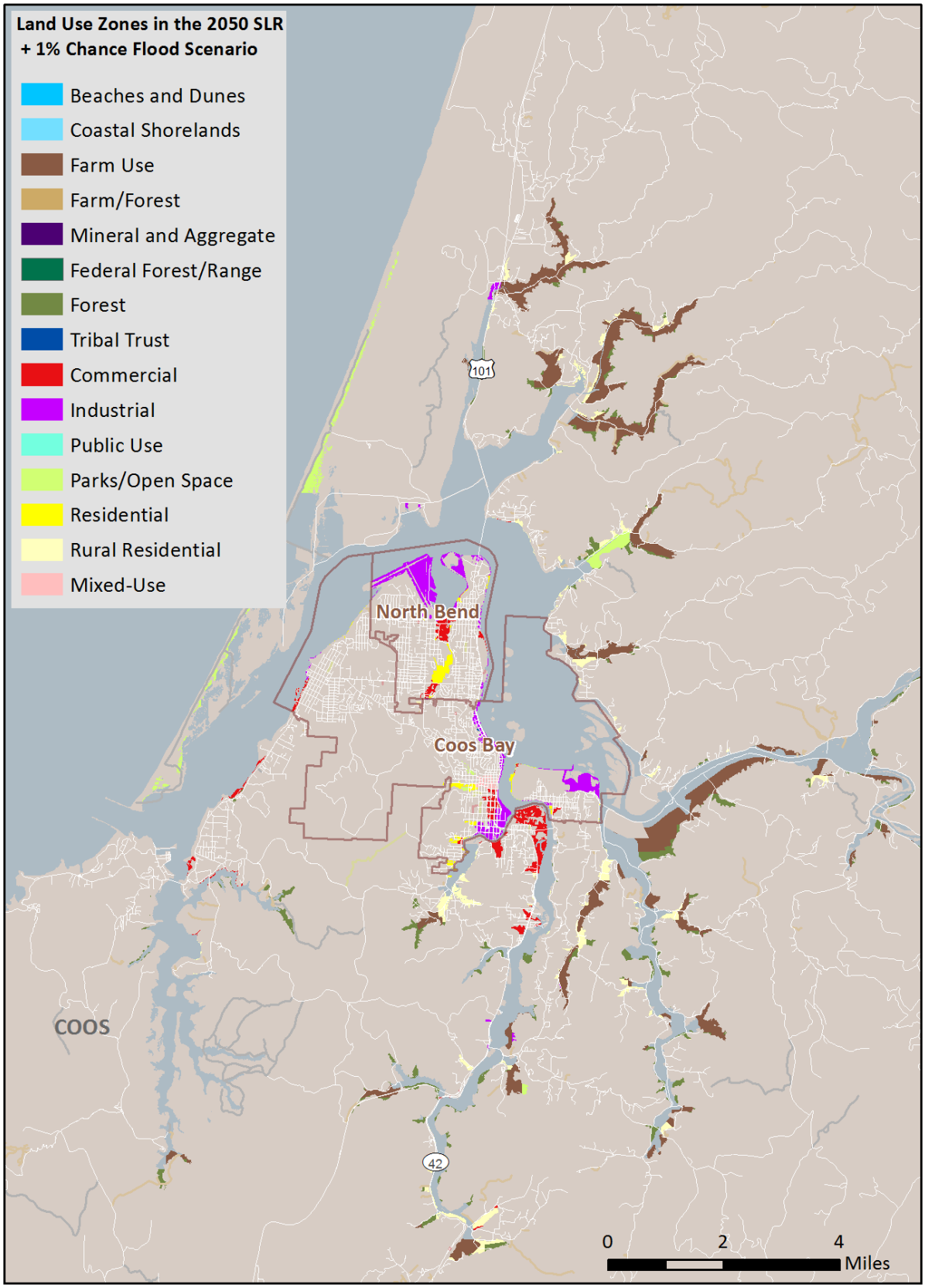

Figure 122. Land Use Zones within the Coos Bay 2050 SLR + 1% chance flood scenario

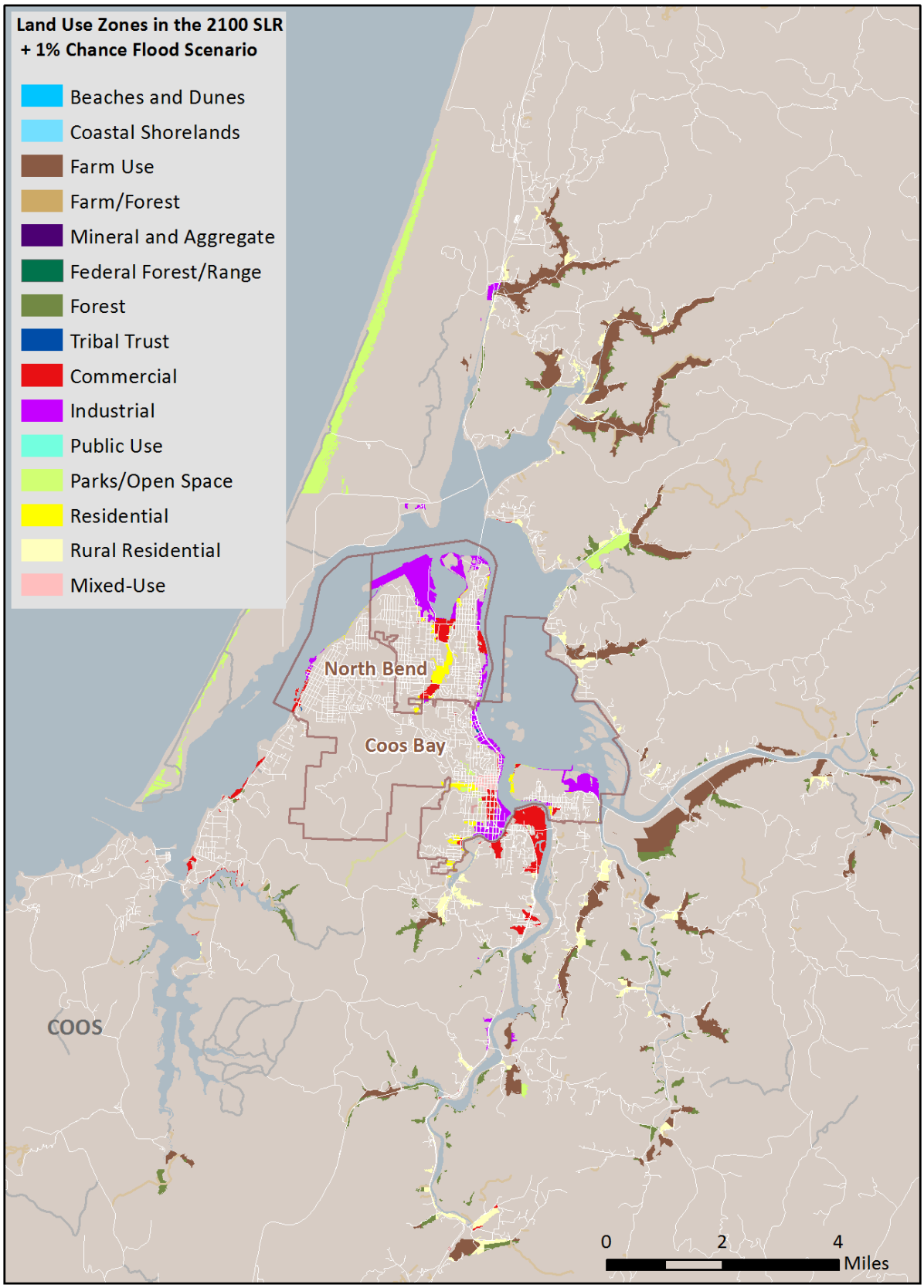

Figure 123. Land Use Zones within the Coos Bay 2100 SLR + 1% chance flood scenario

Coquille River Estuary

This section presents the results of the exposure inventory by asset in the Coquille River system. The Coquille estuary is a large system with an expansive floodplain primarily consisting of agricultural lands. Sea-level rise impacts to development occur in the long-term to the City of Bandon's old town.

State Highways

A number of state highways are inundated under the six future flooding scenarios, Figure 124 provides the total number of miles impacted and Table 20 provides a breakdown of impacted miles per highway.

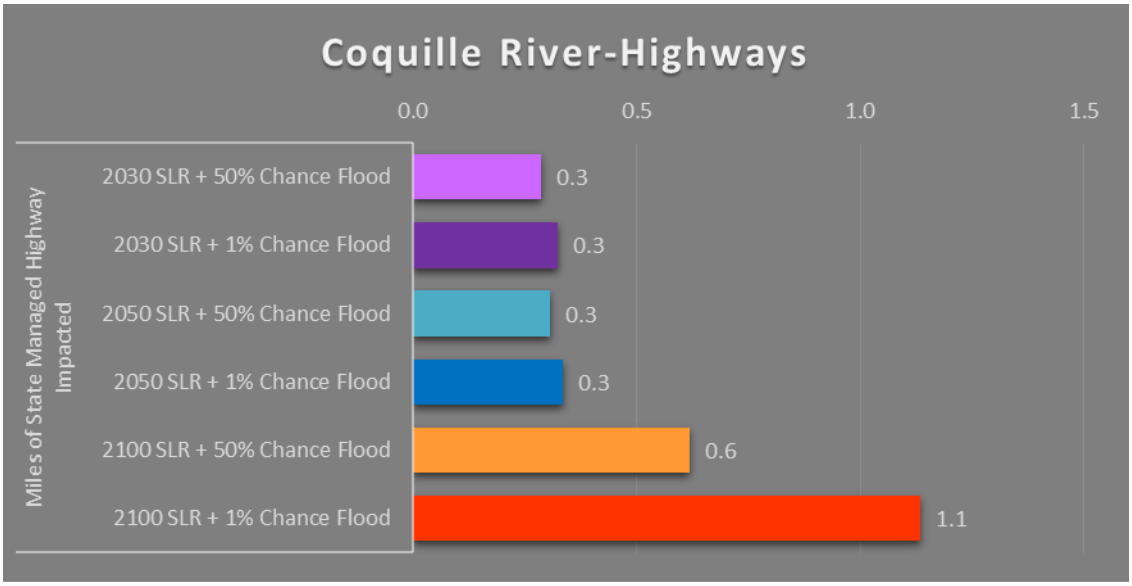

Figure 124. Miles of State Managed Highway Impacted in the Coquille River Future Flooding Scenarios

Table 20 Impacted miles per highway

	2030 SLR + 50% Chance Flood	2030 SLR + 1% Chance Flood	2050 SLR + 50% Chance Flood	2050 SLR + 1% Chance Flood	2100 SLR + 50% Chance Flood	2100 SLR + 1% Chance Flood
Coos Bay-Roseburg Hwy (OR-42)	0.13	0.15	0.14	0.16	0.16	0.17
Coquille-Bandon Hwy (OR-42S)	0.14	0.16	0.15	0.17	0.24	0.72
Oregon Coast Hwy (US-101)	0.01	0.01	0.01	0.01	0.22	0.25

Roads

In addition to the highways impacted, county and local roads also may see flooding under the six flood scenarios. Figure 125 displays the total number of state, county, and local road miles impacted per scenario.

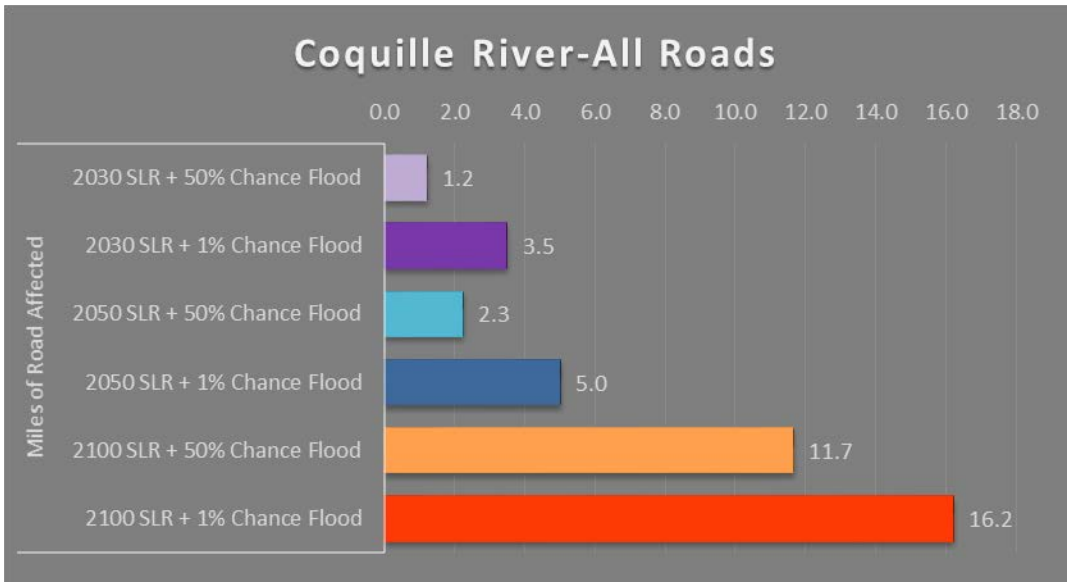

Figure 125. Miles of Road Impacted in the Coquille River Future Flooding Scenarios

Airports

There are no airports that are within the future flood scenarios.

Railway

A portion of the Coos Bay Rail Link is impacted in each of the flooding scenarios, but primarily in the highest scenario. Figure 126 displays the number of miles impacted under each scenario.

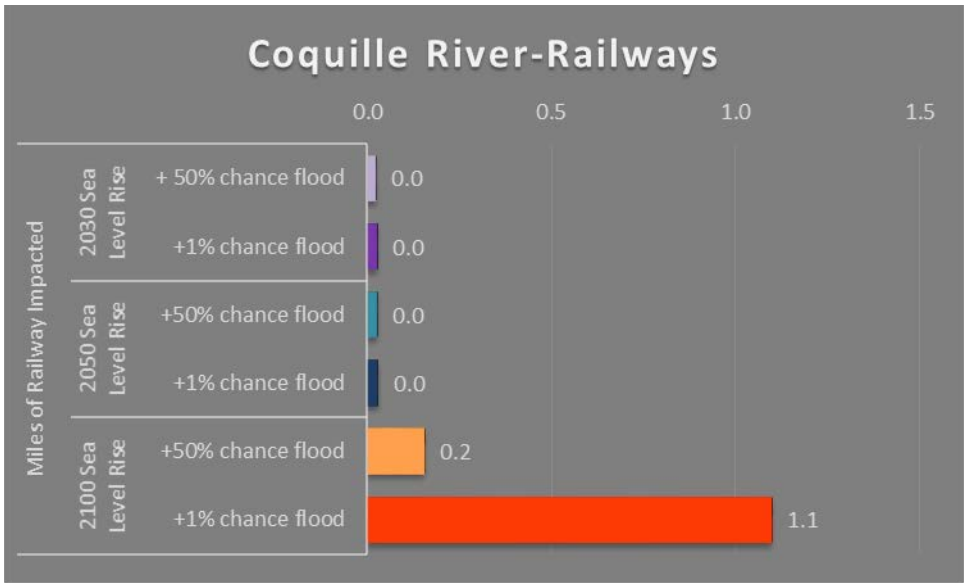

Figure 126. Miles of Railway Impacted in the Coquille River Future Flooding Scenarios

Critical Facilities

There are no fire stations, police stations, sheriff's offices, schools, hospitals, or city halls in the future flood scenarios within the Coquille River system.

Municipal Use Drinking Water

The City of Coquille has rights for a point of diversion on the Coquille River within all six of the future flooding scenarios.

Wastewater Treatment Plant

There are no wastewater treatment plants that are within the future flood scenarios.

Electric Substations

There are no substations within the six future flooding scenarios.

Potential Contaminant Sources

There are a few large contaminant sources in the scenario areas for Coquille River (Table 21); 1 in the 2030 and 2050 flooding scenarios, and 3 in the 2100 flooding scenarios.

Table 21

Potential Contaminant Sources	2030 SLR + 50% Chance Flood	2030 SLR + 1% Chance Flood	2050 SLR + 50% Chance Flood	2050 SLR + 1% Chance Flood	2100 SLR + 50% Chance Flood	2100 SLR + 1% Chance Flood
Confined Animal Feeding Operations (CAFOs)	-	-	-	-	-	1
Surface water on 303d list	1	1	1	1	1	1
Wood/Pulp/ Paper Processing and Mills	-	-	-	-	-	1

Buildings

The number of buildings impacted under each scenario is shown in Figure 127. In the near-term scenarios impacts are primarily to buildings along the river upstream from Bandon. Buildings in Bandon see a jump in impacts in the 2100 flooding scenarios.

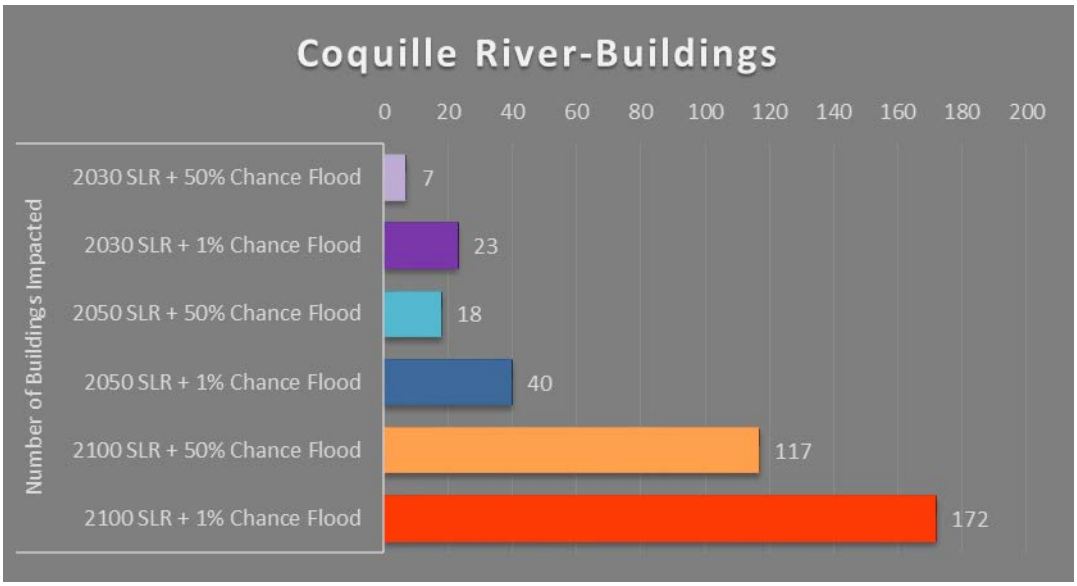

Figure 127. Number of Buildings Exposed to the Future Flooding Scenarios in the Coquille River System

Overview Map

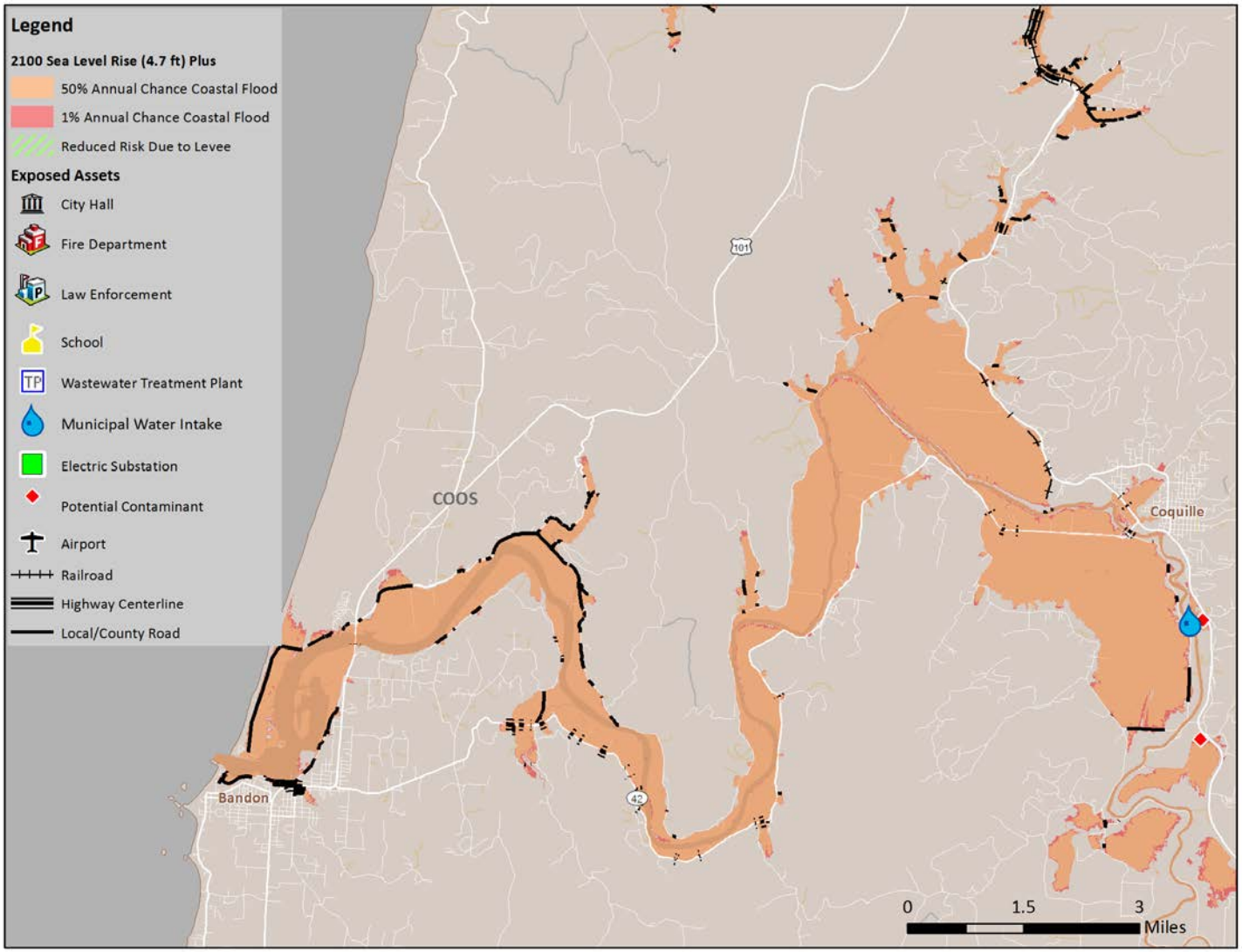

Figure 128. Coquille River 2100 Scenarios and Assets Map (for the 2030 and 2050 scenario maps, please visit http://coastalatlas.net/sealevelriseviewer/)

Land Use Zones

The land use zones within each future flooding scenarios are provided as a percentage of the zoning type within a jurisdiction. Parks/Open Space may be considered an appropriate use for land that is subject to flooding, whereas residential may not be. A community can use these results to identify areas for improvements in their zoning. The results for Coos County are provided in Figure 129, and the City of Bandon are provided in Figure 130. Maps of the results are shown in Figures 131, 132, and 133.

The Coquille River system will flood areas zoned for farm use, industrial, and parks/open space in Coos County; there are not large jumps in percentages as the flood height increases.

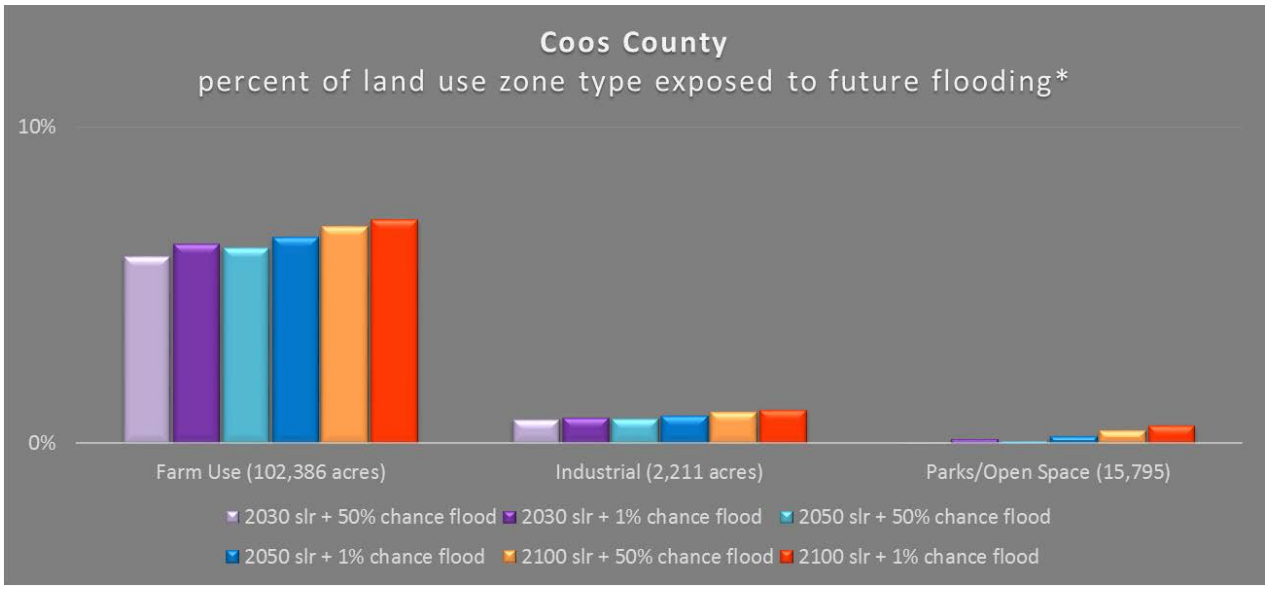

Figure 129. Coos County percent of land use zone types exposed to future flooding

**Only includes flooding from the Coquille River system. Percent of land use zone types flooded from the other estuaries in Coos County are presented separately.*

For the scenario areas in Bandon along the Coquille, appropriately, areas zoned as parks/open space are the most heavily impacted. There are also commercial, industrial, mixed-use, public use, and residential zones within the future flooding scenarios. The commercial, industrial, and residential zones don't see large impact until the long-term scenarios.

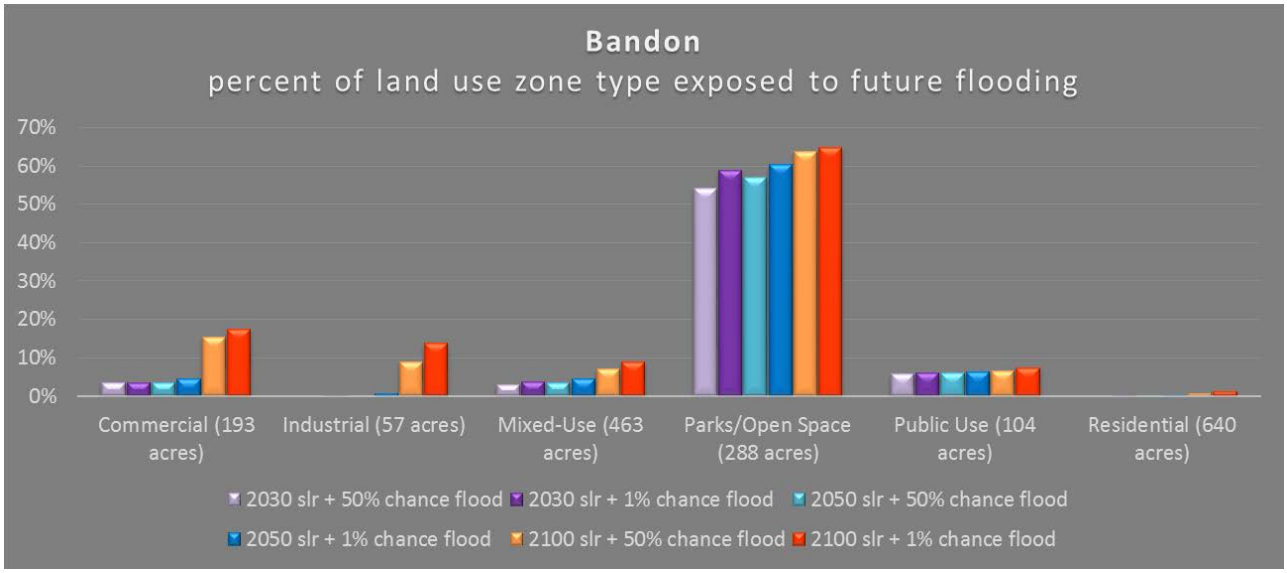

Figure 130. City of Bandon percent of land use zone types exposed to future flooding

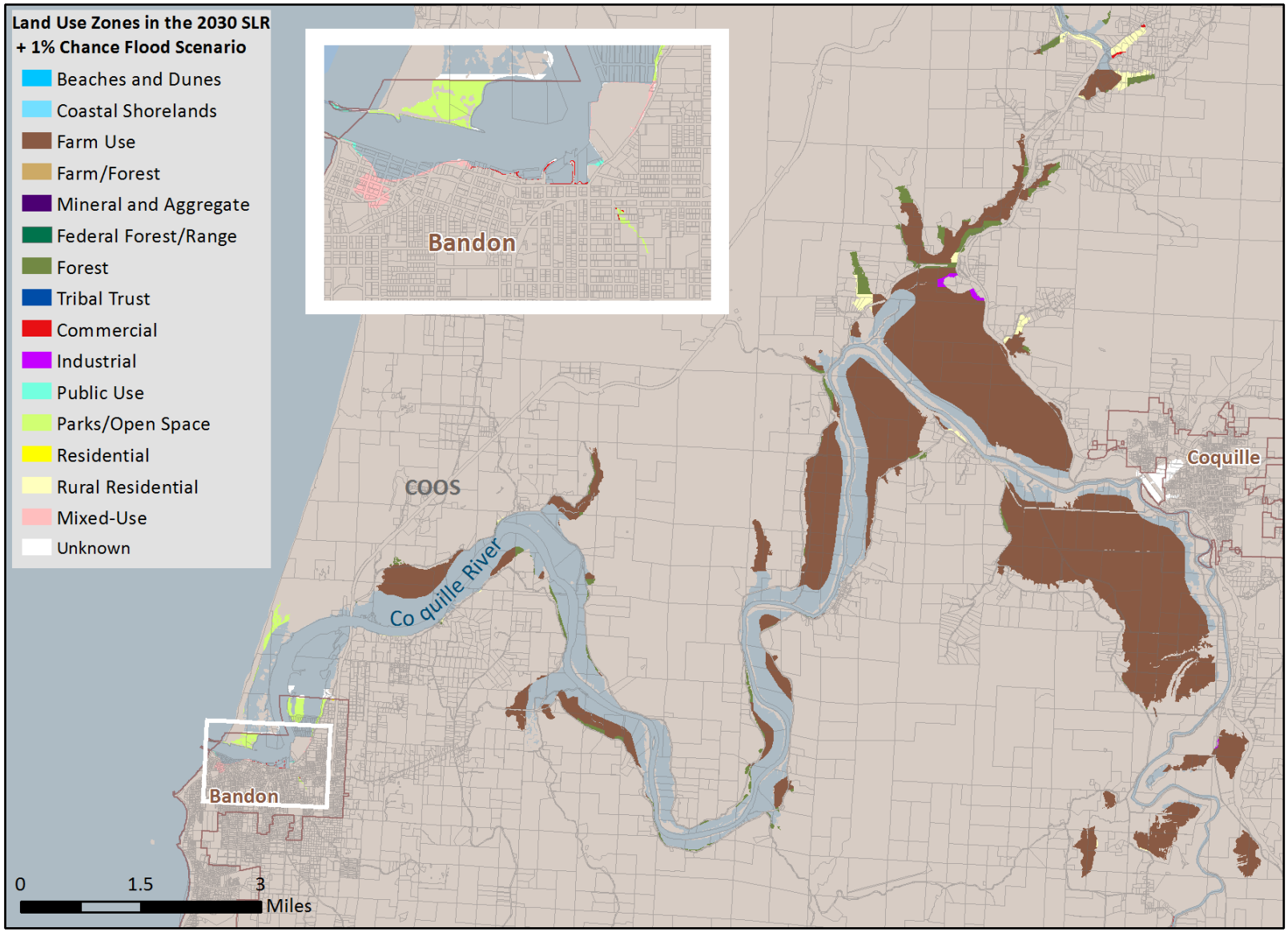

Figure 131. Land Use Zones within the Coquille River 2030 SLR + 1% chance flood scenario

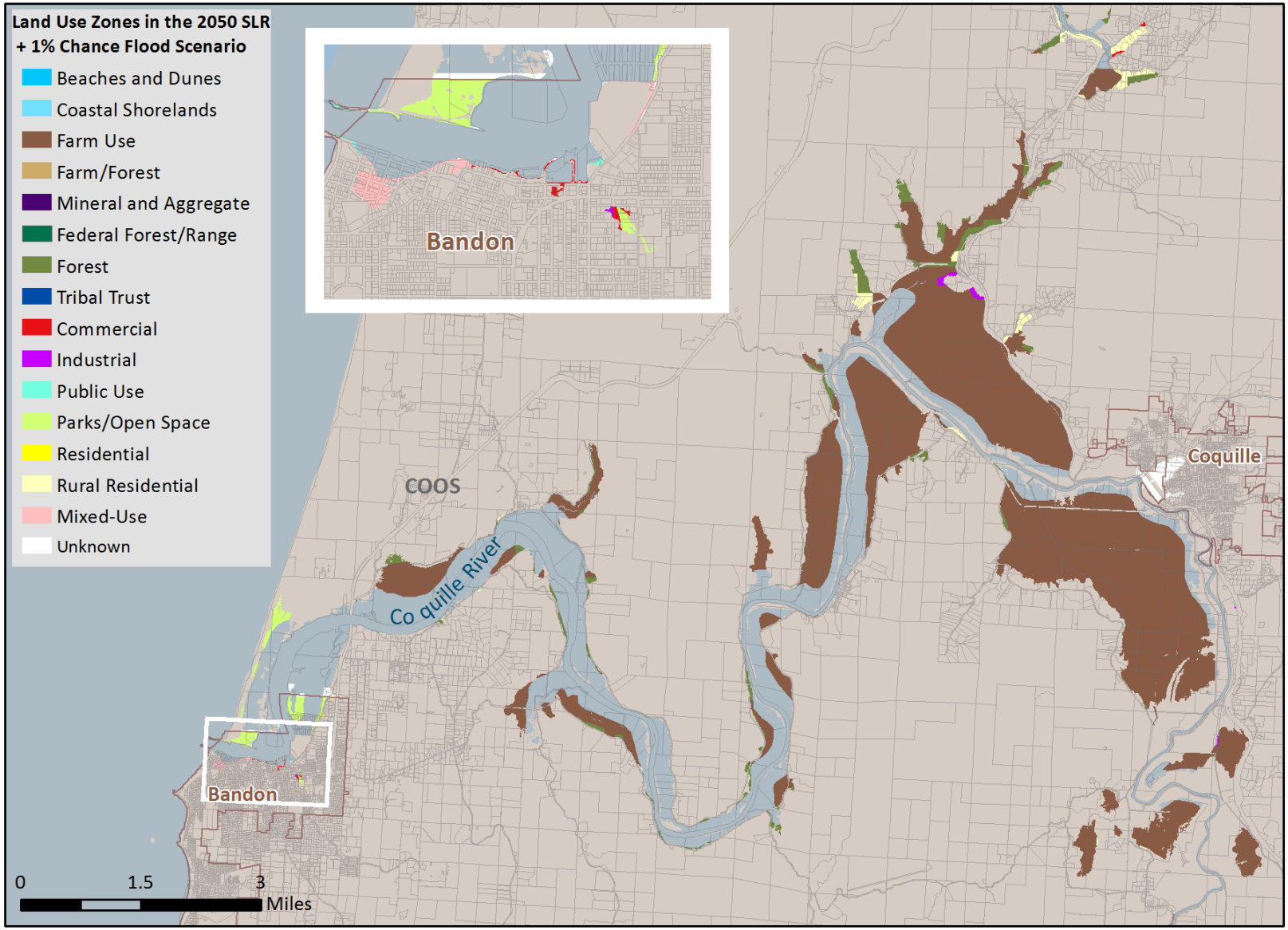

Figure 132. Land Use Zones within the Coquille River 2050 SLR + 1% chance flood scenario

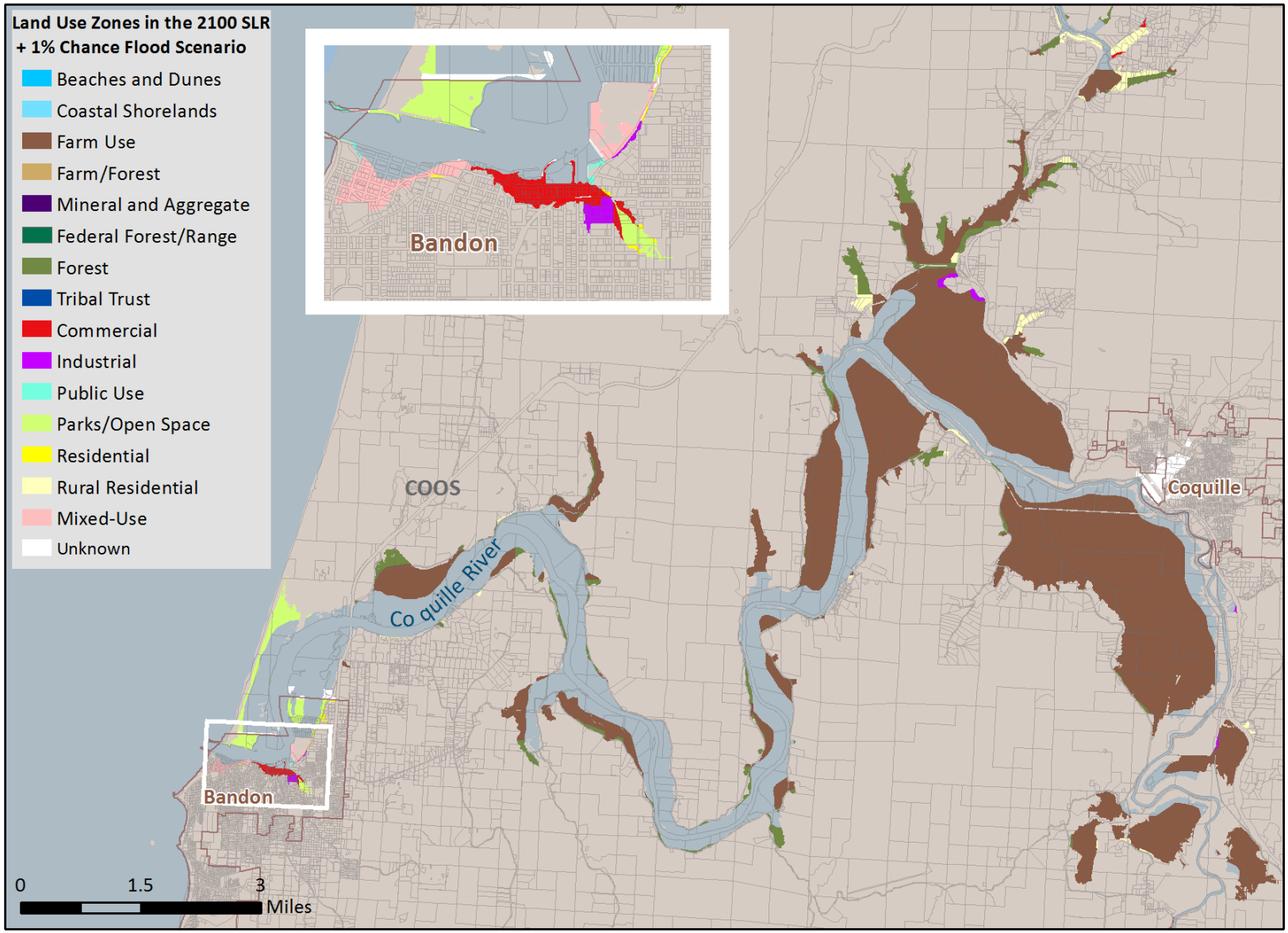

Figure 133 Land Use Zones within the Coquille River 2100 SLR + 1% chance flood scenario

Sixes River Estuary

This section presents the results of the exposure inventory by asset in the Sixes River system. There are minimal impacts from sea-level rise along the Sixes River.

State Highways

There are no state highways impacted by the six future flood scenarios.

Roads

County and local roads may see flooding under the six flood scenarios. Figure 134 displays the total number of county and local road miles impacted per scenario.

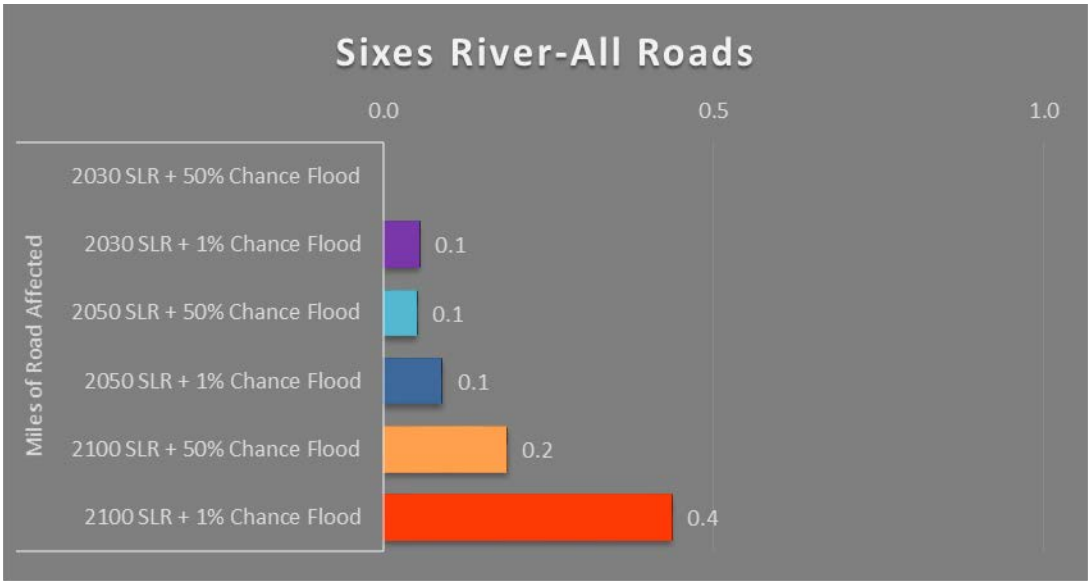

Figure 134. Miles of Road Impacted in the Sixes River Future Flooding Scenarios

Airports

There are no airports that are within the future flood scenarios.

Railway

There are no railroads affected in the future flood scenarios.

Critical Facilities

There are no fire stations, police stations, sheriff's offices, schools, hospitals, or city halls in the future flood scenarios within the Sixes River system.

Municipal Use Drinking Water

There are no municipal drinking water sources that are within the future flood scenarios.

Wastewater Treatment Plant

There are no wastewater treatment plants that are within the future flood scenarios.

Electric Substations

There are no substations within the six future flooding scenarios.

Potential Contaminant Sources

There are no large contaminant sources within the six future flooding scenarios.

Buildings

There are no buildings within the six future flooding scenarios.

Overview Map

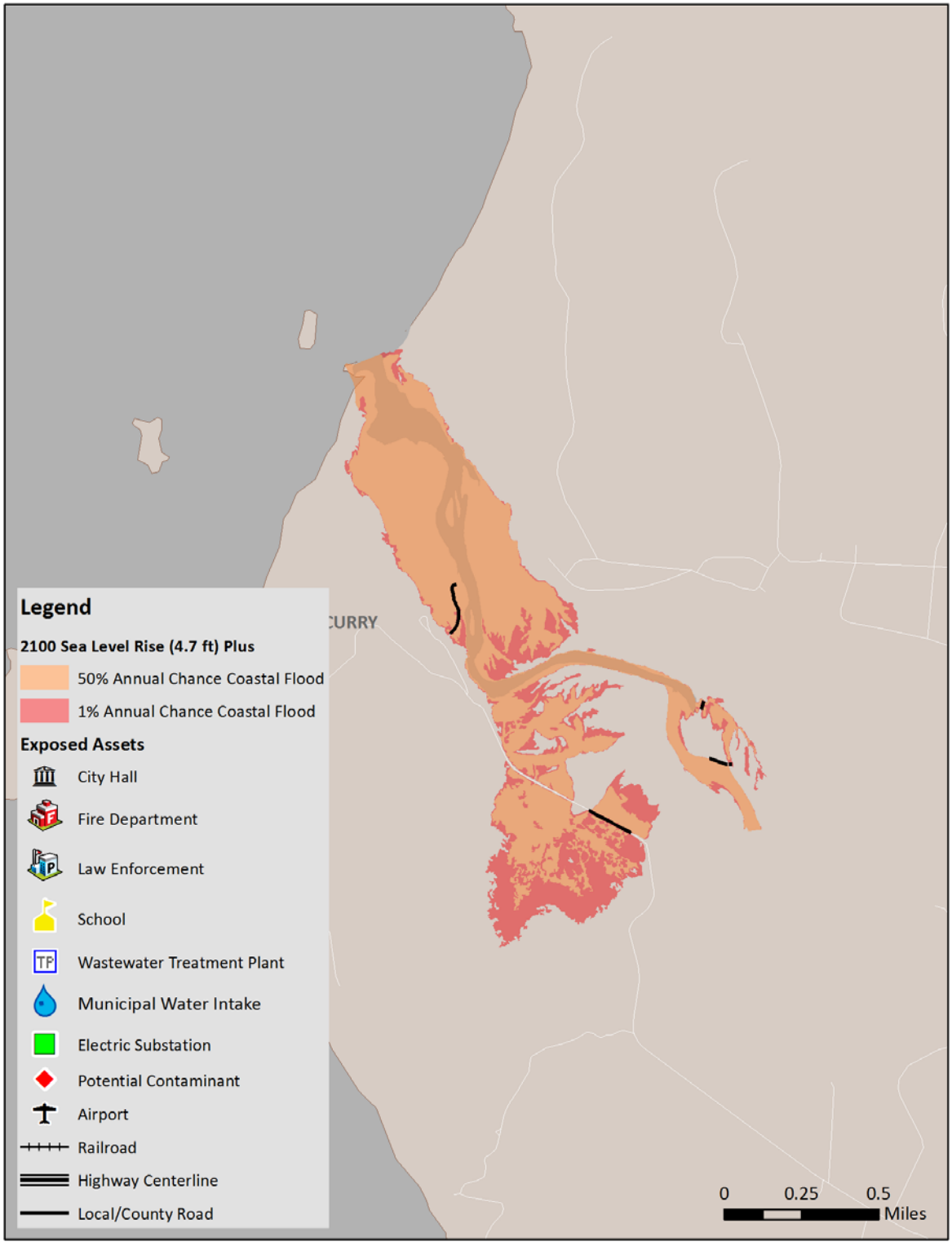

Figure 135. Sixes River 2100 Flood Scenario and Assets Map (for the 2030 and 2050 scenario maps, please visit http://coastalatlas.net/sealevelriseviewer/)

Land Use Zones

The land use zone analysis was not completed for the Sixes River due to minimal flooded area.

Elk River Estuary

This section presents the results of the exposure inventory by asset in the Elk River system. There are minimal impacts from sea-level rise along the Elk River.

State Highways

There are no state highways impacted by the six future flood scenarios.

Roads

A few county and local roads may see flooding under the six flood scenarios. Figure 136 displays the total number of county and local road miles impacted per scenario.

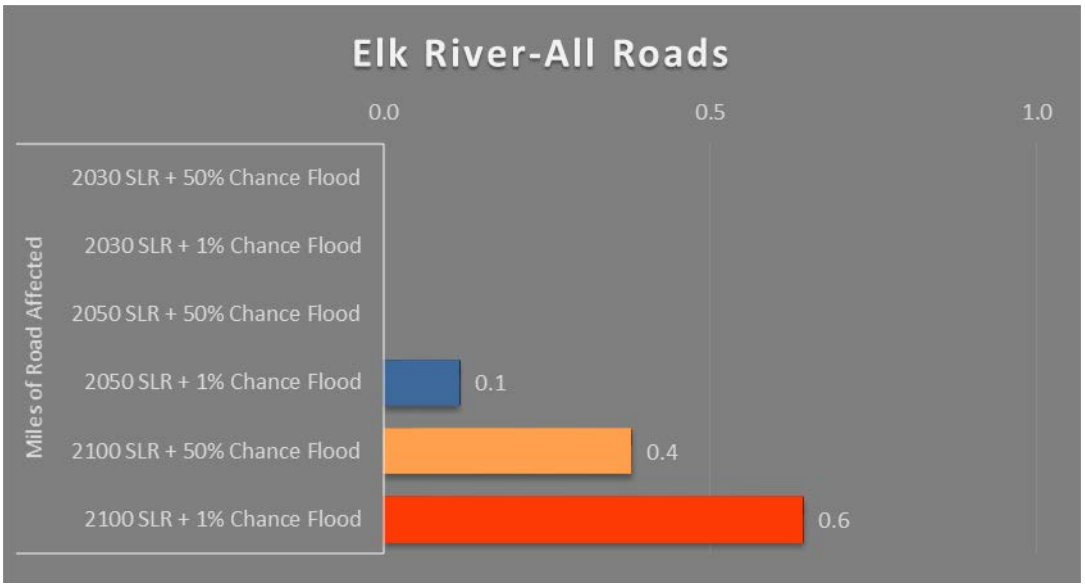

Figure 136. Miles of Road Impacted in the Elk River Future Flooding Scenarios

Airports

There are no airports that are within the future flood scenarios.

Railway

There are no railroads affected in the future flood scenarios.

Critical Facilities

There are no fire stations, police stations, sheriff's offices, schools, hospitals, or city halls in the future flood scenarios within the Elk River system.

Municipal Use Drinking Water

There are no municipal drinking water sources that are within the future flood scenarios.

Wastewater Treatment Plant

There are no wastewater treatment plants that are within the future flood scenarios.

Electric Substations

There are no substations within the six future flooding scenarios.

Potential Contaminant Sources

There are no large contaminant sources within the six future flooding scenarios.

Buildings

There are no building within the six future flooding scenarios.

Overview Map

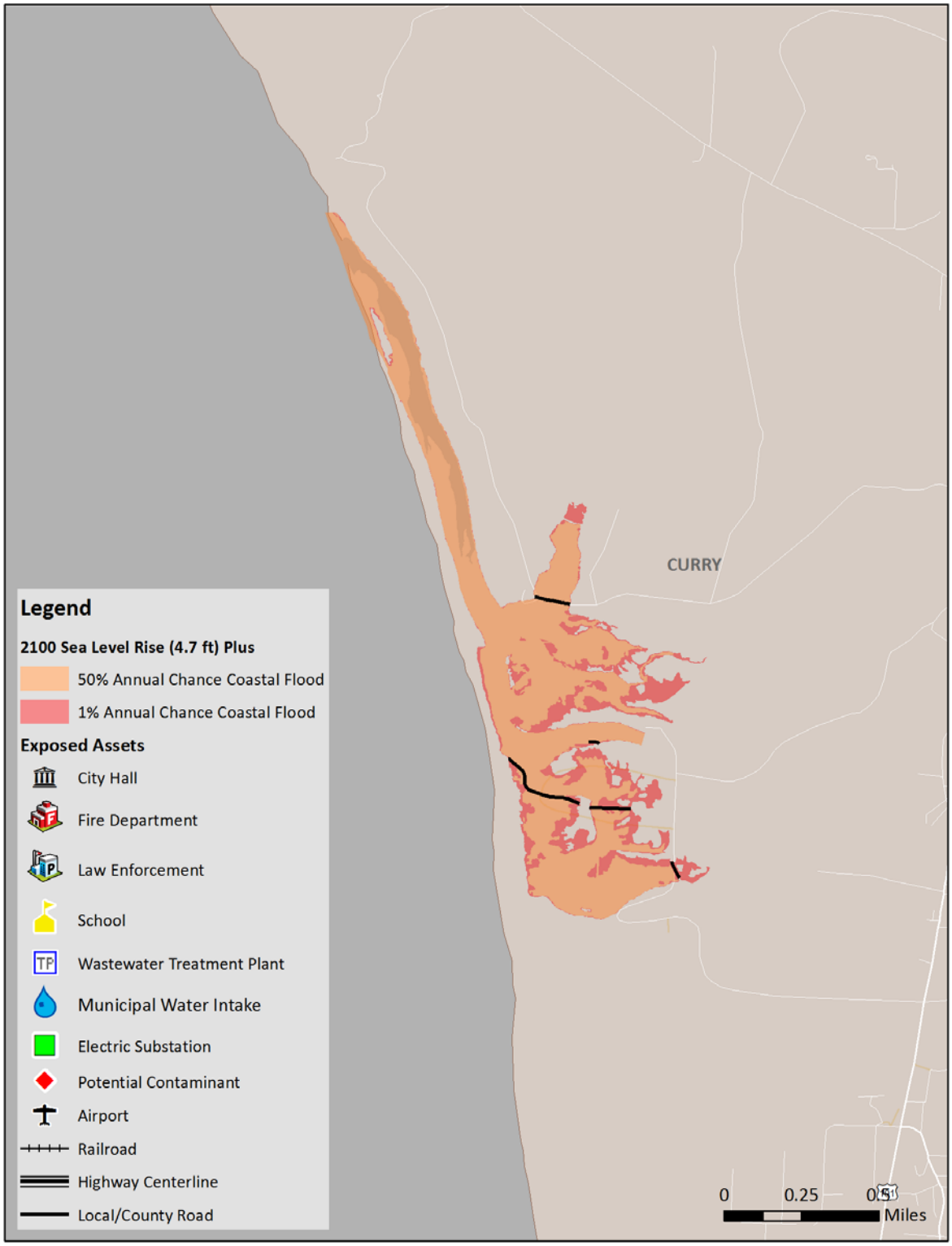

Figure 137. Elk River 2100 Flood Scenario and Assets Map (for the 2030 and 2050 scenario maps, please visit http://coastalatlas.net/sealevelriseviewer/)

Land Use Zones

The land use zone analysis was not completed for the Elk River due to minimal flooded area.

Rogue River Estuary

This section presents the results of the exposure inventory by asset in the Rogue River system. There are minimal impacts from sea-level rise along the Rogue River.

State Highways

There are no state highways impacted by the six future flood scenarios.

Roads

A few county and local roads may see flooding under the six flood scenarios. Figure 138 displays the total number of county and local road miles impacted per scenario.

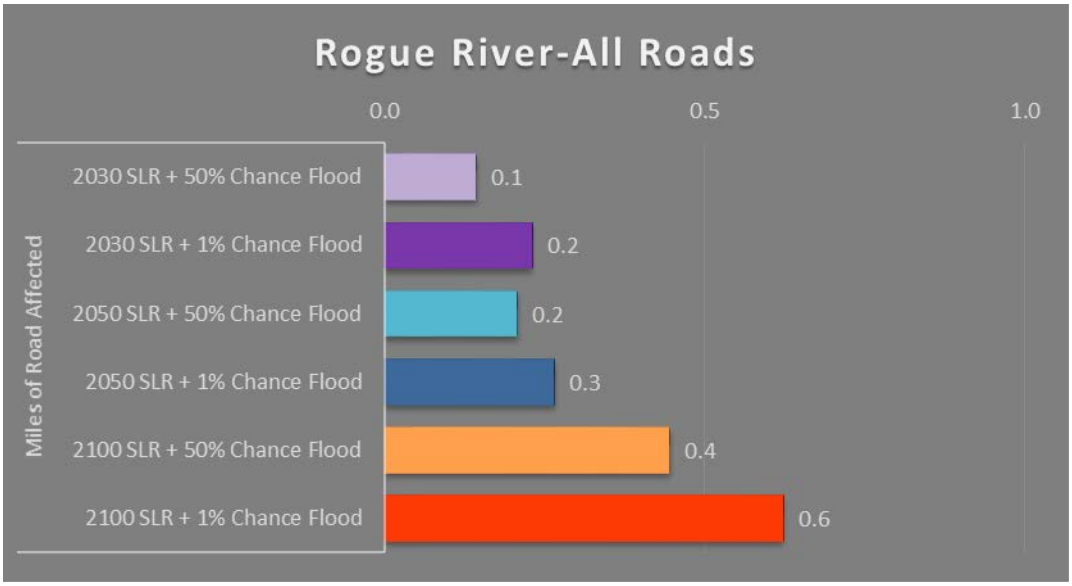

Figure 138. Miles of Road Impacted in the Rogue River Future Flooding Scenarios

Airports

There are no airports that are within the future flood scenarios.

Railway

There are no railroads affected in the future flood scenarios.

Critical Facilities

There are no fire stations, police stations, sheriff's offices, schools, hospitals, or city halls in the future flood scenarios within the Rogue River system.

Municipal Use Drinking Water

There are no municipal drinking water sources that are within the future flood scenarios.

Wastewater Treatment Plant

There are no wastewater treatment plants that are within the future flood scenarios.

Electric Substations

There are no substations within the six future flooding scenarios.

Potential Contaminant Sources

There are no large contaminant sources within the six future flooding scenarios.

Buildings

There are five buildings only impacted by the 2100 SLR + 1% chance flood event.

Overview Map

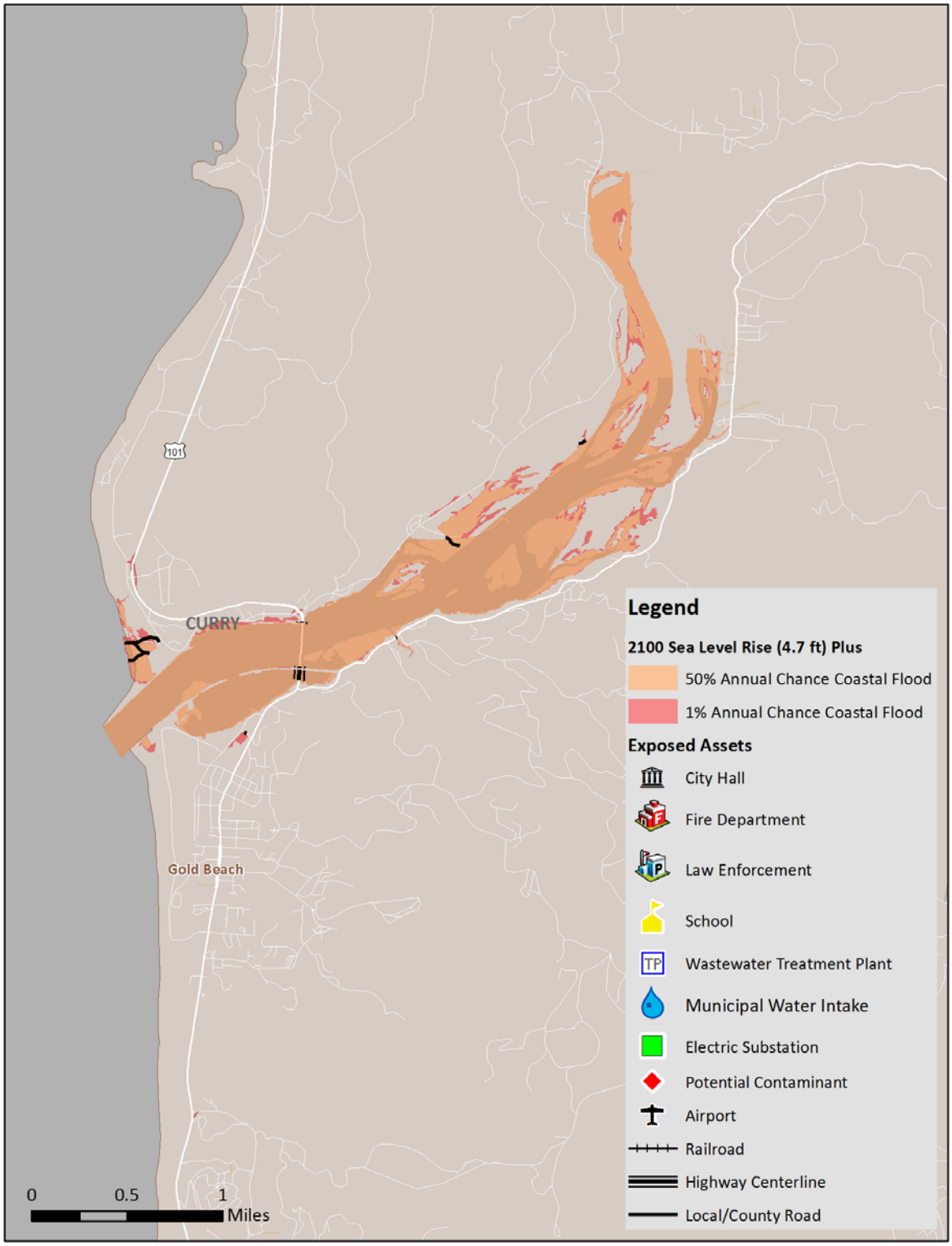

Figure 139. Rogue River 2100 Flood Scenario and Assets Map (for the 2030 and 2050 scenario maps, please visit http://coastalatlas.net/sealevelriseviewer/)

Land Use Zones

The land use zone analysis was not completed for the Rogue River due to minimal flooded area.

Pistol River Estuary

This section presents the results of the exposure inventory by asset in the Pistol River system. There are minimal impacts from sea-level rise along the Pistol River.

State Highways

There are no state highways impacted by the six future flood scenarios.

Roads

A few county and local roads may see flooding under the six flood scenarios. Figure 140 displays the total number of county and local road miles impacted per scenario.

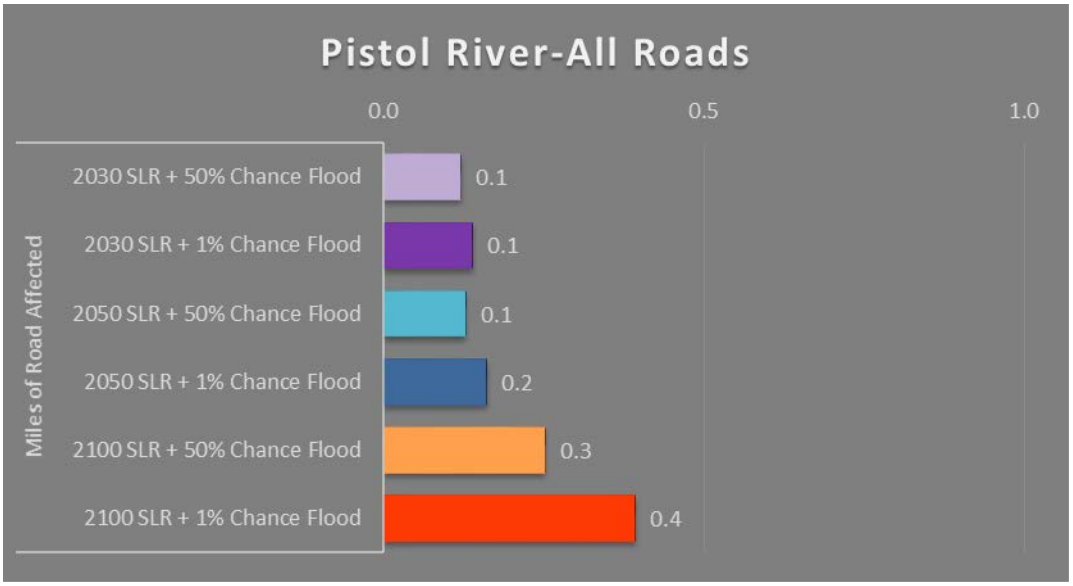

Figure 140. Miles of Road Impacted in the Pistol River Future Flooding Scenarios

Airports

There are no airports that are within the future flood scenarios.

Railway

There are no railroads affected in the future flood scenarios.

Critical Facilities

There are no fire stations, police stations, sheriff's offices, schools, hospitals, or city halls in the future flood scenarios within the Pistol River system.

Municipal Use Drinking Water

There are no municipal drinking water sources that are within the future flood scenarios.

Wastewater Treatment Plant

There are no wastewater treatment plants that are within the future flood scenarios.

Electric Substations

There are no substations within the six future flooding scenarios.

Potential Contaminant Sources

There are no large contaminant sources within the six future flooding scenarios.

Buildings

There are no buildings within the six future flooding scenarios.

Overview Map

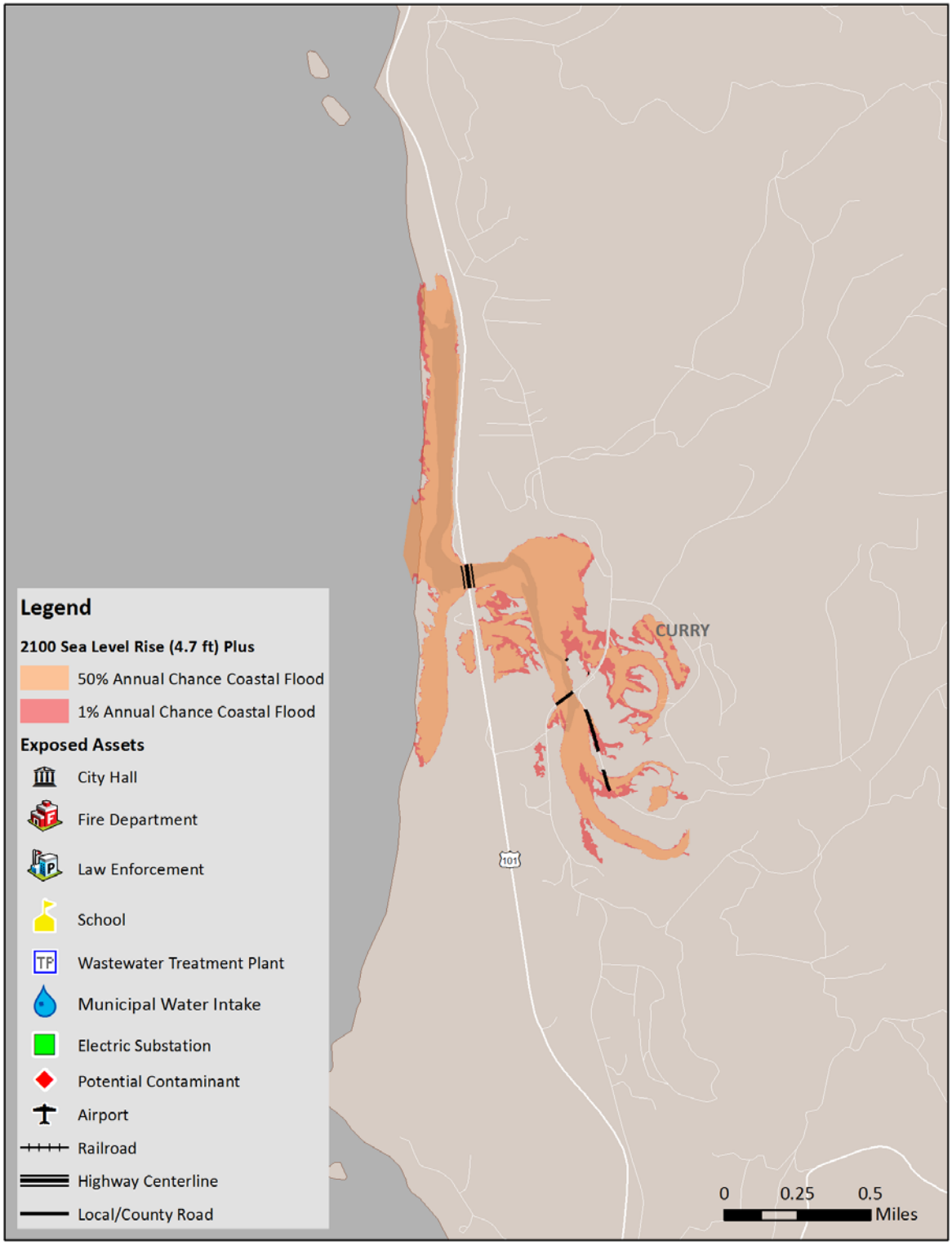

Figure 141. Pistol River 2100 Flood Scenario and Assets Map (for the 2030 and 2050 scenario maps, please visit http://coastalatlas.net/sealevelriseviewer/)

Land Use Zones

The land use zone analysis was not completed for the Pistol River due to minimal flooded area.

Chetco River Estuary

This section presents the results of the exposure inventory by asset in the Chetco River system. There are minimal impacts from sea-level rise along the Chetco River.

State Highways

There are no state highways impacted by the six future flood scenarios.

Roads

A few county and local roads may see flooding under the six flood scenarios. Figure 142 displays the total number of county and local road miles impacted per scenario.

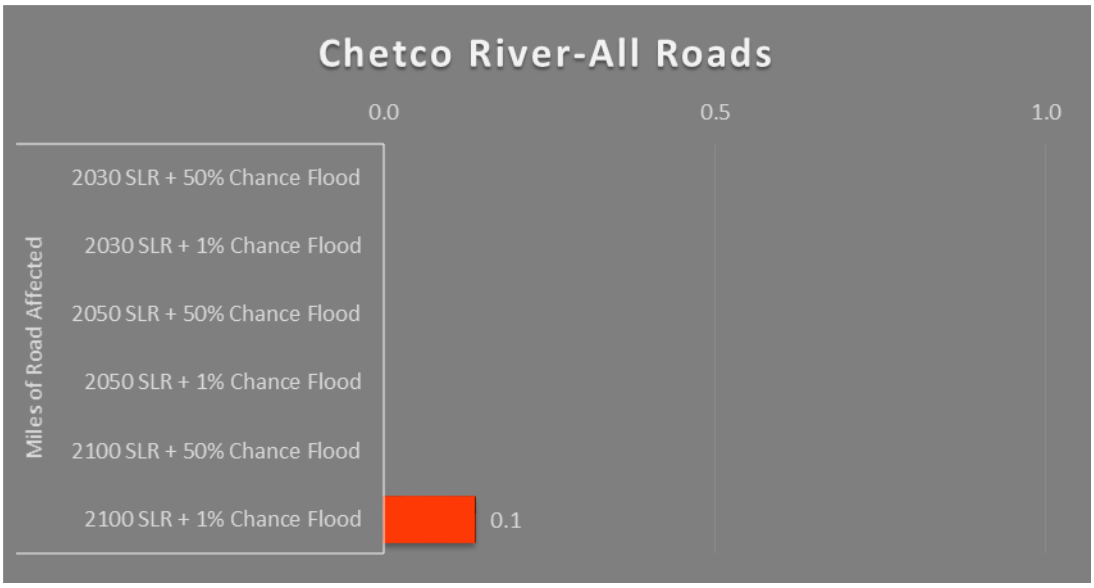

Figure 142. Miles of Road Impacted in the Chetco River Future Flooding Scenarios

Airports

There are no airports that are within the future flood scenarios.

Railway

There are no railroads affected in the future flood scenarios.

Critical Facilities

There are no fire stations, police stations, sheriff's offices, schools, hospitals, or city halls in the future flood scenarios within the Chetco River system.

Municipal Use Drinking Water

There are no municipal drinking water sources that are within the future flood scenarios.

Wastewater Treatment Plant

There are no wastewater treatment plants that are within the future flood scenarios.

Electric Substations

There are no substations within the six future flooding scenarios.

Potential Contaminant Sources

There are no large contaminant sources within the six future flooding scenarios.

Buildings

There are a small number of buildings in Harbor impacted by the future flooding scenarios. The number of buildings impacted under each scenario is shown in Figure 143.

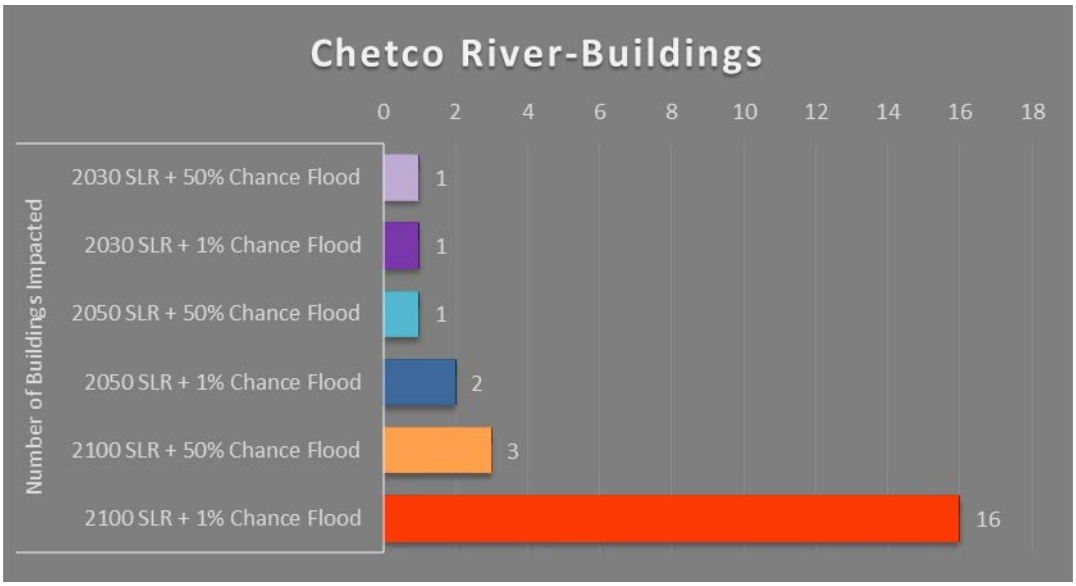

Figure 143. Number of Buildings Exposed to the Future Flooding Scenarios in the Chetco River System

Overview Map

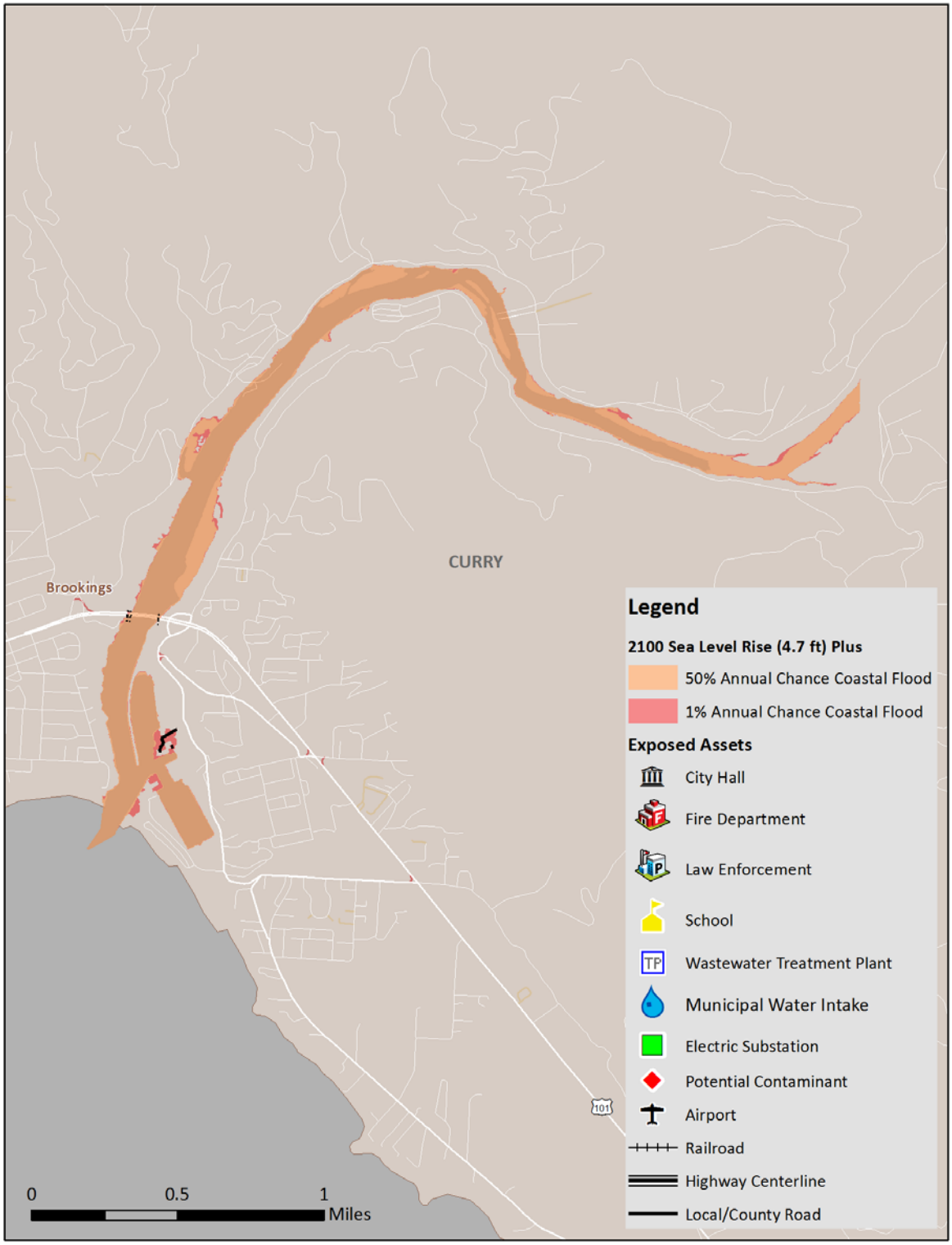

Figure 144. Chetco River 2100 Flood Scenario and Assets Map (for the 2030 and 2050 scenario maps, please visit http://coastalatlas.net/sealevelriseviewer/)

Land Use Zones

The land use zone analysis was not completed for the Chetco River due to minimal flooded area.

Winchuck River Estuary

This section presents the results of the exposure inventory by asset in the Winchuck River system. There are minimal impacts from sea-level rise along the Winchuck River.

State Highways

There are no state highways impacted by the six future flood scenarios.

Roads

A few county and local roads may see flooding under the six flood scenarios. Figure 145 displays the total number of county and local road miles impacted per scenario.

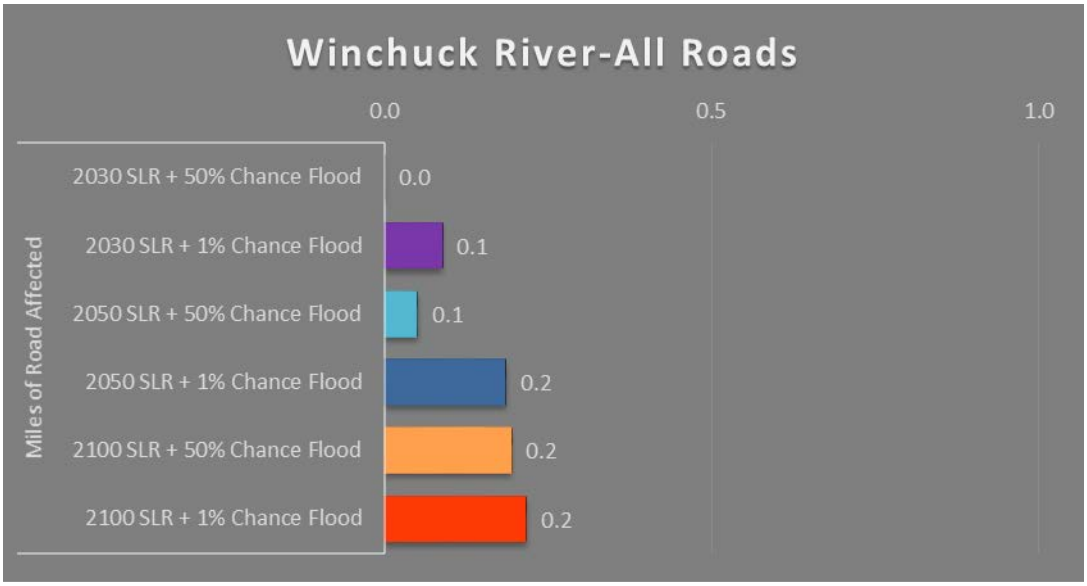

Figure 145. Miles of Road Impacted in the Winchuck River Future Flooding Scenarios

Airports

There are no airports that are within the future flood scenarios.

Railway

There are no railroads affected in the future flood scenarios.

Critical Facilities

There are no fire stations, police stations, sheriff's offices, schools, hospitals, or city halls in the future flood scenarios within the Winchuck River system.

Municipal Use Drinking Water

There are no municipal drinking water sources that are within the future flood scenarios.

Wastewater Treatment Plant

There are no wastewater treatment plants that are within the future flood scenarios.

Electric Substations

There are no substations within the six future flooding scenarios.

Potential Contaminant Sources

There are no large contaminant sources within the six future flooding scenarios.

Buildings

The number of buildings impacted under each scenario is shown in Figure 146.

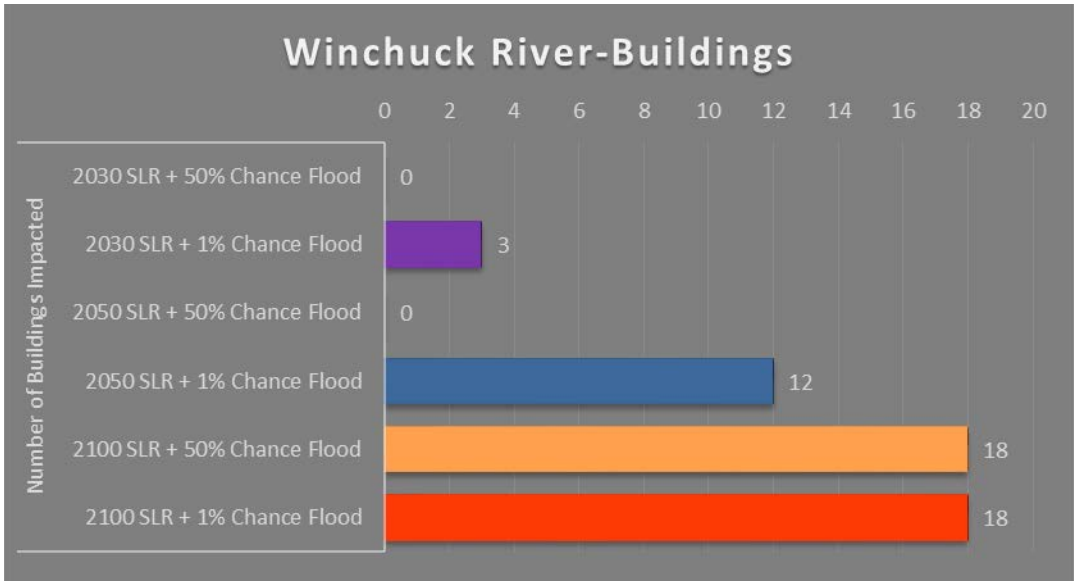

Figure 146. Number of Buildings Exposed to the Future Flooding Scenarios in the Winchuck River System

Overview Map

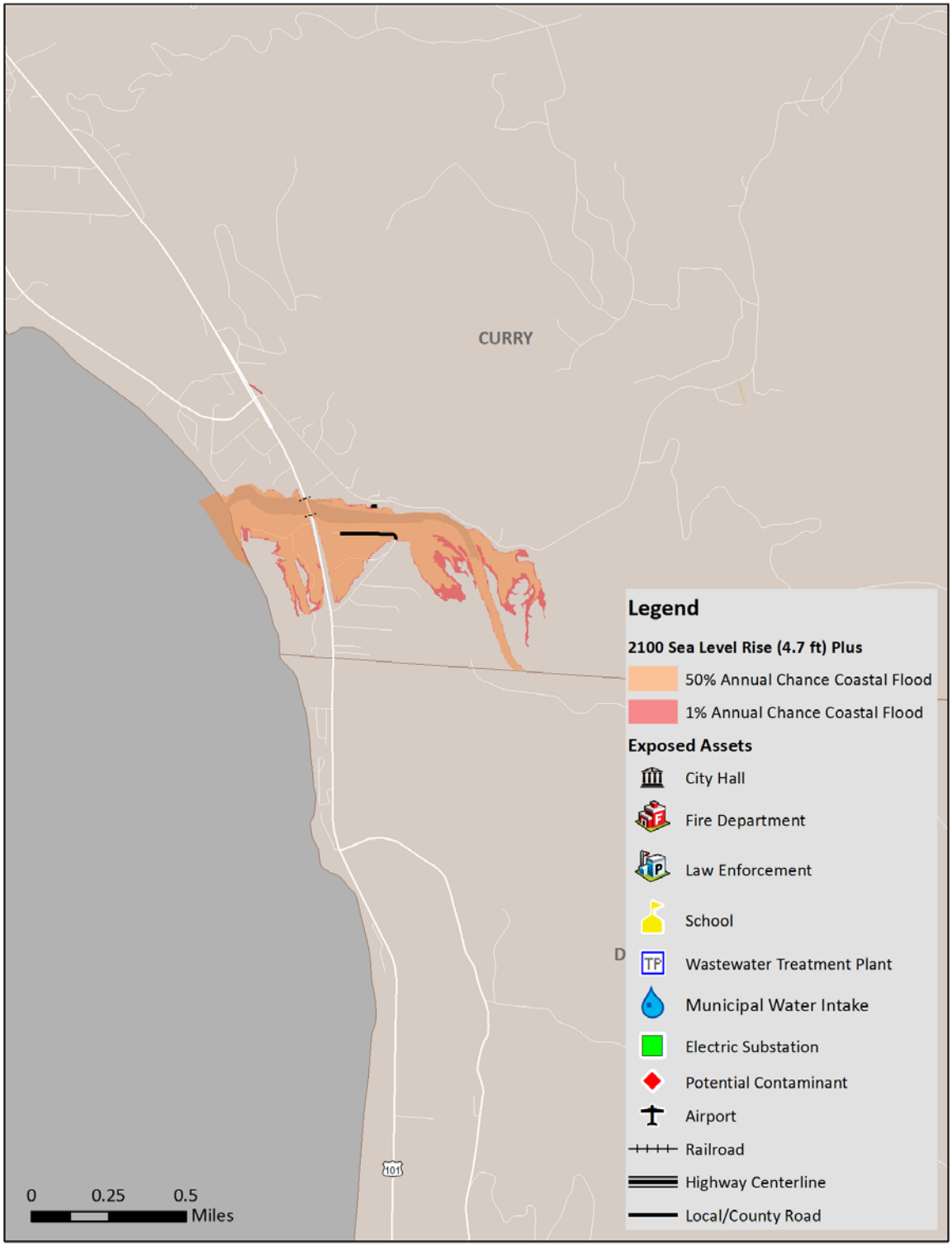

Figure 147. Winchuck River 2100 Flood Scenario and Assets Map (for the 2030 and 2050 scenario maps, please visit http://coastalatlas.net/sealevelriseviewer/)

Land Use Zones

The land use zone analysis was not completed for the Winchuck River due to minimal flooded area.

Incorporating Sea-Level Rise into Decision-Making

This report demonstrates a clear need for a number of communities to begin considering sea-level rise exacerbated flooding into their planning. The obvious question that arises then is where and how can a local government or state agency start incorporating sea-level rise in their decision making processes. A list of places where the sea-level rise scenarios could be used to inform planning or decision-making is provided below, though it is not intended to be a comprehensive list. The list was compiled from a conversation held at the Fall 2017 DLCD Coastal Planners Network Meeting, "Regional Framework for Climate Adaptation: Clatsop and Tillamook Counties" (DLCD, 2015) and "Adaptation Tool Kit: Sea-Level Rise and Coastal Land Use" (Georgetown Climate Center, 2011).

State Agencies	Local
• DLCD Planning Goals 7 and 17 • ODOT Planning • State Hazard Mitigation Plan • DLCD Urban Growth Boundary Decisions • Shoreline Armoring Permitting • Mitigation Wetland Planning	• Estuary Management Plans • Local Hazard Mitigation Plans • Comprehensive Plans • Coastal Flood Hazard Overlay • Floodplain Regulations • Building Design Standards, i.e. increased building elevation requirements • Transportation System Plans • Habitat Restoration Planning • Stormwater Management Plans • Capital Improvement Plans • Conservation Easements

Additional Resources

Sea-level Rise and Wetlands

In addition to impacts to infrastructure and development; natural resources will also be impacted by sea-level rise in the future. On the forefront of those impacts will be tidal wetlands which will suffer if inundated permanently; and have a whole host of ecosystem service values such as serving as vital habitat to numerous species. While the impact to estuarine tidal wetlands were not evaluated in this project, they were analyzed in a separate project which used the same methods as this work for their sea-level rise flood modeling titled "Modeling sea level rise impacts to Oregon's tidal wetlands". The project was completed by the MidCoast Watersheds Council. For information about the future of Oregon's tidal wetlands please visit http://www.midcoastwatersheds.org.

National Sea-level Rise Tools

Numerous other studies have been done at the national scale to estimate the risk of sea-level rise going into the future. Two are particularly worth noting for further research about sea-level rise and the risk associated. The National Oceanic and Atmospheric Administration (NOAA) has a "Sea Level Rise Viewer" that allows users to view sea-level rise inundation along the contiguous United States coast (https://coast.noaa.gov/SLR). Additionally, Climate Central has "Risk Zone Map" (https://ss2.climatecentral.org) and "Risk Finder" (https://riskfinder.climatecentral.org/) which can be used to view areas of inundation, and subsequently identify the risk to U.S. coastal places from various levels of inundation.

Contact

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Appendix A

	50% chance flood in 2030			1% chance flood in 2030			50% chance flood in 2050			1% chance flood in 2050			50% chance flood in 2100			1% chance flood in 2100		
	SLR (ft)	Flood Event Height (ft in MHHW)	Total	SLR (ft)	Flood Event Height (ft in MHHW)	Total	SLR (ft)	Flood Event Height (ft in MHHW)	Total	SLR (ft)	Flood Event Height (ft in MHHW)	Total	SLR (ft)	Flood Event Height (ft in MHHW)	Total	SLR (ft)	Flood Event Height (ft in MHHW)	Total
Necanicum River	0.75	2.63	3.38	0.75	3.95	4.71	1.57	2.63	4.20	1.57	3.95	5.53	4.66	2.63	7.29	4.66	3.95	8.61
Nehalem Bay	0.75	2.64	3.39	0.75	3.97	4.73	1.57	2.64	4.21	1.57	3.97	5.55	4.66	2.64	7.30	4.66	3.97	8.63
Tillamook Bay	0.75	2.64	3.39	0.75	3.98	4.73	1.57	2.64	4.21	1.57	3.98	5.55	4.66	2.64	7.30	4.66	3.98	8.64
Netarts Bay	0.75	2.64	3.40	0.75	3.99	4.74	1.57	2.64	4.22	1.57	3.99	5.56	4.66	2.64	7.30	4.66	3.99	8.64
Sand Lake	0.75	2.64	3.40	0.75	3.99	4.75	1.57	2.64	4.22	1.57	3.99	5.57	4.66	2.64	7.30	4.66	3.99	8.65
Nestucca River	0.75	2.65	3.40	0.75	4.00	4.76	1.57	2.65	4.22	1.57	4.00	5.58	4.66	2.65	7.31	4.66	4.00	8.66
Salmon River	0.75	2.65	3.40	0.75	4.01	4.76	1.57	2.65	4.22	1.57	4.01	5.58	4.66	2.65	7.31	4.66	4.01	8.67
Siletz Bay	0.75	2.65	3.41	0.75	4.02	4.77	1.57	2.65	4.23	1.57	4.02	5.59	4.66	2.65	7.31	4.66	4.02	8.68
Depoe Bay	0.75	2.65	3.41	0.75	4.02	4.78	1.57	2.65	4.23	1.57	4.02	5.60	4.66	2.65	7.31	4.66	4.02	8.68
Yaquina Bay	0.75	2.66	3.41	0.75	4.04	4.79	1.57	2.66	4.23	1.57	4.04	5.61	4.66	2.66	7.32	4.66	4.04	8.69
Alsea Bay	0.75	2.63	3.38	0.75	3.99	4.75	1.57	2.63	4.20	1.57	3.99	5.57	4.66	2.63	7.29	4.66	3.99	8.65
Siuslaw River	0.75	2.56	3.32	0.75	3.90	4.65	1.57	2.56	4.14	1.57	3.90	5.47	4.66	2.56	7.22	4.66	3.90	8.55
Umpqua River	0.75	2.51	3.26	0.75	3.81	4.57	1.57	2.51	4.08	1.57	3.81	5.39	4.66	2.51	7.17	4.66	3.81	8.47
Coos Bay	0.75	2.46	3.22	0.75	3.74	4.49	1.57	2.46	4.04	1.57	3.74	5.31	4.66	2.46	7.12	4.66	3.74	8.40
Coquille River	0.75	2.44	3.19	0.75	3.71	4.46	1.57	2.44	4.01	1.57	3.71	5.28	4.66	2.44	7.10	4.66	3.71	8.37
Sixes River	0.75	2.41	3.16	0.75	3.67	4.42	1.57	2.41	3.98	1.57	3.67	5.24	4.66	2.41	7.07	4.66	3.67	8.33
Elk River	0.75	2.40	3.16	0.75	3.66	4.42	1.57	2.40	3.98	1.57	3.66	5.24	4.66	2.40	7.06	4.66	3.66	8.32
Rogue River	0.75	2.37	3.12	0.75	3.61	4.36	1.57	2.37	3.94	1.57	3.61	5.18	4.66	2.37	7.02	4.66	3.61	8.27
Pistol River	0.75	2.35	3.11	0.75	3.59	4.34	1.57	2.35	3.93	1.57	3.59	5.16	4.66	2.35	7.01	4.66	3.59	8.25
Chetco River	0.75	2.33	3.08	0.75	3.55	4.31	1.57	2.33	3.90	1.57	3.55	5.13	4.66	2.33	6.99	4.66	3.55	8.21
Winchuck River	0.75	2.32	3.08	0.75	3.55	4.30	1.57	2.32	3.90	1.57	3.55	5.12	4.66	2.32	6.98	4.66	3.55	8.21