DATA REPORT

Sea-level Rise

Transportation Vulnerability Assessment

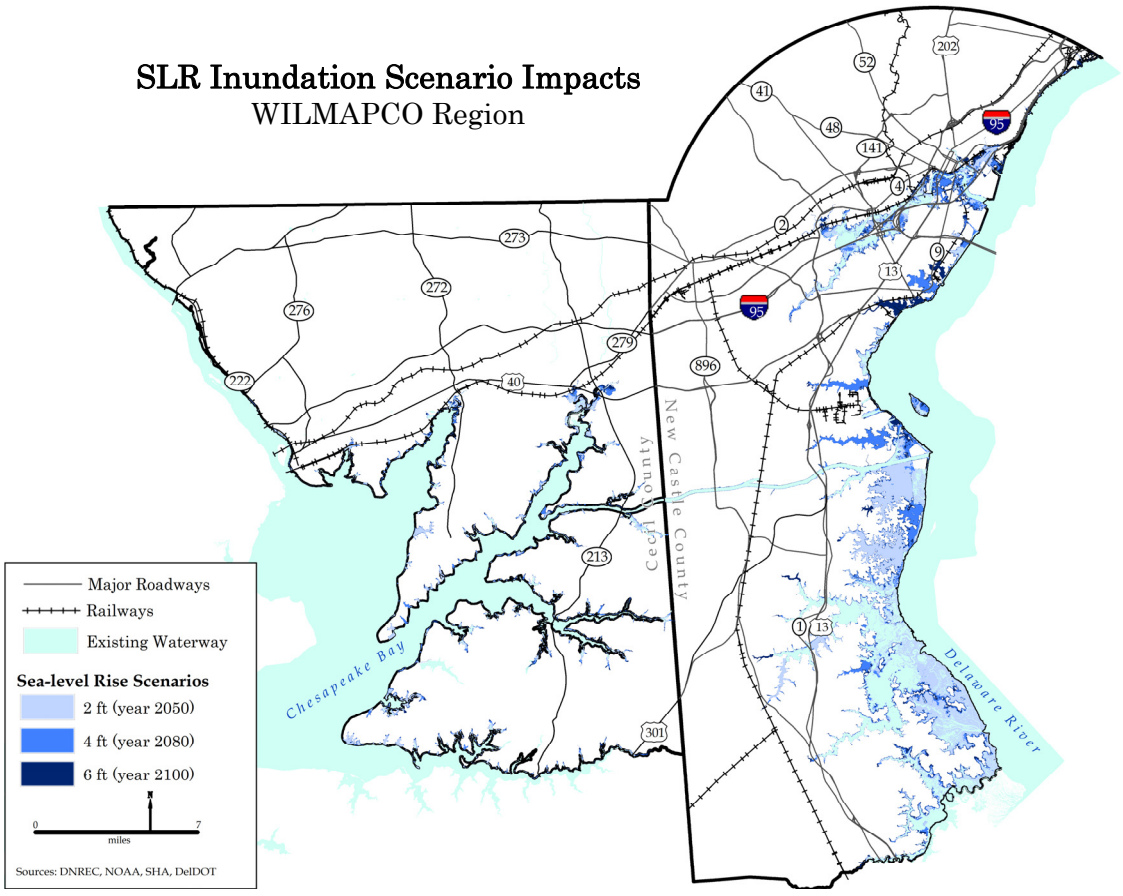
2020 Update

Overview

Global sea levels have been on the rise since the turn of the 20th Century. A byproduct of climate change, scientists expect this trend to continue through the next century. Delaware has had more than 1 foot of sea-level rise (SLR) since 1900, with a further 2 feet expected by 2100. This poses a serious, but far from insurmountable, challenge to our region's transportation system. Early measures to adapt to SLR and lessen future SLR are crucial.

The Wilmington Area Planning Council (WILMAPCO) was one of the first Metropolitan Planning Organizations to begin planning for SLR. WILMAPCO's 2011 Transportation Vulnerability Assessment measured SLR impacts to transportation and housing under different rise scenarios. It informed later work locally, and also influenced national projects, such as Amtrak's assessment of SLR impacts along the Northeast Corridor.

This Data Report is a concise refresh of the 2011 SLR Assessment using updated local projections.



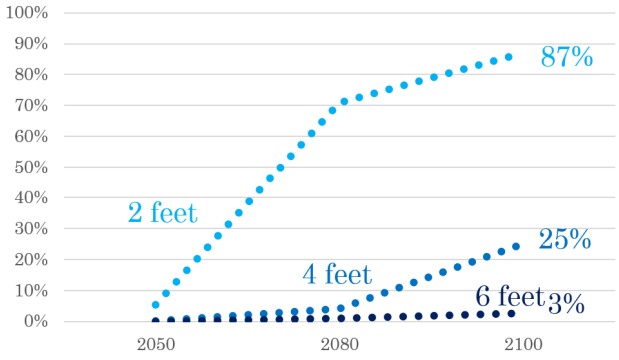
Background

The States of Maryland[1] and Delaware[2] recently made new SLR projections. Considerable uncertainty exists with future global emissions pathways and, by extension, the rate of SLR. Nevertheless, some 2 to 6 feet of SLR is possible locally by 2100, with continued growth thereafter.

We examine the 2, 4, and 6 feet rise scenarios in this report. Each is assigned a horizon year for illustrative purposes — 2050, 2080, and 2100. The chances of those rise levels by those years are small (between 1-5% chance). However, planning and creating resilient infrastructure at these levels will help us prepare for storm surges and the most extreme SLR scenarios.

Note that these scenarios, developed by DNREC and NOAA, are high-level illustrations of potential impacts, which do not account for local variability.

Probability of Rise, in feet by year, Delaware



[1] Boesch, D.F., W.C. Boicourt, R.I. Cullather, T. Ezer, G.E. Galloway, Jr., Z.P. Johnson, K.H. Kilbourne, M.L. Kirwan, R.E. Kopp, S. Land, M. Li, W. Nardin, C.K. Sommerfield, W.V. Sweet. 2018. Sea-level Rise: Projections for Maryland 2018, 27 pp. University of Maryland Center for Environmental Science, Cambridge, MD

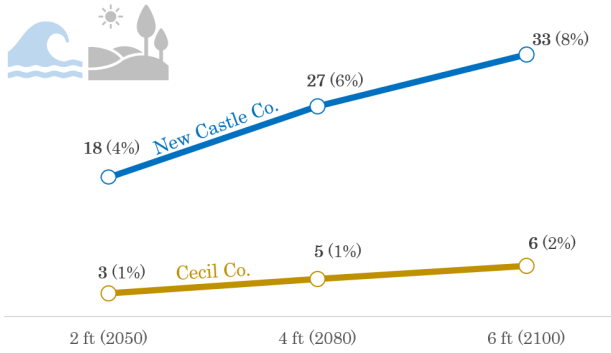
[2] Callahan, John A., Benjamin P. Horton, Daria L. Nikitina, Christopher K. Sommerfield, Thomas E. McKenna, and Danielle Swallow, 2017. Recommendation of Sea-Level Rise Planning Scenarios for Delaware: Technical Report, prepared for Delaware Department of Natural Resources and Environmental Control (DNREC) Delaware Coastal Programs.

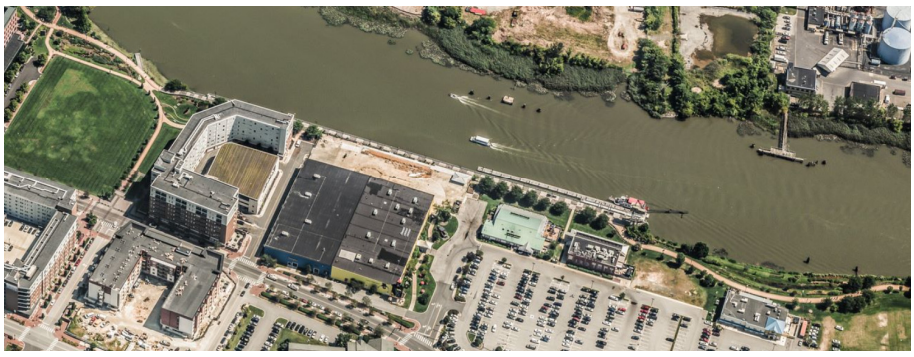
Land Impacts

While they are roughly the same size and both bordered by coastal waters, New Castle County will be more heavily impacted by SLR than Cecil County. This is the result of geological differences between the Delaware River and the Chesapeake Bay.

Some 18 square miles of New Castle County's land, or 4%, would be challenged with a 2-foot rise scenario. That can be compared to only 3 square miles in Cecil County. In a 6-foot rise scenario, 33 square miles (8%) of New Castle County may be impacted. Meanwhile, a 6-foot rise would impact only 6 square miles (2%) of land in Cecil County.

Land Impacted by SLR, in square miles





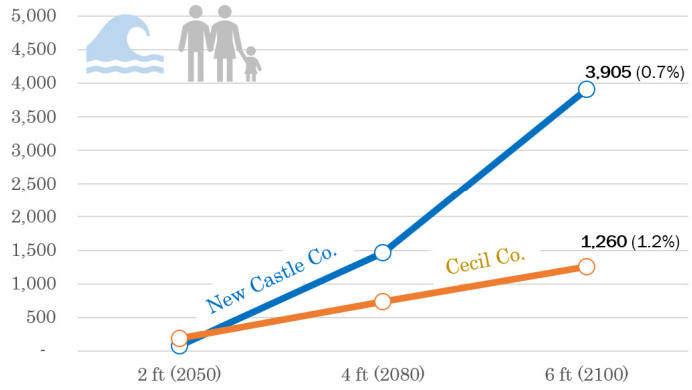
Wilmington Riverfront. Source: Bing Maps 2019

Population Impacts

Sea-level Rise has the potential to directly affect thousands of the region's residents. Using block level data clipped to populated areas, we estimate what these impacts may be at 2010 population levels.

More than 2,000 residents across the region may be impacted with a 4-foot rise and more than 5,000 with a 6-foot rise. That is about 1% of the WILMAPCO region's (2010) population impacted at the 6-foot scenario.

Potential Population Impacts

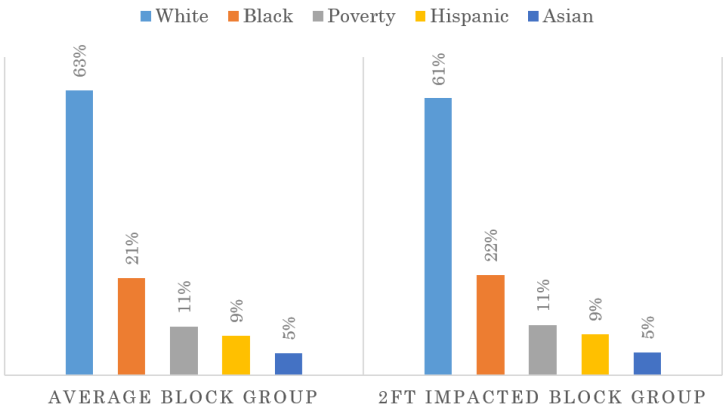


Social Equity

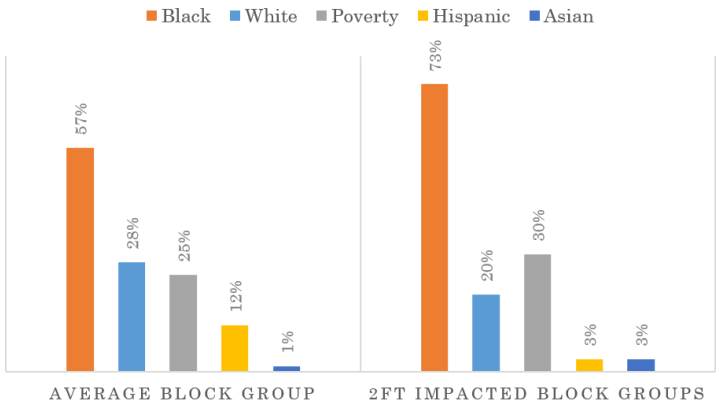
SLR will affect communities with varying demographics and socio-economic conditions. Taken as a whole, the average impacted census block group at the 2-ft SLR scenario closely resembles base regional demographics. As shown in the first bar graph to the right, census block groups impacted have only slightly fewer Whites and slightly more Blacks. Households within impacted block groups also had only slightly lower median annual incomes — $65,000 vs. the regional median of $66,500.

When SLR impacts to block groups within the City of Wilmington are considered separately, however, more pronounced inequities surface. Areas impacted by a 2-ft SLR have significantly more Blacks and low-income residents. Blacks comprise 73% of the population within block groups impacted at the 2 ft SLR scenario, versus their citywide average of 57%. Some 30% of households within impacted block groups are impoverished, compared to 25% of households citywide.

Regional SLR Social Equity Analysis



City of Wilmington SLR Social Equity Analysis



ANALYSIS NOTES

The "Potential Population Impacts" analysis used block-level data from the 2010 Census. The social equity analyses, meanwhile, used block-group data from the 2013-2017 American Community Survey.

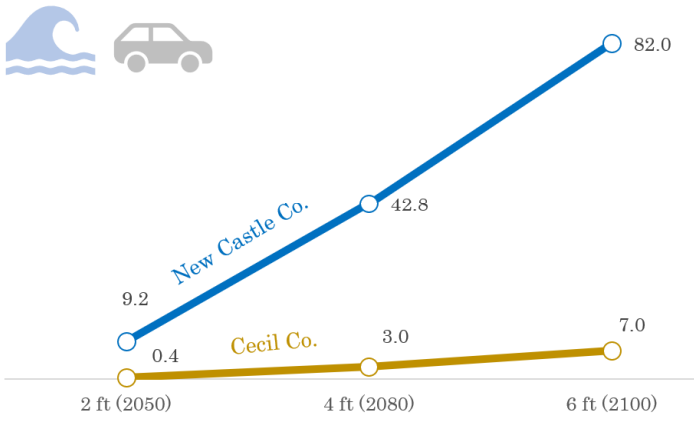
Roadway Impacts

Many miles of roadway risk inundation under all SLR scenarios. These impacts would be more acutely felt in New Castle County, where some 9 miles of roadway centerline may be challenged at 2 ft, 43 miles at 4 ft, and 82 miles at 6 ft.

The map below illustrates which roads may be challenged. Key impacted areas include:

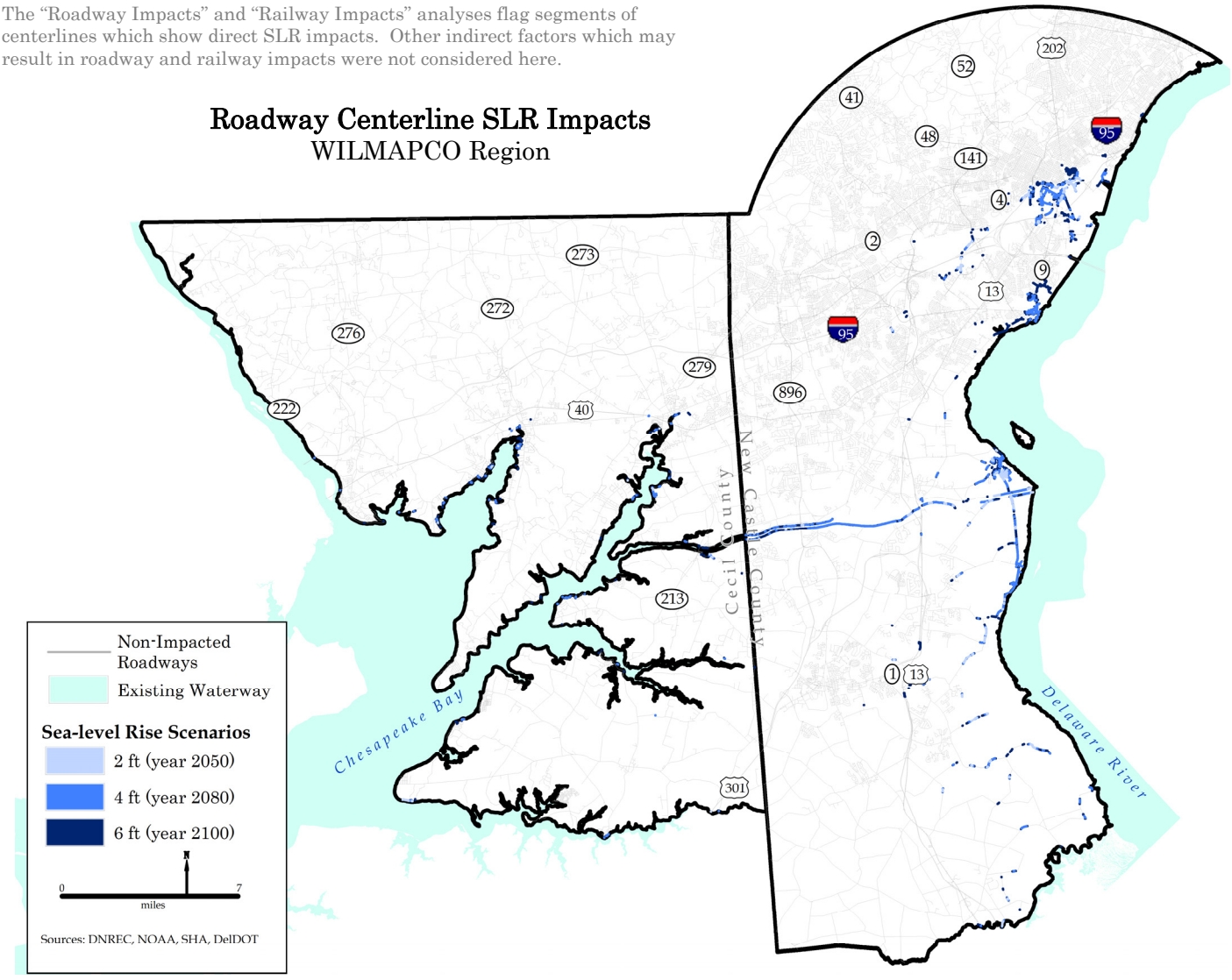
- Around the Christina and Brandywine Rivers in Wilmington
- North of the New Castle County Airport
- The City of New Castle and Delaware City
- The Route 9 Corridor in Southern New Castle County

Roadway Centerline SLR Impacts, in miles



ANALYSIS NOTES

The "Roadway Impacts" and "Railway Impacts" analyses flag segments of centerlines which show direct SLR impacts. Other indirect factors which may result in roadway and railway impacts were not considered here.



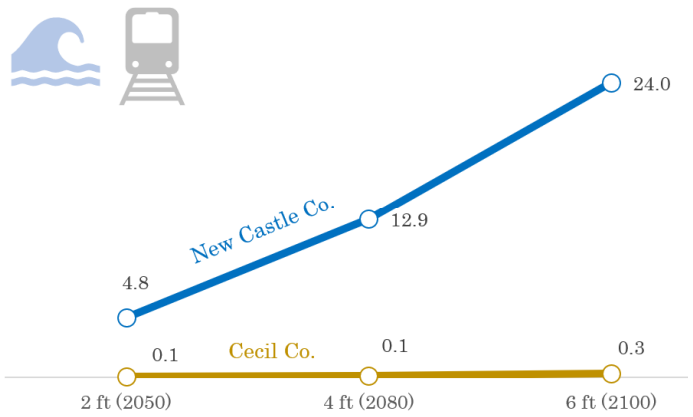
Railway Impacts

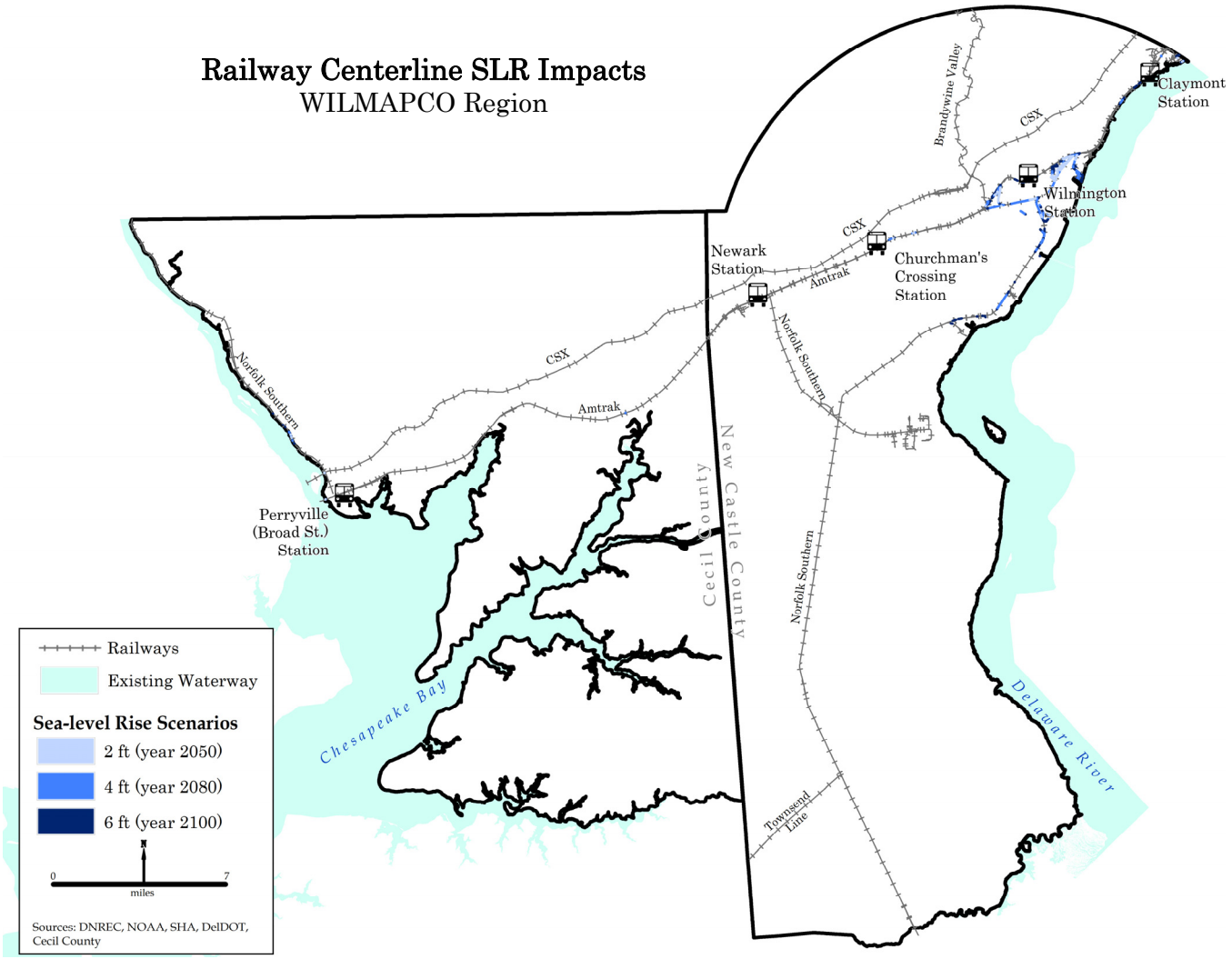
Like roads, many miles of rail track risk inundation under all SLR scenarios. These impacts are greater in New Castle County, where some 5 miles of railway centerline may be challenged at 2 ft, 13 miles at 4 ft, and 24 miles at 6 ft.

The map below illustrates which tracks may be challenged. Key impacts include:

- Commuter and freight lines in and around the City of Wilmington, Claymont, west of Newport, and Perryville
- Freight lines from the Port of Wilmington to the City of New Castle
- A freight line south of Port Deposit

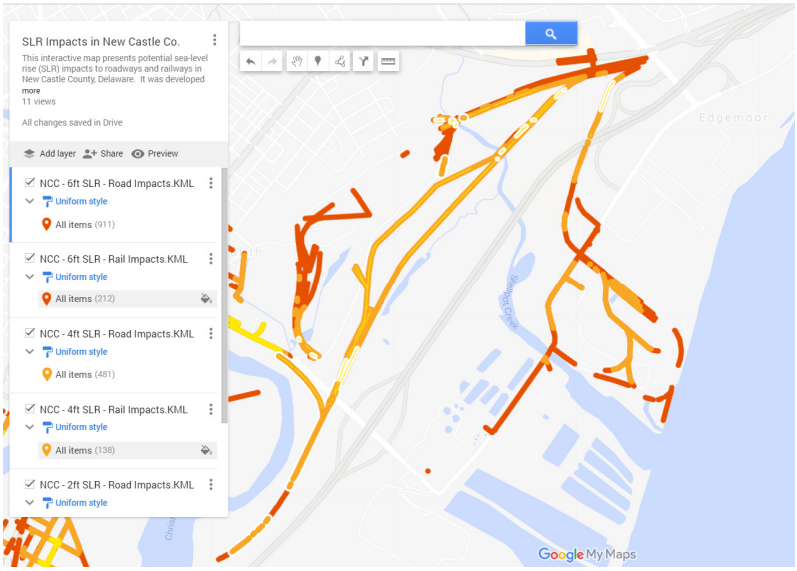
Railway Centerline SLR Impacts, in miles





Interactive Maps—Road and Rail Impacts

For a closer view of impacts to roads and railways we created interactive maps. You can view these on our SLR website at: www.wilmapco.org/slr.

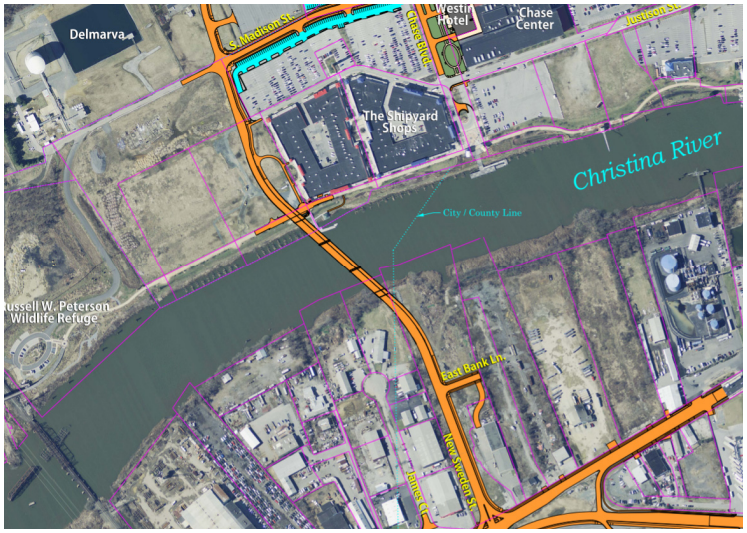


Project Impacts

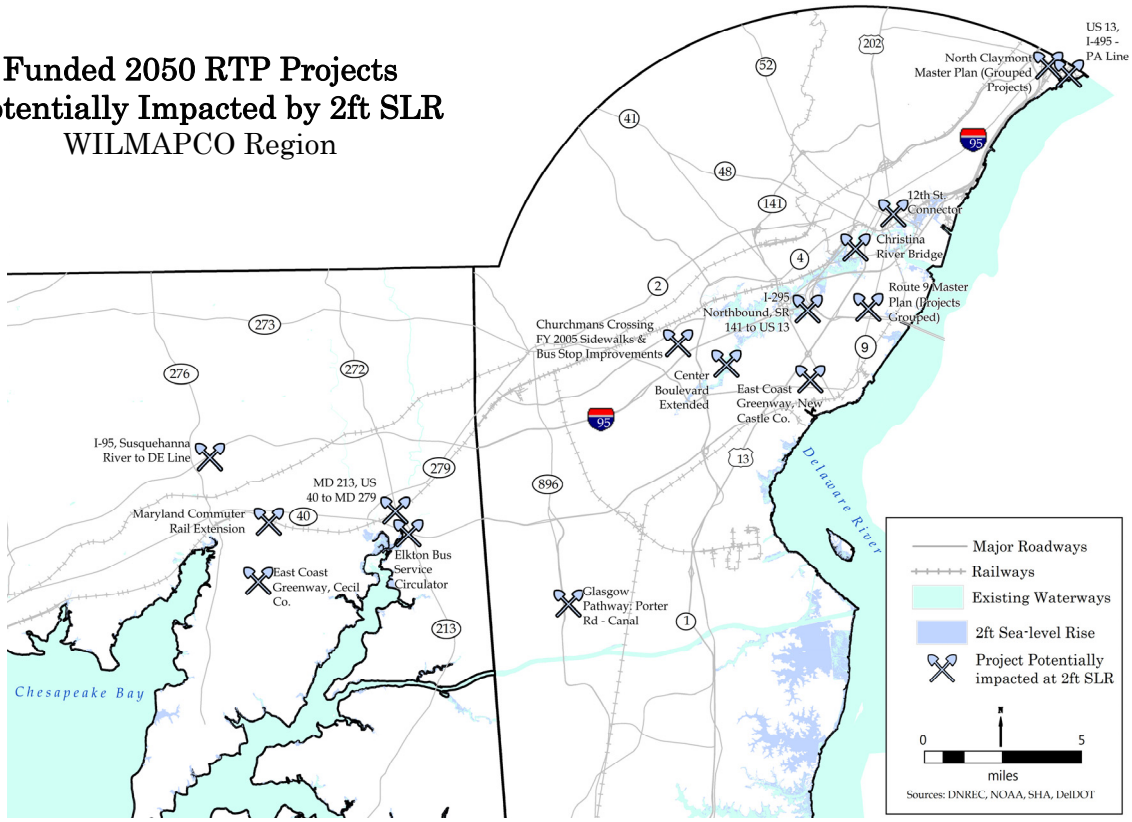
Many transportation projects are planned around locations that may be challenged by SLR. Incorporating SLR adaptation measures—such as raising the height of a road, hardening a shoreline, realigning a railway, or rethinking the project entirely—today will help prepare for tomorrow.

This section represents a high-level, first-cut view of projects from our 2050 Regional Transportation Plan (RTP) potentially challenged by SLR. In many cases, only a small portion of a project may be impacted. And, in many cases, those impacts may be easily resolved. Nevertheless, SLR impacts should be considered as these projects move forward towards implementation.

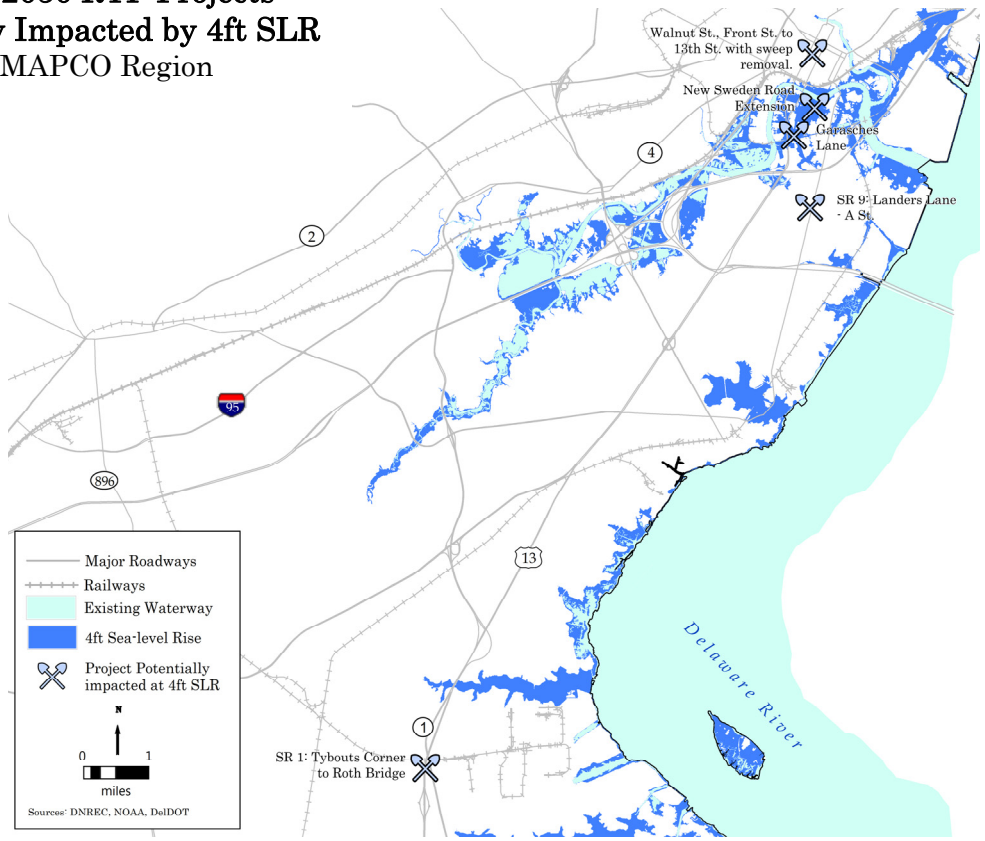
The roadway approaches to the new Christina River Bridge (pictured below), for example, were raised after future SLR impacts were considered during project design.



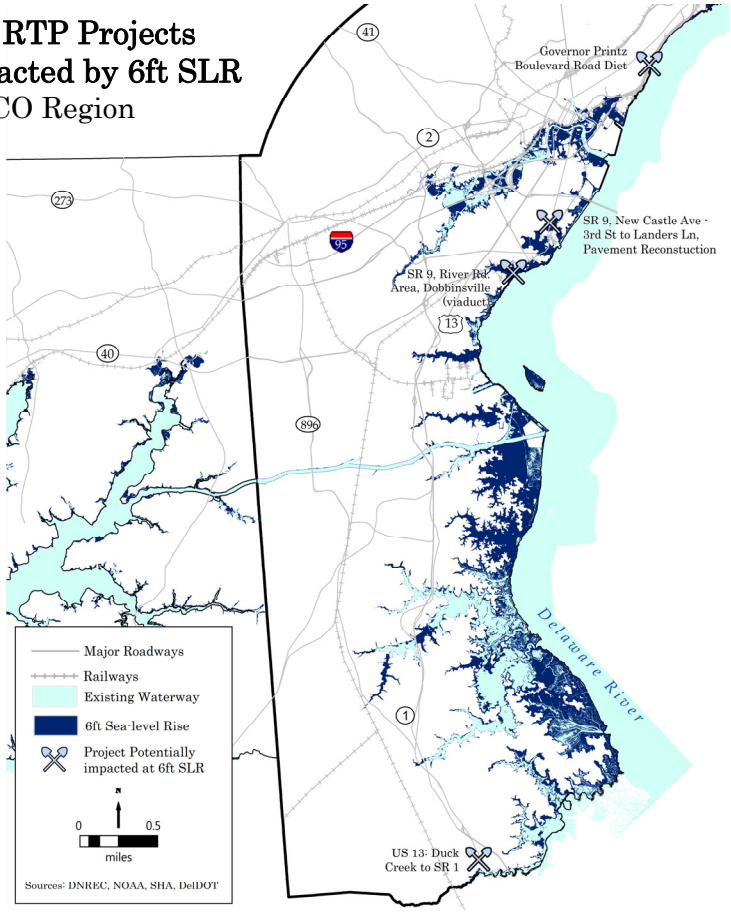
Funded 2050 RTP Projects Potentially Impacted by 2ft SLR
WILMAPCO Region



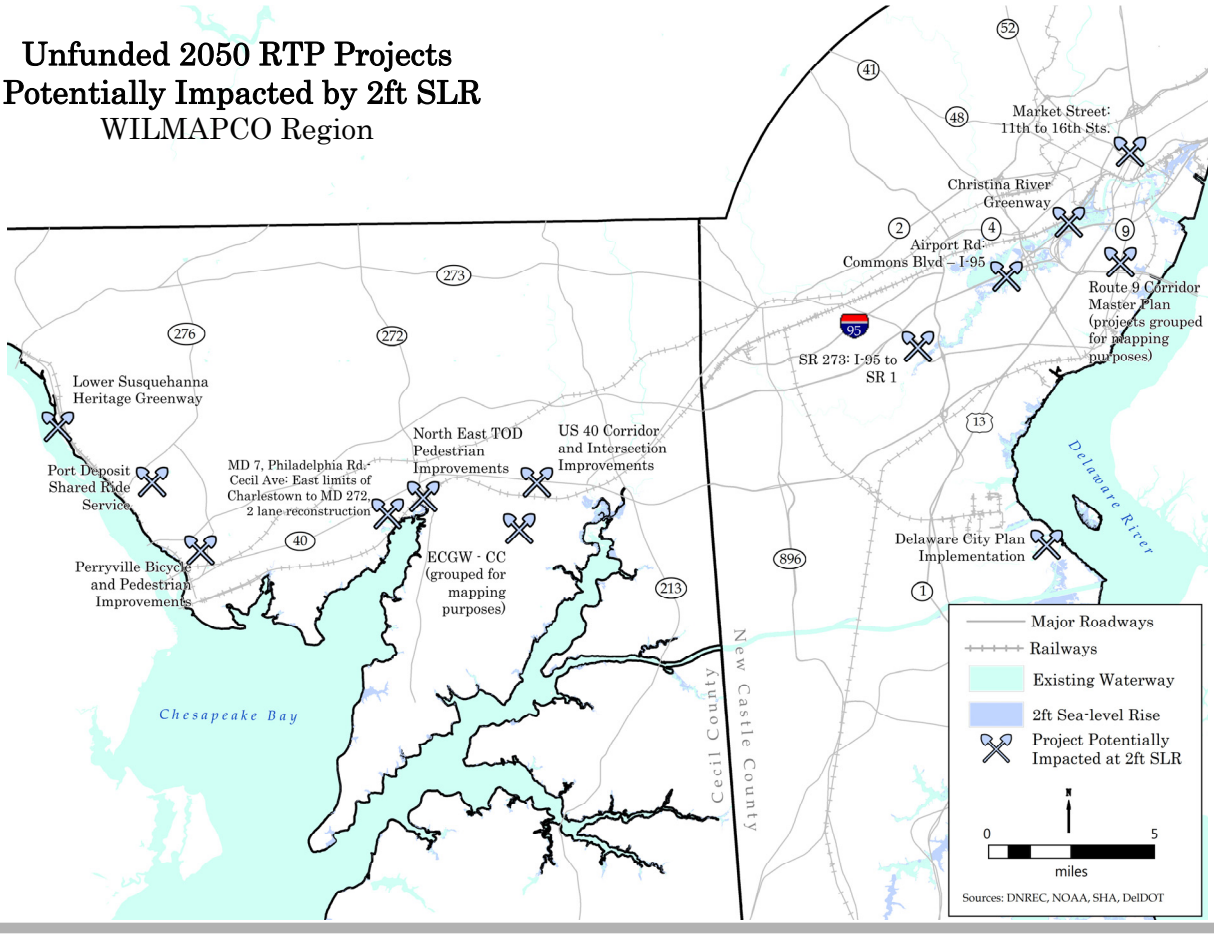
Funded 2050 RTP Projects Potentially Impacted by 4ft SLR
WILMAPCO Region



Funded 2050 RTP Projects Potentially Impacted by 6ft SLR
WILMAPCO Region

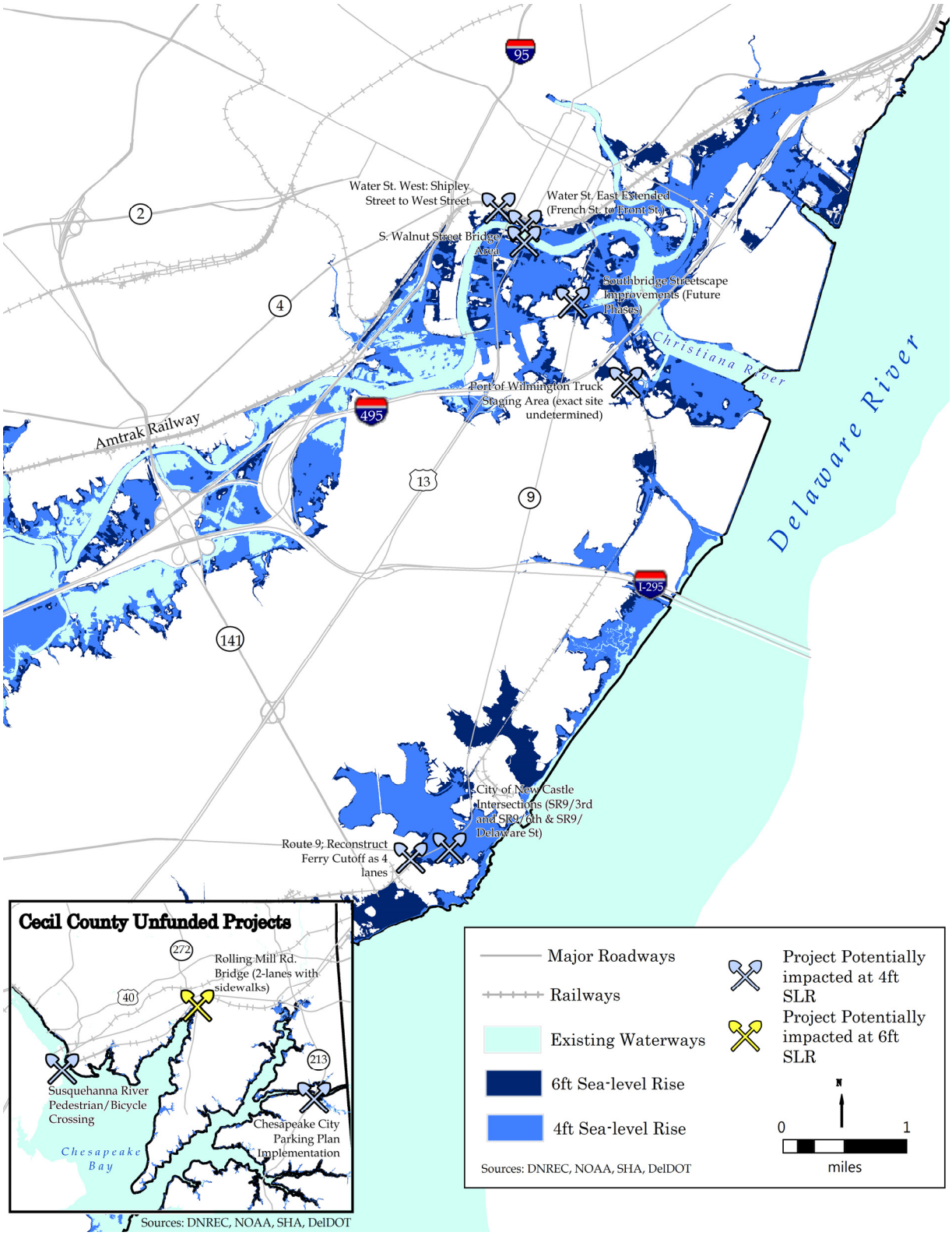


Unfunded 2050 RTP Projects Potentially Impacted by 2ft SLR
WILMAPCO Region



Unfunded 2050 RTP Projects Potentially Impacted by 4ft and 6ft SLR

WILMAPCO Region



Mitigation and Adaptation

The collective response to SLR should be two-pronged. We should first seek to limit greenhouse gas emissions, which drive global warming and SLR. Limiting these emissions now will reduce the severity of future SLR and other climate change impacts.

WILMAPCO's 2050 RTP supports policy to reduce greenhouse gas emissions through lowering vehicle miles traveled, supporting the use of cleaner vehicle fuels, infrastructure and technology, and encouraging an increase of population/employment densities. As shown on the graph to the right, however, we expect an uptick in emissions beginning in the 2040s. New RTP projects that support sharper and more sustained emissions reductions should be identified and pursued.

While it can be lessened, additional SLR is still expected in the coming decades. And while preserving the transportation system is an important aspect to consider, so too are other infrastructures, natural areas, housing, institutions, and businesses. Indeed, there is interplay between these systems, which are often co-dependent on one another. For example, the value of a stretch of highway may be considerably lessened if housing or an industrial development it serves today is abandoned in the future.

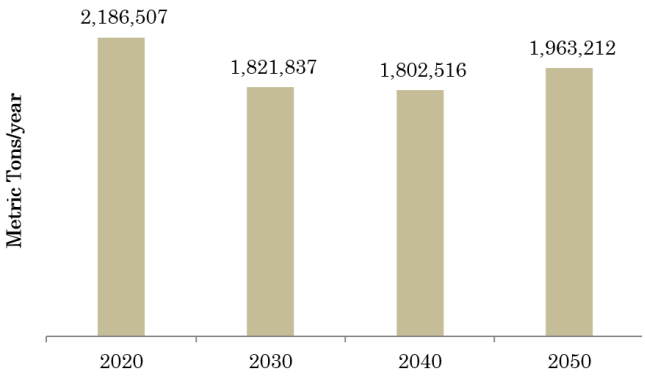
Comprehensive, localized adaptation approaches that consider, plan, and adapt to all impacts are needed. And in places across the region this is already begun.

Adaptation to SLR can take a few forms, including:

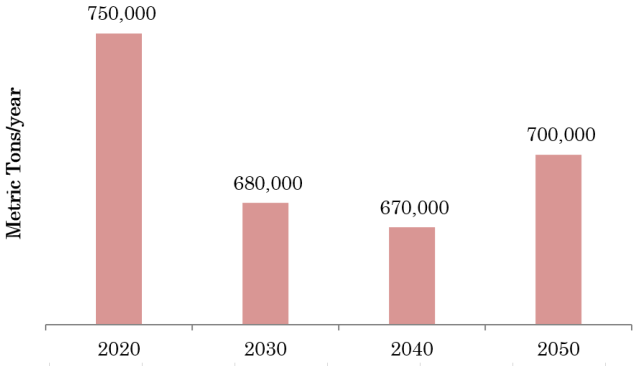
- Fortification (either natural or manmade)
- Raising of structures
- Retreat

The appropriate courses should ultimately be decided locally, considering the wide breadth of impacts SLR may have.

Projected Transportation CO2e Emissions
New Castle County



Projected Transportation CO2e Emissions
Cecil County



WILMAPCO
100 Discovery Boulevard, Suite 800
Newark, DE 19713
Phone: 302.737.6205
Cecil County Toll Free (888) 808-7088
Fax: 302.286.7131
www.wilmapco.org

The Wilmington Area Planning Council (WILMAPCO) is the Metropolitan Planning Organization serving New Castle County, Delaware and Cecil County, Maryland.

This data report is part of a series that summarizes key data to allow both residents and decision-makers to better understand our region.

Other data reports are available at: www.wilmapco.org/data-reports.