East Central Florida
Regional Resiliency Action Plan

Regional Planning for Sea Level Rise Recommendation

Planning for Sea Level Rise

Background

A regional, coordinated approach to planning for sea level rise is important as agencies and communities identify potential risks to infrastructure, plan for future land uses, and determine appropriate mitigation and adaptation measures to minimize the risks of future flooding and inundation. One way that local governments can collaborate is to create sea level rise projections that are jointly developed and utilized across a defined area. Two examples of successful Florida regional coordinated sea level rise adaption workgroups that have undertaken such efforts include:

- The *Southeast Florida Regional Climate Change Compact* which was established in 2010 by Broward, Miami-Dade, Monroe, and Palm Beach Counties as a mechanism for coordinating climate change mitigation, adaption, and associate policy development across the four counties. The Compact's Technical Ad Hoc Working group comprised of experts from local universities, scientists from NOAA and the U.S. Geological Survey, and civil engineers in public service, worked together with the USACE to create 2011, and later, the 2015 Unified Sea Level Rise Projection which establishes a single baseline for regional adaptation planning and provided the foundation for the Southeast Florida Regional Climate Change Action Plan 2.0.

- The Tampa Bay Climate Science Advisory Panel, an ad hoc network of scientists and resource managers in the Tampa Bay region (Pinellas, Hillsborough, Manatee, and Pasco counties) formed in 2014, with the goal of developing recommendations for local governments and regional agencies addressing climate change mitigation strategies associated with sea level rise in the Tampa Bay Region. The Recommended Projection of Sea Level Rise in the Tampa Bay Region was developed by the Panel in 2015. The projection model is used as guidance for the Tampa Bay Regional Planning Council One Bay Resilient Communities workgroup and provided foundation for The Cost of Doing Nothing Report in 2017.

It is important to note that the unified sea level rise projections reached by both groups are regionally specific and rely on tidal gauge data sourced from within each region.

Summary

The East Central Florida Regional Resiliency Action Plan Planning for Sea Level Rise Sub-Committee, comprised of federal, regional and local experts, academia and planners across sectors, developed a regional planning approach to sea level rise. The purpose of this approach is to provide local governments and regional agencies with a coordinated and vetted approach to planning for sea level rise. The recommended sea level rise range developed by the Sea Level Rise Sub-Committee provides a flexible approach to sea level rise planning as no one projection rate curve should be used for planning purposes across the board.

To date in the east central Florida region, most vulnerability analyses conducted have been based on the U.S. Army Corps of Engineers 2013 sea level rise projections. ER 1100-2-8162 is the current USACE guidance for calculating Sea Level Change curves. These curves represent the range of potential future sea level change conditions considered by USACE planners and engineers. These curves were the first to be included in the Florida Department of Transportation funded Sea Level Scenario Sketch Planning Tool developed by the UF Geoplan Center in 2012 to help identify transportation infrastructure vulnerable to current and future flood risks. In phase three of the tool, improvements were made to analyze and visualize current flood risks (100-year and 500-year floodplains and hurricane storm surge zones) as well as future flood risks from sea level rise using the 2012 National Oceanic and Atmospheric Administration (NOAA)/ National Climate Assessment data.

In the 2017 update of the FEMA Community Rating System Manual (CRS), more emphasis was placed on future conditions and impacts of climate change in section 116.c of the CRS Manual by providing credit for communities that:

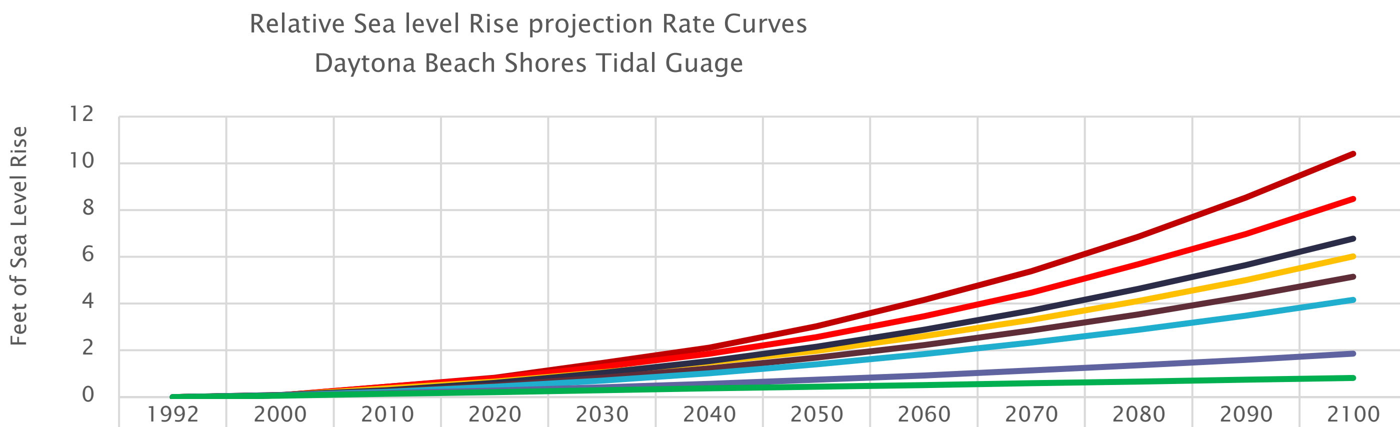
- provide information about areas (not mapped on the FIRM) that are predicted to be susceptible to flooding in the future because of climate change or sea level rise;
- demonstrate that it has programs that minimize increases in future flooding; use regulatory flood elevations in the V and coastal A Zones that reflect future conditions, including sea level rise;
- advise prospective property buyers of the potential for flooding due to climate changes and/or sea level rise; base regulatory map on future-conditions hydrology, including sea level rise; when a community accounts for sea level rise in managing its coastal A Zones;
- regulates runoff from future development in the stormwater program;
- manages future peak flows in the watershed master plan so that they do not exceed present values;
- address impacts of sea level rise in the watershed master plan (coastal communities);
- conducts flood hazard assessment and problem analysis to address areas likely to flood and flood problems that are likely to get worse in the future, including (1) changes in floodplain development and demographics, (2) development in the watershed, and (3) climate change or sea level rise.

According to the guidance in Section 404 of the manual, the CRS has adopted the base minimum projection for sea level rise for the purpose of CRS credits and prerequisites. "*The "intermediate-high" projection for 2100, as included in the report Global Sea Level Rise Scenarios for the United States National Climate Assessment (National Oceanic and Atmospheric Administration, 2012, https://scenarios.globalchange.gov/sites/default/files/NOAA_SLR_r3_0.pdf), is the minimum projection that must be used for CRS purposes. Communities may use other projections provided that they are equal to or greater to NOAA's "intermediate-high" projection for 2100.*"

Also in 2017, as part of the science update for the Fourth National Climate Assessment, NOAA updated its projection rate curves based on the most updated data, science, modeling, literature and technical expertise. NOAA's technical report, NOAA Technical Report NOS CO-OPS 083, provides further information concerning the 2017 Global and Regional Sea Level Rise Scenarios for the United States. These curves exceed the previous projections from 2012. NOAA 2017 projections are "grounded" in 2000, while the NOAA 2012 and USACE curves are "grounded" in 1992 (different tidal epochs). This means that when comparing the mean sea level projections for NOAA 2012 and NOAA 2017 in the USACE sea level change calculator, NOAA 2012 for intermediate high shows 0.08 feet for the year 2000, while NOAA 2017 shows 0.00 feet for high in 2000. Therefore, the calculator settings must be adjusted to compensate for the different tidal epochs and provide a comparable starting point. This is accomplished by checking the box "Adjust to MSL (83-01) Datum" in the calculator when assessing NOAA 2017 curves.

The figure below illustrates the NOAA 2012, USACE 2013 and the NOAA 2017 sea level rise projection rate curves after epoch adjustment.

Figure 1: All Relative Sea Level Rise Projection Rate Curves



	1992	2000	2010	2020	2030	2040	2050	2060	2070	2080	2090	2100
NOAA2017 Extreme	0	0.08	0.44	0.83	1.46	2.11	3.03	4.15	5.39	6.87	8.54	10.41
NOAA 2017 High	0	0.08	0.44	0.8	1.29	1.85	2.57	3.46	4.47	5.69	6.97	8.48
NOAA2017 Int-High	0	0.08	0.38	0.67	1.06	1.49	1.98	2.61	3.3	4.12	5	6.02
NOAA 2012 High	0	0.09	0.3	0.61	1.03	1.54	2.16	2.88	3.7	4.63	5.65	6.78
USACE 2013 High	0	0.09	0.26	0.5	0.83	1.22	1.69	2.23	2.85	3.54	4.31	5.15
NOAA 2012 Int High	0	0.08	0.23	0.44	0.7	1.02	1.4	1.84	2.33	2.88	3.49	4.16
USACE 2013 Int NOAA 2012 Int Low	0	0.07	0.17	0.28	0.42	0.57	0.74	0.93	1.14	1.36	1.6	1.86
USACE Low NOAA 2012 Low	0	0.06	0.14	0.21	0.29	0.37	0.44	0.52	0.59	0.67	0.75	0.82

Based upon the latest updates to the NOAA projection rate curves, the 2017 CRS Manual update, and the past sea level rise vulnerability assessments, as well as the findings from NOAA Technical Report NOS CO-OPS 083 concerning the current and future occurrence of nuisance flooding, the sub-committee developed an approach to implementing these projections into planning processes and plans. The formal recommendation of the sub-committee is described in the following pages.

Formal Recommendation

The East Central Florida Regional Resiliency Action Plan's sea level rise projection sub-committee provides the following recommendation for the east central Florida region for planning for sea level rise:

No one projection rate curve should be used for planning purposes across all projects and programs. Instead, a range of rise should be considered based upon the vulnerability, allowable risk, and project service life and the forecast project "in-service" date of a facility or development. The range should include a minimum rise of 5.15 feet by 2100 (2013 USACE High) with an upper range of 8.48 feet by 2100 (2017 NOAA High). Short-term planning should consider impacts out to 2040 (20-year planning horizon), medium-term planning should consider impacts out to 2070 (50-year planning horizon), and long-term planning should extend out to 2100 (80-year planning horizon). Adaptation plans of the community should also be taken into consideration when planning, engineering and constructing infrastructure relative to sea level rise and flooding to ensure consistency with community development plans.

Upper Bound Description

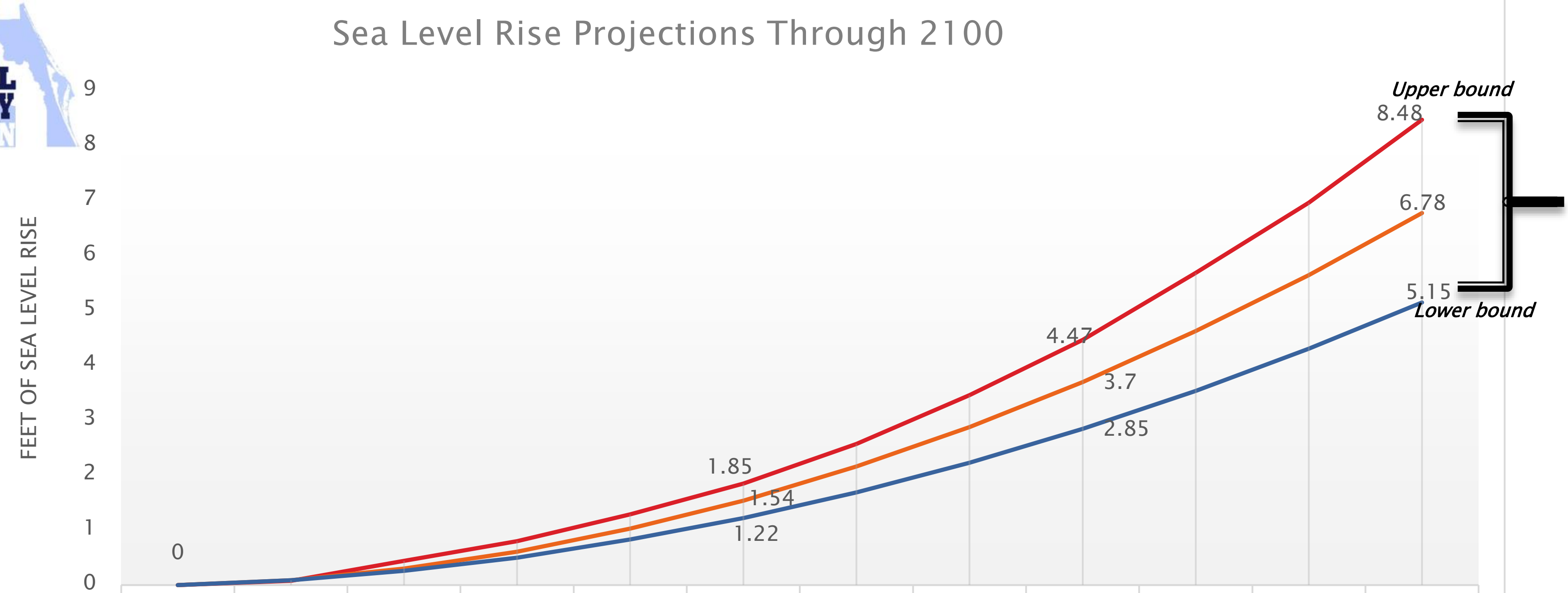
The sea level rise estimates associated with the NOAA 2017 high rate curve are recommended as the upper bound of the planning scenario. These data are recommended for assessment and adaptation, mitigation and minimization planning of those facilities that have little risk tolerance and long functional life span, as well as new/proposed (re)development or significant intensification on previously minimally developed land that may be on future fringes of vulnerable areas. The upper bound of sea level rise planning should consider the local estimate for the forecasted year of facility life expectancy based on in-service date. USACE guidance requires a 100 year potential service life of large infrastructure projects. These projects along with new community development projects should include an approved adaptation strategy prior to construction consistent with the community's adaptation plan. It is recommended that facilities necessitating an upper bound of sea level rise planning are recommended to plan for a minimum rise in sea level of 1.85 feet by 2040, 4.47 feet by 2070 and 8.48 feet by 2100.

Lower Bound Description

The recommended minimal or lower bound of planning level for consideration is the USACE 2013 High Rate Curve or a minimum planning of 5.15 feet of rise by 2100 (1.22 ft. by 2040 and 2.85 ft. by 2070). This minimal planning level would be recommended for facilities that are less vulnerable, have a greater risk tolerance to flooding, are of little impact in terms of the health, safety and welfare of the community, facilities with a short time-frame of functionality or facilities that are easily relocated or planned for relocation. Using the USACE 2013 High Rate Curve as a minimum ensures that CRS activities applying even this lower bound are eligible for CRS credits under the 2017 manual.

The following figure illustrates the recommended range for sea level rise planning and includes the projected rise in sea level by decade. The 2012 NOAA High projection is included for reference to illustrate the change in projection for this rate curve since the initial 2012 assessment.

Figure 2: ECF Regional Resiliency Action Plan Recommended Bounds for Planning for Sea Level Rise; Daytona Beach Shores Tidal Gauge



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