2023 COASTAL MASTER PLAN

FUTURE WITH MASTER PLAN OUTPUTS, REGIONAL SUMMARIES - RISK

ATTACHMENT C6

REPORT: VERSION 02
DATE: MARCH 2023
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COASTAL PROTECTION AND RESTORATION AUTHORITY

This document was developed in support of the 2023 Coastal Master Plan being prepared by the Coastal Protection and Restoration Authority (CPRA). CPRA was established by the Louisiana Legislature in response to Hurricanes Katrina and Rita through Act 8 of the First Extraordinary Session of 2005. Act 8 of the First Extraordinary Session of 2005 expanded the membership, duties, and responsibilities of CPRA and charged the new authority to develop and implement a comprehensive coastal protection plan, consisting of a master plan (revised every six years) and annual plans. CPRA's mandate is to develop, implement, and enforce a comprehensive coastal protection and restoration master plan.

CITATION

Johnson, D. R., Fischbach, J. R., Kane, P., Wang, J., & Wilson, M. (2023). 2023 Coastal Master Plan: Attachment C6: Future With Master Plan Model Outputs, Regional Summaries – Risk. Version 2. (p. 60). Baton Rouge, Louisiana: Coastal Protection and Restoration Authority.

ACKNOWLEDGEMENTS

This document was developed as part of a broader Model Improvement Plan in support of the 2023 Coastal Master Plan under the guidance of the Modeling Decision Team:

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LIST OF ABBREVIATIONS

ADCIRC .... ADVANCED CIRCULATION MODEL
AEP .... ANNUAL EXCEEDANCE PROBABILITY
ATD .... ATCHAFALAYA DELTA
CLARA .... COASTAL LOUISIANA RISK ASSESSMENT MODEL
CPRA .... COASTAL PROTECTION AND RESTORATION AUTHORITY
EADD .... EXPECTED ANNUAL DAMAGE IN DOLLARS
EASD .... EXPECTED ANNUAL STRUCTURAL DAMAGE
ETB .... EASTERN TERREBONNE
FWOA .... FUTURE WITHOUT ACTION
FWP .... FUTURE WITH PROJECTS
IP1 .... IMPLEMENTATION PERIOD 1
IP2 .... IMPLEMENTATION PERIOD 2
IPET .... INTERAGENCY PERFORMANCE EVALUATION TASKFORCE
LBANW .... LOWER BARATARIA NORTHWEST
MBA .... MID BARATARIA
MTTG .... MORGANZA TO THE GULF
NAVD88 .... NORTH AMERICAN VERTICAL DATUM OF 1988
SLR .... SEA LEVEL RISE
SWAN .... SIMULATING WAVES NEARSHORE MODEL
UBA .... UPPER BARATARIA
UNC .... UNCLASSIFIED
USACE .... UNITED STATES ARMY CORPS OF ENGINEERS
VRT .... VERRET
WTE .... WESTERN TERREBONNE

1.0 INTRODUCTION

1.1 PURPOSE OF THIS REPORT

This report describes the simulation modeling results projecting coastal flood risk and damage over a 50-year period in a future with implementation of various structural flood protection projects designed to reduce risk to communities across the Louisiana coast. This is referred to as future with projects (FWP). Results described in this analysis were simulated with the coupled ADCIRC+SWAN surge and wave models and the Coastal Louisiana Risk Assessment (CLARA) model to inform the development of Louisiana's 2023 Coastal Master Plan.

Results are presented for two environmental scenarios representing different rates of future sea level rise (SLR), changes to hurricane intensity, and other key environmental factors (Coastal Protection and Restoration Authority [CPRA], 2023a). Flood damage results also reflect one scenario of projected future population change in Louisiana's coastal parishes. A future without action (FWOA) under these same conditions serves as a baseline against which individual risk reduction projects and the 2023 Coastal Master Plan can be compared to evaluate benefits. However, the scenarios shown represent only two of many possible futures for the Louisiana coast and should be interpreted as plausible projections rather than likely predictions for future flood risk outcomes.

This document is not intended to provide a comprehensive evaluation of the structural risk reduction projects considered by the 2023 Coastal Master Plan. Instead, this document provides illustrative results for five of the projects, each of which was selected for inclusion in the master plan. These five are the Iberia/St. Mary Upland Levee (Central Coast), Morganza to the Gulf (MTTG) (Terrebonne), Upper Barataria Risk Reduction (Barataria), Lafitte Ring Levee (Barataria), and Slidell Ring Levee (Pontchartrain/Breton) projects.

This report should be of interest to CPRA and technical professionals and researchers in the field of flood risk assessment.

1.2 THE CLARA MODEL

The CLARA model was originally created by researchers at RAND Corporation to support development of Louisiana's 2012 Coastal Master Plan. It is designed to estimate flood depth exceedances, direct economic damage exceedances, expected annual damage in dollars (EADD), and expected annual structural damage (EASD) in the Louisiana coastal zone. The model uses high-resolution hydrodynamic simulations of storm surge and waves as inputs. Monte Carlo simulation is used to estimate risk under a range of assumptions about future environmental and economic conditions and with different combinations of structural and nonstructural risk reduction projects on the landscape.

The CLARA model is well described in prior peer-reviewed and published literature, so this report does not include detailed descriptions of the basic methodological approach and assumptions. For interested readers, an introduction to the model can be found in Johnson et al., 2023 (describing the methodology as applied in the 2023 analysis), Fischbach et al. (2012), and Johnson et al. (2013). Model improvements for the 2017 Coastal Master Plan are described in Fischbach et al. (2017), and published examples of CLARA model results can be found in Fischbach et al. (2019), Meyer and Johnson (2019), and Fischbach et al. (2017). Model improvements for Louisiana's 2023 Coastal Master Plan are described in Fischbach et al. (2021).

CLARA estimates flood depths at different annual exceedance probabilities ([AEPs]; e.g., 1% AEP is the 1-in-100 annual chance flood depth) for grid cells across the Louisiana coast. In addition to depth results, two primary metrics are presented for flood exposure and damage estimates from the CLARA model in this report: 1) the exposure of single-family residences to flooding at one of three severity thresholds; and 2) projected flood damage across all asset types summarized as EADD or EASD, an alternate metric designed to be less sensitive to high-value assets in comparatively wealthier areas. The exposure thresholds are based on flood depths with a 2% AEP (1-in-50 annual chance of occurring), and the comparisons are based on a structure inventory estimated for Year 0 that does not vary over time.[1] The three thresholds are:

- **Structures Where Flooded**: CLARA model projections show non-zero flood depths for the grid cell in which the structure is located.
- **Moderate Exposure:** CLARA model projections show flood depths above the first-floor elevation of the structure — a threshold beyond which moderate to major damage is expected to occur.
- **Severe Exposure**: CLARA model projections show flood depths that are 2 or more ft above the first-floor elevation of the structure — major damage to structure and contents would be expected.

Critical infrastructure may have site-specific hardening measures or may not have a first-floor elevation, so for these assets, exposure thresholds are based on depths above the topographic elevation assigned to the grid cell where the infrastructure element is located. Results are mapped for

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[1] CLARA damage estimates account for population change over time (see Hauer et al., 2022), but these changes are not directly incorporated into the inventory of structures. As a result, structure exposure is based on the inventory at Year 0, and the number of structures remains fixed over the period of analysis. For more information, see Fischbach et al. (2021).

each community and summarized across the region as a whole. Mapped and tabular exposure results discussed in this report highlight the percent of homes and critical infrastructure at or above the moderate exposure threshold. Methods used for estimating EADD and EASD with CLARA are described in separate reports (Fischbach et al., 2021; Johnson et al., 2023).

1.3 ORGANIZATION OF THIS REPORT

This report is organized around five representative risk reduction projects selected for inclusion in the 2023 Coastal Master Plan. These five projects are located across four coastal regions. From west to east, these are the Iberia/St. Mary Upland Levee (Central Coast region), MTTG (Terrebonne region), Upper Barataria Risk Reduction (Barataria region), Lafitte Ring Levee (Barataria region), and Slidell Ring Levee (Pontchartrain/Breton region) projects. Each chapter provides a descriptive overview of the project, including key features, costs, and the communities it is intended to protect. Next, the report presents CLARA estimates of flood depths and damage impacts, with a focus on flood depths with a 1% AEP, matching the level of protection commonly used as a design standard. Damage impacts are also summarized as EADD and EASD.

2.0 STRUCTURAL RISK REDUCTION

2.1 CANDIDATE STRUCTURAL PROTECTION PROJECTS

This report highlights the risk reduction potential estimated for five of the structural protection projects recommended for implementation by the 2023 Coastal Master Plan: Iberia/St. Mary Upland Levee, MTTG, Upper Barataria Risk Reduction, Lafitte Ring Levee, and Slidell Ring Levee (Figure 1). Each project was selected for construction in Implementation Period 1 (IP1) based on its substantial contributions to coastwide risk reduction and overall cost effectiveness in the range of scenarios modeled for project selection by the Planning Tool (Wilson et al., 2022). For more information on all structural projects considered for the master plan, please see Attachment F2: Project Fact Sheets (CPRA, 2023b).

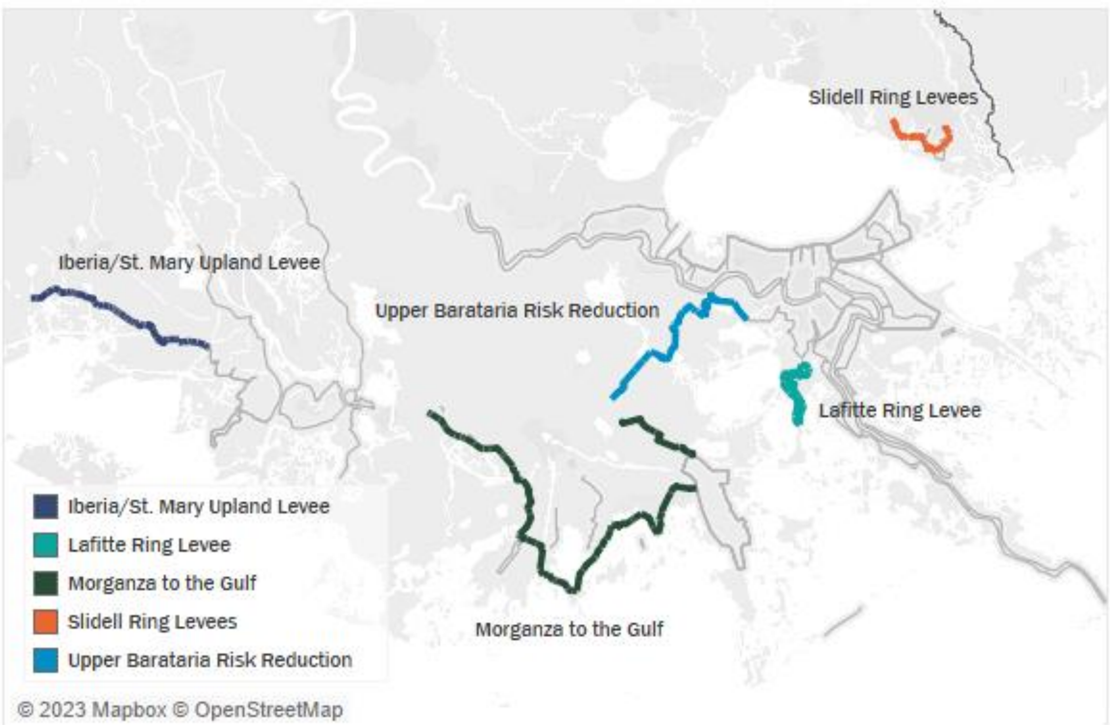

Figure 1. Map of candidate structural protection projects discussed in this report. Light gray lines show structural projects included in initial conditions and FWOA simulations, while thicker lines highlight the five structural protection projects discussed in this report.

2.2 EVALUATION OF PROJECT IMPACTS

When translating flood depth exceedances to damage exceedances, impacts are greatest in areas with a combination of developed assets and substantial flood hazard. As one indicator of these conditions, CLARA tracks the number of structures with moderate exposure to flooding, defined as experiencing flooding above the first-floor elevation (i.e., above the foundation) of a building from a 1-in-50 annual chance flood event (2% AEP). This attachment also reports the exposure of various categories of critical infrastructure, with moderate exposure defined as inundation occurring in the grid cell of the infrastructure element's location from a 1-in-50 annual chance flood event (2% AEP). In addition to exposure from a 2% AEP flood depth, flood depths are also shown in this report for floods with a 1% AEP; which is analogous to the "100-year" flood that has historically been used when delineating flood zones in FEMA flood insurance map products.

The primary metrics used for project selection by the Planning Tool, however, are EADD and EASD. These metrics indicate the average losses that would occur in any given year under a fixed set of underlying conditions, such as the physical landscape (e.g., topographic and bathymetric elevations), the mean arrival rate of storms, and the joint probability distribution of their characteristics at landfall. Specific details on how these metrics are calculated are found in Johnson et al. (2021).

Risk is aggregated and reported at the community level using a set of named communities defined as collections of CLARA grid cells which reflect census designations and local identities. When describing the areas impacted by each project, the Risk Assessment Team examined the extent of changes to flood depth exceedances and risk metrics at multiple return periods and across all modeled scenarios; while project impacts (i.e., differences between the FWOA condition and a FWP implemented) are generally greatest in Year 50 of the higher environmental scenario, this is not always the case. In addition to communities that benefit from each project, this report also highlights communities that may face increased risk due to induced flooding *in front* of structural alignments (i.e., on the unprotected, coastward side where surge originates).

3.0 IBERIA/ST. MARY UPLAND LEVEE

The Iberia/St. Mary Upland Levee project was selected in IP1 of the 2023 Coastal Master Plan and provides storm surge-based risk reduction for the community of New Iberia as well as areas further south, such as Jeanerette, Lydia, and the Port of Iberia. The project consists of a levee at elevations between 15.5 to 20 ft (North American Vertical Datum of 1988 [NAVD88]) and spans approximately 150,000 ft of earthen levee with approximately 15,000 ft of T-wall and numerous gates and pump stations, with an estimated cost of $1.7 billion (Figure 2). It intersects two other Central Coast structural protection projects selected for Implementation Period 2 (IP2), the Abbeville and Vicinity project to the west and Franklin and Vicinity project to the east.

Much of the risk reduction provided by this project is realized in the later years of the CLARA model projections described herein, as SLR, subsidence, and continued land loss over the 50-year period are expected to lead to increased flood risk in areas north of U.S. 90, especially in New Iberia. A similar levee project was among several evaluated in the U.S. Army Corps of Engineers' (USACE) South Central Coast Louisiana Study (USACE, 2022), which ultimately targeted nonstructural projects as the preferred alternative. CPRA will partner with USACE to implement the nonstructural risk reduction measures identified, as it is the most practical path to help these communities adapt to flood risk in the near-term.

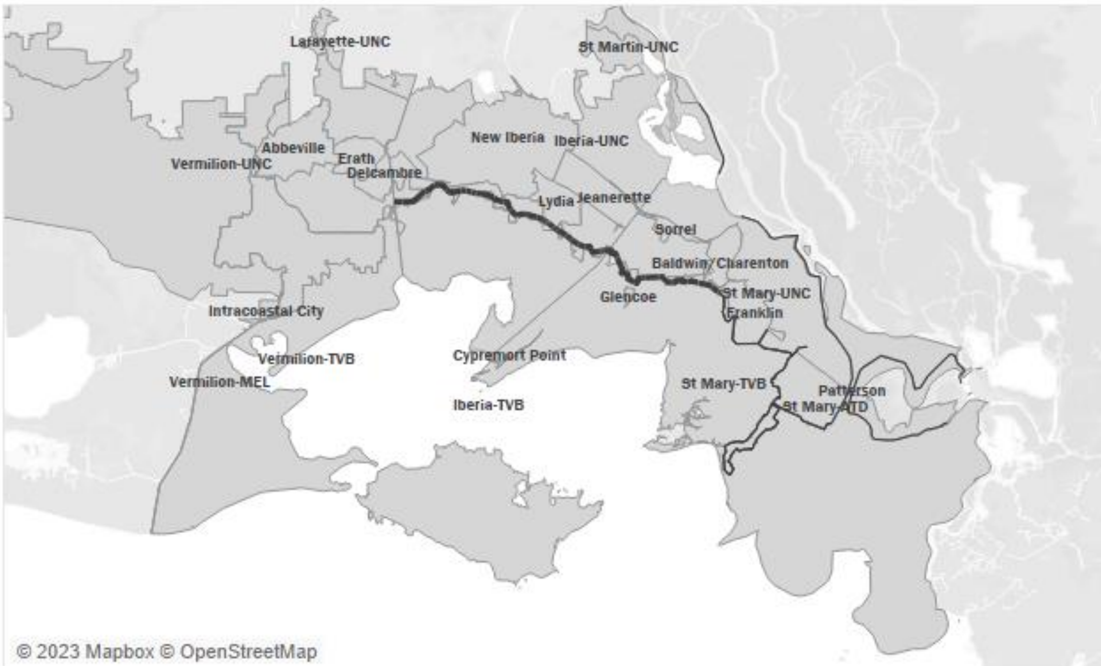

Figure 2. Map of the Iberia/St. Mary Upland Levee project and affected communities. Thin dark gray lines show structural projects included in initial conditions and FWOA simulations, while the thicker black line highlights the proposed new project.

3.1 FLOOD DEPTH IMPACTS

Flood depths with a 1% AEP are substantial in some communities located immediately behind the Iberia/St. Mary Upland Levee project. For example, the projected flood depths in Lydia increase from approximately 14-15 ft in Year 20 to approximately 20 ft by Year 50 of the higher environmental scenario (Figure 3). Communities further inland, such as New Iberia and Jeanerette, also experience flooding of 1-6 ft from a 1% AEP flood in Year 50, although most areas north of U.S. 90 remain dry at the 1% AEP in Year 20. Exceptions occur between U.S. 90 and Bayou Teche south of New Iberia and in the vicinity of Baldwin and Charenton at the eastern edge of the project footprint.

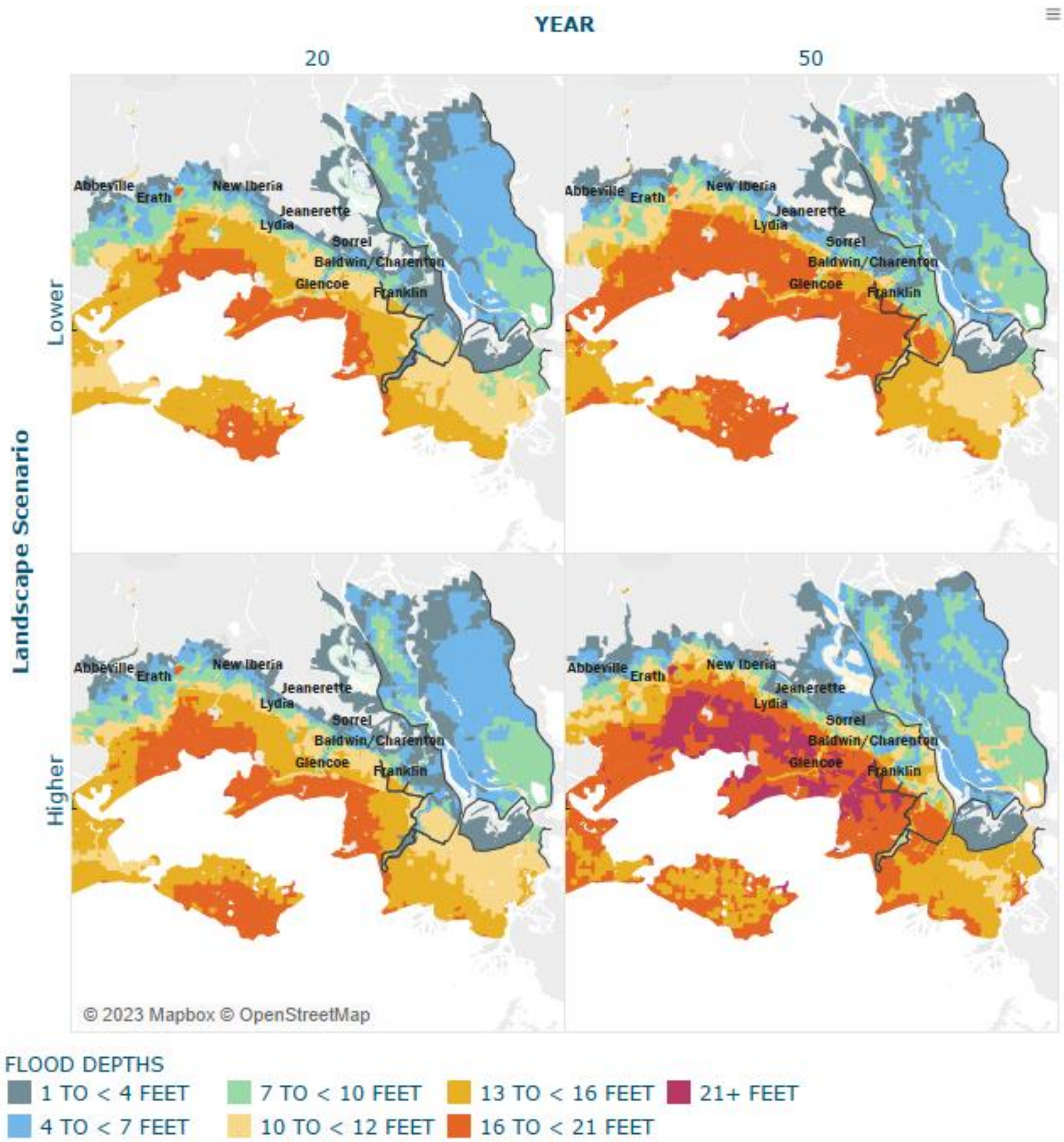

Figure 3. FWOA 1% AEP (1in-100 annual chance) flood depths in Years 20 and 50 in the Central Coast region — Interagency Performance Evaluation Taskforce (IPET) fragility, 50% pumping scenario, 50th percentile.

With the Iberia/St. Mary Upland Levee in place, 1% AEP flooding is eliminated in Year 20 north of U.S. 90, except for 1-3 ft of flooding near Baldwin (Figure 4). Inundation of 1-5 ft along the back side of the levee in Year 20 appears to primarily be driven by overtopping rather than surge propagating around the western terminus of the project, as evidenced by nearly identical patterns of inundation with implementation of other master plan projects, including the Abbeville and Vicinity project.

In Year 50 of the lower environmental scenario, the project still provides similar reduction in 1-in-100 annual chance flood depths, preventing inundation of communities north of U.S. 90. However, in the higher environmental scenario, up to 8 ft of flooding still extends across the highway, reaching areas such as Jeanerette, Baldwin, and Charenton. South of the highway, the project provides approximately 6-8 ft of depth reduction at the 1% AEP in the lower scenario, with a corresponding reduction of 3-6 ft in the higher scenario. Benefits extend west to Vermilion Bayou in Abbeville, with reductions of 2 ft or less in Erath and parts of Abbeville east of the bayou.

In front of the levee project, 100-year flood depths increase by up to 4 ft due to induced surge and water piling up at the foot of the levee. Developed areas impacted by the inducement are primarily Glencoe and the Avery Island salt dome.

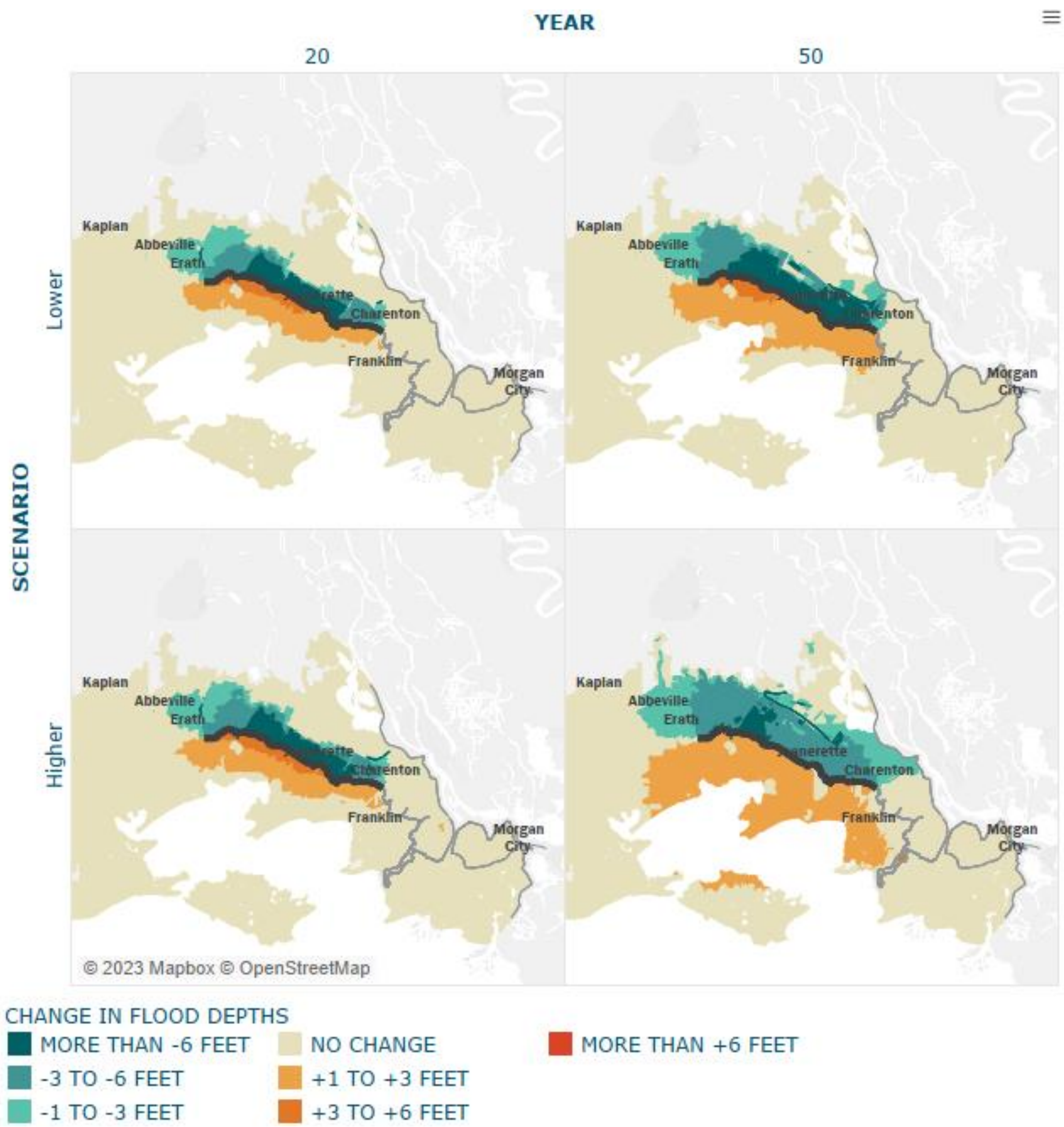

Figure 4. Change in 1% AEP (1-in-100 annual chance) flood depths with Iberia/St. Mary Upland Levee project in place – IPET fragility, 50% pumping scenario, 50th percentile. Thin gray lines show structural projects included in initial conditions and FWOA simulations, while the thicker black line highlights the proposed new project.

3.2 FLOOD DAMAGE IMPACTS

When translating flood depth exceedances to damage exceedances, impacts are greatest in areas with a combination of developed assets and substantial flood hazard. As one indicator of these conditions, CLARA tracks the number of structures with moderate exposure to flooding, defined as experiencing flooding above the first floor elevation (i.e., above the foundation) of a building from a 1-in-50 chance flood event (2% AEP; Table 1).

Table 1. Change in residential exposure to 2% AEP (1-in-50 annual chance) flooding with the Iberia/St. Mary Upland Levee project in place

COMMUNITY NAME	TOTAL STRUCTURES	FWOA EXPOSURE	FWP EXPOSURE	EXPOSURE CHANGE	EXPOSURE CHANGE (%)
NEW IBERIA	19,147	5,628	4,143	-1,485	-26%
LYDIA	1,388	1,148	254	-894	-78%
IBERIA-UNC	3,931	1,925	1,539	-386	-20%
ST MARY-UNC	2,198	1,265	947	-318	-25%
VERMILION-UNC	11,165	6,516	6,317	-199	-3%
JEANERETTE	3,235	347	239	-108	-31%
BALDWIN/CHARENTON	1,877	743	636	-107	-14%
SORREL	430	136	69	-67	-49%
ABBEVILLE	6,767	3,624	3,576	-48	-1%
LAFAYETTE-UNC	1,196	179	154	-25	-14%
ERATH	1,706	1,706	1,697	-9	-1%
DELCAMBRE	1,644	1,630	1,624	-6	0%
LAKE ARTHUR	1,647	395	398	3	1%
ST MARY-ATD	449	333	336	3	1%
GLENCOE	88	79	87	8	10%
GUEYDAN	903	467	477	10	2%
FRANKLIN	3,853	3,315	3,370	55	2%
TOTAL	**61,624**	**29,436**	**25,863**	**-3,573**	**-12%**

NOTES: Results reflect exposure of small residential structures in Year 50 of the lower scenario at the moderate exposure threshold (depths above first floor elevation). Communities with no change in exposure are omitted. Suffixes on some community names denote ecoregions: UNC – Unclassified, ATD – Atchafalaya Delta.

In Lydia, approximately 60% of structures face a moderate level of exposure in Year 20 FWOA, rising to 75% in Year 50 of the lower scenario and 89% in the higher scenario. However, with the Iberia/St.

Mary Upland Levee project in place, exposure is reduced by approximately 80% throughout the planning horizon compared to FWOA, with the exception that hazardous conditions start to overwhelm the project benefits by Year 50 of the higher scenario, resulting in only a 43% reduction in exposure. By contrast, reductions in exposure in New Iberia are a relatively consistent 28-37% in all time periods and scenarios, and benefits increase over time in the higher scenario in the Baldwin/Charenton community (20% reduction in moderate exposure in Year 20 compared to a 31% reduction in Year 50).

When considering the average benefits over events with a wide range of AEPs, the Lydia, New Iberia, and Baldwin/Charenton communities see the majority of benefits in terms of EADD and EASD reductions, as well (Figure 5). The project is estimated to reduce both EADD and EASD by approximately 89% in Year 20 and 77% in Year 50, with similar outcomes in both environmental scenarios (Figure 6). New Iberia's EADD and EASD are reduced by 73-80% in Year 20 and 61-69% in Year 50 (community-specific outcomes not shown). Benefits in Baldwin/Charenton are relatively higher in the lower environmental scenario, with a 43% reduction in EADD and 36% reduction in EASD in Year 50, compared with reductions of 29% in both metrics in the higher scenario.

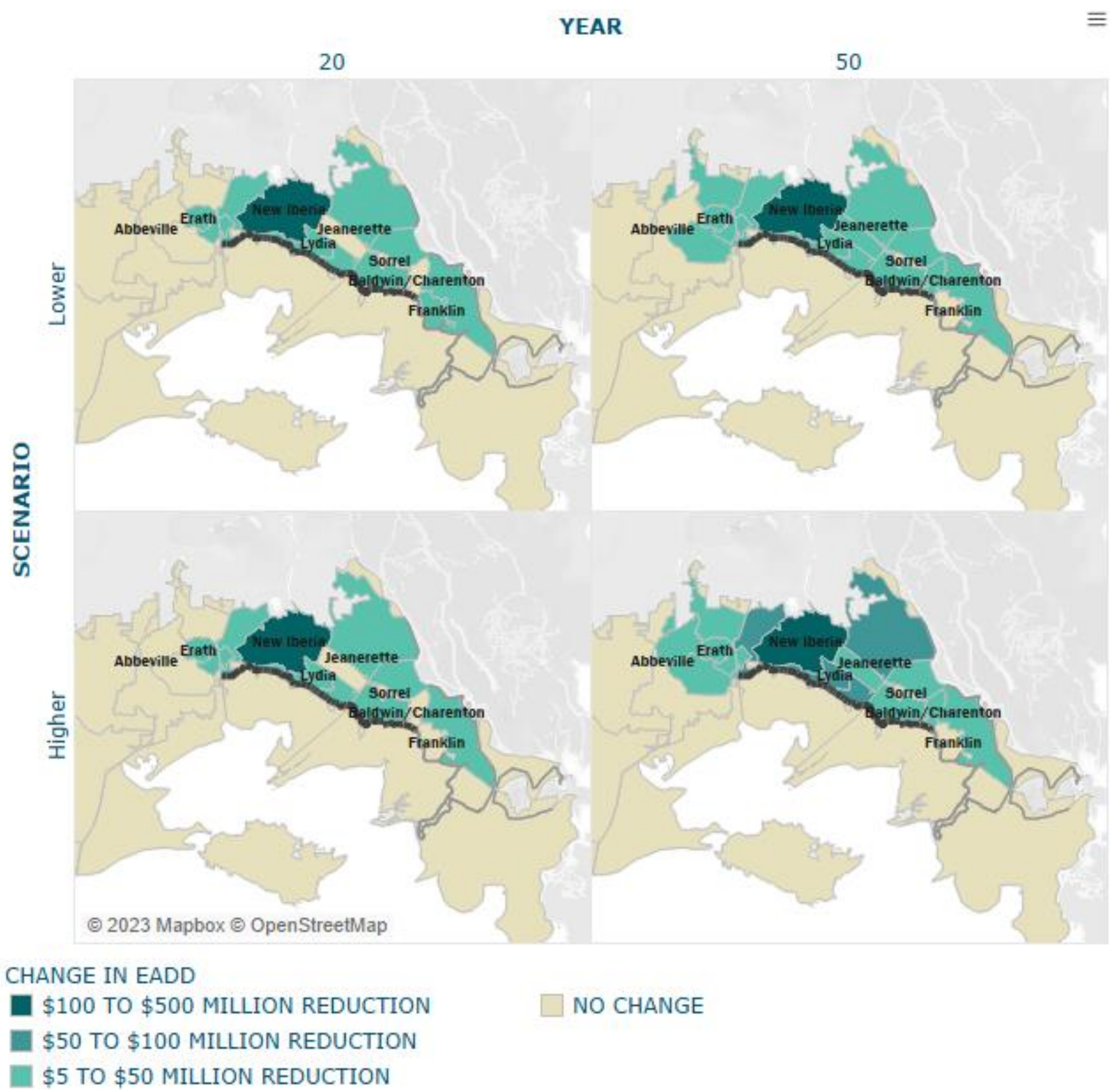

Figure 5. Change in EADD with Iberia/St. Mary Upland Levee project in place – IPET fragility, 50% pumping scenario, 50th percentile. Thin light gray lines show structural projects included in initial conditions and FWOA simulations, while the thicker black line highlights the proposed new project.

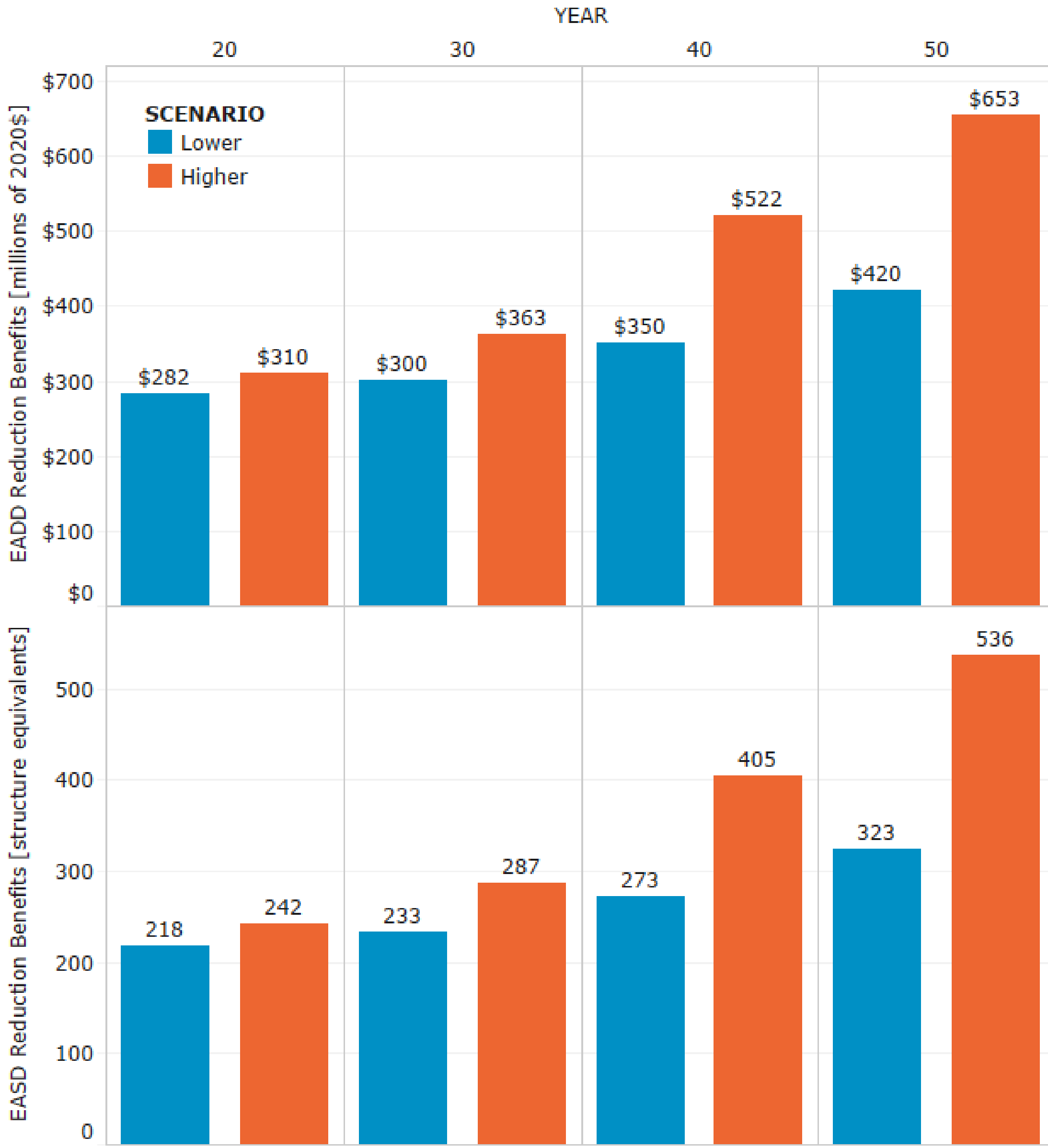

Figure 6. Change in EADD and EASD with the Iberia/St. Mary Upland Levee project in place.

Over the entire area impacted by the project, benefits grow by 48% in both EADD and EASD from Year 20 to Year 50 of the lower scenario. In the higher scenario, benefits grow even more over time, with a 111% increase in EADD reduction from Year 20 to Year 50 and a corresponding 121% increase in EASD reduction.

Benefits to critical infrastructure exposure are smaller, with an overall reduction from the project representing 15% of infrastructure elements that face moderate exposure from 2% AEP flooding in Year 50 of lower environmental scenario (Table 2). There is some variation in benefits across asset categories, however. The highest percentage reduction is in the Energy – Oil and Gas asset class with the only asset affected in the category being protected by the project. Otherwise, the greatest benefits are seen in assets categorized as Other Facilities (23%) and Emergency Services (21%).

Table 2. Change in exposure of critical infrastructure to 2% AEP (1-in-50 annual chance) flooding with the Iberia/St. Mary Upland Levee project in place

ASSET CATEGORY	ASSET TYPE	TOTAL COUNT	FWOA	FWP	CHANGE
CHEMICALS, WATER, AND WASTE	DRINKING WATER TREATMENT PLANTS	65	31	29	-2
	SOLID WASTE LANDFILL FACILITIES	5	2	1	-1
COMMUNICATIONS	MICROWAVE SERVICE TOWERS	173	87	81	-6
EMERGENCY SERVICES	EMS STATIONS	35	15	11	-4
	FIRE STATIONS	36	18	15	-3
	LOCAL LAW ENFORCEMENT	14	5	4	-1
ENERGY - ELECTRICITY	ELECTRIC SUBSTATIONS	54	32	29	-3
	POWER PLANTS	6	4	3	-1
ENERGY - OIL AND GAS	NATURAL GAS STORAGE FACILITIES	2	1	0	-1
GOVERNMENT FACILITIES AND EDUCATION	DAYCARE CENTERS	41	17	15	-2
	PUBLIC SCHOOLS	55	21	15	-6
	SCHOOLS	45	17	14	-3
	SHELTER FACILITIES	57	21	17	-4
HEALTHCARE, PUBLIC HEALTH, AND HOUSING	DIALYSIS CENTERS	6	2	1	-1
	MOBILE HOME PARKS	83	35	30	-5
	PHARMACIES	35	15	12	-3
OTHER FACILITIES	BANKS	35	14	11	-3
	GAS STATIONS	40	18	13	-5
	LIBRARIES	21	6	5	-1

4.0 MORGANZA TO THE GULF

The MTTG project consists of the construction and improvement of a levee system around Houma and other Terrebonne ridge communities extending from Larose in the east to Humphreys Canal at the western terminus. The project consists of approximately 450,000 ft of levee, 22,000 ft of T-wall, 12 barge gates (from 30- to 180-ft), a 30-ft roller gate, two 40-ft roller gates, a 110-ft lock, and 12 sluice gates (Figure 7). Its estimated cost is $3.9 billion, with some federal funding recently being approved. Existing portions were built to USACE standards using local and state funds as a model for moving ahead with a project while awaiting federal authorization and funding. The alignment intersects northern reaches of the Larose to Golden Meadow levee system (selected for improvements in IP2).

The large-scale MTTG project was selected for IP1 due to its extensive damage reduction benefits. For example, it is projected to reduce EADD in Houma by $1.7 billion and EASD by approximately 1,400 structural equivalents in Year 50. Overall benefits are substantial in all years and scenarios modeled, with reductions in EADD ranging from $1.3 billion in Year 20 of the lower scenario to $4.8 billion in Year 50 of the higher scenario. Corresponding EASD benefits range from 1,344 to 4,384 structural equivalents.

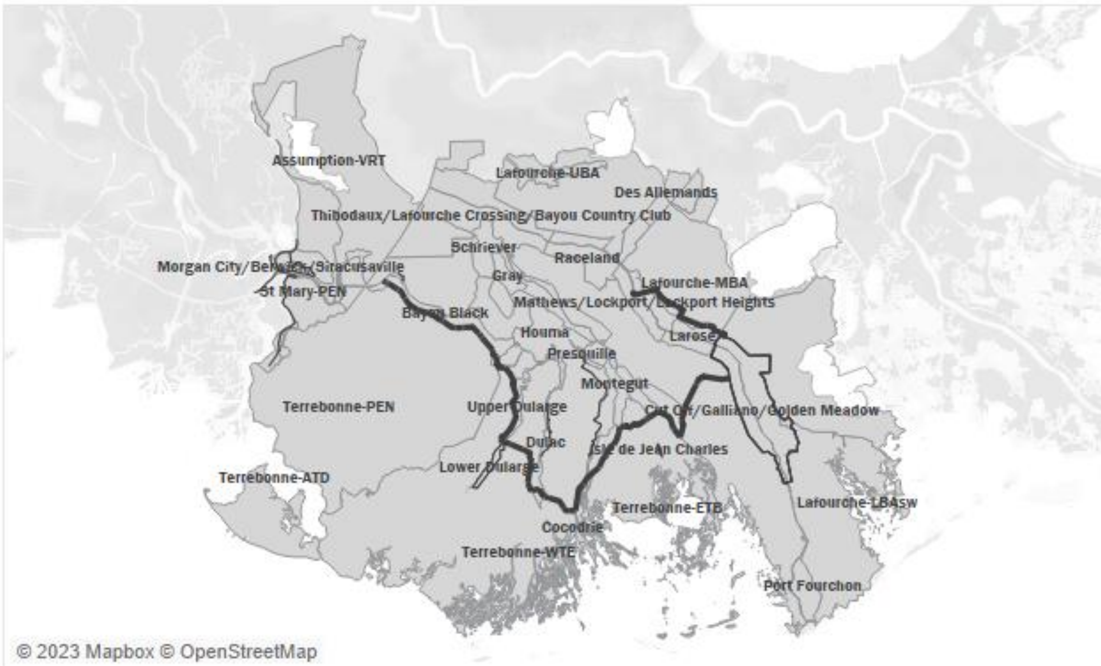

Figure 7. Map of the MTTG project and affected communities. Thin dark gray lines show structural projects included in initial conditions and FWOA simulations, while the thicker black line highlights the proposed new project.

4.1 FLOOD DEPTH IMPACTS

Flood depths with a 1% AEP increase substantially in a FWOA scenario, jumping from 1-4 ft in Year 20 around the Houma community to 7-10 ft in Year 50 in Houma and Bayou Cane (Figure 8). Depth exceedances are more extreme in surrounding areas, with over 13 ft in nearly all unprotected areas in the region south of LA-182 and east of LA-24. This exposes southward communities such as Dulac and Montegut to extreme hazard, with 1% AEP flood depths over 10 ft in Year 20 (lower scenario) and up to over 21 ft in some areas east of Montegut by Year 50 (higher scenario). At Year 50, the 1% AEP extends consistently to the Terrebonne ridge, resulting in some inundation to communities further inland along the ridge, including Thibodaux.

With MTTG fully implemented, 1% AEP flooding behind the protection system is significantly reduced. It is eliminated in areas behind the northwestern reaches; peak inundation around Dulac and Theriot in the southernmost regions behind the alignment remains high (6-9 ft in Year 20), but extreme inundation of this kind does not penetrate so far inland (Figure 9). For example, Houma does not see flooding at the 1% AEP in either environmental scenario at Year 20.

While the project yields a major reduction in hazard in Year 50, the rising threat means that substantial flooding still occurs with a 1% AEP. Some areas along LA-24 remain dry through Houma to Bayou Cane in the lower scenario, but nearly the entire city sees some flooding in Year 50 of the higher scenario. However, communities along the ridge, such as Thibodaux, remain dry from a 1% AEP event. Without implementation of the Larose to Golden Meadow Structural Risk Reduction project, flooding of 6 ft or less occurs from such an event within the Larose to Golden Meadow levee system by Year 50.

The MTTG project does induce some additional flood hazard in front of the alignment. This generally adds 1-3 ft to the 1% AEP flood depths, with an increase of 3-6 ft in front of eastern reaches between Cocodrie and the Larose to Golden Meadow levee system (Figure 9).

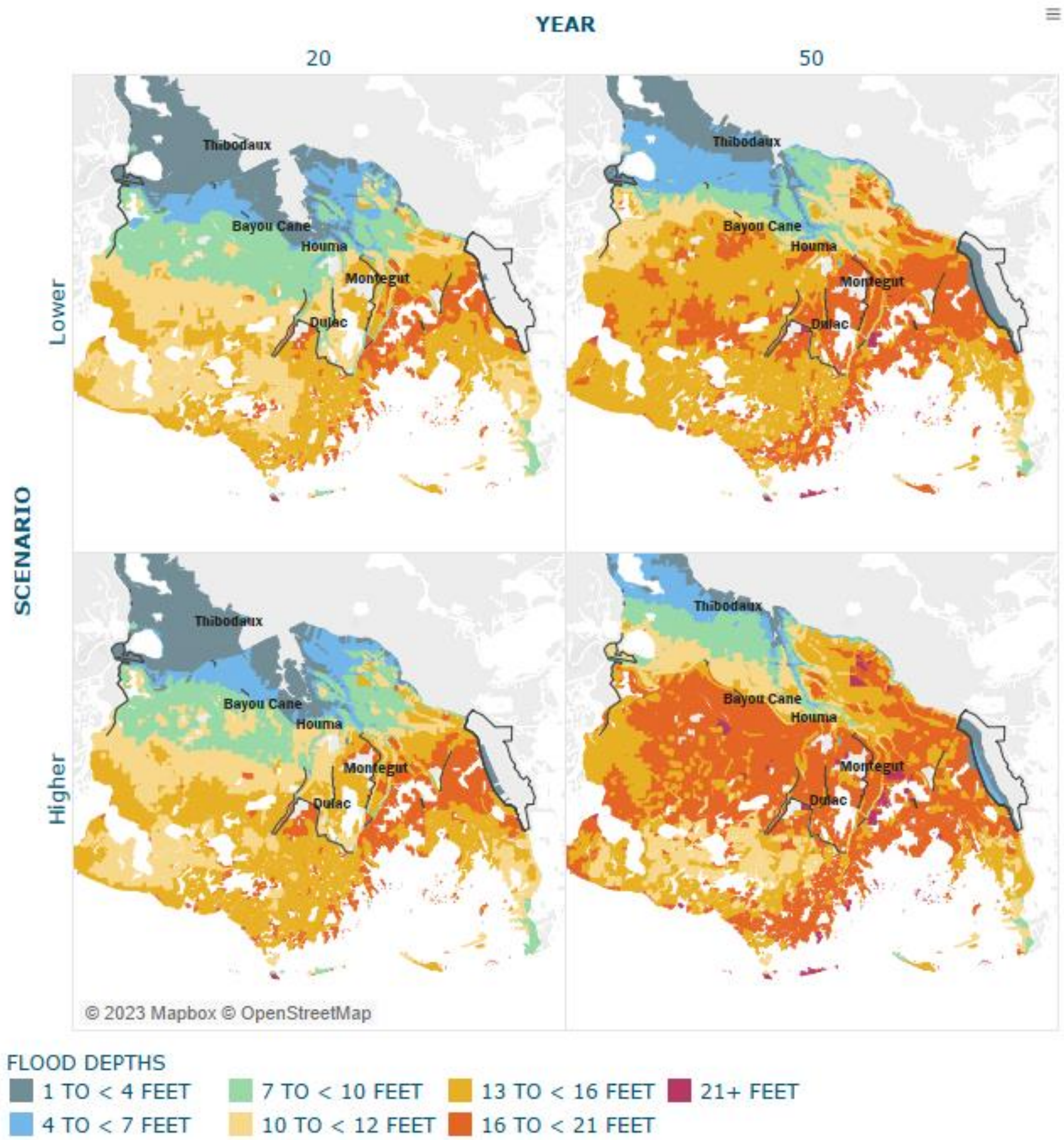

Figure 8. FWOA 1% AEP (1-in-100 annual chance) flood depths in Years 20 and 50 in the Terrebonne region — IPET fragility, 50% pumping scenario, 50th percentile.

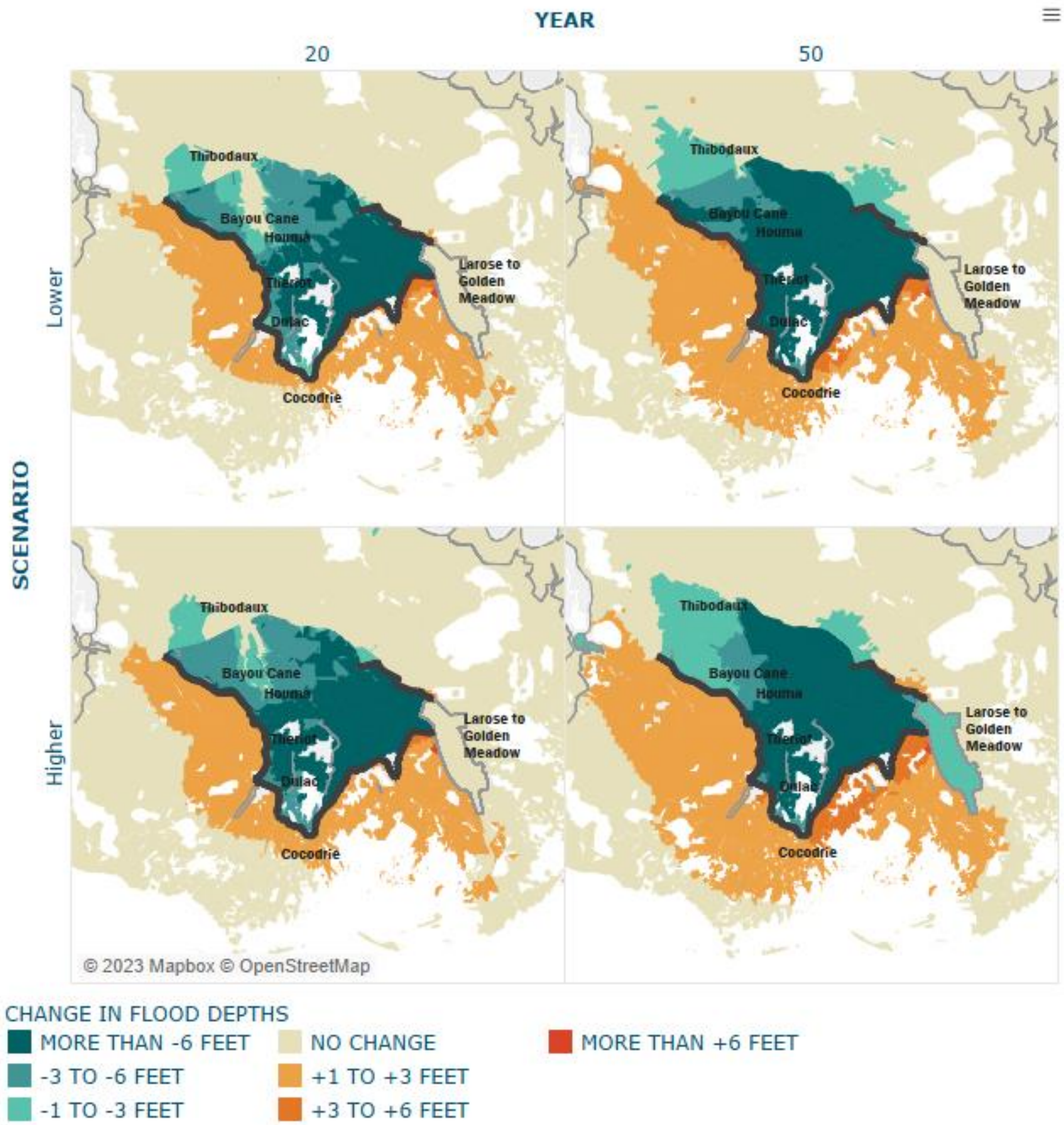

Figure 9. Change in 1% AEP (1-in-100 annual chance) flood depths with MTTG in place – IPET fragility, 50% pumping scenario, 50th percentile. Thin light gray lines show structural projects included in initial conditions and FWOA simulations, while the thicker black line highlights the proposed new project.

4.2 FLOOD DAMAGE IMPACTS

Without implementation of MTTG, 50% of single-family homes in the impacted area face moderate exposure to the 2% AEP flood event in Year 20 of the lower scenario (Table 3). Some communities are extremely vulnerable, with nearly 100% of such buildings in Montegut, Chauvin, and Upper and Lower Dularge having moderate exposure. Generally, areas directly behind the alignment are most vulnerable, in both a FWOA and with implementation of MTTG.

In Year 50 of the lower scenario, approximately 71% of single-family homes face moderate exposure to the 2% AEP flood event at their locations (Table 3). By this time, some ridge communities such as Matthews/Lockport/Lockport Heights also see virtually all single-family homes exposed. Communities with less exposure are generally located further inland, such as Schriever (28%) and Thibodaux/Lafourche Crossing/Bayou Country Club (18%), or have existing structural protection, such as Cut Off/Galliano/Golden Meadow (9%).

Table 3. Change in residential exposure to 2% AEP (1–in-50 annual chance) flooding with MTTG in place

COMMUNITY NAME	TOTAL STRUCTURES	FWOA EXPOSURE	FWP EXPOSURE	EXPOSURE CHANGE	EXPOSURE CHANGE (%)
HOUMA	15,036	15,020	6,574	-8,446	-56%
BAYOU CANE	7,254	7,023	3,637	-3,386	-48%
BAYOU BLUE	5,473	5,205	1,987	-3,218	-62%
RACELAND	5,255	4,600	1,785	-2,815	-61%
MATHEWS/LOCKPORT/ LOCKPORT HEIGHTS	3,946	3,933	1,619	-2,314	-59%
THIBODAUX/LAFOURCHE CROSSING/BAYOU COUNTRY CLUB	11,443	2,079	1,017	-1,062	-51%
BAYOU BLACK	1,676	1,676	615	-1,061	-63%
GRAY	1,912	1,171	347	-824	-70%
PRESQUILLE	1,023	1,023	345	-678	-66%
LAROSE	1,624	1,619	969	-650	-40%
SCHRIEVER	2,590	726	239	-487	-67%
CHAUVIN	2,787	2,781	2,349	-432	-16%
BOURG	1,099	1,099	803	-296	-27%
MONTEGUT	1,585	1,585	1,301	-284	-18%
TERREBONNE-VRT	441	434	192	-242	-56%
DULAC	1,128	1,117	886	-231	-21%
TERREBONNE-WTE	1,423	1,422	1,194	-228	-16%
LAFOURCHE-ETB	732	730	548	-182	-25%

COMMUNITY NAME	TOTAL STRUCTURES	FWOA EXPOSURE	FWP EXPOSURE	EXPOSURE CHANGE	EXPOSURE CHANGE (%)
CUT OFF/GALLIANO/ GOLDEN MEADOW	9,842	891	814	-77	-9%
POINT AUX CHENE	666	666	595	-71	-11%
GIBSON	191	191	149	-42	-22%
UPPER DULARGE	587	587	547	-40	-7%
LAFOURCHE-VRT	71	65	55	-10	-15%
LAFOURCHE-UBA	247	152	149	-3	-2%
DES ALLEMANDS	1,079	1,078	1,076	-2	0%
ASSUMPTION-VRT	1,703	328	332	4	1%
ST MARTIN-VRT	836	772	777	5	1%
MORGAN CITY/BERWICK/ SIRACUSAVILLE	4,967	3,697	4,146	449	12%
TOTAL	**86,616**	**61,670**	**35,047**	**-26,623**	**-43%**

NOTE: Results reflect exposure of small residential structures in Year 50 of the lower scenario at the moderate exposure threshold (depths above first floor elevation). Communities with no change in exposure are omitted. Suffixes on some community names denote ecoregions: ETB – Eastern Terrebonne, UBA – Upper Barataria, VRT – Verret, WTE – Western Terrebonne.

In a FWOA, EADD and EASD also increase significantly over time, with an approximately 2.6-fold increase from Year 20 to Year 50 in the lower scenario; in the higher scenario, values in Year 50 are well over three times as much as in Year 20 (not shown). The majority of risk is concentrated in Houma and surrounding communities such as Bayou Cane, Bayou Blue, Bourg, and Presquille. This spatial pattern is consistent over the years and scenarios modeled.

Benefits of the project are widespread, covering a large geographic footprint (Figure 10), with 15 communities experiencing a greater than 50% reduction in moderate exposure in Year 50 (lower scenario, Table 3). These same communities also would have their EADD reduced by over 50%, with four seeing reductions of 80% or more (Presquille, Schriever, Mathews/Lockport/Lockport Heights, and Gray). Benefits in the region impacted by the project increase substantially over time, with reductions in EADD and EASD by Year 50 being 2.5-3.0 times the Year 20 benefits (Figure 11).

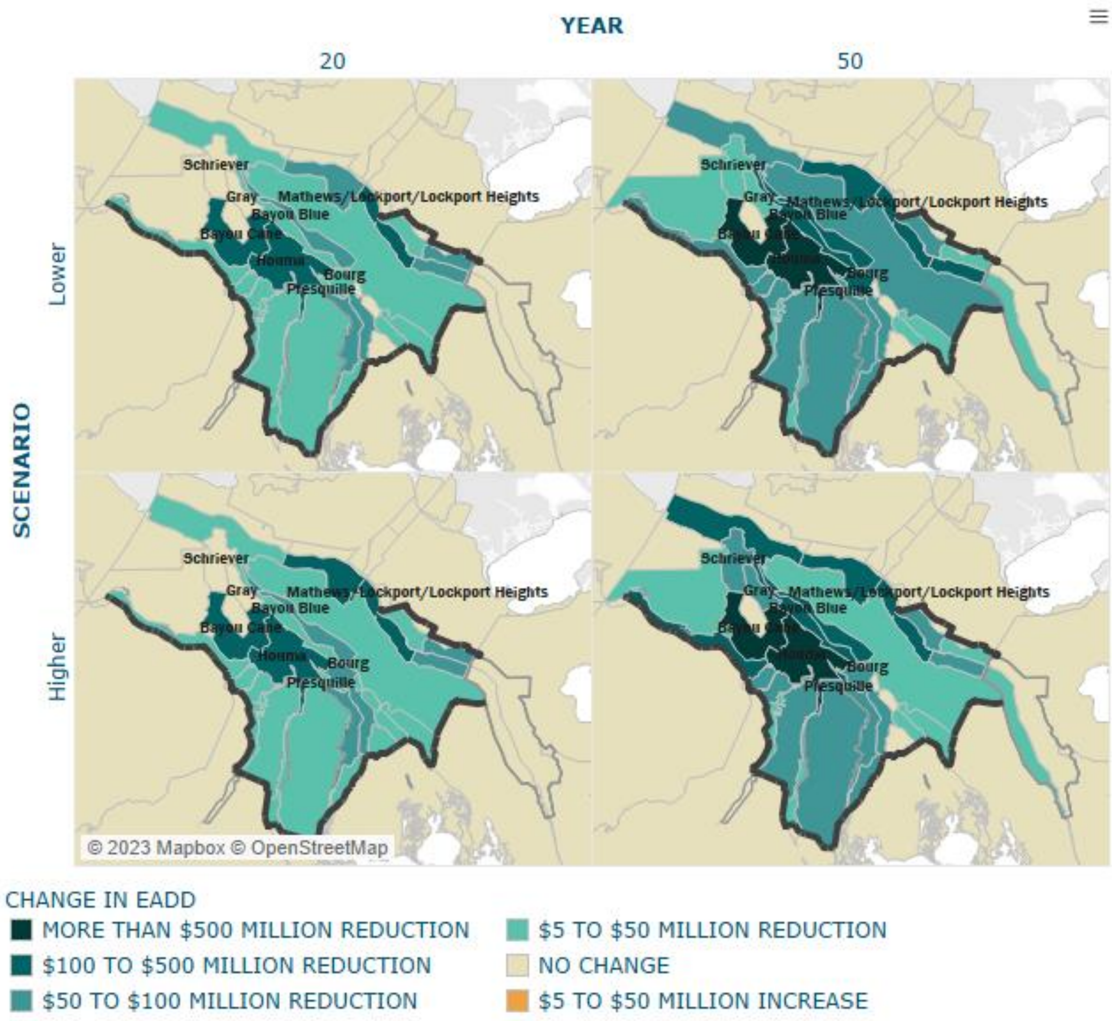

Figure 10. Change in EADD with MTTG in place – IPET fragility, 50% pumping scenario, 50th percentile. Thin gray lines show structural projects included in initial conditions and FWOA simulations, while the thicker black line highlights the proposed new project.

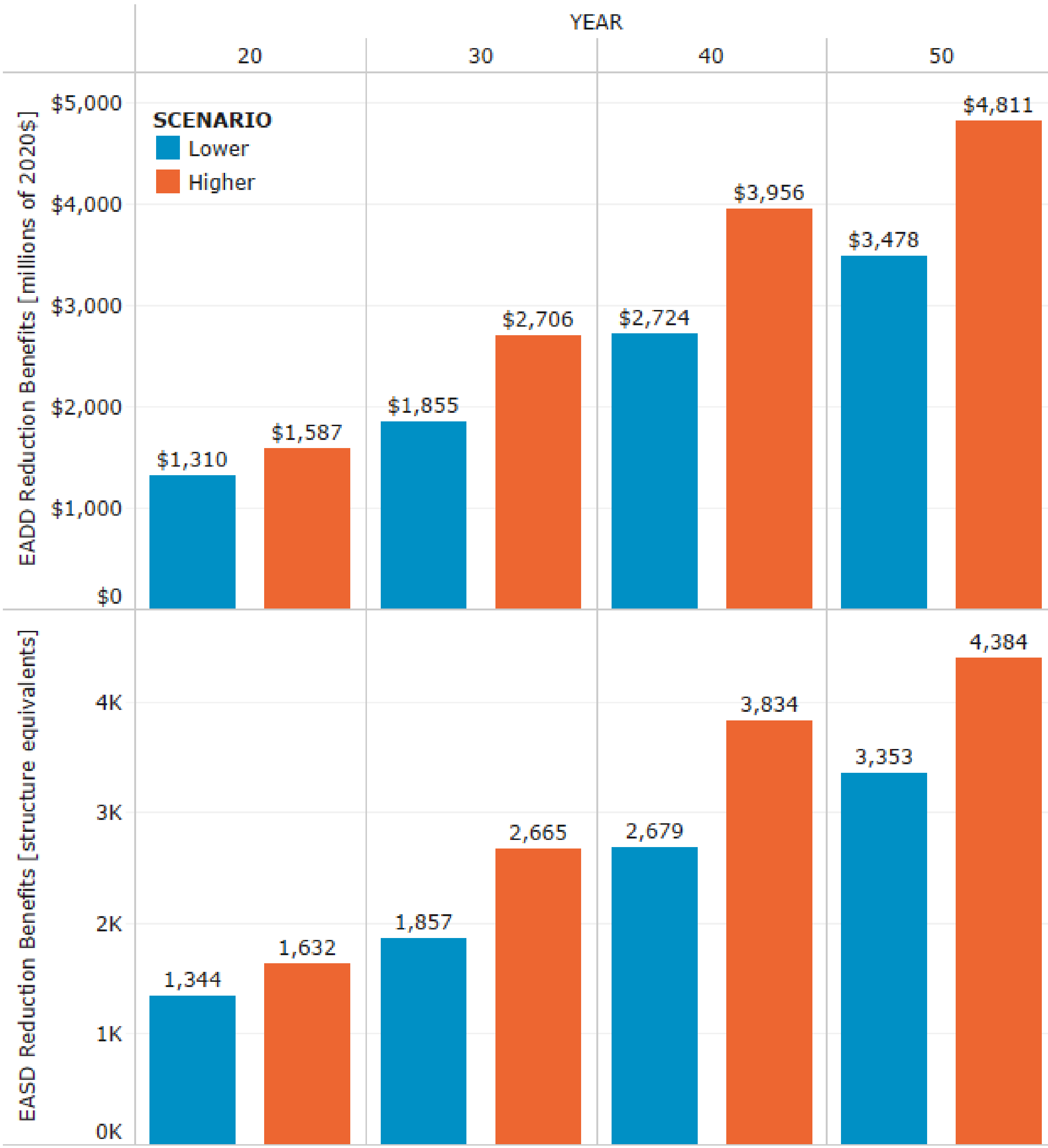

Figure 11. Reductions in EADD and EASD with MTTG in place. Benefit values differ slightly from published project fact sheets due to community boundary updates made for this iteration of the analysis.

Benefits to critical infrastructure exposure are smaller, with an overall reduction representing 18% of infrastructure elements that face moderate exposure without implementation of MTTG (Table 4).

There is substantial variation in benefits across asset categories, however, with the greatest benefits going to assets in the following categories: Healthcare, Public Health, and Housing; Other Facilities; Chemicals, Water, and Waste; and Government Facilities and Education.

Table 4. Change in exposure of critical infrastructure to 2% AEP (1-in-50 annual chance) flooding with MTTG in place

ASSET CATEGORY	ASSET TYPE	TOTAL COUNT	FWOA	FWP	CHANGE
CHEMICALS, WATER, AND WASTE	DRINKING WATER TREATMENT PLANTS	8	5	4	-1
	SOLID WASTE LANDFILL FACILITIES	2	2	1	-1
COMMUNICATIONS	CELLULAR TOWERS	26	22	20	-2
	FM TRANSMISSION TOWERS	11	9	8	-1
	MICROWAVE SERVICE TOWERS	247	225	183	-42
EMERGENCY SERVICES	EMS STATIONS	52	40	34	-6
	FIRE STATIONS	67	57	47	-10
	LOCAL EMERGENCY OPERATIONS CENTERS	3	3	2	-1
	LOCAL LAW ENFORCEMENT	11	7	5	-2
ENERGY – ELECTRICITY	ELECTRIC SUBSTATIONS	33	31	29	-2
GOVERNMENT FACILITIES AND EDUCATION	DAYCARE CENTERS	59	47	25	-22
	PRISONS	7	7	5	-2
	PUBLIC SCHOOLS	74	59	46	-13
	SCHOOLS	73	56	38	-18
	SHELTER FACILITIES	54	45	37	-8
HEALTHCARE, PUBLIC HEALTH, AND HOUSING	DIALYSIS CENTERS	9	7	2	-5
	HOSPITALS	9	7	3	-4
	MOBILE HOME PARKS	98	91	69	-22
	NURSING HOMES	19	14	5	-9
	NURSING RESIDENTIAL CARE FACILITIES	46	30	13	-17
	PHARMACIES	57	44	22	-22
	PUBLIC HEALTH DEPARTMENTS	4	4	3	-1
OTHER FACILITIES	BANKS	79	57	32	-25
	GAS STATIONS	61	51	27	-24
	LIBRARIES	20	15	13	-2
TRANSPORTATION – MARITIME	MAJOR US PORT FACILITIES	2	2	1	-1
	PORT FACILITIES	601	583	570	-13

5.0 UPPER BARATARIA RISK REDUCTION

The Upper Barataria Risk Reduction project was selected for IP1 of the 2023 Coastal Master Plan and is intended to provide protection to multiple communities including Luling/Boutte, Chackbay, and South Vacherie. The levee will be constructed to an elevation of 10.5 to 15 ft NAVD88 along U.S. 90 between Larose and the West Bank of the New Orleans Hurricane and Storm Damage Risk Reduction System. The project features include approximately 200,000 ft of earthen levee, approximately 4,100 ft of T-wall, a 250-ft barge gate, two 40-ft roller gates, six sluice gates, and pump station improvements (Figure 12). The project is projected to reduce EADD by more than $1 billion in Year 50 in both environmental scenarios.

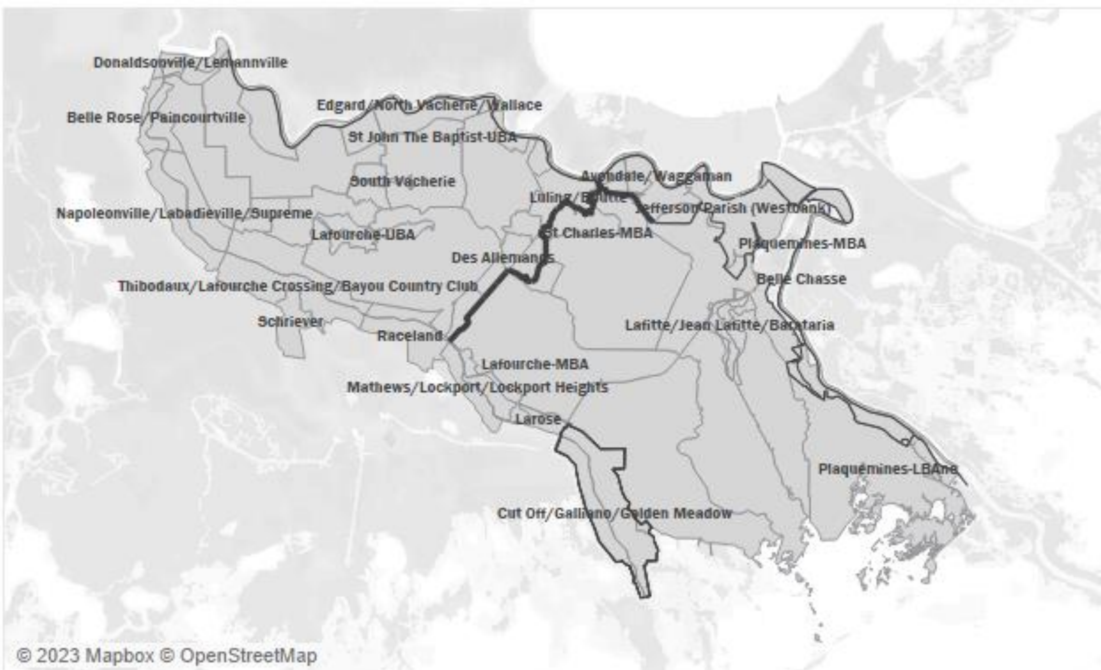

Figure 12. Map of the Upper Barataria Risk Reduction project and affected communities. Thin dark gray lines show structural projects included in initial conditions and FWOA simulations, while the thicker black line highlights the proposed new project.

5.1 FLOOD DEPTH IMPACTS

The 1% AEP flood depths in Year 20 of both the higher and lower environmental scenarios are projected to be relatively minor in the more inland parts of the project area, with most of the area projected for depths in the 1-4 ft range and only a small portion directly to the northwest of the proposed project expected to see depths above 4 ft (Figure 13). To the southeast of the project site, projected depths are higher (7-10 ft directly to the southeast with depths becoming deeper further out).

For Year 50, 1% AEP flood depths increase across the project area. In the lower environmental scenario, the flood depths behind the proposed alignment rise from 1-4 to 4-7 ft, with flooding also extending further inland so that communities expected to remain dry in Year 20 are projected to see 1% AEP flood depths of 1-4 ft. The geographic extent of flooding is similar in the higher environmental scenario, though flood depths in the protected part of the project area are projected to be in the 7-10 ft range. In both scenarios, flood depths on the unprotected side of the project area are estimated to be 10-12 ft directly adjacent to the southwest of the project site with greater projected flooding as one moves further southwest.

In Year 20 for both environmental scenarios, the project is projected to lower 1% AEP flood depths by 1-3 ft for most of the area on the northwestern side of the levee (Figure 14). The areas closest to the levee are projected to see more substantial depth reductions of 3-6 ft, with the Bayou Gauche and Des Allemands communities seeing more than 6 ft of depth reduction. On the unprotected side of the project, flood depths are projected to increase by 1-3 ft across the parts of Lafourche, St. Charles, and Jefferson communities.

In Year 50, the pattern is largely similar in the lower environmental scenario, though flood depth reductions of 3-6 ft are more widespread across the protected parts of St. Charles and Lafourche, with shallower depths extending further to the north and west. In the higher environmental scenario, the areas experiencing flooding extend further to the west. Additionally, the depth reduction is less than in the lower environmental scenario, with only the areas directly surrounding Lac des Allemands seeing flood depth reduction in the 3-6 ft range (the rest of the area sees reductions in the 1-3 ft range). In unprotected communities impacted by the project, the flood depths are much the same as those seen in Year 20.

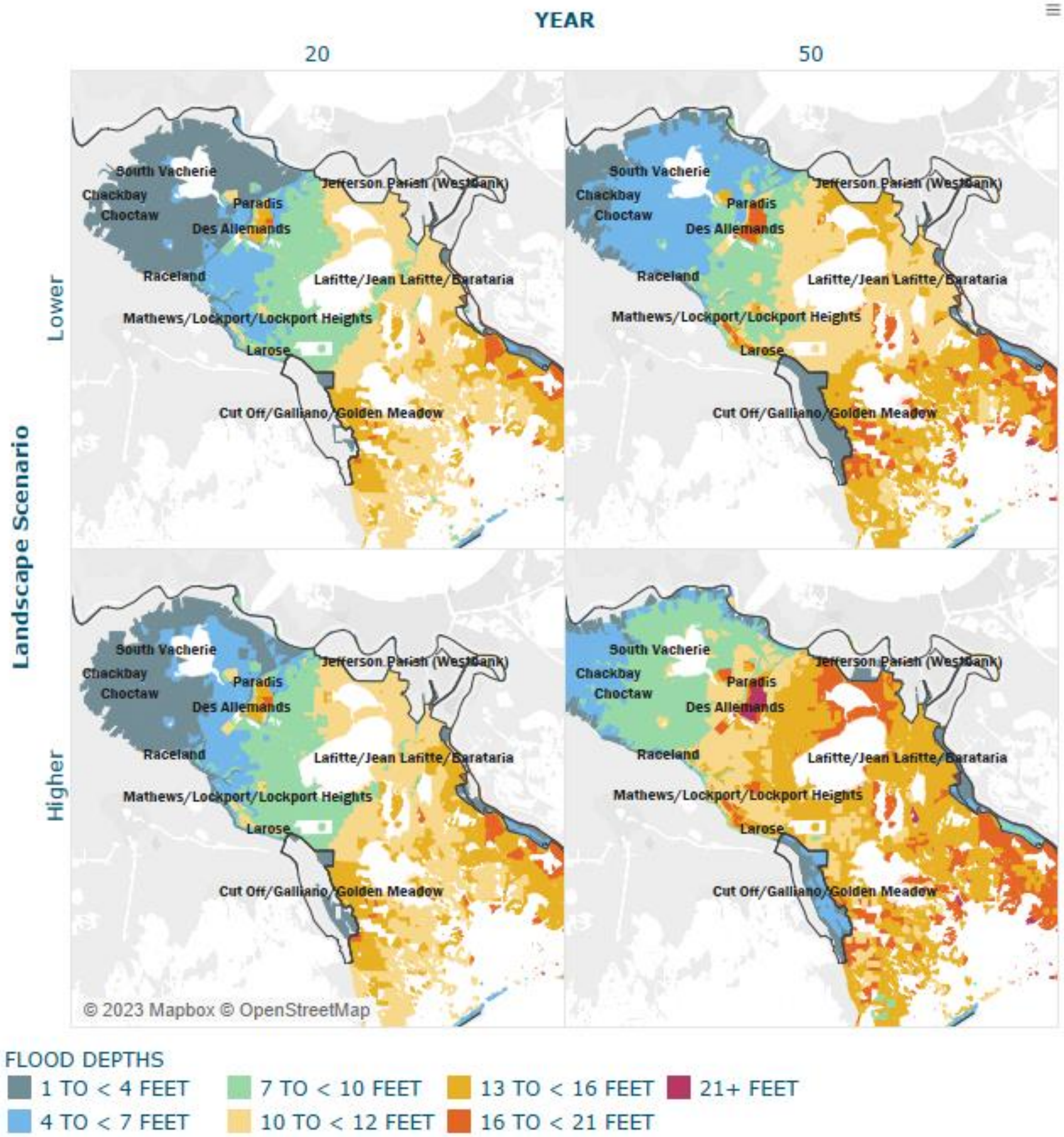

Figure 13. FWOA 1% AEP (1-in-100 annual chance) flood depths in Years 20 and 50 in the Barataria region — IPET fragility, 50% pumping scenario, 50th percentile.

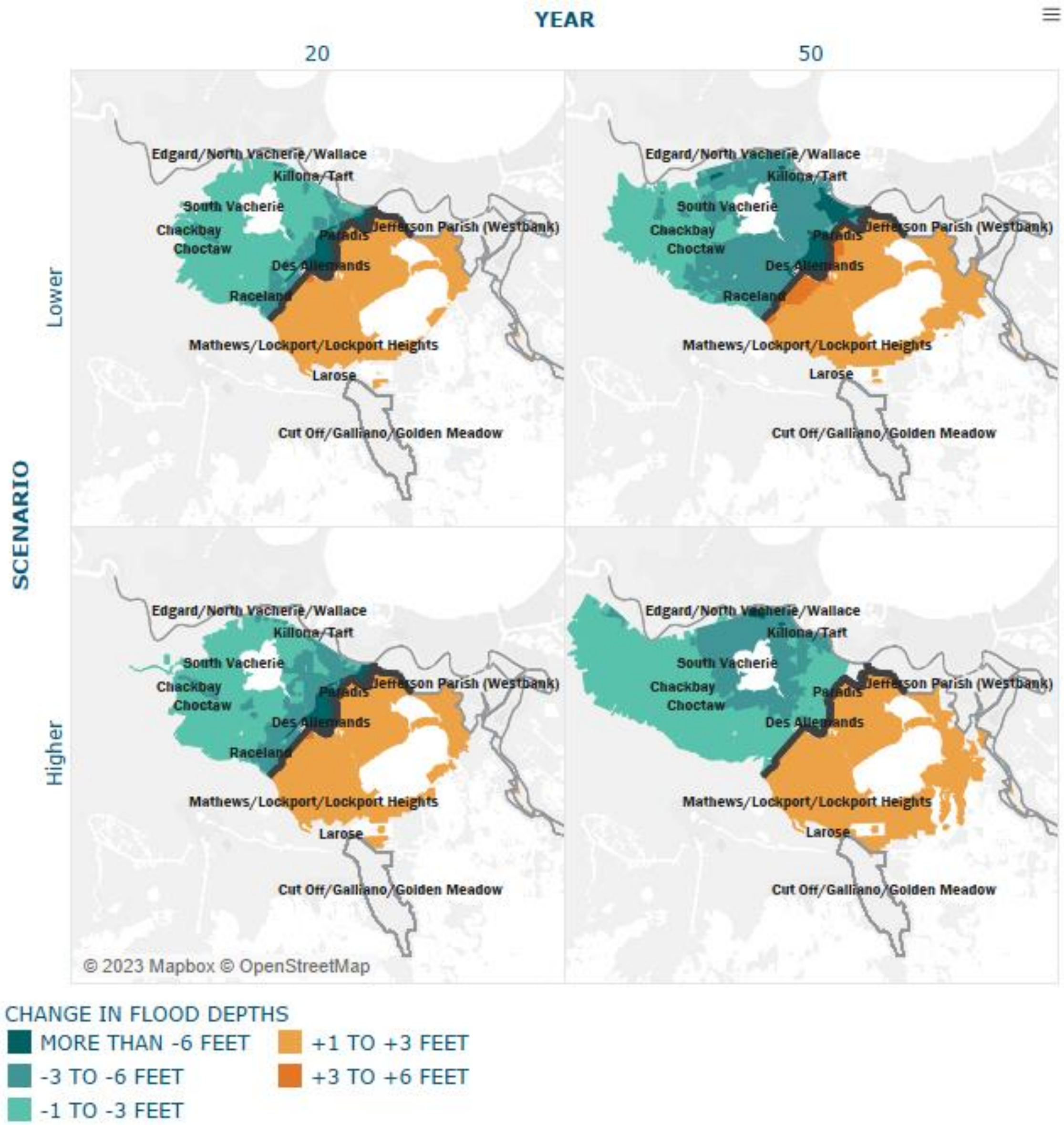

Figure 14. Change in 1% AEP (1-in-100 annual chance) flood depths with the Upper Barataria Risk Reduction project in place – IPET fragility, 50% pumping scenario, 50th percentile. Thin light gray lines show structural projects included in initial conditions and FWOA simulations, while the thicker black line highlights the proposed new project.

5.2 FLOOD DAMAGE IMPACTS

Without implementation of the Upper Barataria Risk Reduction project, 45% of single-family homes in areas affected by the project face moderate exposure to the 2% AEP flood event at their locations in Year 20 of the lower scenario. Some communities are extremely vulnerable, with nearly 100% of such buildings in Des Allemands and Paradis having moderate exposure. Some areas with high proportions of at-risk residences, such as Mathews/Lockport/Lockport Heights, are in front of the project alignment and experience induced flooding with the project implemented, leading to attendant increases in risk. In Year 50 of the lower scenario, about 51% of single-family homes face moderate exposure to the 2% AEP flood event at their locations (Table 5). By Year 50, some additional communities (e.g., Matthews/Lockport/Lockport Heights) see virtually all single-family homes exposed. Communities with less exposure are generally located further up-basin, including Thibodaux/Lafourche Crossing/Bayou Country Club (18%), or along the Mississippi River, such as Hahnville (16%).

Table 5. Change in residential exposure to 2% AEP (1-in-50 annual chance) flooding with the Upper Barataria Risk Reduction project in place

COMMUNITY NAME	TOTAL STRUCTURES	FWOA EXPOSURE	FWP EXPOSURE	EXPOSURE CHANGE	EXPOSURE CHANGE (%)
LULING/BOUTTE	5,588	5,192	2,078	-3,114	-60%
CHACKBAY	2,579	2,195	1,269	-926	-42%
SOUTH VACHERIE	1,849	1,158	579	-579	-50%
DES ALLEMANDS	1,079	1,078	767	-311	-29%
KRAEMER	518	518	243	-275	-53%
RACELAND	5,255	4,600	4,363	-237	-5%
PARADIS	526	526	308	-218	-41%
HAHNVILLE	1,272	205	101	-104	-51%
THIBODAUX/LAFOURCHE CROSSING/ BAYOU COUNTRY CLUB	11,443	2,079	2,015	-64	-3%
LAFOURCHE-UBA	247	152	89	-63	-41%
ST JOHN THE BAPTIST-UBA	88	83	53	-30	-36%
CHOCTAW	471	469	446	-23	-5%
KILLONA/TAFT	292	33	11	-22	-67%
EDGARD/NORTH VACHERIE/WALLACE	2,447	103	86	-17	-17%
BAYOU GAUCHE	889	888	876	-12	-1%
ST CHARLES-UBA	80	23	14	-9	-39%
ST JAMES-UBA	337	12	5	-7	-58%
LAFOURCHE-MBA	596	595	592	-3	-1%

COMMUNITY NAME	TOTAL STRUCTURES	FWOA EXPOSURE	FWP EXPOSURE	EXPOSURE CHANGE	EXPOSURE CHANGE (%)
LAFITTE/JEAN LAFITTE/BARATARIA	2,516	2,481	2,483	2	0%
SCHRIEVER	2,590	726	732	6	1%
MATHEWS/LOCKPORT/ LOCKPORT HEIGHTS	3,946	3,933	3,941	8	0%
CUT OFF/GALLIANO/ GOLDEN MEADOW	9,842	891	1,039	148	17%
TOTAL	**54,450**	**27,940**	**22,090**	**-5,850**	**-21%**

NOTE: Results reflect exposure of small residential structures in Year 50 of the lower scenario at the moderate exposure threshold (depths above first floor elevation). Communities with no change in exposure are omitted. Suffixes on some community names denote ecoregions: MBA – Mid Barataria, UBA – Upper Barataria.

In a FWOA, EADD and EASD also increase over time, more than doubling from Year 20 to Year 50 in the lower scenario; in the higher scenario, values in Year 50 are approximately 2.6 times as much as in Year 20 (not shown). In Year 20 of both environmental scenarios, the majority of risk is concentrated in Luling/Boutte. The same spatial distribution of risk is projected in Year 50, although other communities, such as Chackbay, Paradis, and Bayou Gauche, do see substantial increases in EADD and EASD.

The set of communities that consistently benefits from the project across years and environmental conditions are clustered directly adjacent to the project (though Chackbay, South Vacherie, and Kraemer further inland also benefit; Figure 15). Overall, many communities benefit from the project, with 13 communities experiencing a greater than 25% reduction in EADD, EASD, and moderate exposure in Year 50 (lower scenario, Table 5). Five communities see reductions of 50% or more on all risk metrics (Des Allemands, South Vacherie, Luling/Boutte, Hahnville, and Paradis). Benefits in the region, however, peak in Year 30, with reductions in EADD and EASD in Years 40 and 50 declining in both environmental scenarios as sea levels continue to rise and the project loses some of its effectiveness (Figure 16).

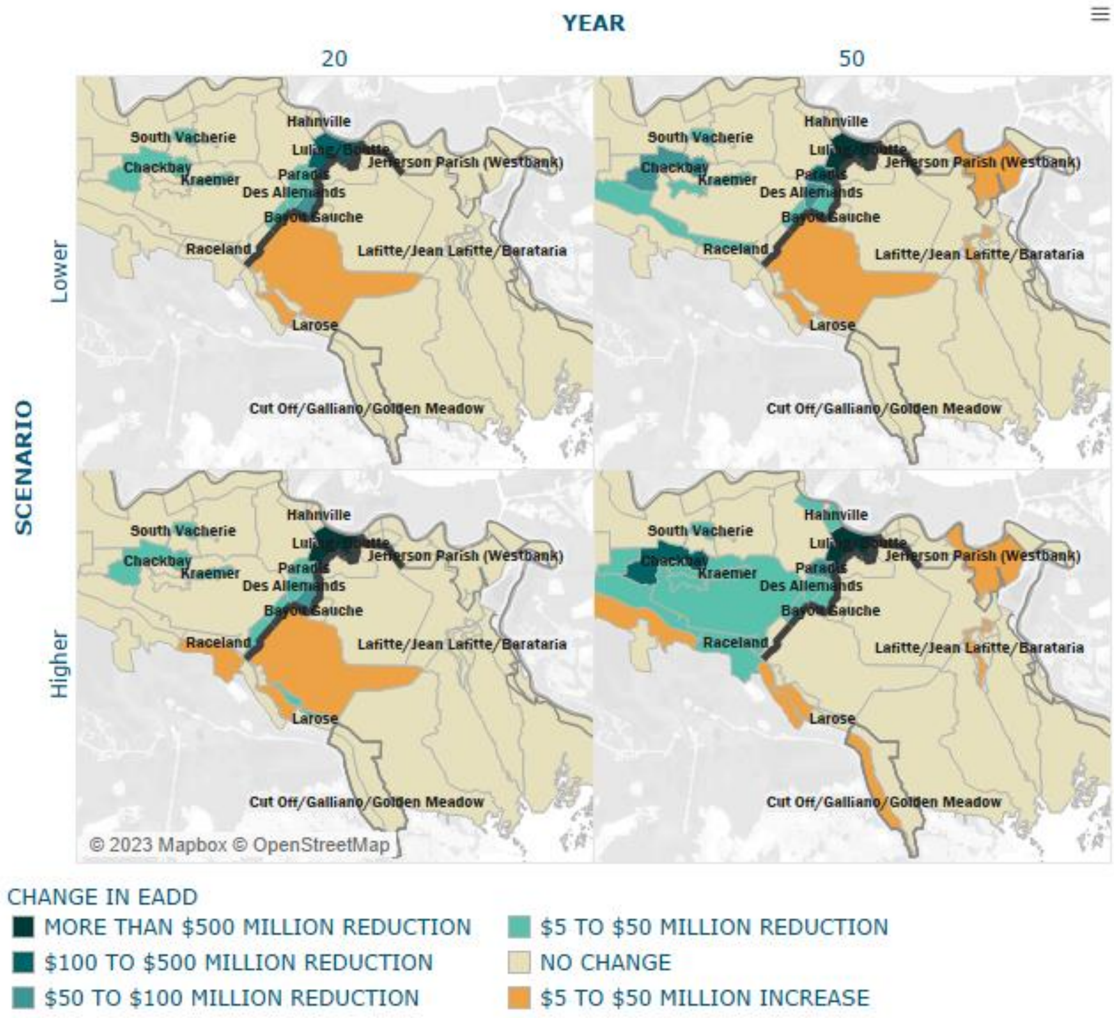

Figure 15. Change in EADD with the Upper Barataria Risk Reduction project in place – IPET fragility, 50% pumping scenario, 50th percentile. Thin gray lines show structural projects included in initial conditions and FWOA simulations, while the thicker black line highlights the proposed new project.

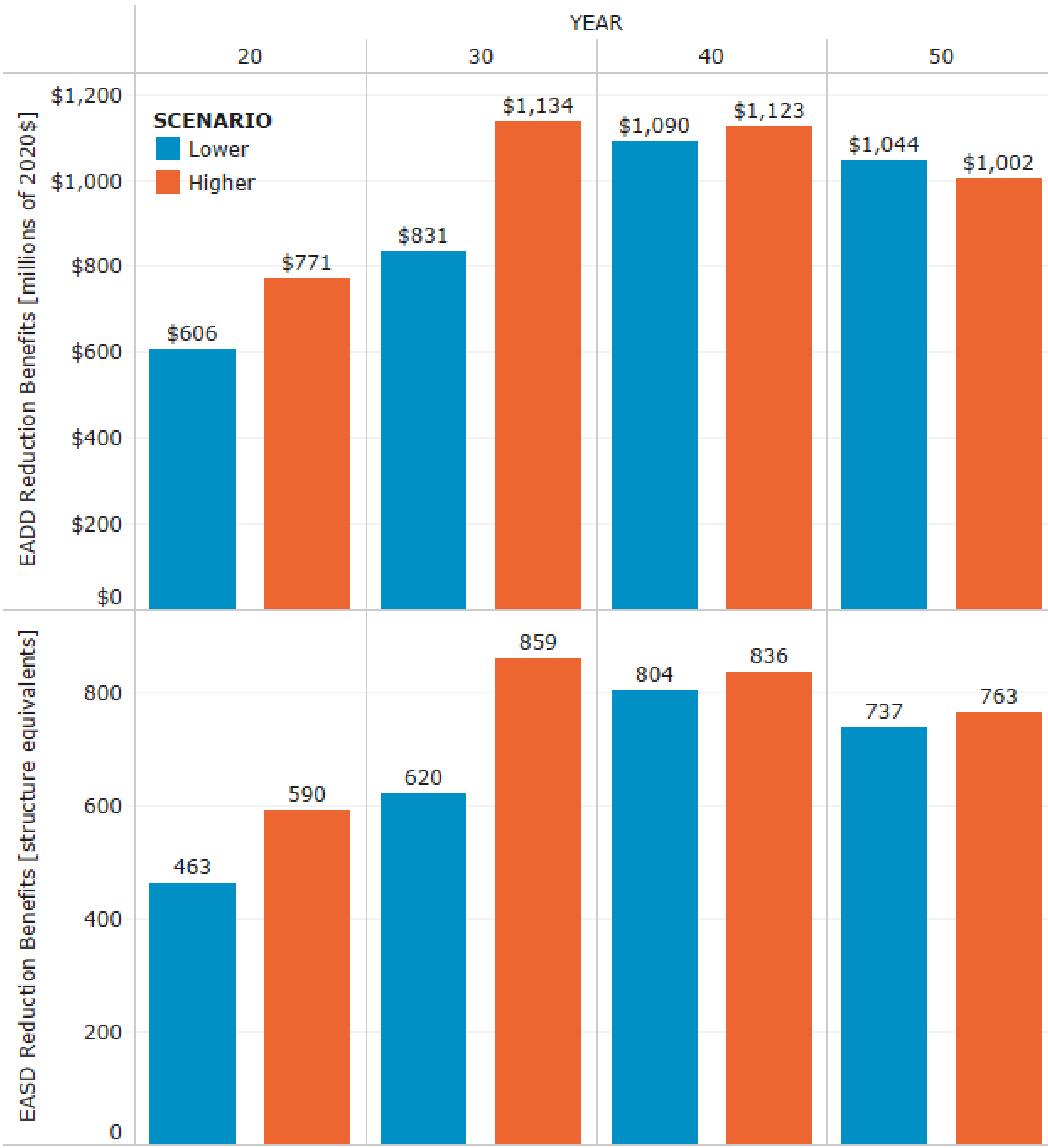

Figure 16. Change in EADD and EASD with the Upper Barataria Risk Reduction project in place.

Benefits to critical infrastructure exposure are not commensurate with the impacts on other risk metrics. In a FWOA, 34% of critical infrastructure assets have moderate exposure in Year 50 of the lower scenario (Table 6). There is substantial variation in benefits across asset categories, however, with the greatest benefits going to Energy – Electricity and Chemical, Water, and Waste assets. Assets from the Energy – Oil and Gas and Other Facilities categories see small increases in their exposure.

Table 6. Change in exposure of critical infrastructure to 2% AEP (1-in-50 annual chance) flooding with the Upper Barataria Risk Reduction project in place

ASSET CATEGORY	ASSET TYPE	TOTAL COUNT	FWOA	FWP	CHANGE
CHEMICALS, WATER, AND WASTE	EPA RCRA TREATMENT, STORAGE, AND DISPOSAL FACILITIES	4	1	0	-1
	SOLID WASTE LANDFILL FACILITIES	7	1	0	-1
COMMUNICATIONS	CELLULAR TOWERS	34	17	18	1
	FM TRANSMISSION TOWERS	24	11	12	1
	MICROWAVE SERVICE TOWERS	213	73	61	-12
EMERGENCY SERVICES	EMS STATIONS	58	15	14	-1
	FIRE STATIONS	85	27	25	-2
ENERGY – ELECTRICITY	ELECTRIC SUBSTATIONS	58	17	11	-6
ENERGY – OIL AND GAS	PETROLEUM TERMINALS	18	3	4	1
GOVERNMENT FACILITIES AND EDUCATION	DAYCARE CENTERS	98	16	14	-2
	PRISONS	10	4	3	-1
	PUBLIC SCHOOLS	122	28	26	-2
	SCHOOLS	110	27	22	-5
	SHELTER FACILITIES	85	16	15	-1
HEALTHCARE, PUBLIC HEALTH, AND HOUSING	DIALYSIS CENTERS	19	3	2	-1
	MOBILE HOME PARKS	48	25	22	-3
	NURSING HOMES	32	5	3	-2
	NURSING RESIDENTIAL CARE FACILITIES	75	11	8	-3
	PHARMACIES	86	16	15	-1
OTHER FACILITIES	BANKS	92	19	20	1
	GAS STATIONS	80	18	17	-1
	LIBRARIES	27	6	8	2
TRANSPORTATION – MARITIME	PORT FACILITIES	328	221	222	1

6.0 LAFITTE RING LEVEE

The Lafitte Ring Levee project was selected in IP1 of the 2023 Coastal Master Plan and provides risk reduction almost exclusively to the Lafitte community that it surrounds. The levee will be constructed to an elevation of 16 ft NAVD88 around most of the developed structures in Lafitte. The project features include approximately 120,000 ft of earthen levee, approximately 30,000 ft of T-wall, two 30-ft barge gates, a 56-ft barge gate, three 150-ft barge gates, and a 40-ft roller gate (Figure 17). In a FWOA, almost of all the structures in Lafitte are projected to have moderate exposure to flooding from 2% AEP events by Year 20. This project is intended to reduce that exposure and corresponding flood damage, lowering EADD by more than 90% by Year 20.

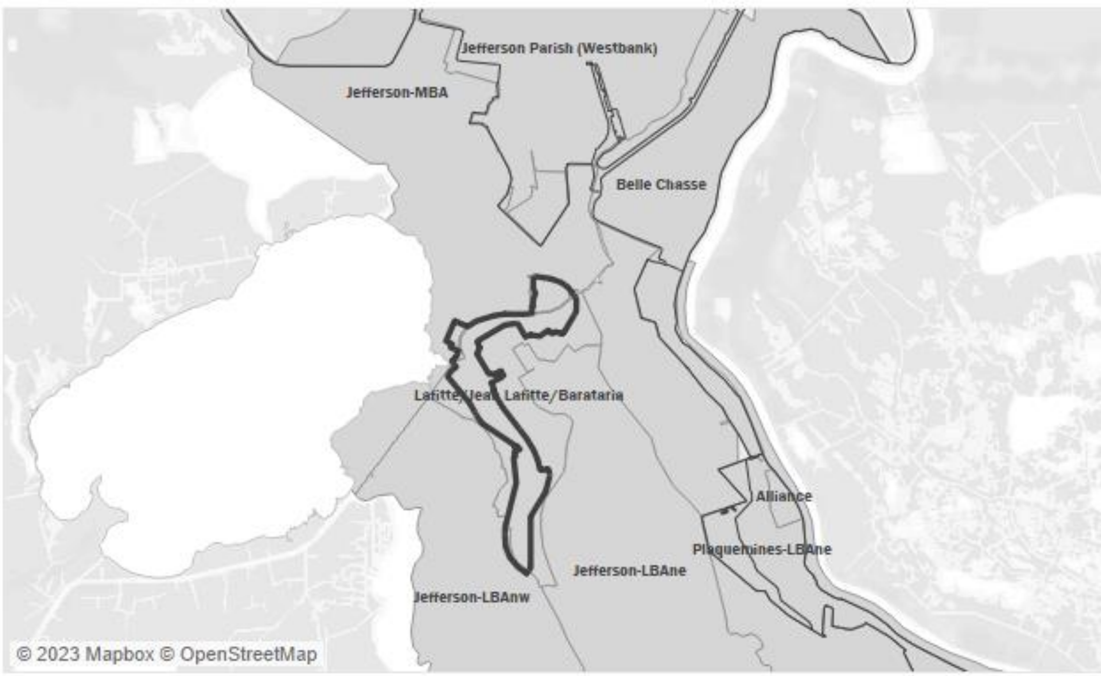

Figure 17. Map of the Lafitte Ring Levee project and affected communities. Thin dark gray lines show structural projects included in initial conditions and FWOA simulations, while the thicker black line highlights the proposed new project.

6.1 FLOOD DEPTH IMPACTS

Flood depths with a 1% AEP are moderate in most of the communities that would be affected by the Lafitte Ring Levee project. In Lafitte, these depths range from approximately 7-10 ft in Year 20 to approximately 10-12 ft by Year 50 of the lower environmental scenario (Figure 18). In the higher environmental scenario, these depths could increase to up to approximately 13-16 ft for Lafitte. Communities to the east that might be impacted by the project, including parts of Jefferson and Plaquemines parishes, are expected to experience higher 1% AEP flood depths in Year 20 of both scenarios (approximately 10-12 ft, though higher in some parts of Plaquemines Parish in the higher environmental scenario). The 1% AEP flood depths for Year 50 for these communities are comparable to Lafitte's in Year 50. Communities that lie within the local New Orleans to Venice protection levees (e.g., Alliance and southern Belle Chasse), however, see much lower hazard, with 1% AEP flood depths below 4 ft in all cases.

With the Lafitte Ring Levee in place, 1% AEP flooding is reduced by more than 6 ft in Year 20 (regardless of the environmental scenario) for the parts of Lafitte enclosed in the levee (Figure 19). There also appear to be some modest flood reduction effects (1-3 ft) in the parts of Jefferson to the immediate northwest of the project. However, some parts of Jefferson and Plaquemines are projected to see an additional 1-3 ft of flooding with the project in place across both environmental scenarios.

The part of Lafitte protected by the levee project sees reductions in 1% AEP flood depths of 6 ft or more in Year 50 of both environmental scenarios. The area northwest of the project that sees decreased flood depths is smaller in Year 50 across both scenarios. The portions of Jefferson and Plaquemines southwest of the project experience largely unchanged hazard, with the same expected level of increased flooding (approximately 1-3 ft).

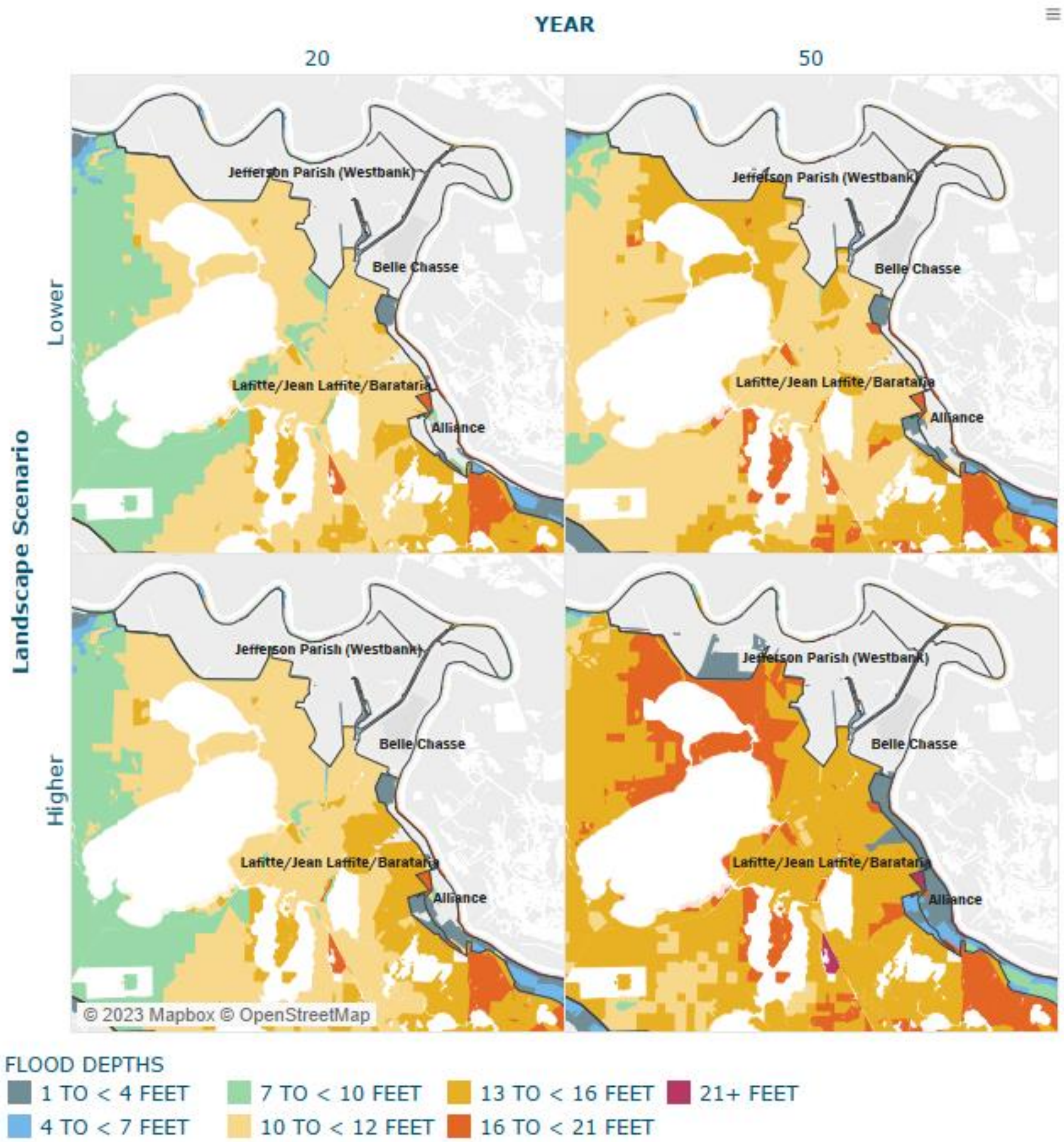

Figure 18. FWOA 1% AEP (1-in-100 annual chance) flood depths in Years 20 and 50 in the Barataria region — IPET fragility, 50% pumping scenario, 50th percentile.

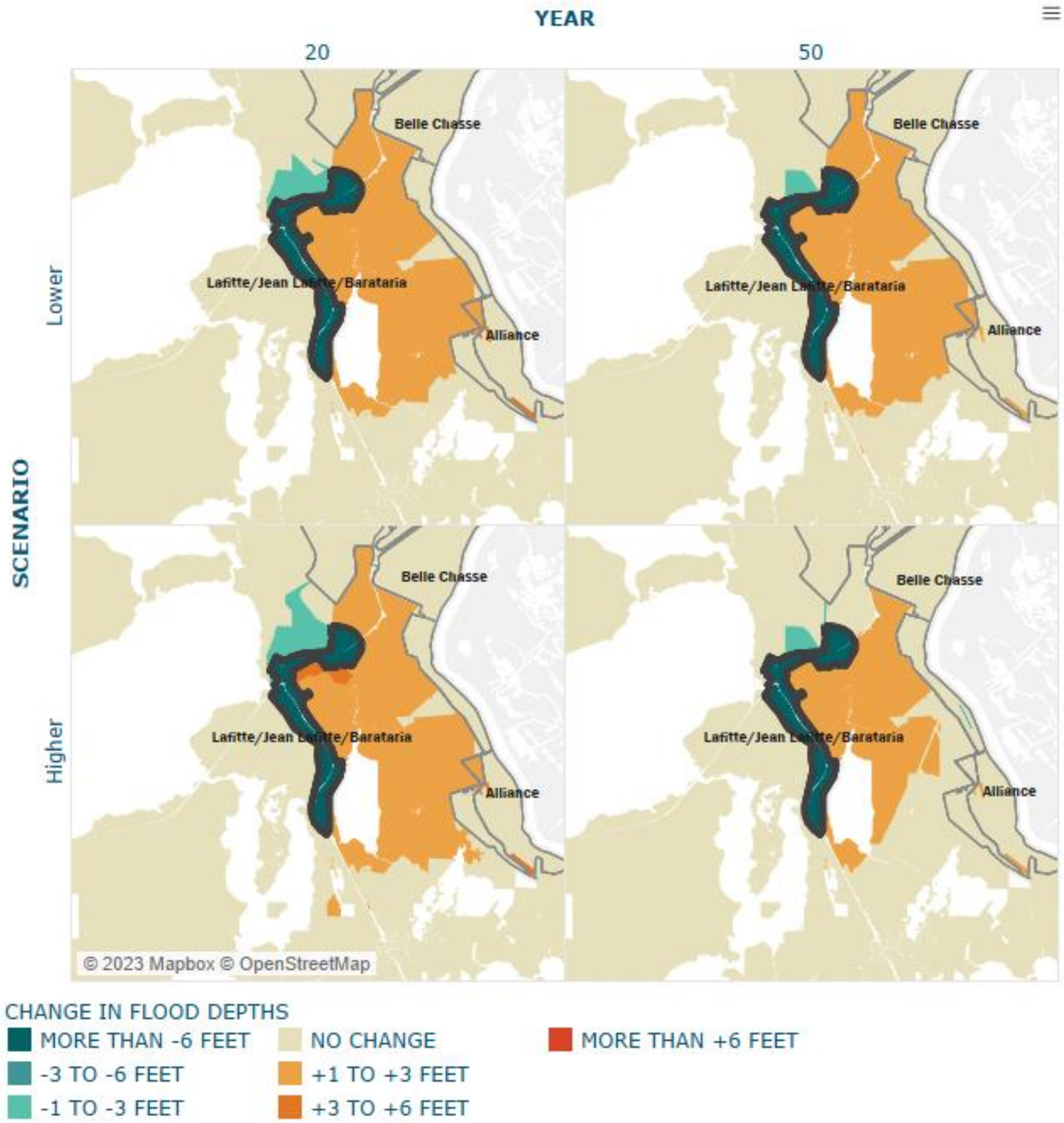

Figure 19. Change in 1% AEP (1-in-100 annual chance) flood depths with Lafitte Ring Levee project in place – IPET fragility, 50% pumping scenario, 50th percentile. Thin light gray lines show structural projects included in initial conditions and FWOA simulations, while the thicker black line highlights the proposed new project.

6.2 FLOOD DAMAGE IMPACTS

In Lafitte, more than 97% of structures face a moderate level of exposure at Year 20 in the lower environmental scenario (Table 7), with slightly higher numbers of structures facing exposure in Year 50; values are approximately the same in the higher environmental scenario (not shown). These numbers are reduced by 74-76% with the Lafitte Ring Levee project in place, depending on the scenario. The levee has minimal effect on exposure for other communities, reducing exposure for a handful of buildings in unincorporated regions of Jefferson Parish.

Table 7. Change in residential exposure to 2% AEP (1-in-50 annual chance) flooding with the Lafitte Ring Levee project in place

COMMUNITY NAME	TOTAL STRUCTURES	FWOA EXPOSURE	FWP EXPOSURE	EXPOSURE CHANGE	EXPOSURE CHANGE (%)
LAFITTE/JEAN LAFITTE/ BARATARIA	2,516	2,481	584	-1,897	-76%
JEFFERSON-MBA	293	240	238	-2	-1%
JEFFERSON-LBANW	36	36	35	-1	-3%
TOTAL	**2,868**	**2,757**	**857**	**-1,900**	**-69%**

NOTE: Results reflect exposure of small residential structures in Year 50 of the lower scenario at the moderate exposure threshold (depth exceeds first floor elevation). Communities with no change in exposure or a change unrelated to the proposed alignment are omitted. Suffixes on some community names denote ecoregions: LBAnw – Lower Barataria Northwest, MBA – Mid Barataria.

When considering the average benefits over events with a wide range of AEPs, almost all of the benefits of the project accrue to Lafitte itself (Figure 20). The project is estimated to reduce EADD by approximately 92% in Year 20 and 94% in Year 50 for the lower environmental scenario. Similarly, EASD is reduced by approximately 89% in Year 20, with risk reduction growing to 92% in Year 50. Values for the higher environmental scenario were lower by approximately 1% in Year 50 across both metrics. These percentages correspond to $179-200 million in benefits in Year 20 and $204-232 million in Year 50 (Figure 21).

In addition, Belle Chasse sees a reduction in EADD and EASD in Year 50 of approximately 10% (though notably FWOA EADD in Belle Chasse is relatively small, only $9 million compared to more than $200 million for Lafitte). Additionally, in the higher scenario for Year 50, the Jefferson Parish (West Bank) community sees a modest increase in EADD of approximately 11% (with a corresponding EASD increase of 10%), indicating some induced flooding may be negatively impacting the area.

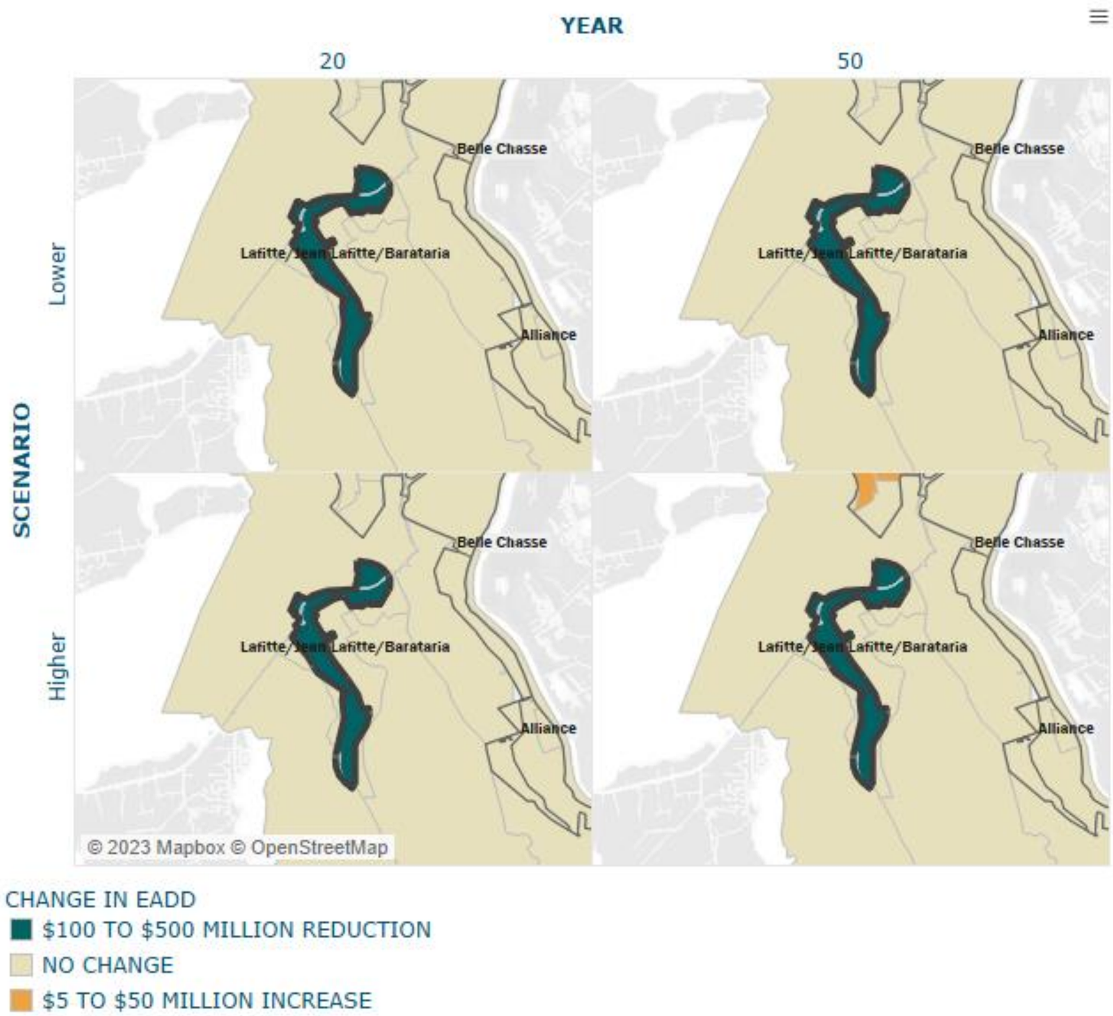

Figure 20. Change in EADD with the Lafitte Ring Levee project in place – IPET fragility, 50% pumping scenario, 50th percentile. Thin light gray lines show structural projects included in initial conditions and FWOA simulations, while the thicker black line highlights the proposed new project.

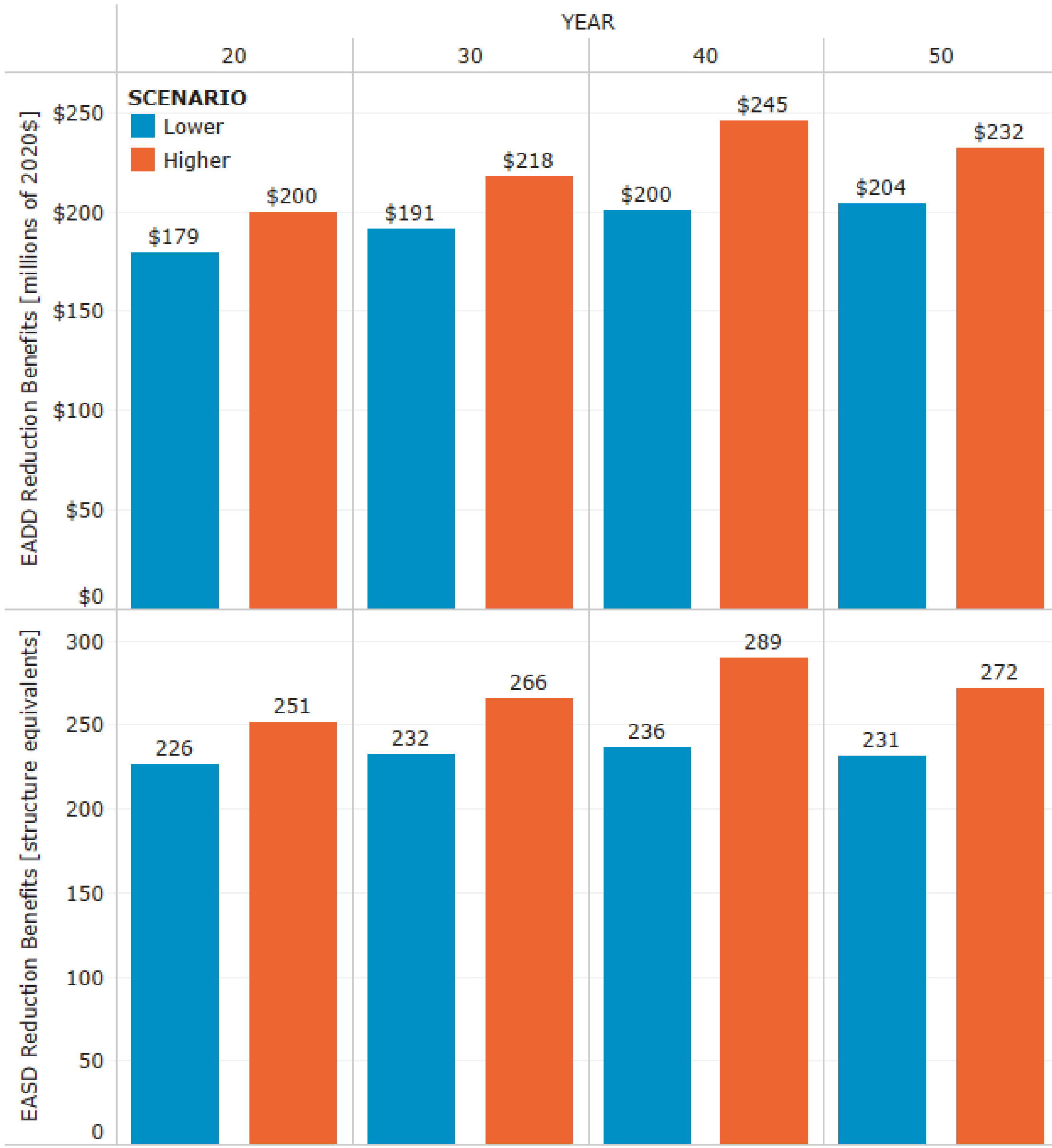

Figure 21. Change in EADD and EASD with the Lafitte Ring Levee project in place.

The only critical infrastructure class facing moderate exposure in the project area under 2% AEP flooding in Year 50 of the lower scenario is Port Facilities (Table 8). Without the project, about half of the port facilities in Lafitte are expected to be impacted by flooding (91 total). The project reduces this number by three, a 3% reduction.

Table 8. Change in exposure of critical infrastructure to 2% AEP (1-in-50 annual chance) flooding with the Lafitte Ring Levee project in place

ASSET CATEGORY	ASSET TYPE	TOTAL COUNT	FWOA	FWP	CHANGE
TRANSPORTATION - MARITIME	PORT FACILITIES	186	91	88	-3

7.0 SLIDELL RING LEVEE

The Slidell Ring Levee project, an alignment along the southern edge of the Slidell community, was selected in IP1 of the 2023 Coastal Master Plan. The levee will be constructed to an elevation of 13-17 ft NAVD88, shielding the northern part of Slidell from Lake Pontchartrain to the south. The project intersects and extends protection from several existing ring levees. Its features include approximately 76,000 ft of earthen levee, approximately 11,000 ft of T-wall, a 30-ft barge gate, a 180-ft barge gate, a 220-ft barge gate, a 20-ft stop log gate, and a 30-ft stop log gate (Figure 22). In a FWOA, EADD in the area is projected to rise above $700 million by Year 20 in the lower scenario. In the higher scenario at Year 50, EADD is greater than $2 billion. This project is intended to reduce this damage, providing as much as $1.4 billion in avoided losses.

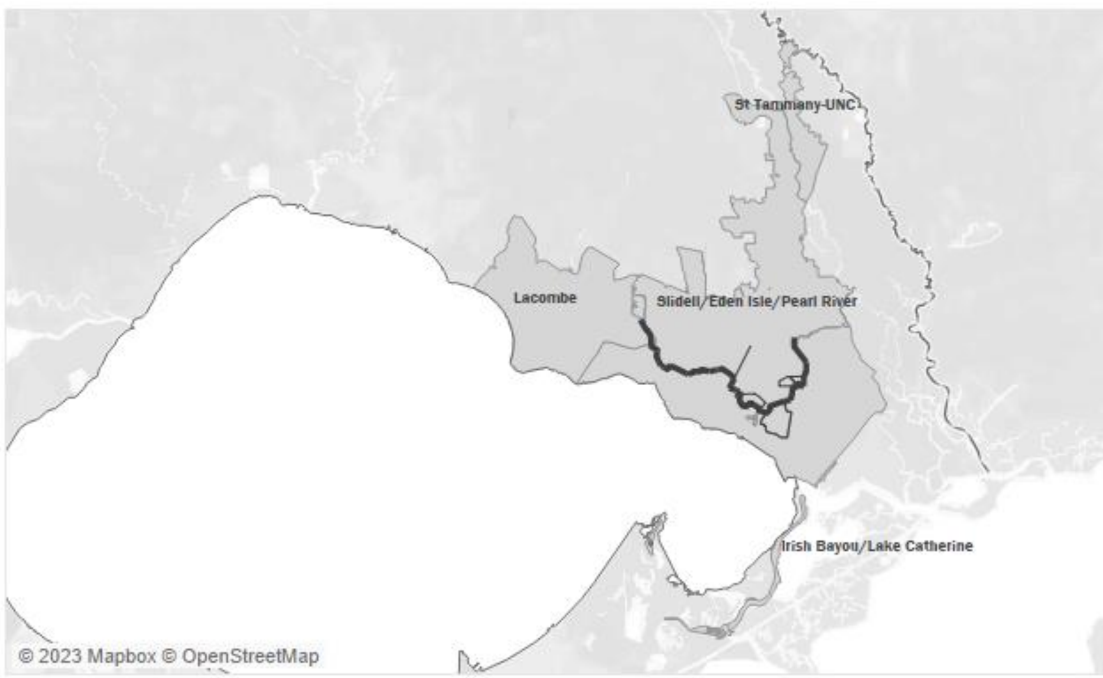

Figure 22. Map of the Slidell Ring Levee project and affected communities. Thin dark gray lines show structural projects included in initial conditions and FWOA simulations, while the thicker black line highlights the proposed new project.

7.1 FLOOD DEPTH IMPACTS

Flood depths with a 1% AEP in Year 20 of the lower environmental scenario are moderate in most parts of the Slidell community included in the project area (Figure 23). These range from approximately 4-7 ft on the southernmost edge of the project area with lower depths moving further inland from Lake Pontchartrain. The far western edge of the project area has higher depths of 10-12 ft close to the shore of Lake Pontchartrain with lower depths further inland. However, the areas directly outside the project see more severe flooding of up to 13-16 ft. This pattern of depths is similar in Year 50 of the lower scenario, with slight increases to depths further inland. In the higher environmental scenario, the Year 20 1% AEP depths are not particularly different from the lower scenario Year 20 1% AEP depths. By contrast, the Year 50 higher scenario 1% AEP depths are higher, especially in the western part of the impacted area that is projected to experience depths in the 13-16 ft range.

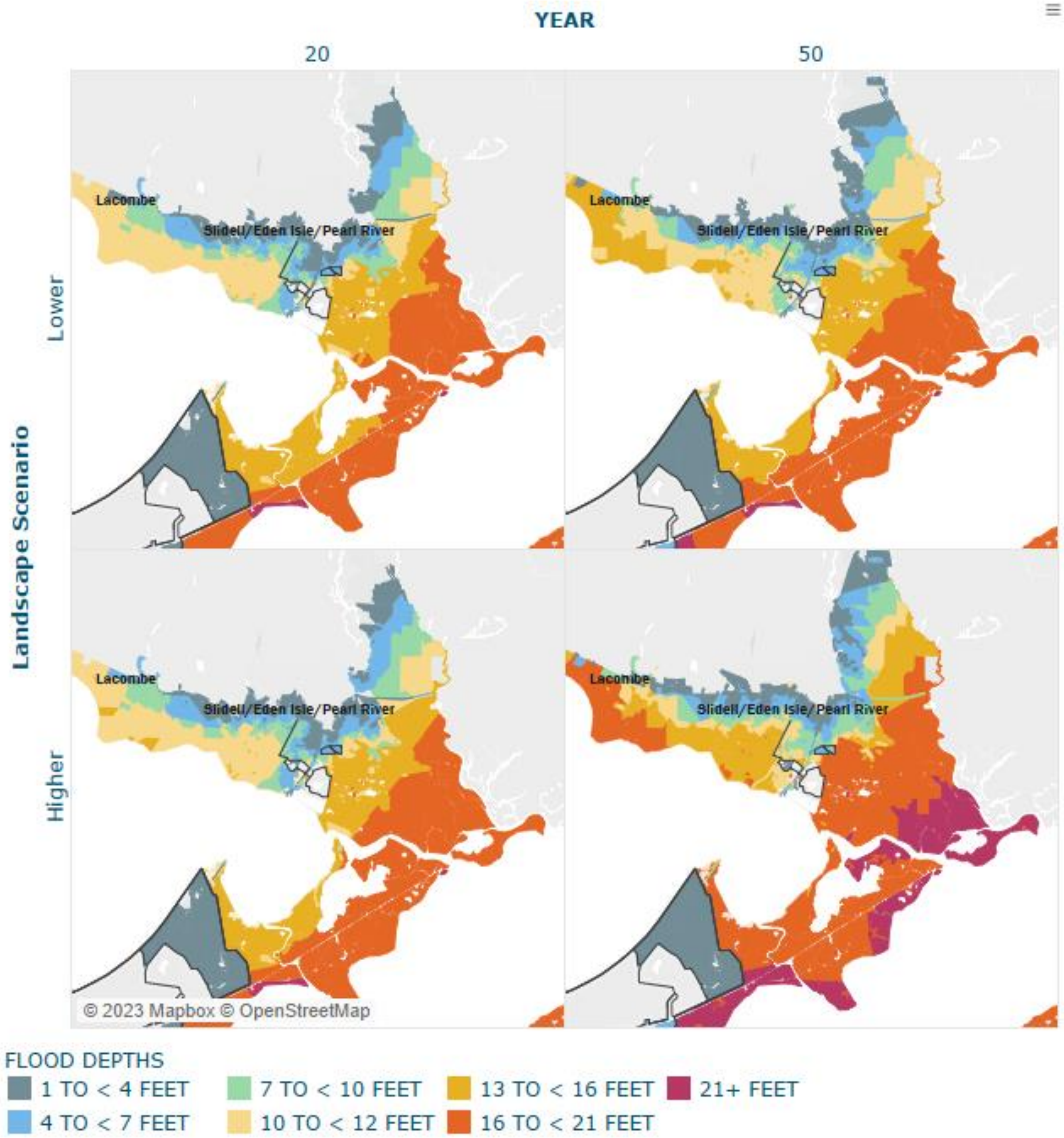

Figure 23. FWOA 1% AEP (1–in-100 annual chance) flood depths in Years 20 and 50 in the Pontchartrain region — IPET fragility, 50% pumping scenario, 50th percentile.

With the Slidell Ring Levee in place, 1% AEP flooding is reduced by more than 6 ft in Year 20 (regardless of the environmental scenario) for the parts of Slidell closest to the levee (Figure 24). Further from the levee, in the northern part of the protected area there appear to be some more modest flood reduction effects (1-3 ft). A small part of Slidell outside the levee could see an additional

1-3 ft of flooding with the project in place in the higher environmental scenario in Year 20.

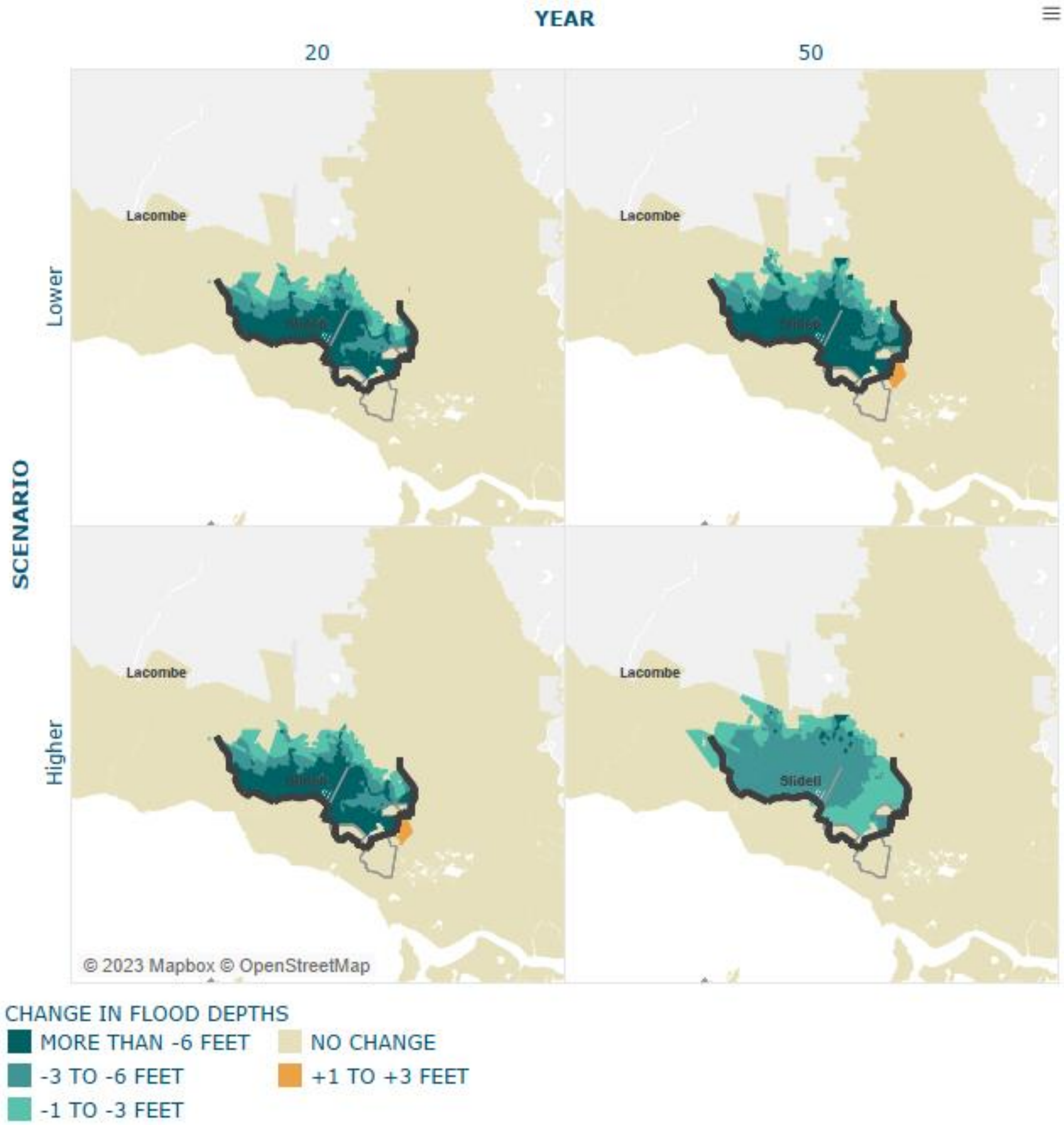

Figure 24. Change in 1% AEP (1-in-100 annual chance) flood depths with the Slidell Ring Levee project in place – IPET fragility, 50% pumping scenario, 50th percentile. Thin light gray lines show structural projects included in initial conditions and FWOA simulations, while the thicker black line highlights the proposed new project.

The reduction in 1% AEP flood depth in the lower environmental scenario in Year 50 is similar to the higher environmental scenario in Year 20, with the part of Slidell closest to the levee seeing reductions in flood depth greater than 6 ft, smaller reductions further to the north, and some increase in flood depths outside the levee to the south. There is also a small increase in the part of Slidell experiencing flood depth reductions on the northern edge of the protected area, compared with both scenarios for Year 20. In the higher environmental scenario, depth reduction in the protected part of Slidell is more modest for Year 50: 3-6 ft in the center of the protected area and 1-3 ft on the periphery. The extent of flood depth reduction is largest in the higher environmental scenario Year 50 case, with more parts of Slidell on the northern edge of the protected area having projected flood depth reductions.

7.2 FLOOD DAMAGE IMPACTS

In Slidell, approximately 55% of structures face a moderate level of exposure at Year 50 in the lower environmental scenario (Table 9). These numbers are reduced by 40% with the project in place. The levee has minimal effect on exposure for other communities, reducing exposure for a small number of buildings in Lacombe.

Table 9. Change in residential exposure to 2% AEP (1-in-50 annual chance) flooding with the Slidell Ring Levee project in place

COMMUNITY NAME	TOTAL STRUCTURES	FWOA EXPOSURE	FWP EXPOSURE	EXPOSURE CHANGE	EXPOSURE CHANGE (%)
SLIDELL/EDEN ISLE/PEARL RIVER	35,589	19,565	11,658	-7,907	-40%
LACOMBE	4,655	1,557	1,541	-16	-1%
TOTAL	**40,244**	**21,122**	**13,199**	**-7,923**	**-38%**

NOTE: Results reflect exposure of small residential structures in Year 50 of the lower scenario at the moderate exposure threshold (depths above first floor elevation).

The project provides benefits exclusively to the Slidell community, with some induced risk in areas on the Lake Pontchartrain side of the alignment, notably Eden Isle (Figure 25). However, the benefits to Slidell are substantial. While the project only reduces EADD by 34-35% depending on year in the lower scenario, these percentage reductions translate into as much as a $776 million reduction in EADD for the lower environmental scenario in Year 50 (Figure 26). Similarly, EASD is reduced by approximately 37% in Year 20 and 36% in Year 50. Reductions for both metrics in the higher environmental scenario are approximately 2-3 percentage points less in Year 50 than the lower scenario. With the much larger FWOA EADD, however, the Year 50 reduction in EADD translates to a $1.4 billion benefit.

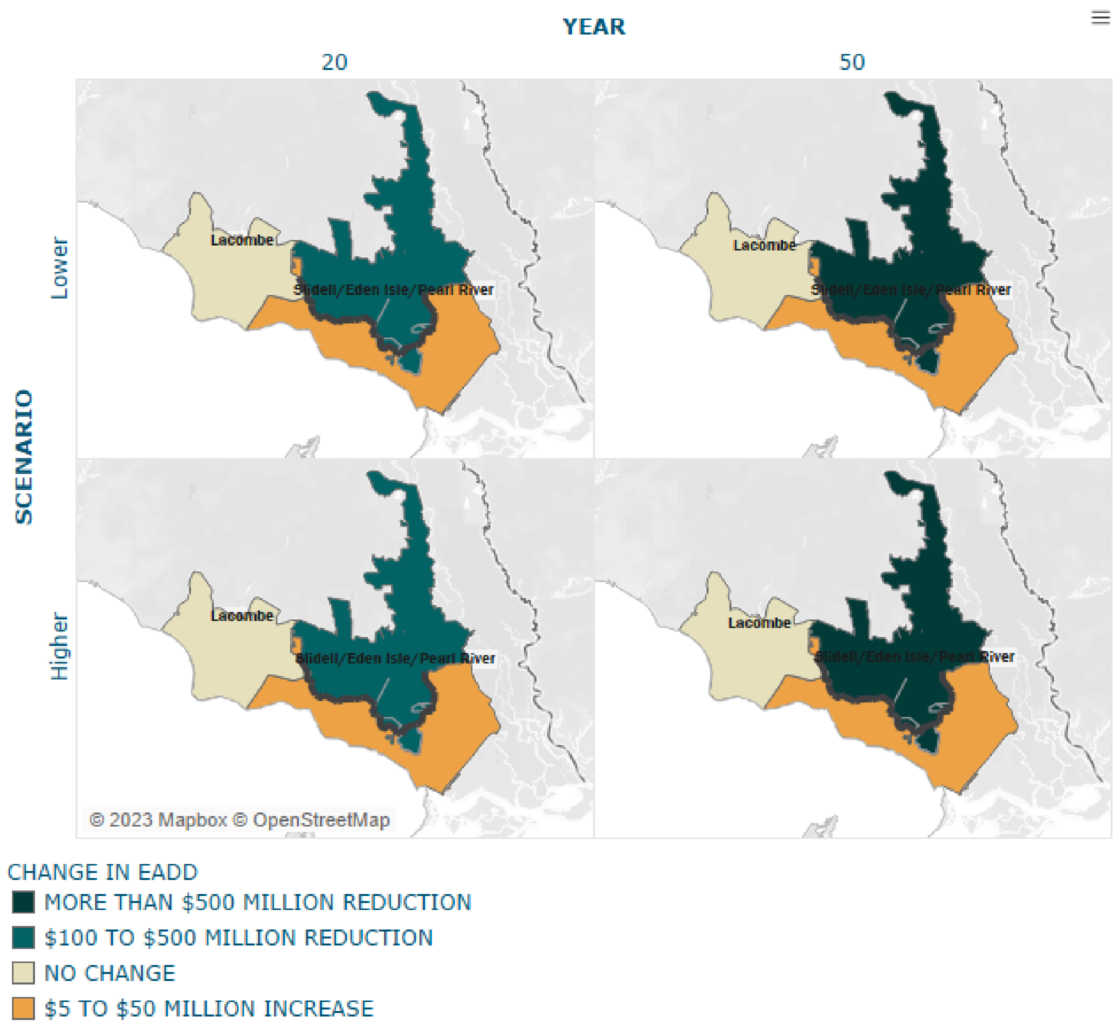

Figure 25. Change in EADD with the Slidell Ring Levee project in place – IPET fragility, 50% pumping scenario, 50th percentile. Thin light gray lines show structural projects included in initial conditions and FWOA simulations, while the thicker black line highlights the proposed new project.

Figure 26. Change in EADD and EASD with the Slidell Ring Levee project in place.

The project reduces the number of critical infrastructure assets facing moderate exposure from 2% AEP flooding in Year 50 of the lower environmental scenario by 47% (Table 10). These benefits are not evenly distributed across attribute classes, with the largest reductions seen by Emergency Services (80%); Government Facilities and Education (69%); and Healthcare, Public Health and Housing (54%). Other critical infrastructure types see lesser benefits.

Table 10. Change in exposure of critical infrastructure to 2% AEP (1-in-50 annual chance) flooding with the Slidell Ring Levee project in place

ASSET CATEGORY	ASSET TYPE	TOTAL COUNT	FWOA	FWP	CHANGE
CHEMICALS, WATER, AND WASTE	DRINKING WATER TREATMENT PLANTS	123	45	29	-16
COMMUNICATIONS	AM TRANSMISSION TOWERS	1	1	0	-1
	MICROWAVE SERVICE TOWERS	27	18	16	-2
EMERGENCY SERVICES	EMS STATIONS	15	5	1	-4
	FIRE STATIONS	12	4	1	-3
	LOCAL LAW ENFORCEMENT	2	1	0	-1
ENERGY - ELECTRICITY	ELECTRIC SUBSTATIONS	9	7	5	-2
GOVERNMENT FACILITIES AND EDUCATION	DAYCARE CENTERS	33	16	4	-12
	PUBLIC SCHOOLS	26	13	5	-8
	SCHOOLS	21	12	4	-8
	SHELTER FACILITIES	16	3	1	-2
	STATE GOVERNMENT BUILDINGS	1	1	0	-1
HEALTHCARE, PUBLIC HEALTH, AND HOUSING	DIALYSIS CENTERS	3	1	0	-1
	MOBILE HOME PARKS	17	4	3	-1
	NURSING HOMES	10	2	1	-1
	NURSING RESIDENTIAL CARE FACILITIES	23	11	1	-10
	PHARMACIES	29	13	9	-4
OTHER FACILITIES	BANKS	21	16	8	-8
	GAS STATIONS	22	9	5	-4
	LIBRARIES	4	1	0	-1
TRANSPORTATION - MARITIME	PORT FACILITIES	16	16	12	-4

8.0 CONCLUSION

This report presented the simulation modeling results projecting coastal flood risk and damage over a 50-year period, contrasting risk in a FWOA to a FWP where five different structural protection systems were constructed and/or upgraded. Results described in this analysis were simulated with the ADCIRC+SWAN and CLARA models to inform the development of Louisiana's 2023 Coastal Master Plan. The document described projected flood depths (with an emphasis on 1% AEP events), exposure of single-family residences, and expected annual damage for coastal Louisiana.

Looking coastwide, each of these projects selected for implementation by the 2023 Coastal Master Plan show substantial reductions in flood depth exceedances in the interior of the proposed alignments, community and critical infrastructure asset exposure to flooding, and flood damage over the 50-year planning horizon when in place on the coastal landscape. The flood risk results described in this report demonstrate the need to take action in the master plan in order to reduce risk to people and assets across Louisiana's coastal communities.

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