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2017 Coastal Master Plan

Attachment C2-5: Options for Sensitivity Analyses



Report: Final

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Coastal Protection and Restoration Authority

This document was prepared in support of the 2017 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 five years) and annual plans. CPRA's mandate is to develop, implement, and enforce a comprehensive coastal protection and restoration master plan.

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Option 1

Table 1: Design of Phase I simulations for Option 1. Grey cells denote values that are different from the baseline. Low = the lowest value of the range to be tested; mid = a value in the mid area of the range; high = the highest value of the range to be tested.

Model Run	Precipitation	Evapotranspiration	ESLR (over 50 years) ¹	Subsidence ²	Tropical Storm Frequency (all storms) ³	Tropical Storm Frequency (major storms) ⁴
1 (Baseline)	Historical (mid)	Historical (high)	.22m (low)	20% of range (low)	Historical; 0% (high)	+13% (low)
2	Historical (mid)	Historical (high)	.43m (low-mid)	20% of range (low)	Historical; 0% (high)	+13% (low)
3	Historical (mid)	Historical (high)	.43m (low-mid)	50% of range (mid)	Historical; 0% (high)	+13% (low)
4	Historical (mid)	Historical (high)	.63m (high-mid)	50% of range (mid)	Historical; 0% (high)	+13% (low)
5	Historical (mid)	Historical (high)	.83m (high)	50% of range (mid)	Historical; 0% (high)	+13% (low)
6	Historical (mid)	Historical (high)	.83m (high)	75% of range (high)	Historical; 0% (high)	+13% (low)
7	Historical (mid)	Historical (high)	.22m (low)	50% of range (mid)	Historical; 0% (high)	+13% (low)
8	Historical (mid)	Historical (high)	.22m (low)	75% of range (high)	Historical; 0% (high)	+13% (low)
9	GENMOM (low)	GENMOM (low)	.22m (low)	20% of range (low)	Historical; 0% (high)	+13% (low)
10	GENMOM (low)	ECHAM (mid)	.22m (low)	20% of range (low)	Historical; 0% (high)	+13% (low)
11	GENMOM (low)	Historical (high)	.22m (low)	20% of range (low)	Historical; 0% (high)	+13% (low)
12	Historical (mid)	GENMOM (low)	.22m (low)	20% of range (low)	Historical; 0% (high)	+13% (low)

¹ 2017 ESLR calculation of 0.22 meters/50 years uses the NRC 1 scenario (0.5 meters by 2100); 0.43 meters/50 years uses the NRC 2 scenario (1 meter by 2100); 0.63 meters/50 years, uses the NRC 3 scenario (1.5 meters ESLR by 2100).

² 20% into the range was used for the 2012 moderate scenario, and 50% into the range was used for the 2012 less optimistic scenario.

³ -28% change from current is equivalent to 17 storms/50 years; -14% change from current is equivalent to 20 storms/50 years; 0% change from current is equivalent to 23 storms/50 years.

⁴ The number of major storms changes as a percentage of the number of total storms.

13	Historical (mid)	ECHAM (mid)	.22m (low)	20% of range (low)	Historical; 0% (high)	+13% (low)
14	ECHAM (high)	GENMOM (low)	.22m (low)	20% of range (low)	Historical; 0% (high)	+13% (low)
15	ECHAM (high)	ECHAM (mid)	.22m (low)	20% of range (low)	Historical; 0% (high)	+13% (low)
16	ECHAM (high)	Historical (high)	.22m (low)	20% of range (low)	Historical; 0% (high)	+13% (low)
17	Historical (mid)	Historical (high)	.22m (low)	20% of range (low)	-28% (low)	+13% (low)
18	Historical (mid)	Historical (high)	.22m (low)	20% of range (low)	-14% (mid)	+50% (mid)
19	Historical (mid)	Historical (high)	.22m (low)	20% of range (low)	Historical; 0% (high)	+50% (mid)
20	Historical (mid)	Historical (high)	.22m (low)	20% of range (low)	Historical; 0% (high)	+83% (high)

The number of major hurricanes changes as a percentage of the total number of tropical storms. For every 23 tropical storms, 10 of them are a major hurricane (i.e., 43%). To determine the number of major hurricanes in any given experimental model run, one must first determine the total number of tropical storms and then use the 0.45 relationship to determine the number of major hurricanes. See Table 2 for example.

Table 2: Changes in the number of all storms and major storms over 50 years under the various test combinations.

	Baseline	Combination 1	Combination 2	Combination 3	Combination 4
% change all storms		-28%	-14%	-14%	0%
% change major storms		13%	13%	50%	83%
# all storms / 50 years	23	17	20	20	23
# major storms / 50 years	10	8	10	13	18

Option 2

Table 3: Sixty-four sensitivity analysis model runs using the three environmental driver combinations detailed in Table 5 of Appendix C. Low = the lowest value of the range to be tested; mid = a value in the mid area of the range; high = the highest value of the range to be tested.

Model Run	Precipitation/Evapotranspiration		RSLR		Tropical Storms	
	Precipitation	Evapotranspiration	ESLR (over 50 years) ⁵	Subsidence ⁶	Tropical Storm Frequency (all storms) ⁷	Tropical Storm Frequency (major storms) ⁸
1	Historical (mid)	IWMI - historical (high)	0.22m (low)	20% into range (low)	-28% (low); 17 storms	+13% (low); 8 major
2	Historical (mid)	IWMI - historical (high)	0.22m (low)	20% into range (low)	-14% (mid); 20 storms	+13% (low); 10 major
3	Historical (mid)	IWMI - historical (high)	0.22m (low)	20% into range (low)	-14% (mid); 20 storms	+50% (mid); 13 major
4	Historical (mid)	IWMI - historical (high)	0.22m (low)	20% into range (low)	0% (high); 23 storms	+83% (high); 18 major
5	Historical (mid)	IWMI - historical (high)	0.43m (mid)	20% into range (low)	-28% (low); 17 storms	+13% (low); 8 major
6	Historical (mid)	IWMI - historical (high)	0.43m (mid)	20% into range (low)	-14% (mid); 20 storms	+13% (low); 10 major
7	Historical (mid)	IWMI - historical (high)	0.43m (mid)	20% into range (low)	-14% (mid); 20 storms	+50% (mid); 13 major

⁵ 2017 ESLR calculation of 0.22 meters/50 years uses the NRC 1 scenario (0.5 meters by 2100); 0.43 meters/50 years uses the NRC 2 scenario (1 meter by 2100); 0.63 meters/50 years, uses the NRC 3 scenario (1.5 meters ESLR by 2100).

⁶ 20% into the range was used for the 2012 moderate scenario, and 50% into the range was used for the 2012 less optimistic scenario.

⁷ -28% change from current is equivalent to 17 storms/50 years; -14% change from current is equivalent to 20 storms/50 years; 0% change from current is equivalent to 23 storms/50 years.

⁸ The number of major storms changes as a percentage of the number of total storms.

Model Run	Precipitation/Evapotranspiration		RSLR		Tropical Storms	
	Precipitation	Evapotranspiration	ESLR (over 50 years) ⁵	Subsidence ⁶	Tropical Storm Frequency (all storms) ⁷	Tropical Storm Frequency (major storms) ⁸
8	Historical (mid)	IWMI - historical (high)	0.43m (mid)	20% into range (low)	0% (high); 23 storms	+83% (high); 18 major
9	Historical (mid)	IWMI - historical (high)	0.43m (mid)	50% into range (mid)	-28% (low); 17 storms	+13% (low); 8 major
10	Historical (mid)	IWMI - historical (high)	0.43m (mid)	50% into range (mid)	-14% (mid); 20 storms	+13% (low); 10 major
11	Historical (mid)	IWMI - historical (high)	0.43m (mid)	50% into range (mid)	-14% (mid); 20 storms	+50% (mid); 13 major
12	Historical (mid)	IWMI - historical (high)	0.43m (mid)	50% into range (mid)	0% (high); 23 storms	+83% (high); 18 major
13	Historical (mid)	IWMI - historical (high)	0.83m (high)	75% into range (high)	-28% (low); 17 storms	+13% (low); 8 major
14	Historical (mid)	IWMI - historical (high)	0.83m (high)	75% into range (high)	-14% (mid); 20 storms	+13% (low); 10 major
15	Historical (mid)	IWMI - historical (high)	0.83m (high)	75% into range (high)	-14% (mid); 20 storms	+50% (mid); 13 major
16	Historical (mid)	IWMI - historical (high)	0.83m (high)	75% into range (high)	0% (high); 23 storms	+83% (high); 18 major
17	GENMOM (low)	GENMOM (low)	0.22m (low)	20% into range (low)	-28% (low); 17 storms	+13% (low); 8 major
18	GENMOM (low)	GENMOM (low)	0.22m (low)	20% into range (low)	-14% (mid); 20 storms	+13% (low); 10 major
19	GENMOM (low)	GENMOM (low)	0.22m (low)	20% into range (low)	-14% (mid); 20 storms	+50% (mid); 13 major

Model Run	Precipitation/Evapotranspiration		RSLR		Tropical Storms	
	Precipitation	Evapotranspiration	ESLR (over 50 years) ⁵	Subsidence ⁶	Tropical Storm Frequency (all storms) ⁷	Tropical Storm Frequency (major storms) ⁸
20	GENMOM (low)	GENMOM (low)	0.22m (low)	20% into range (low)	0% (high); 23 storms	+83% (high); 18 major
21	GENMOM (low)	GENMOM (low)	0.43m (mid)	20% into range (low)	-28% (low); 17 storms	+13% (low); 8 major
22	GENMOM (low)	GENMOM (low)	0.43m (mid)	20% into range (low)	-14% (mid); 20 storms	+13% (low); 10 major
23	GENMOM (low)	GENMOM (low)	0.43m (mid)	20% into range (low)	-14% (mid); 20 storms	+50% (mid); 13 major
24	GENMOM (low)	GENMOM (low)	0.43m (mid)	20% into range (low)	0% (high); 23 storms	+83% (high); 18 major
25	GENMOM (low)	GENMOM (low)	0.43m (mid)	50% into range (mid)	-28% (low); 17 storms	+13% (low); 8 major
26	GENMOM (low)	GENMOM (low)	0.43m (mid)	50% into range (mid)	-14% (mid); 20 storms	+13% (low); 10 major
27	GENMOM (low)	GENMOM (low)	0.43m (mid)	50% into range (mid)	-14% (mid); 20 storms	+50% (mid); 13 major
28	GENMOM (low)	GENMOM (low)	0.43m (mid)	50% into range (mid)	0% (high); 23 storms	+83% (high); 18 major
29	GENMOM (low)	GENMOM (low)	0.83m (high)	75% into range (high)	-28% (low); 17 storms	+13% (low); 8 major
30	GENMOM (low)	GENMOM (low)	0.83m (high)	75% into range (high)	-14% (mid); 20 storms	+13% (low); 10 major
31	GENMOM (low)	GENMOM (low)	0.83m (high)	75% into range (high)	-14% (mid); 20 storms	+50% (mid); 13 major

Model Run	Precipitation/Evapotranspiration		RSLR		Tropical Storms	
	Precipitation	Evapotranspiration	ESLR (over 50 years) ⁵	Subsidence ⁶	Tropical Storm Frequency (all storms) ⁷	Tropical Storm Frequency (major storms) ⁸
32	GENMOM (low)	GENMOM (low)	0.83m (high)	75% into range (high)	0% (high); 23 storms	+83% (high); 18 major
33	ECHAM (high)	ECHAM (mid)	0.22m (low)	20% into range (low)	-28% (low); 17 storms	+13% (low); 8 major
34	ECHAM (high)	ECHAM (mid)	0.22m (low)	20% into range (low)	-14% (mid); 20 storms	+13% (low); 10 major
35	ECHAM (high)	ECHAM (mid)	0.22m (low)	20% into range (low)	-14% (mid); 20 storms	+50% (mid); 13 major
36	ECHAM (high)	ECHAM (mid)	0.22m (low)	20% into range (low)	0% (high); 23 storms	+83% (high); 18 major
37	ECHAM (high)	ECHAM (mid)	0.43m (mid)	20% into range (low)	-28% (low); 17 storms	+13% (low); 8 major
38	ECHAM (high)	ECHAM (mid)	0.43m (mid)	20% into range (low)	-14% (mid); 20 storms	+13% (low); 10 major
39	ECHAM (high)	ECHAM (mid)	0.43m (mid)	20% into range (low)	-14% (mid); 20 storms	+50% (mid); 13 major
40	ECHAM (high)	ECHAM (mid)	0.43m (mid)	20% into range (low)	0% (high); 23 storms	+83% (high); 18 major
41	ECHAM (high)	ECHAM (mid)	0.43m (mid)	50% into range (mid)	-28% (low); 17 storms	+13% (low); 8 major
42	ECHAM (high)	ECHAM (mid)	0.43m (mid)	50% into range (mid)	-14% (mid); 20 storms	+13% (low); 10 major
43	ECHAM (high)	ECHAM (mid)	0.43m (mid)	50% into range (mid)	-14% (mid); 20 storms	+50% (mid); 13 major

Model Run	Precipitation/Evapotranspiration		RSLR		Tropical Storms	
	Precipitation	Evapotranspiration	ESLR (over 50 years) ⁵	Subsidence ⁶	Tropical Storm Frequency (all storms) ⁷	Tropical Storm Frequency (major storms) ⁸
44	ECHAM (high)	ECHAM (mid)	0.43m (mid)	50% into range (mid)	0% (high); 23 storms	+83% (high); 18 major
45	ECHAM (high)	ECHAM (mid)	0.83m (high)	75% into range (high)	-28% (low); 17 storms	+13% (low); 8 major
46	ECHAM (high)	ECHAM (mid)	0.83m (high)	75% into range (high)	-14% (mid); 20 storms	+13% (low); 10 major
47	ECHAM (high)	ECHAM (mid)	0.83m (high)	75% into range (high)	-14% (mid); 20 storms	+50% (mid); 13 major
48	ECHAM (high)	ECHAM (mid)	0.83m (high)	75% into range (high)	0% (high); 23 storms	+83% (high); 18 major
49	GENMOM (low)	IWMI - historical (high)	0.22m (low)	20% into range (low)	-28% (low); 17 storms	+13% (low); 8 major
50	GENMOM (low)	IWMI - historical (high)	0.22m (low)	20% into range (low)	-14% (mid); 20 storms	+13% (low); 10 major
51	GENMOM (low)	IWMI - historical (high)	0.22m (low)	20% into range (low)	-14% (mid); 20 storms	+50% (mid); 13 major
52	GENMOM (low)	IWMI - historical (high)	0.22m (low)	20% into range (low)	0% (high); 23 storms	+83% (high); 18 major
53	GENMOM (low)	IWMI - historical (high)	0.43m (mid)	20% into range (low)	-28% (low); 17 storms	+13% (low); 8 major
54	GENMOM (low)	IWMI - historical (high)	0.43m (mid)	20% into range (low)	-14% (mid); 20 storms	+13% (low); 10 major
55	GENMOM (low)	IWMI - historical (high)	0.43m (mid)	20% into range (low)	-14% (mid); 20 storms	+50% (mid); 13 major

Model Run	Precipitation/Evapotranspiration		RSLR		Tropical Storms	
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56	GENMOM (low)	IWMI - historical (high)	0.43m (mid)	20% into range (low)	0% (high); 23 storms	+83% (high); 18 major
57	GENMOM (low)	IWMI - historical (high)	0.43m (mid)	50% into range (mid)	-28% (low); 17 storms	+13% (low); 8 major
58	GENMOM (low)	IWMI - historical (high)	0.43m (mid)	50% into range (mid)	-14% (mid); 20 storms	+13% (low); 10 major
59	GENMOM (low)	IWMI - historical (high)	0.43m (mid)	50% into range (mid)	-14% (mid); 20 storms	+50% (mid); 13 major
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64	GENMOM (low)	IWMI - historical (high)	0.83m (high)	75% into range (high)	0% (high); 23 storms	+83% (high); 18 major