
PLAN FORMULATION APPENDIX

**COLLIER COUNTY COASTAL STORM RISK MANAGEMENT
FEASIBILITY STUDY**

COLLIER COUNTY, FLORIDA

APPENDIX A

JULY 2020



**U.S. Army Corps
of Engineers
Norfolk District**

TABLE OF CONTENTS

1	CRITICAL ASSUMPTIONS IN THE PLANNING PROCESS	1
2	OTHER SOCIAL EFFECTS PLANNING METRICS	7
2.1	Health and Safety	7
2.2	Economic Vitality	8
2.3	Social Connectedness	8
2.4	Identity	8
2.5	Social Vulnerability.....	9
2.6	Participation	9
2.7	Leisure and Recreation	10

1 CRITICAL ASSUMPTIONS IN THE PLANNING PROCESS

Table 1 below provides a summary of important planning decisions, risks, and consequences encountered during the study.

Table 1. Critical Assumptions and Decisions in the Planning Process

Discipline	Scoping Choice or Event	Risk and Its Cause	Consequence
Economics	Use of Generation 2 Coastal Risk Management (G2CRM) model.	Economists are unfamiliar with inputs and outputs of new G2CRM model, which could increase study cost and schedule.	Unfamiliarity with a new model may increase time required to gather inputs and interpret outputs of modeling.
Economics	G2CRM data requirements.	G2CRM model requires H5 formatted wave characteristic data input based on STWAVE or ADCERC models. It is uncertain where this data will be obtained since the Coastal Hazards System (CHS) does not currently have the H5 files for Southeast Florida.	If appropriate H5 data cannot be obtained, the study area will not be able to be adequately modeled in G2CRM.
Economics	Use both Beach-fx and G2CRM models in this study.	Beach-fx will be used for structures adjacent to the beach and G2CRM will be used for the rest of the back bay study area.	It is possible some benefits may not be captured in the areas where the two models meet. This may result in under estimating damages.
Economics	Large size (square footage and levels) of structures being analyzed in Beach-fx.	Structures analyzed within Beach-fx may fall within the footprint of affected area, but due to the large size of the structures, damages may not affect the entire building.	It is possible some damages may be overestimated due to the overlap of building footprints on the affected area along the beach line. This may result in over estimating benefits.

Discipline	Scoping Choice or Event	Risk and Its Cause	Consequence
Economics	Implementing a suitable Recreational Benefit Analysis Methodology.	Given the lack of OMB approval of surveys initially proposed for developing recreational benefits for the study, a secondary methodology was proposed: use of the Deepwater Horizon Data using the Random Utility Model (a variation of the Travel Cost Method).	If the Deep Water Horizon Data is not approved for use for this analysis, then the recreational benefits will be limited (per policy) to 750,000 user days within the Unit Day Value methodology.
Economics	Use of NACCS depth damage curves in G2CRM model.	The NACCS curves were developed for the northeast U.S., and there have been concerns raised about the conditions in South Florida not being equivalent to those in the northeast. However the NACCS DDFs are the only coastal DDFs developed by USACE, and they are the only ones available; there are no known alternatives to the NACCS DDFs.	The DDFs are a significant factor in how the G2CRM model evaluates damage to the structure inventory. If the DDFs are not accurate, then the damages generated by the model will also be inaccurate. If the damages generated in the model are over- or understated, then the benefits, NED analysis, and plan selection may be affected.

Discipline	Scoping Choice or Event	Risk and Its Cause	Consequence
Economics	Use the National Structure Inventory (NSI) data for G2CRM/Beach-fx structure inventories.	National data sets are never as accurate as locally verified data, but there is not a better data source available from which to build the structure inventory. Elevation certificates were provided by the NFS and cities within the study area, albeit only for approximately 10% of the total number of structures being analyzed.	For nonstructural measures, structures may be incorrectly identified as candidates for mitigation. Later in the process when each individual structure is field verified, some structures may drop out of the recommended plan and affect the project metrics of BCR, NED Benefits, etc. Similarly, some structures which were thought to provide benefits behind structural measures may also be mischaracterized.
Engineering	Defer soil borings/ geotechnical exploration to the Pre-construction, Engineering, and Design (PED) phase for beach project areas only.	Discovery of subsurface conditions that vary from those assumed from existing information could negatively impact construction cost and schedule.	Additional cost and schedule for design and construction.
Engineering	Use sand from an offshore borrow area.	New borrow sources may be required, increasing costs for developing those sand sources.	Additional study costs to determine sand sources for lifecycle of project.
Engineering	Use of Generation 2 Coastal Risk Management (G2CRM) model.	Coastal/H&H engineers are unfamiliar with engineering inputs to new G2CRM model, which could increase study cost and schedule.	Unfamiliarity with a new model may increase time required to gather inputs for modeling.
Engineering	Formulate alternative plans which include barriers and floodwalls along inland bay areas.	Structural issues due to karst geology may induce piping failures.	Constructed structural measures in the project area become structurally deficient.

Discipline	Scoping Choice or Event	Risk and Its Cause	Consequence
Environmental	Including surge barriers in alternatives for Inland Bay Areas.	Significant increase to cost and schedule for inland bay water quality monitoring.	Water quality in inland bay areas may be affected by influx of freshwater from runoff during storm events.
Environmental	Construct wider/higher beach profiles that could impact offshore Hard Bottom resources.	Impacts to resources will affect engineering designs and require mitigation.	Critical habitat may be lost.
Environmental	Justifying NNBF measures for CSRМ using tools that are new and untested in USACE studies.	Quantification of CSRМ benefits attributed to NNBF has not been widely done in USACE CSRМ studies and the PDT will need to rely on tools developed by others such as academic institutions.	NNBF benefits could be miscalculated which would affect the BCR of each alternative that includes NNBF. Also, NNBF may have to be scaled back or eliminated if not compatible with Rookery Bay National Estuarine Research Reserve regulations and public use.
Environmental	EIS completed under SMART Planning may not be to the level of detail that environmental resource agencies are accustomed to seeing.	Lack of detail in the EIS may lead to increased number of agency comments and/or coordination needed.	Agencies will have significant comments on the NEPA document (EIS) and there could be delays in the study if there are significant comments that require extra time to address.

Discipline	Scoping Choice or Event	Risk and Its Cause	Consequence
Environmental	Mitigation plan will have to be developed using interim impacts analysis before the EIS is complete.	The mitigation plan may not include all requirements and cost for mitigation because it must be developed before the EIS is complete.	Because mitigation requirements depend directly on impacts (which may not fully be captured during the preparation of the draft EIS), the mitigation plan may not include all mitigation requirements and/or costs. Second, the costs of mitigation could later influence a preferred alternative to the point where it would no longer be practicable. Third, it is difficult to determine what sites might be appropriate and available for mitigation without further onsite investigation and real estate research. Finally, regulatory agencies will not give their final acceptance of a mitigation plan until after the permit process is complete, and mitigation requirements of agencies could also change over time.
Environmental	All supplemental studies are on the same schedule and are coordinating with the same resource agencies in south Florida.	If resource agencies are inundated with requests from all studies at one time, they will not be able to respond in a timely fashion given their fixed personnel resources. The government shutdown in early 2019 could also exacerbate this issue with Federal agencies such as NOAA and USFWS.	Schedule delays if key NEPA coordination/ products are missing due to limited agency resources affecting their response time.

Discipline	Scoping Choice or Event	Risk and Its Cause	Consequence
Cultural Resources	Possible identification of National Register of Historic Places eligible archeological site(s).	Finding a significant site will require archeological mitigation IAW the National Historic Preservation Act.	Increased costs for mitigation.
Cultural Resources	Defer Section 106 identification surveys to the PED phase of the project through a Programmatic Agreement.	Possible underestimation of cultural resources mitigation costs required because surveys will not be completed until PED.	Increased mitigation costs required late in the project delivery process, possibly affecting the efficiency of the project.
Real Estate	Obtaining Perpetuity Easements.	Private property owners may not sign easements because they are not agreeable to granting public access to beaches via part of their property.	Some sections of beach may not be able to be reconstructed if easements are not granted.
Real Estate	Including acquisition in Recommended Plan.	Buyouts are required by policy when included in the recommended plan.	If Sponsor does not have the appetite to execute the acquisitions recommended from the study, negotiation of a Locally Preferred Plan could extend the post-TSP analysis and writing of the draft report.
Plan Formulation	Inclusion of inland bay areas in study scope.	Study could possibly become 3x3 noncompliant; milestones may not be met on time.	Study could possibly be terminated or remain incomplete until restarted under additional appropriations.

Discipline	Scoping Choice or Event	Risk and Its Cause	Consequence
Plan Formulation	Use 10 feet (NAVD88) as water level for plan formulation. This is specifically applicable to beach dune, structural wall/barrier heights, and nonstructural measure evaluation and analysis.	The team considered the approximate 100-year FEMA water level to be a reasonable running estimate for planning management measures and formulating alternatives throughout the study area. It is possible there are alternate water levels that are more cost efficient than 10 feet.	If 10 feet is too high, construction costs could be overstated resulting in less net NED benefits. If too low, the economic benefits (damages) will be understated.
Plan Formulation	NNBF measures will be added to and evaluated with the alternatives after the TSP has been identified.	There could be instances where NNBF are substituted for structural or nonstructural measures, likely on the basis of avoiding environmental impacts and environmental acceptability, and this would be expected to change the costs and benefits for that alternative.	If the costs and/or benefits change significantly for an alternative as a result of the addition to and/or substitution of NNBF measures for structural or nonstructural measures already included in the final array of alternatives or TSP, it could change the economics and affect plan comparison.

2 OTHER SOCIAL EFFECTS PLANNING METRICS

2.1 HEALTH AND SAFETY

A basic human need is for personal and group safety. Conditions that are seen as unsafe or unhealthy create stress and dissatisfaction among those affected. The level of perceived risk associated with conditions or alternatives is also a factor in determining satisfaction. The health and safety metric considers the implications of each plan to the wellbeing of the community. Health and safety included considerations for impacts to the environment, access to health facilities, and the ability for police and fire to operate. The No Action plan would allow the worsening of flooding to continue. This would allow for flood waters to negatively impact communities within Collier County through potential environmental damage due to flooding, reducing trafficability of roads and access to hospitals, impeding the operations of police and fire vehicles, and damaging some police and fire stations. The nonstructural plan, Alternative 3, would improve upon the No Action plan by removing structures from the floodplain, however, environmental, roadway, and utility damages would still be expected to negatively impact health and safety operations. The structural measures would reduce these damages the most by altering the floodplain such that risk to structures, roadways, and utilities would be mitigated to the design level. Of the plans with structural measures, Alternatives 2 and 4 perform the best in this category because they include measures along interior bays which provide the most extensive project alignments. Alternative 4 also benefits from a combination of nonstructural

effects. Alternative 1 leaves significant neighborhoods outside the project alignment, and alternative 3 reduces risk to fewer neighborhoods within planning areas 1, 3, and 5. Therefore these alternatives score lower than alternatives containing inland bay area structural measures.

2.2 ECONOMIC VITALITY

Personal and group definitions of quality of life are influenced by an economy's ability to provide a good standard of living for residents now and into the future. Factors such as employment opportunities, income, poverty, educational opportunities, and access to markets affect economic vitality and may be affected by a water resources issue. Solutions offered to these problems and the effects created by implementing plans are of great interest to stakeholders. The economic vitality factor includes subcategories which speak to the important role beaches play as an economic driver of the local economy and for county tax revenue. The beach only alternative, in and of itself, provides negligible impact to economic vitality because it doesn't directly affect the community's ability to attract and retain business or provide significant employment opportunities. It does however firmly impact the standard of living and the local tax base, largely through the Collier County tourist development tax (TDT). The TDT is a 5% tax for all short-term occupancies within the County, inherently driven by tourism. The larger tax base allows Collier County to more reliably provide municipal services and maintain beaches. The structural plans with inland bay measures protecting a larger portion of the community performed the best in this category. In addition to the anticipated effects of the plan beach components, the structural alternatives were judged as having significant beneficial effects on the business climate and employment opportunities. Seasonal visitors to Collier County provide the mechanism for a slurry of businesses to sustain themselves within the community. However attracting and retaining these businesses would not be possible without the additional risk reduction provided by the inland bay structural measures in alternatives 2 and 4. The No Action and alternative 3 plans would allow more floodwaters to penetrate inland which is assumed to negatively impact tax revenue through the loss of business and residents. Alternative 3 scored highly for enabling municipal services, giving consideration to the critical infrastructure component of that plan.

2.3 SOCIAL CONNECTEDNESS

Social connectedness refers to the pattern of social networks within which individuals interact, which largely provides meaning and structure to life. Social networks are composed of horizontal associations that are generally focused at community and family levels of interaction and vertical associations that bridge across communities and levels of society. This metric considers issues affecting local social networks, access to community facilities, and an overall sense of identity and connectedness within Collier County. In this case the primary consideration was which plans maintain a similar level of flood mitigation for contiguous neighborhoods. The No Action plan scores poorly because in future scenarios it is assumed that neighborhoods will thrive or decline based on financial means. This would create greater inequality throughout the County. Likewise, the alternative 3 nonstructural plan would likely see increases in inequality because those with financial means will be able to adapt better or will leave higher risk neighborhoods, leaving more vulnerable populations behind. Structural measures provide a more even and equal level of flood mitigation to an area. The structural measures are able to capture both wealthy and low income neighborhoods and provide the same benefit. The alternative 4 plans provide an extensive structural alignment but also includes nonstructural measures where needed. Again, the structural plans perform best.

2.4 IDENTITY

Identity is the sense of self as a member of a group, distinct and distinguished from other

groups by values, beliefs, norms, roles, and culture. The need to cultivate group identities is widely seen as part of human social nature. Related to the concept of identity is the concept of cultural security, which is the need for the recognition and honoring of one's language, traditions, and values. Fulfilling these basic well-being concepts is central to minimizing circumstances where dissatisfaction and conflict occur as a result of threatened, dishonored, or violated identity needs. The cultural identity and significant historic districts, structures, and archaeological sites were considered in this factor. The plans with structural measures scored the best for protecting historic structures. This is because the structures would see reduced flooding and/or would not need to be elevated. This would allow for these structures to maintain their historic look and feel. However when archaeological sites are located where the structural measures are proposed, they will have the most significant negative effects. Construction in these areas would have a negative impact on these sites. Beach fill was seen as a minor beneficial effect since the resources would be protected by its cover. No plan scores well with regards to archaeological sites. In terms of community identity, regardless of measure type, the alternatives with the most widespread alignments and protecting the most structures were rated high. This gives consideration to the perception that will be shared by others who are from outside of Collier County. Implementing these plans will signal to neighboring communities the importance of addressing coastal storm risk and be an exemplary stance on building more resilient communities.

2.5 SOCIAL VULNERABILITY

Social vulnerability refers to the capacity for being damaged or negatively affected by hazards or impacts. Vulnerability is associated with certain groups of the population such as the aged, poor, or minorities because they are generally more vulnerable than other parts of the population. Such groups may lack the resources to resist the hazard or to recover from the effects of the hazard. Alternatives with structural measures generally score best when considering socially vulnerable populations. This is because socially vulnerable populations are more dependent on the functioning of city infrastructure and services than more wealthy populations. Structural measures will create a more comprehensive flood mitigation result throughout the County which will have a significant benefit for low income neighborhoods and citizens. Alternative 3 which is nonstructural will remove properties from the flooding, however, vehicles, roadways, and other infrastructure will remain at a higher risk. With that being said, the most vulnerable census block, according to the CDC social vulnerability index is located in a planning area that was formulated as a nonstructural area. This is an example of *place* vulnerability, which is an alternative way of examining where vulnerable populations live in relation to hazardous areas. Therefore the highest scores for this metric belong to alternatives 3 and 4 because they both include planning area 4 and nonstructural measures for the socially vulnerable neighborhoods in southeast Naples. These plans would allow investment in the area of Collier County with the greatest hazard potential.

2.6 PARTICIPATION

Participation means being able to interact with others to influence social outcomes. Complex social structures, such as government, pose greater challenges for participation. Participation has also been commonly recognized as a critical role in legitimate group action and building cohesion. Every alternative scored well in this metric. The beach only alternative ranked highest as beaches seem to be the top priority for residents of Collier County and local government alike. Therefore a plan to bolster the size of beach features and simultaneously increase community resilience was seen as the *best-fit* solution, answering only the calls of the public and no more. Alternatives 2-4, although complete and acceptable plans, are expected to cause concern amongst the constituents due to the much higher costs of construction.

Committing to a multi-billion dollar project with more environmental impacts than would be seen only on the beach may call into question the trust of local officials and whether or not public opinion was considered regarding public interest in a community beach project.

2.7 LEISURE AND RECREATION

Having leisure time and being able to spend it in preferred recreational pursuits is an important part of well-being for most people. To the degree that water resources problems or solutions affect leisure time and/or recreational opportunities, they are likely to be perceived as important considerations in selecting preferred solutions. While floodwalls may impede access to some waterfront recreation, this affect is expected to be minimal given the proposed alignments. When integrated with a storm surge barrier or tide gate, as they are in the alternative plans, these measures are also noted for their ability to reduce flooding along waterfront property that is behind or upland to the alignment. For this reason the alternatives with structural measures scored best. Alternative 4 was however rated lower than other alternatives because this plan included fewer reaches of beach fill along the coast. This would negatively impact recreational beach capacity and water access to tourists and Collier County residents.