LOUISIANA COASTAL PROTECTION AND RESTORATION
FINAL TECHNICAL REPORT

RISK-INFORMED DECISION FRAMEWORK APPENDIX

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U. S. Army Corps of Engineers
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Mississippi Valley Division

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ATTACHMENTS

GLOSSARY

Eustatic Sea Level Rise: A change in global average sea level brought about by an increase in the volume of the world ocean (Intergovernmental Panel on Climate Change (IPCC) 2007b).

Isostatic or Isostasy: Isostasy refers to the way in which the lithosphere and mantle respond visco-elastically to changes in surface loads. When the loading of the lithosphere and/or the mantle is changed by alterations in land ice mass, ocean mass, sedimentation, erosion or mountain building, vertical isostatic adjustment results, in order to balance the new load (Intergovernmental Panel on Climate Change (IPCC) 2007b).

Measure: A component of plans for risk reduction. Categories of risk reduction measures include structural, nonstructural and coastal restoration.

Metric: A parameter for quantifying the performance of plans in respect to planning objectives.

Natural variability: The heterogeneity of some attribute in a population.

Objective: In general, a *decision objective* is a statement that describes what a decision maker or stakeholder wants to achieve. Each stakeholder or decision maker may have a different set of objectives. A *planning objective* is a statement of the intended purposes of the planning process; it is a statement of what an alternative plan should try to achieve. (Note: Since metrics are just lower-level objectives within the objectives hierarchy, the terms have been used interchangeably.)

Plan: Any detailed scheme, program, or method worked out beforehand to accomplish an objective. A plan incorporates a combination of structural, nonstructural, and coastal restoration measures for risk reduction. Plans emerge from the plan formulation process.

Residual risk: The risk that remains after a risk reduction plan has been implemented.

Risk: The likelihood and severity of adverse outcomes.

Robust: A plan is robust if it remains optimal or near-optimal over most planning scenarios. May also refer to a plan that is strong enough to withstand or overcome intellectual challenges or adversity.

Stakeholder: Any organization, governmental entity, or individual that has a stake in or may be impacted by a given plan.

Uncertainty: A lack of knowledge that originates from an incomplete understanding of the structure and function of natural or manmade systems, the choice of a model to represent those systems, and the choice of the input values for the parameters of the chosen model.

1. INTRODUCTION

The Louisiana Coastal Protection and Restoration (LACPR) Technical Report has been developed by the United States Army Corps of Engineers (USACE) in response to Public Laws 109-103 and 109-148. Under these laws, Congress and the President directed the Secretary of the Army, acting through the Chief of Engineers, to:

- Conduct a comprehensive hurricane protection analysis and design in close coordination with the State of Louisiana and its appropriate agencies;
- Develop and present a full range of flood control, coastal restoration, and hurricane protection measures exclusive of normal policy considerations for South Louisiana;
- Consider providing protection for a storm surge equivalent to a Category 5 hurricane; and
- Submit preliminary and final technical reports.

This appendix describes the development and implementation of the risk-informed decision framework (RIDF), which is discussed in the main technical report. The RIDF has been developed to integrate risk and decision science methods (and detailed risk tradeoff analysis) into the USACE 6-step planning process. The attachments to this appendix provide additional data and background information on the application of MCDA to LACPR and on other evaluation criteria and plan rankings examined to further support the risk informed decision analysis.

1.1 Purpose, Approach, and Limitations of the RIDF

The LACPR team was directed to evaluate alternative solutions without reliance upon the traditional cost-benefit analysis methods. The team was encouraged to identify a final array of comprehensive, coastwide plans that will reduce risks of flooding caused by storm surge and coastline degradation while considering a full range of risks to people, cultural heritage, environment, property and economy as well as infrastructure, construction, operations, and maintenance costs. This approach is known as RIDF, or Risk-Informed Decision Framework.

As an integral part of RIDF, the team pioneered the implementation of a comprehensive evaluation of project alternatives through a multi-criteria decision making approach (MCDA) intended to provide comparable consideration of assets that are difficult to quantify in monetary terms. Over the course of the LACPR effort considerable learning regarding the possible approach to, and application of, such a framework has occurred, and it is necessary to clearly state the revealed shortcomings. Due to the time constraints of the plan formulation process for LACPR, it has not been feasible to incorporate lessons learned to improve the deterministic elements of RIDF or MCDA. However, MCDA has been a successful means to inform tradeoffs and is an effective means of communicating the wide spectrum of risks to stakeholders.

The “Risk Informed” approach to the decision process was conceptualized in response to the performance of existing storm damage reduction system and the contrast between the public perception of their relative risk and the risk designed for in existing or proposed measures. It was clear following Hurricanes Katrina and Rita that the public appreciation of their level of residual risk with some level of storm damage risk reduction in place was, if not inaccurate, inadequate. It was additionally evident that traditional decision making criteria (NED – benefit / cost) would generally discount the impact of extreme, “Category 5” events due to their relative rarity, or low probability. While directing an investigation of measures to potentially supply reduction of risk for extreme events, Congress also alluded to that investigation being conducted in a multi-criteria environment.

The products needed to achieve these objectives are: the decision methodology needs to be refined to achieve greater sensitivity to the extreme impacts of relatively rare events; and regardless of the success at achieving the first, the process needs to provide a clearer understanding of both the relative risk reduction provided to, and the residual risk being assigned to, the public. To achieve these outcomes there are several functional needs: to define the number and range of planning criteria; to determine the potential variations and proportions of those criteria within the decision; to gather data in support of the determination and application of those proportions; and to identify or develop evaluation techniques to appropriately gauge performance relative to the criteria and to scale them to the extreme level of event being considered.

Ultimately the legislatively directed singular purpose of the LACPR effort is the reduction of storm damage risk, particularly from extreme events. For the planning effort, the need for greater sensitivity to extreme events and the better communication of risk information was identified early in the process. The directive to develop a RIDF to effectively integrate all the aspects of the needs and desired outcomes came several months into the study effort. Throughout the plan formulation process, the planning team sought to correctly identify and compare metrics for performance of each alternative, and to involve stakeholders in the evaluation and selection process. However, with the planning objectives, or criteria, already established, performance metrics already identified, and evaluations already underway, certain aspects of this framework were effectively set before RIDF was developed. Despite these constraints, the planning team sought to develop and implement RIDF, and to integrate it with their prior and ongoing efforts.

As the planning effort developed, approaches tested for the RIDF have been found to prematurely eliminate certain alternatives from consideration. Those alternatives that provide greater risk reduction or cost efficiency seem to be discounted by the MCDA process. While the development of a RIDF approach has made significant strides in pursuit of evaluation of plans in light of performance across broad criteria, it does not yet meet the initial expectations.

It was initially concluded, with Vertical Team concurrence, that the Multi Criteria Decision Analysis (MCDA) tool could be effectively adapted to achieve the needed integration of criteria, risk evaluation, and communication. The initial objective for the application of MCDA was the full development of preference data through engagement with a diverse range of stakeholders to enable identification of, and to facilitate understanding of risk reduction based alternatives. The MCDA process does provide a platform for stakeholders to express and explore the relative importance of various performance related outputs and tradeoffs. Through iterative MCDA refinement and comparison of the range of individual preference patterns, and the resulting ordering of alternatives to best achieve the desired performance, stakeholders started to gain an understanding of performance, risk, and tradeoffs. Ultimately, the refined preference data and possible alternative choices based on this understanding will inform the decision process.

Over the course of completing alternative performance evaluations, and through iterative engagement and preference elicitation, several issues concerning both the MCDA tool and its application in LACPR surfaced. It first became evident that due to the lengthy duration of the performance evaluation process it would not be possible to adequately iterate the stakeholder elicitation feedback cycle required for an effective MCDA. Although two elicitation cycles were undertaken with stakeholders, the initial lack of final metric data required that two distinctly different elicitation processes be used. The difference in these techniques effectively limited the usefulness of the first cycle to a dry run of the engagement process and data processing, which was presented for internal and external technical review. The results of the second iteration of MCDA, although procedurally more sound, reveal some apparent inconsistency between the plan rankings resulting from the weighted preference patterns and the basic criteria preferences for population protection provided by the stakeholders. This inconsistency would normally be resolved through successive iteration. However, there is not sufficient time left in the planning process for those additional iterations. Without additional iterations of MCDA, limited confidence must be placed on the completeness of the array of alternative plans identified.

The tested results from the initial MCDA stakeholder elicitation indicated that some potential for the identification of clusters of common stakeholder preference patterns might exist. When the data from the second stakeholder elicitation was similarly tested, no explainable clusters of common value could be identified. As a result, the stakeholder data, resulting preference patterns, and plan utility scores were evaluated entirely on an individual basis. The combinability of the stakeholder results was limited to ordinal rankings (based on utility score) for each individual, for any given plan, as a relative gauge of cumulative preference.

This data indicates that it might be possible to discern trends or consistencies across the individual plan rankings, despite variance in preference patterns. However, the data set is limited by the number and diversity of the stakeholders sampled. The stakeholder group sampled represented a number of public government, non-governmental organizations, and private industry groups. The sample lacks statistical significance relative to the coastal population and the relative diversity is uneven across the planning units. Both numbers and diversity should be improved upon overall. It seems unlikely that the present data set will converge on a single common preference pattern, or utility, even with adequate iteration cycles.

Based on these limitations, the planning team decided that the MCDA tool is not a viable approach for a stand-alone risk based decision process. It was also concluded that the MCDA should be continued for the LACPR effort as a method of capturing stakeholder input and facilitating the process of communicating value differences, plan tradeoffs, and relative risk.

As a result, the planning team believes that MCDA provides a valuable supplement to RIDF by providing a semi-quantitative gauge of stakeholder sentiment regarding performance value. However, for future efforts additional steps must be taken to document the relative significance and diversity of the stakeholder sample, either statistically or through comparative demography.

The LACPR planning team also believes that additional risk informing value can be derived from comparing MCDA results with more traditional decision criteria employed by the USACE. This comparison was initially developed to provide a basis for identifying commonality in plan recommendation between these criteria. However, after further consideration it was decided that, because of the inherent variation in the decisions they potentially could produce, some reaffirmation of the result based on traditional criteria related to effectiveness, efficiency, and acceptability were fundamental to supporting the needs of fiscal decision makers. In addition they provide insight into potential tradeoffs and risk inherent in the decision process itself. Ranking results based on these criteria also provide a basis for the inclusion of alternatives that may be valued by the stakeholders based on their stated preference for plans which protect the population.

The development of evaluation criteria associated with effectiveness and efficiency also affords additional opportunity to assess sensitivity of the decision process to the impact of extreme events. Utilizing the same basic evaluation data used in MCDA, additional assessment of relative plan effectiveness were performed to contrast the effect of annualized versus episodic (based on the period of analysis) damage probabilities. The percent of cumulative potential damage reduction, based on each of the probabilistic surge events assessed, was also considered as a measure of effectiveness. These values were then be contrasted with expressions of plan costs (annual or present value) to test plan efficiency.

The application of episodic probability for damage serves two potential purposes; based on the period of analysis of 65 years employed in LACPR. First, the probabilities associated with the various level surge events (100-yr, 400-yr, 1000-yr, etc.) become more indicative of the chance of an individual experiencing those conditions within a lifetime at one location; and second those longer period probabilities produce a shift in the relative importance of rarer more extreme events and therefore illustrate the relative benefit of higher levels of risk reduction. The application of results based on this type of expression of effectiveness could indicate a greater optimal level of protection than the application of traditional, annualized data. The result of considering these varied evaluations demonstrates there is an observable variation, or potential tradeoff, and resultant risk, associated with possible decision approaches that should be considered.

In an effort to test the sensitivity of overall relative plan ranking to the varied evaluation criteria, the effect of combining these criteria was investigated. Multiple combinations of these criteria were tested, aggregating the ordinal or normalized results for each criteria set. This assessment indicated that by assigning some level of relatively equal importance to each evaluation criteria a tier of consistent optimal plan performance might be identified. As a result, this approach is employed in the report as a method of optimizing across all evaluation considerations, and identifying plans that might merit further, more detailed consideration. However due to the limitations described previously, this report can not provide any certainty as to whether any one or all of these evaluation approaches provides the truly optimal means for integrating the storm damage risk associated with extreme events.

The results of this RIDF analysis provide some insight and may be used as a foundation for further evaluation and development. However additional investigation and refinement of both the MCDA approach for stakeholder value elicitation and the consideration of impacts from extreme storm events is recommended. The Findings, and Conclusions and Recommendations Sections of this report identify some of the needs and possible actions that might be utilized to continue to refine and development a risk informed decision approach.

1.2 Overview of the RIDF

The LACPR decision process has considered a comprehensive set of planning objectives that include reducing risk to people and assets; promoting a sustainable and diverse environment; and sustaining the unique heritage of coastal Louisiana. In addition to these numerous diverse interests, it must also be recognized that the Louisiana coastal area is a dynamic environment that is rapidly changing in ways that are difficult to predict. Prudent decision makers will therefore take account of the uncertainty regarding economic, environmental, and other conditions that may affect the outcome of a project during the planning period of analysis.

The LACPR decision problem is to identify a final array of comprehensive, coastwide plans that will reduce the risks of flooding caused by storm surge and coastline degradation while considering a full range of risks to people, cultural heritage, environment, property, and economy as well as infrastructure construction, operations, and maintenance costs. The RIDF is responsive to these and other decision support needs of LACPR for which conventional decision support methods are poorly suited. The RIDF offers a decision approach that accounts for a comprehensive set of coastal assets in Louisiana, acknowledges the presence of a diverse group of stakeholders who exhibit different interests and objectives, and considers a broad range of decision objectives, in addition to stakeholder preferences, that include efficiency, effectiveness, and costs and future funding requirements. The RIDF approach also addresses uncertainty in certain environmental, social, and economic trends over the planning period of analysis that can affect the desirability of risk reduction strategies.

Conventional approaches to decision making have emphasized cost-benefit analysis, which is suitable only when decision outcomes can be fully monetized. There is now an increasing level of consideration given to assets that are difficult to quantify in monetary terms, such as wildlife habitat and cultural diversity, which tend to confound the application of that approach. Conventional decision methods have also emphasized a single decision methodology built around contributions of proposed actions to national economic development. However, the corporate direction given to the LACPR planning effort required an accounting of impacts on regional economic development, environmental, and other social effects, as well, in the decision process. Therefore, a multi-attribute decision analysis method was used to supplement more traditional methodologies. In addition, there is diverse set of stakeholders whose interests must also be taken into account. Conventional approaches to decision making have also tended to ignore uncertainty. By evaluating and communicating uncertainty during the planning process, the RIDF helps lead decision makers to more well-reasoned and rational choices among tradeoffs. The RIDF attempts to address the shortcomings of conventional decision approaches in a manner that is consistent with the USACE planning process.

1.2.1 RIDF is based on the USACE's Planning Process, Outfitted to Incorporate Risk Analysis and Decision Analysis

The RIDF is consistent with the USACE‘s standard approach to planning, but augments that approach with insights and techniques drawn from the fields of decision and risk analysis, as well as providing for a comprehensive presentation of plan preferences and outputs to facilitate a better understanding of plan tradeoffs that must be considered in making a decision. The RIDF provides procedures to help decision makers identify planning objectives, performance metrics, stakeholder priorities, and tradeoffs.

RIDF as a broader approach draws on tools such as multi-criteria decision analysis (MCDA) techniques (specifically, multi-attribute utility theory), because plan selection involves multiple, competing performance criteria denominated in in-commensurate terms, i.e., when some attributes of performance or project output such as life-cycle infrastructure costs can be expressed in monetary terms and others, such as impacts to wetlands, cannot.

The RIDF draws on risk analysis techniques to characterize and assess the uncertainties that complicate the LACPR decision and to provide for a comprehensive look at competing performance criteria under various future scenario conditions. These include uncertainties in the economic and environmental conditions that will influence the outcome of a decision (such as the rate of relative sea level rise) as well as the stochastic nature of storm surge events. The purpose is to help planners characterize the critical uncertainties most important to the choice among plans and to identify robust risk reduction strategies, which are decision alternatives that perform relatively well across a wide range of future conditions.

1.2.2 Why is RIDF "Risk-Informed?"

The RIDF is risk-informed because it:

- Accounts for the consequences of low-probability storms including expected property damages, population at risk, and regional economic impacts.
- Helps decision makers adjust their decisions to account for a lack of knowledge regarding the economic and environmental conditions that will influence plan performance.
- Provides for a better understanding of tradeoffs and remaining risks among competing areas of interests and project outputs.

1.2.3 What are the Advantages of RIDF?

The RIDF has several advantages.

- The framework engages stakeholders and decision makers in a process of issue identification and priority setting to formally establish project goals. The process helps decision makers to:
  - Identify and reveal hidden agendas
  - Identify, acknowledge and, when possible, fill data gaps that, if filled, could influence decisions;
- Objectives are expressed in the form of a multi-attribute utility function that:
  - Gives objectives that are difficult to monetize the same consideration as monetary objectives, enabling environmental and social decision objectives to receive equal consideration with economic objectives.
  - Allows decision makers to make explicit tradeoffs between objectives because progress on one objective can be used to compensate for lack of progress on another objective.

- Outputs and plan performance and evaluation scoring allow for equal consideration of stakeholder preferences, as well as cost efficiencies, project effectiveness in reducing risk and future funding requirements necessary for plan implementation.

1.3 Scope of this Appendix

This appendix provides an overview of the six planning steps in terms of the LACPR RIDF. Additional detail is provided on Step 3, formulation of plans, in the main report and in the Structural Plan Component Appendix, Nonstructural Plan Component Appendix, and Coastal Restoration Plan and Structural Environmental Impacts Appendix. Contents of this RIDF Appendix include:

- **Main Appendix**
  - Introduction, background, and scope
  - Overview of 6-step planning process and resultant outputs of the RIDF
  - Detailed descriptions of metrics and scenarios
  - Methods used to implement MCDA
  - Other decision support considerations

- **Attachment A - Application of MCDA to LACPR**
  - Results of MCDA rankings and uncertainty
  - Tables and figures showing sample outputs
  - Discussion and path forward

- **Attachment B - Decision Support Documentation (Evaluation Data and Plan Rankings to Support Risk Informed Decision Analysis)**
  - Expanded MCDA rankings
  - Multiple evaluation criteria
  - Tables showing sample outputs and plan rankings

2. BACKGROUND

2.1 Planning in the USACE – The Six-Step Planning Process

The *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies* (also known as Principles and Guidelines or P&G) and Engineering Regulation (ER) 1105-2-100, *Guidance for Conducting Civil Works Planning Studies* sets out a 6-step planning process:

1. Specify problems and opportunities;
2. Inventory, forecast and analyze conditions relevant to the identified problems and opportunities;
3. Formulate alternative plans;
4. Evaluate the effects of the alternative plans;
5. Compare alternative plans;
6. Recommend a plan from the compared alternatives.

Since publication of the P&G in 1983, USACE planning and decision-making have been primarily based on a comparison of alternatives using economic factors. Planners have also been confronted with the challenge to provide for integrated systems that serve multiple objectives (e.g., a coastal system that provides for flood and storm damage reduction, navigation, and ecosystem restoration) and/or whose performance is measured using evaluation criteria factors for conflicting decision objectives not all measured in monetary terms.

2.2 Changes in the Planning Landscape

In response to a USACE request for a review of P&G planning procedures, the National Research Council (1999) provided recommendations for streamlining planning processes, revising P&G guidelines, analyzing cost-sharing requirements and estimating the effects of risk and uncertainty integration in the planning process. Implementation guidance of the Environmental Operating Principles (EOP) (http://www.hq.usace.army.mil/cepa/envprinciples.htm) within USACE civil works planning directs that projects adhere to a concept of environmental sustainability that is defined as "a synergistic process whereby environmental and economic considerations are effectively balanced through the life of project planning, design, construction, operation and maintenance to improve the quality of life for present and future generations" (USACE 2003a, p. 5). While adhering to the overall P&G methodology, USACE (2003b) advises project delivery teams to formulate acceptable, combined economic development/ecosystem restoration alternatives through use of multi-criteria/trade-off methods.

2.3 USACE's Efforts to Address Planning Needs

Over the last several years, the USACE has been developing approaches and guidance for implementing multi-criteria decision analysis (MCDA) approaches for planning (Yoe, 2002; Linkov et al. 2004; Kiker et. al. 2005). This approach utilizes a comprehensive decision analytic framework that considers a broad array of objectives and criteria/metrics, including those associated with ecosystem restoration (Males, 2002). Guidance contained in *Trade-Off Analysis Planning and Procedures Guidebook (2002)* lays out a multi-criterion decision analytic approach for comparing and deciding between alternative plans and relates the P&G six-step planning process described above to outputs of the RIDF, as depicted in Figure 1.

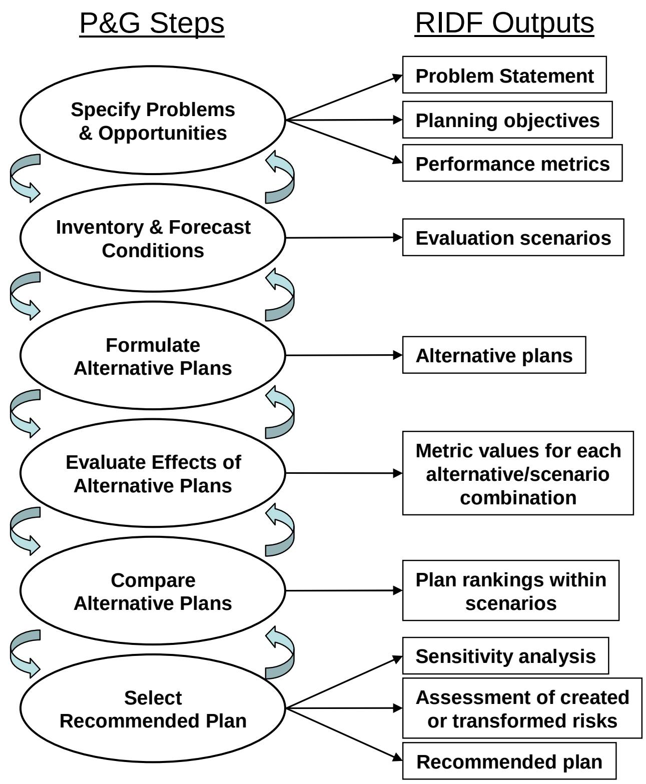

Figure 1: The 6 steps of the P&G and resultant outputs of the risk-informed decision framework.

2.4 How is RIDF an Incremental Improvement in Addressing Planning Needs?

Making effective and credible flood and storm damage reduction planning decisions requires an explicit structure for jointly considering the positive/negative impacts and risks, along with associated uncertainties, relevant to the selection of alternative plans. The complexity of flood and storm damage reduction and coastal landscape stabilization in South Louisiana requires integration of multiple models and tools as well as expert judgment. Integrating this heterogeneous and uncertain information demands a systematic and understandable framework to organize complex and, in some cases, limited technical information and expert judgment and then presenting such information in a way to clearly show tradeoffs among possible choices or decisions.

3 IMPLEMENTATION OF THE RIDF

The RIDF assists decision makers by condensing the decision problem into a transparent and tractable format. The RIDF can be described in terms that are closely aligned with the standard USACE approach to planning. It utilizes techniques from the fields of risk and decision analysis to accommodate multiple objectives, conflicting stakeholder values, both qualitative and quantitative assessments of performance, and uncertainty in the natural, social, and economic environment in which decisions will be played out.

As implemented for LACPR, the RIDF procedure can be summarized as follows. Decision makers and stakeholders establish an objectives hierarchy to fully and uniquely characterize the important outcomes of each decision alternative. A set of outcome measures of performance (or metrics) is then chosen to represent the performance of each alternative in terms of achieving each of the planning objectives. The outcomes of the alternative plans are modeled and, to the extent there are uncertainties present that may significantly affect performance outcomes, this evaluation of plans is replicated over a set of scenarios that represent a range of possible conditions during the performance phase. Once all of these evaluations are complete, a multi-attribute utility function is developed (based on stakeholder assigned values for performance metrics) to assess the overall utility of each plan given its performance in terms of achieving the objectives. Ranking plans based on their individual utility scores is used to provide an indication of stakeholder preferences of plan options available. The LACPR RIDF procedure has also utilized outputs of evaluations of other decision objectives (e.g., cost efficiencies and project effectiveness) to contrast with stakeholder preferences to identify a final array of alternatives (or top performing plans across all decision objective considerations) and to display tradeoffs among these alternatives for decision makers.

The relationship between the USACE planning process and RIDF is illustrated in Figure 1. RIDF activities for the LACPR effort are closely related to the 6-step USACE planning process as follows:

1. <u>Specify Problems and Opportunities</u>: Frame the decision by developing a problem statement and identifying the spatial and temporal boundaries of analysis (i.e. planning area and planning units). Establish planning objectives and choose outcome measures of performance, or metrics, which reflect progress toward achieving the planning objectives.
2. <u>Inventory and Forecast Conditions</u>: Select models of physical and economic systems or other appropriate tools to simulate decision outcomes in terms of the selected performance metrics. Identify important sources of uncertainty in physical and economic models.
3. <u>Formulate Alternative Plans</u>: Formulate decision alternatives by identifying potential measures for flood risk reduction, pre-screening poor performing measures, and formulating an array of alternatives for each LACPR planning unit from remaining measures.
4. <u>Evaluate Effects of Alternative Plans</u>: Model the outcome measures of performance for each alternative and each scenario.
5. <u>Compare Alternative Plans</u>: Obtain weights on metrics from the decision makers and/or stakeholder groups. Calculate multi-attribute utility and implement the stakeholder preference analysis for each alternative and scenario. Identify consistently dominating plans in each planning unit based on the multi-attribute utility values. Develop alternative ranking of plans based on assessment of evaluation criteria addressing other decision objectives viewed as important to decision makers. Conduct an indexed scoring of alternatives based on the MCDA results and alternative plan rankings. Identify the final array of alternatives for each planning unit and prepare detailed tradeoff analysis of plan performance and outputs for these alternatives. Apply secondary evaluation criteria and sensitivity analysis (e.g., varying levels of participation in nonstructural measures

and analysis of alternatives under degraded coastal conditions). Screen out plans that are consistently dominated.

6. Select a Recommended Plan: Develop strategies for combining top performing alternatives in each planning unit to create comprehensive coastwide plans. Develop conclusions and findings based on the above analyses.

3.1 Step 1: Specify the Problem and Opportunities

Framing the problem to be solved is one of the most difficult and critical tasks in the planning process because it forces planners to clarify their objectives. Framing also helps to identify what attributes should be considered in judging decision outcomes and what metrics should be used in assessing progress toward meeting the identified planning objectives. Framing helps to establish what spatial and temporal scales are needed for modeling decision outcomes. For example, the preferred alternative may change with the spatial resolution chosen for an analysis; therefore, factoring such spatial variation into how the framework is used along the coast should be considered. Similarly, the most preferred decision may vary as a function of the timeframe under consideration: a longer planning timeframe may lead to a preference for alternatives with higher fixed costs and lower operational/maintenance costs.

3.1.1 Problem Statement

The people, economy, and environment of coastal Louisiana are vulnerable to flooding caused by the storm surge associated with major hurricanes. This high vulnerability is caused by a uniformly low-lying landscape and severe disruption of a once natural process of sediment deposition and marsh-building associated with the lowermost Mississippi River.

Louisiana's coastal plain has suffered system-scale instability and deterioration from the early 1900s to the present. Effects in the region stem from a combination of natural and human-induced activities that extend into the entire Mississippi River Basin. Drastic landscape changes that have already occurred and are predicted to take place this century place in jeopardy coastal populations, assets, and ecosystems that must exist to continue producing benefits regionally and nationally. Catastrophic impacts of the 2005 Atlantic Tropical Cyclone season in the Gulf of Mexico (as well as subsequent impacts from the 2008 season) revealed the need for additional investment in flood and storm damage risk reduction and coastal ecosystem restoration along the entire Louisiana coast.

LACPR coordinated its planning effort with parallel efforts in other agencies and maintained a continuous exchange of ideas and information with those agencies throughout the planning process. The LACPR project is being coordinated via extensive public involvement through a series of workshops, public scoping meetings, and stakeholder forums. In addition, the USACE is coordinating with other water resources plans and projects including navigation, flood control, and ecosystem restoration projects. These other efforts include the 100-year Hurricane Storm Damage and Risk Reduction System in the New Orleans metropolitan area, Interagency Performance Evaluation Team Task Force (IPET) Study, State of Louisiana Coastal Protection and Restoration Authority (CPRA) Master Plan, and Louisiana Recovery Authority (LRA) Community Recovery and Redevelopment Planning, among many others.

A comprehensive atlas of potential structural, nonstructural, and ecological measures was compiled after the scoping and stakeholder input process (LACPR Plan Formulation Atlas, dated 16 April 2007). This atlas of measures provided the foundation for alternative plan formulation and is available at http://www.lacpr.usace.army.mil/.

Engagement with LACPR stakeholders has continued and has provided further input on problems, solutions, and values.

The following problem statement was drafted with the above issues in mind: The people, economy, environment, and culture of South Louisiana, as well as the Nation, are at risk from severe and catastrophic hurricane storm events as manifested by:

- Increasing risk to people and property from catastrophic hurricane storm events.
- Increasing vulnerability of coastal communities to inundation from hurricane induced storm damages due to coastal subsidence, wetland losses, and relative sea level rise.
- National and regional economic losses from hurricane flooding to residential, public, industrial, and commercial infrastructure / assets.
- Losses to high levels of productivity and resilience of South Louisiana coastal ecosystem due to natural conditions and coastal storm disturbances.
- Risks to historic properties and traditional cultures and their ties and relationships to the natural environment due to catastrophic hurricane storm events.

The risks associated with such complex problems can rarely be eliminated or entirely prevented. Thus, residual risks that will remain after plan implementation must be considered. The nature of the risks to the planning area is identified in the problem statement.

3.1.2 Planning Objectives

The purpose of this section is to delineate the objectives appropriate to a sound solution to the LACPR decision problem that can be readily articulated to an array of audiences.

As a group, a good set of planning objectives must be collectively exhaustive. That is, nothing that really matters can be left out. However, and again with an eye to simplification, the list must be limited to only the ones that really do matter. Each objective should be specific and succinct (Keeney and Raffia 1976). An objective must be unambiguous yet succinctly stated, as brevity helps communication and clarifies thinking. Progress toward each objective must be measurable using one or a few metrics so that predictions can be quantified and performance can be assessed. Objectives must also be realistically achievable and relevant. Finally, there must be concordance with practical time frames (Hobbs and Meier 2000). In other words, predictions must be possible within the planning time frame or monitoring of performance must be possible within a useful time frame.

The objectives, decision attributes, and measures of performance used in this analysis were developed by the LACPR Technical Team. The planning objectives for LACPR are:

- Reduce risk to public health and safety from catastrophic storm inundation;
- Reduce damages from catastrophic storm inundation;

- Promote a sustainable coastal ecosystem;
- Restore and sustain diverse fish and wildlife habitats, and;
- Sustain the unique heritage of coastal Louisiana by protecting historic sites and supporting traditional cultures.

3.1.3 Outcome Metrics of Performance

Metrics to be used to guide the LACPR evaluation are presented in Table 1. These metrics were used to score and then rank flood and storm damage reduction measures and plans. In selecting this set of metrics, we strove to represent the best available information for evaluating alternatives in the LACPR, keeping in mind the characteristics of effective metrics (see Roy, 1985; Seager et al. 2007, Graedel and Allenby 2002, Seager and Theis 2004; Yoe 2002). Metrics for LACPR were selected as being:

- **Verifiable.** Two independent assessments yield similar results.
- **Cost-effective**. The technology required to generate data for the metrics is economically feasible and does not require an intensive deployment of labor.
- **Easy to communicate to a wide audience**. The public understands the scale and context of the metric and can interpret the metric with little additional explanation.
- **Changeable by human intervention**. The metric has a causal relationship between the state of the system and the variables that are under the decision-maker's control. Metrics that are independent of human action do not inform a management, policy-making, or design process.
- **Credible**. Stakeholders perceive that the metric accurately measures that which it is intended to measure.
- **Appropriate scale.** The metric is applicable at the spatial and temporal scales chosen for analysis.
- **Directed.** Metric scales, whether they are qualitative or quantitative, are bi-directional polar scales.
- **Relevant**. The metric reflects stakeholder priorities and enhances the ability of managers and regulators to faithfully execute their stewardship responsibilities. There is no point assembling a metric no one cares about.
- **Sensitive.** The metric will capture the minimum meaningful level of change in performance, and it will have uncertainty bounds that are easy to communicate.
- **Minimally redundant.** Measures for the metric are not essentially reflected by another metric in the set being used.
- **Transparent.** The metric avoids "readily unapparent and/or known agendas."

It is important to acknowledge here that there will be "conflicts" among plan performance as measured by these metrics, resulting in the need to make tradeoffs. For example, a tradeoff may exist between achieving any significant storm surge risk reduction from a project and minimizing direct and indirect environmental impacts. The tradeoff concept is discussed in Step 5. As a consequence of such "conflicts," a given measure or alternative may not take clear precedence over other measures or alternatives in respect to every metric for evaluating performance. This may present a dilemma to decision-makers, who are trying to choose a single measure or plan, or in the case for LACPR, a final array of alternatives. It is important to place development of metrics prior to formulating plans because the "hard thinking" that goes into developing the metrics can create an improved set of measures from which to formulate plans; this in turn permits stakeholders to focus on thinking about the objectives rather than anchoring themselves to favored measures (Keeney and Raiffa 1976).

Within a particular scenario, uncertainty is clarified by delineating the magnitude of uncertainty surrounding metric value estimates. Metric estimates depend upon a mathematical model, empirical data from a study, or expert opinion. All of these sources share varying degrees of knowledge uncertainty, presumably more so for expert opinion than for models and studies. Along with indicating the basic source of metric estimates, it is necessary to explicitly state the important underlying assumptions and indicate which are highly uncertain, moderately uncertain, or highly certain. Beyond these fundamental elements, estimates of uncertainty for metric values should be quantified (e.g., in terms of the variance or range associated with the estimate). Such quantification of the level of uncertainty surrounding metric estimation must be captured and integrated in the decision analysis to make risk-informed decisions.

Table 1 lists the metrics used in LACPR. For complete descriptions of all metrics used in this effort, please see Section 12 in the Main Report.

For simple systems, metrics may be easy to enumerate and interpret and inexpensive to parameterize. However, in cases such as LACPR, which involve both complex human and natural system drivers, development of measurable performance standards poses significant challenges. Both natural and human systems involved in restoration planning are complicated and relate to one another in a myriad of ways. Consequently, any set of metrics is incomplete and may at best be considered only representative of the decision factors that could be brought to bear on the situation. For this reason, metrics are often referred to as indicators to emphasize the representational relationship these measures have to the state of complex systems. They are indicative – but not definitive – gauges, and consequently must be interpreted with their limitations in mind.

In selecting the set of metrics for LACPR, we strove to represent the best available information for evaluating alternatives, keeping in mind the characteristics of effective metrics. The final set of metrics presented in Table 1 reflects a combination of input from the technical team and input from stakeholders. While every effort was made to adhere to all metric criteria, not all criteria were met for a given metric.

Table 1. LACPR Objectives and Metrics.

Planning Objective	Metric (Units)	Metric Goal	Metric Description
Reduce risk to public health and safety from catastrophic storm inundation.	Population Impacted (# of people/year)	Minimize	The number of residents who would experience any amount of flooding after implementation of an alternative plan. This metric represents the residual risk to health and safety of the residential population impacted. In general, the worst case value for this metric represents no action. All risk reduction measures (coastal, nonstructural, and structural) provide improvement in value for this metric. However, because raise-in-place components do not eliminate risk to people, nonstructural measures may not be the most effective in reducing this metric value.
Reduce damages from catastrophic storm inundation.	Residual Damages ($ Millions/year)	Minimize	The remaining risk to assets from flooding after implementation of an alternative plan. Residual damages include damages to residential and non-residential properties, emergency response costs, losses to agricultural resources, and damages to transportation infrastructure. In general, the worst case value for this metric represents no action. All risk reduction measures (coastal, nonstructural, and structural) provide improvement in value for this metric.
	Present Value Life-Cycle Costs ($ Millions/year)	Minimize	The total cost of implementing an alternative plan, which includes engineering and design, construction, facility relocation, operations and maintenance, real estate, and mitigation costs. State and local costs would be 35% or more of the total cost. The best case value for this metric represents no action. All risk reduction measures (coastal, nonstructural, and structural) serve to increase the value for this metric.
	Construction Time (Years)	Minimize	The length of time required to design and construct an alternative plan so that most of its intended benefits are realized. The best case value for this metric would be small structural plans. (For the no action alternative, a minimum construction period of 15 years was assumed). All risk reduction measures (coastal, nonstructural, and structural) serve to increase the value for this metric.
	Employment Impacted (# of jobs disrupted/year)	Minimize	The number of jobs that would be disrupted for one or more days as a direct consequence of flooding after implementation of an alternative plan. In general, the worst case value for this metric represents no action. All risk reduction measures (coastal, nonstructural, and structural) provide some improvement in value for this metric.

Planning Objective	Metric (Units)	Metric Goal	Metric Description
Promote a sustainable coastal ecosystem.	Indirect Environmental Impact Score (Unit-less scale: -8 to +8)	Maximize	The severity of potential aquatic ecosystem impacts (positive or negative) relative to other alternatives in the planning unit. This metric considers impacts to hydrology, fisheries, the potential to induce development of wetlands, and consistency with coastal restoration goals. Qualitative scores fall within the following ranges: -8 to -5 = Highly adverse impact, -4 to -1 = Moderately adverse impact; 0 = No impact (or sum of positive and negative impacts equal to zero); 1 to 4 = Moderately positive impact; 5 to 8 = Highly positive impact. The no action value for this metric is represented by zero. The relative influence on the value for this metric varies for structural risk reduction measures. Nonstructural and coastal measures do not produce any value for this metric.
Restore and sustain diverse fish and wildlife habitats.	Direct Wetland Impacts (acres)	Minimize	The amount of wetlands that would be displaced by an alternative plan. The acreage impacted includes the levee footprint and adjacent borrow areas used for levee construction. These wetland impacts would be offset by creating more acres of wetlands within the impacted basin as mitigation for proposed actions. The best case value for this metric represents no action or no structural risk reduction action. Nonstructural and coastal measures do not produce any value for this metric. Structural measures serve to increase values for this metric.
Sustain the unique heritage of coastal Louisiana by protecting cultural sites and supporting traditional cultures.	Historic Properties Protected (# of properties)	Maximize	The number of historic properties protected by an alternative plan. Historic properties include those listed or eligible for listing on the US Park Service's National Register of Historic Places or register of National Historic Landmarks. Historic properties are protected by hurricane risk reduction alternatives that reduce land loss, erosion, and flooding. The worst case value for this metric represents no action. All risk reduction measures (coastal, nonstructural, and structural) provide some improvement in value for this metric.
	Historical Districts Protected (# of districts)	Maximize	The number of historic districts protected by an alternative plan. Historic districts encompass living communities consisting of clusters of historic buildings and/or other structures that share a similar date or theme. Historic districts are protected by hurricane risk reduction alternatives that reduce land loss, erosion, and flooding. The worst case value for this metric represents no action. All risk reduction measures (coastal, nonstructural, and structural) provide some improvement in value for this metric.

Planning Objective	Metric (Units)	Metric Goal	Metric Description
	Archaeological Sites Protected (# of sites)	Maximize	The number of archeological sites protected by an alternative plan. Archeological sites may include the remains of buildings, trash pits, hearths, pottery and tools (stone, metal and other materials). Archeological sites are protected by hurricane risk reduction system alternatives that reduce land loss, erosion, and flooding. The worst case value for this metric represents no action. All risk reduction measures (coastal, nonstructural, and structural) provide some improvement in value for this metric.

3.2 Step 2: Inventory and Forecast to Establish Baseline Conditions

In this step of the planning process, models and tools are selected to simulate decision outcomes in terms of the selected performance metrics. Each of the alternative plans will perform more or less well depending, in part, on social, economic, and environmental conditions during the planning period of analysis**.** However, these conditions are beyond the control of decision makers and there is much uncertainty about these conditions. Uncertainty is a lack of knowledge that originates from an incomplete understanding of the structure and function of natural or manmade systems (e.g., coastal hydraulics at the mouth of the Mississippi). [1] Uncertainty is often classified as either model uncertainty or parameter uncertainty. Model uncertainty originates from lack of knowledge about the proper structure of a model (*e.g.*, choice of a two vs. a three dimensional model to simulate hydrodynamics). Parameter uncertainty originates from lack of knowledge about the best value to use as an input parameter value for the chosen model.

Decision analytic techniques enable decision makers to make rational decisions despite uncertainty. Rational decisions can be made by accounting for the most important sources of uncertainty, which are those that account for the largest source of error in predictions of decision outcomes. Decision analysis works best when the uncertainty in input values can be fully characterized. However, if it is not possible to do so, decision support can also be achieved by analyzing the robustness of the optimal plan over the scenarios that represent the possible social, economic, and/or environmental conditions under which plan performance might be realized. The LACPR Technical Team selected three uncertain input variables from hydrologic and economic models and simulated performance outcomes for four scenarios. These variables are relative sea level rise, the employment growth rate, and regional land-use policy.

[1] Although the mathematics used to describe variability and uncertainty is essentially similar, uncertainty is widely recognized as being distinct from natural variability. Variability describes the heterogeneity in an inherently random value. For example, the heterogeneity of some size attribute within a population. This variability is, in principle, not reducible (Morgan and Henrion 1990). In contrast, uncertainty can be thought of as a lack of knowledge about what parameter value to use in a model or how to represent a process in a mechanistic model. This lack of knowledge might in principle be reduced, although reducing some uncertainties can often be difficult in practice.

Relative Sea Level Rise

Hydrologic models are used to simulate property damage from storm surge and associated impacts on the regional economy. The uncertain input considered in hydrologic models is the relative rate of relative sea level rise (RSLR). Relative sea level rise is the net effect of eustatic and isostatic changes in sea level. The exact rates of relative sea level rise used in modeling plan performance vary by planning unit to reflect differences in observed rates along the Louisiana coast. In general RSLR may take one of two values: it may be "low" or "high." In Planning Units 1 and 4, "low" means a relative sea level rise of 1.3 feet for 2060. "High" means a relative sea level rise of 2.6 feet for 2060. In Planning Units 2, 3a and 3b, "low" and "high" relative sea level rise are 1.9 and 3.2 feet, respectively for 2060.

Employment Growth Rate

Economic models are used to simulate development over the planning period of analysis. The variable selected for uncertainty analysis is the employment growth rate. These patterns differ in terms of the rates of employment growth. Employment growth may be described as "high" or "business-as-usual". The ***high employment*** future development scenario assumes that the State of Louisiana will implement policies that will be conducive to employment growth in non-traditional industries such as technology. The ***business-as-usual*** (BAU) future development scenario assumes that the State of Louisiana will continue the policies that were in place before Hurricane Katrina, and that growth will primarily occur in the traditional Louisiana growth industries such as oil and gas, medical research, and tourism.

Land Use Allocation Policy

LACPR originally considered three general land-use allocation policies, one leading to dispersed development, one leading to compact development, and one leading to a hybrid development state. Each scenario describes the location and type of development expected to take place throughout southern Louisiana. The location of future development was primarily based on the existing and projected transportation system in each area. However, other factors, including current and projected commercial activity, land elevation, susceptibility to flooding, and other hazards were also considered. The ***compact land*** allocation assumes that redevelopment will primarily take place within the five metropolitan statistical areas in coastal Louisiana, with the construction of more multi-family housing units relative to single family dwellings. The ***dispersed land*** use allocation assumes that redevelopment will be spread out from the major cities and that there will be more single family residential construction relative to multi-family dwellings.

LACPR's original intent was to use these three variables to develop twenty-seven scenarios for simulating the performance of each plan and assess the sensitivity of performance metrics to these planning assumptions. The number of scenarios was reduced to four by collapsing the employment growth rate and the land-use allocation policy into a single variable and dropping the hybrid land-use policy because the scenarios produced limited variation in the modeled performance outcomes. The four scenarios selected by the LACPR Technical Team for use in risk-informed decision making are shown in Table 2.

Table 2: Four scenarios (k) developed for LACPR.

		Relative Sea Level Rise	
		(Low)	(High)
Pattern of Development	High employment / dispersed population	$k = 1$	$k = 2$
	BAU employment / compact population	$k = 3$	$k = 4$

Scenarios provide an overall structure for considering future with and without project conditions.

3.3 Step 3: Formulation of Alternative Plans

3.3.1 Plan Formulation

Plan formulation is the process of building plans that meet planning objectives and account for planning constraints. It requires the knowledge, experience, and judgments from many professional disciplines, as well as the views of stakeholders, other agencies and non-governmental organizations (NGOs), and the public. Plan formulation capitalizes on imagination and creativity wherever it is found, across technical backgrounds and group affiliations. Formulating plans includes developing management measures (e.g., structural and nonstructural), identifying planning units, conducting screening of measures, and combining measures into alternative plans. Plans can be modified into the future within the adaptive management framework. For more details on the formulation of plans and planning units for LACPR, refer to the main report and the Structural Plan Component Appendix, Nonstructural Plan Component Appendix, and Coastal Restoration Plan and Environmental Impacts Appendix.

3.4 Step 4: Evaluate Effects of Alternative Plans

Once the plans have been formulated, the performance of each plan with respect to each metric is estimated for each decision alternative and scenario. The LACPR Technical Team accomplished this step using mechanistic or empirical models of physical, economic, and social systems where available and expert judgment where such models were not available. Descriptions of the models used to generate metric data are presented in the Hydraulics and Hydrology Appendix, Economics Appendix, Coastal Restoration Plan and Structural Environmental Impacts Appendix, etc.

3.5 Step 5: Compare Alternative Plans

The purpose of this section is to provide an overview of the approach used to compare alternative coastal protection and restoration plans. Sub-section 3.5.1 describes how information on stakeholder preferences is incorporated into the decision making process using the multi-criteria decision analysis. Sub-section 3.5.2 describes the calculation of a multi-attribute value score and the ranking of alternatives based on stakeholder preferences. Sub-section 3.5.3 describes sensitivity analysis of the rankings produced through application of MCDA. The results of the MCDA are provided in Attachment A. Attachment B to this appendix provides a summary of other miscellaneous Decision Support Documentation considerations, in addition to MCDA, that were used to support the LACPR RIDF.

When comparing alternative plans using MCDA, the objective is to rank the decision alternatives (plans) using a multi-attribute value score that integrates information about anticipated plan performance outcomes and stakeholder interests. The approach used for the MCDA ranking of LACPR plans is based on multi-attribute utility theory (MAUT) (Keeney and Raiffa 1976). With respect to its applications in LACPR, the advantage of MAUT is that it converts a multi-objective (or in the case for LACPR, multi-criteria) decision problem with competing outputs/project performance indicators into a single objective decision problem for which the decision objective is to maximize a multi-attribute value score given information about the stakeholder's preferences. Here and elsewhere in this report, including Attachment A, we refer to the multi-attribute value function as a multi-attribute utility function to distinguish it from single attribute value functions used in its calculation, although the outcomes over which stakeholders express their preferences are presented as deterministic outcomes rather than uncertain outcomes.

3.5.1 Stakeholder (MCDA) Preferences

The first step toward developing a multi-attribute utility function was to collect information on stakeholder preferences by finding out how much importance stakeholders placed on the various outcome performance metrics. Information about stakeholder preferences is obtained through workshops during which stakeholders participated in a series of assessments designed to obtain information on their preferences, which were expressed as relative weights on outcome performance metrics. These weights were subsequently incorporated into a multi-attribute utility function that was then used to calculate the utility score by which alternatives were ranked. This process gives stakeholders an active role in the decision making process because, if stakeholder weights are used in the utility function, then the resulting plan rankings provide direct information to decision makers about stakeholder preferences. *(Note: The MCDA rankings representing stakeholder preferences, along with the alternative rankings developed to address other decision objectives viewed as important to decision makers (e.g, cost efficiency and project effectiveness, etc.) were used to develop an Indexed Scoring Table for each planning unit to produce combined evaluation criteria rankings of alternatives. The final array of alternatives has been identified from these combined evaluation rankings. This process is described in detail in the main report. Additional Decision Support Documentation to this process is provided in Attachment B to this appendix.)*

Since stakeholders can exhibit a diverse set of preference patterns, it is important to consider how this diversity of preference will be treated in the decision analysis. If there are a large number of stakeholders, it may be very difficult to consider each one's preferences individually. In addition, there would be much redundancy in such an approach because many stakeholders could share some recognizable preference patterns. On the other hand, aggregating preferences of a large stakeholder population into a single group and averaging their weights to represent an amalgamated public interest may not be a good strategy, particularly if a wide diversity of values have been expressed.

The initial approach used in the LACPR analysis was to treat each stakeholder's weights individually. No inferences about the prevalence of any preference pattern within the LACPR planning area were made based on the weight elicitation results. The primary interest was in understanding what patterns of preference exist in the planning area and what affect these different patterns of preference might have on the choice of a risk-reduction plan. However, based on a trend analysis of the frequency of which plans were ranked in the top five positions by all respondents, it became clearly apparent that a consistent set of alternatives were preferred by most of the stakeholders, regardless of differences in preference patterns.

In the end, since there was not much difference in the individual preference patterns expressed for all the alternatives evaluated in each planning unit, with very few outliers or alternative preference patterns identified, the ordinal rankings of all alternatives for each respondent were totaled to produce an aggregated score for ranking all alternatives in a planning unit in to a single listing. A similar ranking was also developed for each future scenario for each planning unit, resulting in very similar results across scenarios. This expanded ranking application is addressed in Attachment B to this appendix. This expanded trend analysis ranking was used to represent the overall stakeholder preferences in identifying the final array of alternatives. This ranking also reflected the same top plans as identified in the limited trend analysis presented in Attachment A to this appendix.

3.5.2 Multi-attribute Utility Scores

The multi-attribute utility function transforms the metrics for the several objectives to a single, aggregate measure of utility. The utility function is compensatory in the sense that it allows progress on one objective to substitute for lack of progress on another objective. The rate of compensation depends upon the relative weight on each objective, which depends upon the preferences of the decision maker. Multi-attribute utility (*U*) is the weighted sum of *L* value functions, $V(m_{jkl})$, which are evaluated for each performance metric, *m*: $U_{jk} = \sum_l w_l V(m_{jkl})$.

Outcome measures of performance are evaluated through modeling studies for $j = \{1,2,3,...,J\}$ decision alternatives and $k = \{1,2,3,...,K\}$ planning scenarios. A set of weights (*w*) that reflects the relative importance of each decision objective is elicited from the decision maker and/or stakeholders using a swing weighting procedure (see Section 4.2). Weights may take any value between zero and one, but must sum exactly to one. Value scores are then calculated from a linear utility function for each metric, $V(m_{jkl})$, that is either increasing or decreasing with that metric, m_{jkl}. For an economic "good" (*i.e.*, more is better): $V(m_{jkl}) = \dfrac{m_{jkl} - \underset{jk}{MIN}(m_{jkl})}{\underset{jk}{MAX}(m_{jkl}) - \underset{jk}{MIN}(m_{jkl})}$

and for an economic "bad": $V(m_{jkl}) = 1 - \dfrac{m_{jkl} - \underset{jk}{MIN}(m_{jkl})}{\underset{jk}{MAX}(m_{jkl}) - \underset{jk}{MIN}(m_{jkl})}$, where the *MIN* and *MAX* functions are over all decision alternatives (plans) and planning scenarios. Value and utility scores are bounded by 0 and 1 so that scores closer to 0 indicate less desirable outcomes. For "risk-based metrics" that are functions of the stage-frequency curves for storm surge elevations in each census block (residual damages, population impacts, employment impacts, historic properties protected, historic districts protected, and archeological sites protected), we used an expected value of each metric to calculate the value score. Expected values of metrics were calculated assuming a triangular distribution for residual damages, population impacts, and employment impacts. Expected values of metrics were calculated assuming a uniform distribution for the historic properties protected, historic districts protected, and archeological sites protected metrics. These distributions were constructed over estimates of the 10^{th}, 50^{th}, and 90^{th} percentile outcomes for each metric. Metric outcomes are listed in the metric tables that are included in the Evaluation Results Appendix.

3.5.3 Risk-Informed Decision Making

Decision analysis is a useful approach to making decisions in the face of uncertainty. In decision analysis, the preferred alternative is the one that that maximizes *expected* utility. The expected utility of a decision alternative is: $E[U_j] = \sum_{k=1}^{K} p(k)U_{jk}$. E is the expectation operator and U_j is the utility of the decision alternative j for a given distribution of probabilities across K scenarios such that $\sum_{k=1}^{K} p(k) = 1$. U_{jk} is the utility of the j^{th} decision alternative given the k^{th} scenario. Implementation of MCDA for LACPR was generally limited because of constraints limiting the ability to calculate metric outcomes for a full complement of scenarios. Therefore, in this application of the risk-informed decision framework, we do not maximize expected utility across the scenarios. Rather, we implement a “Scenario Planning” approach to evaluate the sensitivity of plan rankings under a limited set of scenarios. These scenarios differ in terms of the rate of sea-level rise and the future pattern of development that are assumed over the planning horizon (*e.g.*, the employment growth rate and population distribution). We examine the sensitivity of plan rankings and the robustness of the alternative that maximizes utility under each scenario. Sensitivity analysis can be an effective tool for establishing confidence in rankings and, ultimately, the decisions the planning process and rankings inform. We also consider the sensitivity of plan rankings to stakeholder preferences (allocations of weight among metrics). As previously stated above, but worth repeating again here, ***these results reveal that some plans are consistently preferred by stakeholders despite differences in their preference patterns.***

3.6 Step 6: Recommend a Plan (or in the case for LACPR, identifying a final array of alternatives)

MCDA results assist decision makers by helping them to make tradeoffs among conflicting decision criteria and to identify the plan preferred by stakeholders that maximizes utility for the expressed preference pattern. There are advantages to using a methodical and rational approach to decision making rather than an ad-hoc approach. In contrast to an ad-hoc approach, MCDA forces the decision maker to compile information on all of the preferences and assumptions about decision outcomes to calculate a utility score. Therefore, MCDA forces transparency that should lead to greater acceptance of the identification of stakeholder preferences because stakeholders can see how the decision has been reached. Even stakeholders who might be somewhat at odds with the findings have the potential to see and understand the rationale for why a certain set of alternatives were identified to represent stakeholder preferences. These preferences will be included in the multiple plan rankings submitted for further consideration by decision makers in assessing overall performance and tradeoffs in addressing all decision objectives.

There is a strong theory underlying MCDA. Therefore, if adequate attention has been given to the numerous requirements of the method during the course of analysis, the results of an MCDA should be reliable **–** ***meaning that the decision alternative that maximizes the utility function should be the alternative that is in fact preferred by the stakeholder who supplied the weights.*** These requirements include satisfying the theoretical assumptions of the method as outlined in Keeney and Raiffa (1976), such as ensuring the completeness and comprehensiveness of the objectives hierarchy. Other requirements include adequate modeling of performance outcomes, and accurately assessing the preferences of the decision maker based on all decision objectives, as previously discussed.

What does it mean if a decision maker is uncomfortable with the results of an MCDA and doesn't believe that results represent an accurate portrayal of stakeholder preferences? This could occur, for example, if a stakeholder who supplies information about his or her preferences does not agree that the plans that yield the highest levels of utility are in fact the best alternatives among the choice set and accurately represents their preferences. One possibility is that this suggests that the assumptions of the method were violated or there were other errors in conducting the analysis, such as in modeling performance outcomes. Another possibility is that the MCDA has led the stakeholder to an unexpected result. If that is the case, then hard thinking about why a particular result emerged should enable the decision maker to explain how the result was obtained and why it is an accurate expression of stakeholder preference. In both cases, the stakeholder and decision maker is engaged in a process of learning more about the decision problem, including the planning objectives, the alternatives, the outcomes, and preferences. This process of learning about the decision problem and preferences is an important part of MCDA.

If a decision maker has spent sufficient time learning about the decision problem and developing an analysis, the results of MCDA can be used to help select a decision alternative, but it may not be the only decision objective that needs to be considered. There are several points to consider before choosing an alternative or set of alternatives for further consideration. One is that MCDA is not an exact science. Given a particular preference pattern, large differences in utility scores might be used with reasonable confidence to identify those alternatives that perform relatively well and those alternatives that perform relatively poorly. However, care should be taken not to infer too much from small differences in utility scores because of the potential for error in evaluating those utility scores. Therefore, an alternative that has a relatively high utility score but not the highest score might reasonably be selected by the decision maker as the preferred alternative of stakeholders.

In addition, an assessment of alternative evaluations addressing other decision objectives that are viewed as important to decision makers and that don't appear to be captured in the current MCDA application to LACPR may need to be looked at to advance a final decsion. For example, it appears that the MCDA ranking of alternatives seems to minimize and in some cases ignore the importance of alternatives that provide for a greater level of risk reduction and cost efficiencies and prematurely eliminates these from further consideration by decision makers. It is also believed that further iterations of the stakeholder engagement in the MCDA process may also need to be conducted to obtain better convergence of stakeholders on preferred alternatives and to assure results do in fact represent stakeholder views and desires.

Another point to consider is that all rankings of alternatives are conditional on the preferences expressed by the stakeholder. When there are multiple stakeholders, whose preferences should be used in evaluating the utility scores? One approach is to evaluate the utility scores considering each of the stakeholder preferences separately. If some alternatives consistently appear among those with the highest utility scores for many different stakeholders, the decision maker might reasonably conclude that these alternatives have broad acceptability among the stakeholder population. Assuming that stakeholder acceptance is important to the decision maker, this result could lead the decision maker to advance these alternatives over others. Alternatives that are broadly acceptable may not be best for any one stakeholder, but they lead to consensus because the outcomes are reasonably good for a large number of stakeholders.

4 FINDINGS

The following findings are related to the stakeholder MCDA process and evaluation criteria described in this appendix:

MCDA provides value in interfacing with outside interests and understanding performance preferences. The MCDA tool provides an excellent means of interfacing with stakeholder and interested parties and identifying and quantifying their values regarding areas of plan performance. The tool also provides a working platform to allow these parties to explore their value beliefs and develop their understanding of how those values translate to plan preferences and their attendant risks. The collection of stakeholder input, assessment of their values and preferences, and the communication of those relationships provides insight to the planning team and decision makers regarding potential tradeoffs between alternatives and their acceptability.

The development of evaluation data for the metrics selected in an MCDA is critical. Although the MCDA performed in the LACPR technical analysis has provided great insight with regard to stakeholder values and where performance tradeoffs exist further refinement of metric evaluations would enhance overall confidence in the final output. Several of the selected metrics in the LACPR analysis were limited in their evaluation due to the complex nature of the needed analysis relative to the large number of alternatives and time available. More detailed methodologies have been investigated for the evaluation of both regional economic outputs and cultural and sociological impacts. These investigations are presented in the appendices of this report to support the development of future planning efforts. The indirect environmental impact metric has also been identified for future refinement. Indirect impacts have been assigned to the alternative plans qualitatively using expert judgment and applying a scale of -8 to +8. This particular metric value provides a representation of significant potential ecologic impacts that is one of the most significant areas of tradeoff between alternative plans. The current qualitative scale is deceptive in its representation of these impacts relative to other significant, and quantitatively gauged performance factors such as expected damage, cost, and population impacted. Future refinement of the LACPR effort should include steps to adequately analyze and quantify potential indirect impacts.

MCDA has key requirements and limitations as a plan selection methodology. The application of MCDA should begin at the onset of study scoping and support the development of plan formulation and the plan evaluation. Although all information gathered directly from stakeholders may provide valuable insight, without adequate iterations of engagement and information feedback with stakeholders full confidence can not be developed in the plan preference information produced using MCDA. Most importantly, even with adequate development and stakeholder engagement, the MCDA tool does not represent a stand alone plan selection process.

Comparison of performance tradeoffs are critical to risk informed decision making. While the MCDA tool can provide a clearer appreciation of the performance values across a range of key performance attributes, certain critical performance criteria should always be considered independently and compared to allow full understanding of risks and tradeoffs. Decision makers must always consider efficiency, effectiveness, and ultimately costs. Consideration should also be given to environmental tradeoffs, if not independently through the MCDA methodology.

Consideration of risk reduction for extreme events or a range of events requires use of non-traditional evaluations of efficiency and effectiveness. The traditional annualized presentation of cost and damages minimizes the potential impact of large storm surge events by expressing their probability over a short, one year, timeframe. Considering the probability of these larger events occurring over a longer period (perhaps the period of analysis, i.e. 65 years) more effectively communicates true damage risk levels. The individual event probabilities and relative damage risks would change by an order of magnitude or greater when considering such a timeframe. Some consideration should be given to whether the period of analysis or a longer "period of performance" might be appropriate. The comparison of plan preferences based on both annualized values and period of analysis values may be useful in alternative screening.

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Attachment A - Application of Multi-Criteria Decision Analysis to LACPR

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ATTACHMENTS

1. Introduction

The purpose of this attachment is to describe the application and results of the Multi-Criteria Decision Analysis (MCDA) to the LACPR Risk-Informed Decision Framework (RIDF). MCDA was applied to LACPR to provide structured opportunities for stakeholder communication and interaction and to help ensure that decision makers are aware of stakeholder objectives and preferences. This approach enables decision makers to consider a diverse set of decision objectives and evaluate plan outcomes while making tradeoffs among those objectives in a manner consistent with their own preferences and the preferences of other stakeholders.

2. Stakeholder Workshops

The purpose of the stakeholder workshops was to collect information on stakeholder preferences by finding out how much importance stakeholders place on the various decision objectives. Hence, by design, stakeholders did not rank plans. Information about stakeholder preferences was obtained through a series of workshops during which stakeholders participated in assessments that obtained information on their preferences. These preferences were expressed as relative weights on decision objectives. These weights were later incorporated into a multi-attribute utility function that was then used to calculate the utility score by which decision alternatives were ranked.

Stakeholders were invited in advance of the workshops via email by the LACPR Technical Team to participate in the workshops. Stakeholder workshops were held in four locations across coastal Louisiana to assess individual stakeholder preferences with respect to the ten performance metrics chosen to evaluate the decision alternatives. Workshops were held at the Vermilion Parish Library in Abbeville (28 July), at the Civic Center in Lake Charles (29 July), at the Lindy Boggs Building on the campus of the University of New Orleans (30 July), and at the Municipal Auditorium in Houma (31 July). Two sessions were held at each workshop to promote stakeholder participation: a morning session (10 am to noon) and an afternoon session (2 to 4 pm). Stakeholders were recruited by MVN to participate in these workshops based on their participation in previous LACPR stakeholder meetings and/or their affiliation with a particular organization (including business, government, and non-profit representing a diverse set of stakeholder interests). These groups and individuals were invited by the LACPR technical team in advance to ensure diversity of opinions (see participation lists in Attachment 1).

As a sample of the general population, the selection and size of workshop attendees was not intended to be scientific, representative, or random. These workshops, however, specifically targeted people representing an array of diverse stakeholder groups who have either previously participated in USACE planning studies or who expressed interest in LACPR. Out of the more than 500 stakeholders who were personally invited to these workshops, more than 100 stakeholders attended. Although no one from the public was turned away, they were not specifically targeted for this exercise. The purpose of the workshop was to get a sampling of different views and to see what impact different stakeholder views could have on the ranking of alternatives.

Prior to the workshop, USACE provided stakeholders with an overview of LACPR, the workshop, and the ten performance metrics. During the workshop, stakeholders received a brief update on the status of LACPR and participated in a preference assessment using a computerized survey instrument designed specifically for this project. Results of the preference assessment were used to derive the weights for the multi-attribute utility functions used in ranking plans. During the workshops, the LACPR Technical Team developed and followed a script that detailed what was to be communicated to the stakeholders at each session. The script, in its entirety, is provided in Attachment 2. This ensured that stakeholders were consistently receiving the same technical information across sessions (see Attachment 2).

The LACPR Technical Team began each stakeholder session by 1) describing the progress of LACPR, the background and purpose of the workshop, and answering stakeholder questions, 2) discussing the ten metrics, their definitions, and implications, and 3) describing the swing weight method through the use of a simple car-buying example. The technical team then demonstrated how to use the survey instrument considering the same car-buying example in order to familiarize stakeholders with the mechanics of the survey instrument. The survey instrument consisted of six parts including:

1. Login screen: Participants provided general information about themselves and their organization affiliation (if any).
2. Entry survey: Stakeholders responded to an initial set of screening questions meant to assist in explaining observed differences in preferences.

3. Swing weight elicitation: Stakeholders completed a two-stage procedure that included: 1) ranking the potential improvements in each metric considering a hypothetical outcome with all metrics at their worst possible level; and 2) rating those potential improvements to indicate the importance of each improvement relative to the top-ranked improvement. Metrics were presented to each stakeholder in a unique random order (*i.e.*, the order presented to each respondent was different) to avoid biasing the results. In subsequent steps of the weight elicitation, metrics and the potential improvements in those metrics were presented in the order that the respondent ranked them.
4. Indirect monetization: The implied willingness-to-pay for potential improvements in metrics was calculated from swing weights using the life-cycle cost metric as a reference variable for monetization. Stakeholders were asked either to confirm the implied willingness-to-pay for each potential metric improvement or revise their ratings to more accurately reflect their willingness-to-pay. Almost all stakeholders made some revisions to their ratings and modified their swing weights; however, the indirect monetization weights did not perform significantly better (or worse) in terms of their ability to predict the outcome of choice experiments in any planning unit (see item 5, below). Therefore, we did not use indirect monetization weights to calculate the multi-attribute utility scores. Preference was given to the weights obtained by swing weighting because that method is widely recognized and was specifically recommended by the National Academy of Sciences review panel.
5. Choice experiments: Stakeholders were given a set of ten choices between two outcomes that differed in terms of the ten metrics and were asked to select their preferred outcome. The results of the choice experiments are used to validate both the swing weights and the indirect monetization weights. The choices offered were actual plans, but respondents were not told that these were actual plans. An example of a choice set follows (each respondent was given ten choice sets). The respondents were instructed as follows: “You are being asked to make a series of ten choices between two possible decision outcomes. Carefully consider the two possible decision outcomes shown in the table below. Each outcome differs in terms of one or more metrics. Fill in the radio button underneath the outcome that you prefer and click the submit button.”

Metric	Outcome A	Outcome B
Life-cycle Project Cost ($ Million / year)	2,880	1,112
Residual Damages ($ Million / year)	478	387
Resident Population Impacted (# / year)	34,302	34,496
Employment Impacted (# Jobs disrupted/ year)	1,753	1,333
Construction Time (Years)	16	14
Indirect Impacts (Unitless scale, -8 to +8)	-8	-8
Direct Wetland Impacts (Acres)	7,500	1,000
Archeological Sites Protected (# Sites)	326	295
Historic Properties Protected (# Properties)	146	133
Historic Districts Protected (# Districts)	50	50
Select the preferred outcome:	**O**	**O**

6. Exit survey: Stakeholders responded to a series of questions to assess their level of understanding of what they had done and obtain feedback on the process.

Since decisions in each planning unit are made independently, a separate set of weights was needed in each planning unit, requiring one iteration of the survey instrument for that planning unit. Stakeholders were given an opportunity to complete multiple iterations of the survey instrument for each planning unit. Plans under consideration for each planning unit were displayed in the room at each workshop location. Participants had the opportunity to view and discuss these plan alignments with the LACPR Technical Team before the workshop began. Plans were not provided as an integrated part of the survey instrument. More information about the survey instrument is provided in Attachment 2.

2.1 Workshop Participants

A total of 114 individual stakeholders participated in one or more workshop sessions, yielding 154 completed surveys in the five planning units. Sample sizes achieved in this effort were consistent with, if not higher than, the level of participation observed at previous LACPR stakeholder meetings. Table 1 shows the number of surveys completed in each planning unit. An inventory of participants and their affiliation is provided in Attachment 1. Stakeholders were affiliated with a variety of organizations including businesses, government agencies, non-profit organizations, and academic institutions (Table 2). Tables A1-1 to A1-4 in Attachment 1 list in alphabetical order by location the people (and corresponding affiliation) who participated in the LACPR stakeholder sessions. Results of the survey instrument are summarized in Attachments 3 and 4.

Table 1. Number of Completed Surveys for each Planning Unit.

Planning Unit	Number of Surveys Completed
1	45
2	27
3a	30
3b	25
4	27

Table 2. Respondents by Organization Type

Organization Type	Planning Unit					Total
	1	**2**	**3a**	**3b**	**4**	
Business	3	3	7	0	3	16
Federal agency	2	4	5	3	5	19
Not-for-profit	11	5	4	6	5	31
State agency	8	2	6	5	4	25
Local government	6	6	3	2	4	21
Parish government	6	4	2	3	2	17
Academia	2	0	0	0	1	3
Other	7	3	3	6	3	22
Number of Survey Responses	45	27	30	25	27	154

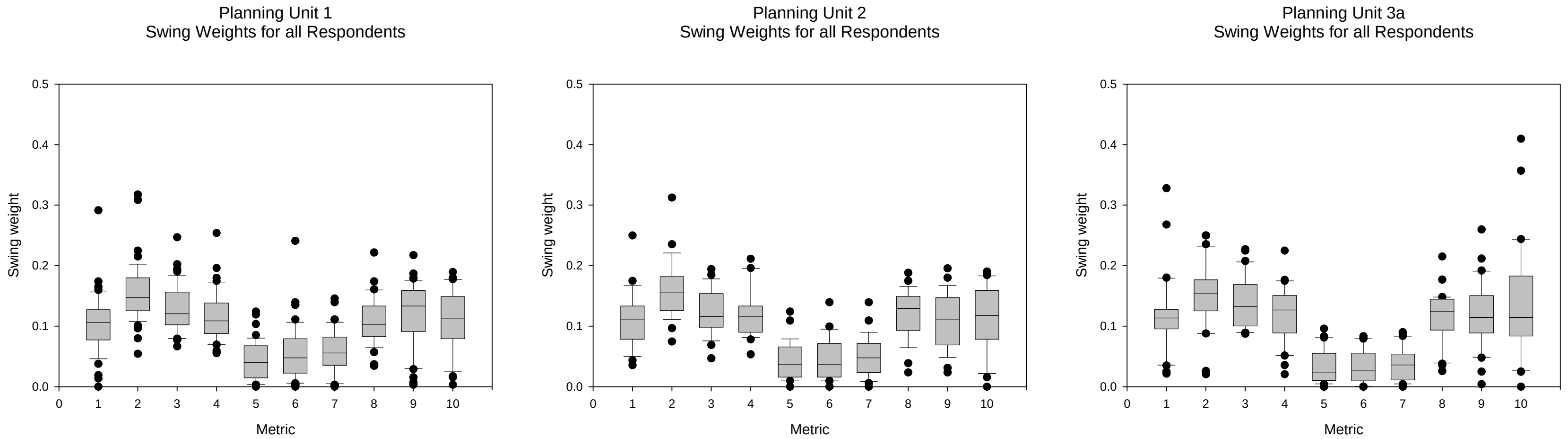
2.2 Swing Weight Elicitation

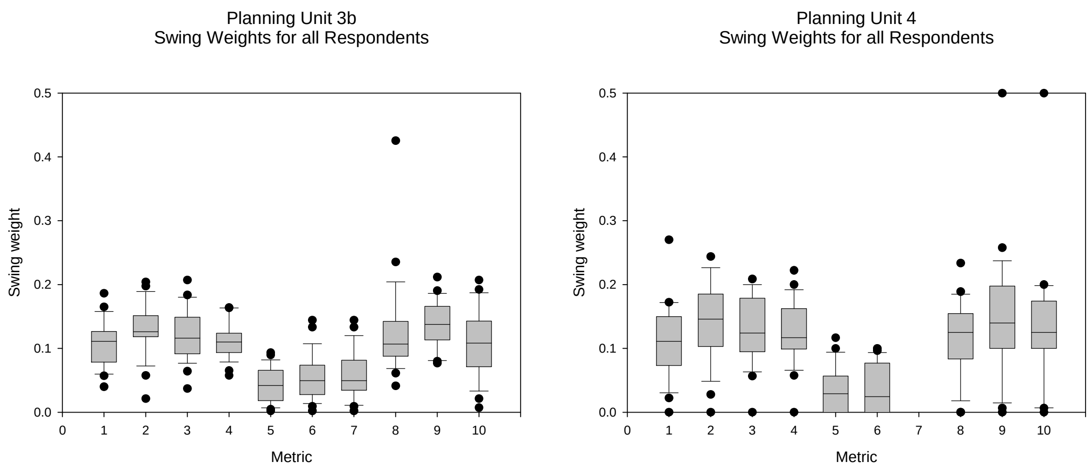
Consistent with the LACPR technical team's plans and recommendations received from the National Academy of Sciences, the swing weight method was used to obtain stakeholder weights. In swing weighting, each survey respondent is shown a hypothetical baseline outcome in which all metrics are evaluated at their worst possible outcome. The participant then considers the possible improvements to these metrics and ranks the metrics to reflect his or her preference for those improvements to the baseline outcome. After ranking the metrics in this manner, the participant then rates each of the possible improvements in terms of their importance relative to the top-ranked metric, which is given a weight of 100. The script presented in Attachment 2 provides additional detail as to how stakeholder preferences were obtained using the swing weight method and illustrates the swing-weight method through a familiar car-buying example. This illustration was presented to each respondent before they began the survey instrument.

The LACPR Technical Team along with Group Solutions facilitated each session. Each participant was provided a dedicated PC to access the survey instrument. An intranet-based system was used to gather preference data from each participant. Group Solutions compiled the resultant data and submitted all results electronically to the LACPR Technical Team for analysis and reporting. The LACPR Technical Team derived weights from survey responses and calculated multi-attribute utility scores to rank plans for each stakeholder. Scores can be used to evaluate measures or plans against the without project condition, as well as to compare the performance of individual measures or plans (see more detailed discussion below).

3. Summary of Stakeholder Weights by Planning Unit

The LACPR weight elicitation sessions yielded 154 complete survey responses (Table 1). The results of weight elicitation are summarized in Figure 1, which shows the distribution of weights on each metric in each planning unit. In Figure 1, the box plots show the distribution of weights on each metric. The lower bound of the box, closest to zero, indicates the 25th percentile of the weight on that metric, the line within the box indicates the median (50^{th} percentile of weights) of that distribution, and the upper bound of the box, furthest from zero, indicates the 75th percentile of the distribution of weights. The whiskers ("error bars") that extend above and below each box indicates the 90th and 10th percentiles. Outliers, those points in the distribution that fall outside the central 80 percent of the weights for each metric, are marked as solid circles. Figure 1 shows that, in most planning units, respondents tended to place more importance on reducing the number people exposed to flood risk (Metric 2) and reducing direct wetland impacts (Metric 9). This tendency is most apparent for PUs 1, 3b, and 4. Respondents also tended to place lower importance on protecting historic districts, properties and archeological sites (Metrics 5, 6 and 7) relative to the other metrics. Although there are some differences among the planning units, a consistent overall pattern is also apparent.





#	Metric Name
1	Life-cycle Cost ($ Billions)
2	Population Impacted (People/Year)
3	Direct Economic Damages ($ Millions/Year)
4	Employment Impacts (Jobs Disrupted/Year)
5	Archeological Sites Protected (Number of Sites)
6	Historic Districts Protected (Number of Districts)
7	Historic Properties Protected (Number of Properties)
8	Construction Time (Years)
9	Direct Wetland Impacts (Acres)
10	Indirect Environmental Impacts (Scale; -8 to +8)

Figure 1: Distribution of Weight Elicitation Results for Each Metric in Each Planning Unit.

For each respondent, we identified the metric with the highest weight. Table 3 lists, for each metric, the number of survey respondents in each planning unit for which that metric was top-ranked.

Table 3. Top-Ranked Metrics by Planning Unit.

Top-ranked Metric	Planning Unit					Total
	1	2	3a	3b	4	
1. Population impacted (people/year)	21	15	17	8	10	71
2. Residual damages ($, million/year)	3	2	2	3	4	14
3. Life-cycle cost ($, million/year)	1	1	0	1	1	4
4. Construction time (years)	1	1	3	4	1	10
5. Employment impacts (jobs disrupted/year)	2	2	0	2	1	7
6. Indirect environmental impact (unit-less scale, -8 to +8)	8	2	5	2	4	21
7. Direct wetland impacts (acres)	8	4	3	4	6	25
8. Historic properties protected (# of properties)	1	0	0	0	0	1
9. Historic districts protected (# of districts)	0	0	0	1	0	1
10. Archeological sites protected (# of sites)	0	0	0	0	0	0
Number of Survey Respondents	45	27	30	25	27	154

4. Validation of Swing Weights

The validity of swing weights was assessed by testing the ability of the multi-attribute utility function informed by an individual's swing weights to predict that individual's response to a series of ten choice experiments. The choice experiments were administered following the weight elicitation procedure. In a choice experiment, the survey respondent is presented with two possible decision outcomes that vary in terms of the ten LACPR performance metrics under consideration. In these choice experiments, the outcomes presented to respondents were drawn from among the Scenario 1 outcomes projected for the LACPR planning unit for which the survey respondent was providing the swing weights. The accuracy of the multi-attribute utility model is measured as the fraction of choice experiments for which the multi-attribute utility model accurately predicts the respondent's choice. Figure 2 shows a series of box plots illustrating the distribution of accuracy in each planning unit. The lower bound of the box, closest to zero, indicates the 25th percentile of the accuracy scores in that planning unit, the line within the box indicates the median (50th percentile of weights) of the distribution, and the upper bound of the box, furthest from zero, indicates the 75th percentile of the accuracy scores. The dashed line in each box shows the mean accuracy. The whiskers ("error bars") that extend above and below each box indicates the 10th and 90th percentiles. Outliers, those points in the distribution that fall outside the central 80 percent of the accuracy scores, are marked as solid circles. The mean and median accuracy in each planning unit is between 60 and 70 percent.

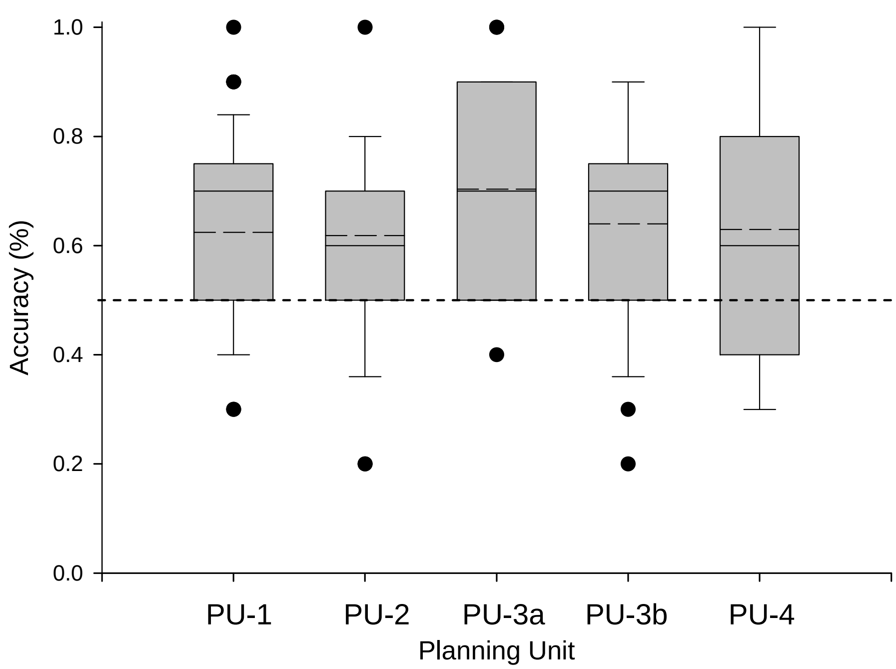


Figure 2. Prediction accuracy of swing weights of 154 LACPR respondents across the five planning units.

5. MCDA Results

The weights obtained from each respondent constitute a preference pattern. These weights are used to calculate a utility score for each plan. The utility score indicates how much "satisfaction" the stakeholder who exhibits that particular preference pattern would derive from the outcome associated with that plan relative to the outcome associated with another plan. These utility scores provide a convenient means to rank the plans in decreasing order of utility. The top-ranked plan maximizes the stakeholder's utility. The second-ranked plan yields less utility than the top-ranked plan, but the ranking indicates nothing about how much less desirable that plan might be relative to the top-ranked plan. If there is little difference in utility between the two plans, this suggests that either plan would be equally satisfactory to the stakeholder. For many preference patterns, differences in utility among the top several plans appear to be very minor, but this report makes no conclusions about how much more desirable one plan might be relative to another. Our interest is in understanding how frequently a plan appears among the top ranked plans to obtain an indication of how broadly acceptable the candidate plans would be to a diverse group of stakeholders. In this case, that group of stakeholders is characterized by the set of preference patterns elicited from stakeholders who participated in the weight elicitation session. Attachment 5 includes a table showing all of the swing weights that were obtained from each respondent.

This section of the attachment summarizes MCDA results by considering which plans ranked among the top five plans in each planning unit. The five top-ranked plans are always preferred to all of the other plans. We recorded the number of times each plan ranked among the top-five plans in each planning unit and for each scenario. Results are summarized in Tables 4-8. For example, Table 4 contains four sub-tables, one for each scenario. Results for Scenario 1 are shown in the upper left-hand sub-table. All of the plans that ranked among the top five plans for at least one respondent in PU1 for at least one of the four scenarios are listed alphabetically in the left-hand column. The five cells to the right of the plan code give the number of respondents for whom this plan ranked in position one, two, three, four, or five given the scenario. The right-most column gives the total number of times a plan ranked among the top five plans given the scenario. For example, the sub-table for Scenario 1 shows that PU-1-C-HL-a-100-2 never ranked first, second, third, or fourth under sea-level rise conditions and development patterns described for Scenario 1, but did rank fifth under those assumptions for five of the preference patterns obtained from survey respondents in this planning unit. Under Scenario 2 assumptions, this plan ranked fourth for two preference patterns and fifth for six preference patterns. Thus, as shown in the right-hand column of the sub-table for Scenario 2, this plan was ranked among the top five plans a total of eight times under the conditions described for that scenario. If a plan frequently ranks among the top-five plans, it provides a relatively high level of utility for many stakeholders compared to other plans under consideration. The bottom row of each sub-table shows the number of different preference patterns for which rank positions were tallied.

Results for Planning Unit 1 are summarized in Table 4. In Planning Unit 1, non-structural plans (PU1-NS-100, PU1-NS-400, and PU1-NS-1000) ranked consistently high for almost all of the preference patterns and for all four scenarios. One structural plan (PU-1:C-HL-a-100-3) also ranked relatively high for a large number of preference patterns. One interpretation of these MCDA results is that these particular plans should be afforded further consideration in PU1 because their outcomes are broadly acceptable to a diverse stakeholder group. Not only are these alternatives broadly acceptable, but they are also robust because they yield consistently high level of utility over a diverse set of scenario conditions. Under this interpretation, the analysis helps decision makers to focus in on those plans that are most acceptable. However, more deliberative interpretations are also possible. For example, one might consider whether or not these results are possibly an artifact of considering certain objectives and not others or the way the performance metrics were evaluated. One might also consider whether or not the stakeholders who were engaged in the process represented a sufficiently diverse group of individuals.

Results for the other planning units can be interpreted similarly. Results for Planning Unit 2 are summarized in Table 5. Structural plan PU2-WBI-100-1 stands out as the top-ranked plan for all scenarios. Other structural plans that consistently appear among the top five ranked plans include PU2-C-R-100-2, PU2-C-R-100-3, and PU2-WBI-100-1. In contrast to Planning Unit 1, the non-structural plans ranked relatively low. Results for Planning Unit 3a are summarized in Table 6. These tables show that structural plans (PU3a-C-M-100-2, PU3a-M-100-2) and non-structural plans (PU3a-NS-100, PU3a-NS-400, and PU3a-NS-1000) dominated the rankings for all scenarios. Results for Planning Unit 3b are summarized in Table 7. These tables show that structural plans (PU3b-C-F-100-1, PU3b-C-RL-100-1, and PU3b-F-100-1) tended to dominate the rankings for all four scenarios. However, the frequency with which these plans appear among the top five plans is notably less than in the other planning units. For example, a number of plans (PU3b-C-G-100-1, PU3b-RL-100-1) have a moderately high rate of occurrence among the top five plans. Therefore, the results in this planning unit may be considered somewhat less conclusive. Results for Planning Unit 4 are summarized in Table 8. Both structural plans (PUU4-C-RL-1000-1, PU4-C-RL-400-1) and non-structural plans (PU4-NS-100, PU4-NS-400, and PU4-NS-1000) dominated the ranking.

Table 4. MCDA results for Planning Unit 1. Each table lists those plans that ranked among the top five ranked plans in PU1 for at least one preference pattern and scenario. Each cell shows the number of times that plan was ranked in each of the top five ranked positions.

PU1, Scenario 1						
PLAN CODE	Rank Based on Swing Weights					Total
	1	2	3	4	5	
PU1-C-HL-a-100-2	0	0	0	0	5	5
PU1-C-HL-a-100-3	0	0	0	10	28	38
PU1-C-HL-b-400-2	1	0	0	3	0	4
PU1-C-LP-a-100-1	0	0	0	3	1	4
PU1-C-LP-a-100-2	0	0	0	0	1	1
PU1-C-LP-b-1000-2	0	0	1	0	0	1
PU1-HL-a-100-2	0	0	0	0	0	0
PU1-HL-a-100-3	0	0	0	1	2	3
PU1-HL-b-400-2	0	1	0	0	2	3
PU1-LP-b-1000-2	0	0	0	1	0	1
PU1-NS-100	16	13	15	0	0	44
PU1-NS-1000	28	6	7	2	0	43
PU1-NS-400	0	23	21	0	0	44
PU1-R2	0	2	1	25	6	34
Total	45	45	45	45	45	225

PU1, Scenario 2						
PLAN CODE	Rank Based on Swing Weights					Total
	1	2	3	4	5	
PU1-C-HL-a-100-2	0	0	0	2	6	8
PU1-C-HL-a-100-3	0	0	0	16	24	40
PU1-C-HL-b-400-2	1	0	0	2	0	3
PU1-C-LP-a-100-1	0	0	0	2	0	2
PU1-C-LP-a-100-2	0	0	0	0	0	0
PU1-C-LP-b-1000-2	0	0	0	0	0	0
PU1-HL-a-100-2	0	0	0	0	1	1
PU1-HL-a-100-3	0	0	0	1	3	4
PU1-HL-b-400-2	0	1	0	0	1	2
PU1-LP-b-1000-2	0	0	0	0	0	0
PU1-NS-100	12	8	24	0	0	44
PU1-NS-1000	32	5	6	1	0	44
PU1-NS-400	0	30	14	0	0	44
PU1-R2	0	1	1	21	10	33
Total	45	45	45	45	45	225

PU1, Scenario 3						
PLAN CODE	Rank Based on Swing Weights					Total
	1	2	3	4	5	
PU1-C-HL-a-100-2	0	1	0	1	4	6
PU1-C-HL-a-100-3	1	2	0	7	29	39
PU1-C-HL-b-400-2	1	0	0	2	0	3
PU1-C-LP-a-100-1	0	1	1	2	1	5
PU1-C-LP-b-1000-2	0	0	1	0	0	1
PU1-C-LP-a-100-2	0	0	0	0	0	0
PU1-HL-a-100-2	0	0	0	0	0	0
PU1-HL-a-100-3	0	0	1	0	5	6
PU1-HL-b-400-2	0	1	0	0	1	2
PU1-LP-b-1000-2	0	0	0	1	0	1
PU1-NS-100	28	2	12	0	0	42
PU1-NS-1000	15	15	5	7	1	43
PU1-NS-400	0	15	24	2	1	42
PU1-R2	0	8	1	23	3	35
Total	45	45	45	45	45	225

PU1, Scenario 4						
PLAN CODE	Rank Based on Swing Weights					Total
	1	2	3	4	5	
PU1-C-HL-a-100-2	0	0	3	1	3	7
PU1-C-HL-a-100-3	0	2	0	9	29	40
PU1-C-HL-b-400-2	1	0	0	2	0	3
PU1-C-LP-a-100-1	0	0	0	1	2	3
PU1-C-LP-b-1000-2	0	0	0	0	0	0
PU1-C-LP-a-100-2	0	0	0	0	1	1
PU1-HL-a-100-2	0	0	0	1	0	1
PU1-HL-a-100-3	0	0	1	0	3	4
PU1-HL-b-400-2	0	1	0	0	1	2
PU1-LP-b-1000-2	0	0	0	0	0	0
PU1-NS-100	24	5	13	1	0	43
PU1-NS-1000	20	14	5	4	0	43
PU1-NS-400	0	21	20	1	1	43
PU1-R2	0	2	3	25	5	35
Total	45	45	45	45	45	225

Table 5. MCDA results for Planning Unit 2. Each table lists those plans that ranked among the top five ranked plans in PU2 for at least one preference pattern and scenario. Each cell shows the number of times that plan was ranked in each of the top five ranked positions.

PU2, Scenario 1

PLAN CODE	Rank Based on Swing Weights					Total
	1	2	3	4	5	
PU2-C-G-100-1	0	1	2	1	1	5
PU2-C-G-100-4	1	0	1	0	0	2
PU2-C-R-100-2	0	1	13	8	0	22
PU2-C-R-100-3	0	1	2	11	10	24
PU2-C-R-100-4	0	0	0	0	8	8
PU2-C-R-400-2	0	0	0	0	0	0
PU2-C-R-400-3	2	1	4	1	2	10
PU2-C-WBI-100-1	24	1	0	0	0	25
PU2-C-WBI-400-1	0	0	0	0	1	1
PU2-G-100-1	0	0	0	1	0	1
PU2-G-100-4	0	0	1	0	0	1
PU2-NS-1000	0	1	0	0	0	1
PU2-NS-400	0	1	1	0	0	2
PU2-R-100-2	0	0	0	2	5	7
PU2-R-400-3	0	1	0	0	0	1
PU2-WBI-100-1	0	19	3	3	0	25
Total	27	27	27	27	27	135

PU2, Scenario 2

PLAN CODE	Rank Based on Swing Weights					Total
	1	2	3	4	5	
PU2-C-G-100-1	0	1	2	1	2	6
PU2-C-G-100-4	1	0	1	0	0	2
PU2-C-R-100-2	0	1	9	8	3	21
PU2-C-R-100-3	0	1	5	11	4	21
PU2-C-R-100-4	0	0	0	0	4	4
PU2-C-R-400-2	0	0	0	0	1	1
PU2-C-R-400-3	2	3	3	0	4	12
PU2-C-WBI-100-1	24	1	0	0	0	25
PU2-C-WBI-400-1	0	0	0	1	0	1
PU2-G-100-1	0	0	0	1	1	2
PU2-G-100-4	0	0	1	0	0	1
PU2-NS-1000	0	1	1	0	0	2
PU2-NS-400	0	1	1	1	1	4
PU2-R-100-2	0	0	0	1	5	6
PU2-R-400-3	0	1	0	1	1	3
PU2-WBI-100-1	0	17	4	2	1	24
Total	27	27	27	27	27	135

PU2, Scenario 3

PLAN CODE	Rank Based on Swing Weights					Total
	1	2	3	4	5	
PU2-C-G-100-1	0	1	2	1	1	5
PU2-C-G-100-4	1	0	1	0	0	2
PU2-C-R-100-2	0	5	14	4	2	25
PU2-C-R-100-3	0	0	2	14	6	22
PU2-C-R-100-4	0	0	0	0	9	9
PU2-C-R-400-2	0	0	0	0	0	0
PU2-C-R-400-3	1	2	2	2	2	9
PU2-C-WBI-100-1	25	0	0	0	0	25
PU2-C-WBI-400-1	0	0	0	0	0	0
PU2-G-100-1	0	0	0	1	1	2
PU2-G-100-4	0	0	1	0	0	1
PU2-NS-1000	0	0	1	0	0	1
PU2-NS-400	0	0	0	1	0	1
PU2-R-100-2	0	0	0	2	5	7
PU2-R-400-3	0	0	1	0	0	1
PU2-WBI-100-1	0	19	3	2	1	25
Total	27	27	27	27	27	135

PU2, Scenario 4

PLAN CODE	Rank Based on Swing Weights					Total
	1	2	3	4	5	
PU2-C-G-100-1	0	1	2	1	1	5
PU2-C-G-100-4	1	0	1	0	1	3
PU2-C-R-100-2	0	3	14	4	2	23
PU2-C-R-100-3	0	1	2	14	5	22
PU2-C-R-100-4	0	0	0	0	8	8
PU2-C-R-400-2	0	0	0	0	0	0
PU2-C-R-400-3	2	3	2	1	1	9
PU2-C-WBI-100-1	24	1	0	0	0	25
PU2-C-WBI-400-1	0	0	0	0	0	0
PU2-G-100-1	0	0	0	1	1	2
PU2-G-100-4	0	0	1	0	0	1
PU2-NS-1000	0	0	1	0	1	2
PU2-NS-400	0	0	0	1	0	1
PU2-R-100-2	0	0	0	1	6	7
PU2-R-400-3	0	1	0	1	1	3
PU2-WBI-100-1	0	17	4	3	0	24
Total	27	27	27	27	27	135

Table 6. MCDA results for Planning Unit 3a. Each table lists those plans that ranked among the top five ranked plans in PU3a for at least one preference pattern and scenario. Each cell shows the number of times that plan was ranked in each of the top five ranked positions.

PU3a, Scenario 1						
PLAN CODE	**Rank Based on Swing Weights**					**Total**
	1	**2**	**3**	**4**	**5**	
PU3a-0	2	0	0	2	2	6
PU3a-C-G-1000-2	2	0	1	0	0	3
PU3a-C-G-400-2	0	1	1	0	0	2
PU3a-C-M-100-1	0	2	1	0	1	4
PU3a-C-M-100-2	0	0	3	17	3	23
PU3a-G-1000-2	0	0	0	0	2	2
PU3a-M-100-1	0	0	1	1	1	3
PU3a-M-100-2	0	0	0	3	14	17
PU3a-NS-100	0	1	21	1	3	26
PU3a-NS-1000	26	1	0	0	1	28
PU3a-NS-400	0	25	1	1	0	27
PU3a-R1	0	0	1	5	3	9
Total	30	30	30	30	30	150

PU3a, Scenario 2						
PLAN CODE	**Rank Based on Swing Weights**					**Total**
	1	**2**	**3**	**4**	**5**	
PU3a-0	2	0	0	2	1	5
PU3a-C-G-1000-2	2	1	0	0	0	3
PU3a-C-G-400-2	0	0	2	0	0	2
PU3a-C-M-100-1	0	2	1	0	3	6
PU3a-C-M-100-2	0	0	5	17	3	25
PU3a-G-1000-2	0	0	0	1	1	2
PU3a-M-100-1	0	0	1	1	1	3
PU3a-M-100-2	0	0	0	4	16	20
PU3a-NS-100	0	0	19	3	2	24
PU3a-NS-1000	26	1	1	0	0	28
PU3a-NS-400	0	26	1	0	0	27
PU3a-R1	0	0	0	2	3	5
Total	30	30	30	30	30	150

PU3a, Scenario 3						
PLAN CODE	**Rank Based on Swing Weights**					**Total**
	1	**2**	**3**	**4**	**5**	
PU3a-0	2	0	0	2	3	7
PU3a-C-G-1000-2	2	0	1	0	0	3
PU3a-C-G-400-2	0	1	1	0	0	2
PU3a-C-M-100-1	0	2	0	1	0	3
PU3a-C-M-100-2	0	0	4	16	2	22
PU3a-G-1000-2	0	0	0	0	2	2
PU3a-M-100-1	0	0	1	1	1	3
PU3a-M-100-2	0	0	0	1	14	15
PU3a-NS-100	0	0	22	3	1	26
PU3a-NS-1000	26	1	0	0	1	28
PU3a-NS-400	0	25	1	1	1	28
PU3a-R1	0	1	0	5	5	11
Total	30	30	30	30	30	150

PU3a, Scenario 4						
PLAN CODE	**Rank Based on Swing Weights**					**Total**
	1	**2**	**3**	**4**	**5**	
PU3a-0	2	0	0	2	1	5
PU3a-C-G-1000-2	2	1	0	0	0	3
PU3a-C-G-400-2	0	0	2	0	0	2
PU3a-C-M-100-1	0	2	1	0	0	3
PU3a-C-M-100-2	0	0	3	17	5	25
PU3a-G-1000-2	0	0	0	1	1	2
PU3a-M-100-1	0	0	1	1	1	3
PU3a-M-100-2	0	0	0	3	14	17
PU3a-NS-100	0	0	22	1	3	26
PU3a-NS-1000	26	1	0	1	0	28
PU3a-NS-400	0	26	1	0	1	28
PU3a-R1	0	0	0	4	4	8
Total	30	30	30	30	30	150

Table 7. The top five ranked plans and the frequency by which these plans were ranked in each of the top five ranked positions for Planning Unit 3b.

PU3b, Scenario 1

PLAN CODE	Rank Based on Swing Weights					Total
	1	2	3	4	5	
PU3b-C-F-100-1	5	5	7	1	6	24
PU3b-C-F-1000-1	0	0	0	1	0	1
PU3b-C-F-400-1	1	0	3	0	1	5
PU3b-C-G-100-1	6	1	3	1	1	12
PU3b-C-RL-100-1	12	5	2	2	0	21
PU3b-C-RL-400-1	0	0	1	4	6	11
PU3b-F-100-1	0	0	3	8	5	16
PU3b-F-1000-1	0	0	0	0	0	0
PU3b-F-400-1	0	1	0	2	0	3
PU3b-G-100-1	0	6	0	2	2	10
PU3b-NS-100	0	0	0	1	0	1
PU3b-NS-1000	1	2	0	0	3	6
PU3b-NS-400	0	1	1	1	0	3
PU3b-RL-100-1	0	4	5	2	1	12
Total	25	25	25	25	25	125

PU3b, Scenario 2

PLAN CODE	Rank Based on Swing Weights					Total
	1	2	3	4	5	
PU3b-C-F-100-1	6	5	6	4	3	24
PU3b-C-F-1000-1	0	0	1	0	0	1
PU3b-C-F-400-1	1	0	3	0	4	8
PU3b-C-G-100-1	6	4	1	2	0	13
PU3b-C-RL-100-1	10	4	3	3	1	21
PU3b-C-RL-400-1	0	0	0	0	4	4
PU3b-F-100-1	0	0	4	10	3	17
PU3b-F-1000-1	0	0	0	0	1	1
PU3b-F-400-1	0	1	0	2	1	4
PU3b-G-100-1	0	6	1	1	2	10
PU3b-NS-100	0	0	0	0	1	1
PU3b-NS-1000	2	1	0	1	3	7
PU3b-NS-400	0	1	2	0	0	3
PU3b-RL-100-1	0	3	4	2	2	11
Total	25	25	25	25	25	125

PU3b, Scenario 3

PLAN CODE	Rank Based on Swing Weights					Total
	1	2	3	4	5	
PU3b-C-F-100-1	4	6	6	2	6	24
PU3b-C-F-1000-1	0	0	0	1	0	1
PU3b-C-F-400-1	1	0	3	0	1	5
PU3b-C-G-100-1	6	1	2	2	1	12
PU3b-C-RL-100-1	13	5	2	1	0	21
PU3b-C-RL-400-1	0	0	1	3	7	11
PU3b-F-100-1	0	0	4	9	3	16
PU3b-F-1000-1	0	0	0	0	0	0
PU3b-F-400-1	0	1	0	2	0	3
PU3b-G-100-1	0	6	0	1	1	8
PU3b-NS-100	0	0	0	1	0	1
PU3b-NS-1000	0	0	1	2	2	5
PU3b-NS-400	1	0	2	0	1	4
PU3b-RL-100-1	0	6	4	1	3	14
Total	25	25	25	25	25	125

PU3b, Scenario 4

PLAN CODE	Rank Based on Swing Weights					Total
	1	2	3	4	5	
PU3b-C-F-100-1	5	6	6	4	3	24
PU3b-C-F-1000-1	0	0	1	0	0	1
PU3b-C-F-400-1	1	0	3	1	3	8
PU3b-C-G-100-1	6	2	1	3	1	13
PU3b-C-RL-100-1	12	4	2	2	1	21
PU3b-C-RL-400-1	0	0	0	0	4	4
PU3b-F-100-1	0	0	5	10	2	17
PU3b-F-1000-1	0	0	0	0	1	1
PU3b-F-400-1	0	1	0	2	1	4
PU3b-G-100-1	0	6	0	1	3	10
PU3b-NS-100	0	0	0	0	1	1
PU3b-NS-1000	1	2	0	0	3	6
PU3b-NS-400	0	1	2	0	1	4
PU3b-RL-100-1	0	3	5	2	1	11
Total	25	25	25	25	25	125

Table 8. The top five ranked plans and the frequency by which these plans were ranked in each of the top five ranked positions for Planning Unit 4.

PU4, Scenario 1						
	Rank Based on Swing Weights					Total
PLAN CODE	1	2	3	4	5	
PU4-0	0	0	1	0	0	1
PU4-C-G-100-1	0	1	0	0	0	1
PU4-C-G-100-2	0	0	0	1	0	1
PU4-C-G-1000-3	1	0	0	0	0	1
PU4-C-G-400-3	0	0	1	0	0	1
PU4-C-RL-100-1	3	3	0	1	5	12
PU4-C-RL-1000-1	0	1	0	2	14	17
PU4-C-RL-400-1	6	3	6	10	0	25
PU4-NS-100	0	1	9	7	5	22
PU4-NS-1000	15	3	7	1	1	27
PU4-NS-400	1	14	6	4	1	26
PU4-R1	0	0	1	0	0	1
Total	26	26	31	26	26	135

PU4, Scenario 2						
	Rank Based on Swing Weights					Total
PLAN CODE	1	2	3	4	5	
PU4-0	0	0	1	0	0	1
PU4-C-G-100-1	0	1	0	0	0	1
PU4-C-G-100-2	0	0	0	1	0	1
PU4-C-G-1000-3	1	0	0	0	0	1
PU4-C-G-400-3	0	0	1	0	0	1
PU4-C-RL-100-1	2	2	1	2	4	11
PU4-C-RL-1000-1	0	0	2	10	7	19
PU4-C-RL-400-1	2	3	9	2	9	25
PU4-NS-100	0	0	10	6	5	21
PU4-NS-1000	20	3	2	1	1	27
PU4-NS-400	1	17	4	4	0	26
PU4-R1	0	0	1	0	0	1
Total	26	26	31	26	26	135

PU4, Scenario 3						
	Rank Based on Swing Weights					Total
PLAN CODE	1	2	3	4	5	
PU4-0	0	0	1	0	0	1
PU4-C-G-100-1	0	1	0	0	0	1
PU4-C-G-100-2	0	0	0	1	0	1
PU4-C-G-1000-3	1	0	0	0	0	1
PU4-C-G-400-3	0	0	1	0	0	1
PU4-C-RL-100-1	3	1	2	2	4	12
PU4-C-RL-1000-1	0	0	1	2	14	17
PU4-C-RL-400-1	3	2	6	12	2	25
PU4-NS-100	0	1	11	5	5	22
PU4-NS-1000	16	4	5	1	1	27
PU4-NS-400	3	17	3	3	0	26
PU4-R1	0	0	1	0	0	1
Total	26	26	31	26	26	135

PU4, Scenario 4						
	Rank Based on Swing Weights					Total
PLAN CODE	1	2	3	4	5	
PU4-0	0	0	1	0	0	1
PU4-C-G-100-1	0	1	0	0	0	1
PU4-C-G-100-2	0	0	0	1	0	1
PU4-C-G-1000-3	1	0	0	0	0	1
PU4-C-G-400-3	0	0	1	0	0	1
PU4-C-RL-100-1	2	0	2	3	4	11
PU4-C-RL-1000-1	0	0	1	11	7	19
PU4-C-RL-400-1	0	1	3	11	10	25
PU4-NS-100	0	0	17	0	4	21
PU4-NS-1000	21	3	2	0	1	27
PU4-NS-400	2	21	3	0	0	26
PU4-R1	0	0	1	0	0	1
Total	26	26	31	26	26	135

NOTE: The total number of plans ranked third is 31 because, for one respondent, the five top-ranked plans all have the same utility. There were 27 survey responses in PU4.

6. Illustrative Preference Patterns

The remainder of this discussion of MCDA results explores what differences exist in the preference patterns expressed by individual respondents. In each planning unit, three illustrative preference patterns are selected from among the survey responses. No generalizations or conclusions are drawn from these results. These preference patterns have been selected to highlight what differences exist among individual stakeholders in each planning unit, not because they represent the average stakeholder or a "typical" preference pattern. No conclusions are made here about what preference patterns are most common among stakeholders that participated in the preference assessment or how well these preference patterns represent those of stakeholders who did not participate in the preference assessment. These results are illustrative in the sense that they are presented simply to illustrate how different sets of weights can lead to different conclusions about which alternative is preferred.

In the results that follow, MAU scores are evaluated for each coastal, structural and nonstructural plan and the no-action alternative in each planning unit using the illustrative stakeholder weights from that planning unit. The alternatives are then ranked by the MAU score for each of four planning scenarios. The plan with the highest MAU score is the "preferred" alternative given the scenarios and preferences under consideration. However, as noted in Section 5, care should be taken not to ascribe too much importance to identifying the top-ranked plan. The interest should be in developing a more comprehensive understanding about which alternatives rank relatively high, which rank relatively low, and which alternatives might represent consensus plans because they are acceptable to a large number of stakeholders with diverse preferences. Therefore, rather than focusing on identifying the top-ranked plan and choosing this as the "best" alternative, it may be more useful to consider other types of questions. For example:

- How much do the MAU scores vary across the alternatives?
- Is there a group of plans at the top that have MAU scores that are relatively close to one another? What are the similarities and differences of the plans that form this "top tier?"
- How sensitive are plan rankings to planning assumptions and stakeholder preferences?
- Do stakeholders with different preference patterns prefer one particular plan but for different reasons?

Results of the analysis are presented in the form of numerous tables and graphs that summarize the results for each planning unit so that they can be used to support these types of deliberations among decision makers and stakeholders.

6.1 Introduction to the Presentation of Illustrative MCDA Results

The purpose of this introduction to the results is to familiarize the reader with the several different presentation formats and facilitate the discussion of results for each planning unit in the next several sections. Results are presented for each scenario and illustrative preference pattern using six types of tables and figures, including:

1. tables showing plans ranked by their MAU score;
2. figures showing the contribution of each metric to the MAU score;
3. tables showing the plan that maximizes the MAU score;
4. figures showing an expected MAU score and its range; and
5. figures showing the sensitivity of an MCDA that maximizes expected utility.

1. **<u>Tables Showing Plans Ranked by their MAU Score</u>**: In this presentation format, the plans are ranked by MAU score shown in Figure 3. There is one table for each of the characteristic set of preferences (Preference Pattern A, etc.) as indicated in the upper left-hand corner of each table. The table includes four rankings, one for each planning scenario. The scenarios are described in Table 2 in Section 3.2 of the main RIDF Appendix. For each scenario, the first column lists the plan number (provided for each planning unit in the following presentation of results) and the LACPR plan code with which it is associated. The MAU score in the third column is a measure of the utility of each alternative and takes a value between zero and one. As described in Section 3.5.1 of the main RIDF Appendix, MAU is the weighted sum of scaled performance metrics, where the weights reflect one of the three characteristic preference patterns identified among the stakeholders who participated in the weight elicitation exercises. This type of analysis, in which alternatives are ranked within each planning unit by a deterministic utility score, is replicated for each of the four scenarios representing possible, but uncertain, future conditions that might affect performance.

PU-1: A

	Scenario 1	
Plan	***Plan Code***	***Utility***
19	PU1-C-HL-b-400-2	0.725
8	PU1-HL-b-400-2	0.717
3	PU1-NS-100	0.698
4	PU1-NS-400	0.691
5	PU1-NS-1000	0.689
17	PU1-C-HL-a-100-2	0.689
6	PU1-HL-a-100-2	0.683
27	PU1-C-LP-b-1000-2	0.681
18	PU1-C-HL-a-100-3	0.678
16	PU1-LP-b-1000-2	0.673
22	PU1-C-LP-a-100-2	0.672
7	PU1-HL-a-100-3	0.671
21	PU1-C-LP-a-100-1	0.671
20	PU1-C-HL-b-400-3	0.667
11	PU1-LP-a-100-2	0.664
10	PU1-LP-a-100-1	0.659
9	PU1-HL-b-400-3	0.658
2	PU1-R2	0.657
23	PU1-C-LP-a-100-3	0.655
25	PU1-C-LP-b-400-3	0.654
24	PU1-C-LP-b-400-1	0.653
12	PU1-LP-a-100-3	0.646
14	PU1-LP-b-400-3	0.645
13	PU1-LP-b-400-1	0.640
26	PU1-C-LP-b-1000-1	0.637
15	PU1-LP-b-1000-1	0.623
1	PU1-0	0.526

	Scenario 2	
Plan	***Plan Code***	***Utility***
19	PU1-C-HL-b-400-2	0.674
3	PU1-NS-100	0.669
4	PU1-NS-400	0.668
5	PU1-NS-1000	0.666
8	PU1-HL-b-400-2	0.665
17	PU1-C-HL-a-100-2	0.655
6	PU1-HL-a-100-2	0.649
18	PU1-C-HL-a-100-3	0.642
7	PU1-HL-a-100-3	0.634
20	PU1-C-HL-b-400-3	0.628
22	PU1-C-LP-a-100-2	0.625
21	PU1-C-LP-a-100-1	0.623
2	PU1-R2	0.617
24	PU1-C-LP-b-400-1	0.617
9	PU1-HL-b-400-3	0.617
11	PU1-LP-a-100-2	0.617
10	PU1-LP-a-100-1	0.610
23	PU1-C-LP-a-100-3	0.606
25	PU1-C-LP-b-400-3	0.606
13	PU1-LP-b-400-1	0.602
12	PU1-LP-a-100-3	0.598
14	PU1-LP-b-400-3	0.596
26	PU1-C-LP-b-1000-1	0.593
15	PU1-LP-b-1000-1	0.576
27	PU1-C-LP-b-1000-2	0.532
16	PU1-LP-b-1000-2	0.523
1	PU1-0	0.447

	Scenario 3	
Plan	***Plan Code***	***Utility***
19	PU1-C-HL-b-400-2	0.739
8	PU1-HL-b-400-2	0.733
3	PU1-NS-100	0.706
17	PU1-C-HL-a-100-2	0.705
6	PU1-HL-a-100-2	0.700
18	PU1-C-HL-a-100-3	0.695
27	PU1-C-LP-b-1000-2	0.694
4	PU1-NS-400	0.691
7	PU1-HL-a-100-3	0.689
16	PU1-LP-b-1000-2	0.689
5	PU1-NS-1000	0.688
21	PU1-C-LP-a-100-1	0.686
22	PU1-C-LP-a-100-2	0.686
11	PU1-LP-a-100-2	0.681
20	PU1-C-HL-b-400-3	0.681
2	PU1-R2	0.677
10	PU1-LP-a-100-1	0.677
9	PU1-HL-b-400-3	0.674
23	PU1-C-LP-a-100-3	0.669
25	PU1-C-LP-b-400-3	0.667
24	PU1-C-LP-b-400-1	0.665
12	PU1-LP-a-100-3	0.664
14	PU1-LP-b-400-3	0.661
13	PU1-LP-b-400-1	0.657
26	PU1-C-LP-b-1000-1	0.646
15	PU1-LP-b-1000-1	0.640
1	PU1-0	0.556

	Scenario 4	
Plan	***Plan Code***	***Utility***
19	PU1-C-HL-b-400-2	0.692
8	PU1-HL-b-400-2	0.686
3	PU1-NS-100	0.678
17	PU1-C-HL-a-100-2	0.676
6	PU1-HL-a-100-2	0.670
4	PU1-NS-400	0.668
5	PU1-NS-1000	0.666
18	PU1-C-HL-a-100-3	0.662
7	PU1-HL-a-100-3	0.656
20	PU1-C-HL-b-400-3	0.646
21	PU1-C-LP-a-100-1	0.643
22	PU1-C-LP-a-100-2	0.643
2	PU1-R2	0.643
9	PU1-HL-b-400-3	0.639
11	PU1-LP-a-100-2	0.638
24	PU1-C-LP-b-400-1	0.634
10	PU1-LP-a-100-1	0.633
23	PU1-C-LP-a-100-3	0.625
13	PU1-LP-b-400-1	0.625
25	PU1-C-LP-b-400-3	0.623
12	PU1-LP-a-100-3	0.620
14	PU1-LP-b-400-3	0.617
26	PU1-C-LP-b-1000-1	0.607
15	PU1-LP-b-1000-1	0.599
27	PU1-C-LP-b-1000-2	0.549
16	PU1-LP-b-1000-2	0.544
1	PU1-0	0.492

Figure 3. Illustrative Example of Table: *Plans Ranked by MAU Score for Planning Unit and Preference Pattern.*

2. **Figures Showing the Contribution of Each Metric to the MAU Score:** Figure 4 illustrates how much of the MAU score can be attributed to performance on each metric. The numbers and abbreviations for these metrics are shown in Table 9. Plans are shown ranked from left to right in terms of decreasing MAU score. The color coding of the bars shows the relative contribution of each metric to the MAU score. Although a plan may perform well on an objective, a stakeholder who places little or no weight on that objective will derive little or no utility from that aspect of performance. In this case, there will be little or no contribution of a metric to the MAU score and the color-coded metric may be difficult to see in this figure. In some cases, a metric may show consistently high performance on an objective for all plans. This demonstrates another point to consider when interpreting plan rankings. Although a metric contributes to the MAU score, it may have little or no impact on plan rankings if there is not much variation in the performance on that metric across the decision alternatives. Although stakeholders derive utility from the outcome, performance on that objective will have little or not impact on the decision.

Table 9. Metric Numbers, Names and Abbreviations.

Metric	Metric Name	Abbreviation
1	Life-cycle Cost ($ Billions)	COST
2	Population Impacted (People/Year)	POP
3	Direct Economic Damages ($ Millions/Year)	DAM
4	Employment Impacts (Jobs Disrupted/Year)	EMP
5	Archeological Sites Protected (Number of Sites)	ASIT
6	Historic Properties Protected (Number of Properties)	HPRO
7	Historic Districts Protected (Number of Districts)	HDIS
8	Construction Time (Years)	TIME
9	Direct Wetland Impacts (Acres)	DWI
10	Indirect Environmental Impacts (Unitless Scale; -8 to +8)	IEI

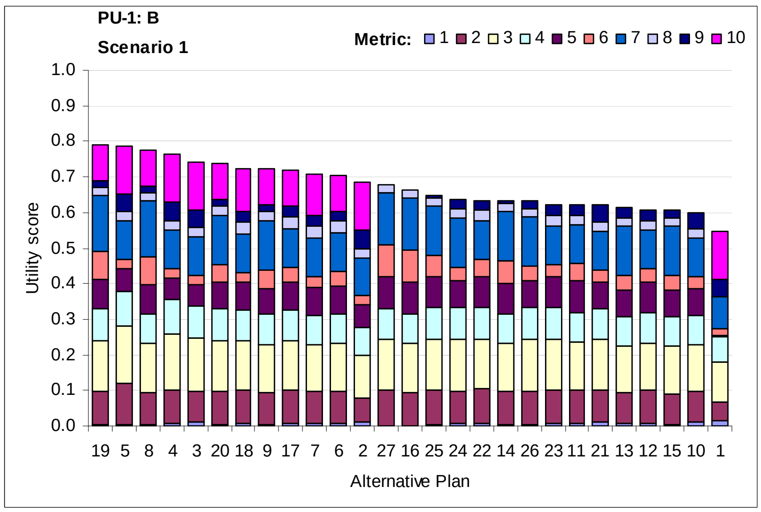


Figure 4. Illustrative Example of the Figure: *Contributions of Metrics to the MAU Score.*

3. **Tables Showing the Plan that Maximizes the MAU Score**: This table illustrates the sensitivity of the decision to the planning assumptions for each preference pattern (see Figure 5 example). No information is being presented in this table that has not been previously presented above, but in some ways these tables make it is easier to assess sensitivity.

PU-1: A	Relative Sea-level Rise	
Pattern of Development	Lower	Higher
High/Dispersed	PU1-NS-100	PU1-NS-100
BAU/Compact	PU1-NS-100	PU1-NS-100

PU-1: B	Relative Sea-level Rise	
Pattern of Development	Lower	Higher
High/Dispersed	PU1-NS-1000	PU1-NS-1000
BAU/Compact	PU1-NS-1000	PU1-NS-1000

PU-1: C	Relative Sea-level Rise	
Pattern of Development	Lower	Higher
High/Dispersed	PU1-C-HL-b-400-2	PU1-C-HL-b-400-2
BAU/Compact	PU1-C-HL-b-400-2	PU1-C-HL-b-400-2

Figure 5. Illustrative Example of the Table: *Table of Preferred Plans.*

4. **Figures Showing the Expected MAU Score and Range**: In a decision analysis with uncertainty, the preferred alternative is the one that maximizes expected utility. This type of figure is illustrated in Figure 6 which plots the expected utility of each alternative for a hypothetical allocation of probability to each of the two relative sea level rise scenarios for one of the preference patterns. In this analysis, we calculate expected utility for each of the development scenarios treating relative sea level rise (RSLR) as uncertain. Figure 6 illustrates how the utility of some alternatives may be more or less sensitive to relative sea level rise assumptions than the utility of other alternatives. The error bands on expected utility represent the minimum and maximum levels of utility over the four scenarios considered in this analysis. Alternatives that are more sensitive to relative sea level rise and development assumptions will have larger error bands. Alternatives that are less sensitive to those assumptions have narrow error bands. These alternatives may be preferred to those that have larger ranges because these alternatives lead to decision outcomes that are less uncertain.

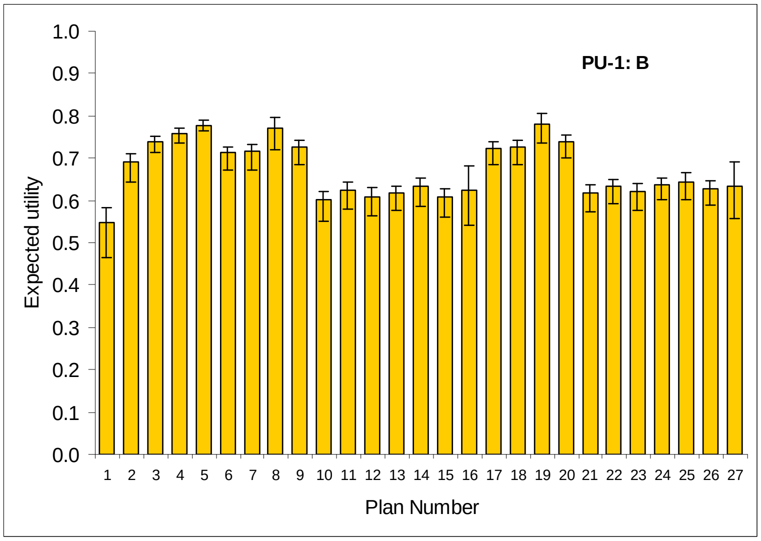


Figure 6. Illustrative Example of Figure: *Expected Utility of each Plan showing minimum and maximum utility scores. (Scenarios 1 & 2: High Employment/ Dispersed Population).*

5. **Figures Showing the Sensitivity of an MCDA that Maximizes Expected Utility:** This figure shows how the decision changes in response to the distribution of probabilities across the relative sea level rise scenarios given the two development scenarios. In this figure (see Figure 7 example), each cell indicates what plan (by plan number) maximizes expected utility for the indicated preferences. Although a decision maker may not have precise knowledge about the probabilities associated with the scenarios, it is still possible to inform a decision by thinking in less precise terms and characterizing the decision landscape.

PU-1: C	**Probability (RSLR = Higher)**										
Development Scenario	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
High Employment/ Dispersed Population (Scenarios 1&2)	5	5	5	5	5	5	5	5	5	5	5
BAU Employment/Compact Population (Scenarios 3&4)	3	3	3	3	3	3	5	5	5	5	5

Figure 7. Illustrative Example of Figure: *Sensitivity of an MCDA that Maximizes Expected Utility.*

6.2 Results for Illustrative Preference Patterns – Planning Unit 1

The illustrative preference patterns are assigned the labels PU-1:A, PU-1:B, and PU-1:C. Table 10 lists the weights for each preference pattern and Figure 8 displays the weights in a graphical format. PU-1:A has the highest weight on minimizing direct wetland impacts (DWI) and reducing direct economic damages (DAM). PU-1:A also has a high weight on reducing the length of time to construct a hurricane protection system (TIME), and maximizing the number of historic properties protected (HPRO). PU-1:A places relatively little importance on minimizing life-cycle project costs (COST). PU-1:B has the highest weight on minimizing direct wetland impacts (DWI) and indirect environmental impacts (IEI) and the lowest weight on the archeological sites, historic properties, and historic districts protected objectives (ASIT, HPRO, and HDIS). PU-1:B weights potential improvements with respect to other objectives (COST, POP, DAM, EMP, and TIME) more or less evenly. PU-1:C put the highest weight on minimizing population impacts (POP), but also places a high importance on minimizing employment impacts (EMP). PU-1:C also places a relatively high weight on the other social effect objectives.

Table 10. Swing weights for three illustrative preference patterns discussed for PU1.

#	Code	Name	PU-1:A	PU-1:B	PU-1:C
1	COST	Life-cycle Cost ($ Billions)	0.0135	0.1032	0.0775
2	POP	Population Impacted (People/Year)	0.1012	0.1190	0.1550
3	DAM	Direct Economic Damages ($ Millions/Year)	0.1686	0.1032	0.0775
4	EMP	Employment Impacts (Jobs Disrupted/Year)	0.1012	0.1190	0.1473
5	ASIT	Archeological Sites Protected (Number of Sites)	0.0337	0.0476	0.1240
6	HDIS	Historic Districts Protected (Number of Districts)	0.1349	0.0476	0.1395
7	HPRO	Historic Properties Protected (Number of Properties)	0.0506	0.0397	0.1395
8	TIME	Construction Time (Years)	0.1349	0.1032	0.0930
9	DWI	Direct Wetland Impacts (Acres)	0.1686	0.1587	0.0310
10	IEI	Indirect Environmental Impacts (Scale; -8 to +8)	0.0927	0.1587	0.0155
		Top-ranked metric	DWI, DAM	IEI, DWI	POP

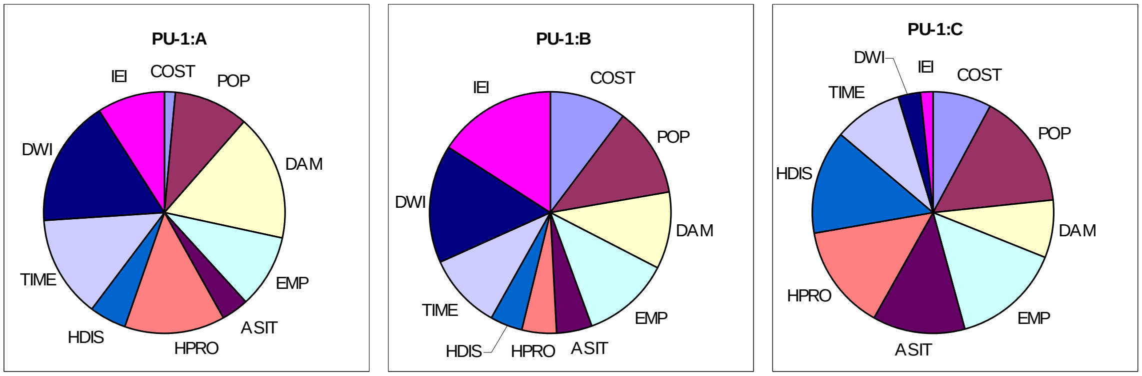
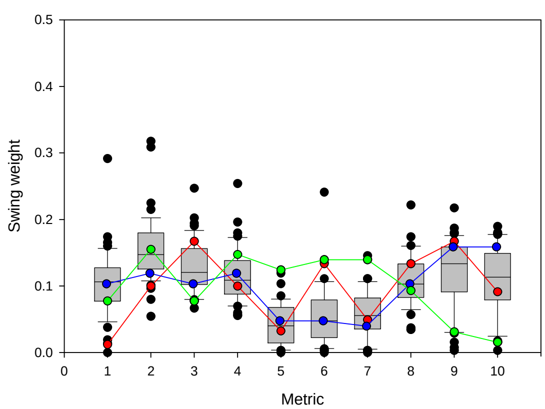


Figure 8. Three illustrative preference patterns discussed for PU1.

The illustrative preference patterns selected for discussion here are each unique within the planning unit, but they are not necessarily atypical. Usually, a preference pattern contains some weights that are similar to those of other stakeholders and some weights that represent extremes. Figure 9 shows how each of the swing weights in the illustrative preference pattern compares to the other swing weights in this planning unit. In this figure, the three color-coded sets of weights are overlaid on the box plots that were introduced in Section 3. The closer each of the color-coded points is to being within the gray box for a particular performance measure, the more typical the weight. Points that fall outside the error bars that surround the gray box indicate extreme positions relative to other survey respondents, or outliers. For example, illustrative preference pattern PU-1:A is color coded red. The weights for metric 1 (COST) and metric 2 (POP) are below the error bars in the box plot; therefore, these are uncharacteristically low. The weight on metric 6 (HDIS) is uncharacteristically high. Of all the three illustrative preference patterns considered here, PU-1:B weights appears to be most similar to others in the planning unit. PU-1:C has unusually high weights on metrics 5 (ASIT), metric 6 (HDIS), and 7 (HPRO) and unusually low weights on metric 9 (DWI) and metric 10 (IEI).



#	Code	Metric Name
1	COST	Life-cycle Cost ($ Billions)
2	POP	Population Impacted (People/Year)
3	DAM	Direct Economic Damages ($ Millions/Year)
4	EMP	Employment Impacts (Jobs Disrupted/Year)
5	ASIT	Archeological Sites Protected (Number of Sites)
6	HDIS	Historic Districts Protected (Number of Districts)
7	HPRO	Historic Properties Protected (Number of Properties)
8	TIME	Construction Time (Years)
9	DWI	Direct Wetland Impacts (Acres)
10	IEI	Indirect Environmental Impacts (Scale; -8 to +8)

Figure 9. Swing weights for the three preference patterns evaluated for PU1 superimposed on the swing weight box plot (previously introduced in Section 3). See Table 10 for explanation of how the metrics are numbered. The preference patterns are color coded as follows: PU-1:A is red, PU-1:B is blue, and PU-1:C is green.

These three illustrative preference patterns produce a unique rank order of plans. These rank orders are illustrated in Figure 10 for each of the preference patterns. The underlying table was introduced in Section 5 and shows the number of times that each plan ranked first, second, third, fourth, or fifth when plans were ranked in decreasing order by the utility score. For PU-1:A, the top five plans are marked in red: PU1-NS-1000, PU1-NS-400, PU1-NS-100, PU1-C-HL-a-100-3, and PU1-R2. For PU-1:B, the top five plans are marked in blue: PU1-NS-100, PU1-NS-1000, PU1-NS-400, PU1-R2, and PU1-C-HL-a-100-3. For PU-1:C, the top five plans are marked in green and all of the top five plans are structural. These results are presented here to illustrate that different sets of weights lead to different rankings of plans. While the rankings suggest order of preference, they do not indicate how much more or less preferred a plan is relative to other plans. In addition, these figures do not help explain why a particular set of weights leads to a particular ranking of plans. These issues are discussed in greater detail below.

PU1, Scenario 1						
PLAN CODE	**Rank Based on Swing Weights**					**Total**
	1	**2**	**3**	**4**	**5**	
PU1-C-HL-a-100-2	0	0	0	0	5	5
PU1-C-HL-a-100-3	0	0	0	10	28	38
PU1-C-HL-b-400-2	1	0	0	3	0	4
PU1-C-LP-a-100-1	0	0	0	3	1	4
PU1-C-LP-a-100-2	0	0	0	0	1	1
PU1-C-LP-b-1000-2	0	0	1	0	0	1
PU1-HL-a-100-2	0	0	0	0	0	0
PU1-HL-a-100-3	0	0	0	1	2	3
PU1-HL-b-400-2	0	1	0	0	2	3
PU1-LP-b-1000-2	0	0	0	1	0	1
PU1-NS-100	16	13	15	0	0	44
PU1-NS-1000	28	6	7	2	0	43
PU1-NS-400	0	23	21	0	0	44
PU1-R2	0	2	1	25	6	34
Total	45	45	45	45	45	225

Figure 10. Rank order of the top five plans for the illustrative preference patterns. The preference patterns are color coded as follows: PU-1:A is red, PU-1:B is blue, and PU-1:C is green.

In the discussion of PU-1 results that follows, plans are numbered 1-27 to facilitate references in tables and figures (Table 11). Plans are ranked by MAU for each planning scenario and characteristic sets of preferences in Tables 12 through 14.

Table 11. Plan Numbers and Plan Names for PU1.

Plan	***Plan Code***
1	PU1-0
2	PU1-R2
3	PU1-NS-100
4	PU1-NS-400
5	PU1-NS-1000
6	PU1-HL-a-100-2
7	PU1-HL-a-100-3
8	PU1-HL-b-400-2
9	PU1-HL-b-400-3
10	PU1-LP-a-100-1
11	PU1-LP-a-100-2
12	PU1-LP-a-100-3
13	PU1-LP-b-400-1
14	PU1-LP-b-400-3
15	PU1-LP-b-1000-1
16	PU1-LP-b-1000-2
17	PU1-C-HL-a-100-2
18	PU1-C-HL-a-100-3
19	PU1-C-HL-b-400-2
20	PU1-C-HL-b-400-3
21	PU1-C-LP-a-100-1
22	PU1-C-LP-a-100-2
23	PU1-C-LP-a-100-3
24	PU1-C-LP-b-400-1
25	PU1-C-LP-b-400-3
26	PU1-C-LP-b-1000-1
27	PU1-C-LP-b-1000-2

The 27 plans are ranked by MAU for each scenario and each of the three preference patterns in Tables 12 through 14. For example, Table 13 shows the utility of Plan 5 for PU-1:B under the planning assumptions used in Scenarios 1 and 3 is 0.806 and 0.807, respectively. Under the assumptions of Scenario 2 and 4, Plan 5 remains the top-ranked plan, but the utility score decreases to 0.793 and 0.795, respectively. The lower-levels of performance for this plan in Scenarios 2 and 4 can be attributed to the higher rates of sea-level rise assumed in these scenarios. For preference pattern PU-1:C, the effect of higher rates of sea-level rise is to make a 400-year structural plan (PU1-C-HL-b-400-2) more attractive than the non-structural plan. This shows sensitivity of the preferred plan to uncertainty in sea-level rise assumptions. For PU-1:A and PU-1:B, non-structural plans dominate the rankings under all four scenarios.

Figures 11 through 13 illustrate why different preference patterns might lead to different plan rankings by showing the contribution of each metric to utility for each plan, scenario, and preference pattern. For example, Figure 11 illustrates the contribution of each metric to utility for PU-1:A. Under a set of planning assumptions consistent with Scenario 1 (Lower RSLR and High Employment/Dispersed Population), the utility of Plan 3 for PU-1:A is 0.808. This can be attributed to the relative performance of this plan on those performance objectives that are important for this preference pattern. Although a plan may contribute substantially towards one of the performance objectives, if the weights reflect relatively little importance on that objective, the performance with respect to that objective will make little contribution towards the overall utility for this preference pattern.

For PU-1:A, the top-ranked plan is one that includes non-structural measures: Plans 3, 5 and 4 (Table 12 and Figure 11). For this preference pattern, the rank order of the top three plans is not dependent upon scenario assumptions. Metrics most contributing to the MAU scores for PU-1:A were direct wetland impacts (No. 9) and indirect environmental impacts (No. 10). Although a particular metric may make substantial contributions toward overall utility, performance metrics that do not vary among decision alternatives will tend to have little impact on plan rankings. This holds true for direct economic damages (No. 3) and employment impacts (No. 4). Although these metrics contribute to the MAU score, they have little influence on the ranking of structural and nonstructural alternatives because they do not vary. Metrics most influencing overall utility for Plans 3, 5 and 4 are direct wetland impacts and indirect environmental impacts (Nos. 9 and 10).

For PU-1:B, the three top-ranking plans are those that include nonstructural measures: Plans 5, 4 and 3 (Table 13 and Figure 12). For this group, the rank order of the top three plans is not dependent upon scenario assumptions. Metrics most contributing to the MAU scores for

Preference Pattern C were direct wetland impacts (No. 9) and indirect environmental impacts (No. 10).

The top ranking plans for PU-1:C are those that include both comprehensive (contains both structural and non-structural measures; Plan 19) and structural plans (Plan 8) (Table 14 and Figure 13) which have structural plans in common. The rank order for these plans was not sensitive to scenario assumptions. The metrics most contributing to MAU of the comprehensive plan (Plan 19) were historic districts protected (No. 7), direct wetland impacts (No. 9) and indirect environmental impacts (No. 10). The metrics most contributing to MAU of the structural plan (Plan 8) were protection of historic districts (No. 7), direct wetland impacts (No. 9) and indirect environmental impacts (No. 10).

Table 12. Plans Ranked by Multi-attribute Utility Score for PU-1, Preference Pattern A.

PU-1: A

	Scenario 1	
Plan	***Plan Code***	***Utility***
3	PU1-NS-100	0.808
5	PU1-NS-1000	0.802
4	PU1-NS-400	0.799
2	PU1-R2	0.767
18	PU1-C-HL-a-100-3	0.747
7	PU1-HL-a-100-3	0.740
17	PU1-C-HL-a-100-2	0.721
6	PU1-HL-a-100-2	0.715
19	PU1-C-HL-b-400-2	0.654
8	PU1-HL-b-400-2	0.646
20	PU1-C-HL-b-400-3	0.646
21	PU1-C-LP-a-100-1	0.641
1	PU1-0	0.638
9	PU1-HL-b-400-3	0.637
10	PU1-LP-a-100-1	0.630
23	PU1-C-LP-a-100-3	0.595
22	PU1-C-LP-a-100-2	0.595
12	PU1-LP-a-100-3	0.588
11	PU1-LP-a-100-2	0.588
24	PU1-C-LP-b-400-1	0.564
13	PU1-LP-b-400-1	0.553
26	PU1-C-LP-b-1000-1	0.541
15	PU1-LP-b-1000-1	0.529
25	PU1-C-LP-b-400-3	0.510
14	PU1-LP-b-400-3	0.501
27	PU1-C-LP-b-1000-2	0.482
16	PU1-LP-b-1000-2	0.474

	Scenario 2	
Plan	***Plan Code***	***Utility***
3	PU1-NS-100	0.793
5	PU1-NS-1000	0.792
4	PU1-NS-400	0.788
2	PU1-R2	0.743
18	PU1-C-HL-a-100-3	0.728
7	PU1-HL-a-100-3	0.720
17	PU1-C-HL-a-100-2	0.704
6	PU1-HL-a-100-2	0.698
19	PU1-C-HL-b-400-2	0.628
20	PU1-C-HL-b-400-3	0.626
8	PU1-HL-b-400-2	0.619
9	PU1-HL-b-400-3	0.616
21	PU1-C-LP-a-100-1	0.615
10	PU1-LP-a-100-1	0.604
1	PU1-0	0.579
22	PU1-C-LP-a-100-2	0.573
23	PU1-C-LP-a-100-3	0.572
11	PU1-LP-a-100-2	0.566
12	PU1-LP-a-100-3	0.564
24	PU1-C-LP-b-400-1	0.545
13	PU1-LP-b-400-1	0.532
26	PU1-C-LP-b-1000-1	0.516
15	PU1-LP-b-1000-1	0.501
25	PU1-C-LP-b-400-3	0.485
14	PU1-LP-b-400-3	0.476
27	PU1-C-LP-b-1000-2	0.431
16	PU1-LP-b-1000-2	0.422

	Scenario 3	
Plan	***Plan Code***	***Utility***
3	PU1-NS-100	0.818
5	PU1-NS-1000	0.802
4	PU1-NS-400	0.801
2	PU1-R2	0.793
18	PU1-C-HL-a-100-3	0.768
7	PU1-HL-a-100-3	0.762
17	PU1-C-HL-a-100-2	0.742
6	PU1-HL-a-100-2	0.737
1	PU1-0	0.672
19	PU1-C-HL-b-400-2	0.672
8	PU1-HL-b-400-2	0.666
20	PU1-C-HL-b-400-3	0.664
21	PU1-C-LP-a-100-1	0.660
9	PU1-HL-b-400-3	0.658
10	PU1-LP-a-100-1	0.652
23	PU1-C-LP-a-100-3	0.614
22	PU1-C-LP-a-100-2	0.613
12	PU1-LP-a-100-3	0.609
11	PU1-LP-a-100-2	0.609
24	PU1-C-LP-b-400-1	0.580
13	PU1-LP-b-400-1	0.574
26	PU1-C-LP-b-1000-1	0.554
15	PU1-LP-b-1000-1	0.549
25	PU1-C-LP-b-400-3	0.527
14	PU1-LP-b-400-3	0.522
27	PU1-C-LP-b-1000-2	0.498
16	PU1-LP-b-1000-2	0.493

	Scenario 4	
Plan	***Plan Code***	***Utility***
3	PU1-NS-100	0.804
5	PU1-NS-1000	0.793
4	PU1-NS-400	0.791
2	PU1-R2	0.773
18	PU1-C-HL-a-100-3	0.753
7	PU1-HL-a-100-3	0.747
17	PU1-C-HL-a-100-2	0.728
6	PU1-HL-a-100-2	0.723
19	PU1-C-HL-b-400-2	0.650
20	PU1-C-HL-b-400-3	0.648
8	PU1-HL-b-400-2	0.644
9	PU1-HL-b-400-3	0.641
21	PU1-C-LP-a-100-1	0.639
10	PU1-LP-a-100-1	0.630
1	PU1-0	0.627
22	PU1-C-LP-a-100-2	0.595
23	PU1-C-LP-a-100-3	0.595
11	PU1-LP-a-100-2	0.590
12	PU1-LP-a-100-3	0.590
24	PU1-C-LP-b-400-1	0.566
13	PU1-LP-b-400-1	0.558
26	PU1-C-LP-b-1000-1	0.533
15	PU1-LP-b-1000-1	0.527
25	PU1-C-LP-b-400-3	0.507
14	PU1-LP-b-400-3	0.501
27	PU1-C-LP-b-1000-2	0.451
16	PU1-LP-b-1000-2	0.446

Table 13. Plans Ranked by Multi-attribute Utility Score for PU-1, Preference Pattern B.

PU-1: B

	Scenario 1			Scenario 2			Scenario 3			Scenario 4	
Plan	***Plan Code***	***Utility***	***Plan***	***Plan Code***	***Utility***	***Plan***	***Plan Code***	***Utility***	***Plan***	***Plan Code***	***Utility***
5	PU1-NS-1000	0.806	5	PU1-NS-1000	0.793	5	PU1-NS-1000	0.807	5	PU1-NS-1000	0.795
4	PU1-NS-400	0.787	4	PU1-NS-400	0.773	4	PU1-NS-400	0.792	4	PU1-NS-400	0.779
3	PU1-NS-100	0.769	3	PU1-NS-100	0.749	3	PU1-NS-100	0.775	3	PU1-NS-100	0.757
18	PU1-C-HL-a-100-3	0.721	18	PU1-C-HL-a-100-3	0.694	18	PU1-C-HL-a-100-3	0.737	18	PU1-C-HL-a-100-3	0.714
2	PU1-R2	0.716	17	PU1-C-HL-a-100-2	0.690	2	PU1-R2	0.736	2	PU1-R2	0.711
17	PU1-C-HL-a-100-2	0.716	2	PU1-R2	0.686	17	PU1-C-HL-a-100-2	0.731	17	PU1-C-HL-a-100-2	0.710
19	PU1-C-HL-b-400-2	0.715	7	PU1-HL-a-100-3	0.681	19	PU1-C-HL-b-400-2	0.728	7	PU1-HL-a-100-3	0.703
7	PU1-HL-a-100-3	0.709	19	PU1-C-HL-b-400-2	0.681	7	PU1-HL-a-100-3	0.726	6	PU1-HL-a-100-2	0.700
6	PU1-HL-a-100-2	0.705	6	PU1-HL-a-100-2	0.679	6	PU1-HL-a-100-2	0.722	19	PU1-C-HL-b-400-2	0.698
8	PU1-HL-b-400-2	0.702	8	PU1-HL-b-400-2	0.666	8	PU1-HL-b-400-2	0.718	8	PU1-HL-b-400-2	0.687
21	PU1-C-LP-a-100-1	0.678	20	PU1-C-HL-b-400-3	0.647	21	PU1-C-LP-a-100-1	0.692	20	PU1-C-HL-b-400-3	0.664
20	PU1-C-HL-b-400-3	0.677	21	PU1-C-LP-a-100-1	0.641	20	PU1-C-HL-b-400-3	0.691	21	PU1-C-LP-a-100-1	0.661
9	PU1-HL-b-400-3	0.663	9	PU1-HL-b-400-3	0.630	9	PU1-HL-b-400-3	0.679	9	PU1-HL-b-400-3	0.652
10	PU1-LP-a-100-1	0.660	10	PU1-LP-a-100-1	0.622	10	PU1-LP-a-100-1	0.677	10	PU1-LP-a-100-1	0.645
22	PU1-C-LP-a-100-2	0.647	22	PU1-C-LP-a-100-2	0.610	22	PU1-C-LP-a-100-2	0.660	22	PU1-C-LP-a-100-2	0.627
23	PU1-C-LP-a-100-3	0.638	23	PU1-C-LP-a-100-3	0.601	11	PU1-LP-a-100-2	0.652	23	PU1-C-LP-a-100-3	0.619
11	PU1-LP-a-100-2	0.635	11	PU1-LP-a-100-2	0.597	23	PU1-C-LP-a-100-3	0.651	11	PU1-LP-a-100-2	0.618
12	PU1-LP-a-100-3	0.625	24	PU1-C-LP-b-400-1	0.588	12	PU1-LP-a-100-3	0.642	12	PU1-LP-a-100-3	0.610
24	PU1-C-LP-b-400-1	0.619	12	PU1-LP-a-100-3	0.588	24	PU1-C-LP-b-400-1	0.631	24	PU1-C-LP-b-400-1	0.606
27	PU1-C-LP-b-1000-2	0.603	26	PU1-C-LP-b-1000-1	0.570	26	PU1-C-LP-b-1000-1	0.614	13	PU1-LP-b-400-1	0.586
26	PU1-C-LP-b-1000-1	0.603	13	PU1-LP-b-400-1	0.564	27	PU1-C-LP-b-1000-2	0.614	26	PU1-C-LP-b-1000-1	0.586
13	PU1-LP-b-400-1	0.596	25	PU1-C-LP-b-400-3	0.552	13	PU1-LP-b-400-1	0.613	25	PU1-C-LP-b-400-3	0.568
16	PU1-LP-b-1000-2	0.589	15	PU1-LP-b-1000-1	0.543	16	PU1-LP-b-1000-2	0.605	15	PU1-LP-b-1000-1	0.565
25	PU1-C-LP-b-400-3	0.588	14	PU1-LP-b-400-3	0.537	25	PU1-C-LP-b-400-3	0.601	14	PU1-LP-b-400-3	0.558
15	PU1-LP-b-1000-1	0.579	27	PU1-C-LP-b-1000-2	0.492	15	PU1-LP-b-1000-1	0.595	1	PU1-0	0.524
14	PU1-LP-b-400-3	0.574	1	PU1-0	0.480	14	PU1-LP-b-400-3	0.591	27	PU1-C-LP-b-1000-2	0.507
1	PU1-0	0.550	16	PU1-LP-b-1000-2	0.477	1	PU1-0	0.579	16	PU1-LP-b-1000-2	0.498

Table 14. Plans Ranked by Multi-attribute Utility Score for PU-1, Preference Pattern C.

PU-1: C

	Scenario 1	
Plan	***Plan Code***	***Utility***
19	PU1-C-HL-b-400-2	0.752
8	PU1-HL-b-400-2	0.742
27	PU1-C-LP-b-1000-2	0.737
16	PU1-LP-b-1000-2	0.726
17	PU1-C-HL-a-100-2	0.711
22	PU1-C-LP-a-100-2	0.709
25	PU1-C-LP-b-400-3	0.703
6	PU1-HL-a-100-2	0.703
11	PU1-LP-a-100-2	0.700
5	PU1-NS-1000	0.699
18	PU1-C-HL-a-100-3	0.696
14	PU1-LP-b-400-3	0.692
23	PU1-C-LP-a-100-3	0.692
20	PU1-C-HL-b-400-3	0.691
21	PU1-C-LP-a-100-1	0.690
7	PU1-HL-a-100-3	0.687
24	PU-1:C-LP-b-400-1	0.685
4	PU1-NS-400	0.685
3	PU1-NS-100	0.683
12	PU1-LP-a-100-3	0.682
9	PU1-HL-b-400-3	0.680
10	PU1-LP-a-100-1	0.676
26	PU1-C-LP-b-1000-1	0.676
13	PU1-LP-b-400-1	0.669
15	PU1-LP-b-1000-1	0.658
2	PU1-R2	0.635
1	PU1-0	0.449

	Scenario 2	
Plan	***Plan Code***	***Utility***
19	PU1-C-HL-b-400-2	0.700
8	PU1-HL-b-400-2	0.689
17	PU1-C-HL-a-100-2	0.678
5	PU1-NS-1000	0.675
6	PU1-HL-a-100-2	0.670
22	PU1-C-LP-a-100-2	0.665
4	PU1-NS-400	0.660
18	PU1-C-HL-a-100-3	0.659
25	PU1-C-LP-b-400-3	0.656
11	PU1-LP-a-100-2	0.655
20	PU1-C-HL-b-400-3	0.655
24	PU1-C-LP-b-400-1	0.653
3	PU1-NS-100	0.653
7	PU1-HL-a-100-3	0.650
23	PU1-C-LP-a-100-3	0.645
14	PU1-LP-b-400-3	0.644
9	PU1-HL-b-400-3	0.642
21	PU-1:C-LP-a-100-1	0.642
13	PU1-LP-b-400-1	0.635
12	PU1-LP-a-100-3	0.634
26	PU-1:C-LP-b-1000-1	0.632
10	PU1-LP-a-100-1	0.628
15	PU1-LP-b-1000-1	0.611
27	PU1-C-LP-b-1000-2	0.598
2	PU1-R2	0.595
16	PU1-LP-b-1000-2	0.586
1	PU1-0	0.369

	Scenario 3	
Plan	***Plan Code***	***Utility***
19	PU1-C-HL-b-400-2	0.771
8	PU1-HL-b-400-2	0.764
27	PU1-C-LP-b-1000-2	0.755
16	PU1-LP-b-1000-2	0.748
17	PU1-C-HL-a-100-2	0.733
22	PU1-C-LP-a-100-2	0.729
6	PU1-HL-a-100-2	0.727
11	PU1-LP-a-100-2	0.723
25	PU1-C-LP-b-400-3	0.722
18	PU1-C-HL-a-100-3	0.719
14	PU1-LP-b-400-3	0.715
23	PU1-C-LP-a-100-3	0.712
7	PU1-HL-a-100-3	0.712
21	PU1-C-LP-a-100-1	0.711
20	PU1-C-HL-b-400-3	0.711
12	PU1-LP-a-100-3	0.706
9	PU1-HL-b-400-3	0.703
24	PU-1:C-LP-b-400-1	0.703
10	PU1-LP-a-100-1	0.700
5	PU1-NS-1000	0.700
3	PU1-NS-100	0.693
13	PU1-LP-b-400-1	0.692
26	PU1-C-LP-b-1000-1	0.691
4	PU1-NS-400	0.689
15	PU1-LP-b-1000-1	0.681
2	PU1-R2	0.664
1	PU1-0	0.487

	Scenario 4	
Plan	***Plan Code***	***Utility***
19	PU1-C-HL-b-400-2	0.724
8	PU1-HL-b-400-2	0.717
17	PU1-C-HL-a-100-2	0.704
6	PU1-HL-a-100-2	0.698
22	PU1-C-LP-a-100-2	0.688
18	PU1-C-HL-a-100-3	0.686
11	PU1-LP-a-100-2	0.682
25	PU1-C-LP-b-400-3	0.679
20	PU1-C-HL-b-400-3	0.679
7	PU1-HL-a-100-3	0.679
5	PU1-NS-1000	0.677
24	PU1-C-LP-b-400-1	0.676
14	PU1-LP-b-400-3	0.672
9	PU1-HL-b-400-3	0.670
23	PU-1:C-LP-a-100-3	0.669
21	PU-1:C-LP-a-100-1	0.668
4	PU1-NS-400	0.665
3	PU1-NS-100	0.665
13	PU1-LP-b-400-1	0.664
12	PU1-LP-a-100-3	0.663
10	PU1-LP-a-100-1	0.658
26	PU1-C-LP-b-1000-1	0.652
15	PU1-LP-b-1000-1	0.640
2	PU1-R2	0.629
27	PU1-C-LP-b-1000-2	0.620
16	PU1-LP-b-1000-2	0.613
1	PU1-0	0.423

Figure 11. Contributions of Each Metric to the Multi-attribute Utility Score for Preference Pattern A by Scenario for PU-1.

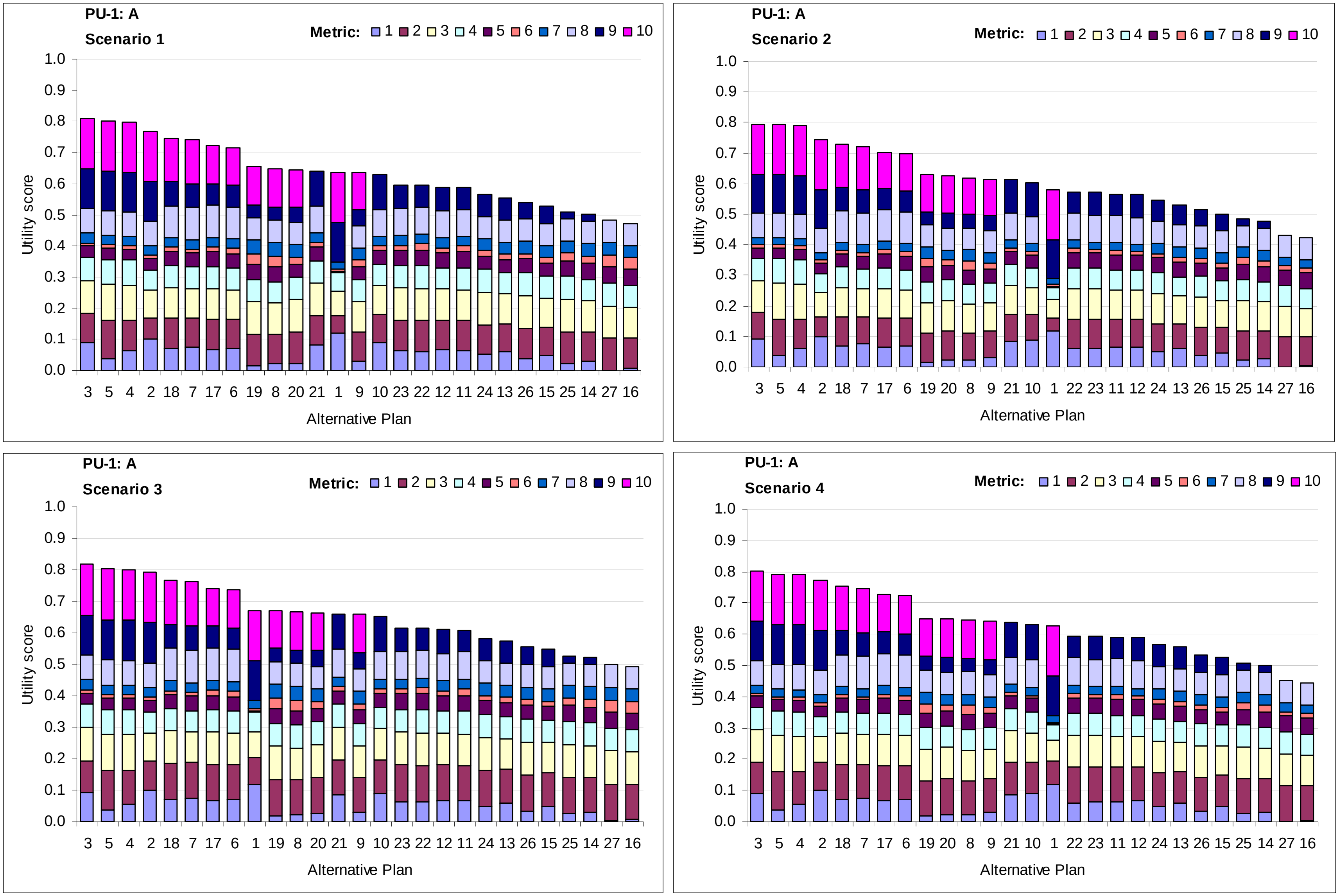


Figure 12. Contributions of Each Metric to the Multi-attribute Utility Score for Preference Pattern B by Scenario for PU-1.

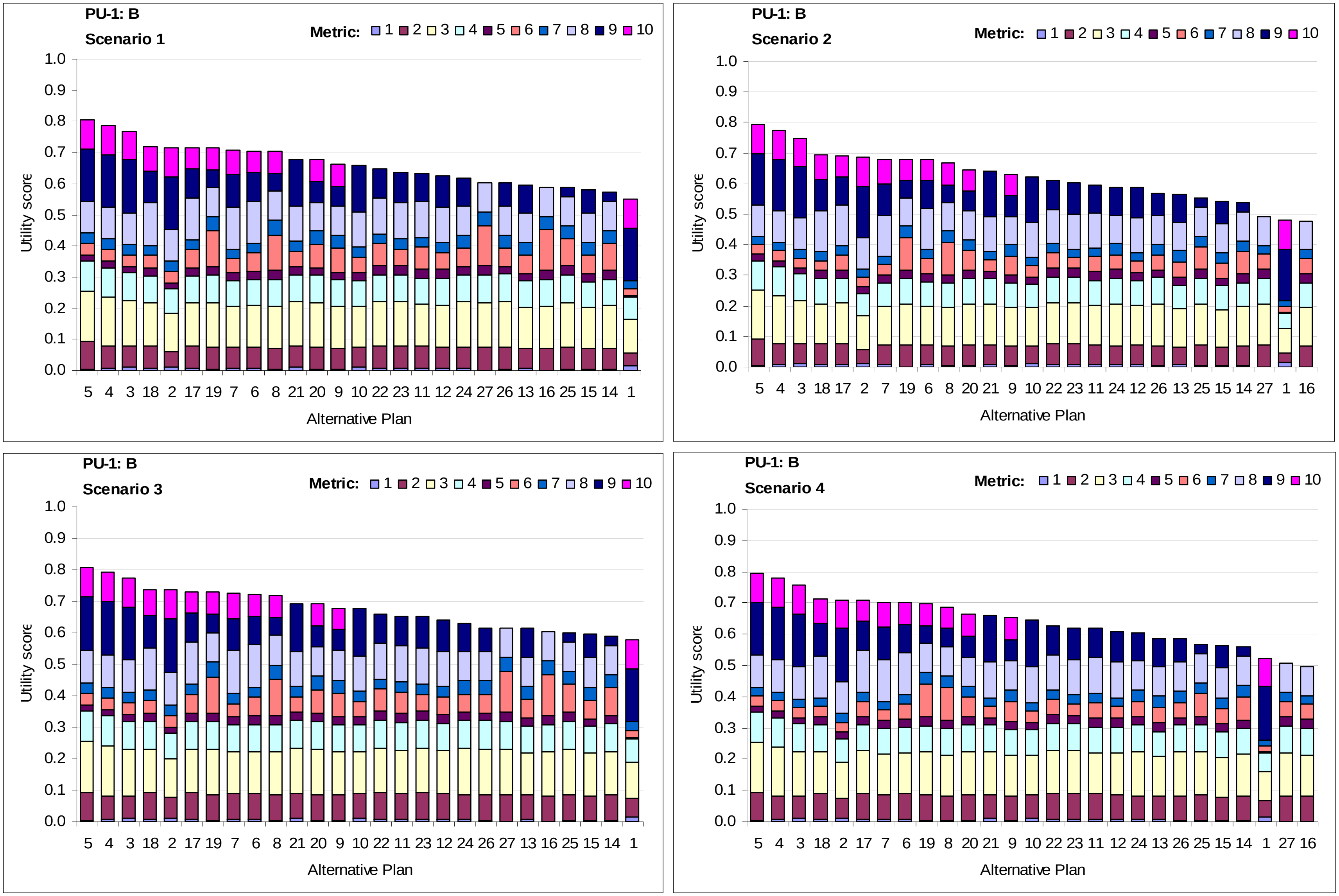
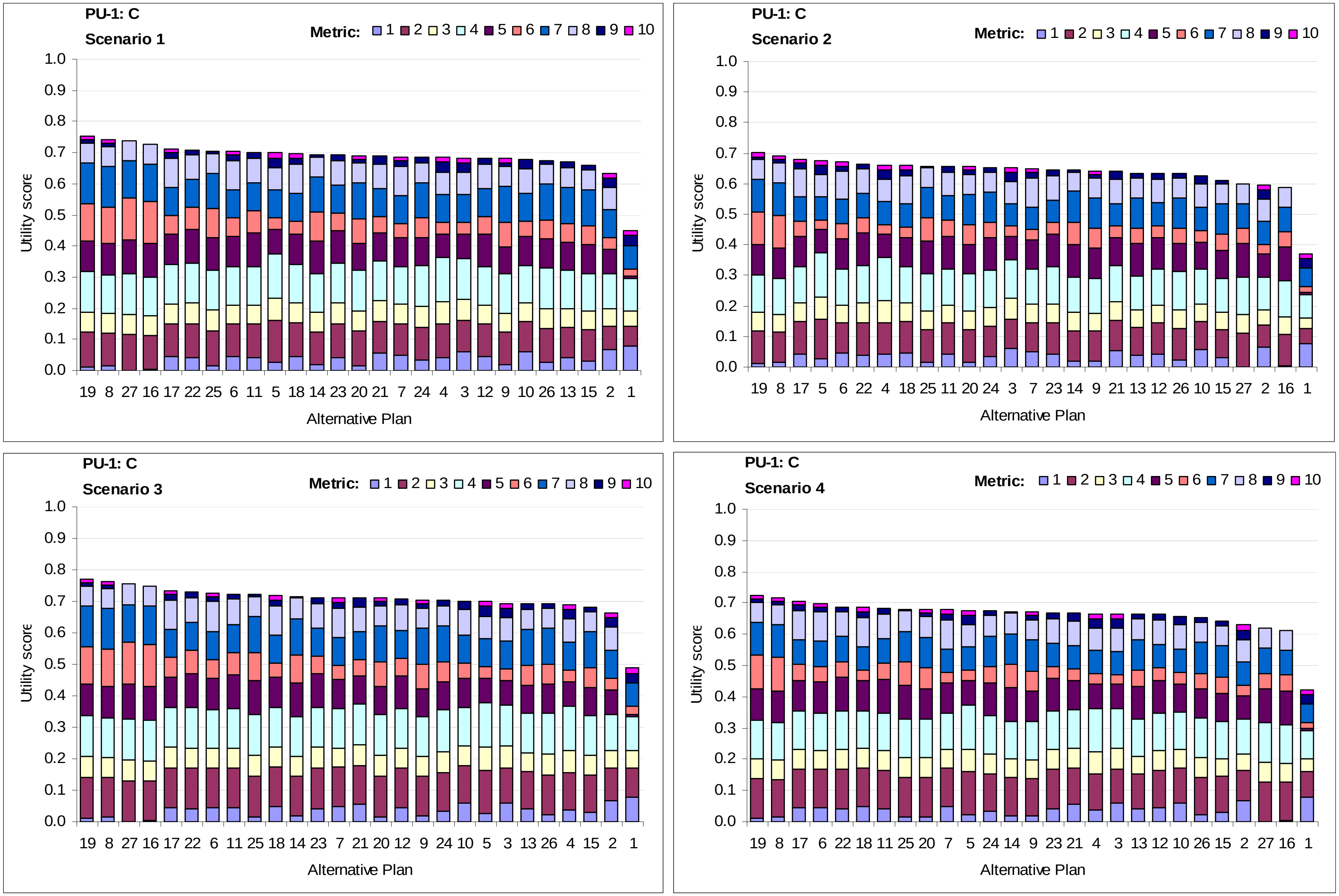


Figure 13. Contributions of Each Metric to the Multi-attribute Utility Score for Preference Pattern C by Scenario for PU-1.



6.2.1 Sensitivity of Preferred Alternatives – Planning Unit 1

Table 15 shows the preferred alternatives over four possible relative sea level rise and re-development scenarios. Each cell indicates the preferred alternative given the scenario and the coastal alternative. For example, for PU-1:C, plan PU1-C-HL-b-400-2 (Plan 19) is preferred regardless of rate of relative sea level rise and pattern of development. This table shows that, for PU-1:B, the preference for plan PU1-NS-1000 (Plan 5) is also not sensitive to the assumptions made about relative sea level rise and pattern of redevelopment. This trend also holds for PU-1:A, where PU1-NS-100 (Plan 3) is preferred.

Table 15. Preferred Plan for Three Preference Patterns in PU1.

PU-1:A	**Relative Sea-level Rise**	
Pattern of Development	Lower	Higher
High/Dispersed	PU1-NS-100	PU1-NS-100
BAU/Compact	PU1-NS-100	PU1-NS-100

PU-1:B	**Relative Sea-level Rise**	
Pattern of Development	Lower	Higher
High/Dispersed	PU1-NS-1000	PU1-NS-1000
BAU/Compact	PU1-NS-1000	PU1-NS-1000

PU-1:C	**Relative Sea-level Rise**	
Pattern of Development	Lower	Higher
High/Dispersed	PU1-C-HL-b-400-2	PU1-C-HL-b-400-2
BAU/Compact	PU1-C-HL-b-400-2	PU1-C-HL-b-400-2

6.2.2. Expected Utility – Planning Unit 1

In a decision analysis with uncertainty, the preferred alternative is the one that maximizes expected utility. In this analysis, we calculate expected utility for each of the development scenarios treating relative sea-level rise (RSLR) as uncertain. Our ability to address uncertainty in the development patterns is limited because these scenarios are associated with the extreme values of the regional economy metrics. This reduced set of development scenarios was necessitated by logistical and resource constraints.

Figures 14 through 16 plot the expected utility of each alternative given an allocation of probability to each of the two relative sea level rise scenarios (P(RSLR = Lower) = 0.5 and P(RSLR = Higher) = 0.5) for each the characteristic stakeholder groups. These three figures illustrate the expected utility of each alternative assuming a high employment growth rate and a dispersed population scenario. (BAU/Compact was not generated.) These figures illustrate how the utility of some alternatives may be more or less sensitive to relative sea level rise assumptions than the utility of other alternatives. The error bands on expected utility represent the minimum and maximum levels of utility over the four scenarios considered in the LACPR plan. Alternatives that are more sensitive to relative sea level rise and development assumptions will have larger error bands and those alternatives with narrow error bands yield the most predictable levels of utility. For example, Plans 4 and 5 have narrow error bands for all three preference patterns. The expected utility of any given alternative and its range of possible values depends in part upon what set of weights is chosen.

The calculation of expected utility requires the assignment of probability to each scenario, but in this case our interest is not in any particular set of probabilities. Rather, our interest is in understanding how the different alternatives perform under different allocations of probability to the scenarios. For example, a change in the probabilities might cause expected utility for some alternatives to increase while causing expected utility for other alternatives to decrease. We are also interested in the range of expected utility for each scenario. The expected utilities shown in these figures assume high employment/dispersed populations. Alternatives that have expected utilities with smaller ranges represent more predictable outcomes. These alternatives (for example, Plan 5 in Figure 14) may be preferred to others that have larger ranges (for example, Plan 3) because these alternatives lead to more predictable outcomes.

Figure 14. Expected Utility of each PU-1 Alternative for Preference Pattern A, showing minimum and maximum utility scores. (Scenarios 1 & 2: High Employment/ Dispersed Population).

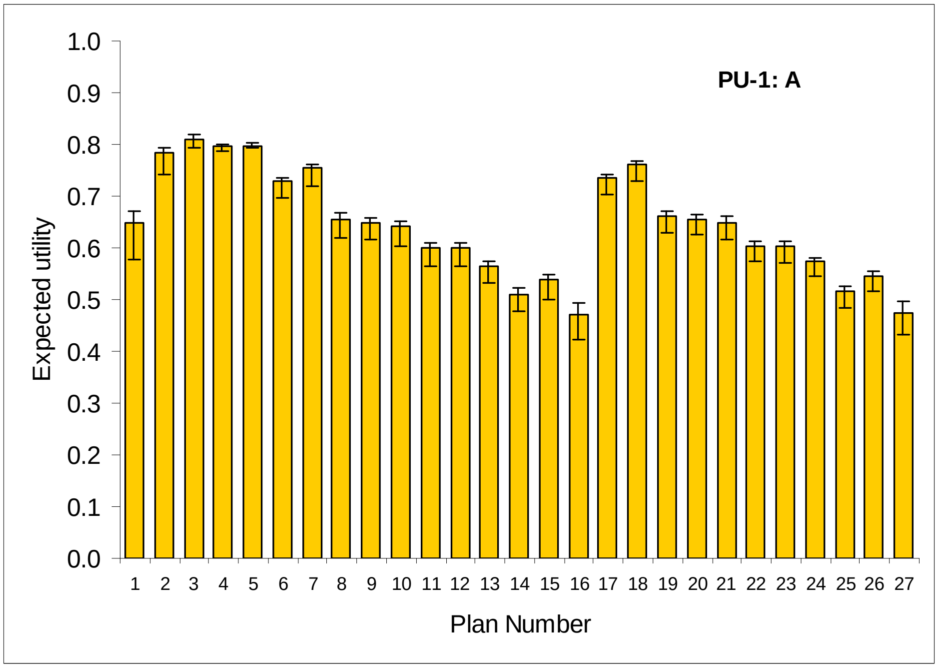


Figure 15. Expected Utility of each PU-1 Alternative for Preference Pattern B, showing minimum and maximum utility scores. (Scenarios 1 & 2: High Employment/ Dispersed Population).

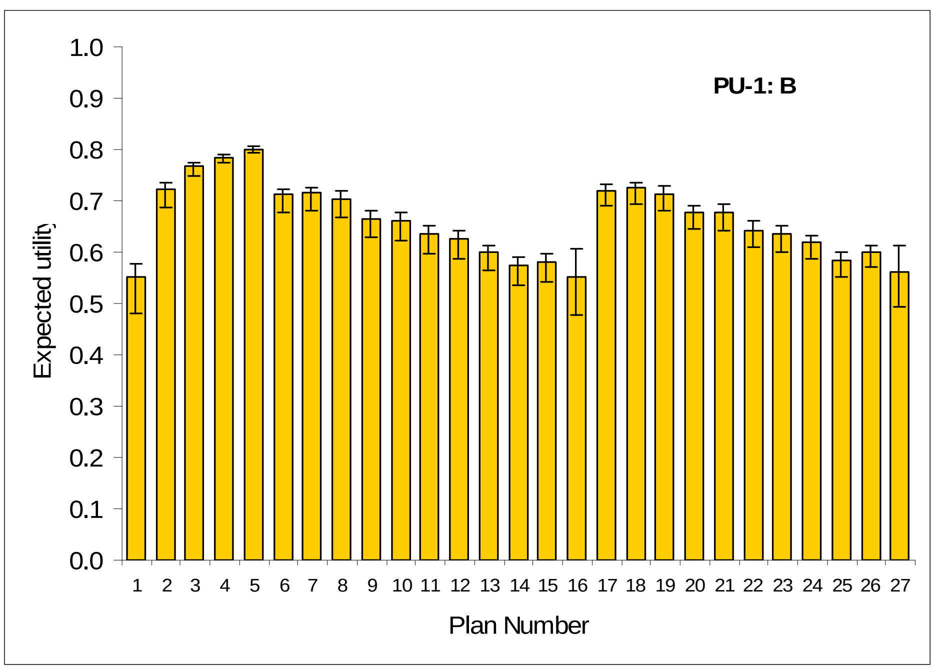
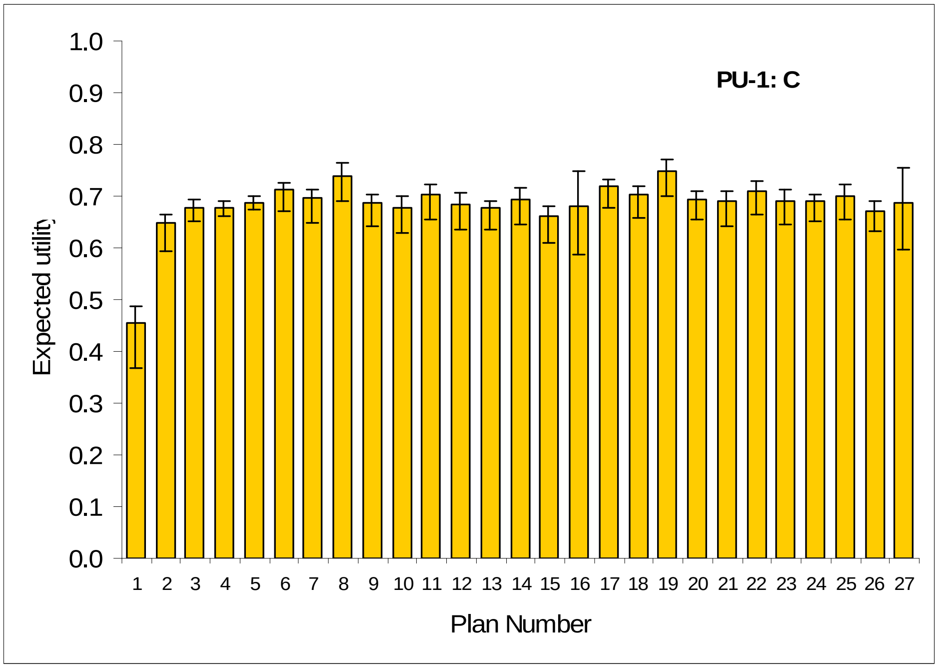


Figure 16. Expected Utility of each PU-1 Alternative for Preference Pattern C, showing minimum and maximum utility scores. (Scenarios 1 & 2: High Employment/ Dispersed Population).



6.2.3 Sensitivity of Decisions to Assumptions about the Probability of Higher Levels of Relative Sea Level Rise – Planning Unit 1

Table 16 shows the sensitivity of the preferred alternative to assumptions about the allocation of probabilities to relative sea level rise scenarios for each of the three preference patterns and for each development scenario. For PU-1:A, the decision is insensitive for all scenarios, with Plan 3 being preferred. This trend holds for PU-1:B and PU-1:C, where Plans 5 and 19 are preferred, respectively.

Table 16. Preferred Plan Matrix for PU-1

PU-1: A		**Probability (RSLR = Higher)**										
Development Scenario		0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
High Employment/ Dispersed Population (Scenarios 1&2)		3	3	3	3	3	3	3	3	3	3	3
BAU Employment/ Compact Population (Scenarios 3&4)		3	3	3	3	3	3	3	3	3	3	3

PU-1: B		**Probability (RSLR = Higher)**										
Development Scenario		0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
High Employment/ Dispersed Population (Scenarios 1&2)		5	5	5	5	5	5	5	5	5	5	5
BAU Employment/ Compact Population (Scenarios 3&4)		5	5	5	5	5	5	5	5	5	5	5

PU-1: C		**Probability (RSLR = Higher)**										
Development Scenario		0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
High Employment/ Dispersed Population (Scenarios 1&2)		19	19	19	19	19	19	19	19	19	19	19
BAU Employment/ Compact Population (Scenarios 3&4)		19	19	19	19	19	19	19	19	19	19	19

6.3 Results for Illustrative Preference Patterns – Planning Unit 2

The illustrative preference patterns are assigned the labels PU-2:A, PU-2:B, and PU-2:C. Table 17 lists the weights for each preference pattern and Figure 17 displays the weights graphically by showing the proportion of total weight on each objective in a pie-chart. PU-2:A has the highest weights on minimizing direct wetland impacts (DWI), minimizing indirect environmental impacts (IEI), and minimizing construction time (TIME). Also of high importance to this preference pattern is reducing life cycle costs (COST), minimizing direct economic damages (DAM), and minimizing employment impacts (EMP). Protecting historic districts, historic properties, and archeological sites are less important than the other objectives. PU-2:B puts the highest weight on minimizing resident population impacts (POP), but also values minimizing employment impacts (EMP) and protecting historic properties, districts and archeological sites (HPRO, HDIS and ASIT). PU-2:B places relatively little importance on minimizing direct wetland impacts (DWI) and indirect environmental impacts (IEI). The preference pattern embodied by PU-2:C emphasizes minimizing indirect environmental impacts (IEI), minimizing life cycle costs (COST), and minimizing population impacts (POP). PU-2:C also emphasizes minimizing impacts to archeological sites (ASIT), historic properties protected (HPRO) and historic districts (HDIS), but places relatively little importance on minimizing construction time and minimizing direct economic damages (DAM).

Table 17. Swing weights for three illustrative preference patterns discussed for PU2.

#	Code	Name	PU-2:A	PU-2:B	PU-2:C
1	COST	Life-cycle Cost ($ Billions)	0.1194	0.0775	0.1406
2	POP	Population Impacted (People/Year)	0.0746	0.1550	0.1406
3	DAM	Direct Economic Damages ($ Millions/Year)	0.1119	0.0775	0.0469
4	EMP	Employment Impacts (Jobs Disrupted/Year)	0.1119	0.1473	0.0859
5	ASIT	Archeological Sites Protected (Number of Sites)	0.0448	0.1240	0.1094
6	HDIS	Historic Districts Protected (Number of Districts)	0.0448	0.1395	0.0938
7	HPRO	Historic Properties Protected (Number of Properties)	0.0448	0.1395	0.1094
8	TIME	Construction Time (Years)	0.1493	0.0930	0.0234
9	DWI	Direct Wetland Impacts (Acres)	0.1493	0.0310	0.0938
10	IEI	Indirect Environmental Impacts (Scale; -8 to +8)	0.1493	0.0155	0.1563
		Top-ranked metric	DWI, IEI, TIME	POP	IEI

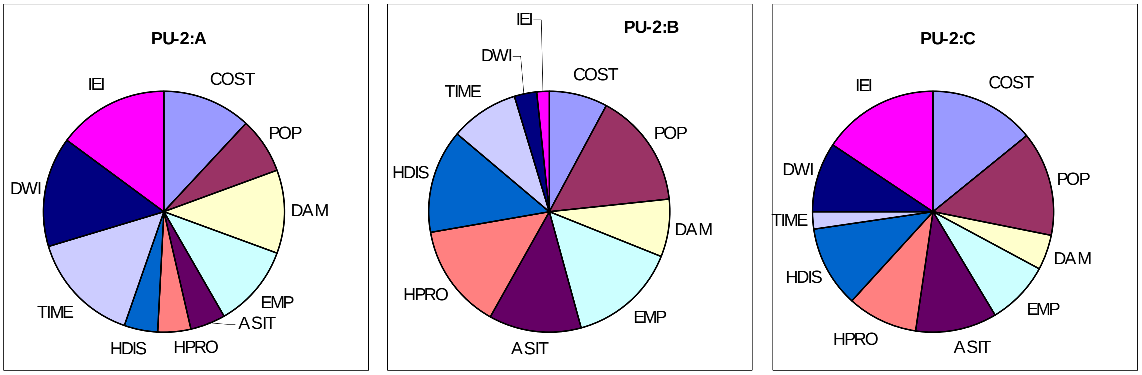
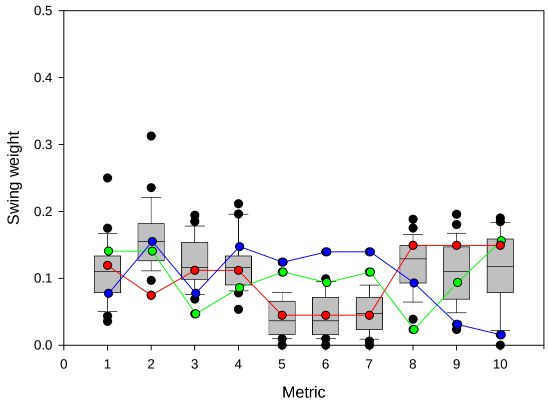


Figure 17. Three illustrative preference patterns discussed for PU2.

The illustrative preference patterns selected for discussion here are each unique within the planning unit, but they are not necessarily atypical. Usually, a preference pattern contains some weights that are similar to those of other stakeholders and some weights that represent extremes. Figure 18 shows how each of the swing weights in the illustrative preference pattern compares to the other swing weights in this planning unit. In this figure, the three color-coded sets of weights are overlaid on the box plots that were introduced in Section 3. The closer each of the color-coded points is to being within the gray box for a particular performance measure, the more typical the weight. Points that fall outside the error bars that surround the gray box indicate extreme positions relative to other survey respondents, or outliers. For example, PU-2:A is color-coded red. Of all the stakeholders who participated in the preference assessment in this planning unit, this stakeholder placed the lowest weight on metric 2, minimizing population impacts (POP). However, all of the other weights were in the typical range. PU-2:B is color-coded in blue. This stakeholder placed unusually high weight on metric 5, protecting archeological sites (ASIT), metric 6, protecting historic properties (HPRO), and metric 7, protecting historic districts (HDIS). This stakeholder also placed unusually low weights on metric 9, minimizing direct wetland impacts (DWI), and minimizing indirect environmental impacts (IEI). PU-2:C stands out for unusually low weights on metric 3, minimizing direct economic damages (DAM), metric 8, minimizing construction time (TIME), and unusually high weights on metric 5, protecting archeological sites (ASIT), metric 6, protecting historic properties (HPRO), and metric 7, protecting historic districts (HDIS).



#	Code	Metric Name
1	COST	Life-cycle Cost ($ Billions)
2	POP	Population Impacted (People/Year)
3	DAM	Direct Economic Damages ($ Millions/Year)
4	EMP	Employment Impacts (Jobs Disrupted/Year)
5	ASIT	Archeological Sites Protected (Number of Sites)
6	HDIS	Historic Districts Protected (Number of Districts)
7	HPRO	Historic Properties Protected (Number of Properties)
8	TIME	Construction Time (Years)
9	DWI	Direct Wetland Impacts (Acres)
10	IEI	Indirect Environmental Impacts (Scale; -8 to +8)

Figure 18. Swing weights for the three preference patterns evaluated for PU2 superimposed on the swing weight box plot (previously introduced in Section 3). See Table 17 for explanation of how the metrics are numbered. The preference patterns are color coded as follows: PU-2:A is red, PU-2:B is blue, and PU-2:C is green.

These three illustrative preference patterns produce a unique rank order of plans. These rank orders are illustrated in Figure 19 for each of the preference patterns. The underlying table was introduced in Section 5 and shows the number of times that each plan ranked first, second, third, fourth, or fifth when plans were ranked in decreasing order by the utility score. The top five plans for PU-2:A are marked in red. The top-ranked plan for PU-2:A was the comprehensive 100-year West Bank Interior (C-WBI) alignment (PU2-C-WBI-100-1). This was the top ranked plan for 24 of the stakeholders who participated in the preference assessment. The other plans among the top five for this preference pattern include PU2-WBI-100-1 (100-year West Bank Interior alignment), PU2-C-R-100-2, PU2-C-R-100-3 (two 100-year Comprehensive Ridge alignments), and PU2-R-100-2 (a 100-year Ridge alignment). These results are presented here to illustrate that different sets of weights lead to different rankings of plans. While the rankings suggest order of preference, they do not indicate how much more or less preferred a plan is relative to other plans. In addition, these figures do not help explain why a particular set of weights leads to a particular ranking of plans. These issues are discussed in greater detail below.

PU2, Scenario 1						
PLAN CODE	Rank Based on Swing Weights					Total
	1	2	3	4	5	
PU2-C-G-100-1	0	1	2	1	1	5
PU2-C-G-100-4	1	0	1	0	0	2
PU2-C-R-100-2	0	1	13	8	0	22
PU2-C-R-100-3	0	1	2	11	10	24
PU2-C-R-100-4	0	0	0	0	8	8
PU2-C-R-400-2	0	0	0	0	0	0
PU2-C-R-400-3	2	1	4	1	2	10
PU2-C-WBI-100-1	24	1	0	0	0	25
PU2-C-WBI-400-1	0	0	0	0	1	1
PU2-G-100-1	0	0	0	1	0	1
PU2-G-100-4	0	0	1	0	0	1
PU2-NS-1000	0	1	0	0	0	1
PU2-NS-400	0	1	1	0	0	2
PU2-R-100-2	0	0	0	2	5	7
PU2-R-400-3	0	1	0	0	0	1
PU2-WBI-100-1	0	19	3	3	0	25
Total	27	27	27	27	27	135

Figure 19. Rank order of the top five plans for the illustrative preference patterns. The preference patters are color coded as follows: PU-2:A is red, PU-2:B is blue, and PU-2:C is green.

MAU scores were calculated for each of the structural and nonstructural plans and the no-action alternative using a full set of ten metrics. In the discussion of PU-2 results that follows, plans are numbered 1 – 31 as indicated in Table 18 to facilitate discussion.

Table 18. Plan Numbers and Plan Names for PU2.

Plan	***Plan Code***
1	PU2-0
2	PU2-R2
3	PU2-NS-100
4	PU2-NS-400
5	PU2-NS-1000
6	PU2-G-100-1
7	PU2-G-100-4
8	PU2-G-400-4
9	PU2-G-1000-4
10	PU2-R-100-2
11	PU2-R-100-3
12	PU2-R-100-4
13	PU2-R-400-2
14	PU2-R-400-3
15	PU2-R-400-4
16	PU2-R-1000-4
17	PU2-WBI-100-1

18	PU2-WBI-400-1
19	PU2-C-G-100-1
20	PU2-C-G-100-4
21	PU2-C-G-400-4
22	PU2-C-G-1000-4
23	PU2-C-R-100-2
24	PU2-C-R-100-3
25	PU2-C-R-100-4
26	PU2-C-R-400-2
27	PU2-C-R-400-3
28	PU2-C-R-400-4
29	PU2-C-R-1000-4
30	PU2-C-WBI-100-1
31	PU2-C-WBI-400-1

The 31 plans are ranked by MAU for each scenario and each of the three preference patterns in Tables 19 through 21. For example, Table 19 shows the utility of the top-ranked Plan 30 for PU-2:A under the planning assumptions used in Scenarios 1 and 3 is 0.795 and 0.815, respectively. Under the assumptions of Scenario 2 and 4, Plan 30 remains the top-ranked plan, but the utility score decreases to 0.779 and 0.802, respectively. The lower-levels of performance for this plan in Scenarios 2 and 4 can be attributed to the higher rates of sea-level rise assumed in these scenarios. For preference pattern PU-2:B, the effect of higher rates of sea-level rise is to make a different comprehensive plan (PU2-C-G-100-4; Plan 20) more attractive than Plan 30. This shows sensitivity of the preferred plan to uncertainty in sea-level rise assumptions. For PU-1:C, a third comprehensive plan (PU2-C-R-400-3; Plan 27) dominates the rankings under all four scenarios.

Figures 20 through 22 illustrate why different preference patterns might lead to different plan rankings by showing the contribution of each metric to utility for each plan, scenario, and preference pattern. For example, Figure 21 illustrates the contribution of each metric to utility for PU-2:A. Under a set of planning assumptions consistent with Scenario 1 (Lower RSLR and High Employment/Dispersed Population), the utility of Plan 30 for PU-2:A is 0.795. This can be attributed to the relative performance of this plan on those performance objectives that are important for this preference pattern. Although a plan may contribute substantially towards one of the performance objectives, if the weights reflect relatively little importance on that objective, the performance with respect to that objective will make little contribution towards the overall utility for this preference pattern.

For PU-2:A, the top-ranked plan is one that includes a combination of structural and non-structural measures: Plan 30 (Table 19 and Figure 20). For this group, the rank order of the top nine plans is not dependent upon scenario assumptions. The second ranked plan across all scenarios was also a comprehensive plan, combining structural and non-structural measures (Plan 17). Metrics most contributing to the MAU scores for PU-2:A were direct economic damages, (No. 3), employment impacts (No. 4), construction time (No. 8), direct wetland impacts (No. 9) and indirect environmental impacts (No. 10). Although a particular metric may make substantial contributions toward overall utility, performance metrics that do not vary among decision alternatives will tend to have little impact on plan rankings. This holds true for direct wetland impacts (No. 9) and indirect environmental impacts (No. 10). Although these metrics contribute to the MAU score, they have little influence on the ranking of structural and nonstructural alternatives because they do not vary. Metrics most influencing overall utility for the two top ranked plans are construction time and direct wetland impacts (Nos. 8 and 9).

The top ranking plans for PU-2:B are those that include a combination of structural and non-structural plans (Plans 20 and 19) (Table 20 and Figure 21). The rank order for the top four plans was not sensitive to scenario assumptions. The metrics most contributing to MAU that distinguish the top and second-ranked plans were population impacts (No. 2) and economic damages (No. 3).

For PU-2:C, the three top-ranking plans are those that include a combination of structural and nonstructural measures: Plans 27, 14 and 23 (Table 21 and Figure 22). The rank order of the top three plans is dependent upon scenario assumptions. Plan 14 is second-ranked under Scenarios 1, 2 and 4 whereas Plan 23 is second ranked under Scenario 3. The metric most contributing to the MAU score for the top-ranked plan (Plan 27) in PU-2:C was indirect environmental impacts (No. 10) and protection of historic districts (No. 7) and archeological sites (No. 5). Metrics most influencing overall utility for the top ranked plan are population and employment impacts (Nos. 2 and 3).

Table 19. Plans Ranked by Multi-attribute Utility Score for PU-2, Preference Pattern A.

PU-2: A

	Scenario 1			Scenario 2			Scenario 3			Scenario 4	
Plan	***Plan Code***	***Utility***	***Plan***	***Plan Code***	***Utility***	***Plan***	***Plan Code***	***Utility***	***Plan***	***Plan Code***	***Utility***
30	PU2-C-WBI-100-1	0.795	30	PU2-C-WBI-100-1	0.779	30	PU2-C-WBI-100-1	0.815	30	PU2-C-WBI-100-1	0.802
17	PU2-WBI-100-1	0.781	17	PU2-WBI-100-1	0.766	17	PU2-WBI-100-1	0.801	17	PU2-WBI-100-1	0.788
23	PU2-C-R-100-2	0.762	23	PU2-C-R-100-2	0.746	23	PU2-C-R-100-2	0.784	23	PU2-C-R-100-2	0.771
24	PU2-C-R-100-3	0.754	24	PU2-C-R-100-3	0.741	24	PU2-C-R-100-3	0.775	24	PU2-C-R-100-3	0.765
10	PU2-R-100-2	0.749	10	PU2-R-100-2	0.733	10	PU2-R-100-2	0.772	10	PU2-R-100-2	0.759
11	PU2-R-100-3	0.742	11	PU2-R-100-3	0.729	11	PU2-R-100-3	0.764	11	PU2-R-100-3	0.754
25	PU2-C-R-100-4	0.735	25	PU2-C-R-100-4	0.720	25	PU2-C-R-100-4	0.757	25	PU2-C-R-100-4	0.745
12	PU2-R-100-4	0.724	12	PU2-R-100-4	0.709	12	PU2-R-100-4	0.746	12	PU2-R-100-4	0.734
27	PU2-C-R-400-3	0.717	27	PU2-C-R-400-3	0.706	27	PU2-C-R-400-3	0.734	27	PU2-C-R-400-3	0.725
4	PU2-NS-400	0.702	4	PU2-NS-400	0.695	14	PU2-R-400-3	0.719	14	PU2-R-400-3	0.711
3	PU2-NS-100	0.698	3	PU2-NS-100	0.690	31	PU2-C-WBI-400-1	0.715	3	PU2-NS-100	0.707
14	PU2-R-400-3	0.698	14	PU2-R-400-3	0.686	3	PU2-NS-100	0.715	31	PU2-C-WBI-400-1	0.706
31	PU2-C-WBI-400-1	0.698	31	PU2-C-WBI-400-1	0.686	26	PU2-C-R-400-2	0.711	26	PU2-C-R-400-2	0.701
26	PU2-C-R-400-2	0.692	26	PU2-C-R-400-2	0.680	18	PU2-WBI-400-1	0.697	5	PU2-NS-1000	0.687
5	PU2-NS-1000	0.682	5	PU2-NS-1000	0.677	2	PU2-R2	0.696	2	PU2-R2	0.686
2	PU2-R2	0.675	2	PU2-R2	0.663	13	PU2-R-400-2	0.695	18	PU2-WBI-400-1	0.686
18	PU2-WBI-400-1	0.675	18	PU2-WBI-400-1	0.661	5	PU2-NS-1000	0.693	4	PU2-NS-400	0.685
13	PU2-R-400-2	0.672	28	PU2-C-R-400-4	0.660	4	PU2-NS-400	0.692	13	PU2-R-400-2	0.685
28	PU2-C-R-400-4	0.671	13	PU2-R-400-2	0.659	28	PU2-C-R-400-4	0.690	28	PU2-C-R-400-4	0.681
19	PU2-C-G-100-1	0.665	19	PU2-C-G-100-1	0.654	19	PU2-C-G-100-1	0.687	19	PU2-C-G-100-1	0.677
15	PU2-R-400-4	0.654	15	PU2-R-400-4	0.642	15	PU2-R-400-4	0.677	15	PU2-R-400-4	0.668
6	PU2-G-100-1	0.652	6	PU2-G-100-1	0.641	6	PU2-G-100-1	0.674	6	PU2-G-100-1	0.664
20	PU2-C-G-100-4	0.643	20	PU2-C-G-100-4	0.633	20	PU2-C-G-100-4	0.663	20	PU2-C-G-100-4	0.656
29	PU2-C-R-1000-4	0.633	7	PU2-G-100-4	0.622	7	PU2-G-100-4	0.652	7	PU2-G-100-4	0.645
7	PU2-G-100-4	0.631	29	PU2-C-R-1000-4	0.622	29	PU2-C-R-1000-4	0.652	29	PU2-C-R-1000-4	0.643
16	PU2-R-1000-4	0.616	16	PU2-R-1000-4	0.603	16	PU2-R-1000-4	0.639	16	PU2-R-1000-4	0.629
21	PU2-C-G-400-4	0.506	21	PU2-C-G-400-4	0.496	21	PU2-C-G-400-4	0.526	21	PU2-C-G-400-4	0.518
8	PU2-G-400-4	0.491	8	PU2-G-400-4	0.480	8	PU2-G-400-4	0.513	8	PU2-G-400-4	0.505
1	PU2-0	0.460	22	PU2-C-G-1000-4	0.450	1	PU2-0	0.510	1	PU2-0	0.479
22	PU2-C-G-1000-4	0.459	9	PU2-G-1000-4	0.433	22	PU2-C-G-1000-4	0.479	22	PU2-C-G-1000-4	0.472
9	PU2-G-1000-4	0.443	1	PU2-0	0.420	9	PU2-G-1000-4	0.465	9	PU2-G-1000-4	0.457

Table 20. Plans Ranked by Multi-attribute Utility Score for PU-2, Preference Pattern B.

PU-2: B

	Scenario 1			Scenario 2			Scenario 3			Scenario 4	
Plan	***Plan Code***	***Utility***	***Plan***	***Plan Code***	***Utility***	***Plan***	***Plan Code***	***Utility***	***Plan***	***Plan Code***	***Utility***
20	PU2-C-G-100-4	0.789	20	PU2-C-G-100-4	0.776	20	PU2-C-G-100-4	0.827	20	PU2-C-G-100-4	0.816
19	PU2-C-G-100-1	0.785	19	PU2-C-G-100-1	0.770	19	PU2-C-G-100-1	0.825	19	PU2-C-G-100-1	0.811
7	PU2-G-100-4	0.773	7	PU2-G-100-4	0.760	7	PU2-G-100-4	0.812	7	PU2-G-100-4	0.801
6	PU2-G-100-1	0.767	6	PU2-G-100-1	0.751	6	PU2-G-100-1	0.807	6	PU2-G-100-1	0.794
27	PU2-C-R-400-3	0.748	27	PU2-C-R-400-3	0.731	27	PU2-C-R-400-3	0.782	21	PU2-C-G-400-4	0.768
21	PU2-C-G-400-4	0.743	21	PU2-C-G-400-4	0.729	21	PU2-C-G-400-4	0.780	27	PU2-C-R-400-3	0.767
22	PU2-C-G-1000-4	0.729	22	PU2-C-G-1000-4	0.716	22	PU2-C-G-1000-4	0.766	22	PU2-C-G-1000-4	0.755
14	PU2-R-400-3	0.724	8	PU2-G-400-4	0.707	14	PU2-R-400-3	0.762	8	PU2-G-400-4	0.749
8	PU2-G-400-4	0.722	14	PU2-R-400-3	0.706	8	PU2-G-400-4	0.761	14	PU2-R-400-3	0.747
31	PU2-C-WBI-400-1	0.713	31	PU2-C-WBI-400-1	0.693	31	PU2-C-WBI-400-1	0.748	9	PU2-G-1000-4	0.733
9	PU2-G-1000-4	0.705	9	PU2-G-1000-4	0.691	9	PU2-G-1000-4	0.745	31	PU2-C-WBI-400-1	0.731
26	PU2-C-R-400-2	0.703	28	PU2-C-R-400-4	0.685	26	PU2-C-R-400-2	0.740	28	PU2-C-R-400-4	0.724
28	PU2-C-R-400-4	0.703	26	PU2-C-R-400-2	0.685	28	PU2-C-R-400-4	0.739	26	PU2-C-R-400-2	0.724
29	PU2-C-R-1000-4	0.691	29	PU2-C-R-1000-4	0.672	29	PU2-C-R-1000-4	0.726	29	PU2-C-R-1000-4	0.710
18	PU2-WBI-400-1	0.683	18	PU2-WBI-400-1	0.662	18	PU2-WBI-400-1	0.723	15	PU2-R-400-4	0.706
15	PU2-R-400-4	0.681	15	PU2-R-400-4	0.662	15	PU2-R-400-4	0.721	18	PU2-WBI-400-1	0.705
13	PU2-R-400-2	0.677	13	PU2-R-400-2	0.657	13	PU2-R-400-2	0.719	13	PU2-R-400-2	0.702
16	PU2-R-1000-4	0.667	16	PU2-R-1000-4	0.647	16	PU2-R-1000-4	0.707	16	PU2-R-1000-4	0.691
30	PU2-C-WBI-100-1	0.658	30	PU2-C-WBI-100-1	0.627	30	PU2-C-WBI-100-1	0.695	30	PU2-C-WBI-100-1	0.667
23	PU2-C-R-100-2	0.647	24	PU2-C-R-100-3	0.619	23	PU2-C-R-100-2	0.687	24	PU2-C-R-100-3	0.660
24	PU2-C-R-100-3	0.642	23	PU2-C-R-100-2	0.616	24	PU2-C-R-100-3	0.680	23	PU2-C-R-100-2	0.660
17	PU2-WBI-100-1	0.639	17	PU2-WBI-100-1	0.609	17	PU2-WBI-100-1	0.677	17	PU2-WBI-100-1	0.649
10	PU2-R-100-2	0.630	11	PU2-R-100-3	0.604	10	PU2-R-100-2	0.671	11	PU2-R-100-3	0.645
11	PU2-R-100-3	0.627	10	PU2-R-100-2	0.599	11	PU2-R-100-3	0.665	10	PU2-R-100-2	0.643
25	PU2-C-R-100-4	0.626	25	PU2-C-R-100-4	0.596	25	PU2-C-R-100-4	0.665	25	PU2-C-R-100-4	0.638
12	PU2-R-100-4	0.611	4	PU2-NS-400	0.594	12	PU2-R-100-4	0.650	12	PU2-R-100-4	0.624
4	PU2-NS-400	0.610	5	PU2-NS-1000	0.587	5	PU2-NS-1000	0.625	5	PU2-NS-1000	0.611
5	PU2-NS-1000	0.602	12	PU2-R-100-4	0.581	3	PU2-NS-100	0.622	4	PU2-NS-400	0.605
3	PU2-NS-100	0.591	3	PU2-NS-100	0.573	4	PU2-NS-400	0.621	3	PU2-NS-100	0.605
2	PU2-R2	0.559	2	PU2-R2	0.537	2	PU2-R2	0.597	2	PU2-R2	0.578
1	PU2-0	0.257	1	PU2-0	0.203	1	PU2-0	0.331	1	PU2-0	0.288

Table 21. Plans Ranked by Multi-attribute Utility Score for PU-2, Preference Pattern C.

PU-2: C

	Scenario 1			Scenario 2			Scenario 3			Scenario 4	
Plan	*Plan Code*	*Utility*	*Plan*	*Plan Code*	*Utility*	*Plan*	*Plan Code*	*Utility*	*Plan*	*Plan Code*	*Utility*
27	PU2-C-R-400-3	0.717	27	PU2-C-R-400-3	0.705	27	PU2-C-R-400-3	0.745	27	PU2-C-R-400-3	0.735
14	PU2-R-400-3	0.705	14	PU2-R-400-3	0.692	23	PU2-C-R-100-2	0.738	14	PU2-R-400-3	0.727
23	PU2-C-R-100-2	0.704	23	PU2-C-R-100-2	0.682	14	PU2-R-400-3	0.737	23	PU2-C-R-100-2	0.719
10	PU2-R-100-2	0.698	24	PU2-C-R-100-3	0.680	10	PU2-R-100-2	0.732	24	PU2-C-R-100-3	0.715
24	PU2-C-R-100-3	0.696	26	PU2-C-R-400-2	0.678	24	PU2-C-R-100-3	0.728	10	PU2-R-100-2	0.713
26	PU2-C-R-400-2	0.691	10	PU2-R-100-2	0.676	11	PU2-R-100-3	0.722	26	PU2-C-R-400-2	0.709
11	PU2-R-100-3	0.690	11	PU2-R-100-3	0.674	26	PU2-C-R-400-2	0.720	11	PU2-R-100-3	0.709
30	PU2-C-WBI-100-1	0.684	31	PU2-C-WBI-400-1	0.670	30	PU2-C-WBI-100-1	0.716	13	PU2-R-400-2	0.701
31	PU2-C-WBI-400-1	0.683	28	PU2-C-R-400-4	0.665	13	PU2-R-400-2	0.712	31	PU2-C-WBI-400-1	0.700
28	PU2-C-R-400-4	0.678	13	PU2-R-400-2	0.663	31	PU2-C-WBI-400-1	0.712	28	PU2-C-R-400-4	0.697
17	PU2-WBI-100-1	0.678	30	PU2-C-WBI-100-1	0.662	17	PU2-WBI-100-1	0.710	30	PU2-C-WBI-100-1	0.696
13	PU2-R-400-2	0.677	17	PU2-WBI-100-1	0.656	28	PU2-C-R-400-4	0.708	18	PU2-WBI-400-1	0.691
25	PU2-C-R-100-4	0.673	18	PU2-WBI-400-1	0.655	25	PU2-C-R-100-4	0.706	17	PU2-WBI-100-1	0.690
18	PU2-WBI-400-1	0.669	15	PU2-R-400-4	0.653	18	PU2-WBI-400-1	0.703	15	PU2-R-400-4	0.689
12	PU2-R-100-4	0.667	25	PU2-C-R-100-4	0.652	15	PU2-R-400-4	0.700	25	PU2-C-R-100-4	0.687
15	PU2-R-400-4	0.666	19	PU2-C-G-100-1	0.649	12	PU2-R-100-4	0.700	19	PU2-C-G-100-1	0.684
19	PU2-C-G-100-1	0.659	12	PU2-R-100-4	0.645	19	PU2-C-G-100-1	0.693	12	PU2-R-100-4	0.681
6	PU2-G-100-1	0.651	6	PU2-G-100-1	0.640	6	PU2-G-100-1	0.686	6	PU2-G-100-1	0.676
20	PU2-C-G-100-4	0.647	20	PU2-C-G-100-4	0.638	20	PU2-C-G-100-4	0.679	20	PU2-C-G-100-4	0.672
29	PU2-C-R-1000-4	0.647	29	PU2-C-R-1000-4	0.633	29	PU2-C-R-1000-4	0.676	7	PU2-G-100-4	0.665
7	PU2-G-100-4	0.639	7	PU2-G-100-4	0.630	7	PU2-G-100-4	0.672	29	PU2-C-R-1000-4	0.665
16	PU2-R-1000-4	0.635	4	PU2-NS-400	0.621	16	PU2-R-1000-4	0.668	16	PU2-R-1000-4	0.656
3	PU2-NS-100	0.632	3	PU2-NS-100	0.620	3	PU2-NS-100	0.660	3	PU2-NS-100	0.648
4	PU2-NS-400	0.631	16	PU2-R-1000-4	0.620	2	PU2-R2	0.650	2	PU2-R2	0.637
2	PU2-R2	0.616	2	PU2-R2	0.602	4	PU2-NS-400	0.628	5	PU2-NS-1000	0.617
5	PU2-NS-1000	0.607	5	PU2-NS-1000	0.597	5	PU2-NS-1000	0.627	4	PU2-NS-400	0.617
21	PU2-C-G-400-4	0.551	21	PU2-C-G-400-4	0.541	21	PU2-C-G-400-4	0.582	21	PU2-C-G-400-4	0.574
8	PU2-G-400-4	0.539	8	PU2-G-400-4	0.529	8	PU2-G-400-4	0.573	8	PU2-G-400-4	0.565
22	PU2-C-G-1000-4	0.514	22	PU2-C-G-1000-4	0.505	22	PU2-C-G-1000-4	0.545	22	PU2-C-G-1000-4	0.538
9	PU2-G-1000-4	0.501	9	PU2-G-1000-4	0.491	9	PU2-G-1000-4	0.535	9	PU2-G-1000-4	0.527
1	PU2-0	0.435	1	PU2-0	0.399	1	PU2-0	0.493	1	PU2-0	0.464

Figure 20. Contributions of Each Metric to the Multi-attribute Utility Score for Preference Pattern A by Scenario for PU-2.

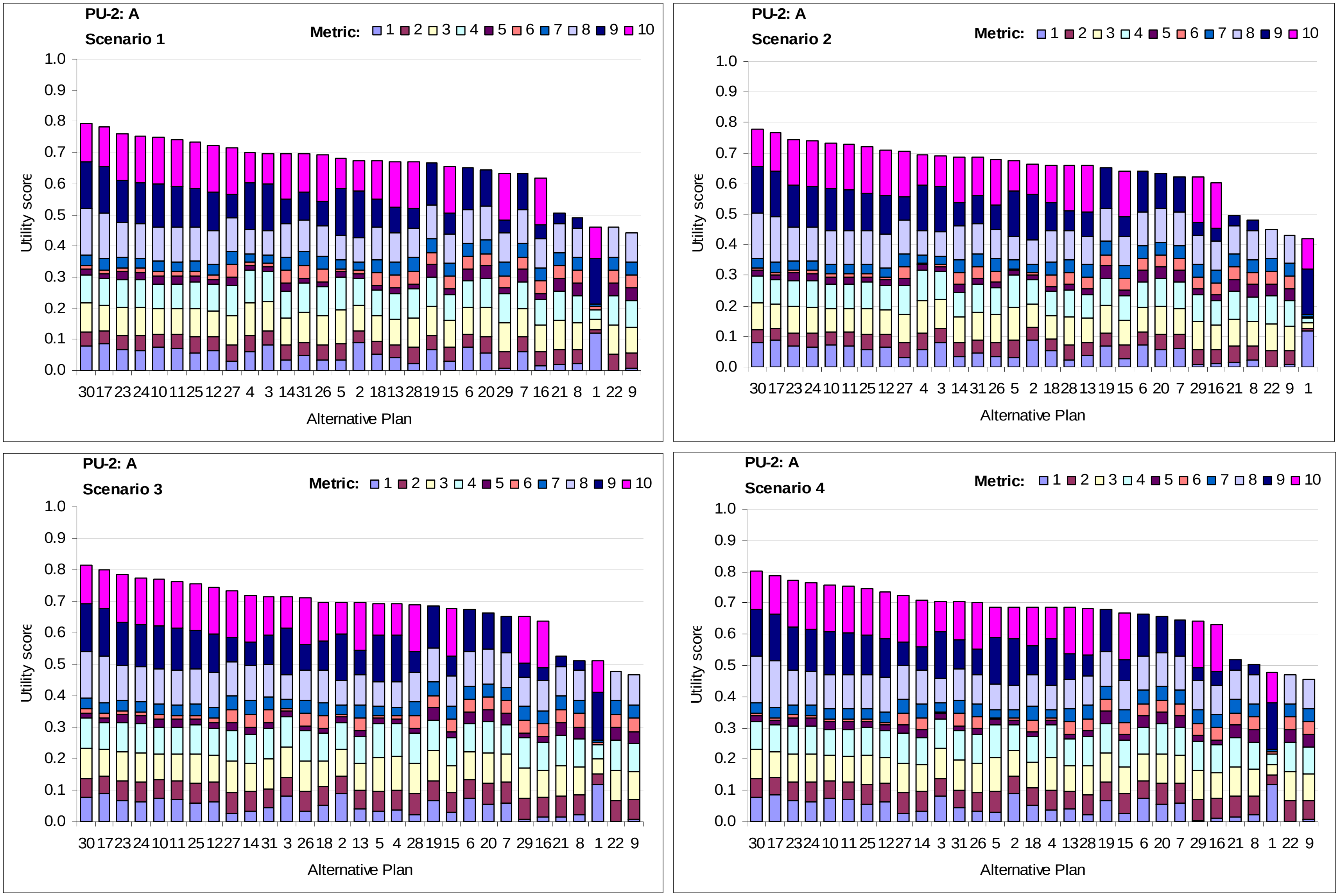


Figure 21. Contributions of Each Metric to the Multi-attribute Utility Score for Preference Pattern B by Scenario for PU-2.

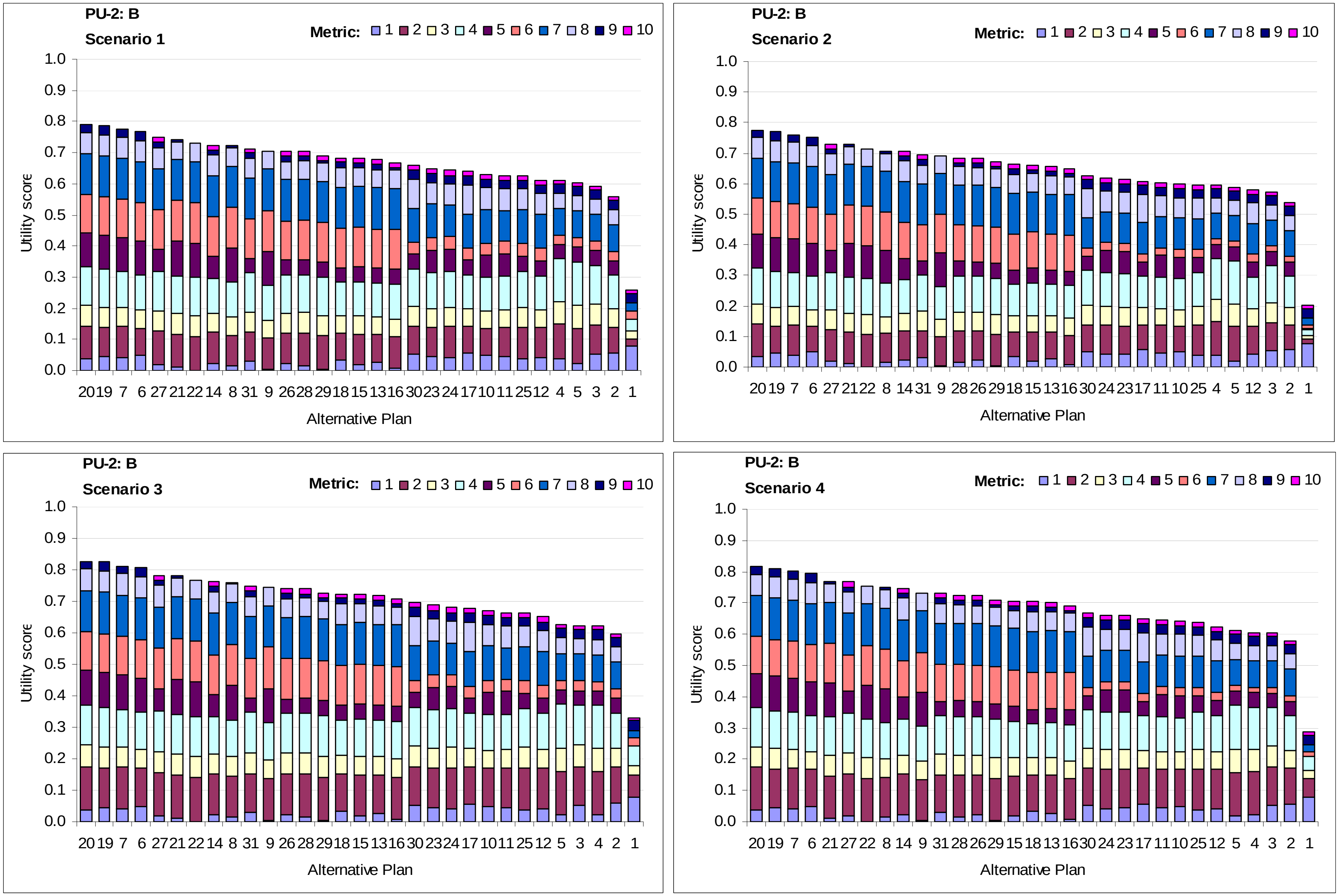
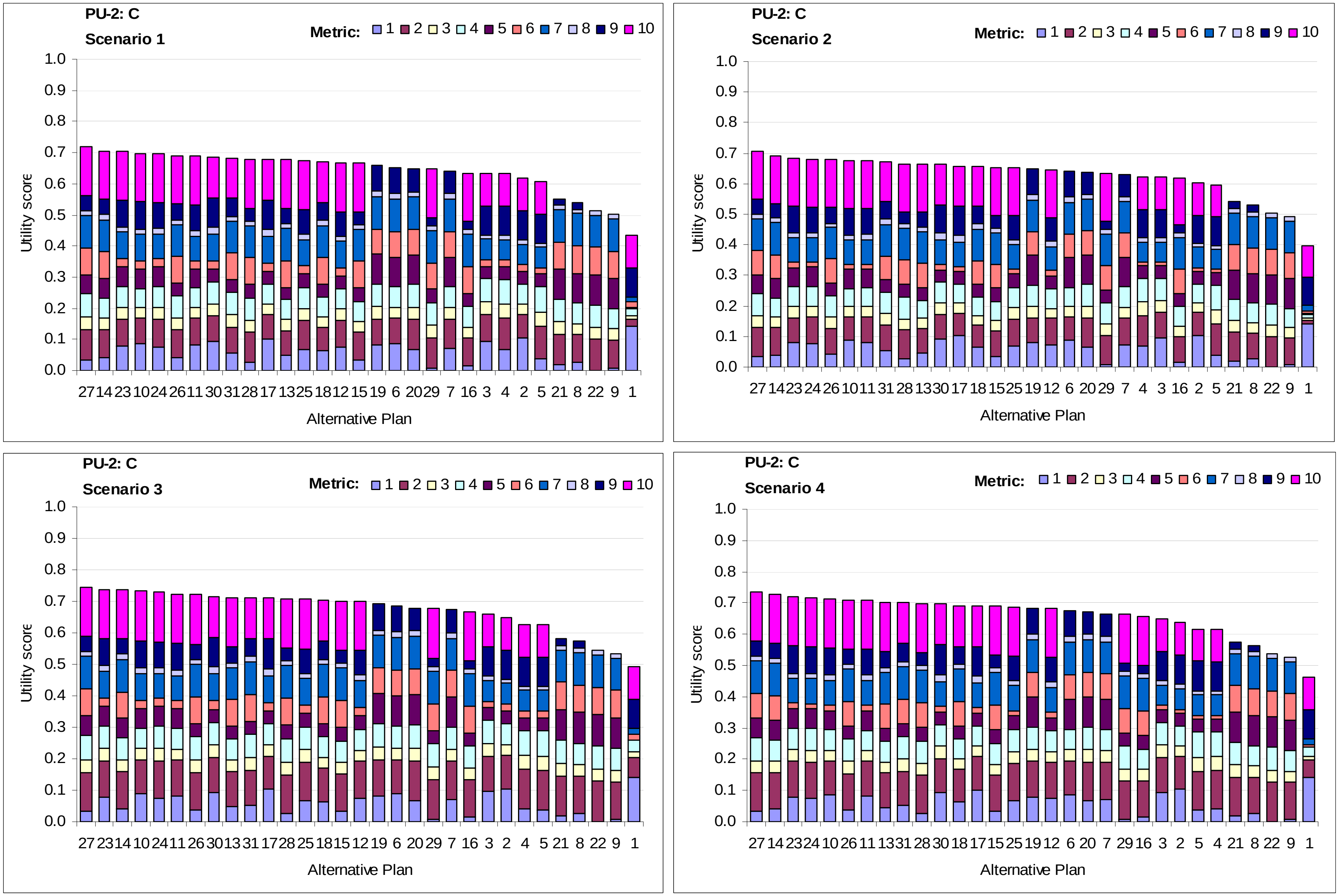


Figure 22. Contributions of Each Metric to the Multi-attribute Utility Score for Preference Pattern C by Scenario for PU-2.



6.3.1 Sensitivity of Preferred Alternatives – Planning Unit 2

Table 22 shows the preferred alternatives over four possible relative sea level rise and re-development scenarios. Each cell indicates the preferred alternative given the scenario and the coastal alternative. For example, for PU-2:A, plan PU2-C-WBI-100-1 (Plan 30) is preferred regardless of rate of relative sea level rise and pattern of development. This table shows that this pattern also holds for Preference Patterns B and C, where plan PU2-C-G-100-4 (Plan 20) and plan PU2-C-R-400-3 (Plan 27) are preferred, respectively.

Table 22. Preferred Plan Matrix for Three Preference Patterns in PU2.

PU-2:A	**Relative Sea-level Rise**	
Pattern of Development	Lower	Higher
High/Dispersed	PU2-C-WBI-100-1	PU2-C-WBI-100-1
BAU/Compact	PU2-C-WBI-100-1	PU2-C-WBI-100-1

PU-2:B	Relative Sea-level Rise	
Pattern of Development	Lower	Higher
High/Dispersed	PU2-C-G-100-4	PU2-C-G-100-4
BAU/Compact	PU2-C-G-100-4	PU2-C-G-100-4

PU-2:C	**Relative Sea-level Rise**	
Pattern of Development	Lower	Higher
High/Dispersed	PU2-C-R-400-3	PU2-C-R-400-3
BAU/Compact	PU2-C-R-400-3	PU2-C-R-400-3

6.3.2 Expected Utility – Planning Unit 2

Figures 23 through 25 plot the expected utility of each alternative assuming a uniform distribution of probability across the two relative sea level rise scenarios (P(RSLR = Lower) = 0.5 and P(RSLR = Higher) = 0.5) for each preference pattern. These three figures illustrate the expected utility of each alternative assuming a High Employment and Dispersed Population scenario. (BAU/Compact was not generated.) These figures illustrate how the utility of some alternatives may be more or less sensitive to relative sea level rise assumptions than the utility of other alternatives. The error bands on expected utility represent the minimum and maximum levels of utility over the four scenarios considered in the LACPR plan. Alternatives with more sensitivity to relative sea level rise and development assumptions will have wider error bands than those with less sensitivity. Alternatives that have narrower error bands can be judged to be more predictable in terms of the level of utility they will provide. For example, Plan 4 has a narrow error band for PU-2:A (Figure 23). The expected utility of any given alternative and its range of possible values depends in part upon what set of weights is chosen to calculate utility.

The calculation of expected utility requires the assignment of probability to each scenario, but in this case our interest is not in any particular set of probabilities. Rather, our interest is in understanding how the different alternatives perform under different allocations of probability to the scenarios. For example, a change in the probabilities might cause expected utility for some alternatives to increase while causing expected utility for other alternatives to decrease. We are also interested in the range of expected utility for each scenario. The expected utilities shown in these figures assume high employment/dispersed populations. Alternatives that have expected utilities with smaller ranges represent more predictable outcomes. These alternatives (for example, Plan 4 in Figure 23) may be preferred to others that have larger ranges (for example, Plan 17 in Figure 23) because these alternatives lead to more predictable outcomes.

Figure 23. Expected Utility of each PU-2 Alternative for Preference Pattern A, showing minimum and maximum utility scores (Scenarios 1 & 2: High Employment/ Dispersed Population).

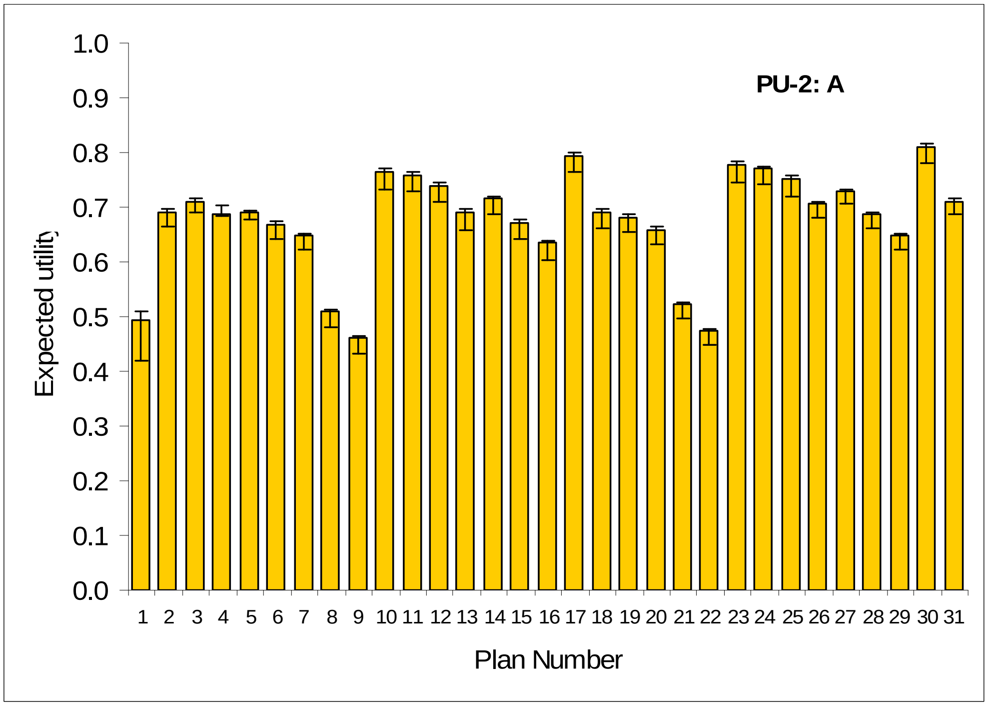


Figure 24. Expected Utility of each PU-2 Alternative for Preference Pattern B, showing minimum and maximum utility scores. (Scenarios 1 & 2: High Employment/ Dispersed Population).

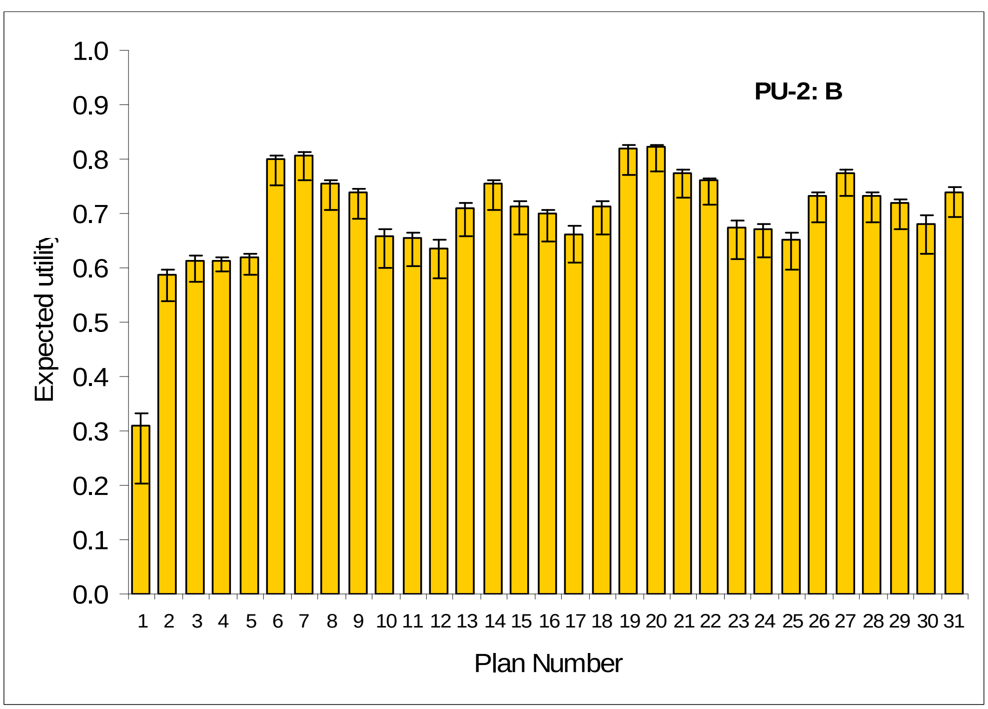
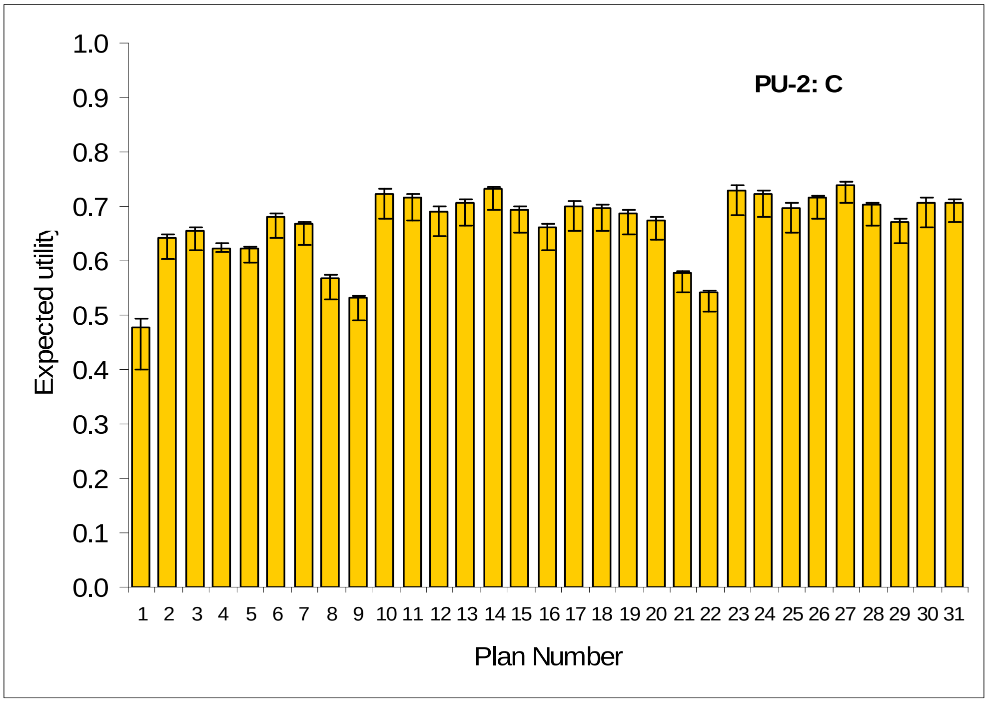


Figure 25. Expected Utility of each PU-2 Alternative for Preference Pattern C, showing minimum and maximum utility scores. (Scenarios 1 & 2: High Employment/ Dispersed Population).



6.3.3 Sensitivity of Decisions to Assumptions about the Probability of Higher Levels of Relative Sea Level Rise – Planning Unit 2

Table 23 shows the sensitivity of the preferred alternative to assumptions about the allocation of probabilities to relative sea level rise scenarios for each of the three preference patterns and for each development scenario. For PU-2:A, the decision is insensitive for all scenarios, with Plan 30 being preferred. For stakeholders with preferences that are consistent with those of PU-2:B, the plan that maximizes expected utility is Plan 20. For stakeholders with preferences that are consistent with those of PU-2:C, the plan that maximizes expected utility is Plan 27.

Table 23. Preferred Plan Matrix for PU2.

PU-2: A		**Probability (RSLR = Higher)**										
Development Scenario		0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
High Employment/ Dispersed Population (Scenarios 1&2)		30	30	30	30	30	30	30	30	30	30	30
BAU Employment/Compact Population (Scenarios 3&4)		30	30	30	30	30	30	30	30	30	30	30

PU-2: B	**Probability (RSLR = Higher)**										
Development Scenario	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
High Employment/ Dispersed Population (Scenarios 1&2)	20	20	20	20	20	20	20	20	20	20	20
BAU Employment/Compact Population (Scenarios 3&4)	20	20	20	20	20	20	20	20	20	20	20

PU-2: C	**Probability (RSLR = Higher)**										
Development Scenario	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
High Employment/ Dispersed Population (Scenarios 1&2)	27	27	27	27	27	27	27	27	27	27	27
BAU Employment/Compact Population (Scenarios 3&4)	27	27	27	27	27	27	27	27	27	27	27

6.4 Results for Illustrative Preference Patterns – Planning Unit 3a

MAU scores were calculated for each of the coastal, structural, and nonstructural plans and the no-action alternative for three illustrative preference patterns selected for this discussion (Table 24). Figure 26 shows the proportion of total weight placed on each of the metrics. Preference pattern PU-3a:A put the highest weight on minimizing indirect environmental impact (IEI) and minimizing life-cycle costs (COST). Preference pattern PU-3a:B put the highest weight on minimizing population impacts (POP) and direct economic damages (DAM). Preference pattern PU-3a:C differs from the other two because a high weight is placed on minimizing construction time (TIME). PU-3a:C also values minimizing population impacts (POP) employment impacts (EMP) and direct wetland impacts (DWI).

Table 24. Swing weights for three illustrative preference patterns discussed for PU3a.

#	Code	Name	PU-3a:A	PU-3a:B	PU-3a:C
1	COST	Life-cycle Cost ($ Billions)	0.2679	0.0250	0.0215
2	POP	Population Impacted (People/Year)	0.0893	0.2500	0.1613
3	DAM	Direct Economic Damages ($ Millions/Year)	0.0893	0.2250	0.1075
4	EMP	Employment Impacts (Jobs Disrupted/Year)	0.0357	0.1750	0.1613
5	ASIT	Archeological Sites Protected (Number of Sites)	0.0000	0.0500	0.0215
6	HDIS	Historic Districts Protected (Number of Districts)	0.0000	0.0500	0.0215
7	HPRO	Historic Properties Protected (Number of Properties)	0.0357	0.0500	0.0215
8	TIME	Construction Time (Years)	0.0357	0.1250	0.2151
9	DWI	Direct Wetland Impacts (Acres)	0.0893	0.0250	0.1613
10	IEI	Indirect Environmental Impacts (Scale; -8 to +8)	0.3571	0.0250	0.1075
		Top-ranked metric	IEI	POP	TIME

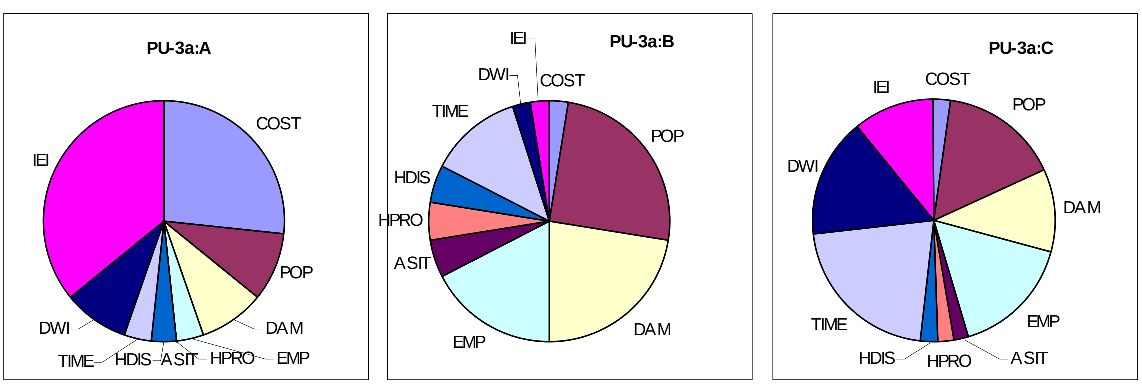
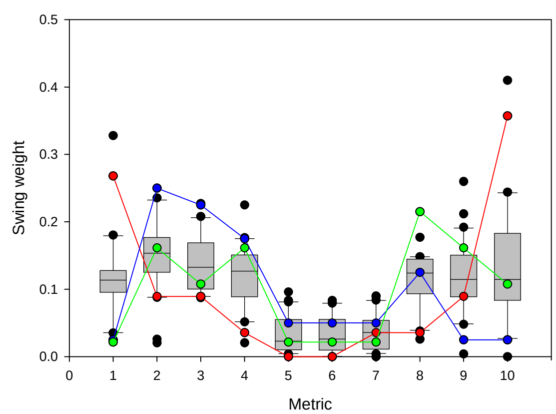


Figure 26. Three illustrative preference patterns discussed for PU3a.

The illustrative preference patterns selected for discussion here are each unique within the planning unit, but they are not necessarily atypical. Usually, a preference pattern contains some weights that are similar to those of other stakeholders and some weights that represent extremes. Figure 27 shows how each of the swing weights in the illustrative preference pattern compares to the other swing weights in this planning unit. In this figure, the three color-coded sets of weights are overlaid on the box plots that were introduced in Section 3. The closer each of the color-coded points is to being within the gray box for a particular performance measure, the more typical the weight. Points that fall outside the error bars that surround the gray box indicate extreme positions relative to other survey respondents, or outliers. For example, PU-3a:A, shown in red, takes extreme positions on several objectives, placing much more weight on minimizing cost (COST) and minimizing direct environmental impacts (IEI) than other survey respondents and less weight on several other objectives. PU-3a:B, shown in blue, is an outlier with respect to its relatively low weight on minimizing cost (COST), direct wetland impacts (DWI), indirect environmental impacts (IEI) and its relatively high weight on minimizing population impacts (POP), direct economic damages (DAM), and employment impacts (EMP). PU-3a:C is perhaps more typical of other survey respondents, although this survey respondent is an outlier with respect to the low weight on minimizing cost (COST) and the high weight on minimizing the amount of construction time (TIME).



#	Code	Metric Name
1	COST	Life-cycle Cost ($ Billions)
2	POP	Population Impacted (People/Year)
3	DAM	Direct Economic Damages ($ Millions/Year)
4	EMP	Employment Impacts (Jobs Disrupted/Year)
5	ASIT	Archeological Sites Protected (Number of Sites)
6	HDIS	Historic Districts Protected (Number of Districts)
7	HPRO	Historic Properties Protected (Number of Properties)
8	TIME	Construction Time (Years)
9	DWI	Direct Wetland Impacts (Acres)
10	IEI	Indirect Environmental Impacts (Scale; -8 to +8)

Figure 27. Swing weights for the three preference patterns evaluated for PU3a superimposed on the weight elicitation results summarized in Figure 1. The swing weights of three individual stakeholders represent illustrative preference patterns designated as PU-3a:A (red), PU-3a:B (blue), and PU-3a:C (green).

These three illustrative preference patterns produce a unique rank order of plans. These rank orders are illustrated in Figure 28 for each of the preference patterns. The underlying table was introduced in Section 5 and shows the number of times that each plan ranked first, second, third, fourth, or fifth when plans were ranked in decreasing order by the utility score. The top five plans for PU-3a:A are marked in red. The top-ranked plan for PU-3a:B is the no-action alternative (PU3a-0). This is followed by the non-structural (PU3a-NS-100, PU3a-NS-400, and PU3a-NS-1000) and coastal alternatives (PU3a-R1) in positions two through five. The top-ranked plans for PU-3a:B are structural alternatives and the top-ranked plan is the GIWW/Morganza/Ring levee (C-G) alignment as its top-ranked plan. For PU-3a:C, the five top-ranked plans include the three non-structural plans and two structural plans. These results are presented here to illustrate that different sets of weights lead to different rankings of plans. While the rankings suggest order of preference, they do not indicate how much more or less preferred a plan is relative to other plans. In addition, these figures do not help explain why a particular set of weights leads to a particular ranking of plans. These issues are discussed in greater detail below.

PU3a, Scenario 1						
PLAN CODE	**Rank Based on Swing Weights**					**Total**
	1	**2**	**3**	**4**	**5**	
PU3a-0	2	0	0	2	2	6
PU3a-C-G-1000-2	2	0	1	0	0	3
PU3a-C-G-400-2	0	1	1	0	0	2
PU3a-C-M-100-1	0	2	1	0	1	4
PU3a-C-M-100-2	0	0	3	17	3	23
PU3a-G-1000-2	0	0	0	0	2	2
PU3a-M-100-1	0	0	1	1	1	3
PU3a-M-100-2	0	0	0	3	14	17
PU3a-NS-100	0	1	21	1	3	26
PU3a-NS-1000	26	1	0	0	1	28
PU3a-NS-400	0	25	1	1	0	27
PU3a-R1	0	0	1	5	3	9
Total	30	30	30	30	30	150

Figure 28. Rank order of the top five plans for the illustrative preference patterns. The preference patters are color coded as follows: PU-3a:A is red, PU-3a:B is blue, and PU-3a:C is green.

MAU scores were calculated for each of the structural and nonstructural plans and the no-action alternative using a full set of ten weights and metrics. In the discussion of PU-3a results that follows, plans are numbered 1-13 as indicated in Table 25 to facilitate discussion.

Table 25. Plan Numbers and Plan Names for PU3a.

Plan	Plan Code
1	PU3a-0
2	PU3a-R1
3	PU3a-NS-100
4	PU3a-NS-400
5	PU3a-NS-1000
6	PU3a-M-100-1
7	PU3a-M-100-2
8	PU3a-G-400-2
9	PU3a-G-1000-2
10	PU3a-C-M-100-1
11	PU3a-C-M-100-2
12	PU3a-C-G-400-2
13	PU3a-C-G-1000-2

The 13 plans are ranked by MAU for each scenario and each of the three preference patterns in Tables 26 through 28. For example, Table 26 shows the utility of Plan 1 for PU1-3a under the planning assumptions used in Scenarios 1 and 3 is 0.810 and 0.824, respectively. Under the assumptions of Scenario 2 and 4, Plan 1 remains the top-ranked plan, but the utility score decreases to 0.784 and 0.802, respectively. The lower-levels of performance for this plan in Scenarios 2 and 4 can be attributed to the higher rates of sea-level rise assumed in these scenarios. For preference pattern PU-3a:B, the effect of higher rates of sea-level rise is to make a comprehensive 1000-year plan (PU3a-C-G-1000-2) more attractive than the no action plan. This shows sensitivity of the preferred plan to uncertainty in sea-level rise assumptions. For PU-3a:C, a non-structural plan (PU3a-NS-1000) dominates the rankings under all four scenarios, again showing sensitivity of the preferred plan to uncertainty in sea-level rise assumptions.

Figures 29 through 31 illustrate why different preference patterns might lead to different plan rankings by showing the contribution of each metric to utility for each plan, scenario, and preference pattern. For example, Figure 29 illustrates the contribution of each metric to utility for PU-3a:A. Under a set of planning assumptions consistent with Scenario 1 (Lower RSLR and High Employment/Dispersed Population), the utility of Plan 1 for PU-1:A is 0.810. This can be attributed to the relative performance of this plan on those performance objectives that are important for this preference pattern. Although a plan may contribute substantially towards one of the performance objectives, if the weights reflect relatively little importance on that objective, the performance with respect to that objective will make little contribution towards the overall utility for this preference pattern.

For PU-3a:A, the top-ranked plan is the no action plan: Plan 1 (Table 26 and Figure 29). For this preference pattern, the rank order of all plans is not dependent upon scenario assumptions. The second and third-ranked plans for all scenarios were Plans 5 and 4 (non-structural). The two metrics most contributing to the MAU scores for PU-3a:A were life-cycle cost and indirect environmental impacts (Nos. 1 and 10).

The top ranking plans for PU-3a:B are those that include comprehensive plan (Plans 13, 10 and 12) (Table 27 and Figure 30). The rank order for all plans in this preference pattern was not sensitive to scenario assumptions. The metrics most contributing to MAU of the top-ranked plans were population impacts (No. 2) and economic damages (No. 3). Although a particular metric may make substantial contributions toward overall utility, performance metrics that do not vary among decision alternatives will tend to have little impact on plan rankings. This holds true for both population impacts and direct economic damages. Although these metrics contribute to the MAU score, they have little influence on the ranking of structural and nonstructural alternatives because they do not vary. The metric most contributing to the MAU score of the top-ranked plan for PU-3a:B was historic districts protected (No. 7).

For PU-3a:C, the two top-ranking plans are those that include nonstructural measures (Plans 5 and 4) (Table 28 and Figure 31). For this group, the rank order of the top two plans is not dependent upon scenario assumptions. Metrics most contributing to the MAU scores for these two top-ranked plans in PU-3a:C were population (No. 2) and economic impacts (No. 3) and impacts to employment (No. 4).

Table 26. Plans Ranked by Multi-attribute Utility Score for PU-3a, Preference Pattern A.

PU-3a: A

	Scenario 1	
Plan	***Plan Code***	***Utility***
1	PU3a-0	0.810
5	PU3a-NS-1000	0.749
4	PU3a-NS-400	0.744
3	PU3a-NS-100	0.736
2	PU3a-R1	0.719
11	PU3a-C-M-100-2	0.468
7	PU3a-M-100-2	0.467
10	PU3a-C-M-100-1	0.300
6	PU3a-M-100-1	0.298
12	PU3a-C-G-400-2	0.288
8	PU3a-G-400-2	0.286
9	PU3a-G-1000-2	0.259
13	PU3a-C-G-1000-2	0.257

	Scenario 2	
Plan	***Plan Code***	***Utility***
1	PU3a-0	0.783644
5	PU3a-NS-1000	0.740505
4	PU3a-NS-400	0.734326
3	PU3a-NS-100	0.720308
2	PU3a-R1	0.689992
11	PU3a-C-M-100-2	0.459283
7	PU3a-M-100-2	0.457755
10	PU3a-C-M-100-1	0.291065
6	PU3a-M-100-1	0.289664
12	PU3a-C-G-400-2	0.280255
8	PU3a-G-400-2	0.277597
9	PU3a-G-1000-2	0.249946
13	PU3a-C-G-1000-2	0.248987

	Scenario 3	
Plan	***Plan Code***	***Utility***
1	PU3a-0	0.824
5	PU3a-NS-1000	0.753
4	PU3a-NS-400	0.752
3	PU3a-NS-100	0.745
2	PU3a-R1	0.733
11	PU3a-C-M-100-2	0.473
7	PU3a-M-100-2	0.472
10	PU3a-C-M-100-1	0.305
6	PU3a-M-100-1	0.303
12	PU3a-C-G-400-2	0.292
8	PU3a-G-400-2	0.292
9	PU3a-G-1000-2	0.264
13	PU3a-C-G-1000-2	0.261

	Scenario 4	
Plan	***Plan Code***	***Utility***
1	PU3a-0	0.802
5	PU3a-NS-1000	0.746
4	PU3a-NS-400	0.744
3	PU3a-NS-100	0.732
2	PU3a-R1	0.709
11	PU3a-C-M-100-2	0.465
7	PU3a-M-100-2	0.464
10	PU3a-C-M-100-1	0.296
6	PU3a-M-100-1	0.295
12	PU3a-C-G-400-2	0.284
8	PU3a-G-400-2	0.284
9	PU3a-G-1000-2	0.256
13	PU3a-C-G-1000-2	0.253

Table 27. Plans Ranked by Multi-attribute Utility Score for PU-3a, Preference Pattern B.

PU-3a: B

	Scenario 1			Scenario 2			Scenario 3			Scenario 4	
Plan	*Plan Code*	*Utility*	*Plan*	*Plan Code*	*Utility*	*Plan*	*Plan Code*	*Utility*	*Plan*	*Plan Code*	*Utility*
13	PU3a-C-G-1000-2	0.803	13	PU3a-C-G-1000-2	0.785208	13	PU3a-C-G-1000-2	0.816	13	PU3a-C-G-1000-2	0.800
10	PU3a-C-M-100-1	0.786	10	PU3a-C-M-100-1	0.765622	10	PU3a-C-M-100-1	0.799	10	PU3a-C-M-100-1	0.780
12	PU3a-C-G-400-2	0.780	12	PU3a-C-G-400-2	0.758752	12	PU3a-C-G-400-2	0.794	12	PU3a-C-G-400-2	0.774
6	PU3a-M-100-1	0.774	6	PU3a-M-100-1	0.753184	6	PU3a-M-100-1	0.788	6	PU3a-M-100-1	0.768
9	PU3a-G-1000-2	0.771	9	PU3a-G-1000-2	0.749743	9	PU3a-G-1000-2	0.785	9	PU3a-G-1000-2	0.766
11	PU3a-C-M-100-2	0.768	11	PU3a-C-M-100-2	0.742259	11	PU3a-C-M-100-2	0.782	11	PU3a-C-M-100-2	0.758
7	PU3a-M-100-2	0.754	7	PU3a-M-100-2	0.728632	7	PU3a-M-100-2	0.768	7	PU3a-M-100-2	0.745
8	PU3a-G-400-2	0.750	8	PU3a-G-400-2	0.726425	8	PU3a-G-400-2	0.765	8	PU3a-G-400-2	0.743
5	PU3a-NS-1000	0.719	5	PU3a-NS-1000	0.700354	5	PU3a-NS-1000	0.734	5	PU3a-NS-1000	0.719
4	PU3a-NS-400	0.690	4	PU3a-NS-400	0.667194	4	PU3a-NS-400	0.710	4	PU3a-NS-400	0.691
3	PU3a-NS-100	0.619	3	PU3a-NS-100	0.578847	3	PU3a-NS-100	0.645	3	PU3a-NS-100	0.612
2	PU3a-R1	0.452	2	PU3a-R1	0.369497	2	PU3a-R1	0.491	2	PU3a-R1	0.423
1	PU3a-0	0.351	1	PU3a-0	0.266757	1	PU3a-0	0.391	1	PU3a-0	0.320

Table 28. Plans Ranked by Multi-attribute Utility Score for PU-3a, Preference Pattern C.

PU-3a: C

	Scenario 1	
Plan	***Plan Code***	***Utility***
5	PU3a-NS-1000	0.788
4	PU3a-NS-400	0.768
3	PU3a-NS-100	0.718
11	PU3a-C-M-100-2	0.710
7	PU3a-M-100-2	0.702
10	PU3a-C-M-100-1	0.663
6	PU3a-M-100-1	0.656
12	PU3a-C-G-400-2	0.653
13	PU3a-C-G-1000-2	0.635
8	PU3a-G-400-2	0.633
9	PU3a-G-1000-2	0.613
2	PU3a-R1	0.609
1	PU3a-0	0.462

	Scenario 2	
Plan	***Plan Code***	***Utility***
5	PU3a-NS-1000	0.774713
4	PU3a-NS-400	0.752799
11	PU3a-C-M-100-2	0.694004
3	PU3a-NS-100	0.691817
7	PU3a-M-100-2	0.686278
10	PU3a-C-M-100-1	0.650351
6	PU3a-M-100-1	0.643267
12	PU3a-C-G-400-2	0.64016
13	PU3a-C-G-1000-2	0.62327
8	PU3a-G-400-2	0.617918
9	PU3a-G-1000-2	0.599176
2	PU3a-R1	0.554537
1	PU3a-0	0.407701

	Scenario 3	
Plan	***Plan Code***	***Utility***
5	PU3a-NS-1000	0.797
4	PU3a-NS-400	0.780
3	PU3a-NS-100	0.735
11	PU3a-C-M-100-2	0.718
7	PU3a-M-100-2	0.711
10	PU3a-C-M-100-1	0.671
6	PU3a-M-100-1	0.664
12	PU3a-C-G-400-2	0.661
13	PU3a-C-G-1000-2	0.643
8	PU3a-G-400-2	0.642
2	PU3a-R1	0.635
9	PU3a-G-1000-2	0.622
1	PU3a-0	0.488

	Scenario 4	
Plan	***Plan Code***	***Utility***
5	PU3a-NS-1000	0.787
4	PU3a-NS-400	0.768
3	PU3a-NS-100	0.713
11	PU3a-C-M-100-2	0.704
7	PU3a-M-100-2	0.697
10	PU3a-C-M-100-1	0.659
6	PU3a-M-100-1	0.653
12	PU3a-C-G-400-2	0.650
13	PU3a-C-G-1000-2	0.633
8	PU3a-G-400-2	0.628
9	PU3a-G-1000-2	0.609
2	PU3a-R1	0.588
1	PU3a-0	0.441

Figure 29. Contributions of Each Metric to the Multi-attribute Utility Score for Preference Pattern A by Scenario for PU-3a.

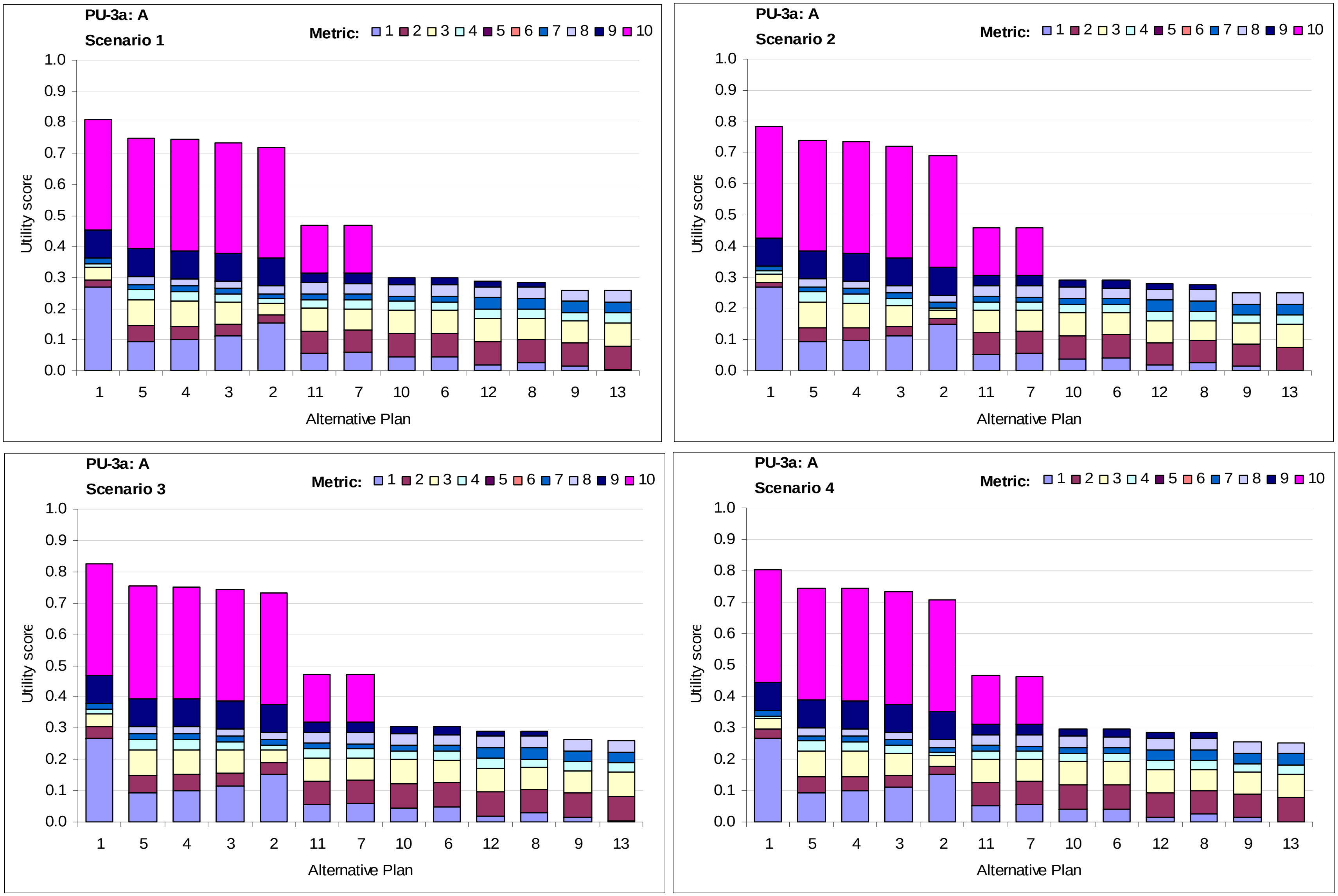


Figure 30. Contributions of Each Metric to the Multi-attribute Utility Score for Preference Pattern B by Scenario for PU-3a.

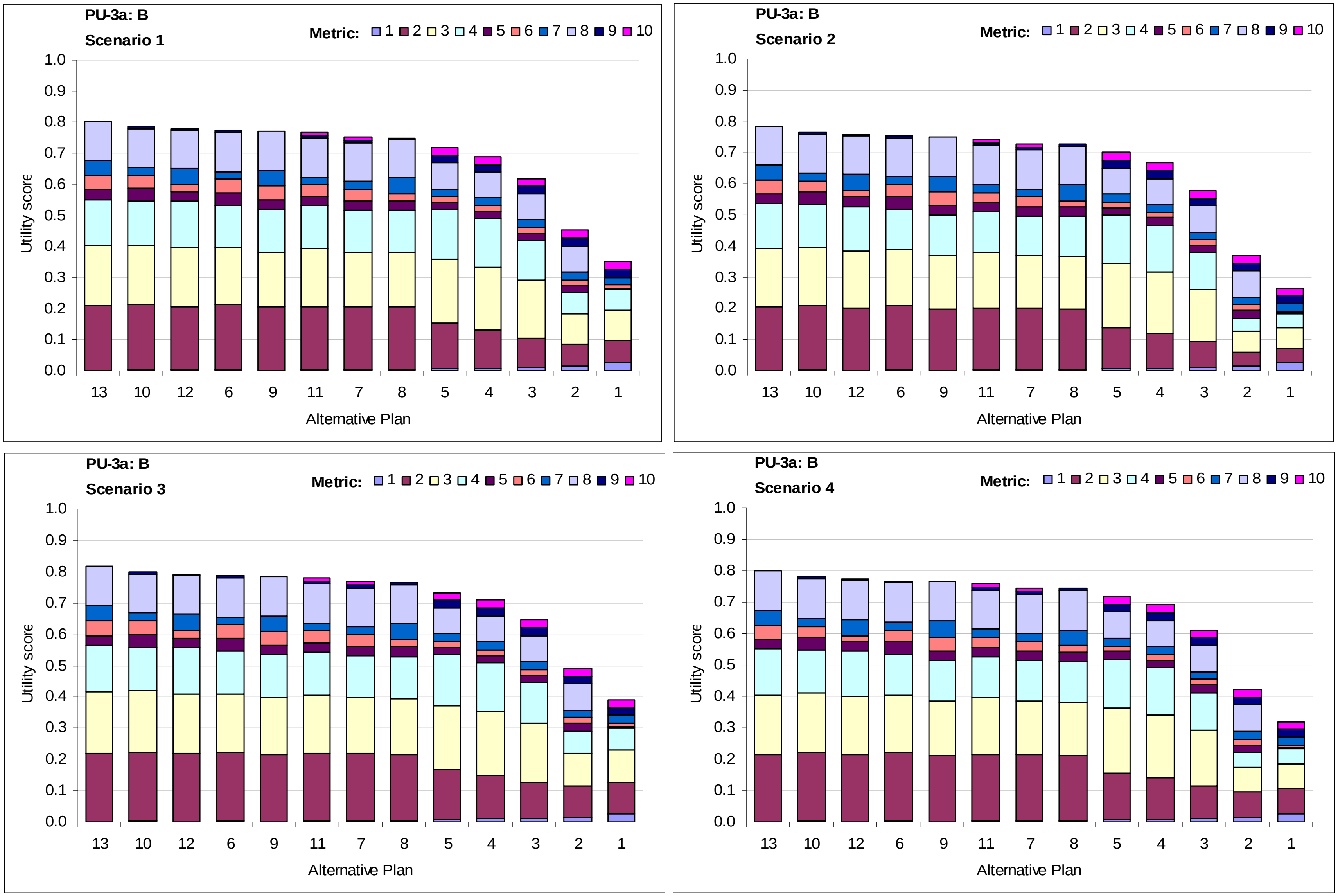
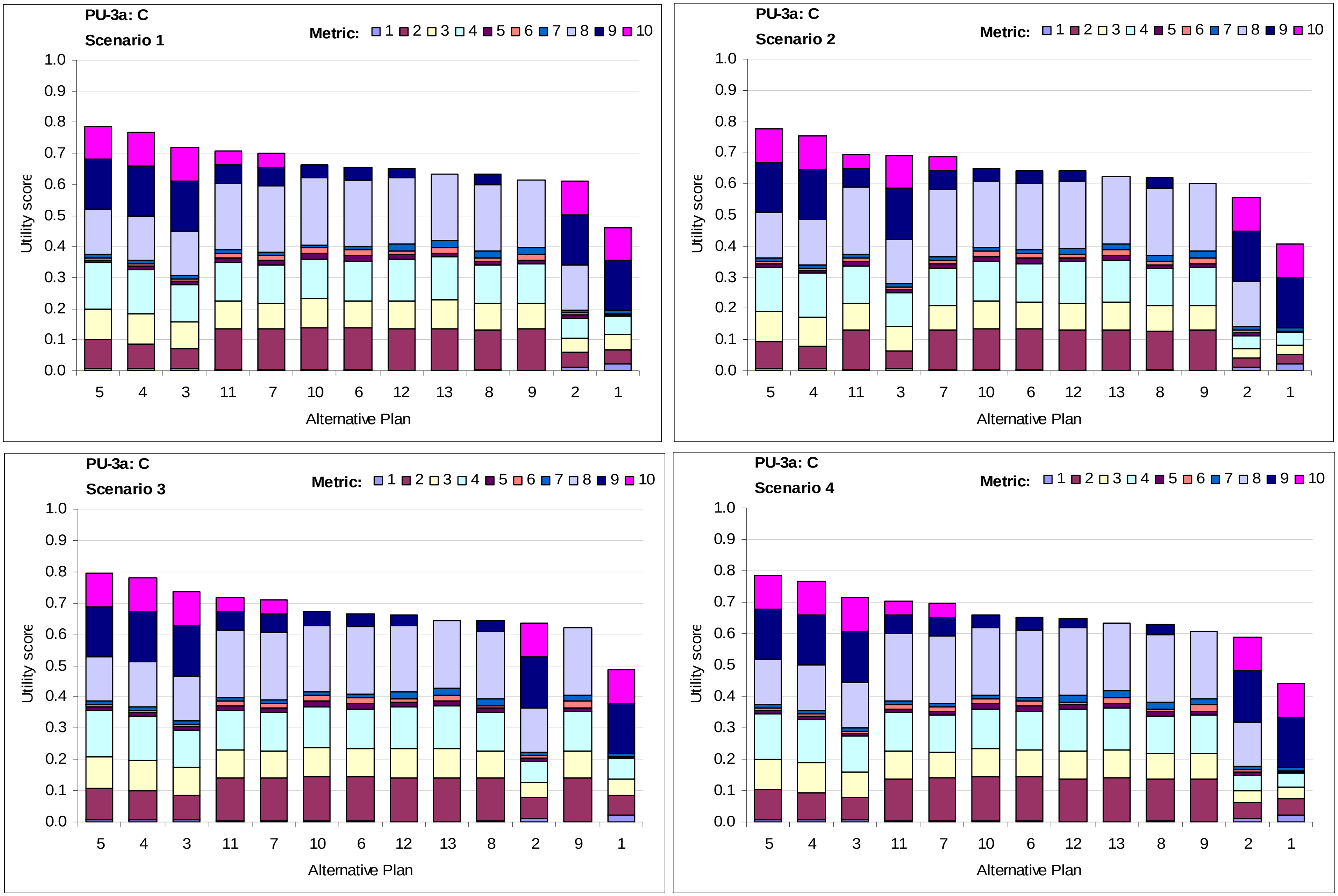


Figure 31. Contributions of Each Metric to the Multi-attribute Utility Score for Preference Pattern C by Scenario for PU-3a.



6.4.1 Sensitivity of Preferred Alternatives – Planning Unit 3a

Table 29 shows the preferred alternatives over four possible relative sea level rise and re-development scenarios. Each cell indicates the preferred alternative given the scenario and the coastal alternative. For example, for PU-3a:A, plan PU3a-0 (Plan 1) is preferred regardless of rate of relative sea level rise and pattern of development. For PU-3a:B and PU-3a:C, plan PU3a-C-G-1000-2 (Plan 13) and plan PU3a-NS-1000 (Plan 5) are preferred, respectively, regardless of rate of relative sea level rise and pattern of development.

Table 29. Preferred Plan Matrix for Three Preference Patterns in PU3a.

PU-3a:A	**Relative Sea-level Rise**	
Pattern of Development	Lower	Higher
High/Dispersed	PU3a-0	PU3a-0
BAU/Compact	PU3a-0	PU3a-0

PU-3a:B	**Relative Sea-level Rise**	
Pattern of Development	Lower	Higher
High/Dispersed	PU3a-C-G-1000-2	PU3a-C-G-1000-2
BAU/Compact	PU3a-C-G-1000-2	PU3a-C-G-1000-2

PU-3a:C	**Relative Sea-level Rise**	
Pattern of Development	Lower	Higher
High/Dispersed	PU3a-NS-1000	PU3a-NS-1000
BAU/Compact	PU3a-NS-1000	PU3a-NS-1000

6.4.2 Expected Utility – Planning Unit 3a

Figures 32 through 34 plot the expected utility of each alternative assuming a uniform distribution of probability across the two relative sea level rise scenarios (P(RSLR = Lower) = 0.5 and P(RSLR = Higher) = 0.5) for each preference pattern. These three figures illustrate the expected utility of each alternative assuming a High Employment and Dispersed Population scenario. (BAU/Compact was not generated.) These figures illustrate how the utility of some alternatives may be more or less sensitive to relative sea level rise assumptions than the utility of other alternatives. The error bands on expected utility represent the minimum and maximum levels of utility over the four scenarios considered in the LACPR plan. Alternatives with more sensitivity to relative sea level rise and development assumptions will have wider error bands than those with less sensitivity. Alternatives that have narrower error bands can be judged to be more predictable in terms of the level of utility they will provide. For example, Plans 4 and 5 have narrow error bands for PU-3a:A (Figure 32). The expected utility of any given alternative and its range of possible values depends in part upon what set of weights is chosen to calculate utility.

The calculation of expected utility requires the assignment of probability to each scenario, but in this case our interest is not in any particular set of probabilities. Rather, our interest is in understanding how the different alternatives perform under different allocations of probability to the scenarios. For example, a change in the probabilities might cause expected utility for some alternatives to increase while causing expected utility for other alternatives to decrease. We are also interested in the range of expected utility for each scenario. The expected utilities shown in these figures assume high employment/dispersed populations. Alternatives that have expected utilities with smaller ranges represent more predictable outcomes. These alternatives (for example, Plan 5 in Figure 32) may be preferred to others that have larger ranges (for example, Plan 1 in Figure 32) because these alternatives lead to more predictable outcomes.

Figure 32. Expected Utility of each PU-3a Alternative for Preference Pattern A, showing minimum and maximum utility scores (Scenarios 1 & 2: High Employment/ Dispersed Population).

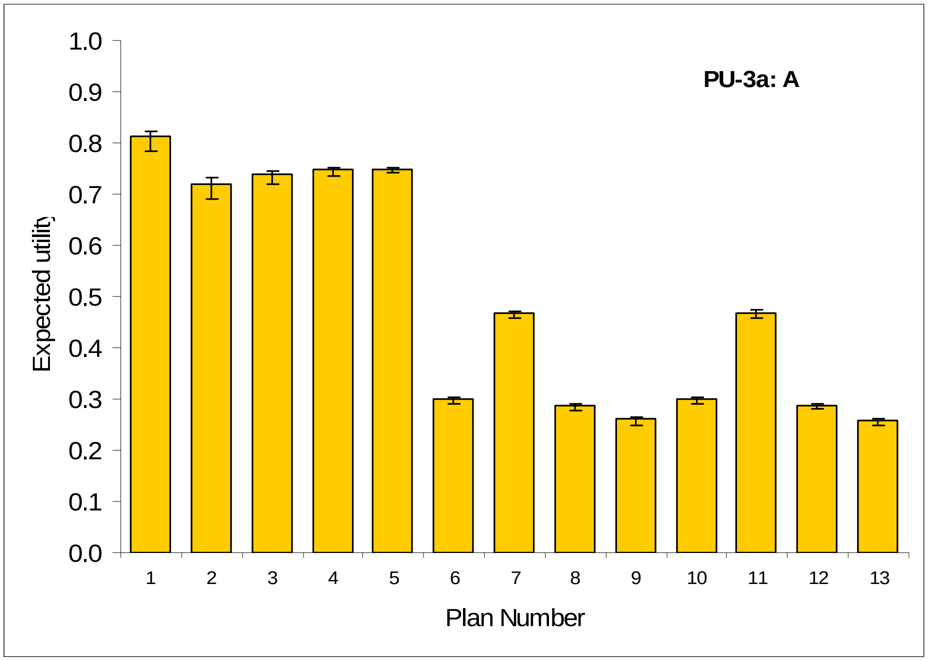


Figure 33. Expected Utility of each PU-3a Alternative for Preference Pattern B, showing minimum and maximum utility scores. (Scenarios 1 & 2: High Employment/ Dispersed Population).

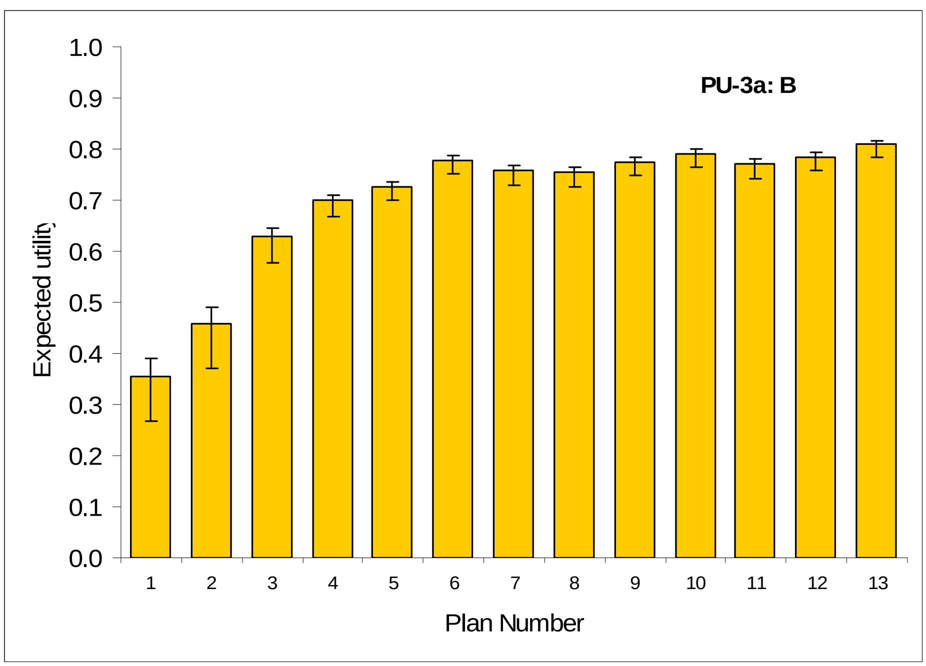
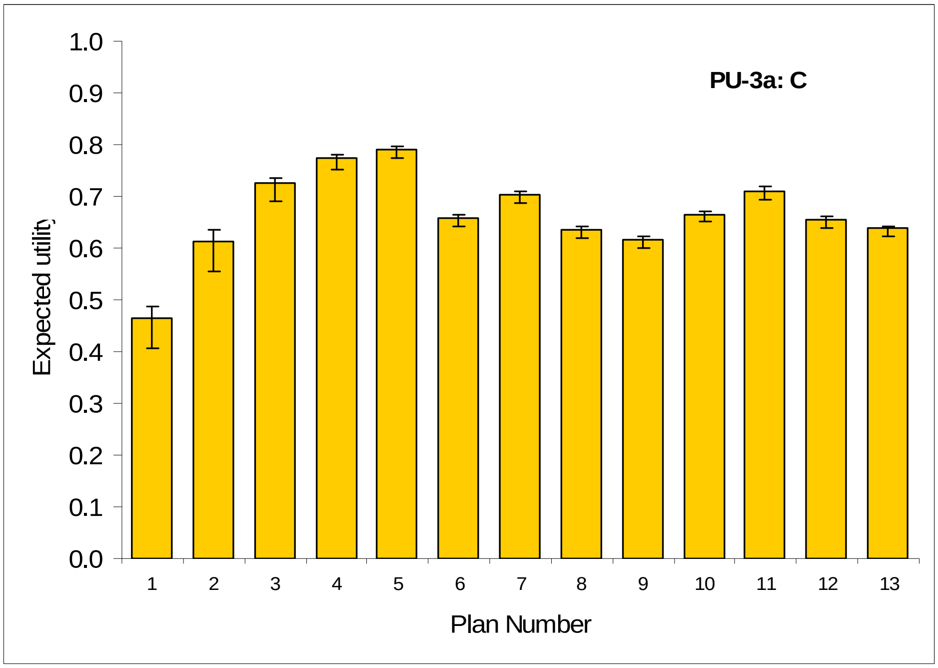


Figure 34. Expected Utility of each PU-3a Alternative for Preference Pattern C, showing minimum and maximum utility scores. (Scenarios 1 & 2: High Employment/ Dispersed Population).



6.4.3 Sensitivity of Decisions to Assumptions about the Probability of Higher Levels of Relative Sea Level Rise – Planning Unit 3a

Table 30 shows the sensitivity of the preferred alternative to assumptions about the allocation of probabilities to relative sea level rise scenarios for each of the three preference patterns and for each development scenario. For PU-3a:A, the decision is insensitive for all scenarios, with Plan 1 being preferred. Likewise, for PU-3a:B and PU-3a:C, the decision is insensitive for all scenarios, with Plans 13 and 5 being preferred, respectively.

Table 30. Preferred Plan Matrix for PU-3a.

PU-3a: A	**Probability (RSLR = Higher)**										
Development Scenario	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
High Employment/ Dispersed Population (Scenarios 1&2)	1	1	1	1	1	1	1	1	1	1	1
BAU Employment/Compact Population (Scenarios 3&4)	1	1	1	1	1	1	1	1	1	1	1

PU-3a: B		Probability (RSLR = Higher)										
Development Scenario		0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
High Employment/ Dispersed Population (Scenarios 1&2)		13	13	13	13	13	13	13	13	13	13	13
BAU Employment/Compact Population (Scenarios 3&4)		13	13	13	13	13	13	13	13	13	13	13

PU-3a: C		Probability (RSLR = Higher)										
Development Scenario		0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
High Employment/ Dispersed Population (Scenarios 1&2)		5	5	5	5	5	5	5	5	5	5	5
BAU Employment/Compact Population (Scenarios 3&4)		5	5	5	5	5	5	5	5	5	5	5

6.5 Results for Illustrative Preference Patterns – Planning Unit 3b

MAU scores were calculated for each of the coastal, structural, and nonstructural plans and the no-action alternative for three illustrative preference patterns selected for discussion (Table 31). Figure 35 shows the proportion of total weight placed on each of the metrics. Preference pattern PU-3b:A put the highest weight on minimizing direct wetland impacts (DWI) and indirect environmental impact (IEI), but also places a high importance on minimizing life-cycle project costs (COST) and residual risks to the resident population (POP), and reducing direct economic damages (DAM) and the length of time to construct a protection system (TIME). PU-3b:B puts the highest weight on minimizing residual risks to the resident population (POP), but also places high importance on reducing direct economic damages (DAM) and minimizing employment impacts (EMP), and maximizing the number of historic properties protected (HDIS). PU-3b:B places the least importance on minimizing impacts to archeological sites (ASIT). In contrast, the PU-3b:C preference pattern places the most importance on minimizing construction time (TIME). This pattern also values minimizing direct wetland impacts (DWI), indirect environmental impacts (IEI) and life-cycle costs. PU-3b:C places little importance on protecting historic districts, historic properties, and archeological sites (HDIS, HPRO and ASIT, respectively).

Table 31. Swing weights for three illustrative preference patterns discussed for PU3b.

#	Code	Name	PU-3b:A	PU-3b:A	PU-3b:C
1	COST	Life-cycle Cost ($ Billions)	0.1104	0.0612	0.1376
2	POP	Population Impacted (People/Year)	0.1004	0.2041	0.1193
3	DAM	Direct Economic Damages ($ Millions/Year)	0.1129	0.1837	0.0642
4	EMP	Employment Impacts (Jobs Disrupted/Year)	0.0878	0.1633	0.0917
5	ASIT	Archeological Sites Protected (Number of Sites)	0.0753	0.0204	0.0275
6	HDIS	Historic Districts Protected (Number of Districts)	0.0778	0.0816	0.0275
7	HPRO	Historic Properties Protected (Number of Properties)	0.0828	0.102	0.0275
8	TIME	Construction Time (Years)	0.1066	0.0612	0.1835
9	DWI	Direct Wetland Impacts (Acres)	0.1255	0.0816	0.1651
10	IEI	Indirect Environmental Impacts (Scale; -8 to +8)	0.1205	0.0408	0.156
		Top-ranked metric	DWI	POP	TIME

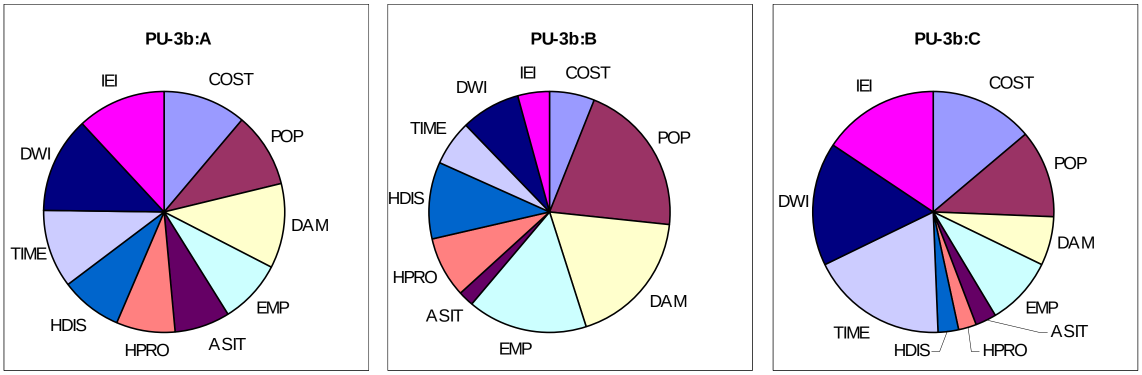
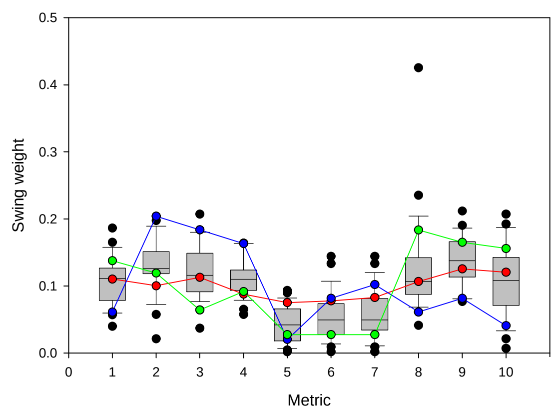


Figure 35. Three illustrative preference patterns discussed for PU3b.

The illustrative preference patterns selected for discussion here are each unique within the planning unit, but they are not necessarily atypical. Usually, a preference pattern contains some weights that are similar to those of other stakeholders and some weights that represent extremes. Figure 36 shows how each of the swing weights in the illustrative preference pattern compares to the other swing weights in this planning unit. In this figure, the three color-coded sets of weights are overlaid on the box plots that were introduced in Section 3. The closer each of the color-coded points is to being within the gray box for a particular performance measure, the more typical the weight. Points that fall outside the error bars that surround the gray box indicate extreme positions relative to other survey respondents, or outliers.



#	Code	Metric Name
1	COST	Life-cycle Cost ($ Billions)
2	POP	Population Impacted (People/Year)
3	DAM	Direct Economic Damages ($ Millions/Year)
4	EMP	Employment Impacts (Jobs Disrupted/Year)
5	ASIT	Archeological Sites Protected (Number of Sites)
6	HDIS	Historic Districts Protected (Number of Districts)
7	HPRO	Historic Properties Protected (Number of Properties)
8	TIME	Construction Time (Years)
9	DWI	Direct Wetland Impacts (Acres)
10	IEI	Indirect Environmental Impacts (Scale; -8 to +8)

Figure 36. Swing weights for the three preference patterns evaluated for PU3b superimposed on the weight elicitation results summarized in Figure 1. The swing weights of three individual stakeholders represent illustrative preference patterns designated as PU-3b:A (red), PU-3b:B (blue), and PU-3b:C (green).

These three illustrative preference patterns produce a unique rank order of plans. These rank orders are illustrated in Figure 37 for each of the preference patterns. The underlying table was introduced in Section 5 and shows the number of times that each plan ranked first, second, third, fourth, or fifth when plans were ranked in decreasing order by the utility score. For example, the top five plans for PU-3b:A are marked in red. The 100-year comprehensive Franklin to Abbeville (C-F) alignment (PU3b-C-F-100-1) is the top-ranked plan. For PU-3b:B, the 100-year comprehensive GIWW (C-G) alignment (PU3b-C-G-100-1) is the top-ranked plan. For PU-3b:C, the 100-year comprehensive ring levee (C-RL) alignment (PU3b-C-RL-100-1) is the top-ranked plan. These results are presented here to illustrate that different sets of weights lead to different rankings of plans. While the rankings suggest order of preference, they do not indicate how much more or less preferred a plan is relative to other plans. In addition, these figures do not help explain why a particular set of weights leads to a particular ranking of plans. These issues are discussed in greater detail below.

PU3b, Scenario 1						
PLAN CODE	**Rank Based on Swing Weights**					**Total**
	1	**2**	**3**	**4**	**5**	
PU3b-C-F-100-1	5	5	7	1	6	24
PU3b-C-F-1000-1	0	0	0	1	0	1
PU3b-C-F-400-1	1	0	3	0	1	5
PU3b-C-G-100-1	6	1	3	1	1	12
PU3b-C-RL-100-1	12	5	2	2	0	21
PU3b-C-RL-400-1	0	0	1	4	6	11
PU3b-F-100-1	0	0	3	8	5	16
PU3b-F-1000-1	0	0	0	0	0	0
PU3b-F-400-1	0	1	0	2	0	3
PU3b-G-100-1	0	6	0	2	2	10
PU3b-NS-100	0	0	0	1	0	1
PU3b-NS-1000	1	2	0	0	3	6
PU3b-NS-400	0	1	1	1	0	3
PU3b-RL-100-1	0	4	5	2	1	12
Total	25	25	25	25	25	125

Figure 37. Rank order of the top five plans for the illustrative preference patterns. The preference patters are color coded as follows: PU-3b:A is red, PU-3b:B is blue, and PU-3b:C is green.

In the discussion of PU-3b results that follows, plans are numbered 1-17 to facilitate references in tables and figures (Table 32). Plans are ranked by MAU for each planning scenario and characteristic sets of preferences in Tables 35-37.

Table 32. Plan Numbers and Plan Names for PU3b.

Plan	*Plan Code*
1	PU3b-0
2	PU3b-R1
3	PU3b-NS-100
4	PU3b-NS-400
5	PU3b-NS-1000
6	PU3b-G-100-1
7	PU3b-F-100-1
8	PU3b-F-400-1
9	PU3b-F-1000-1
10	PU3b-RL-100-1
11	PU3b-RL-400-1
12	PU3b-C-G-100-1
13	PU3b-C-F-100-1
14	PU3b-C-F-400-1
15	PU3b-C-F-1000-1
16	PU3b-C-RL-100-1
17	PU3b-C-RL-400-1

The 17 plans are ranked by MAU for each scenario and each of the three preference patterns in Tables 33 through 35. For example, Table 33 shows the utility of the top-ranked plans (Plan 13 or Plan 16) for PU-3b:A under the planning assumptions used in Scenarios 1 and 3 is 0.719 and 0.725, respectively. Under the assumptions of Scenario 2 and 4, Plan 13 remains the top-ranked plan, but the utility score decreases to 0.705 and 0.710, respectively. The lower-levels of performance for this plan in Scenarios 2 and 4 can be attributed to the higher rates of sea-level rise assumed in these scenarios. This trend also holds for PU-3b:B and PU-3b:C, where Plans 12 and 16 remain the top-ranked plan under all four scenarios.

Figures 38 through 40 illustrate why different preference patterns might lead to different plan rankings by showing the contribution of each metric to utility for each plan, scenario, and preference pattern. For example, Figure 38 illustrates the contribution of each metric to utility for PU-3b:A. Under a set of planning assumptions consistent with Scenario 1 (Lower RSLR and High Employment/Dispersed Population), the utility of Plan 12 for PU-1:A is 0.719. This can be attributed to the relative performance of this plan on those performance objectives that are important for this preference pattern. Although a plan may contribute substantially towards one of the performance objectives, if the weights reflect relatively little importance on that objective, the performance with respect to that objective will make little contribution towards the overall utility for this preference pattern.

For PU-3b:A, the top-ranked plans are those that include comprehensive plans consisting of both structural and non-structural measures: Plans 13 and 16 (Table 33 and Figure 38). For this group, the rank order of the top plans is dependent upon scenario assumptions. The second-ranked plan for Scenario 3 was Plan 13 (comprehensive). Metrics most influencing overall utility for Plan 13 are protection of archeological sites (No. 5), historic properties and historic districts (Nos. 5, 6 and 7). When Plan 16 is top-ranked, direct wetland impacts (No. 9) most contributes to overall utility.

The top ranking plans for PU-3b:B are those that include a combination of structural and non-structural plans (comprehensive; Plan 12, 6 and 14) (Table 34 and Figure 39). The rank order for the top five-ranked plans in this group was not sensitive to scenario assumptions. The metrics most contributing to MAU of the top two plans (Plans 12 and 6) were employment impacts (No. 4), economic impacts (No. 3) and population impacts (No. 2). Although a particular metric may make substantial contributions toward overall utility, performance metrics that do not vary among decision alternatives will tend to have little impact on plan rankings. This holds true for employment impacts (No. 4), economic impacts (No. 3) and population impacts (No. 2). Although these metrics contribute to the MAU score, they have little influence on the ranking of structural and nonstructural alternatives because they do not vary. The metric most influencing overall utility for Plan 12, the top-ranked plan, is direct wetland impacts (No. 9).

For PU-3b:C, the top-ranking plan is a comprehensive plan, including both structural and non-structural measures: Plan 16 (Table 35 and Figure 40). For this preference pattern, the rank order of the top five plans is not dependent upon scenario assumptions. Metrics most contributing to the MAU scores for Plans 12 and 6 in PU-3b:C were life-cycle costs (No. 1), construction time (No. 8), direct wetland impacts (No. 9) and indirect environmental impacts (No. 10). The metric most influencing overall utility for Plan 16, the top-ranked plan, is employment impacts (No. 4).

Table 33. Plans Ranked by Multi-attribute Utility Score for PU-3b, Preference Pattern A.

PU-3b: A

	Scenario 1	
Plan	***Plan Code***	***Utility***
13	PU3b-C-F-100-1	0.719
16	PU3b-C-RL-100-1	0.718
7	PU3b-F-100-1	0.707
12	PU3b-C-G-100-1	0.707
17	PU3b-C-RL-400-1	0.707
14	PU3b-C-F-400-1	0.705
10	PU3b-RL-100-1	0.701
6	PU3b-G-100-1	0.700
8	PU3b-F-400-1	0.692
11	PU3b-RL-400-1	0.685
5	PU3b-NS-1000	0.640
4	PU3b-NS-400	0.638
3	PU3b-NS-100	0.626
15	PU3b-C-F-1000-1	0.626
9	PU3b-F-1000-1	0.613
2	PU3b-R1	0.542
1	PU3b-0	0.481

	Scenario 2	
Plan	***Plan Code***	***Utility***
13	PU3b-C-F-100-1	0.705
16	PU3b-C-RL-100-1	0.697
12	PU3b-C-G-100-1	0.694
7	PU3b-F-100-1	0.694
14	PU3b-C-F-400-1	0.690
6	PU3b-G-100-1	0.687
17	PU3b-C-RL-400-1	0.682
10	PU3b-RL-100-1	0.680
8	PU3b-F-400-1	0.676
11	PU3b-RL-400-1	0.657
5	PU3b-NS-1000	0.638
4	PU3b-NS-400	0.635
3	PU3b-NS-100	0.615
15	PU3b-C-F-1000-1	0.611
9	PU3b-F-1000-1	0.597
2	PU3b-R1	0.519
1	PU3b-0	0.442

	Scenario 3	
Plan	***Plan Code***	***Utility***
16	PU3b-C-RL-100-1	0.725
13	PU3b-C-F-100-1	0.724
7	PU3b-F-100-1	0.712
12	PU3b-C-G-100-1	0.710
17	PU3b-C-RL-400-1	0.710
14	PU3b-C-F-400-1	0.709
10	PU3b-RL-100-1	0.708
6	PU3b-G-100-1	0.703
8	PU3b-F-400-1	0.696
11	PU3b-RL-400-1	0.692
4	PU3b-NS-400	0.644
5	PU3b-NS-1000	0.643
3	PU3b-NS-100	0.633
15	PU3b-C-F-1000-1	0.631
9	PU3b-F-1000-1	0.618
2	PU3b-R1	0.549
1	PU3b-0	0.488

	Scenario 4	
Plan	***Plan Code***	***Utility***
13	PU3b-C-F-100-1	0.710
16	PU3b-C-RL-100-1	0.705
7	PU3b-F-100-1	0.699
12	PU3b-C-G-100-1	0.698
14	PU3b-C-F-400-1	0.695
6	PU3b-G-100-1	0.690
10	PU3b-RL-100-1	0.688
17	PU3b-C-RL-400-1	0.685
8	PU3b-F-400-1	0.682
11	PU3b-RL-400-1	0.665
5	PU3b-NS-1000	0.642
4	PU3b-NS-400	0.641
3	PU3b-NS-100	0.622
15	PU3b-C-F-1000-1	0.616
9	PU3b-F-1000-1	0.602
2	PU3b-R1	0.526
1	PU3b-0	0.450

Table 34. Plans Ranked by Multi-attribute Utility Score for PU-3b, Preference Pattern B.

PU-3b: B

	Scenario 1			Scenario 2			Scenario 3			Scenario 4	
Plan	***Plan Code***	***Utility***	***Plan***	***Plan Code***	***Utility***	***Plan***	***Plan Code***	***Utility***	***Plan***	***Plan Code***	***Utility***
12	PU3b-C-G-100-1	0.800	12	PU3b-C-G-100-1	0.782	12	PU3b-C-G-100-1	0.806	12	PU3b-C-G-100-1	0.788
6	PU3b-G-100-1	0.786	6	PU3b-G-100-1	0.768	6	PU3b-G-100-1	0.792	6	PU3b-G-100-1	0.775
14	PU3b-C-F-400-1	0.756	14	PU3b-C-F-400-1	0.735	14	PU3b-C-F-400-1	0.765	14	PU3b-C-F-400-1	0.744
8	PU3b-F-400-1	0.732	8	PU3b-F-400-1	0.710	8	PU3b-F-400-1	0.741	8	PU3b-F-400-1	0.720
13	PU3b-C-F-100-1	0.729	13	PU3b-C-F-100-1	0.709	13	PU3b-C-F-100-1	0.738	13	PU3b-C-F-100-1	0.719
17	PU3b-C-RL-400-1	0.716	7	PU3b-F-100-1	0.688	17	PU3b-C-RL-400-1	0.726	7	PU3b-F-100-1	0.698
7	PU3b-F-100-1	0.708	17	PU3b-C-RL-400-1	0.682	7	PU3b-F-100-1	0.717	17	PU3b-C-RL-400-1	0.693
16	PU3b-C-RL-100-1	0.697	15	PU3b-C-F-1000-1	0.674	16	PU3b-C-RL-100-1	0.709	15	PU3b-C-F-1000-1	0.683
15	PU3b-C-F-1000-1	0.697	16	PU3b-C-RL-100-1	0.667	15	PU3b-C-F-1000-1	0.705	16	PU3b-C-RL-100-1	0.682
11	PU3b-RL-400-1	0.675	9	PU3b-F-1000-1	0.648	11	PU3b-RL-400-1	0.688	9	PU3b-F-1000-1	0.658
9	PU3b-F-1000-1	0.671	11	PU3b-RL-400-1	0.636	9	PU3b-F-1000-1	0.681	11	PU3b-RL-400-1	0.651
10	PU3b-RL-100-1	0.665	10	PU3b-RL-100-1	0.635	10	PU3b-RL-100-1	0.678	10	PU3b-RL-100-1	0.650
5	PU3b-NS-1000	0.624	5	PU3b-NS-1000	0.617	5	PU3b-NS-1000	0.633	5	PU3b-NS-1000	0.627
4	PU3b-NS-400	0.617	4	PU3b-NS-400	0.607	4	PU3b-NS-400	0.628	4	PU3b-NS-400	0.619
3	PU3b-NS-100	0.589	3	PU3b-NS-100	0.566	3	PU3b-NS-100	0.602	3	PU3b-NS-100	0.579
2	PU3b-R1	0.431	2	PU3b-R1	0.385	2	PU3b-R1	0.444	2	PU3b-R1	0.399
1	PU3b-0	0.414	1	PU3b-0	0.353	1	PU3b-0	0.427	1	PU3b-0	0.367

Table 35. Plans Ranked by Multi-attribute Utility Score for PU-3b, Preference Pattern C.

PU-3b: C

	Scenario 1	
Plan	***Plan Code***	***Utility***
16	PU3b-C-RL-100-1	0.786
10	PU3b-RL-100-1	0.774
13	PU3b-C-F-100-1	0.758
7	PU3b-F-100-1	0.750
17	PU3b-C-RL-400-1	0.726
5	PU3b-NS-1000	0.716
4	PU3b-NS-400	0.716
11	PU3b-RL-400-1	0.712
3	PU3b-NS-100	0.709
14	PU3b-C-F-400-1	0.673
8	PU3b-F-400-1	0.663
12	PU3b-C-G-100-1	0.649
6	PU3b-G-100-1	0.643
2	PU3b-R1	0.642
15	PU3b-C-F-1000-1	0.568
9	PU3b-F-1000-1	0.558
1	PU3b-0	0.536

	Scenario 2	
Plan	***Plan Code***	***Utility***
16	PU3b-C-RL-100-1	0.773
10	PU3b-RL-100-1	0.762
13	PU3b-C-F-100-1	0.750
7	PU3b-F-100-1	0.742
17	PU3b-C-RL-400-1	0.713
5	PU3b-NS-1000	0.712
4	PU3b-NS-400	0.710
3	PU3b-NS-100	0.696
11	PU3b-RL-400-1	0.696
14	PU3b-C-F-400-1	0.664
8	PU3b-F-400-1	0.653
12	PU3b-C-G-100-1	0.642
6	PU3b-G-100-1	0.637
2	PU3b-R1	0.619
15	PU3b-C-F-1000-1	0.559
9	PU3b-F-1000-1	0.549
1	PU3b-0	0.508

	Scenario 3	
Plan	***Plan Code***	***Utility***
16	PU3b-C-RL-100-1	0.792
10	PU3b-RL-100-1	0.781
13	PU3b-C-F-100-1	0.763
7	PU3b-F-100-1	0.755
17	PU3b-C-RL-400-1	0.730
4	PU3b-NS-400	0.722
5	PU3b-NS-1000	0.720
11	PU3b-RL-400-1	0.719
3	PU3b-NS-100	0.716
14	PU3b-C-F-400-1	0.677
8	PU3b-F-400-1	0.668
12	PU3b-C-G-100-1	0.652
2	PU3b-R1	0.649
6	PU3b-G-100-1	0.647
15	PU3b-C-F-1000-1	0.573
9	PU3b-F-1000-1	0.563
1	PU3b-0	0.543

	Scenario 4	
Plan	***Plan Code***	***Utility***
16	PU3b-C-RL-100-1	0.780
10	PU3b-RL-100-1	0.770
13	PU3b-C-F-100-1	0.755
7	PU3b-F-100-1	0.747
17	PU3b-C-RL-400-1	0.717
4	PU3b-NS-400	0.716
5	PU3b-NS-1000	0.715
11	PU3b-RL-400-1	0.704
3	PU3b-NS-100	0.703
14	PU3b-C-F-400-1	0.668
8	PU3b-F-400-1	0.659
12	PU3b-C-G-100-1	0.646
6	PU3b-G-100-1	0.640
2	PU3b-R1	0.627
15	PU3b-C-F-1000-1	0.564
9	PU3b-F-1000-1	0.554
1	PU3b-0	0.515

Figure 38. Contributions of Each Metric to the Multi-attribute Utility Score for Preference Pattern A by Scenario for PU-3b.

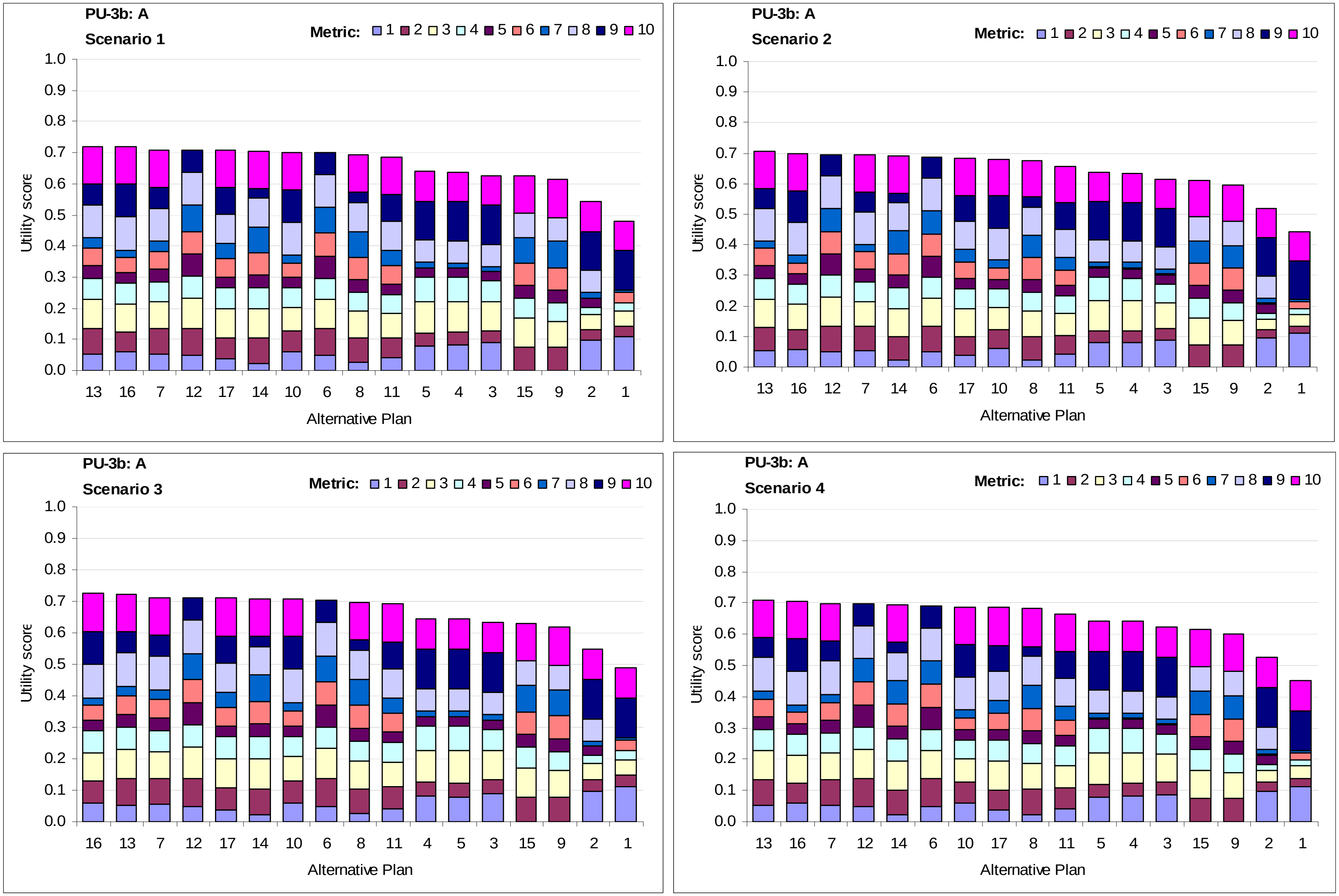


Figure 39. Contributions of Each Metric to the Multi-attribute Utility Score for Preference Pattern B by Scenario for PU-3b.

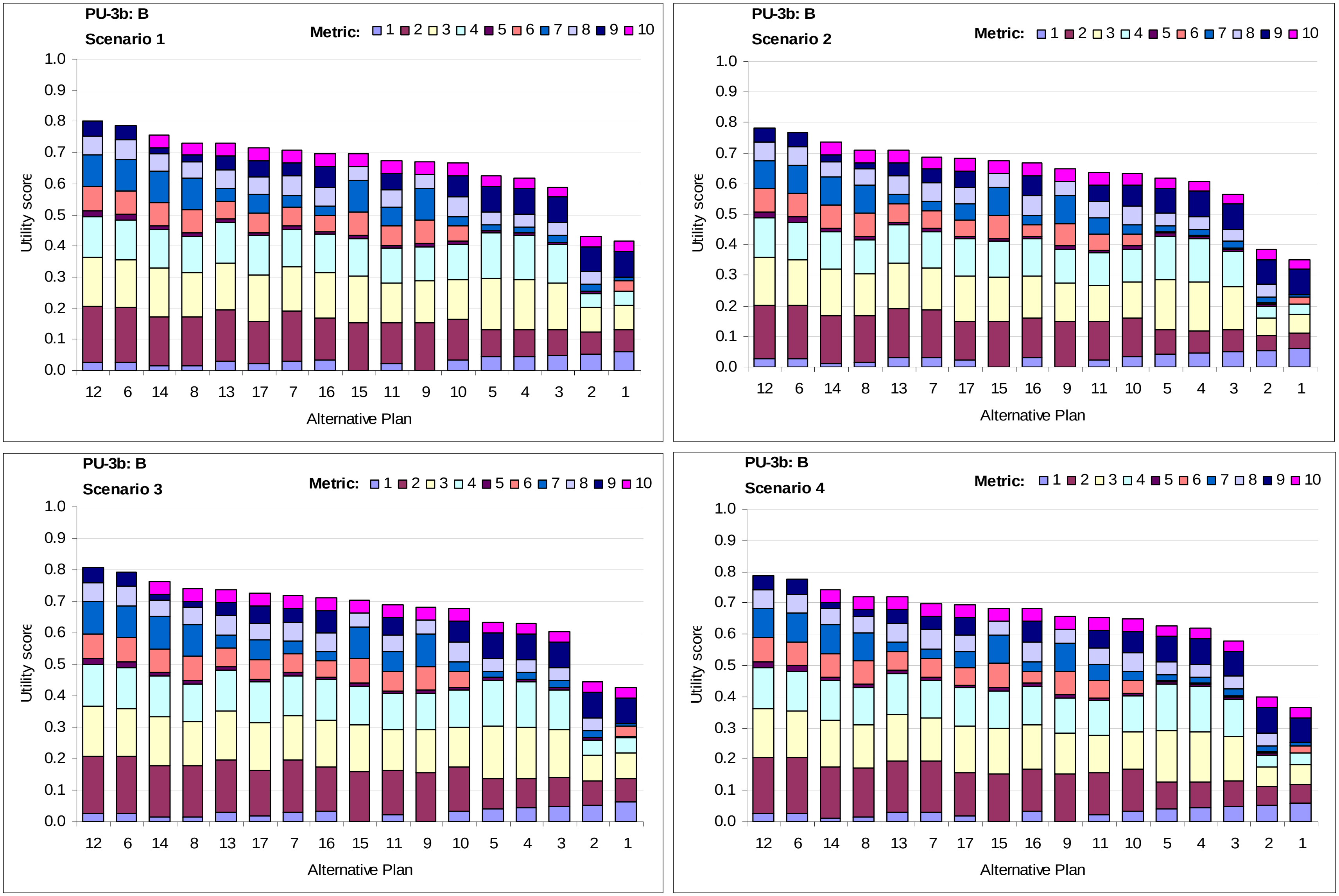
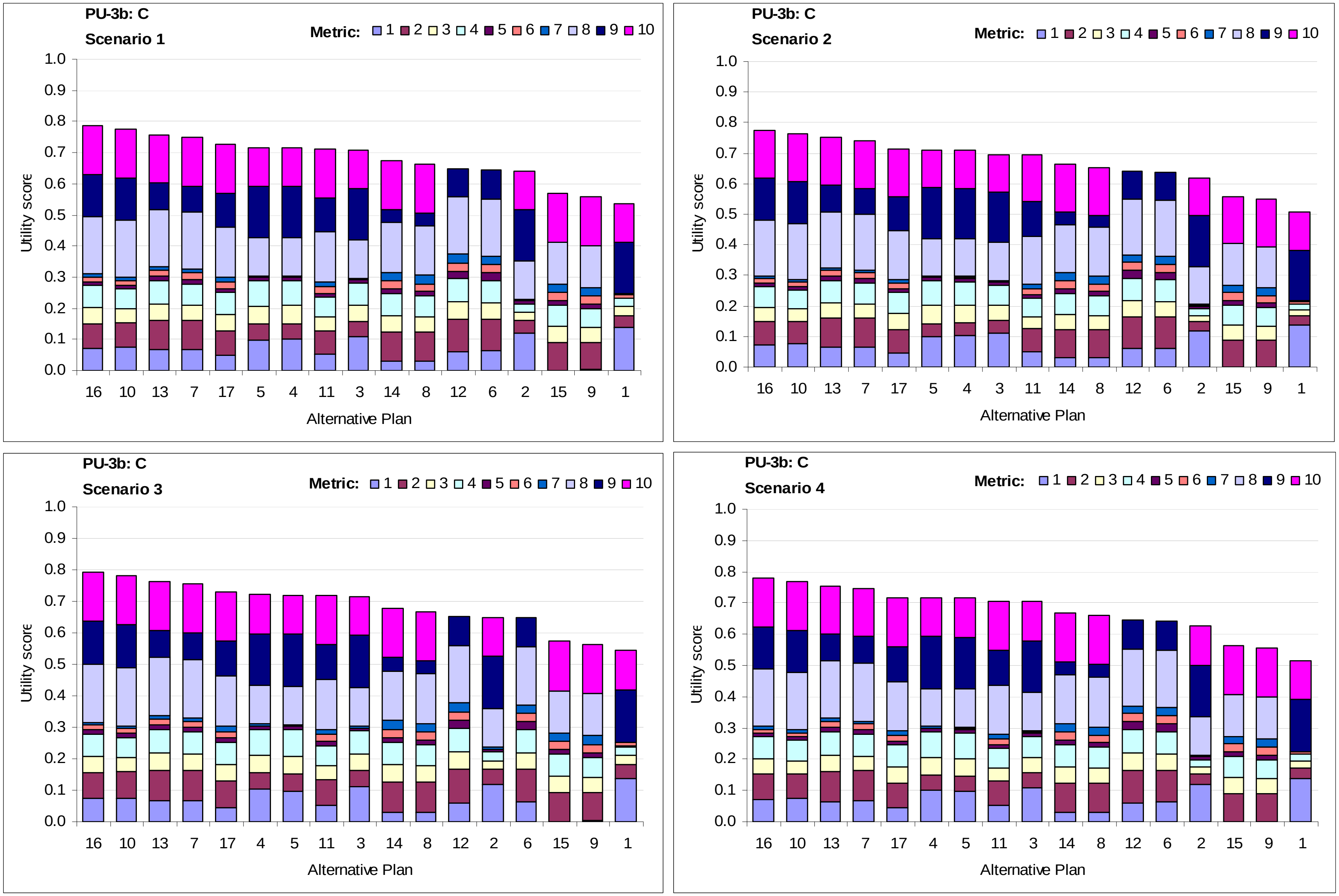


Figure 40. Contributions of Each Metric to the Multi-attribute Utility Score for Preference Pattern C by Scenario for PU-3b.



6.5.1 Sensitivity of Preferred Alternatives – Planning Unit 3b

Table 36 shows the preferred alternatives over four possible relative sea level rise and re-development scenarios. Each cell indicates the preferred alternative given the scenario and the coastal alternative. This table shows that, for PU-3b:A, the preference for plan PU3b-C-F-100-1 (Plan 13) is sensitive to the assumptions made about relative sea level rise and pattern of development. For PU-3b:A, the preferred alternative, plan PU3b-C-F-100-1 (Plan 13), is preferred under both higher and lower rates of relative sea level rise (Scenarios 2 and 4) under the high/dispersed pattern of development. Plan PU3b-C-RL-100-1 (Plan 5) is preferred under lower rate of relative sea level rise and the business as usual/compact pattern of development. For PU-3b:B, plan PU3b-C-G-100-1 (Plan 12) is preferred regardless of the rate of relative sea level rise and pattern of development. This table shows that this pattern also holds for PU-3b:C, where plan PU3b-C-RL-100-1 (Plan 16) is preferred.

Table 36. Preferred Plan Matrix for Three Preference Patterns in PU3b.

PU-3b: A	Relative Sea-level Rise	
Pattern of Development	Lower	Higher
High/Dispersed	PU3b-C-F-100-1	PU3b-C-F-100-1
BAU/Compact	PU3b-C-RL-100-1	PU3b-C-F-100-1

PU-3b: B	Relative Sea-level Rise	
Pattern of Development	Lower	Higher
High/Dispersed	PU3b-C-G-100-1	PU3b-C-G-100-1
BAU/Compact	PU3b-C-G-100-1	PU3b-C-G-100-1

PU-3b: C	Relative Sea-level Rise	
Pattern of Development	Lower	Higher
High/Dispersed	PU3b-C-RL-100-1	PU3b-C-RL-100-1
BAU/Compact	PU3b-C-RL-100-1	PU3b-C-RL-100-1

6.5.2 Expected Utility – Planning Unit 3b

Figures 41 through 43 plot the expected utility of each alternative assuming a uniform distribution of probability across the two relative sea level rise scenarios (P(RSLR = Lower) = 0.5 and P(RSLR = Higher) = 0.5) for each preference pattern. These four figures illustrate the expected utility of each alternative assuming a High Employment and Dispersed Population scenario. (BAU/Compact was not generated.) These figures illustrate how the utility of some alternatives may be more or less sensitive to relative sea level rise assumptions than the utility of other alternatives. The error bands on expected utility represent the minimum and maximum levels of utility over the four scenarios considered in the LACPR plan. Alternatives with more sensitivity to relative sea level rise and development assumptions will have wider error bands than those with less sensitivity. Alternatives that have narrower error bands can be judged to be more predictable in terms of the level of utility they will provide. For example, Plans 4 and 5 have narrow error bands for PU-3b:A (Figure 41). The expected utility of any given alternative and its range of possible values depends in part upon what set of weights is chosen to calculate utility.

The calculation of expected utility requires the assignment of probability to each scenario, but in this case our interest is not in any particular set of probabilities. Rather, our interest is in understanding how the different alternatives perform under different allocations of probability to the scenarios. For example, a change in the probabilities might cause expected utility for some alternatives to increase while causing expected utility for other alternatives to decrease. We are also interested in the range of expected utility for each scenario. The expected utilities shown in these figures assume high employment/dispersed populations. Alternatives that have expected utilities with smaller ranges represent more predictable outcomes. These alternatives (for example, Plan 13 in Figure 41) may be preferred to others that have larger ranges (for example, Plan 16 in Figure 41) because these alternatives lead to more predictable outcomes.

Figure 41. Expected Utility of each PU-3b Alternative for Preference Pattern A, showing minimum and maximum utility scores (Scenarios 1 & 2: High Employment/ Dispersed Population).

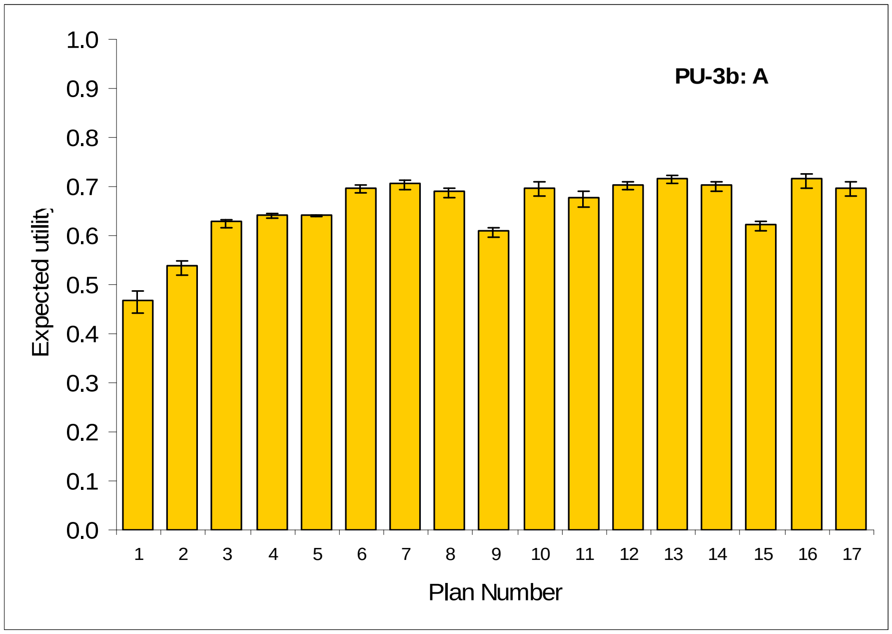


Figure 42. Expected Utility of each PU-3b Alternative for Preference Pattern B, showing minimum and maximum utility scores. (Scenarios 1 & 2: High Employment/ Dispersed Population).

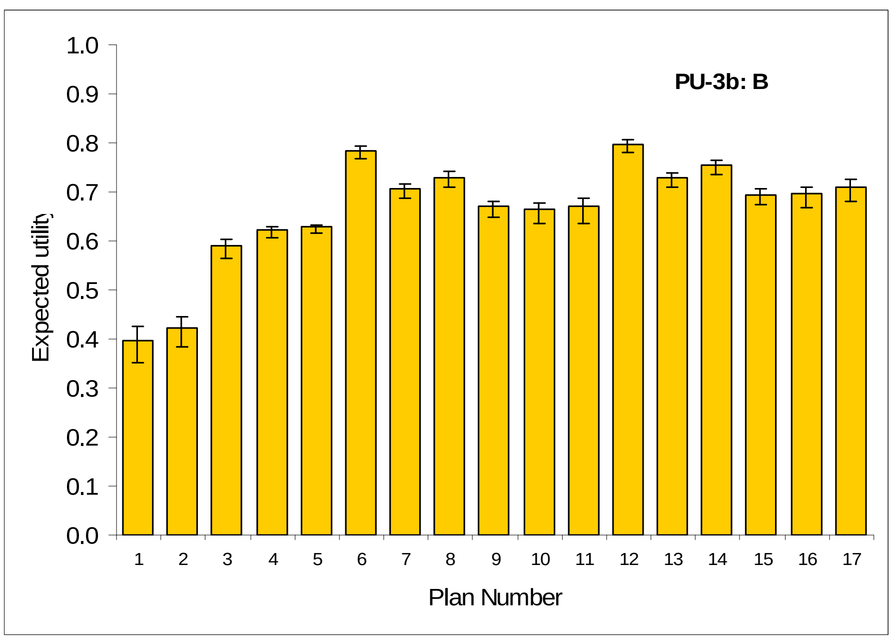
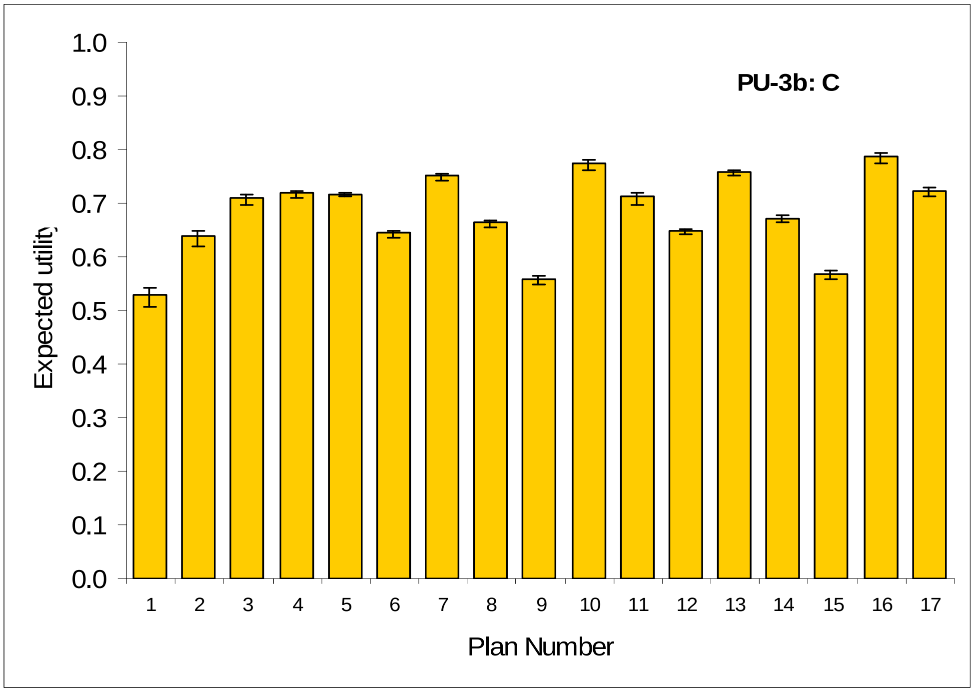


Figure 43. Expected Utility of each PU-3b Alternative for Preference Pattern C, showing minimum and maximum utility scores. (Scenarios 1 & 2: High Employment/ Dispersed Population).



6.5.3 Sensitivity of Decisions to Assumptions about the Probability of Higher Levels of Relative Sea Level Rise – Planning Unit 3b

Table 37 shows the sensitivity of the preferred alternative to assumptions about the allocation of probabilities to relative sea level rise scenarios for each of the three preference patterns and for each development scenario.

For PU-3b:A, under Scenarios 3 and 4, the preferred alternative changes between P(RSLR = Higher) = 0.1 and P(RSLR = Higher) = 0.2. A decision maker who has preferences that are consistent with those of PU-3b:A and who believes that the P(RSLR = Higher) < 0.2 would prefer Plan 16 under Scenarios 3 and 4. This illustrates an important point. Although a decision maker may not have precise knowledge about the probabilities associated with the scenarios, it is still possible to inform a decision by thinking in less precise terms. For PU-3b:B, the decision is insensitive for all scenarios, with Plan 12 being preferred. For stakeholders with preferences that are consistent with those of PU-3b:B, the plan that maximizes expected utility is also Plan 12.

For stakeholders with preferences that are consistent with those of PU-3b:C, the plan that maximizes expected utility is Plan 16.

Table 37. Preferred Plan Matrix for PU3b.

PU-3b: A	**Probability (RSLR = Higher)**										
Development Scenario	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
High Employment/ Dispersed Population (Scenarios 1&2)	13	13	13	13	13	13	13	13	13	13	13
BAU Employment/Compact Population (Scenarios 3&4)	16	16	13	13	13	13	13	13	13	13	13

PU-3b: B	**Probability (RSLR = Higher)**										
Development Scenario	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
High Employment/ Dispersed Population (Scenarios 1&2)	12	12	12	12	12	12	12	12	12	12	12
BAU Employment/Compact Population (Scenarios 3&4)	12	12	12	12	12	12	12	12	12	12	12

PU-3b: C	**Probability (RSLR = Higher)**										
Development Scenario	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
High Employment/ Dispersed Population (Scenarios 1&2)	16	16	16	16	16	16	16	16	16	16	16
BAU Employment/Compact Population (Scenarios 3&4)	16	16	16	16	16	16	16	16	16	16	16

6.6 Results for Illustrative Preference Patterns – Planning Unit 4

MAU scores were calculated for each of the coastal, structural, and nonstructural plans and the no-action alternative for three illustrative preference patterns selected for this discussion (Table 38). Figure 44 shows the proportion of total weight placed on each of the metrics. Preference pattern PU-4:A put the highest weight on reducing direct economic damages (DAM) and residual risks to the resident population (POP). PU-4:A also places importance on minimizing the length of time to construct a protection system (TIME) and reducing life-cycle costs (COST). PU-4:B puts the highest weight on minimizing direct wetland impacts (DWI), but also places a high importance on reducing the length of time to construct a protection system (TIME) and minimizing life-cycle project costs (COST). PU-4:B places no importance on maximizing the number of historic districts, historic properties, and archeological sites protected. The preference pattern PU-4:C contrasts with the other two in terms of the relative importance that is placed on minimizing population impacts (POP). PU-4:C places little importance on maximizing the number of historic districts, historic properties, and archeological sites protected, as well as direct wetland impacts (DWI) and indirect environmental impacts (IEI).

Table 38. Swing weights for three illustrative preference patterns discussed for PU4.

#	Code	Name	PU-1:A	PU-1:B	PU-1:C
1	COST	Life-cycle Cost ($ Billions)	0.1286	0.1724	0.0325
2	POP	Population Impacted (People/Year)	0.1429	0.1149	0.6494
3	DAM	Direct Economic Damages ($ Millions/Year)	0.1429	0.069	0.0649
4	EMP	Employment Impacts (Jobs Disrupted/Year)	0.1000	0.1149	0.1623
5	ASIT	Archeological Sites Protected (Number of Sites)	0.1000	0.0000	0.0065
6	HDIS	Historic Districts Protected (Number of Districts)	0.1000	0.0000	0.0065
7	HPRO	Historic Properties Protected (Number of Properties)	0.0000	0.0000	0.0000
8	TIME	Construction Time (Years)	0.1286	0.1839	0.0649
9	DWI	Direct Wetland Impacts (Acres)	0.1000	0.2299	0.0065
10	IEI	Indirect Environmental Impacts (Scale; -8 to +8)	0.0571	0.1149	0.0065
		Top-ranked metric	DAM	DWI	POP

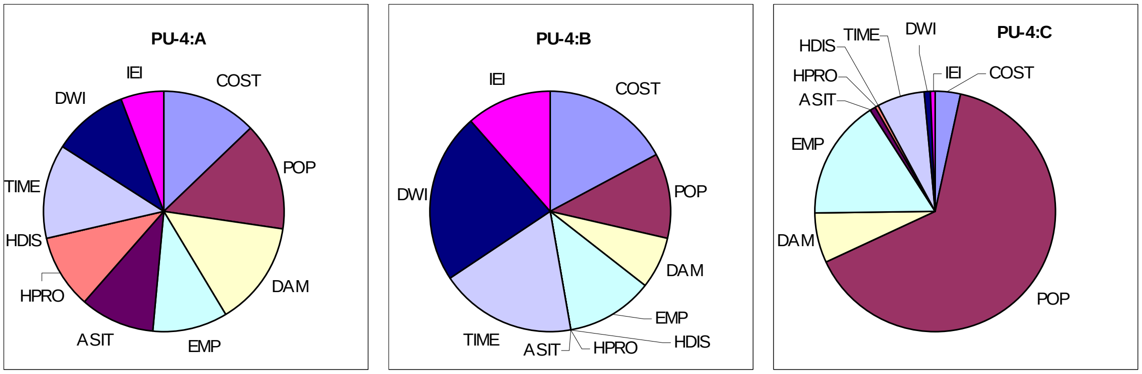
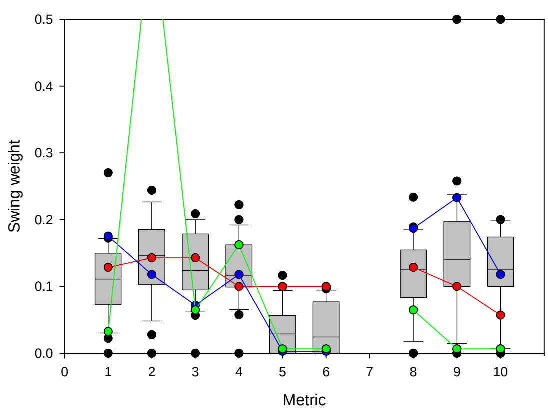


Figure 44. Three illustrative preference patterns discussed for PU4.

The illustrative preference patterns selected for discussion here are each unique within the planning unit, but they are not necessarily atypical. Usually, a preference pattern contains some weights that are similar to those of other stakeholders and some weights that represent extremes. Figure 45 shows how each of the swing weights in the illustrative preference pattern compares to the other swing weights in this planning unit. In this figure, the three color-coded sets of weights are overlaid on the box plots that were introduced in Section 3. The closer each of the color-coded points is to being within the gray box for a particular performance measure, the more typical the weight. Points that fall outside the error bars that surround the gray box indicate extreme positions relative to other survey respondents, or outliers.



#	Code	Metric Name
1	COST	Life-cycle Cost ($ Billions)
2	POP	Population Impacted (People/Year)
3	DAM	Direct Economic Damages ($ Millions/Year)
4	EMP	Employment Impacts (Jobs Disrupted/Year)
5	ASIT	Archeological Sites Protected (Number of Sites)
6	HDIS	Historic Districts Protected (Number of Districts)
7	HPRO	Historic Properties Protected (Number of Properties)
8	TIME	Construction Time (Years)
9	DWI	Direct Wetland Impacts (Acres)
10	IEI	Indirect Environmental Impacts (Scale; -8 to +8)

Figure 45. Swing weights for the three preference patterns evaluated for PU4 superimposed on the weight elicitation results summarized in Figure 1. The swing weights of three individual stakeholders represent illustrative preference patterns designated as PU-4:A (red), PU-4:B (blue), and PU-4:C (green).

These three illustrative preference patterns produce a unique rank order of plans. These rank orders are illustrated in Figure 46 for each of the preference patterns. The underlying table was introduced in Section 5 and shows the number of times that each plan ranked first, second, third, fourth, or fifth when plans were ranked in decreasing order by the utility score. The top five plans for PU-4:A are shown in red. The non-structural plans (PU4-NS-100, PU4-NS-400, and PU4-NS-1000) are the top three plans and comprehensive ring levee (C-RL) alignments rank fourth and fifth. The top five plans for PU-4:B are shown in blue. The 100-year comprehensive ring levee (C-RL) alignment is the top-ranked plan, followed by the 400-year comprehensive ring levee alignment. The three non-structural plans are also among the top five ranked plans. The top five plans for PU4-C are shown in green. The top-five plans include four comprehensive GIWW (C-G) alignments and the 1000-year non-structural alternatives. These results are presented here to illustrate that different sets of weights lead to different rankings of plans. While the rankings suggest order of preference, they do not indicate how much more or less preferred a plan is relative to other plans. In addition, these figures do not help explain why a particular set of weights leads to a particular ranking of plans. These issues are discussed in greater detail below.

PU4, Scenario 1						
PLAN CODE	**Rank Based on Swing Weights**					**Total**
	1	**2**	**3**	**4**	**5**	
PU4-0	0	0	1	0	0	1
PU4-C-G-100-1	0	1	0	0	0	1
PU4-C-G-100-2	0	0	0	1	0	1
PU4-C-G-1000-3	1	0	0	0	0	1
PU4-C-G-400-3	0	0	1	0	0	1
PU4-C-RL-100-1	3	3	0	1	5	12
PU4-C-RL-1000-1	0	1	0	2	14	17
PU4-C-RL-400-1	6	3	6	10	0	25
PU4-NS-100	0	1	9	7	5	22
PU4-NS-1000	15	3	7	1	1	27
PU4-NS-400	1	14	6	4	1	26
PU4-R1	0	0	1	0	0	1
Total	26	26	31	26	26	135

Figure 46. Rank order of the top five plans for the illustrative preference patterns. The preference patters are color coded as follows: PU-4:A is red, PU-4:B is blue, and PU-4:C is green.

In the discussion of PU-4 results that follows, plans are numbered 1-19 to facilitate references in tables and figures (Table 39). Plans are ranked by MAU for each planning scenario and characteristic sets of preferences in Tables 42-44.

Table 39. Plan Numbers and Plan Names for PU4.

Plan	*Plan Code*
1	PU4-0
2	PU4-R1
3	PU4-NS-100
4	PU4-NS-400
5	PU4-NS-1000
6	PU4-G-100-1
7	PU4-G-100-2
8	PU4-G-400-3
9	PU4-G-1000-3
10	PU4-RL-100-1
11	PU4-RL-400-1
12	PU4-RL-1000-1
13	PU4-C-G-100-1
14	PU4-C-G-100-2
15	PU4-C-G-400-3
16	PU4-C-G-1000-3
17	PU4-C-RL-100-1
18	PU4-C-RL-400-1
19	PU4-C-RL-1000-1

The 19 plans are ranked by MAU for each scenario and each of the three preference patterns in Tables 40 through 42. For example, Table 40 shows the utility of Plan 13 for PU-4:A under the planning assumptions used in Scenarios 1 and 3 is 0.699 and 0.702, respectively. Under the assumptions of Scenario 2 and 4, Plan 13 remains the top-ranked plan, but the utility score decreases to 0.682 and 0.683, respectively. The lower-levels of performance for this plan in Scenarios 2 and 4 can be attributed to the higher rates of sea-level rise assumed in these scenarios. For preference pattern PU-4:B, the effect of higher rates of sea-level rise is to make a different 100-year comprehensive plan (PU4-C-RL-100-1; Plan 17) more attractive. This shows sensitivity of the preferred plan to uncertainty in sea-level rise assumptions. For PU-4:C, Plan 16, another comprehensive plan, dominates the rankings under all four scenarios.

Figures 47 through 49 illustrate why different preference patterns might lead to different plan rankings by showing the contribution of each metric to utility for each plan, scenario, and preference pattern. For example, Figure 47 illustrates the contribution of each metric to utility for PU-4:A. Under a set of planning assumptions consistent with Scenario 1 (Lower RSLR and High Employment/Dispersed Population), the utility of Plan 13 for PU-4:A is 0.699. This can be attributed to the relative performance of this plan on those performance objectives that are important for this preference pattern. Although a plan may contribute substantially towards one of the performance objectives, if the weights reflect relatively little importance on that objective, the performance with respect to that objective will make little contribution towards the overall utility for this preference pattern.

For PU-4:A, the top-ranked plan is one that is comprehensive, including both structural and non-structural measures: Plan 13 (Table 40 and Figure 47). For this preference pattern, the rank order of the top four plans is not dependent upon scenario assumptions. The second and third-ranked plans for all scenarios were Plan 5 (non-structural) and Plan 4 (non-structural). The metrics most contributing to the MAU scores and influencing utility for PU-4:A were indirect environmental impacts (No. 10), construction time (No. 8), and historic properties and archeological sites protected (Nos. 5 and 6).

The top ranked plan for PU-4:B is one that is comprehensive (Plan 17), including both structural and non-structural measures (Table 41 and Figure 48). The rank order for PU-4:B plans was sensitive to scenario assumptions. The second-ranked plan for Scenarios 1, 2, and 3 was Plan 18 (comprehensive); the second-ranked plan for Scenario 4 was Plan 4 (non-structural). The metrics most contributing to MAU and influencing utility for PU-4:B were direct wetland impacts (No. 9) and construction time (No. 8).

For PU-4:C, the three top-ranked plans are comprehensive plans, which include both structural and non-structural measures: Plans 16, 13 and 15 (Table 42 and Figure 49). For this preference pattern, the rank order of the top three plans is not dependent upon scenario assumptions. Metrics most contributing to the MAU scores and influencing utility for PU-4:C were employment impacts (No. 4) and population impacts (No. 2).

Table 40. Plans Ranked by Multi-attribute Utility Score for PU-4, Preference Pattern A.

PU-4: A

	Scenario 1	
Plan	***Plan Code***	***Utility***
13	PU4-C-G-100-1	0.699
5	PU4-NS-1000	0.690
4	PU4-NS-400	0.687
3	PU4-NS-100	0.673
18	PU4-C-RL-400-1	0.668
16	PU4-C-G-1000-3	0.636
15	PU4-C-G-400-3	0.632
19	PU4-C-RL-1000-1	0.630
14	PU4-C-G-100-2	0.628
17	PU4-C-RL-100-1	0.627
6	PU4-G-100-1	0.604
2	PU4-R1	0.555
7	PU4-G-100-2	0.531
11	PU4-RL-400-1	0.515
10	PU4-RL-100-1	0.514
8	PU4-G-400-3	0.508
9	PU4-G-1000-3	0.508
12	PU4-RL-1000-1	0.499
1	PU4-0	0.408

	Scenario 2	
Plan	***Plan Code***	***Utility***
13	PU4-C-G-100-1	0.682
5	PU4-NS-1000	0.663
4	PU4-NS-400	0.659
3	PU4-NS-100	0.638
16	PU4-C-G-1000-3	0.623
19	PU4-C-RL-1000-1	0.613
18	PU4-C-RL-400-1	0.611
14	PU4-C-G-100-2	0.610
17	PU4-C-RL-100-1	0.603
15	PU4-C-G-400-3	0.601
6	PU4-G-100-1	0.586
7	PU4-G-100-2	0.512
2	PU4-R1	0.499
10	PU4-RL-100-1	0.489
9	PU4-G-1000-3	0.489
12	PU4-RL-1000-1	0.474
11	PU4-RL-400-1	0.473
8	PU4-G-400-3	0.472
1	PU4-0	0.371

	Scenario 3	
Plan	***Plan Code***	***Utility***
13	PU4-C-G-100-1	0.702
5	PU4-NS-1000	0.699
4	PU4-NS-400	0.697
3	PU4-NS-100	0.682
18	PU4-C-RL-400-1	0.669
16	PU4-C-G-1000-3	0.640
19	PU4-C-RL-1000-1	0.636
14	PU4-C-G-100-2	0.634
15	PU4-C-G-400-3	0.633
17	PU4-C-RL-100-1	0.633
6	PU4-G-100-1	0.597
2	PU4-R1	0.553
7	PU4-G-100-2	0.527
11	PU4-RL-400-1	0.517
10	PU4-RL-100-1	0.515
8	PU4-G-400-3	0.504
9	PU4-G-1000-3	0.504
12	PU4-RL-1000-1	0.500
1	PU4-0	0.407

	Scenario 4	
Plan	***Plan Code***	***Utility***
13	PU4-C-G-100-1	0.683
5	PU4-NS-1000	0.673
4	PU4-NS-400	0.670
3	PU4-NS-100	0.647
16	PU4-C-G-1000-3	0.626
19	PU4-C-RL-1000-1	0.618
14	PU4-C-G-100-2	0.615
18	PU4-C-RL-400-1	0.613
17	PU4-C-RL-100-1	0.610
15	PU4-C-G-400-3	0.601
6	PU4-G-100-1	0.574
7	PU4-G-100-2	0.504
2	PU4-R1	0.495
10	PU4-RL-100-1	0.488
9	PU4-G-1000-3	0.481
12	PU4-RL-1000-1	0.476
11	PU4-RL-400-1	0.473
8	PU4-G-400-3	0.465
1	PU4-0	0.367

Table 41. Plans Ranked by Multi-attribute Utility Score for PU-4, Preference Pattern B.

PU-4: B

	Scenario 1			Scenario 2			Scenario 3			Scenario 4	
Plan	***Plan Code***	***Utility***	***Plan***	***Plan Code***	***Utility***	***Plan***	***Plan Code***	***Utility***	***Plan***	***Plan Code***	***Utility***
17	PU4-C-RL-100-1	0.694	17	PU4-C-RL-100-1	0.675	17	PU4-C-RL-100-1	0.699	17	PU4-C-RL-100-1	0.681
18	PU4-C-RL-400-1	0.685	18	PU4-C-RL-400-1	0.671	18	PU4-C-RL-400-1	0.684	4	PU4-NS-400	0.674
4	PU4-NS-400	0.674	4	PU4-NS-400	0.664	4	PU4-NS-400	0.683	5	PU4-NS-1000	0.672
5	PU4-NS-1000	0.673	5	PU4-NS-1000	0.664	5	PU4-NS-1000	0.680	18	PU4-C-RL-400-1	0.670
3	PU4-NS-100	0.666	3	PU4-NS-100	0.650	3	PU4-NS-100	0.673	3	PU4-NS-100	0.658
19	PU4-C-RL-1000-1	0.657	19	PU4-C-RL-1000-1	0.642	19	PU4-C-RL-1000-1	0.661	19	PU4-C-RL-1000-1	0.646
10	PU4-RL-100-1	0.607	10	PU4-RL-100-1	0.586	10	PU4-RL-100-1	0.609	10	PU4-RL-100-1	0.587
14	PU4-C-G-100-2	0.591	14	PU4-C-G-100-2	0.575	14	PU4-C-G-100-2	0.597	14	PU4-C-G-100-2	0.581
11	PU4-RL-400-1	0.582	11	PU4-RL-400-1	0.561	11	PU4-RL-400-1	0.584	11	PU4-RL-400-1	0.562
2	PU4-R1	0.575	13	PU4-C-G-100-1	0.556	13	PU4-C-G-100-1	0.575	13	PU4-C-G-100-1	0.559
13	PU4-C-G-100-1	0.571	15	PU4-C-G-400-3	0.555	2	PU4-R1	0.574	16	PU4-C-G-1000-3	0.555
15	PU4-C-G-400-3	0.568	16	PU4-C-G-1000-3	0.552	15	PU4-C-G-400-3	0.567	15	PU4-C-G-400-3	0.554
16	PU4-C-G-1000-3	0.564	2	PU4-R1	0.543	16	PU4-C-G-1000-3	0.567	2	PU4-R1	0.542
12	PU4-RL-1000-1	0.557	12	PU4-RL-1000-1	0.536	12	PU4-RL-1000-1	0.559	12	PU4-RL-1000-1	0.540
1	PU4-0	0.521	7	PU4-G-100-2	0.499	1	PU4-0	0.520	7	PU4-G-100-2	0.497
7	PU4-G-100-2	0.516	1	PU4-0	0.491	7	PU4-G-100-2	0.515	1	PU4-0	0.490
6	PU4-G-100-1	0.499	6	PU4-G-100-1	0.483	6	PU4-G-100-1	0.495	6	PU4-G-100-1	0.476
8	PU4-G-400-3	0.468	8	PU4-G-400-3	0.451	8	PU4-G-400-3	0.467	8	PU4-G-400-3	0.448
9	PU4-G-1000-3	0.467	9	PU4-G-1000-3	0.450	9	PU4-G-1000-3	0.466	9	PU4-G-1000-3	0.447

Table 42. Plans Ranked by Multi-attribute Utility Score for PU-4, Preference Pattern C.

PU-4: C

	Scenario 1			Scenario 2			Scenario 3			Scenario 4	
Plan	***Plan Code***	***Utility***	***Plan***	***Plan Code***	***Utility***	***Plan***	***Plan Code***	***Utility***	***Plan***	***Plan Code***	***Utility***
16	PU4-C-G-1000-3	0.800	16	PU4-C-G-1000-3	0.773	16	PU4-C-G-1000-3	0.833	16	PU4-C-G-1000-3	0.805
13	PU4-C-G-100-1	0.782	13	PU4-C-G-100-1	0.750	13	PU4-C-G-100-1	0.809	13	PU4-C-G-100-1	0.777
15	PU4-C-G-400-3	0.768	15	PU4-C-G-400-3	0.737	15	PU4-C-G-400-3	0.799	15	PU4-C-G-400-3	0.769
14	PU4-C-G-100-2	0.736	14	PU4-C-G-100-2	0.704	14	PU4-C-G-100-2	0.772	14	PU4-C-G-100-2	0.739
5	PU4-NS-1000	0.714	5	PU4-NS-1000	0.677	5	PU4-NS-1000	0.757	5	PU4-NS-1000	0.725
19	PU4-C-RL-1000-1	0.693	4	PU4-NS-400	0.651	19	PU4-C-RL-1000-1	0.736	4	PU4-NS-400	0.699
4	PU4-NS-400	0.689	19	PU4-C-RL-1000-1	0.647	4	PU4-NS-400	0.732	19	PU4-C-RL-1000-1	0.689
18	PU4-C-RL-400-1	0.673	18	PU4-C-RL-400-1	0.624	18	PU4-C-RL-400-1	0.714	18	PU4-C-RL-400-1	0.670
3	PU4-NS-100	0.658	3	PU4-NS-100	0.612	3	PU4-NS-100	0.701	3	PU4-NS-100	0.659
17	PU4-C-RL-100-1	0.631	6	PU4-G-100-1	0.582	17	PU4-C-RL-100-1	0.675	17	PU4-C-RL-100-1	0.629
6	PU4-G-100-1	0.616	17	PU4-C-RL-100-1	0.577	6	PU4-G-100-1	0.631	6	PU4-G-100-1	0.595
7	PU4-G-100-2	0.568	7	PU4-G-100-2	0.533	7	PU4-G-100-2	0.591	7	PU4-G-100-2	0.555
9	PU4-G-1000-3	0.549	9	PU4-G-1000-3	0.514	9	PU4-G-1000-3	0.572	9	PU4-G-1000-3	0.536
8	PU4-G-400-3	0.544	8	PU4-G-400-3	0.508	8	PU4-G-400-3	0.567	8	PU4-G-400-3	0.530
11	PU4-RL-400-1	0.449	11	PU4-RL-400-1	0.393	11	PU4-RL-400-1	0.486	12	PU4-RL-1000-1	0.442
12	PU4-RL-1000-1	0.447	12	PU4-RL-1000-1	0.392	12	PU4-RL-1000-1	0.483	11	PU4-RL-400-1	0.432
2	PU4-R1	0.441	10	PU4-RL-100-1	0.385	10	PU4-RL-100-1	0.477	10	PU4-RL-100-1	0.424
10	PU4-RL-100-1	0.440	2	PU4-R1	0.349	2	PU4-R1	0.468	2	PU4-R1	0.382
1	PU4-0	0.403	1	PU4-0	0.313	1	PU4-0	0.430	1	PU4-0	0.347

Figure 47. Contributions of Each Metric to the Multi-attribute Utility Score for Preference Pattern A by Scenario for PU-4.

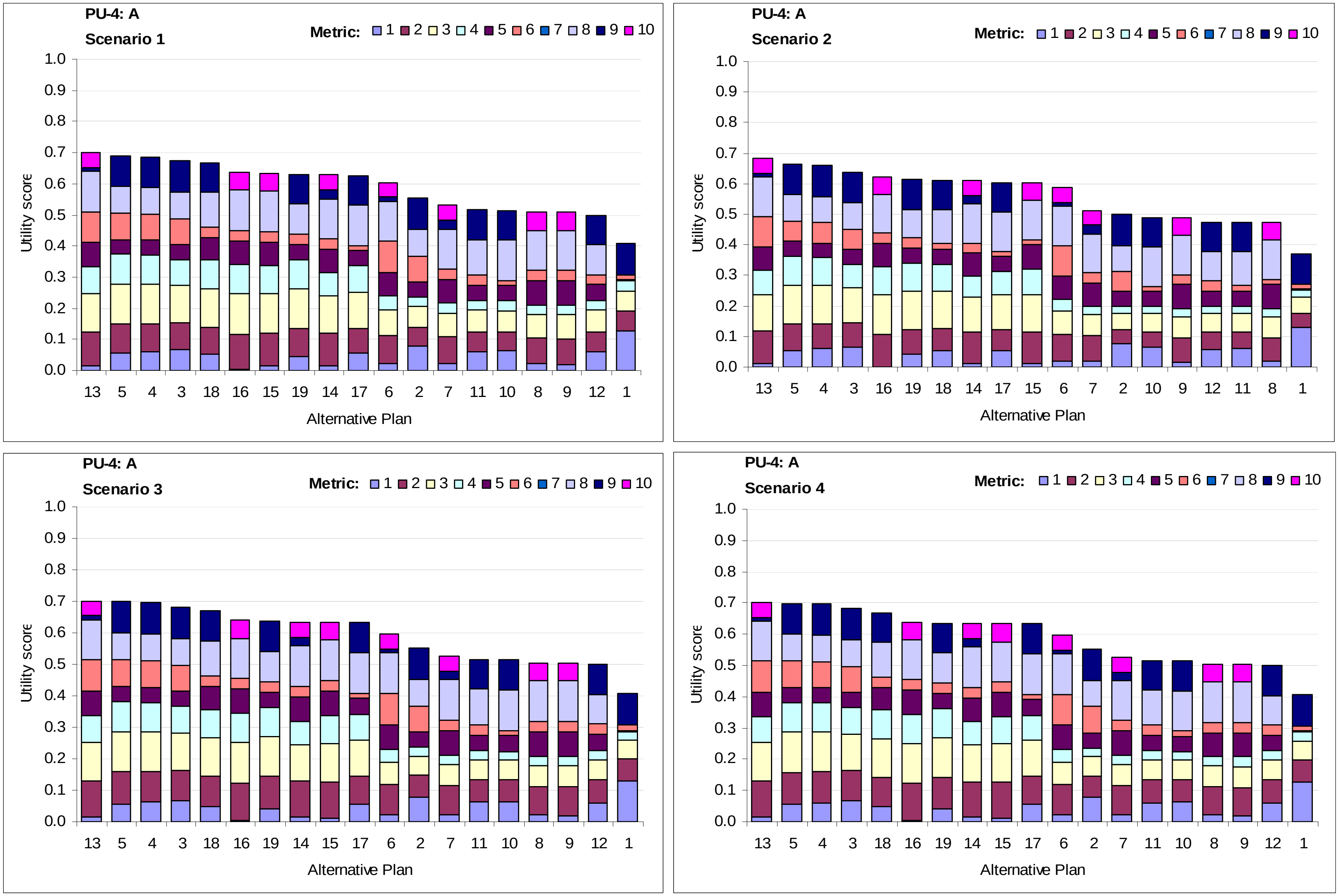


Figure 48. Contributions of Each Metric to the Multi-attribute Utility Score for Preference Pattern B by Scenario for PU-4.

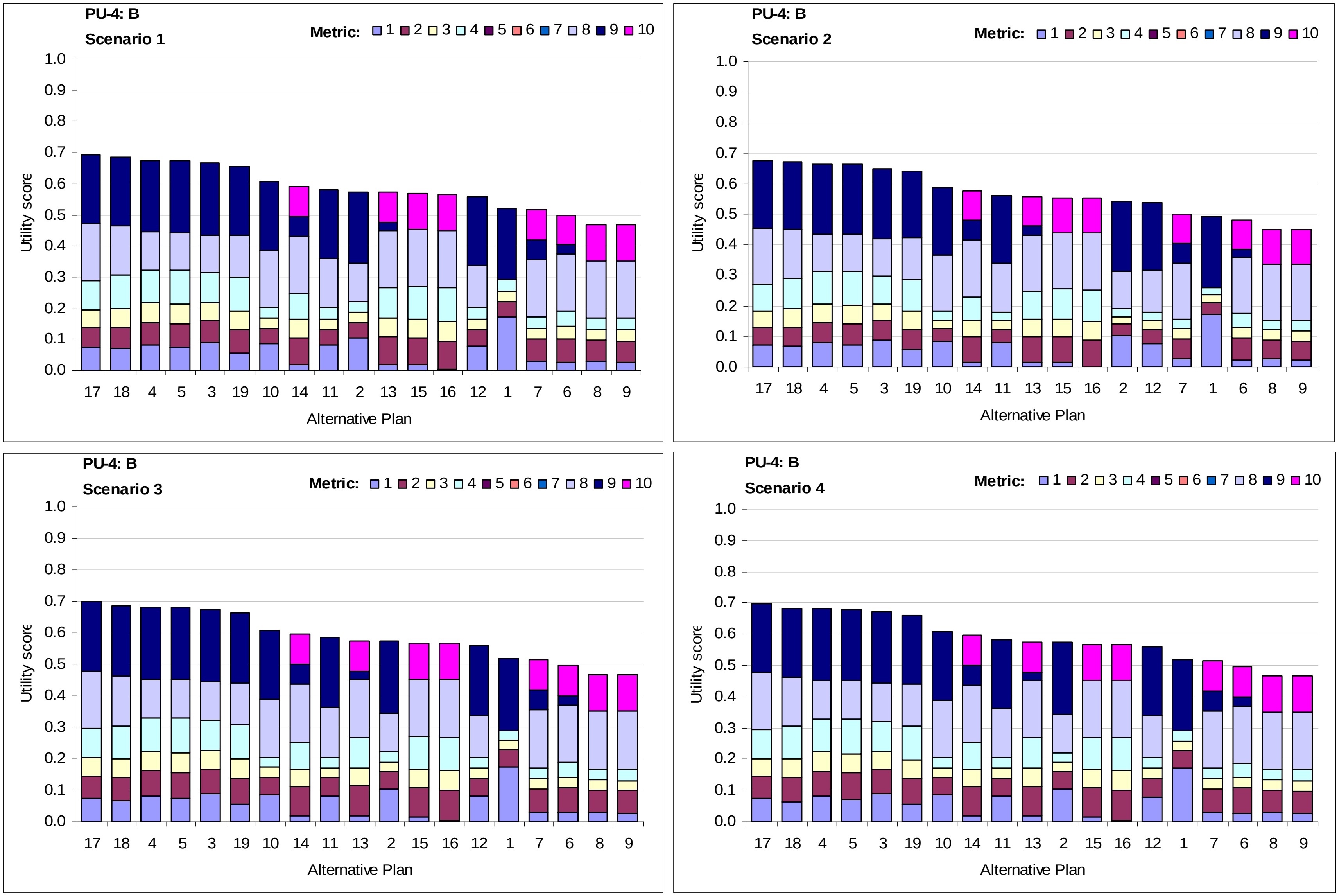
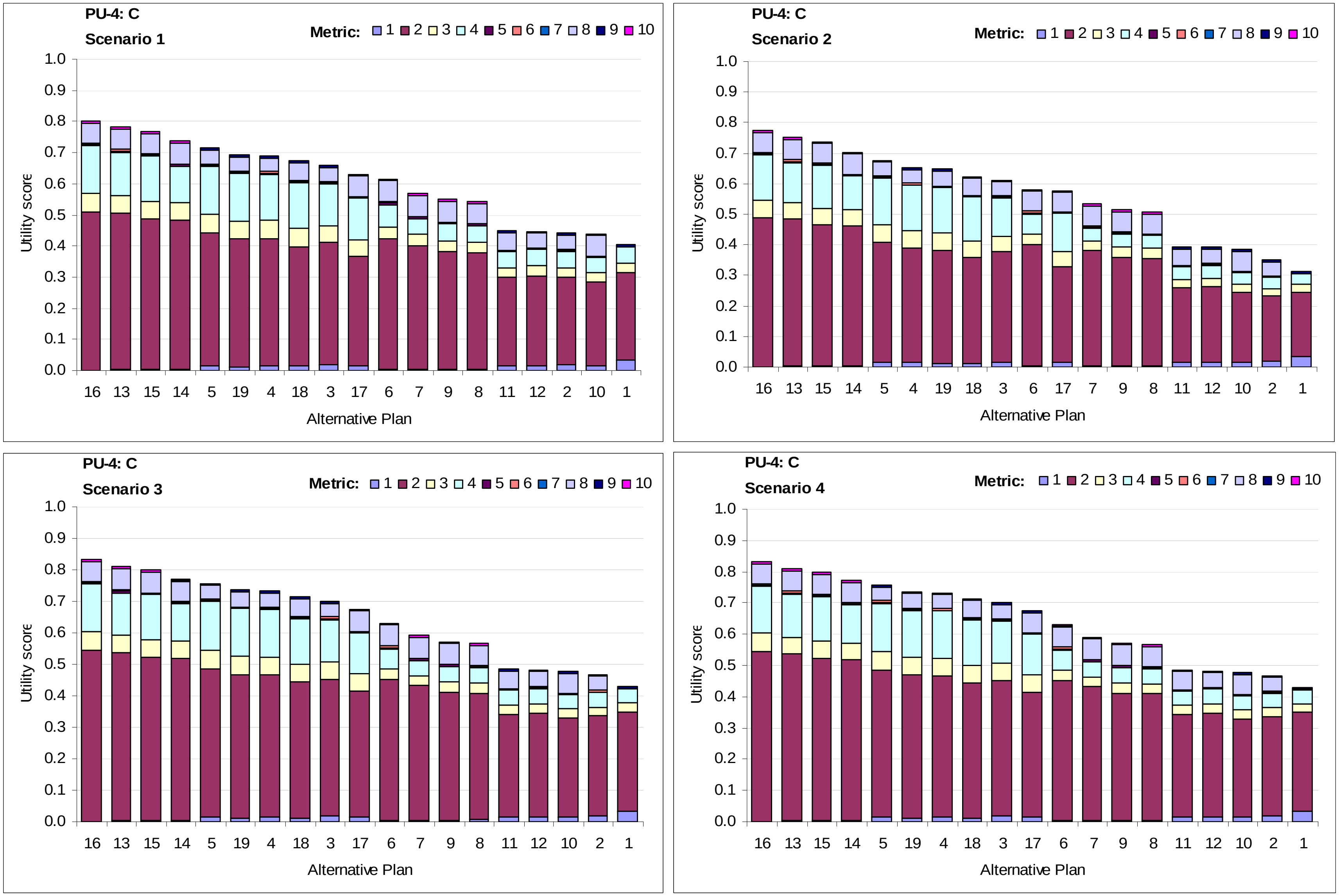


Figure 49. Contributions of Each Metric to the Multi-attribute Utility Score for Preference Pattern C by Scenario for PU-4.



6.6.1 Sensitivity of Preferred Alternatives – Planning Unit 4

Table 43 shows the preferred alternatives over four possible relative sea level rise and re-development scenarios. Each cell indicates the preferred alternative given the scenario. For example, for PU-4:A, plan PU4-C-G-100-1 (Plan 13) is preferred regardless of rate of relative sea level rise and pattern of development. For PU-4:B and PU-4:C, plan PU4-C-RL-100-1 (Plan 17) and plan PU4-C-G-1000-3 (Plan 16) are preferred, respectively, regardless of rate of relative sea level rise and pattern of development.

Table 43. Preferred Plan Matrix for Three Preference Patterns in PU4.

PU-4: A	**Relative Sea-level Rise**	
Pattern of Development	Lower	Higher
High/Dispersed	PU4-C-G-100-1	PU4-C-G-100-1
BAU/Compact	PU4-C-G-100-1	PU4-C-G-100-1

PU-4: B	**Relative Sea-level Rise**	
Pattern of Development	Lower	Higher
High/Dispersed	PU4-C-RL-100-1	PU4-C-RL-100-1
BAU/Compact	PU4-C-RL-100-1	PU4-C-RL-100-1

PU-4: C	**Relative Sea-level Rise**	
Pattern of Development	Lower	Higher
High/Dispersed	PU4-C-G-1000-3	PU4-C-G-1000-3
BAU/Compact	PU4-C-G-1000-3	PU4-C-G-1000-3

6.6.2 Expected Utility – Planning Unit 4

Figures 50 through 52 plot the expected utility of each alternative assuming a uniform distribution of probability across the two relative sea level rise scenarios (P(RSLR = Lower) = 0.5 and P(RSLR = Higher) = 0.5) for each preference pattern. These three figures illustrate the expected utility of each alternative assuming a High Employment and Dispersed Population scenario. (BAU/Compact was not generated.) These figures illustrate how the utility of some alternatives may be more or less sensitive to relative sea level rise assumptions than the utility of other alternatives. The error bands on expected utility represent the minimum and maximum levels of utility over the four scenarios considered in the LACPR plan. Alternatives with more sensitivity to relative sea level rise and development assumptions will have wider error bands than those with less sensitivity. Alternatives that have narrower error bands can be judged to be more predictable in terms of the level of utility they will provide. For example, Plan 13 has narrow error bands for PU-4:A (Figure 50). The expected utility of any given alternative and its range of possible values depends in part upon what set of weights is chosen to calculate utility.

The calculation of expected utility requires the assignment of probability to each scenario, but in this case our interest is not in any particular set of probabilities. Rather, our interest is in understanding how the different alternatives perform under different allocations of probability to the scenarios. For example, a change in the probabilities might cause expected utility for some alternatives to increase while causing expected utility for other alternatives to decrease. We are also interested in the range of expected utility for each scenario. The expected utilities shown in these figures assume high employment/dispersed populations. Alternatives that have expected utilities with smaller ranges represent more predictable outcomes. These alternatives (for example, Plan 18 in Figure 51) may be preferred to others that have larger ranges (for example, Plan 17 in Figure 51) because these alternatives lead to more predictable outcomes.

Figure 50. Expected Utility of each PU-4 Alternative for Preference Pattern A, showing minimum and maximum utility scores (Scenarios 1 & 2: High Employment/ Dispersed Population).

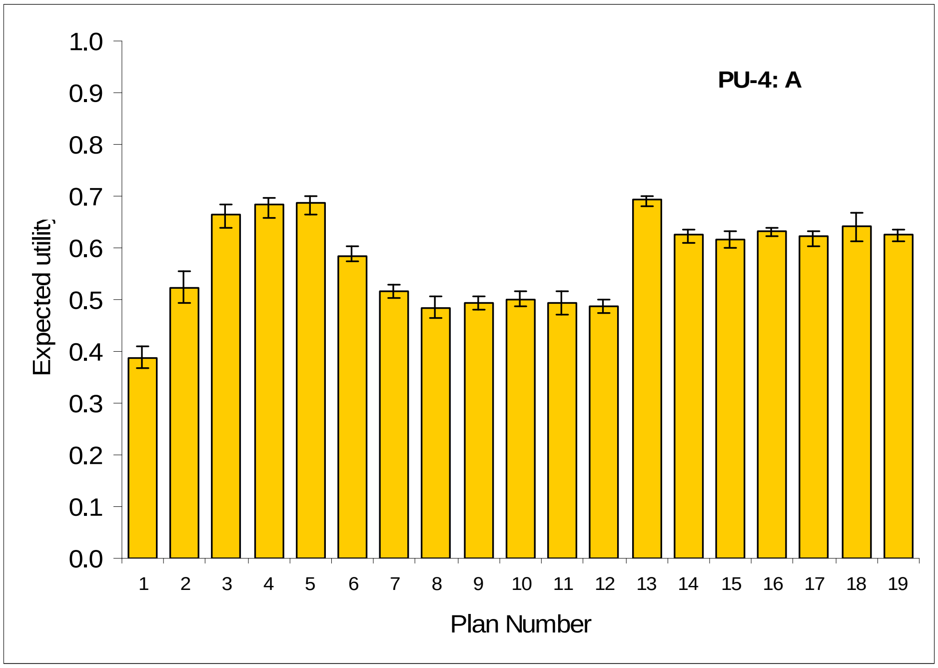


Figure 51. Expected Utility of each PU-4 Alternative for Preference Pattern B, showing minimum and maximum utility scores. (Scenarios 1 & 2: High Employment/ Dispersed Population).

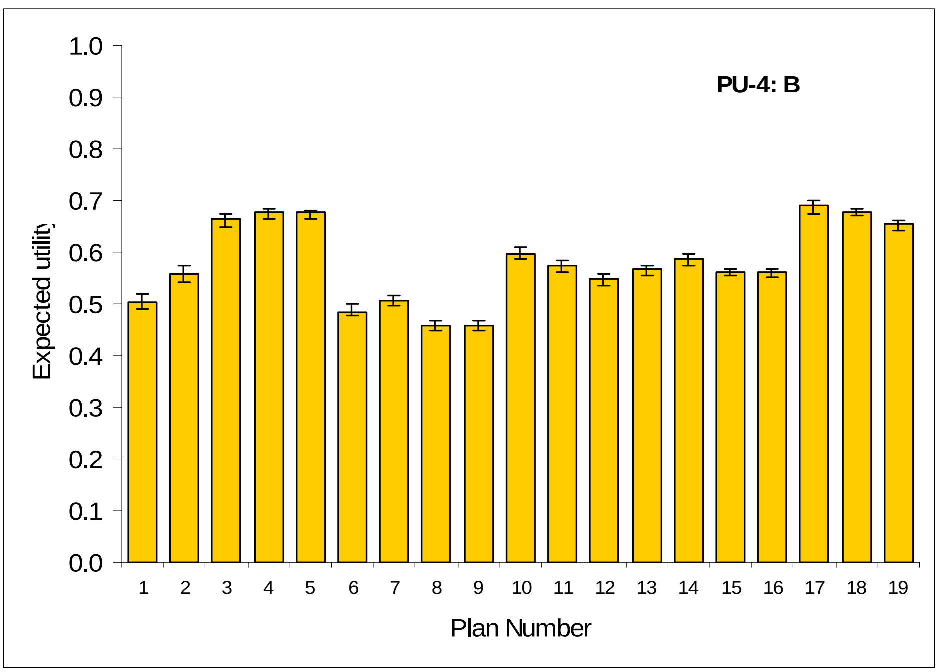
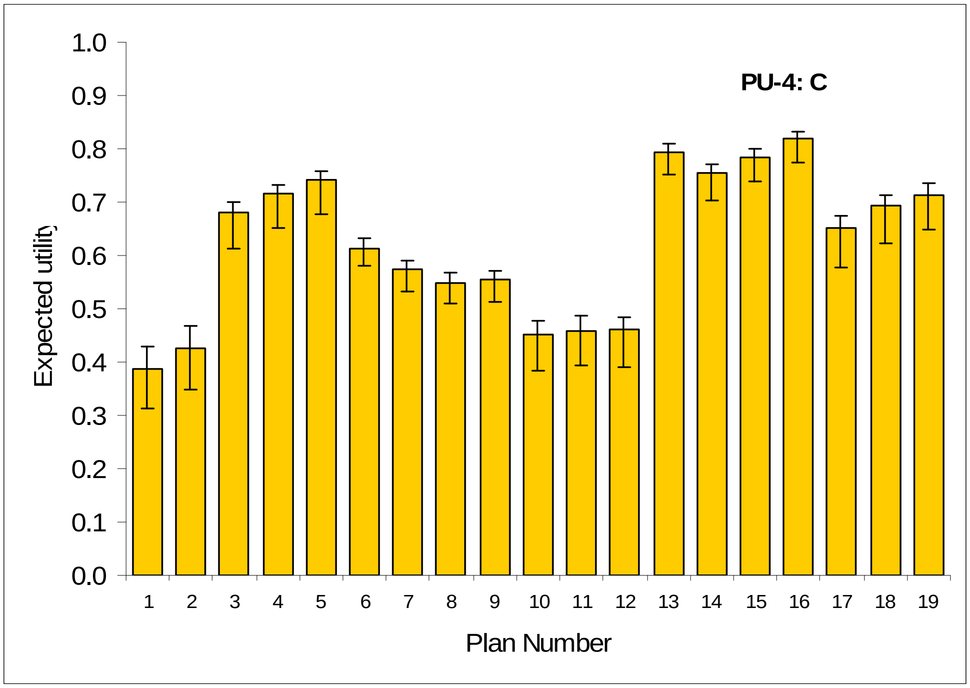


Figure 52. Expected Utility of each PU-4 Alternative for Preference Pattern C, showing minimum and maximum utility scores. (Scenarios 1 & 2: High Employment/ Dispersed Population).



6.6.3 Sensitivity of Decisions to Assumptions about the Probability of Higher Levels of Relative Sea Level Rise – Planning Unit 4

Table 44 shows the sensitivity of the preferred alternative to assumptions about the allocation of probabilities to relative sea level rise scenarios for each of the three preference patterns and for each development scenario. For PU-4:A, the decision is insensitive for all scenarios, with Plan 13 being preferred. Likewise, for PU-4:B and PU4-C, the decision is insensitive for all scenarios, with Plan 17 and Plan 16 being preferred, respectively.

Table 44. Preferred Plan Matrix for PU-4.

PU-4: A	Probability (RSLR = Higher)										
Development Scenario	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
High Employment/ Dispersed Population (Scenarios 1&2)	13	13	13	13	13	13	13	13	13	13	13
BAU Employment/Compact Population (Scenarios 3&4)	13	13	13	13	13	13	13	13	13	13	13

PU-4: B	Probability (RSLR = Higher)										
Development Scenario	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
High Employment/ Dispersed Population (Scenarios 1&2)	17	17	17	17	17	17	17	17	17	17	17
BAU Employment/Compact Population (Scenarios 3&4)	17	17	17	17	17	17	17	17	17	17	17

PU-4: C	Probability (RSLR = Higher)										
Development Scenario	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
High Employment/ Dispersed Population (Scenarios 1&2)	16	16	16	16	16	16	16	16	16	16	16
BAU Employment/Compact Population (Scenarios 3&4)	16	16	16	16	16	16	16	16	16	16	16

7. Discussion

This application of MCDA to the RIDF has focused on developing an objectives hierarchy for LACPR, identifying a set of metrics to model performance outcomes, and developing a multi-attribute utility function to rate the relative performance of alternatives. In the analysis of results, LACPR plan alternatives are ranked by MAU score using three different sets of attribute weights. Each set of weights characterizes an illustrative pattern of preference that exists within the stakeholder community. Plans are ranked by MAU score and, in the absence of uncertainty in the assumptions used to model plan outcomes, the preferred plan for each preference pattern is the plan with the highest MAU score. However, most decisions with long-range planning horizons involve a considerable amount of uncertainty and LACPR is no exception. Therefore, the LACPR team has expended considerable effort to evaluate the sensitivity of plans to uncertainty in the parameters or assumptions of models used to simulate performance outcomes.

Uncertain parameters and assumptions of interest to LACPR include the rates of relative sea level rise, the employment growth rate, and the population distribution. Decisions under uncertainty should maximize expected utility, which would require a set of probability distributions for the uncertain variables in order to calculate probabilities for each scenario. At this point in the planning process, a set of probability distributions has not been developed for the four scenarios. Therefore, this analysis assesses sensitivity over a limited scenario set to assess the robustness of decision alternatives. Robust decision alternatives are those that have consistently high MAU scores across the planning scenarios.

In addition to augmenting the USACE's 6-step P&G guidelines with uncertainty, MCDA also provides mechanisms to engage stakeholders more actively in the USACE's planning process. For example, MCDA helps decision makers and stakeholders: 1) systematically structure the decision process; 2) assess tradeoffs among decision objectives; 3) reflect upon, articulate, and apply explicit value judgments concerning conflicting decision criteria; 4) make more consistent and rational evaluations of risks and uncertainties; and 5) facilitate negotiation (Hobbs and Meier 2000). In addition to improving the quality of decisions, MCDA helps decision makers engage stakeholders. Stakeholders assist decision makers to develop an objectives hierarchy and to assess the relative importance of those decision objectives. An obvious benefit of engaging stakeholders during the planning process is that this is likely to engender greater trust and confidence on the part of stakeholders and may enhance the sense of legitimacy of the decision or final outcome. The objectives hierarchy is described in Section 3.1.3 of the main RIDF Appendix and the stakeholder weight elicitation sessions are described in Section 2 of this attachment.

The results of this analysis can be used to draw conclusions and inform decisions. For example, in all five planning units, the decision for any one preference pattern appears relatively insensitive to the uncertainty in relative sea level rise or to the potential patterns of development considered in this analysis. An example of this result can be observed in Planning Unit 2, Figures 23 through 25 and in Table 22. In this example, the plan that maximizes utility for PU-2:A (Plan 30, PU2-C-WBI-100-1) is the same regardless of differences in relative sea level rise or development. This lack of sensitivity of the preferred plan also was observed for PU-2:B and PU-2:C. In many instances, the scenarios produce changes in the rank ordering of the top few alternatives, but only minor changes in MAU. This suggests that stakeholders would be just as happy with any one of these alternatives despite these uncertainties in assumptions used to model performance outcomes. A similar lack of sensitivity was observed with respect to patterns of development. If the uncertainties in relative sea level rise or the pattern of development have been understated, these results and conclusions may not hold. There are also other possible development states that exist that have not been considered in this analysis and the insensitivity of the decision to the two states that have been considered should not be viewed as an indication of sensitivity in other possible states. In addition, if other uncertainties exist in the modeling of performance outcomes that are more important than those considered here, these uncertainties should be considered in future analyses.

One pattern apparent in these results is the consistently high rank given to non-structural plans in Planning Units 1 and 3a (See Section 5). It is worth considering why these non-structural plans are so consistently preferred in these planning units. Non-structural plans include raising in-place and buying out properties. Buying out the properties at risk of flooding from storm surge eliminates the risk, simultaneously removing the residential population from the flood-prone area and eliminating the potential for disruptions to employment in that area. This is accomplished without causing direct wetland impacts or negative indirect environmental impacts. Therefore, it is easy to see why these alternatives may be attractive given the objectives hierarchy and performance metrics chosen for this analysis. However, these results should be interpreted with caution because there may be unaccounted impacts associated with these alternatives. The evaluation of metrics for the non-structural plans does not account for direct wetland impacts or indirect environmental impacts that might be caused by creating development elsewhere. In addition, it assumes that the new developments would not be subject to flood risks, which is unknown. The employment effects associated with displacing businesses or industries have not been evaluated for these plans. Finally, the social impacts associated with breaking up communities that have evolved in buyout areas over time have not been considered in the objectives hierarchy. Therefore, any apparent preference for non-structural plans indicated by these results should be considered carefully.

While considerable effort has gone into estimating the performance outcomes reflected in these metrics, most observers will perceive that there is much uncertainty in these estimates that has not yet been addressed and that a more comprehensive analysis of uncertainty is possible. Therefore, while the LACPR decision strategy emphasizes the ranking of plans by MAU, these results should be interpreted with some caution. For example, rather than attempting to identify "the preferred plan," a more cautious interpretation of these results would focus on identifying which plans form a top tier of plans with the highest MAU scores in each planning unit. It is also important to understand what the common elements of these plans are and how and why these top tiers differ across preference patterns.

One of the benefits of subjecting policy decisions such as those being considered in LACPR to a multi-attribute decision analysis and stakeholder involvement is that it helps decision makers to identify where common interests exist and where and how bridges can be built to unite stakeholders who hold competing views. In this case, comprehensive plans are top-ranked across all three preference patterns for PU4. Plan PU4-C-G-100-1 (Plan 13) is the top-ranked plan in PU-4:A and the second-ranked plan in PU4-C. Similarly, comprehensive plan PU2-C-R-400-3 (Plan 27) is top-ranked in PU-2:C, ranked fifth or sixth in PU-2:B and ninth for PU2-A. This result implies that these plans each offer a set of outcomes about which stakeholders who hold substantially different preference patterns could agree. Therefore, these plans deserve further investigation. However, it is important to note that although a plan may have a high rank over a large number of preference patterns, the utility of that plan for one or more of those preference types may be substantially lower than for others. In this case, consideration should be given to how large these differences in utility are, whether or not these differences represent an inequity, and to what extent this outcome may be the product of having considered only a limited scope of decision alternatives.

8. Path Forward

This version of the MCDA document for LACPR represents a second iteration of MCDA for this planning process. In this revision, the LACPR Technical Team has made several important improvements. We have modified the objectives hierarchy and revised the metric set, eliminating some of the redundancy in the first iteration by combining or eliminating metrics and improving the quality of the metric definitions so that they are easier for stakeholders to understand. We have also reduced the number of qualitative metric scales.

The LACPR Technical Team re-engaged stakeholders in July 2008, to conduct additional weight elicitation sessions. In this round of stakeholder interaction, we used a much-improved survey instrument to obtain swing weights. The swing weight method improves on the direct weight elicitation method used in previous weight elicitation session by providing stakeholders with information on the range of outcomes associated with the alternatives under consideration. In this method, stakeholders are made explicitly aware of the tradeoffs they are making.

The LACPR Technical Team also implemented controls during the weight elicitation procedure. The team followed a script so that the procedure is consistently applied from one implementation to another and is documented. The team introduced tests to validate swing weights. Following the elicitation of swing weights, respondents completed a second weight elicitation activity in which they adjusted the ratings of potential metric improvements until they were satisfied with implied willingness-to-pay amounts for these improvements. These results largely confirm the results obtained from swing weighting. Stakeholders also completed a series of choice experiments in which stakeholders considered two alternatives that differed in terms of the ten metrics and then chose a preferred alternative. The LACPR Technical Team was able to predict the outcome of choice experiments using the swing weights and multi-attribute utility model most of the time.

Although a number of improvements have been made, continued use of MCDA as an approach for informing planning decisions will provide the opportunity to make further improvements to the application of MCDA for hurricane risk-reduction planning. An iterative approach to developing the use of MCDA is justified by the complexity of this decision and the potential costs and consequences of the decision alternatives. The clarifications and improvements that will be pursued as it is appropriate and possible to do so will include:

- Continuing to engage stakeholders, requesting their feedback on the results of the MCDA.
- Expanding the discussion of the MCDA method, emphasizing the concept of tradeoffs and stakeholder indifference among outcomes.
- Enhancing the discussion of the weight elicitation procedure emphasizing validation of the weights (ability to predict choice set selections) and the impact of indirect monetization on the swing weights.
- Directing additional attention to analyzing preference patterns, discussing what attributes of the LACPR plans cause them to have the highest utility given a particular preference pattern, especially non-structural plans.
- Investing additional effort on focusing and optimizing the objectives hierarchy and the evaluation of metrics used for LACPR, including challenges associated with 1) using multiple monetary metrics, 2) the use of a construction time metric; 3) missing metrics that may account for the environmental, social, and employment consequences of displacing development under the non-structural plans.
- Further analysis of relevant uncertainties. The scope of uncertain inputs to the analysis should be re-evaluated to confirm that the inputs selected for the analysis of uncertainty are indeed the most important ones. Presently, the analysis considers only three uncertain inputs (relative sea level rise, employment growth rate, and population dispersion). If necessary, additional inputs should be evaluated and the process for selecting these inputs to the analysis should be documented. The analysis should consider not only the scenarios

associated with most extreme outcomes, but also the most probable scenarios. When manipulating these inputs to generate the scenarios, the scenarios should encompass the full range of potential values that might actually be realized during the planning horizon. A joint probability distribution for the scenarios can then be derived for the scenarios and the decision can be framed to maximize expected utility. Since probability distributions for uncertain inputs to the analysis are not well known, a sensitivity analysis should be conducted varying the parameters of the input probability distributions.

The experience and insights gained by the LACPR Technical Team using MCDA emphasize the importance and value of using such a structured approach to facilitate stakeholder engagement and decision making. An MCDA process provides the means for achieving productive engagement with stakeholders while providing the mechanics for eliciting specific forms of information that are useful for planners and decision makers. Continued engagement using this approach also provides basis for building educational and outreach process with the public and partnering organizations.

A comprehensive systems approach which also employs adaptive management pursues collaborative engagement with stakeholders, while seeking to design, construct, maintain and update engineered systems to be more robust with respect to future conditions. Here we emphasize the role MCDA can play within an overall adaptive management structure within the LACPR as a mechanism for addressing uncertainties within planning and, ultimately, the performance of the selected measures. In this sense, adaptive management transcends the planning process and encompasses the full life-cycle of LACPR, from planning through construction and operations and maintenance. The quantitative nature of MCDA provides a practical means for translating information regarding plan performance, which is collected over time, into a form that is relevant to future management decisions.

Attachment 1 – Stakeholder Workshop Participants

Table A1-1. Abbeville Participants 28 July: 21 participants

Name	Organization
Gerry Bodin	Private Citizen
Ronnie Bodin	Private Citizen
Charles Broussard	Vermilion Parish
Rebecca Broussard	Vermilion Parish Office of Homeland Security and Emergency Preparedness
Juanita Constible	National Wildlife Federation
Chad Courville	Miami Corporation
Tim Creswell	Vermilion Parish Office of Homeland Security and Emergency Preparedness
Daniel Didier	Natural Resources Conservation Service
Bob Gramling	University of Louisiana
Mandy Green	CPRA – Planning Branch
Lynn Guillory	Greater Abbeville-Vermilion Chamber of Commerce
Gwen Lanoux	FARM
Joseph LeBlanc	CPRA – Planning Branch
James R. LeLeux, Sr.	Vermilion Parish Cattlemen’s Association
Troy Mallach	Natural Resources Conservation Service
Summer Martin	CPRA
Donald Menard	Town of Erath
Randy Moertle	McLlhenny Co./Avery Island, Inc.
Robert Rusho	Private Citizen
Sherrill Sagrera	Vermilion Parish CRAC

Table A1-2. Lake Charles Participants 29 July: 17 participants

Name	**Organization**
Kirk Burleigh	Cameron Parish Police Jury
John Coppock	Calcasieu Parish Police Jury
Jennifer Grand	Ducks Unlimited, Inc.
Glenn Harris	SW Louisiana NWR Complex
Channing Hayden	Lake Charles Harbor and Terminal District
Courtney Hearod	U.S. Senator David Vitter
Tom Hess	LDWF
Earnestine Horn	Cameron Parish Police Jury
Dan Llewellyn	OCPR/CPRA
Randy Moertle	Little Lake Land Company/M.O. Miller Estates
David Richard	LLA
Dean Roberts	Stream Companies
Chris Simon	Simon and Delany
Natalie Snider	Coalition to Restore Coastal Louisiana
Rusty Vincent	CCA-LA
Donald Voros	US Fish and Wildlife Service
Carolyn Woosley	Coalition to Restore Coastal Louisiana

Table A1-3. New Orleans Participants 30 July: 44 participants

Name	**Organization**
David Cagnolatti	ConocoPhillips
Emily Campbell	ConocoPhillips
Paul Carroll	St. Tammany Parish Government
Brad Case	City of New Orleans
John Davis	Home Owners Association
Morgan Elzey	Common Ground Relief
Alexander Evans	Louisiana Recovery Authority
Kurt Evans	City of Kenner
Brian Fortson	St. Tammany Parish Government

Name	**Organization**
P.J. Hahn	Plaquemines Parish Government
Maurice Jordan	Tangipahoa Parish
Debbie Kelly	COPE
KC King	CHAT
John Koeferl	CAWIC
Shirley Laska	University of New Orleans
Carrie Bet Lasley	UNO-CHART
John Lopez	Lake Pontchartrain Basin Foundation
William McCartney	St. Bernard Parish Government
Randy Moertle	Biloxi Marsh Lands Corporation
Tina Morgan	OCPR
James Murphy	U.S. Maritime Administration
David Muth	NPS – Jean Lafitte NHP
Earthea Nance	City of New Orleans
Donald Olson	Citizen for a Safer Jefferson Parish
Paul Oncale	St. John the Baptist Parish
Amanda Phillips	Edward Wisner Donation
Mark Popovich	Shannon & Wilson
Gary Rauber	Lake Catherine Civic Association
Brittany Rojas	DOTD
Matt Rota	Gulf Restoration Network
Charlotte Ruiz	Citizens for a Safer Jefferson and Metairie Lake
Aloma Savastano	COPE
Mark Schexnayder	LA Sea Grant/Louisiana State University Agriculture Center
Mark Schleifstein	The Times-Picayune
Sam Scholle	St. Charles Parish
John Shadding, Jr.	City of Westwego
Judith Shaddinger	City of Westwego
DeEtte Smythe	St. Tammany Parish Government

Name	**Organization**
VJ St. Pierre	St. Charles Parish
Kelley Templet	OCPRA
Lou Vaughn	St. John Parish Planning and Zoning
John Wilson	Sewerage & Water Board of New Orleans
Marnie Winter	Jefferson Parish Environmental Affairs
Ann Yoachim	Tulane Institute on Water Resources Law & Policy

Table A1-4. Houma Participants 31 July: 32 participants

Name	**Organization**
Jane Arnette	SCIA
Gary Beadle	Town of Berwick
Steve Becnel	J Ray McDermott
Karim Belhadjali	CPRA
Henri Boulet	LA 1 Coalition
David Bourgeois	LA Sea Grant Marine Extension Program/Louisiana State University Agriculture Center
Nikki Buskey	The Houma Courier
Carl Callahan	City of Morgan City
Chett Chiasson	Port Fourchon
Crystal Chiasson	Lafouche Parrish Government
Kermit Coulon	LL&E/ConocoPhillips
Daniel Dearmond	LDNR
Jammie Favorite	CPRA
Alan Gibson	Buquet Corp.
Wes Kungel	Senator Mary Landrieu
Shane Landry	St. James Parish
Darin Lee	CPRA
Al Levron	Terrebonne Parish Government

Name	**Organization**
Greg Linscombe	Continental Land & Fur Company
Danny Lott	J Ray McDermott
Robert Mahoney	FHWA
Nicholas Matherne	Lafourche Parish Government
Phil Schexnayder	Gulf South Engineers, Inc.
James Setze	Federal Highway Administration
Cindy Steyer	Natural Resources Conservation Service
Leslie Suazo	Terrebonne Parish Government
Jeri Theriot	Congressman Melancon
Cyrus Theriot, Jr.	Harry Bourg Corp.
Luke Theriot	U.S. House of Representatives, LA-03
Kevin Voisin	Motivatit Seafoods, LLC
Paul Yakupzack	Terrebonne Parish – CZM

Attachment 2 –Stakeholder Workshop Script

Slide: Introduction to LACPR

Louisiana Coastal Protection and Restoration (LACPR)
Stakeholder Preference Assessment
State-wide Stakeholder Meetings
July 2008

Thanks for contributing your time, once again, and assisting us in identifying a good solution to meet the hurricane risk reduction needs of coastal Louisiana.

Slide: Purpose

We have one main purpose today: to capture your organization's preferences to assist us in identifying the best hurricane risk reduction system for coastal Louisiana.

Those of you that participate in the last session really helped the project planners refine our thinking on viable alternatives.

Your input from the last session was peer reviewed and incorporated into the project planning.

Those of you new to the process, we thank you for attending today and look forward to gaining from your valuable insight.

I want to stress that we are NOT voting today, we are assessing preferences through an objective process (recommended by the National Academy of Sciences) known as swing weighting.

Preferences are the key to understanding this process. We are asking you to make trade-offs among a set of performance outcomes for the hurricane risk reduction system. We will use these results to determine the outcomes that are most important to you. This will assist us in selecting the final alternatives we present in our report to the Assistant Secretary of the Army.

Slide: Since we last met…

We used the information from the last preference assessment to reduce the number metrics (removing 4 that had no impact on project selection).

We refined our planning options to better reflect the stakeholder preferences.

As I said, the metrics, process and results were externally reviewed and the remaining metrics represent valuable factors for our final decisions. We reduced the metric set from 14 to 10.

Slide: Agenda

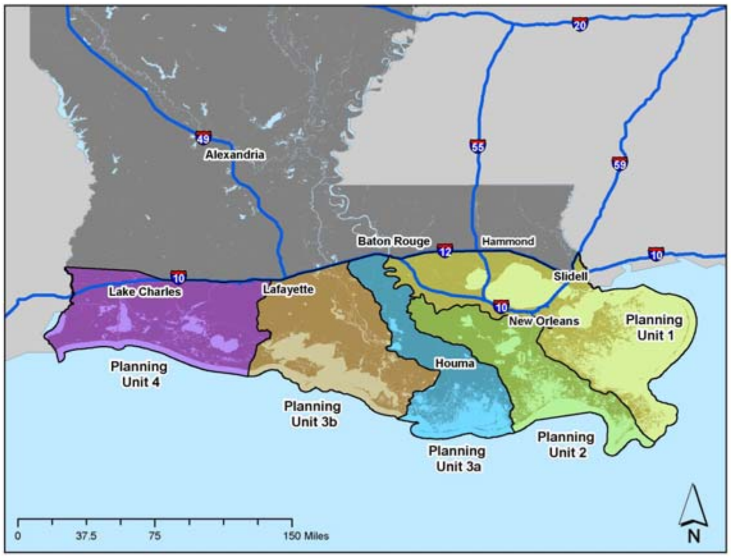
Brief introduction on status of LACPR Project

- Review metrics
- Introduce the preference assessment tool

- Capture information about your preferences
- Additional input for other planning units
- Review the path ahead

If you can only make this one session, but have input for other planning units, you will have the opportunity to provide input for each planning unit here today, if you wish.

Slide: Planning Area



We have 5 planning areas, planning area 3 was split early in the planning process and treated as 3a and 3b. We will be gathering input BY PLANNING AREA, and you will have a chance to provide information on your preferences for any or all areas.

Slide: General Categories of Alternatives

- No Action
- Coastal Restoration Only
- Non-Structural + Coastal Restoration
- Structural + Coastal Restoration
- Comprehensive Alternatives = Coastal Restoration + Non-Structural + Structural

Each alternative represents a collection of risk reduction measures that were screened prior to formulating alternatives to ensure consideration of the most effective and efficient plans. The information you provide today will have a significant effect in determining which alternatives provide the most desired result.

Two Slides: Path Ahead

- Identify the combination of plans that represent the most viable options for risk reduction for the state as a whole
- Develop supplemental information on alternative rankings and incremental plan performance
  - Planning team will consider additional combinations of life cycle project costs and risk reduction benefits (property, health and safety)
- Present all information to Corps decision-makers
  - Consider stakeholder preference patterns
  - Consider incremental cost analysis
  - Consider MCDA performed in real-time
  - Consider, rank and select plans
- Final Technical Report (FTR) will include:
  - External peer review
  - Refined evaluation data
  - Systems modeling analysis (LACPR and MSCIP)
  - Additional stakeholder engagement
  - Multi-Criteria Decision Analysis
  - Expanded risk assessment
  - Limited recommendations for further study
- Report to Chief of Engineer's

Slide: Introduction to Stakeholder Preference Assessment

I am going to provide a brief overview of:

- Why we need your input,
- The decision making tool we are using,
- How that tool is used by way of a car-buying example, and
- An overview of the survey instrument using the car buying example.

Slide: Why We Need Your Input

- We have characterized each alternative plan in terms of its performance with respect to selected metrics
- We need input from your organization on how much importance to place on each of these performance outcomes
- Your organization's opinions count!

Slide: Multi-Criteria Decision Analysis

MCDA is a tool for structuring and analyzing complex decisions. It is a tool that can be used to help make a decision.

Within MCDA, emphasis is given to:

- Defining the problem
- Establishing desired objectives
- Identifying metrics to represent progress toward those objectives
- Assessing the relative importance of those objectives
- Determining the level of satisfaction that stakeholders would derive from each alternative

Slide: Buying a Car: Sue and Bob Identify Performance Outcomes for the Family Car

Sue and Bob Identify Performance Outcomes for the Family Car

- Purchase cost ($)
- Resale value after three years (% of original price)
- Annual repair/maintenance cost ($/year)
- Fuel efficiency (mpg)
- Interior volume (ft^3)
- Style and comfort (qualitative)
- NHTSA safety rating (1 (low) to 5 (high))

One Team: Communicating, Collaborating, Consensus

This is a simple decision I think we can all identify with: buying a car. What do Sue and Bob Jones want in a new car? They listed their desired performance metrics that are important to them. In this case, they identified the following measures of performance:

- Purchase cost ($)
- Resale value after three years (% of original price)
- Annual repair/maintenance cost ($/year)
- Fuel efficiency (mpg)
- Interior volume (cubic feet)
- Style and comfort (qualitative) (poor, fair, good, finest)
- NHTSA safety rating (1 (worst) to 5 (best))

Slide: Sue and Bob Identify their Alternatives

Sue and Bob Identify their Alternatives

Metric	Units	Outcome			Best
		Worst			Best
Cost	Dollars	45,000			12,000
Resale Value After Three Years	% of Original Value	33			57
Repair/Maintenance Cost Per Year	Dollars	1,000			300
Fuel Efficiency	MPG	15			35
Interior Volume	ft^3	80			170
Style and Comfort	Qualitative	Poor			Finest
NHTSA Safety Rating	Scale (1-5); 1 is lowest	2			5

One Team: Communicating, Collaborating, Consensus

Sue and Bob determined the best and worst possible outcomes for their alternatives. The alternatives are a set of specific cars that they are interested in buying. No alternatives are worst or best in terms of all performance metrics. So they listed the best and worst potential outcomes for each of their performance metrics. Note that the worst outcome is not the outcome associate with a particular alternative. It is a hypothetical worst case outcome given the range of possible performance on each metric.

Slide: Sue and Bob Rank the Potential Improvements in the Worst Outcome

Sue and Bob Rank the Potential Improvements in the Worst Outcome

Sue Jones			Bob Jones		
Metric	Worst Outcome	Improve to:	Metric	Worst Outcome	Improve to:
Purchase cost ($)	$45,000	$12,000	Fuel efficiency (mpg)	15	35
Fuel efficiency (MPG)	15	35	Safety rating (1-5)	2	5
Safety rating (1-5)	2	5	Purchase cost ($)	$45,000	$12,000
Interior volume (ft^3)	80	170	Resale value (%)	33	57
Resale value (%)	33	57	Interior volume (ft^3)	80	170
R&M cost ($/year)	$1,000	$300	R&M cost ($/year)	$1,000	$300
Style (qualitative)	Poor	Finest	Style (qualitative)	Poor	Finest

One Team: Communicating, Collaborating, Consensus

Sue and Bob ranked the potential improvements to the hypothetical worst possible outcome. They ranked them in terms of how important each potential improvement is to them. Sue is most concerned about purchase cost and fuel efficiency, while Bob is most concerned with fuel efficient and safety. Note that they have difference rankings. Sue notes that there is a $33,000 potential improvement to purchase cost and this is her most important potential improvement. The next most important is fuel efficiency, etc.

Slide: Sue and Bob Rate the Potential Improvements in the Worst Outcome

Sue and Bob Rate the Potential Improvements in the Worst Outcome

Sue Jones			Bob Jones		
Metric	**Improvement**	**Rating**	**Metric**	**Improvement**	**Rating**
Purchase cost ($)	-$33,000	100	Fuel efficiency (mpg)	+ 20 mpg	100
Fuel efficiency (MPG)	+ 20 mpg	67	Safety rating (1-5)	+ 3 steps	100
Safety rating (1 - 5)	+ 3 steps	67	Purchase cost ($)	-$33,000	100
Interior volume (ft^3)	+ 90 ft^3	50	Resale value (%)	+ 24%	75
Resale value (%)	+ 24%	17	Interior volume (ft^3)	+ 90 ft^3	75
R&M cost ($/year)	- $700 /yr	17	R&M cost ($/year)	- $700 /yr	25
Style (qualitative)	+ 5 steps	17	Style (qualitative)	+ 5 steps	25

One Team: Communicating, Collaborating, Consensus

Sue and Bob then rate the potential improvements in terms of the relative importance to them. They give their top-ranked improvement a rating of 100. For Sue, this is the purchase cost. For Bob, this is fuel efficiency. Bob and Sue each rate the potential improvements in terms of how important it is to them relative to their top-ranked improvement.

Sue considers her second most important improvement relative to her top-ranked improvement. In this case increasing fuel efficiency 20 mpg is worth two-thirds as much to Sue as reducing the purchase price $33,000. Sue's third-ranked improvement is increasing the NHTSA Safety Rating. In this case, increasing the safety rating from 2 to 5, or three steps, is worth two-thirds as much as decreasing the purchase cost $33,000. Because Sue rates a three-step increase in the safety rating equally to the improvement in fuel efficiency, this means that she would be equally satisfied increasing the fuel efficiency 20 mpg as she would increasing the safety rating 3 steps.

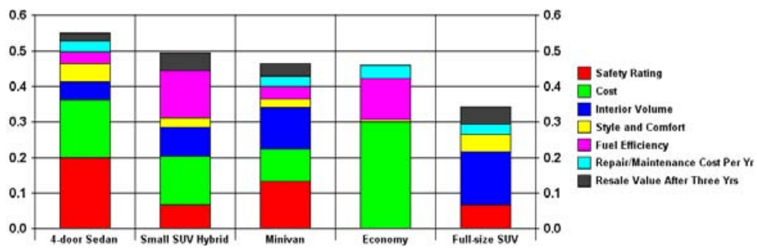
Bob's top-ranked improvement is increasing the fuel efficiency 20 mpg. He gives the next two improvements -- increasing the safety rating 3 steps and reducing the purchase cost $33,000 – a rating of 100 also. This indicates that he values these two improvements just as much as increasing fuel efficiency 20 mpg. He gives the 24% increase in the resale value and the 90 ft^3 increase in the interior volume a rating of 75, indicating that he values these potential improvements only 75% as much as the first three possible improvements.

Are there any questions?

Slide: Car Buying Example: Sue Ranks the Alternatives

Sue Ranks the Alternatives

- Sue prefers the 4-door sedan because it has a high safety rating and a low purchase price.



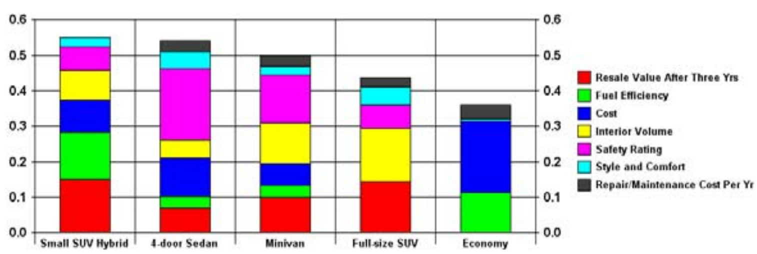
One Team: Communicating, Collaborating, Consensus

Since Sue emphasized cost and safety, these two metrics contribute most to the ranking of the top-ranked vehicle. As a result, the 4-door sedan is Sue's top ranked choice. Note her second ranked choice is the small SUV hybrid.

Slide: Car Buying Example: Using the Instrument

Bob Ranks the Alternatives

- Bob prefers the small SUV Hybrid because it has high resale value and high fuel efficiency.
- Even though Bob prefers the SUV, he and Sue are about equally satisfied with the 4-door sedan



One Team: Communicating, Collaborating, Consensus

Bob rated fuel efficiency and resale value highest; thus these two metrics contribute most to his top-ranked vehicle, the small SUV hybrid. Note his second ranked choice is the 4-door sedan and that these two choices have near identical rankings. For this reason, Bob and Sue will be roughly equally satisfied with the 4-door sedan as the small SUV hybrid.

What is accomplished here is that 5 car choices have been reduced to 2, allowing the Joneses to focus their choice between the 2 highest ranked vehicles. It must be emphasized that as this example shows, MCDA does not make the decision for you, it makes decision making easier and more transparent.

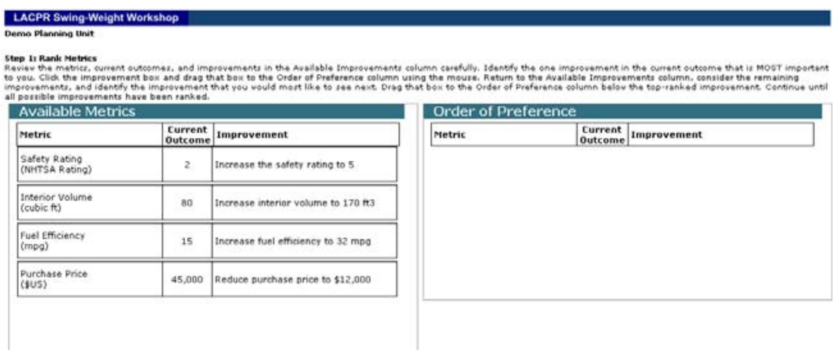
Slide: Car Buying Example: Using the Instrument

Swing weighting

- Step 1: Rank
- Step 2: Rate
- Step 3: Willingness-to-Tradeoff

We will demonstrate with the car buying example how you will use the instrument to provide your preferences.

Screen Shot: Step 1 Rank Metrics



Review the metrics, current outcomes and improvements in the Available Metrics column carefully.

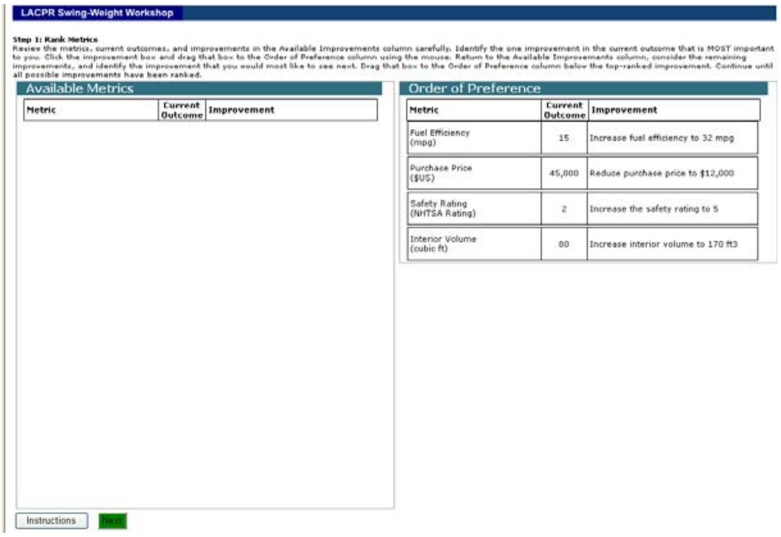
Column 1 titled "Metric" lists the metrics in a random order.

Column 2 titled "Current Outcome" lists a worst case outcome value for each metric.

Column 3 titled "Improvement" shows how the outcome values can be improved.

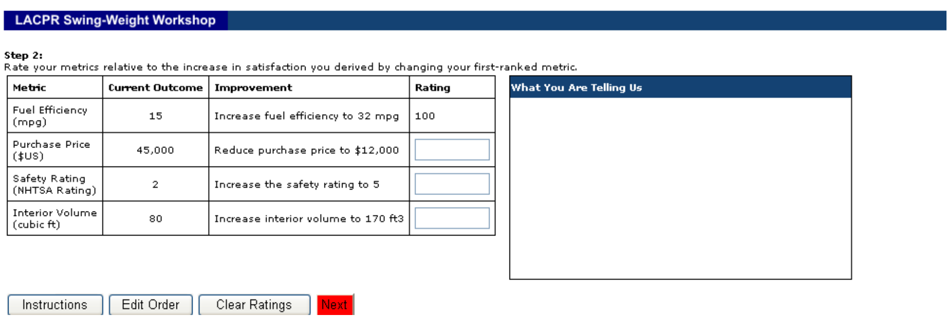
Identify the one improvement in the current outcome that is MOST important to you. Click the improvement box and drag that box to the Order of Preference column using the mouse.

Return to the Available Metrics column, consider the remaining improvements, and identify the improvement that you would most like to see next. Drag that box to the Order of Preference column below the top ranked improvement. Continue until all possible improvements have been made.



When you are satisfied with your ranking, click next.

Screen Shot: Step 2 Rate Your Metrics



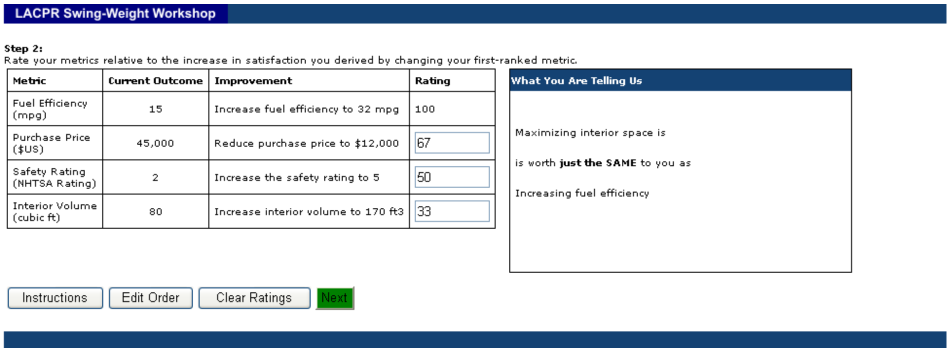
Rate the potential improvement in each metric relative to the increase in satisfaction you derived by changing your first-ranked metric.

Review the information in the "What You are Telling Us" dialogue box. This box describes the tradeoff that you are making. It describes the improvement you are making and says that you would derive the same level of satisfaction from this improvement as from some fraction of your top-ranked improvement.

We are demonstrating:

- If I rate all improvements 100, I am saying that they are all equally important to me
- If I put a 50 in the rating box, that means that I value the improvement half as much as the top-ranked improvement

Screen Shot: Willingness to tradeoff



LACPR Swing-Weight Workshop

Step 2:
Rate your metrics relative to the increase in satisfaction you derived by changing your first-ranked metric.

Metric	Current Outcome	Improvement	Rating
Fuel Efficiency (mpg)	15	Increase fuel efficiency to 32 mpg	100
Purchase Price ($US)	45,000	Reduce purchase price to $12,000	67
Safety Rating (NHTSA Rating)	2	Increase the safety rating to 5	50
Interior Volume (cubic ft)	80	Increase interior volume to 170 ft3	33

What You Are Telling Us

Maximizing interior space is

is worth **just the SAME** to you as

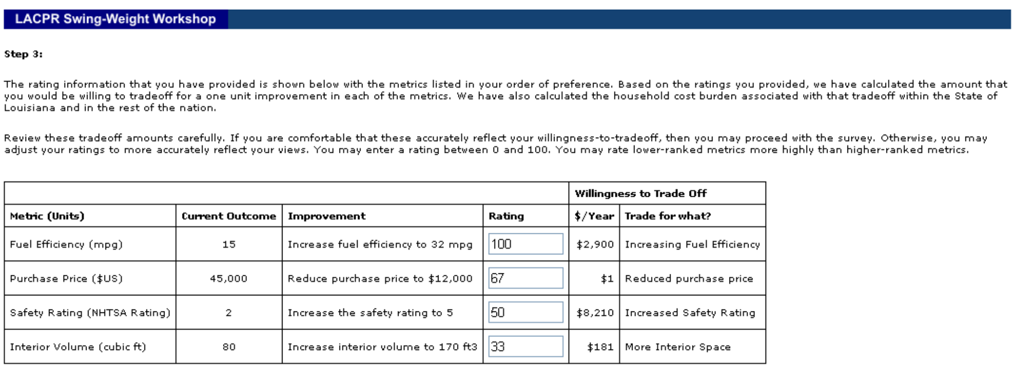
Increasing fuel efficiency

Instructions | Edit Order | Clear Ratings | Next

Note in the above screen grab that this is dollars for a one unit change in the metric.

The rating information that you have provided is shown here with the metrics listed in your order of preference. Based on the ratings you provided, we have used indirect monetization to calculate the dollar amount that you would be willing to tradeoff for a one unit improvement in each of the metrics.

Review these tradeoff amounts carefully. If you are comfortable that these accurately reflect your willingness-to-tradeoff, then you are done with this exercise. Otherwise, you may adjust your ratings to more accurately reflect your views. You may enter a rating between 0 and 100. You may rate lower-ranked metrics more highly than higher-ranked metrics.



LACPR Swing-Weight Workshop

Step 3:

The rating information that you have provided is shown below with the metrics listed in your order of preference. Based on the ratings you provided, we have calculated the amount that you would be willing to tradeoff for a one unit improvement in each of the metrics. We have also calculated the household cost burden associated with that tradeoff within the State of Louisiana and in the rest of the nation.

Review these tradeoff amounts carefully. If you are comfortable that these accurately reflect your willingness-to-tradeoff, then you may proceed with the survey. Otherwise, you may adjust your ratings to more accurately reflect your views. You may enter a rating between 0 and 100. You may rate lower-ranked metrics more highly than higher-ranked metrics.

				Willingness to Trade Off	
Metric (Units)	**Current Outcome**	**Improvement**	**Rating**	**$/Year**	**Trade for what?**
Fuel Efficiency (mpg)	15	Increase fuel efficiency to 32 mpg	100	$2,900	Increasing Fuel Efficiency
Purchase Price ($US)	45,000	Reduce purchase price to $12,000	67	$1	Reduced purchase price
Safety Rating (NHTSA Rating)	2	Increase the safety rating to 5	50	$8,210	Increased Safety Rating
Interior Volume (cubic ft)	80	Increase interior volume to 170 ft3	33	$181	More Interior Space

The willingness to trade-off amount is the most that you would be willing to pay for a one-unit change in the performance outcome. For example, based on our ratings, the most we would be willing to trade in monetary terms for a one mpg increase in fuel efficiency is $2,900.

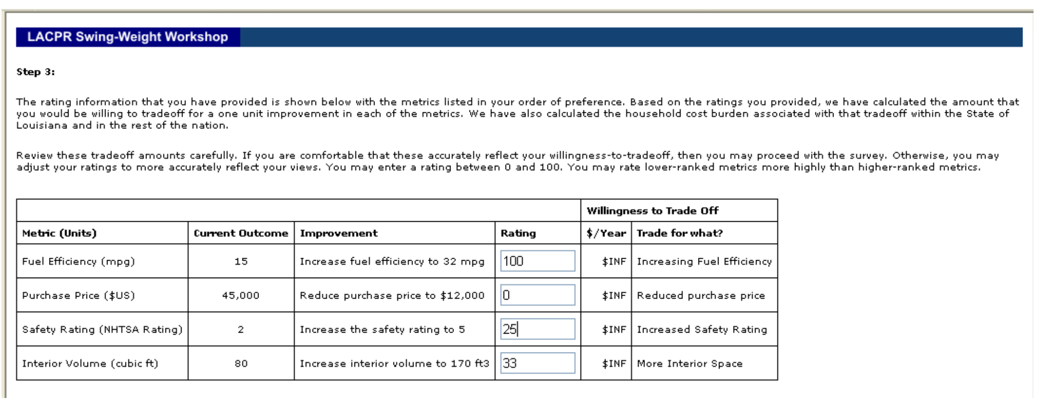
- The most that we would be willing to pay to reduce the purchase price $1 is $1.
- The most that we would be willing to pay to increase the safety rating one step is $8210.
- The most that we would be willing to pay to increase the interior volume 1 cubic foot is $181.

This means that I would be just as satisfied with increasing my fuel efficiency 1 mpg and having $2900.

Now suppose that I am dissatisfied with these willingness to trade-off amounts. I can change the ratings for each of the metric improvements. For example, suppose I think that a one step improvement in the safety rating is not worth $8210, I can reduce the rating on this metric improvement. Suppose I think it is worth only half as much, I would reduce my rating to 25. In that case, my willingness to trade off for a one step increase in the safety rating decreases to $4100.

Notice that my rating for this metric improvement is now lower than the rating for the next metric improvement (33). There are no restrictions that require higher ranked metric improvements to have a higher rank.

Now suppose that I reduce the rating on the purchase price from 67 to 30. This means that I value money less; therefore, the willingness to tradeoff amounts for all metric improvements increases. In other words, I am saying that money is worth less to me, therefore I'd be willing to trade more money for these other benefits. Increasing rating on cost improvement means I value money more highly, therefore my willingness to trade off amounts for all other possible improvements decreases.


LACPR Swing-Weight Workshop

Step 3:

The rating information that you have provided is shown below with the metrics listed in your order of preference. Based on the ratings you provided, we have calculated the amount that you would be willing to tradeoff for a one unit improvement in each of the metrics. We have also calculated the household cost burden associated with that tradeoff within the State of Louisiana and in the rest of the nation.

Review these tradeoff amounts carefully. If you are comfortable that these accurately reflect your willingness-to-tradeoff, then you may proceed with the survey. Otherwise, you may adjust your ratings to more accurately reflect your views. You may enter a rating between 0 and 100. You may rate lower-ranked metrics more highly than higher-ranked metrics.

				Willingness to Trade Off	
Metric (Units)	**Current Outcome**	**Improvement**	**Rating**	**$/Year**	**Trade for what?**
Fuel Efficiency (mpg)	15	Increase fuel efficiency to 32 mpg	100	$INF	Increasing Fuel Efficiency
Purchase Price ($US)	45,000	Reduce purchase price to $12,000	0	$INF	Reduced purchase price
Safety Rating (NHTSA Rating)	2	Increase the safety rating to 5	25	$INF	Increased Safety Rating
Interior Volume (cubic ft)	80	Increase interior volume to 170 ft3	33	$INF	More Interior Space

If I put a 0 in the cost metric, am I saying that I do not value money at all (see above screen shot). Therefore, I'd be willing to pay an infinite amount of money for a one unit improvement of any metric. $INF stands for infinity.

Slide: Metric Value Implications
This slide was also provided to all participants as a handout.

Metric Value Implications

How Plans Rank for Each Metric

METRIC	BEST CASE VALUES	WORST CASE VALUES
Population Impacted	Comprehensive (some exceptions)	No Action or Coastal Only
Residual Damages	Nonstructural (some exceptions)	No Action or Coastal Only
Life Cycle Cost	No Action or Coastal Only	Large Structural or Comprehensive
Construction Time	No Action or Small Structural	Nonstructural (some exceptions)
Employment Impacted	Nonstructural (some exceptions)	No Action or Coastal Only (some exceptions)
Indirect Environmental Impact Score	No Action or Coastal Only (some exceptions)	Large Structural or Comprehensive
Direct Wetland Impacts	No Action or Coastal Only	Large Structural or Comprehensive
Historic Properties Protected	Large Structural or Comprehensive	No Action or Nonstructural (some exceptions)
Historic Districts Protected	Large Structural or Comprehensive	No Action or Nonstructural (some exceptions)
Archeological Sites Protected	Large Structural or Comprehensive	No Action or Nonstructural

- This Metric Value Implications chart describes (in general) which categories of plans would rank highest for the Best Case Metric Values (Best Performing Plans for that metric) and which categories of plans would rank lowest for the Worst Case Metric Values (Worst Performing Plans for that metric).
- These categories and their exceptions will be discussed in more detail once we discuss the individual metrics and their definitions.

Note:

- "Small" means limited area included in risk reduction measures and/or 100-yr level of risk reduction provided.
- "Large" means expanded area included in risk reduction measures and/or 400/1000-year level of risk reduction provided.

Slides: Overview of Metrics and their Definitions

Handouts: The following three pages were provided to all participants as handouts before beginning each session. The metrics, units, definitions, metric value implications, and worst case outcome and best case improvement for each of the five planning units that are described in the handouts were shown to participants using PowerPoint slides before starting the survey instrument.

Louisiana Coastal Protection and Restoration (LACPR) Metrics
Page 1 of 3

Metric (Units)	**Population Impacted (# of people/year)**				
Metric Definition	The number of residents who would experience any amount of flooding after implementation of an alternative plan. This metric represents the residual risk to health and safety of the residential population impacted.				
Metric Value Implications	In general, the worst case value for this metric represents no action. All risk reduction measures (coastal, nonstructural, and structural) provide improvement in value for this metric. However, because raise-in-place components do not eliminate risk to people, nonstructural measures may not be the most effective in reducing this metric value.				
Planning Unit	**1**	**2**	**3a**	**3b**	**4**
Worst Case Outcome	55,748	31,441	20,522	8,345	5,279
Best Case Improvement	25,257	7,845	5,049	1,526	1,698

Metric (Units)	**Residual Damages ($ Millions/year)**				
Metric Definition	The remaining risk to assets from flooding after implementation of an alternative plan. Residual damages include damages to residential and non-residential properties, emergency response costs, losses to agricultural resources, and damages to transportation infrastructure.				
Metric Value Implications	In general, the worst case value for this metric represents no action. All risk reduction measures (coastal, nonstructural, and structural) provide improvement in value for this metric.				
Planning Unit	**1**	**2**	**3a**	**3b**	**4**
Worst Case Outcome	2,129	2,285	1,221	529	465
Best Case Improvement	151	110	149	70	87

Metric (Units)	**Life Cycle Cost ($ Millions/year)**				
Metric Definition	The total cost of implementing an alternative plan, which includes engineering and design, construction, facility relocation, operations and maintenance, real estate, and mitigation costs. State and local costs would be 35% or more of the total cost.				
Metric Value Implications	The best case value for this metric represents no action. All risk reduction measures (coastal, nonstructural, and structural) serve to increase the value for this metric.				
Planning Unit	**1**	**2**	**3a**	**3b**	**4**
Worst Case Outcome	3,777	3,147	2,765	1,857	1,388
Best Case Improvement	0	0	0	0	0

Metric (Units)	**Construction Time (Years)**				
Metric Definition	The length of time required to design and construct an alternative plan so that most of its intended benefits are realized.				
Metric Value Implications	The best case value for this metric represents no action. All risk reduction measures (coastal, nonstructural, and structural) serve to increase the value for this metric.				
Planning Unit	**1**	**2**	**3a**	**3b**	**4**
Worst Case Outcome	16	15	15	15	15
Best Case Improvement	0	0	0	0	0

Louisiana Coastal Protection and Restoration (LACPR) Metrics
Page 2 of 3

Metric (Units)	**Employment Impacted (# of jobs disrupted/year)**				
Metric Definition	The number of jobs that would be disrupted for one or more days as a direct consequence of flooding after implementation of an alternative plan.				
Metric Value Implications	In general, the worst case value for this metric represents no action. All risk reduction measures (coastal, nonstructural, and structural) provide some improvement in value for this metric.				
Planning Unit	**1**	**2**	**3a**	**3b**	**4**
Worst Case Outcome	11,040	9,325	6,024	2,358	1,105
Best Case Improvement	411	300	557	308	225

Metric (Units)	**Indirect Environmental Impact Score (Unit-less scale: -8 to +8)**				
Metric Definition	The severity of potential aquatic ecosystem impacts (positive or negative) relative to other alternatives in the planning unit. This metric considers impacts to hydrology, fisheries, the potential to induce development of wetlands, and consistency with coastal restoration goals. Qualitative scores fall within the following ranges: -8 to -5 = Highly adverse impact, -4 to -1 = Moderately adverse impact; 0 = No impact (or sum of positive and negative impacts equal to zero); 1 to 4 = Moderately positive impact; 5 to 8 = Highly positive impact.				
Metric Value Implications	The no action value for this metric is represented by zero. The relative influence on the value for this metric varies for structural risk reduction measures. Nonstructural and coastal measures do not produce any value for this metric.				
Planning Unit	**1**	**2**	**3a**	**3b**	**4**
Worst Case Outcome	-8	-8	-7	-8	-6
Best Case Improvement	0	4	0	2	0

Metric (Units)	**Direct Wetland Impacts (acres)**				
Metric Definition	The amount of wetlands that would be displaced by an alternative plan. The acreage impacted includes the levee footprint and adjacent borrow areas used for levee construction. These wetland impacts would be offset by creating more acres of wetlands within the impacted basin.				
Metric Value Implications	The best case value for this metric represents no action or no structural risk reduction action. Nonstructural and coastal measures do not produce any value for this metric. Structural measures serve to increase values for this metric.				
Planning Unit	**1**	**2**	**3a**	**3b**	**4**
Worst Case Outcome	9,100	9,500	6,600	5,200	2,500
Best Case Improvement	0	0	0	0	0

Louisiana Coastal Protection and Restoration (LACPR) Metrics

Metric (Units)	**Historic Properties Protected (# of properties)**				
Metric Definition	The number of historic properties protected by an alternative plan. Historic properties include those listed or eligible for listing on the US Park Service's National Register of Historic Places or register of National Historic Landmarks. Historic properties are protected by hurricane risk reduction alternatives that reduce land loss, erosion, and flooding.				
Metric Value Implications	The worst case value for this metric represents no action. All risk reduction measures (coastal, nonstructural, and structural) provide some improvement in value for this metric.				
Planning Unit	**1**	**2**	**3a**	**3b**	**4**
Worst Case Outcome	119	11	0	2	0
Best Case Improvement	159	27	18	20	3

Metric (Units)	**Historic Districts Protected (# of districts)**				
Metric Definition	The number of historic districts protected by an alternative plan. Historic districts encompass living communities consisting of clusters of historic buildings and/or other structures that share a similar date or theme. Historic districts are protected by hurricane risk reduction alternatives that reduce land loss, erosion, and flooding.				
Metric Value Implications	The worst case value for this metric represents no action. All risk reduction measures (coastal, nonstructural, and structural) provide some improvement in value for this metric.				
Planning Unit	**1**	**2**	**3a**	**3b**	**4**
Worst Case Outcome	38	0	0	0	0
Best Case Improvement	52	9	1	5	0

Metric (Units)	**Archaeological Sites Protected (# of sites)**				
Metric Definition	The number of archeological sites protected by an alternative plan. Archeological sites may include the remains of buildings, trash pits, hearths, pottery and tools (stone, metal and other materials). Archeological sites are protected by hurricane risk reduction system alternatives that reduce land loss, erosion, and flooding.				
Metric Value Implications	The worst case value for this metric represents no action. All risk reduction measures (coastal, nonstructural, and structural) provide some improvement in value for this metric.				
Planning Unit	**1**	**2**	**3a**	**3b**	**4**
Worst Case Outcome	111	42	72	14	29
Best Case Improvement	363	502	203	312	140

Introduction for the Survey Instrument

Tradeoffs are an inherent part of most decisions. For example, when we buy a car, we want the nicest car money can buy. However, if our supply of money is limited, we must choose from among the available amenities. Everybody is willing to pay more for some amenities than others. For example, some people are willing to pay more for safety features than speed or style. Others value speed and style over safety. Still others are willing to sacrifice speed, style, and safety to save money. The car that we eventually purchase represents a compromise that reflects our individual preferences, or our willingness to make tradeoffs among the various amenities that are available to us.

1. Screen Shot: Log-in

This is the log-in screen. We ask that you complete all fields, but only your first and last name, your organization's name and planning unit are required. Your responses to this survey instrument are specific to that planning unit. You may repeat the survey for additional planning units after you have completed your first survey.

All of you have been invited to represent your organization's views in this survey. Therefore, please respond to this survey considering your organization's views. However, if you are representing yourself rather than your organization, please indicate this when you login. Individual input will receive equal consideration in our analysis of the alternatives.

This log-in information will be retained to document your attendance and will be stored separately from your responses to the survey. Your responses to the survey will not be published or otherwise released along with any information that might be used to identify you.

Click create account.

2. Screen Shot: Initial Survey

These survey questions will help us understand why some people's weights are different than other people's weights. Read each question and fill-in the button that describes how strongly you agree or disagree with each statement.

Your responses to the initial survey will not be published or otherwise released along with any information that might be used to identify you.

You must provide answers to all questions before you will be allowed to proceed.

Click complete survey and proceed.

3. Screen Shot: Step 1 Rank Metrics Screen

Introduction

In this activity you will consider a set of outcomes from the LACPR decision in a planning unit and you will be asked to rank the importance of various improvements in ten metrics in order of your organization's preferences.

Column 1 titled "Metric" lists the metrics in a random order (refer to the handout for a more detailed description of these metrics).

Column 2 titled "Current Outcome" lists a worst case outcome value for each metric.

Column 3 titled "Improvement" shows how the outcome values can be improved.

Carefully consider the outcome and the potential improvements in that outcome that are available to you. Choose the improvement in Column 1 that describes the change that you would MOST like to see. Drag it over to the bottom right, under "Order of Preference." Review the information in the "What You are Telling Us" dialogue box. If you agree with the statement, click the Close button. Otherwise, move the metric row up or down within the "Order of Preference" list or back to the list of "Available Metrics." Repeat this process until all the items have been moved to the right. If at any time you decide that you don't like the order of the metric rows, you can adjust the ranks by selecting a row and moving it up or down the list. Each time you move an item, you will need to re-confirm that you agree with the statement in the dialogue box. After all possible improvements have been ranked, you may proceed to the next step.

What to Do If You Make a Mistake
If at any time you decide that you don't like the order of the list in Columns 4-6, you can adjust the ranks by selecting a tab and moving it up or down the list. You can also move the tab back to the “Available” Column. Each time you re-rank an item, you will need to re-confirm that you agree with the statement in the dialogue box. You are done after you rank all possible improvements.

When you are finished, click next.

4. Screen Shot: Step 2 Rating Screen

Listed below in Columns 1 - 3 are the metrics, outcomes, and improvements in the order that you provided in the last screen. Your top-ranked improvement has been given a rating of 100.

Consider the next possible improvement and rate how important that improvement is relative to your top ranked improvement. For example, if that improvement would be equally important to you as your top-ranked improvement, then place a 100 in the space provided. If that improvement would be worth only half as much to you, place a 50 in the space provided. If that improvement would be worth nothing to you, place a 0 in the space provided. Assume the improvements would occur with all other metric outcomes, including your top-ranked metric outcome, at their hypothetical level.

You may assign a rating between 0 and 100. No lesser ranked improvement may receive a rating that is greater than the one above it.

If at any time you would like to revise your order of preference in this table, you may click the Edit Order button provided to return to the previous step in which you ranked the improvements to metric outcomes. If you wish to revise some of your ratings, you can type over them, or if you wish to clear all of your ratings, you can click the Clear Ratings button.

When you are finished, click next.

5. Screen Shot: Step 3

On the next page, we will show a table (also shown below) that lists:

- the metric;
- the current outcome;
- the improvement;
- your current rating for each metric;
- the national maximum willingness-to-tradeoff (WTT) for a unit improvement in each metric implied by your ratings;
- the average household WTT within the State of Louisiana and the rest of the nation that would be needed to support your assessment of the national maximum WTT.

Based on your responses in the previous section, we have inferred what you believe to be the aggregate national maximum WTT for a one unit improvement in each metric. Your maximum WTT for something depends upon your personal values. It is the most money that you believe the nation would be willing to pay in exchange for achieving a unit of improvement in each metric outcome. In other words, it means that the nation would derive the same level of satisfaction from having that sum of money as from achieving the indicated improvement. **This amount does not represent the actual cost.**

For example, if you rated a 50 acre decrease in wetland acreage lost and mitigated twice as highly as $100 million per year reduction in life-cycle costs, your WTT in monetary terms for that increase in wetland acreage would be twice the potential reduction in life-cycle cost, or $200 million per year. Your WTT for a one acre change in the area of wetlands lost and mitigated would be $200 million per year divided by 50 acres, or $4 million per wetland acre per year. This is the most you would be willing-to-tradeoff for a one unit improvement in the metric, not the actual cost of that improvement. The table shows the average household maximum WTT that would be required to support your assessment of the national aggregate maximum WTT. These estimates reflect an allocation of 35% of the WTT amount, the approximate state cost share, to Louisiana households and the remainder to the nation as a whole.

In the next task, you will carefully consider the amounts in your WTT column. If you are satisfied with each WTT amount, then do nothing. However, if you are not satisfied with the tradeoff amount, you may edit the rating.

Click next.

6. Screen Shot: Step 3 Continued

The rating information that you have provided is shown below with the metrics listed in your order of preference. Based on the ratings you provided, we have calculated the Total WTT amount for a one unit improvement in each of the metrics. To help you interpret these large numbers, we have also calculated the average household WTT required to support the total national WTT within the State of Louisiana and in the rest of the nation.

Review these tradeoff amounts carefully. If you are comfortable that these accurately reflect your willingness-to-tradeoff, then you may proceed with the survey. Otherwise, you may adjust your ratings to more accurately reflect your views. You may enter a rating between 0 and 100. You may rate lower-ranked metrics more highly than higher-ranked metrics.

- If you change the rating for an improvement in a metric other than life-cycle cost, the WTT amount for that metric will update.
- If you change the rating for the life-cycle cost improvement, all WTT amounts will update except the amount for the life-cycle cost metric. This is because improvements in the life-cycle cost are the reference variable.
- If you rate an improvement in any metric other than life-cycle cost 0, this implies that you do not value improvements in this metric at all and therefore, would not be willing to trade money for any amount of improvement.
- If you rate an improvement in the life-cycle cost metric 0, this implies that you do not value money at all and would therefore be willing to pay an infinite amount for a unit improvement in any metric. In this case, you would see $INF in the WTT column.

Your responses to this portion of the survey are in no way constrained by your previous responses.

When finished, click I am satisfied with my ratings and wish to proceed.

7. Screen Shot: Step 4 Choice Experiments

You are being asked to make a series of ten choices between two possible decision outcomes. Carefully consider the two possible decision outcomes shown in the table below. Each outcome differs in terms of one or more metrics. There are ten such outcome screens. Fill in the radio button underneath the outcome you prefer and click the submit button to proceed to the next screen.

When you have made your choices for all ten decision outcomes, the instrument automatically forwards to the exit interview screen.

8. Screen Shot: Exit Interview

We want to know how well you understood what you were doing while completing the survey instrument. We also want your opinion on this process. Please let us know how well we did.

When finished, click submit.

9. Screen Shot: Exit Screen

Thank you for your participation in this stakeholder assessment. Please wait for the administrator to initiate a new session and Click Here to continue and start another planning unit or Click Here to log out.

Slide: How will we use this Information?

The information about your preferences that we gather today will be used to identify what alternatives lead to the most desirable outcomes given those preferences.

Attachment 3 – Stakeholder Initial Survey Results

Participants were asked a series of eight questions in the initial survey. The purpose of the initial survey was to generate additional information that may explain observed stakeholder preference patterns. For example, when asked if their organization has changed significantly as a direct result of hurricanes Katrina and Rita, most respondents (108 of 154) agreed or strongly agreed. When asked if they believe that wetlands alone, in sufficient quantities, would provide a buffer against future storm surge, 95 of 154 participants disagreed or strongly disagreed. One hundred thirteen of 154 respondents indicated that they disagreed or strongly disagreed with the statement that sea level rise will have a meaningful impact on the economy of the Louisiana coast over the next fifty years. When asked whether there is an adequate hurricane risk reduction system that provides direct benefits to the area where their organization's interests are located, 121 of 154 participants disagreed or strongly disagreed.

Responses to Entry Survey Question 1

My organization has changed significantly as a direct result of Hurricanes Katrina and/or Rita.	Planning Unit					Total
	1	2	3a	3b	4	
Strongly disagree	0	0	2	1	4	7
Disagree	3	3	6	6	7	25
No opinion	4	3	3	1	3	14
Agree	20	14	14	11	8	67
Strongly agree	18	7	5	6	5	41
Total responses	45	27	30	25	27	154

Responses to Entry Survey Question 2

My organization believes that wetlands alone, in sufficient quantity, would provide a buffer against future storm surge	Planning Unit					Total
	1	2	3a	3b	4	
Strongly disagree	8	3	4	6	4	25
Disagree	19	14	16	11	10	70
No opinion	2	1	1	1	4	9
Agree	13	4	7	3	5	32
Strongly agree	3	5	2	4	4	18
Total responses	45	27	30	25	27	154

Responses to Entry Survey Question 3

My organization believes that it is unlikely that sea-level rise will have any meaningful impact on the economy of the Louisiana coastal area over the next fifty years.	Planning Unit					Total
	1	2	3a	3b	4	
Strongly disagree	14	9	10	10	3	46
Disagree	23	9	16	5	14	67
No opinion	3	4	3	5	6	21
Agree	2	0	1	2	0	5
Strongly agree	3	5	0	3	4	15
Total responses	45	27	30	25	27	154

Responses to Entry Survey Question 4

Since Hurricanes Katrina and Rita, my organization has invested a lot of money to reduce the impact of natural disasters that may occur in the future.	Planning Unit					Total
	1	2	3a	3b	4	
Strongly disagree	1	1	1	1	1	5
Disagree	8	2	3	4	4	21
No opinion	7	4	7	7	6	31
Agree	17	13	11	11	10	62
Strongly agree	12	7	8	2	6	35
Total responses	45	27	30	25	27	154

Responses to Entry Survey Question 5

There is an adequate hurricane risk reduction system that provides direct benefits to the area where my organization's interests are located.	Planning Unit					Total
	1	2	3a	3b	4	
Strongly disagree	20	9	14	11	10	64
Disagree	15	12	9	10	11	57
No opinion	4	1	1	2	2	10
Agree	4	3	6	2	3	18
Strongly agree	2	2	0	0	1	5
Total responses	45	27	30	25	27	154

Responses to Entry Survey Question 6						
My organization believes that it may be more important to preserve significant archeological and historical heritage sites in Louisiana than it is to provide hurricane risk reduction to some of the more remote communities along the coast.	**Planning Unit**					**Total**
	1	**2**	**3a**	**3b**	**4**	
Strongly disagree	9	5	6	6	5	31
Disagree	18	10	15	13	9	65
No opinion	13	9	6	6	10	44
Agree	5	3	1	0	2	11
Strongly agree	0	0	2	0	1	3
Total responses	45	27	30	25	27	154

Responses to Entry Survey Question 7						
My organization is deeply concerned about the effects that climate change may have on future generations.	**Planning Unit**					**Total**
	1	**2**	**3a**	**3b**	**4**	
Strongly disagree	6	1	2	2	1	12
Disagree	6	2	3	5	2	18
No opinion	8	6	7	6	8	35
Agree	15	10	14	4	11	54
Strongly agree	10	8	4	8	5	35
Total responses	45	27	30	25	27	154

Responses to Entry Survey Question 8						
For the questions above, my own personal views align closely with those of my organization.	**Planning Unit**					**Total**
	1	**2**	**3a**	**3b**	**4**	
Strongly disagree	1	0	1	1	0	3
Disagree	2	0	1	1	2	6
No opinion	2	2	5	3	5	17
Agree	23	19	19	12	15	88
Strongly agree	17	6	4	8	5	40
Total responses	45	27	30	25	27	154

Attachment 4 – Stakeholder Exit Survey Results

Participants answered a series of questions to complete the survey instrument. The purpose of the exit survey was to expose the respondents to a series of questions that would identify their level of understanding of what they had done, the instrument's ease of use, and future improvements they would like to see made to the weight elicitation process. While completing the exit survey, the preponderance of the participants indicated they understood what they had done. When asked how well they understood the metrics, performance outcomes and tradeoffs, the majority of participants indicated they knew about the same or knew more than before. Ninety-six of 154 participants admitted to having questions about the willingness-to-tradeoff amount, but most agreed that having the information that was provided to them on the amount helped them refine their ratings. When asked questions related to the amount of preparatory materials and instructions provided and the amount of time allotted to complete the survey, most participants indicated that these amounts were about right (60% to 91%). Lastly, 104 of 154 respondents (68%) stated that they would recommend this survey technique for similar evaluations. The level of understanding exhibited by the participants suggests that the preference values they provided are valid.

Response	*Number of Respondents*	How well do you feel you understand the metrics and performance outcomes for the hurricane risk reduction alternatives now that you have completed the survey?
1	5	*Less than before taking the survey*
2	65	*About the same as before taking the survey*
3	84	*More than before taking the survey*

Response	*Number of Respondents*	How well do you feel that you understand the tradeoffs that are involved in choosing a hurricane risk reduction alternative?
1	15	*Less than before taking the survey*
2	68	*About the same as before taking the survey*
3	71	*More than before taking the survey*

Response	*Number of Respondents*	How well do you feel that you understand what the maximum willingness-to-tradeoff amount represents?
1	10	*Not at all*
2	96	*I have some questions about what this amount represents*
3	48	*I have a full understanding of what this amount represents*

Response	*Number of Respondents*	Do you feel that having information on the maximum willingness-to-tradeoff amount for each improvement helped you refine your rating scale?
1	3	*Disagree strongly*
2	13	*Disagree*
3	38	*No opinion*
4	83	*Agree*
5	17	*Agree strongly*

Response	*Number of Respondents*	The amount of information that I received about the LACPR project in preparation for participating in this survey was:
1	56	*Too little*
2	93	*About right*
3	5	*Too much*

Response	*Number of Respondents*	The instructions that I received regarding how to use the survey instrument were:
1	12	*Too little*
2	136	*About right*
3	6	*Too much*

Response	*Number of Respondents*	The amount of time provided to complete the survey was:
1	12	*Too little*
2	140	*About right*
3	2	*Too much*

Response	*Number of Respondents*	Would you recommend this survey technique be used for similar evaluations?
1	104	*Yes (100)*
2	50	*No (0)*

Response	*Number of Respondents*	How would you prefer to receive information regarding the LACPR swing-weight exercise?
1	117	*Send me an email*
2	17	*Post updates to the LACPR web page*
3	1	*Teleconference*
4	17	*Other*
5	2	*In- person meetings*

Response	*Number of Respondents*	If the same survey were given to 100 people, what percentage do you believe would agree with you on the ranking of your top-ranked improvement (metric)?
0	0	*0%*
1	1	*10%*
2	10	*20%*
3	12	*30%*
4	9	*40%*
5	21	*50%*
6	12	*60%*
7	25	*70%*
8	33	*80%*
9	25	*90%*
10	6	*100%*

Response	*Number of Respondents*	If the same survey were given to 100 people, what percentage would agree with you on the ranking of your lowest-ranked improvement (metric)?
0	0	*0%*
1	3	*10%*
2	8	*20%*
3	10	*30%*
4	9	*40%*
5	17	*50%*
6	13	*60%*
7	37	*70%*
8	28	*80%*
9	24	*90%*
10	5	*100%*

Attachment 5. Swing Weights for Stakeholders Participating in LACPR Workshops, July 2008.

Respondent	PU	SESSION	SWT_POP	SWT_DAM	SWT_COST	SWT_TIME	SWT_EMP	SWT_IEI	SWT_DWI	SWT_HPRO	SWT_HDIS	SWT_ASIT
1	1	New Orleans 073008 AM	0.13120	0.10204	0.29155	0.14577	0.07289	0.18950	0.05831	0.00292	0.00292	0.00292
2	1	New Orleans 073008 AM	0.17857	0.17857	0.05357	0.08929	0.08929	0.08929	0.17857	0.03571	0.07143	0.03571
3	1	New Orleans 073008 AM	0.18095	0.19048	0.01905	0.05714	0.17143	0.09524	0.15238	0.03810	0.05714	0.03810
4	1	Houma 080109 PM	0.19417	0.19417	0.09709	0.09709	0.17476	0.02913	0.02913	0.01942	0.14563	0.01942
5	1	Lake Charles 0729 PM	0.05435	0.10870	0.17391	0.17391	0.10870	0.16304	0.21739	0.00000	0.00000	0.00000
6	1	New Orleans 073008 AM	0.15652	0.13043	0.16522	0.12174	0.12174	0.01739	0.17391	0.03478	0.03478	0.04348
7	1	New Orleans 073008 AM	0.11215	0.11215	0.14953	0.14953	0.09346	0.05607	0.18692	0.04673	0.04673	0.04673
8	1	New Orleans 073008 AM	0.14286	0.07937	0.12698	0.12698	0.07937	0.09524	0.15873	0.06349	0.06349	0.06349
9	1	New Orleans 073008 PM	0.10118	0.16863	0.01349	0.13491	0.10118	0.09275	0.16863	0.13491	0.05059	0.03373
10	1	New Orleans 073008 PM	0.12500	0.08333	0.08333	0.06944	0.06944	0.13889	0.13889	0.11111	0.11111	0.06944
11	1	New Orleans 073008 PM	0.13793	0.09483	0.05172	0.03448	0.08621	0.15517	0.17241	0.09483	0.10345	0.06897
12	1	Abbeville 72808 PM	0.11465	0.11465	0.11210	0.08917	0.07643	0.12102	0.12739	0.08280	0.08790	0.07389
13	1	New Orleans 073008 AM	0.08000	0.08000	0.16000	0.16000	0.16000	0.08000	0.14400	0.04800	0.04800	0.04000
14	1	New Orleans 073008 AM	0.14706	0.14706	0.07843	0.07843	0.19608	0.07843	0.14706	0.02941	0.04902	0.04902
15	1	New Orleans 073008 PM	0.09639	0.12048	0.08434	0.09639	0.12048	0.09639	0.12048	0.24096	0.01205	0.01205
16	1	Lake Charles 0729 PM	0.16667	0.17544	0.13158	0.13158	0.07018	0.17544	0.08772	0.00877	0.04386	0.00877
17	1	New Orleans 073008 AM	0.11644	0.10274	0.06849	0.11644	0.11644	0.13699	0.13699	0.06849	0.06849	0.06849
18	1	New Orleans 073008 AM	0.12500	0.16071	0.05357	0.16071	0.12500	0.17857	0.07143	0.03571	0.07143	0.01786
19	1	New Orleans 073008 AM	0.11905	0.10317	0.10317	0.10317	0.11905	0.15873	0.15873	0.04762	0.03968	0.04762
20	1	New Orleans 073008 PM	0.12925	0.12925	0.09524	0.08844	0.09524	0.13605	0.12245	0.08163	0.09524	0.02721
21	1	New Orleans 073008 PM	0.13433	0.08955	0.11940	0.07463	0.05970	0.14925	0.13433	0.05970	0.05970	0.11940
22	1	New Orleans 073008 PM	0.12613	0.09009	0.12613	0.08108	0.09009	0.18018	0.18018	0.03604	0.03604	0.05405
23	1	Houma 080109 PM	0.12752	0.11409	0.12752	0.12081	0.12081	0.13423	0.13423	0.04027	0.04027	0.04027
24	1	New Orleans 073008 AM	0.13333	0.06667	0.13333	0.12000	0.10667	0.09333	0.13333	0.06667	0.09333	0.05333
25	1	New Orleans 073008 AM	0.15385	0.15385	0.07692	0.11538	0.15385	0.07692	0.07692	0.07692	0.07692	0.03846
26	1	New Orleans 073008 AM	0.15504	0.07752	0.07752	0.09302	0.14729	0.01550	0.03101	0.13953	0.13953	0.12403
27	1	New Orleans 073008 AM	0.13793	0.13793	0.10345	0.03448	0.10345	0.03448	0.13793	0.10345	0.10345	0.10345
28	1	New Orleans 073008 AM	0.18519	0.14815	0.00000	0.03704	0.05556	0.12963	0.16667	0.09259	0.11111	0.07407
29	1	New Orleans 073008 AM	0.14184	0.12057	0.09929	0.07092	0.11348	0.11348	0.12766	0.07092	0.07092	0.07092
30	1	New Orleans 073008 AM	0.15748	0.10236	0.11811	0.07874	0.10236	0.11811	0.14961	0.04724	0.07874	0.04724
31	1	New Orleans 073008 AM	0.14881	0.11161	0.06696	0.09970	0.14881	0.14881	0.11161	0.02976	0.06696	0.06696
32	1	New Orleans 073008 AM	0.16863	0.14334	0.11804	0.08432	0.10118	0.14334	0.15177	0.01686	0.05565	0.01686
33	1	New Orleans 073008 AM	0.30864	0.24691	0.15432	0.15432	0.08642	0.01543	0.01543	0.00617	0.00617	0.00617
34	1	New Orleans 073008 AM	0.15361	0.11521	0.10292	0.10292	0.11521	0.10292	0.11521	0.07680	0.03840	0.07680
35	1	New Orleans 073008 AM	0.21505	0.16129	0.10753	0.10753	0.12903	0.06452	0.07527	0.05376	0.05376	0.03226
36	1	New Orleans 073008 AM	0.11682	0.11682	0.11682	0.09229	0.11682	0.09346	0.09229	0.08178	0.08762	0.08528
37	1	New Orleans 073008 AM	0.18868	0.13208	0.03774	0.11321	0.05660	0.11321	0.16981	0.07547	0.05660	0.05660
38	1	New Orleans 073008 AM	0.14184	0.12057	0.10638	0.07092	0.11348	0.09929	0.11348	0.09220	0.08511	0.05674
39	1	New Orleans 073008 AM	0.18182	0.09091	0.12727	0.14545	0.16364	0.07273	0.10909	0.05455	0.03636	0.01818
40	1	New Orleans 073008 PM	0.18692	0.17757	0.14953	0.15888	0.16822	0.14019	0.00748	0.00561	0.00187	0.00374
41	1	New Orleans 073008 PM	0.31746	0.15873	0.12698	0.12698	0.25397	0.00317	0.00317	0.00317	0.00317	0.00317
42	1	New Orleans 073008 PM	0.22472	0.20225	0.05618	0.08989	0.17978	0.08989	0.08989	0.02247	0.03371	0.01124
43	1	Houma 080108 AM	0.18692	0.14953	0.14019	0.10280	0.09346	0.17757	0.10280	0.00935	0.02804	0.00935
44	1	Abbeville 72808 PM	0.16000	0.12800	0.09600	0.16000	0.09600	0.16000	0.16000	0.01600	0.01600	0.00800
45	1	New Orleans 073008 PM	0.17738	0.07761	0.11086	0.22173	0.07761	0.17738	0.11086	0.02217	0.02217	0.00222
46	2	Lake Charles 072908 AM	0.12500	0.10000	0.25000	0.17500	0.08750	0.16250	0.06250	0.01250	0.01250	0.01250
47	2	Lake Charles 0729 PM	0.16505	0.19417	0.17476	0.03883	0.11650	0.18447	0.09709	0.00971	0.00971	0.00971

48	2	Houma 080108 AM	0.14599	0.14599	0.07299	0.12409	0.13139	0.14599	0.12409	0.03650	0.03650	0.03650
49	2	New Orleans 073008 AM	0.07463	0.11194	0.11940	0.14925	0.11194	0.14925	0.14925	0.04478	0.04478	0.04478
50	2	New Orleans 073008 AM	0.11475	0.09836	0.09836	0.14754	0.08197	0.09836	0.16393	0.06557	0.06557	0.06557
51	2	New Orleans 073008 PM	0.12613	0.09009	0.12613	0.08108	0.09009	0.18018	0.18018	0.03604	0.03604	0.05405
52	2	Abbeville 72808 PM	0.09677	0.11613	0.10968	0.10323	0.09032	0.12258	0.12903	0.07742	0.08387	0.07097
53	2	New Orleans 073008 AM	0.14706	0.14706	0.07843	0.07843	0.19608	0.07843	0.14706	0.02941	0.04902	0.04902
54	2	Houma 080108 AM	0.18605	0.10571	0.08457	0.13742	0.21142	0.19027	0.05285	0.01057	0.01057	0.01057
55	2	New Orleans 073008 AM	0.15517	0.15517	0.05172	0.15517	0.12069	0.17241	0.06897	0.03448	0.06897	0.01724
56	2	New Orleans 073008 PM	0.14063	0.04688	0.14063	0.02344	0.08594	0.15625	0.09375	0.09375	0.10938	0.10938
57	2	New Orleans 073008 AM	0.13333	0.09333	0.13333	0.09333	0.12000	0.12000	0.13333	0.05333	0.06667	0.05333
58	2	New Orleans 073008 AM	0.15504	0.07752	0.07752	0.09302	0.14729	0.01550	0.03101	0.13953	0.13953	0.12403
59	2	New Orleans 073008 AM	0.17857	0.10714	0.03571	0.12500	0.05357	0.12500	0.16071	0.07143	0.07143	0.07143
60	2	New Orleans 073008 AM	0.14184	0.12057	0.10638	0.07092	0.11348	0.09220	0.11348	0.09929	0.08511	0.05674
61	2	New Orleans 073008 AM	0.18182	0.09091	0.12727	0.14545	0.16364	0.07273	0.10909	0.05455	0.03636	0.01818
62	2	New Orleans 073008 PM	0.19608	0.17647	0.12745	0.15686	0.13725	0.11765	0.05882	0.01373	0.00588	0.00980
63	2	New Orleans 073008 PM	0.21739	0.18478	0.04348	0.16304	0.19565	0.00000	0.19565	0.00000	0.00000	0.00000
64	2	New Orleans 073008 PM	0.23529	0.17647	0.16471	0.18824	0.11765	0.02353	0.02353	0.02353	0.02353	0.02353
65	2	New Orleans 073008 PM	0.16667	0.13333	0.12500	0.11667	0.13333	0.08333	0.10833	0.05000	0.05000	0.03333
66	2	New Orleans 073008 PM	0.31250	0.15625	0.07813	0.15625	0.07813	0.06250	0.06250	0.03125	0.03125	0.03125
67	2	New Orleans 073008 PM	0.11628	0.11628	0.11047	0.11628	0.11628	0.11047	0.11047	0.07558	0.07558	0.05233
68	2	Houma 080108 AM	0.14388	0.12950	0.12950	0.14388	0.12950	0.10791	0.12950	0.02878	0.03597	0.02158
69	2	Houma 080108 AM	0.17241	0.06897	0.13793	0.13793	0.08621	0.06897	0.13793	0.06897	0.05172	0.06897
70	2	Houma 080108 AM	0.19231	0.15385	0.13462	0.08654	0.10577	0.18269	0.10577	0.00962	0.01923	0.00962
71	2	Abbeville 72808 PM	0.15873	0.11111	0.07937	0.14286	0.11111	0.15873	0.15873	0.01587	0.04762	0.01587
72	2	Houma 080108 AM	0.12258	0.10968	0.09032	0.12903	0.11613	0.09677	0.10323	0.07742	0.08387	0.07097
73	3a	Houma 080108 AM	0.17045	0.22727	0.11364	0.14773	0.14773	0.10227	0.05682	0.01136	0.01136	0.01136
74	3a	Houma 080108 AM	0.12860	0.19194	0.09597	0.06334	0.14395	0.15355	0.19194	0.00000	0.00000	0.03071
75	3a	New Orleans 073008 PM	0.12613	0.09009	0.12613	0.08108	0.09009	0.18018	0.18018	0.03604	0.03604	0.05405
76	3a	Houma 080109 PM	0.02597	0.20779	0.15584	0.02597	0.05195	0.23377	0.25974	0.01299	0.01299	0.01299
77	3a	Abbeville 72808 PM	0.08796	0.12179	0.11908	0.09472	0.08796	0.12991	0.13532	0.06766	0.07442	0.08119
78	3a	Lake Charles 0729 PM	0.17143	0.19048	0.17143	0.03810	0.11429	0.19048	0.09524	0.00952	0.00952	0.00952
79	3a	Houma 080108 AM	0.17476	0.09709	0.09709	0.14563	0.17476	0.19417	0.08738	0.00971	0.00971	0.00971
80	3a	Houma 080108 AM	0.12195	0.12195	0.09756	0.12195	0.09756	0.24390	0.12195	0.02439	0.02439	0.02439
81	3a	Houma 080109 PM	0.08929	0.08929	0.26786	0.03571	0.03571	0.35714	0.08929	0.00000	0.03571	0.00000
82	3a	Houma 080109 PM	0.02049	0.10246	0.32787	0.10246	0.02049	0.40984	0.00410	0.00410	0.00410	0.00410
83	3a	New Orleans 073008 AM	0.17544	0.14035	0.03509	0.12281	0.05263	0.12281	0.15789	0.07018	0.05263	0.07018
84	3a	New Orleans 073008 AM	0.18182	0.09091	0.12727	0.14545	0.16364	0.07273	0.10909	0.05455	0.03636	0.01818
85	3a	New Orleans 073008 PM	0.23529	0.11765	0.11765	0.14118	0.17647	0.00000	0.21176	0.00000	0.00000	0.00000
86	3a	Houma 080108 AM	0.14388	0.12950	0.12950	0.14388	0.12950	0.10791	0.12950	0.02878	0.03597	0.02158
87	3a	Houma 080108 AM	0.18018	0.18018	0.18018	0.14414	0.14414	0.05405	0.09009	0.00901	0.00901	0.00901
88	3a	Houma 080108 AM	0.15873	0.08730	0.11111	0.10317	0.09524	0.08730	0.11905	0.07937	0.07937	0.07937
89	3a	Houma 080108 AM	0.16529	0.13223	0.11570	0.09091	0.12397	0.14050	0.08264	0.04959	0.04959	0.04959
90	3a	Houma 080108 AM	0.20619	0.16495	0.11340	0.13402	0.05155	0.19588	0.10309	0.01031	0.01031	0.01031
91	3a	Houma 080108 AM	0.14493	0.14493	0.09420	0.09420	0.14493	0.10870	0.09420	0.05797	0.05797	0.05797
92	3a	Houma 080108 AM	0.11905	0.10119	0.10119	0.10119	0.11905	0.10119	0.10119	0.08333	0.08929	0.08333
93	3a	Houma 080108 AM	0.14706	0.08824	0.11765	0.14706	0.14706	0.11765	0.14706	0.02941	0.04412	0.01471
94	3a	Houma 080108 AM	0.14815	0.14815	0.10370	0.11852	0.08889	0.13333	0.14815	0.03704	0.03704	0.03704
95	3a	Houma 080108 AM	0.14815	0.14815	0.13333	0.14815	0.13333	0.11111	0.13333	0.01481	0.02222	0.00741
96	3a	Houma 080109 PM	0.18018	0.16216	0.12613	0.13514	0.14414	0.04505	0.05405	0.02703	0.09009	0.03604
97	3a	Houma 080109 PM	0.25000	0.18750	0.06250	0.05000	0.22500	0.02500	0.12500	0.02500	0.01250	0.03750
98	3a	Houma 080109 PM	0.25000	0.22500	0.02500	0.12500	0.17500	0.02500	0.02500	0.05000	0.05000	0.05000

99	3a	Houma 080109 PM	0.16000	0.16000	0.04000	0.14400	0.16000	0.04800	0.04800	0.08000	0.06400	0.09600
100	3a	Houma 080108 AM	0.12258	0.09032	0.10323	0.12903	0.11613	0.09677	0.10968	0.07742	0.08387	0.07097
101	3a	Houma 080109 PM	0.16129	0.10753	0.02151	0.21505	0.16129	0.10753	0.16129	0.02151	0.02151	0.02151
102	3a	Houma 080109 PM	0.13274	0.13274	0.06195	0.17699	0.08850	0.17699	0.17699	0.00885	0.02655	0.01770
103	3b	Abbeville 72808 PM	0.12500	0.12500	0.12500	0.11250	0.11250	0.10000	0.11250	0.06250	0.06250	0.06250
104	3b	Houma 080108 AM	0.13245	0.13245	0.09934	0.09934	0.09934	0.11921	0.11921	0.06623	0.06623	0.06623
105	3b	Abbeville 72808 AM	0.10054	0.13405	0.06702	0.10054	0.11394	0.10054	0.11394	0.08981	0.08981	0.08981
106	3b	Abbeville 72808 AM	0.12000	0.16000	0.04000	0.12000	0.12000	0.08000	0.16000	0.08000	0.08000	0.04000
107	3b	New Orleans 073008 PM	0.12613	0.09009	0.12613	0.08108	0.09009	0.18018	0.18018	0.03604	0.03604	0.05405
108	3b	Abbeville 72808 AM	0.13333	0.03704	0.11852	0.10370	0.09630	0.13333	0.14815	0.06667	0.11111	0.05185
109	3b	Abbeville 72808 AM	0.15238	0.13333	0.05714	0.09524	0.09524	0.15238	0.19048	0.03810	0.04762	0.03810
110	3b	Abbeville 72808 PM	0.10038	0.11292	0.11041	0.10665	0.08783	0.12045	0.12547	0.07779	0.08281	0.07528
111	3b	Abbeville 72808 AM	0.12295	0.14754	0.14754	0.08197	0.16393	0.08197	0.13934	0.03279	0.03279	0.04918
112	3b	Abbeville 72808 AM	0.11733	0.11600	0.10000	0.12000	0.13333	0.09867	0.11867	0.06400	0.06667	0.06533
113	3b	Houma 080109 PM	0.12000	0.09333	0.08000	0.09333	0.10667	0.06667	0.08000	0.13333	0.13333	0.09333
114	3b	Lake Charles 0729 PM	0.12422	0.20704	0.18634	0.04141	0.10352	0.20704	0.12422	0.00207	0.00207	0.00207
115	3b	Abbeville 72808 AM	0.05769	0.09615	0.07692	0.07692	0.05769	0.19231	0.07692	0.14423	0.14423	0.07692
116	3b	New Orleans 073008 AM	0.18182	0.09091	0.12727	0.14545	0.16364	0.07273	0.10909	0.05455	0.03636	0.01818
117	3b	Houma 080108 AM	0.14706	0.08824	0.11765	0.14706	0.14706	0.11765	0.14706	0.02941	0.04412	0.01471
118	3b	Houma 080108 AM	0.13889	0.11111	0.11111	0.13889	0.11111	0.06944	0.11111	0.06944	0.06944	0.06944
119	3b	Abbeville 72808 AM	0.20408	0.18367	0.06122	0.06122	0.16327	0.04082	0.08163	0.08163	0.10204	0.02041
120	3b	Abbeville 72808 AM	0.13123	0.11549	0.12073	0.12205	0.11680	0.11811	0.12467	0.04068	0.06824	0.04199
121	3b	Abbeville 72808 AM	0.18349	0.13761	0.16514	0.07339	0.11009	0.11009	0.13761	0.02752	0.03670	0.01835
122	3b	Abbeville 72808 AM	0.19763	0.17787	0.09881	0.09881	0.06522	0.06522	0.14822	0.04941	0.04941	0.04941
123	3b	Abbeville 72808 PM	0.18349	0.09174	0.11009	0.12844	0.09174	0.18349	0.18349	0.00917	0.00917	0.00917
124	3b	Abbeville 72808 AM	0.15000	0.15000	0.11667	0.16667	0.10000	0.10833	0.16667	0.01667	0.01667	0.00833
125	3b	Abbeville 72808 AM	0.08235	0.15294	0.15294	0.23529	0.11765	0.00706	0.21176	0.02353	0.01176	0.00471
126	3b	Abbeville 72808 AM	0.02128	0.08511	0.06383	0.42553	0.12766	0.02128	0.17021	0.02128	0.04255	0.02128
127	3b	Abbeville 72808 PM	0.11927	0.06422	0.13761	0.18349	0.09174	0.15596	0.16514	0.02752	0.02752	0.02752
128	4	Lake Charles 072908 AM	0.12162	0.09459	0.27027	0.13514	0.06757	0.17568	0.05405	0.04054		0.04054
129	4	Lake Charles 072908 AM	0.14286	0.14286	0.12857	0.12857	0.10000	0.05714	0.10000	0.10000		0.10000
130	4	Lake Charles 0729 PM	0.05357	0.17857	0.05357	0.17857	0.17857	0.17857	0.17857	0.00000		0.00000
131	4	Abbeville 72808 AM	0.16667	0.18519	0.07407	0.08333	0.14815	0.07407	0.08333	0.09259		0.09259
132	4	Abbeville 72808 PM	0.08000	0.20000	0.05000	0.13000	0.19000	0.10000	0.14000	0.09000		0.02000
133	4	Lake Charles 072908 AM	0.15094	0.05660	0.16981	0.05660	0.15094	0.11321	0.18868	0.05660		0.05660
134	4	Lake Charles 0729 PM	0.10309	0.10309	0.05155	0.15464	0.15464	0.16237	0.25773	0.00000		0.01289
135	4	Lake Charles 0729 PM	0.11494	0.06897	0.17241	0.18391	0.11494	0.11494	0.22989	0.00000		0.00000
136	4	Lake Charles 0729 PM	0.02784	0.20882	0.17169	0.00000	0.18561	0.17401	0.23202	0.00000		0.00000
137	4	New Orleans 073008 PM	0.13834	0.09881	0.13834	0.08893	0.09881	0.19763	0.19763	0.00198		0.03953
138	4	Abbeville 72808 PM	0.10430	0.12386	0.11734	0.11082	0.09909	0.12647	0.13038	0.09648		0.09126
139	4	Lake Charles 0729 PM	0.20000	0.20000	0.02222	0.02222	0.22222	0.16667	0.16667	0.00000		0.00000
140	4	Lake Charles 072908 AM	0.15842	0.14851	0.12871	0.09901	0.09901	0.19802	0.13861	0.01980		0.00990
141	4	Lake Charles 072908 AM	0.14050	0.15702	0.12397	0.08264	0.11570	0.16529	0.15702	0.01653		0.04132
142	4	Lake Charles 0729 PM	0.00000	0.00000	0.00000	0.00000	0.00000	0.50000	0.50000	0.00000		0.00000
143	4	Lake Charles 0729 PM	0.10000	0.10000	0.15000	0.15000	0.10000	0.20000	0.20000	0.00000		0.00000
144	4	Lake Charles 072908 AM	0.16667	0.12500	0.10833	0.12500	0.13333	0.12500	0.01667	0.08333		0.11667
145	4	Lake Charles 072908 AM	0.24390	0.19512	0.07317	0.17073	0.14634	0.12195	0.00000	0.02439		0.02439
146	4	Lake Charles 072908 AM	0.14599	0.12409	0.12409	0.13869	0.12409	0.13139	0.13869	0.03650		0.03650
147	4	Lake Charles 072908 AM	0.22222	0.07778	0.08889	0.18889	0.08889	0.11111	0.16667	0.02222		0.03333
148	4	Lake Charles 0729 PM	0.14925	0.11940	0.10448	0.10448	0.10448	0.11940	0.11940	0.08955		0.08955
149	4	New Orleans 073008 AM	0.18519	0.09259	0.11111	0.14815	0.16667	0.07407	0.12963	0.05556		0.03704

150	4	New Orleans 073008 PM	0.22222	0.20000	0.16667	0.16667	0.20000	0.00000	0.04444	0.00000		0.00000
151	4	Abbeville 72808 AM	0.64935	0.06494	0.03247	0.06494	0.16234	0.00649	0.00649	0.00649		0.00649
152	4	Abbeville 72808 AM	0.19231	0.17308	0.09615	0.09615	0.05769	0.15385	0.17308	0.02885		0.02885
153	4	Abbeville 72808 PM	0.15408	0.12327	0.10786	0.11402	0.11556	0.10015	0.13867	0.07704		0.06934
154	4	Abbeville 72808 AM	0.08178	0.15187	0.15187	0.23364	0.11682	0.00701	0.21028	0.03505		0.01168

Attachment B –
Decision Support Documentation

(Evaluation Data and Plan Rankings to Support Risk Informed Decision Analysis)

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Table of Contents

Introduction

The purpose of this attachment is to present a summary of other miscellaneous Decision Support Documentation considerations, in addition to the Multi-Criteria Decision Analysis (MCDA), that were used to support the LACPR Risk-Informed Decision Framework (RIDF). This additional documentation is provided in a series of sample evaluation data tables and plan rankings across the future without project condition scenarios, as described else where in the LACPR report. These data and rankings, along with the MCDA analysis, were used to develop the Indexed Scoring Tables presented in the LACPR main report, to facilitate identification of the final array of alternatives, and to provide input to the detailed tradeoff analysis of plan performance and outputs of these alternatives.

Relying primarily on the outputs of the MCDA analysis, as conducted to date, and the resulting initial indications of stakeholder preferences on alternatives, it became readily apparent that the MCDA process may be eliminating plans from further consideration that address a wider range of decision objectives important to decision makers and, in general, to a broader range of taxpayers nationwide.

Although the applied MCDA process provides insights to local and regional stakeholder preferences, the resulting ranking of plans for LACPR seemed to minimize the importance of alternatives that provide for a ***greater level of risk reduction*** and ***cost efficiency***. To assure that such plans were not prematurely eliminated from further consideration in the final array of alternatives, an evaluation process was developed to look at various combinations of multiple evaluation criteria to address these broader, overall decision objectives. This process is detailed in the LACPR main report.

The multiple combinations of evaluation criteria included (1) stakeholder input on preferences; (2) direct and indirect environmental impacts; (3) cost efficiency; (4) effectiveness in reducing risk; as well as (5) project costs and the realities of future funding requirements for both Federal and non-Federal interests. Based on these data, a more enlightened risk-informed decision could be made among alternatives, considering specific identified tradeoffs in these performance categories.

Without further iterations and refinements of the MCDA stakeholder process (which have not been possible for the current LACPR planning effort because of time constraints and available funding resources), it is not known whether the continuation of this process would have resulted in convergence on a more refined set of alternatives that better addresses the broader range of decision objectives as discussed above.

The data tables and plan rankings presented in this attachment are provided to increase the basic understanding of the evaluation criteria used to refine the list of alternatives and to provide the supporting documentation for how these evaluation data were developed and the impact they have on plan rankings across scenarios.

Sample evaluation data tables and plan rankings presented herein are grouped by LACPR planning unit. Evaluation data are provided for Scenario 1 (low relative sea level rise, high employment, and dispersed population) for the 90% confidence level (low uncertainty) for water surface elevations. Plan rankings across scenarios are shown to present the possible variations considering alternative futures which take into account sea level rise, changes in population and differing land use patterns. As can be seen from these rankings, there is not a significant change in the relative ranking of alternatives based on differing future conditions. In general, the same set of alternatives, regardless of which scenario is being examined, is represented in the top tier of alternatives for each criteria or evaluation data set.

Each planning unit presentation includes the following evaluation data and tables, presented in the order shown:

- Metric Data
  - Output values or scoring of metrics for each alternative for the 10 metrics used in the MCDA
  - Relative ranking of the performance of all alternatives within each individual metric
- MCDA Trend Analysis
  - Expansion of MCDA presentation as included in Attachment A, which just identifies the frequency of which alternatives were ranked in the top 5.
  - Plan ranking for each alternative for each respondent who provided input in the stakeholder swing weighting meetings
  - Total (cumulative) ranking score for each alternative for all respondents
  - Ordinal ranking of alternatives across scenarios based on the total ranking scores
- Evaluation Criteria
  - Values calculated for each evaluation criteria for each alternative
  - Ordinal ranking of alternatives based on evaluation criteria values

Tables presented for the following data sets include: (1) sample data and ranking and (2) ranking of alternatives across scenarios.

- Cost Efficiency
- Total System Costs
- Period of Analysis Cost Efficiency
- Residual Damages (Remaining Risk)
- Period of Analysis Risk Reduction
- Average % Risk Reduction of Total Damages for 100-year to 2000-year frequency events.

Planning Unit 1

Sample Data Rankings and Evaluation Criteria Tables

Planning Unit 1 - Metric Data Summary

(Scenario 1 - Low Relative Sea Level Rise, High Employment, Dispersed Population; Low Uncertainty)

Plan #	Alternative	Population Impacted	Residual Damages	Life Cycle Cost	Construction Time	Employment Impacted	Indirect Environmental Impact Score	Direct Wetland Impacts	Historic Properties Protected	Historic Districts Protected	Archeo. Sites Protected
		Ann. Equiv. #	Ann. Equiv. $ Millions	Ann. Equiv. $ Millions	Years	Ann. Equiv. #	Unit-less Scale -8 to +8	Acres	# Properties	# Districts	# Sites
1	No Action	51,017	1,401	0	15	6,339	0	0	122	41	111
2	Coastal	45,113	1,106	543	15	4,983	0	0	126	43	221
3	NS-100	39,672	732	873	15	3,236	0	0	126	43	221
4	NS-400	38,517	463	1,761	15	1,760	0	0	126	43	221
5	NS-1000	33,107	384	2,535	15	1,370	0	0	126	43	221
6	HL-a-100-2	39,955	950	1,525	12	4,019	-2	4,200	132	43	282
7	HL-a-100-3	40,309	961	1,356	12	4,058	-1	3,600	126	43	275
8	HL-b-400-2	38,544	797	3,076	16	3,261	-2	6,000	148	50	284
9	HL-b-400-3	38,940	810	2,837	16	3,306	-2	5,500	140	48	277
10	LP-a-100-1	40,916	904	903	14	3,715	-8	1,000	127	43	265
11	LP-a-100-2	38,655	842	1,691	14	3,435	-8	4,100	134	43	301
12	LP-a-100-3	38,931	850	1,622	14	3,467	-8	3,700	127	43	294
13	LP-b-400-1	40,570	878	1,849	16	3,598	-8	4,200	131	48	267
14	LP-b-400-3	38,442	811	2,847	16	3,279	-8	7,500	141	48	296
15	LP-b-1000-1	40,423	874	2,247	16	3,561	-8	5,100	131	48	267
16	LP-b-1000-2	37,940	796	3,578	16	3,203	-8	9,100	156	48	303
17	C-HL-a-100-2	39,008	873	1,672	12	3,709	-2	4,200	132	43	282
18	C-HL-a-100-3	39,309	870	1,514	12	3,717	-1	3,600	126	43	275
19	C-HL-b-400-2	37,294	708	3,238	16	2,864	-2	6,000	148	50	284
20	C-HL-b-400-3	37,636	704	3,011	16	2,853	-2	5,500	140	48	277
21	C-LP-a-100-1	39,725	744	1,100	14	3,102	-8	1,000	127	43	265
22	C-LP-a-100-2	37,747	751	1,834	14	3,057	-8	4,100	134	43	301
23	C-LP-a-100-3	37,976	750	1,773	14	3,068	-8	3,700	127	43	294
24	C-LP-b-400-1	38,960	684	2,147	16	2,758	-8	4,200	131	48	267
25	C-LP-b-400-3	37,263	705	3,008	16	2,830	-8	7,500	141	48	296
26	C-LP-b-1000-1	38,446	667	2,579	16	2,618	-8	5,100	131	48	267
27	C-LP-b-1000-2	36,596	697	3,754	16	2,780	-8	9,100	156	48	303

Planning Unit 1 - Relative Ranking of Alternatives Based On Individual Metrics

Best Case Improvement to Worst Case Outcome

(Scenario 1 - Low Relative Sea Level Rise, High Employment, Dispersed Population; Low Uncertainty)

Rank	Population Impacted	Residual Damages	Life Cycle Cost	Construction Time	Employment Impacted	Indirect Environmental Impact Score	Direct Wetland Impacts	Historic Properties Protected	Historic Districts Protected	Archeo. Sites Protected
1	NS-1000	NS-1000	No Action	HL-a-100-3	NS-1000	No Action	No Action	LP-b-1000-2	HL-b-400-2	LP-b-1000-2
2	C-LP-b-1000-2	NS-400	Coastal	C-HL-a-100-3	NS-400	Coastal	Coastal	C-LP-b-1000-2	C-HL-b-400-2	C-LP-b-1000-2
3	C-LP-b-400-3	C-LP-b-1000-1	NS-100	HL-a-100-2	C-LP-b-1000-1	NS-100	NS-100	HL-b-400-2	LP-b-400-1	LP-a-100-2
4	C-HL-b-400-2	C-LP-b-400-1	LP-a-100-1	C-HL-a-100-2	C-LP-b-400-1	NS-400	NS-400	C-HL-b-400-2	C-LP-b-400-1	C-LP-a-100-2
5	C-HL-b-400-3	C-LP-b-1000-2	C-LP-a-100-1	LP-a-100-1	C-LP-b-1000-2	NS-1000	NS-1000	LP-b-400-3	LP-b-1000-1	LP-b-400-3
6	C-LP-a-100-2	C-HL-b-400-3	HL-a-100-3	C-LP-a-100-1	C-LP-b-400-3	HL-a-100-3	LP-a-100-1	C-LP-b-400-3	C-LP-b-1000-1	C-LP-b-400-3
7	LP-b-1000-2	C-LP-b-400-3	C-HL-a-100-3	LP-a-100-3	C-HL-b-400-3	C-HL-a-100-3	C-LP-a-100-1	HL-b-400-3	HL-b-400-3	LP-a-100-3
8	C-LP-a-100-3	C-HL-b-400-2	HL-a-100-2	LP-a-100-2	C-HL-b-400-2	HL-a-100-2	HL-a-100-3	C-HL-b-400-3	LP-b-400-3	C-LP-a-100-3
9	LP-b-400-3	NS-100	LP-a-100-3	C-LP-a-100-3	C-LP-a-100-2	C-HL-a-100-2	C-HL-a-100-3	LP-a-100-2	C-LP-b-400-3	HL-b-400-2
10	C-LP-b-1000-1	C-LP-a-100-1	C-HL-a-100-2	C-LP-a-100-2	C-LP-a-100-3	HL-b-400-3	LP-a-100-3	C-LP-a-100-2	C-HL-b-400-3	C-HL-b-400-2
11	NS-400	C-LP-a-100-3	LP-a-100-2	No Action	C-LP-a-100-1	C-HL-b-400-3	C-LP-a-100-3	HL-a-100-2	LP-b-1000-2	HL-a-100-2
12	HL-b-400-2	C-LP-a-100-2	NS-400	Coastal	LP-b-1000-2	HL-b-400-2	LP-a-100-2	C-HL-a-100-2	C-LP-b-1000-2	C-HL-a-100-2
13	LP-a-100-2	LP-b-1000-2	C-LP-a-100-3	NS-100	NS-100	C-HL-b-400-2	C-LP-a-100-2	LP-b-400-1	Coastal	HL-b-400-3
14	LP-a-100-3	HL-b-400-2	C-LP-a-100-2	NS-400	HL-b-400-2	LP-a-100-1	HL-a-100-2	C-LP-b-400-1	NS-100	C-HL-b-400-3
15	HL-b-400-3	HL-b-400-3	LP-b-400-1	NS-1000	LP-b-400-3	C-LP-a-100-1	C-HL-a-100-2	LP-b-1000-1	LP-a-100-1	HL-a-100-3
16	C-LP-b-400-1	LP-b-400-3	C-LP-b-400-1	LP-b-400-1	HL-b-400-3	LP-a-100-3	LP-b-400-1	C-LP-b-1000-1	C-LP-a-100-1	C-HL-a-100-3
17	C-HL-a-100-2	LP-a-100-2	LP-b-1000-1	C-LP-b-400-1	LP-a-100-2	LP-a-100-2	C-LP-b-400-1	LP-a-100-1	HL-a-100-3	LP-b-400-1
18	C-HL-a-100-3	LP-a-100-3	NS-1000	LP-b-1000-1	LP-a-100-3	C-LP-a-100-3	LP-b-1000-1	C-LP-a-100-1	C-HL-a-100-3	C-LP-b-400-1
19	NS-100	C-HL-a-100-3	C-LP-b-1000-1	C-LP-b-1000-1	LP-b-1000-1	C-LP-a-100-2	C-LP-b-1000-1	LP-a-100-3	HL-a-100-2	LP-b-1000-1
20	C-LP-a-100-1	C-HL-a-100-2	HL-b-400-3	HL-b-400-3	LP-b-400-1	LP-b-400-1	HL-b-400-3	C-LP-a-100-3	LP-a-100-3	C-LP-b-1000-1
21	HL-a-100-2	LP-b-1000-1	LP-b-400-3	LP-b-400-3	C-HL-a-100-2	C-LP-b-400-1	C-HL-b-400-3	Coastal	C-HL-a-100-2	LP-a-100-1
22	HL-a-100-3	LP-b-400-1	C-LP-b-400-3	C-LP-b-400-3	LP-a-100-1	LP-b-1000-1	HL-b-400-2	NS-100	LP-a-100-2	C-LP-a-100-1
23	LP-b-1000-1	LP-a-100-1	C-HL-b-400-3	C-HL-b-400-3	C-HL-a-100-3	C-LP-b-1000-1	C-HL-b-400-2	HL-a-100-3	NS-400	Coastal
24	LP-b-400-1	HL-a-100-2	HL-b-400-2	HL-b-400-2	HL-a-100-2	LP-b-400-3	LP-b-400-3	C-HL-a-100-3	C-LP-a-100-3	NS-100
25	LP-a-100-1	HL-a-100-3	C-HL-b-400-2	C-HL-b-400-2	HL-a-100-3	C-LP-b-400-3	C-LP-b-400-3	NS-400	C-LP-a-100-2	NS-400
26	Coastal	Coastal	LP-b-1000-2	LP-b-1000-2	Coastal	LP-b-1000-2	LP-b-1000-2	NS-1000	NS-1000	NS-1000
27	No Action	No Action	C-LP-b-1000-2	C-LP-b-1000-2	No Action	C-LP-b-1000-2	C-LP-b-1000-2	No Action	No Action	No Action

Planning Unit 1 - Multi-Criteria Decision Analysis (MCDA) Trend Analysis

(Scenario 1 - Low Relative Sea Level Rise, High Employment, Dispersed Population; Low Uncertainty)

Plan #	Alternative	Plan Rank By Each Respondant (Page 1 of 2)																									
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
1	**No Action**	11	9	20	17	18	27	27	27	16	19	21	20	9	19	22	9	13	19	9	27	20	22	27	19	26	22
2	**Coastal**	4	2	4	6	3	9	26	5	4	4	6	7	4	4	4	2	4	5	4	15	4	5	8	4	5	5
3	**NS-100**	1	1	1	1	1	3	19	2	1	3	3	3	1	2	3	1	1	3	2	2	3	2	3	1	1	3
4	**NS-400**	3	3	2	2	2	2	18	3	2	2	2	2	3	3	2	3	3	2	3	3	2	3	2	3	2	2
5	**NS-1000**	2	4	3	3	4	1	10	1	3	1	1	1	2	1	1	6	2	1	1	1	1	1	1	2	3	1
6	**HL-a-100-2**	8	8	8	10	8	7	8	10	10	8	11	8	8	8	9	7	8	8	8	8	8	8	7	8	8	8
7	**HL-a-100-3**	6	6	6	8	6	6	16	11	7	6	9	5	6	6	6	4	6	6	6	7	6	6	6	6	6	6
8	**HL-b-400-2**	13	19	12	22	16	10	2	12	20	10	5	10	12	10	15	16	12	10	15	22	13	11	14	12	10	10
9	**HL-b-400-3**	12	15	16	23	19	13	21	20	21	12	12	12	15	14	16	12	15	12	14	21	14	14	18	18	14	14
10	**LP-a-100-1**	15	11	10	5	10	15	22	6	8	14	14	14	14	13	10	10	10	14	11	11	10	12	11	10	12	13
11	**LP-a-100-2**	19	17	17	14	14	17	9	15	14	17	18	17	19	17	18	18	19	17	19	12	18	17	16	15	17	17
12	**LP-a-100-3**	18	13	18	13	13	18	20	16	13	18	19	18	18	18	17	14	18	18	18	13	17	18	17	16	18	18
13	**LP-b-400-1**	21	21	21	16	21	23	24	19	17	21	23	22	21	21	21	20	21	22	21	19	22	20	21	21	20	21
14	**LP-b-400-3**	25	25	25	25	25	25	12	25	25	26	27	26	25	25	25	24	25	25	25	24	25	26	25	25	25	26
15	**LP-b-1000-1**	23	23	23	21	23	26	25	23	23	23	26	25	23	23	23	22	23	23	23	23	23	23	23	23	23	23
16	**LP-b-1000-2**	27	27	27	27	27	24	4	26	27	27	25	27	27	27	27	26	27	27	27	26	27	27	26	27	27	27
17	**C-HL-a-100-2**	7	7	7	9	7	5	5	9	9	7	8	6	7	7	7	8	7	7	7	5	7	7	5	7	7	7
18	**C-HL-a-100-3**	5	5	5	7	5	4	11	8	6	5	7	4	5	5	5	5	5	4	5	4	5	4	4	5	4	4
19	**C-HL-b-400-2**	10	18	11	20	15	8	1	7	18	9	4	9	10	9	11	17	11	9	13	18	11	9	10	11	9	9
20	**C-HL-b-400-3**	9	14	13	19	17	12	14	18	19	11	10	11	13	12	12	13	14	11	12	17	12	13	15	17	13	12
21	**C-LP-a-100-1**	14	10	9	4	9	11	15	4	5	13	13	13	11	11	8	11	9	13	10	6	9	10	9	9	11	11
22	**C-LP-a-100-2**	17	16	14	12	12	14	6	13	12	15	15	15	17	15	14	19	17	15	17	10	16	15	12	13	15	15
23	**C-LP-a-100-3**	16	12	15	11	11	16	13	14	11	16	16	16	16	16	13	15	16	16	16	9	15	16	13	14	16	16
24	**C-LP-b-400-1**	20	20	19	15	20	19	17	17	15	20	17	19	20	20	19	21	20	20	20	14	19	19	19	20	19	19
25	**C-LP-b-400-3**	24	24	24	24	24	22	7	22	24	24	24	23	24	24	24	25	24	24	24	20	24	24	22	24	22	24
26	**C-LP-b-1000-1**	22	22	22	18	22	20	23	21	22	22	20	21	22	22	20	23	22	21	22	16	21	21	20	22	21	20
27	**C-LP-b-1000-2**	26	26	26	26	26	21	3	24	26	25	22	24	26	26	26	27	26	26	26	25	26	25	24	26	24	25

Planning Unit 1 - Multi-Criteria Decision Analysis (MCDA) Trend Analysis

(Scenario 1 - Low Relative Sea Level Rise, High Employment, Dispersed Population; Low Uncertainty)

Plan #	Alternative	Plan Rank By Each Respondant (Page 2 of 2)																			Total Ranking Score (All Respondants)
		27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	
1	No Action	20	22	23	20	15	15	24	27	15	27	9	13	26	16	9	14	27	12	18	847
2	Coastal	4	5	6	8	4	4	7	5	4	24	4	4	8	6	4	4	21	4	4	283
3	NS-100	2	3	2	2	2	1	2	3	2	3	1	3	3	2	1	1	3	2	1	106
4	NS-400	3	2	3	3	3	3	3	2	3	2	2	2	2	3	3	2	2	3	2	127
5	NS-1000	1	1	1	1	1	2	1	1	1	1	3	1	1	1	2	3	1	1	3	85
6	HL-a-100-2	8	9	8	7	8	8	8	9	9	10	8	10	7	8	8	8	9	8	8	373
7	HL-a-100-3	6	7	5	5	6	6	10	8	6	9	6	7	6	5	6	6	6	6	6	297
8	HL-b-400-2	10	12	17	13	10	10	5	10	10	25	14	8	12	13	14	13	13	15	10	567
9	HL-b-400-3	14	13	18	12	12	13	12	13	12	22	15	12	13	12	13	15	19	14	14	675
10	LP-a-100-1	13	14	10	14	14	14	14	14	14	11	11	15	14	14	15	10	15	10	13	554
11	LP-a-100-2	17	18	14	17	18	18	16	17	17	12	19	18	18	19	19	19	17	19	17	756
12	LP-a-100-3	18	19	15	18	19	19	20	18	19	13	18	20	19	18	18	18	18	18	19	779
13	LP-b-400-1	21	21	20	22	21	21	23	22	21	19	21	21	21	21	21	21	22	21	21	941
14	LP-b-400-3	26	26	25	25	26	25	25	26	27	21	25	26	25	25	25	25	25	25	25	1,119
15	LP-b-1000-1	23	24	22	24	23	23	27	25	23	23	23	23	23	23	23	23	24	23	23	1,050
16	LP-b-1000-2	27	27	27	27	27	27	18	23	26	26	27	27	27	27	27	27	26	27	27	1,167
17	C-HL-a-100-2	7	6	7	6	7	7	6	6	8	5	7	9	5	7	7	7	5	7	7	307
18	C-HL-a-100-3	5	4	4	4	5	5	9	4	5	4	5	5	4	4	5	5	4	5	5	227
19	C-HL-b-400-2	9	8	13	10	9	9	4	7	7	18	12	6	9	10	11	11	8	13	9	470
20	C-HL-b-400-3	12	10	16	9	11	11	11	12	11	17	13	11	10	9	10	12	14	11	12	575
21	C-LP-a-100-1	11	11	9	11	13	12	13	11	13	6	10	14	11	11	12	9	7	9	11	462
22	C-LP-a-100-2	15	16	11	16	16	16	15	15	16	7	17	16	16	17	17	17	10	17	15	656
23	C-LP-a-100-3	16	15	12	15	17	17	19	16	18	8	16	17	15	15	16	16	11	16	16	665
24	C-LP-b-400-1	19	17	19	19	20	20	21	19	20	14	20	19	17	20	20	20	12	20	20	843
25	C-LP-b-400-3	24	23	24	23	24	24	22	24	25	16	24	24	22	24	24	24	20	24	24	1,034
26	C-LP-b-1000-1	22	20	21	21	22	22	26	21	22	15	22	22	20	22	22	22	16	22	22	950
27	C-LP-b-1000-2	25	25	26	26	25	26	17	20	24	20	26	25	24	26	26	26	23	26	26	1,095

Planning Unit 1 - MCDA Trend Analysis
(Scenario 1; Low Uncertainty)

Plan #	Alternative	Total Ranking Score (All Respondants)	Rank
5	**NS-1000**	85	**1**
3	**NS-100**	106	**2**
4	**NS-400**	127	**3**
18	**C-HL-a-100-3**	227	**4**
2	**Coastal**	283	**5**
7	**HL-a-100-3**	297	**6**
17	**C-HL-a-100-2**	307	**7**
6	**HL-a-100-2**	373	**8**
21	**C-LP-a-100-1**	462	**9**
19	**C-HL-b-400-2**	470	**10**
10	**LP-a-100-1**	554	**11**
8	**HL-b-400-2**	567	**12**
20	**C-HL-b-400-3**	575	**13**
22	**C-LP-a-100-2**	656	**14**
23	**C-LP-a-100-3**	665	**15**
9	**HL-b-400-3**	675	**16**
11	**LP-a-100-2**	756	**17**
12	**LP-a-100-3**	779	**18**
24	**C-LP-b-400-1**	843	**19**
1	**No Action**	847	**20**
13	**LP-b-400-1**	941	**21**
26	**C-LP-b-1000-1**	950	**22**
25	**C-LP-b-400-3**	1034	**23**
15	**LP-b-1000-1**	1050	**24**
27	**C-LP-b-1000-2**	1095	**25**
14	**LP-b-400-3**	1119	**26**
16	**LP-b-1000-2**	1167	**27**

Planning Unit 1

MCDA Trend Analysis (Ranked by Total Ranking Scores - All Respondants)

Rank	Scenario 1 Low RSLR High Employment Dispersed Population	Scenario 2 High RSLR High Employment Dispersed Population	Scenario 3 Low RSLR Business-as-Usual Compact Population	Scenario 4 High RSLR Business-as-Usual Compact Population
1	NS-1000	NS-1000	NS-100	NS-1000
2	NS-100	NS-400	NS-1000	NS-100
3	NS-400	NS-100	NS-400	NS-400
4	C-HL-a-100-3	C-HL-a-100-3	C-HL-a-100-3	C-HL-a-100-3
5	Coastal	HL-a-100-3	Coastal	Coastal
6	HL-a-100-3	Coastal	HL-a-100-3	HL-a-100-3
7	C-HL-a-100-2	C-HL-a-100-2	C-HL-a-100-2	C-HL-a-100-2
8	HL-a-100-2	HL-a-100-2	HL-a-100-2	HL-a-100-2
9	C-LP-a-100-1	C-LP-a-100-1	C-LP-a-100-1	C-LP-a-100-1
10	C-HL-b-400-2	C-HL-b-400-2	C-HL-b-400-2	C-HL-b-400-2
11	LP-a-100-1	C-HL-b-400-3	LP-a-100-1	C-HL-b-400-3
12	HL-b-400-2	LP-a-100-1	HL-b-400-2	LP-a-100-1
13	C-HL-b-400-3	HL-b-400-2	C-HL-b-400-3	HL-b-400-2
14	C-LP-a-100-2	C-LP-a-100-2	C-LP-a-100-2	HL-b-400-3
15	C-LP-a-100-3	HL-b-400-3	HL-b-400-3	C-LP-a-100-2
16	HL-b-400-3	C-LP-a-100-3	C-LP-a-100-3	C-LP-a-100-3
17	LP-a-100-2	LP-a-100-2	LP-a-100-2	LP-a-100-2
18	LP-a-100-3	LP-a-100-3	LP-a-100-3	LP-a-100-3
19	C-LP-b-400-1	C-LP-b-400-1	No Action	C-LP-b-400-1
20	No Action	LP-b-400-1	C-LP-b-400-1	No Action
21	LP-b-400-1	C-LP-b-1000-1	LP-b-400-1	LP-b-400-1
22	C-LP-b-1000-1	No Action	C-LP-b-1000-1	C-LP-b-1000-1
23	C-LP-b-400-3	C-LP-b-400-3	LP-b-1000-1	C-LP-b-400-3
24	LP-b-1000-1	LP-b-1000-1	C-LP-b-400-3	LP-b-1000-1
25	C-LP-b-1000-2	LP-b-400-3	LP-b-400-3	LP-b-400-3
26	LP-b-400-3	C-LP-b-1000-2	C-LP-b-1000-2	C-LP-b-1000-2
27	LP-b-1000-2	LP-b-1000-2	LP-b-1000-2	LP-b-1000-2

Planning Unit 1

Evaluation Criteria Values

(Scenario 1, Low Relative Sea Level Rise, High Employment, Dispersed Population; Low Confidence)

Plan #	Alternative	Stakeholder (Multi-Criteria Decision Analysis)	Minimizing Environmental Impacts		Investment Decision (Efficiency)			Minimizing Remaining Risk (Effectiveness)			Year 2025 Present Value Life Cycle Costs (2010-2075) ($Millions)
Evaluation Criteria		Cumulative Ranking Score from MCDA Trend Analysis	Direct Wetland Impact	Indirect Impacts	Cost Efficiency	Total System Costs	Period of Analysis Cost Efficiency	Annualized Residual Damages	Period of Analysis Risk Reduction	Average % Risk Reduction	
(Units)		*(Unit-less Weight)*	*(Acres)*	*(Unit-less Scale)*	*Ratio: Risk Reduction / Present Value Life Cycle Costs (PV LCC)*	*Annualized Life Cycle Costs + EA Residual Damages ($Millions)*	*Cost Efficiency Ratio: Event Freq Risk Reduction X Probability of Occurrence (2010-2075) / PV LCC*	*Average Annual Remaining Risk (Millions)*	*Event Freq Risk Reduction X Probability (2010-2075) ($Millions)*	*2075: 100-yr to 2,000-yr Frequency Events (Avg % of No Action Damages)*	
2	Coastal	283	0	0	0.0277	1,649	1.01	1,106	10,769	31.34	10,666
3	NS-100	106	0	0	0.0391	1,606	0.83	732	14,261	41.94	17,119
4	NS-400	127	0	0	0.0272	2,224	0.67	463	23,035	61.86	34,538
5	NS-1000	85	0	0	0.0205	2,919	0.56	384	27,882	78.81	49,732
6	HL-a-100-2	373	4,200	-2	0.0151	2,475	0.46	950	13,686	41.81	29,860
7	HL-a-100-3	297	3,600	-1	0.0166	2,317	0.51	961	13,455	41.02	26,559
8	HL-b-400-2	567	6,000	-2	0.0100	3,873	0.46	797	27,659	87.06	60,234
9	HL-b-400-3	675	5,500	-2	0.0106	3,647	0.49	810	27,167	85.50	55,561
10	LP-a-100-1	554	1,000	-8	0.0281	1,807	1.07	904	18,914	52.13	17,690
11	LP-a-100-2	756	4,100	-8	0.0169	2,533	0.62	842	20,651	57.88	33,109
12	LP-a-100-3	779	3,700	-8	0.0174	2,472	0.64	850	20,411	57.04	31,758
13	LP-b-400-1	941	4,200	-8	0.0144	2,727	0.68	878	24,547	75.78	36,204
14	LP-b-400-3	1119	7,500	-8	0.0106	3,658	0.49	811	27,314	85.01	55,747
15	LP-b-1000-1	1050	5,100	-8	0.0120	3,121	0.57	874	25,211	79.55	44,005
16	LP-b-1000-2	1167	9,100	-8	0.0086	4,373	0.41	796	28,547	91.19	70,064
17	C-HL-a-100-2	307	4,200	-2	0.0161	2,545	0.45	873	14,900	45.18	32,756
18	C-HL-a-100-3	227	3,600	-1	0.0179	2,384	0.50	870	14,829	44.84	29,661
19	C-HL-b-400-2	470	6,000	-2	0.0109	3,946	0.46	708	29,328	91.73	63,416
20	C-HL-b-400-3	575	5,500	-2	0.0118	3,715	0.49	704	29,165	91.11	58,975
21	C-LP-a-100-1	462	1,000	-8	0.0305	1,845	0.99	744	21,308	59.95	21,559
22	C-LP-a-100-2	656	4,100	-8	0.0181	2,586	0.62	751	22,151	62.63	35,929
23	C-LP-a-100-3	665	3,700	-8	0.0187	2,523	0.63	750	22,039	62.20	34,735
24	C-LP-b-400-1	843	4,200	-8	0.0170	2,832	0.67	684	28,159	86.92	42,061
25	C-LP-b-400-3	1034	7,500	-8	0.0118	3,713	0.50	705	29,172	90.83	58,919
26	C-LP-b-1000-1	950	5,100	-8	0.0145	3,246	0.59	667	29,767	94.09	50,512
27	C-LP-b-1000-2	1095	9,100	-8	0.0096	4,451	0.41	697	30,329	96.85	73,523

Planning Unit 1

Evaluation Criteria Data Ordinal Rankings

(Scenario 1, Low Relative Sea Level Rise, High Employment, Dispersed Population; Low Uncertainty)

Plan #	Alternative	Stakeholder (Multi-Criteria Decision Analysis)	Minimizing Environmental Impacts		Investment Decision (Efficiency)			Minimizing Remaining Risk (Effectiveness)			Year 2025 Present Value Life Cycle Costs (2010-2075) ($Millions)
Evaluation Criteria		Cumulative Ranking Score from MCDA Trend Analysis	Direct Wetland Impact	Indirect Impacts	Cost Efficiency	Total System Costs	Period of Analysis Cost Efficiency	Annualized Residual Damages	Period of Analysis Risk Reduction	Average % Risk Reduction	
(Units)		*(Unit-less Weight)*	*(Acres)*	*(Unit-less Scale)*	*Ratio: Risk Reduction / Present Value Life Cycle Costs (PV LCC)*	*Annualized Life Cycle Costs + EA Residual Damages ($Millions)*	*Cost Efficiency Ratio: Event Freq Risk Reduction X Probability of Occurrence (2010-2075) / PV LCC*	*Average Annual Remaining Risk (Millions)*	*Event Freq Risk Reduction X Probability (2010-2075) ($Millions)*	*2075: 100-yr to 2,000-yr Frequency Events (Avg % of No Action Damages)*	
2	**Coastal (R2)**	5	2	2	4	2	2	27	27	27	1
3	**NS-100**	2	1	1	1	1	4	9	24	24	2
4	**NS-400**	3	3	3	5	5	7	2	15	17	12
5	**NS-1000**	1	4	4	6	17	15	1	8	13	18
6	**HL-a-100-2**	8	14	7	16	9	24	25	25	25	7
7	**HL-a-100-3**	6	7	5	14	6	16	26	26	26	5
8	**HL-b-400-2**	13	22	12	25	24	23	15	9	7	24
9	**HL-b-400-3**	17	20	9	23	20	21	16	12	9	20
10	**LP-a-100-1**	12	5	14	3	3	1	24	21	21	3
11	**LP-a-100-2**	18	12	18	13	12	10	18	19	19	10
12	**LP-a-100-3**	19	9	16	10	8	8	19	20	20	8
13	**LP-b-400-1**	21	16	20	18	15	5	23	14	14	15
14	**LP-b-400-3**	26	24	24	24	21	20	17	10	10	21
15	**LP-b-1000-1**	24	18	22	19	18	14	22	13	12	17
16	**LP-b-1000-2**	27	26	26	27	26	27	14	6	4	26
17	**C-HL-a-100-2**	7	15	8	15	13	25	21	22	22	9
18	**C-HL-a-100-3**	4	8	6	9	7	17	20	23	23	6
19	**C-HL-b-400-2**	10	23	13	22	25	22	8	3	3	25
20	**C-HL-b-400-3**	14	21	10	21	23	19	6	5	5	23
21	**C-LP-a-100-1**	9	6	15	2	4	3	10	18	18	4
22	**C-LP-a-100-2**	15	13	19	8	14	12	13	16	15	14
23	**C-LP-a-100-3**	16	10	17	7	10	9	12	17	16	13
24	**C-LP-b-400-1**	20	17	21	12	16	6	4	7	8	16
25	**C-LP-b-400-3**	23	25	25	20	22	18	7	4	6	22
26	**C-LP-b-1000-1**	22	19	23	17	19	13	3	2	2	19
27	**C-LP-b-1000-2**	25	27	27	26	27	26	5	1	1	27

Planning Unit 1
Cost Efficiency Analysis
(Scenario 1- LRSLR, High Employment, Dispersed Population; Low Uncertainty)

Plan #	Alternative	Present Value Life-Cycle Costs ($ Millions)	Risk Reduction Annual Equivalent ($ Millions)	Cost Efficiency Factor Risk Red / PV Costs	Rank
3	NS-0100	17,119	669	0.0391	**1**
21	C-LP-1a-0100-1	21,559	657	0.0305	**2**
10	LP-1a-0100-1	17,690	497	0.0281	**3**
2	Coastal	10,666	295	0.0277	**4**
4	NS-0400	34,538	939	0.0272	**5**
5	NS-1000	49,732	1,018	0.0205	**6**
23	C-LP-1a-0100-3	34,735	651	0.0187	**7**
22	C-LP-1a-0100-2	35,929	650	0.0181	**8**
18	C-HL-1a-0100-3	29,661	532	0.0179	**9**
12	LP-1a-0100-3	31,758	551	0.0174	**10**
24	C-LP-1b-0400-1	42,061	717	0.0170	**11**
11	LP-1a-0100-2	33,109	559	0.0169	**12**
7	HL-1a-0100-3	26,559	440	0.0166	**13**
17	C-HL-1a-0100-2	32,756	529	0.0161	**14**
6	HL-1a-0100-2	29,860	451	0.0151	**15**
26	C-LP-1b-1000-1	50,512	734	0.0145	**16**
13	LP-1b-0400-1	36,204	523	0.0144	**17**
15	LP-1b-1000-1	44,005	527	0.0120	**18**
25	C-LP-1b-0400-3	58,919	697	0.0118	**19**
20	C-HL-1b-0400-3	58,975	697	0.0118	**20**
19	C-HL-1b-0400-2	63,416	693	0.0109	**21**
9	HL-1b-0400-3	55,561	591	0.0106	**22**
14	LP-1b-0400-3	55,747	590	0.0106	**23**
8	HL-1b-0400-2	60,234	604	0.0100	**24**
27	C-LP-1b-1000-2	73,523	704	0.0096	**25**
16	LP-1b-1000-2	70,064	606	0.0086	**26**

Planning Unit 1
Cost Efficiency Rankings

Rank	Scenario 1 Low RSLR High Employment Dispersed Population	Scenario 2 High RSLR High Employment Dispersed Population	Scenario 3 Low RSLR Business-as-Usual Compact Population	Scenario 4 High RSLR Business-as-Usual Compact Population
1	NS-0100	Coastal	NS-0100	NS-0100
2	C-LP-1a-0100-1	NS-0100	C-LP-1a-0100-1	Coastal
3	LP-1a-0100-1	LP-1a-0100-1	LP-1a-0100-1	LP-1a-0100-1
4	Coastal	C-LP-1a-0100-1	NS-0400	C-LP-1a-0100-1
5	NS-0400	NS-0400	Coastal	NS-0400
6	NS-1000	HL-1a-0100-3	NS-1000	C-HL-1a-0100-3
7	C-LP-1a-0100-3	C-HL-1a-0100-3	C-LP-1a-0100-3	HL-1a-0100-3
8	C-LP-1a-0100-2	NS-1000	C-LP-1a-0100-2	C-LP-1a-0100-3
9	C-HL-1a-0100-3	LP-1a-0100-3	C-HL-1a-0100-3	LP-1a-0100-3
10	LP-1a-0100-3	C-LP-1a-0100-3	LP-1a-0100-3	NS-1000
11	C-LP-1b-0400-1	HL-1a-0100-2	LP-1a-0100-2	C-LP-1a-0100-2
12	LP-1a-0100-2	LP-1a-0100-2	C-LP-1b-0400-1	C-HL-1a-0100-2
13	HL-1a-0100-3	C-HL-1a-0100-2	C-HL-1a-0100-2	LP-1a-0100-2
14	C-HL-1a-0100-2	C-LP-1a-0100-2	HL-1a-0100-3	HL-1a-0100-2
15	HL-1a-0100-2	C-LP-1b-0400-1	HL-1a-0100-2	C-LP-1b-0400-1
16	C-LP-1b-1000-1	LP-1b-0400-1	LP-1b-0400-1	LP-1b-0400-1
17	LP-1b-0400-1	C-LP-1b-1000-1	C-LP-1b-1000-1	C-LP-1b-1000-1
18	LP-1b-1000-1	LP-1b-1000-1	C-HL-1b-0400-3	LP-1b-1000-1
19	C-LP-1b-0400-3	C-LP-1b-0400-3	C-LP-1b-0400-3	C-HL-1b-0400-3
20	C-HL-1b-0400-3	C-HL-1b-0400-3	LP-1b-1000-1	C-LP-1b-0400-3
21	C-HL-1b-0400-2	LP-1b-0400-3	C-HL-1b-0400-2	LP-1b-0400-3
22	HL-1b-0400-3	HL-1b-0400-3	LP-1b-0400-3	HL-1b-0400-3
23	LP-1b-0400-3	C-HL-1b-0400-2	HL-1b-0400-3	C-HL-1b-0400-2
24	HL-1b-0400-2	HL-1b-0400-2	HL-1b-0400-2	HL-1b-0400-2
25	C-LP-1b-1000-2	C-LP-1b-1000-2	C-LP-1b-1000-2	C-LP-1b-1000-2
26	LP-1b-1000-2	LP-1b-1000-2	LP-1b-1000-2	LP-1b-1000-2

Planning Unit 1
Total System Costs Analysis
(Scenario 1- LRSLR, High Employment, Dispersed Population; Low Uncertainty)

Plan #	Alternative	Annual Equivalent Life-Cycle Costs ($Millions)	With Project Residual Damages ($ Millions)	Total System Costs ($ Millions)	Rank
3	NS-0100	873	732	1,606	1
2	Coastal	543	1,106	1,649	2
10	LP-1a-0100-1	903	904	1,807	3
21	C-LP-1a-0100-1	1,100	744	1,845	4
4	NS-0400	1,761	463	2,224	5
7	HL-1a-0100-3	1,356	961	2,317	6
18	C-HL-1a-0100-3	1,514	870	2,384	7
12	LP-1a-0100-3	1,622	850	2,472	8
6	HL-1a-0100-2	1,525	950	2,475	9
23	C-LP-1a-0100-3	1,773	750	2,523	10
11	LP-1a-0100-2	1,691	842	2,533	11
17	C-HL-1a-0100-2	1,672	873	2,545	12
22	C-LP-1a-0100-2	1,834	751	2,586	13
13	LP-1b-0400-1	1,849	878	2,727	14
24	C-LP-1b-0400-1	2,147	684	2,832	15
5	NS-1000	2,535	384	2,919	16
15	LP-1b-1000-1	2,247	874	3,121	17
26	C-LP-1b-1000-1	2,579	667	3,246	18
9	HL-1b-0400-3	2,837	810	3,647	19
14	LP-1b-0400-3	2,847	811	3,658	20
25	C-LP-1b-0400-3	3,008	705	3,713	21
20	C-HL-1b-0400-3	3,011	704	3,715	22
8	HL-1b-0400-2	3,076	797	3,873	23
19	C-HL-1b-0400-2	3,238	708	3,946	24
16	LP-1b-1000-2	3,578	796	4,373	25
27	C-LP-1b-1000-2	3,754	697	4,451	26

Planning Unit 1

Total System Costs Rankings

Rank	Scenario 1 Low RSLR High Employment Dispersed Population	Scenario 2 High RSLR High Employment Dispersed Population	Scenario 3 Low RSLR Business-as-Usual Compact Population	Scenario 4 High RSLR Business-as-Usual Compact Population
1	NS-0100	NS-0100	NS-0100	NS-0100
2	Coastal	Coastal	Coastal	Coastal
3	LP-1a-0100-1	LP-1a-0100-1	LP-1a-0100-1	LP-1a-0100-1
4	C-LP-1a-0100-1	C-LP-1a-0100-1	C-LP-1a-0100-1	C-LP-1a-0100-1
5	NS-0400	NS-0400	HL-1a-0100-3	HL-1a-0100-3
6	HL-1a-0100-3	HL-1a-0100-3	C-HL-1a-0100-3	C-HL-1a-0100-3
7	C-HL-1a-0100-3	C-HL-1a-0100-3	NS-0400	NS-0400
8	LP-1a-0100-3	HL-1a-0100-2	LP-1a-0100-3	HL-1a-0100-2
9	HL-1a-0100-2	LP-1a-0100-3	HL-1a-0100-2	LP-1a-0100-3
10	C-LP-1a-0100-3	C-HL-1a-0100-2	C-LP-1a-0100-3	C-HL-1a-0100-2
11	LP-1a-0100-2	C-LP-1a-0100-3	C-HL-1a-0100-2	C-LP-1a-0100-3
12	C-HL-1a-0100-2	LP-1a-0100-2	LP-1a-0100-2	LP-1a-0100-2
13	C-LP-1a-0100-2	C-LP-1a-0100-2	C-LP-1a-0100-2	C-LP-1a-0100-2
14	LP-1b-0400-1	NS-1000	LP-1b-0400-1	LP-1b-0400-1
15	C-LP-1b-0400-1	LP-1b-0400-1	C-LP-1b-0400-1	C-LP-1b-0400-1
16	NS-1000	C-LP-1b-0400-1	NS-1000	NS-1000
17	LP-1b-1000-1	LP-1b-1000-1	LP-1b-1000-1	LP-1b-1000-1
18	C-LP-1b-1000-1	C-LP-1b-1000-1	C-LP-1b-1000-1	C-LP-1b-1000-1
19	HL-1b-0400-3	LP-1b-0400-3	LP-1b-0400-3	LP-1b-0400-3
20	LP-1b-0400-3	HL-1b-0400-3	HL-1b-0400-3	HL-1b-0400-3
21	C-LP-1b-0400-3	C-LP-1b-0400-3	C-LP-1b-0400-3	C-LP-1b-0400-3
22	C-HL-1b-0400-3	C-HL-1b-0400-3	C-HL-1b-0400-3	C-HL-1b-0400-3
23	HL-1b-0400-2	HL-1b-0400-2	HL-1b-0400-2	HL-1b-0400-2
24	C-HL-1b-0400-2	C-HL-1b-0400-2	C-HL-1b-0400-2	C-HL-1b-0400-2
25	LP-1b-1000-2	LP-1b-1000-2	LP-1b-1000-2	LP-1b-1000-2
26	C-LP-1b-1000-2	C-LP-1b-1000-2	C-LP-1b-1000-2	C-LP-1b-1000-2

Planning Unit 1
Period of Analysis Cost Efficiency
(2075 Risk Reduction X Probablility (2010-2075) / Present Value Costs For Frequency Events Included in Economic Evaluation)

(Scenario 1: Low RSLR, High Employment, Dispersed Population - Low Uncertainty)

Plan #	Alternative	Remaining Damages by Frequency ($Billions)					Total Risk Reduction X Probabilty 2010-2075 ($ Billions)	Present Value - Life-Cycle Costs ($ Billions)	Cost Efficiency Ratio - Total Risk Reduction / PV Costs	Rank
		10-yr	100-yr	400-yr	1000-yr	2000-yr				
No Action Damages ($ Billions)		1.2	11.9	89.9	118.3	122.3				
10	LP-a-100-1	1.0	4.2	19.7	54.3	108.1	18.9	17.7	1.07	1
2	Coastal	1.2	6.0	54.5	78.8	119.2	10.8	10.7	1.01	2
21	C-LP-a-100-1	0.7	1.7	16.3	50.4	104.2	21.3	21.6	0.99	3
3	NS-100	0.5	2.2	50.6	74.9	115.4	14.3	17.1	0.83	4
13	LP-b-400-1	1.0	4.1	11.2	20.4	39.6	24.5	36.2	0.68	5
24	C-LP-b-400-1	0.7	1.2	2.8	14.2	33.5	28.2	42.1	0.67	6
4	NS-400	0.2	0.8	5.4	62.0	106.8	23.0	34.5	0.67	7
12	LP-a-100-3	1.0	2.7	16.5	51.2	106.6	20.4	31.8	0.64	8
23	C-LP-a-100-3	0.7	1.2	14.2	48.4	103.7	22.0	34.7	0.63	9
11	LP-a-100-2	0.9	2.5	16.2	50.6	105.8	20.7	33.1	0.62	10
22	C-LP-a-100-2	0.7	1.1	14.0	47.8	103.0	22.2	35.9	0.62	11
26	C-LP-b-1000-1	0.7	1.1	1.4	3.3	12.0	29.8	50.5	0.59	12
15	LP-b-1000-1	1.0	4.1	11.1	18.3	23.5	25.2	44.0	0.57	13
5	NS-1000	0.1	0.6	2.1	5.1	89.3	27.9	49.7	0.56	14
7	HL-a-100-3	1.0	2.4	52.2	72.8	117.7	13.5	26.6	0.51	15
18	C-HL-a-100-3	0.7	1.4	49.8	70.2	114.9	14.8	29.7	0.50	16
25	C-LP-b-400-3	0.7	1.0	1.3	6.9	25.7	29.2	58.9	0.50	17
20	C-HL-b-400-3	0.7	1.0	1.8	6.6	23.8	29.2	59.0	0.49	18
14	LP-b-400-3	1.0	2.7	4.4	10.3	29.3	27.3	55.7	0.49	19
9	HL-b-400-3	1.0	2.2	6.5	11.1	28.0	27.2	55.6	0.49	20
19	C-HL-b-400-2	0.7	1.0	1.5	5.7	22.5	29.3	63.4	0.46	21
8	HL-b-400-2	1.0	2.0	5.5	9.5	26.1	27.7	60.2	0.46	22
6	HL-a-100-2	1.0	2.2	52.1	72.4	116.8	13.7	29.9	0.46	23
17	C-HL-a-100-2	0.7	1.4	49.8	69.9	114.2	14.9	32.8	0.45	24
27	C-LP-b-1000-2	0.7	0.9	1.0	1.4	3.1	30.3	73.5	0.41	25
16	LP-b-1000-2	0.9	2.5	3.9	5.3	7.2	28.5	70.1	0.41	26

Planning Unit 1

Period of Analysis Cost Efficiency Rankings

(2075 Risk Reduction X Probability (2010 - 2075) / Present Value Costs Rankings For Frequency Events Included in Economic Evaluation)

Rank	Scenario 1 Low RSLR High Employment Dispersed Population	Scenario 2 High RSLR High Employment Dispersed Population	Scenario 3 Low RSLR Business-as-Usual Compact Population	Scenario 4 High RSLR Business-as-Usual Compact Population
1	LP-a-100-1	Coastal	LP-a-100-1	Coastal
2	Coastal	LP-a-100-1	C-LP-a-100-1	LP-a-100-1
3	C-LP-a-100-1	C-LP-a-100-1	Coastal	C-LP-a-100-1
4	NS-100	NS-100	NS-100	NS-100
5	LP-b-400-1	LP-a-100-3	LP-b-400-1	LP-a-100-3
6	C-LP-b-400-1	LP-a-100-2	LP-a-100-3	LP-a-100-2
7	NS-400	C-LP-a-100-3	C-LP-b-400-1	C-LP-a-100-3
8	LP-a-100-3	NS-400	C-LP-a-100-3	C-LP-a-100-2
9	C-LP-a-100-3	LP-b-400-1	LP-a-100-2	HL-a-100-3
10	LP-a-100-2	C-LP-a-100-2	C-LP-a-100-2	LP-b-400-1
11	C-LP-a-100-2	HL-a-100-3	NS-400	C-HL-a-100-3
12	C-LP-b-1000-1	C-LP-b-400-1	C-LP-b-1000-1	C-LP-b-400-1
13	LP-b-1000-1	C-HL-a-100-3	NS-1000	NS-400
14	NS-1000	HL-a-100-2	C-HL-b-400-3	HL-a-100-2
15	HL-a-100-3	C-HL-a-100-2	C-HL-a-100-3	C-HL-a-100-2
16	C-HL-a-100-3	C-LP-b-1000-1	C-LP-b-400-3	LP-b-1000-1
17	C-LP-b-400-3	LP-b-1000-1	LP-b-400-3	C-LP-b-1000-1
18	C-HL-b-400-3	NS-1000	HL-b-400-3	NS-1000
19	LP-b-400-3	LP-b-400-3	HL-a-100-3	LP-b-400-3
20	HL-b-400-3	C-LP-b-400-3	C-HL-b-400-2	C-LP-b-400-3
21	C-HL-b-400-2	C-HL-b-400-3	HL-b-400-2	HL-b-400-3
22	HL-b-400-2	HL-b-400-3	LP-b-1000-1	C-HL-b-400-3
23	HL-a-100-2	C-HL-b-400-2	C-HL-a-100-2	HL-b-400-2
24	C-HL-a-100-2	HL-b-400-2	HL-a-100-2	C-HL-b-400-2
25	C-LP-b-1000-2	LP-b-1000-2	C-LP-b-1000-2	LP-b-1000-2
26	LP-b-1000-2	C-LP-b-1000-2	LP-b-1000-2	C-LP-b-1000-2

Planning Unit 1
Residual Damages (Remaining Risk) Analysis
(Scenario 1: Low RSLR, High Employment, Dispersed Population - Low Uncertainty)

Plan #	Alternative	No Action Residual Damages ($Millions)	With Project Residual Damages ($ Millions)	% of No Action Damages	Rank
5	NS-1000	1,401	384	27.4	**1**
4	NS-0400	1,401	463	33.0	**2**
26	C-LP-1b-1000-1	1,401	667	47.6	**3**
24	C-LP-1b-0400-1	1,401	684	48.8	**4**
27	C-LP-1b-1000-2	1,401	697	49.8	**5**
20	C-HL-1b-0400-3	1,401	704	50.3	**6**
25	C-LP-1b-0400-3	1,401	705	50.3	**7**
19	C-HL-1b-0400-2	1,401	708	50.5	**8**
3	NS-0100	1,401	732	52.3	**9**
21	C-LP-1a-0100-1	1,401	744	53.1	**10**
23	C-LP-1a-0100-3	1,401	750	53.5	**11**
22	C-LP-1a-0100-2	1,401	751	53.6	**12**
16	LP-1b-1000-2	1,401	796	56.8	**13**
8	HL-1b-0400-2	1,401	797	56.9	**14**
9	HL-1b-0400-3	1,401	810	57.8	**15**
14	LP-1b-0400-3	1,401	811	57.9	**16**
11	LP-1a-0100-2	1,401	842	60.1	**17**
12	LP-1a-0100-3	1,401	850	60.7	**18**
18	C-HL-1a-0100-3	1,401	870	62.1	**19**
17	C-HL-1a-0100-2	1,401	873	62.3	**20**
15	LP-1b-1000-1	1,401	874	62.4	**21**
13	LP-1b-0400-1	1,401	878	62.7	**22**
10	LP-1a-0100-1	1,401	904	64.5	**23**
6	HL-1a-0100-2	1,401	950	67.8	**24**
7	HL-1a-0100-3	1,401	961	68.6	**25**
2	Coastal (R2)	1,401	1,106	78.9	**26**

Planning Unit 1
Residual Damages (Remaining Risk) Rankings

Rank	Scenario 1 Low RSLR High Employment Dispersed Population	Scenario 2 High RSLR High Employment Dispersed Population	Scenario 3 Low RSLR Business-as-Usual Compact Population	Scenario 4 High RSLR Business-as-Usual Compact Population
1	NS-1000	NS-1000	NS-1000	NS-1000
2	NS-0400	NS-0400	NS-0400	NS-0400
3	C-LP-1b-1000-1	NS-0100	C-LP-1b-1000-1	C-LP-1b-1000-1
4	C-LP-1b-0400-1	C-LP-1b-1000-1	C-LP-1b-0400-1	NS-0100
5	C-LP-1b-1000-2	C-LP-1b-1000-2	C-HL-1b-0400-3	C-LP-1b-0400-1
6	C-HL-1b-0400-3	C-LP-1b-0400-1	C-LP-1b-1000-2	C-LP-1b-1000-2
7	C-LP-1b-0400-3	C-HL-1b-0400-3	C-HL-1b-0400-2	C-HL-1b-0400-3
8	C-HL-1b-0400-2	C-LP-1b-0400-3	C-LP-1b-0400-3	C-HL-1b-0400-2
9	NS-0100	C-HL-1b-0400-2	C-LP-1a-0100-1	C-LP-1b-0400-3
10	C-LP-1a-0100-1	C-LP-1a-0100-2	C-LP-1a-0100-3	C-LP-1a-0100-2
11	C-LP-1a-0100-3	C-LP-1a-0100-3	C-LP-1a-0100-2	C-LP-1a-0100-3
12	C-LP-1a-0100-2	C-LP-1a-0100-1	NS-0100	C-LP-1a-0100-1
13	LP-1b-1000-2	LP-1b-1000-2	LP-1b-1000-2	LP-1b-1000-2
14	HL-1b-0400-2	LP-1a-0100-2	HL-1b-0400-2	HL-1b-0400-2
15	HL-1b-0400-3	LP-1b-0400-3	LP-1b-0400-3	LP-1a-0100-2
16	LP-1b-0400-3	HL-1b-0400-2	HL-1b-0400-3	LP-1b-0400-3
17	LP-1a-0100-2	LP-1a-0100-3	LP-1a-0100-2	LP-1a-0100-3
18	LP-1a-0100-3	C-HL-1a-0100-2	LP-1a-0100-3	HL-1b-0400-3
19	C-HL-1a-0100-3	C-HL-1a-0100-3	C-HL-1a-0100-3	C-HL-1a-0100-2
20	C-HL-1a-0100-2	HL-1b-0400-3	LP-1b-1000-1	C-HL-1a-0100-3
21	LP-1b-1000-1	LP-1b-1000-1	C-HL-1a-0100-2	LP-1b-1000-1
22	LP-1b-0400-1	LP-1b-0400-1	LP-1b-0400-1	LP-1a-0100-1
23	LP-1a-0100-1	LP-1a-0100-1	LP-1a-0100-1	LP-1b-0400-1
24	HL-1a-0100-2	HL-1a-0100-2	HL-1a-0100-2	HL-1a-0100-2
25	HL-1a-0100-3	HL-1a-0100-3	HL-1a-0100-3	HL-1a-0100-3
26	Coastal	Coastal	Coastal	Coastal

Planning Unit 1

Period of Analysis Risk Reduction

(2075 Risk Reduction X Probablility (2010-2075)

For Frequency Events Included in Economic Evaluation)

(Scenario 1: Low RSLR, High Employment, Dispersed Population - 90% Confidence Level)

Plan #	Alternative	Remaining Damages by Frequency ($Millions)					Total Risk Reduction X Probabilty 2010-2075 ($Million)	Rank
		10-yr	100-yr	400-yr	1,000-yr	2,000-yr		
No Action Damages ($ Million)		1,215	11,935	89,937	118,260	122,343		
27	C-LP-b-1000-2	696	931	996	1,362	3,099	30,329	1
26	C-LP-b-1000-1	695	1,125	1,408	3,324	12,020	29,767	2
19	C-HL-b-400-2	703	980	1,531	5,672	22,470	29,328	3
25	C-LP-b-400-3	702	995	1,337	6,866	25,731	29,172	4
20	C-HL-b-400-3	708	1,023	1,793	6,558	23,779	29,165	5
16	LP-b-1000-2	939	2,451	3,853	5,330	7,208	28,547	6
24	C-LP-b-400-1	704	1,175	2,761	14,209	33,494	28,159	7
5	NS-1000	139	618	2,090	5,057	89,283	27,882	8
8	HL-b-400-2	958	1,952	5,474	9,482	26,064	27,659	9
14	LP-b-400-3	959	2,668	4,448	10,316	29,258	27,314	10
9	HL-b-400-3	1,011	2,209	6,516	11,051	28,009	27,167	11
15	LP-b-1000-1	1,033	4,142	11,126	18,304	23,524	25,211	12
13	LP-b-400-1	1,033	4,144	11,216	20,434	39,642	24,547	13
4	NS-400	246	804	5,450	61,995	106,842	23,035	14
22	C-LP-a-100-2	713	1,109	14,016	47,839	102,967	22,151	15
23	C-LP-a-100-3	714	1,166	14,212	48,364	103,665	22,039	16
21	C-LP-a-100-1	723	1,703	16,335	50,410	104,180	21,308	17
11	LP-a-100-2	941	2,536	16,183	50,576	105,784	20,651	18
12	LP-a-100-3	960	2,742	16,545	51,238	106,606	20,411	19
10	LP-a-100-1	1,034	4,200	19,737	54,345	108,114	18,914	20
17	C-HL-a-100-2	717	1,368	49,813	69,880	114,192	14,900	21
18	C-HL-a-100-3	721	1,440	49,754	70,154	114,933	14,829	22
3	NS-100	490	2,191	50,601	74,874	115,364	14,261	23
6	HL-a-100-2	960	2,156	52,133	72,433	116,819	13,686	24
7	HL-a-100-3	1,011	2,398	52,213	72,825	117,664	13,455	25
2	Coastal	1,214	5,957	54,550	78,763	119,248	10,769	26

Planning Unit 1
Period of Analysis Risk Reduction
(2075 Risk Reduction X Probability (2010 - 2075) Rankings
For Frequency Events Included in Economic Evaluation)

Rank	Scenario 1 Low RSLR High Employment Dispersed Population	Scenario 2 High RSLR High Employment Dispersed Population	Scenario 3 Low RSLR Business-as-Usual Compact Population	Scenario 4 High RSLR Business-as-Usual Compact Population
1	C-LP-b-1000-2	C-LP-b-1000-2	C-LP-b-1000-2	C-LP-b-1000-2
2	C-LP-b-1000-1	C-HL-b-400-2	C-LP-b-1000-1	C-HL-b-400-2
3	C-HL-b-400-2	C-LP-b-1000-1	C-HL-b-400-2	C-HL-b-400-3
4	C-LP-b-400-3	C-LP-b-400-3	C-HL-b-400-3	LP-b-1000-2
5	C-HL-b-400-3	C-HL-b-400-3	LP-b-1000-2	C-LP-b-1000-1
6	LP-b-1000-2	LP-b-1000-2	C-LP-b-400-3	C-LP-b-400-3
7	C-LP-b-400-1	NS-1000	NS-1000	HL-b-400-2
8	NS-1000	LP-b-400-3	C-LP-b-400-1	LP-b-400-3
9	HL-b-400-2	C-LP-b-400-1	HL-b-400-2	NS-1000
10	LP-b-400-3	HL-b-400-2	LP-b-400-3	HL-b-400-3
11	HL-b-400-3	HL-b-400-3	HL-b-400-3	C-LP-b-400-1
12	LP-b-1000-1	LP-b-1000-1	LP-b-400-1	LP-b-1000-1
13	LP-b-400-1	LP-b-400-1	NS-400	C-LP-a-100-2
14	NS-400	C-LP-a-100-2	C-LP-a-100-2	LP-b-400-1
15	C-LP-a-100-2	C-LP-a-100-3	C-LP-a-100-3	C-LP-a-100-3
16	C-LP-a-100-3	NS-400	C-LP-a-100-1	NS-400
17	C-LP-a-100-1	LP-a-100-2	LP-a-100-2	LP-a-100-2
18	LP-a-100-2	LP-a-100-3	LP-a-100-3	LP-a-100-3
19	LP-a-100-3	C-LP-a-100-1	LP-b-1000-1	C-LP-a-100-1
20	LP-a-100-1	LP-a-100-1	LP-a-100-1	LP-a-100-1
21	C-HL-a-100-2	C-HL-a-100-2	C-HL-a-100-2	C-HL-a-100-2
22	C-HL-a-100-3	C-HL-a-100-3	C-HL-a-100-3	C-HL-a-100-3
23	NS-100	HL-a-100-2	NS-100	HL-a-100-2
24	HL-a-100-2	HL-a-100-3	HL-a-100-2	HL-a-100-3
25	HL-a-100-3	NS-100	HL-a-100-3	NS-100
26	Coastal	Coastal	Coastal	Coastal

Planning Unit 1
Average % Risk Reduction of Total Damages
For 100-yr to 2,000-yr Frequency Event Range Based on 2075 Population / Land Use
(Scenario 1: Low RSLR, High Employment, Dispersed Population - Low Uncertainty)

Plan #	Alternative	Average % Risk Reduction for 100-yr to 2,000-yr Freq Events	Average Risk Reduction for 100-yr to 2,000-yr Frequency Events ($ Millions)	Life Cycle Costs Equiv. Annual ($ Millions)	Rank
Total No Action Residual Damages 100-yr to 2,000-yr Freq Events ($ Million)		342,474			
27	C-LP-b-1000-2	96.85	331,693	3,754	1
26	C-LP-b-1000-1	94.09	322,242	2,579	2
19	C-HL-b-400-2	91.73	314,155	3,238	3
16	LP-b-1000-2	91.19	312,318	3,578	4
20	C-HL-b-400-3	91.11	312,036	3,011	5
25	C-LP-b-400-3	90.83	311,086	3,008	6
8	HL-b-400-2	87.06	298,153	3,076	7
24	C-LP-b-400-1	86.92	297,689	2,147	8
9	HL-b-400-3	85.50	292,823	2,837	9
14	LP-b-400-3	85.01	291,152	2,847	10
15	LP-b-1000-1	79.55	272,452	2,247	11
5	NS-1000	78.81	269,907	2,535	12
13	LP-b-400-1	75.78	259,535	1,849	13
22	C-LP-a-100-2	62.63	214,485	1,834	14
23	C-LP-a-100-3	62.20	213,019	1,773	15
4	NS-400	61.86	211,866	1,761	16
21	C-LP-a-100-1	59.95	205,306	1,100	17
11	LP-a-100-2	57.88	198,225	1,691	18
12	LP-a-100-3	57.04	195,355	1,622	19
10	LP-a-100-1	52.13	178,548	903	20
17	C-HL-a-100-2	45.18	154,734	1,672	21
18	C-HL-a-100-3	44.84	153,553	1,514	22
3	NS-100	41.94	143,641	873	23
6	HL-a-100-2	41.81	143,183	1,525	24
7	HL-a-100-3	41.02	140,494	1,356	25
2	Coastal	31.34	107,334	543	26

Planning Unit 1
Average % Risk Reduction of Total Damages
For 100-yr to 2,000-yr Frequency Event Range Based on 2075 Population / Land Use

Rank	Scenario 1 Low RSLR High Employment Dispersed Population	Scenario 2 High RSLR High Employment Dispersed Population	Scenario 3 Low RSLR Business-as-Usual Compact Population	Scenario 4 High RSLR Business-as-Usual Compact Population
1	C-LP-b-1000-2	C-LP-b-1000-2	C-LP-b-1000-2	C-LP-b-1000-2
2	C-LP-b-1000-1	LP-b-1000-2	C-LP-b-1000-1	LP-b-1000-2
3	C-HL-b-400-2	C-LP-b-1000-1	LP-b-1000-2	C-HL-b-400-2
4	LP-b-1000-2	C-HL-b-400-2	C-HL-b-400-2	C-LP-b-1000-1
5	C-HL-b-400-3	C-LP-b-400-3	C-HL-b-400-3	C-HL-b-400-3
6	C-LP-b-400-3	C-HL-b-400-3	C-LP-b-400-3	C-LP-b-400-3
7	HL-b-400-2	HL-b-400-2	HL-b-400-2	HL-b-400-2
8	C-LP-b-400-1	LP-b-400-3	HL-b-400-3	HL-b-400-3
9	HL-b-400-3	HL-b-400-3	LP-b-400-3	LP-b-400-3
10	LP-b-400-3	C-LP-b-400-1	C-LP-b-400-1	C-LP-b-400-1
11	LP-b-1000-1	LP-b-1000-1	NS-1000	LP-b-1000-1
12	NS-1000	LP-b-400-1	LP-b-400-1	LP-b-400-1
13	LP-b-400-1	NS-1000	LP-b-1000-1	NS-1000
14	C-LP-a-100-2	C-LP-a-100-2	C-LP-a-100-2	C-LP-a-100-2
15	C-LP-a-100-3	C-LP-a-100-3	C-LP-a-100-3	C-LP-a-100-3
16	NS-400	LP-a-100-2	NS-400	LP-a-100-2
17	C-LP-a-100-1	LP-a-100-3	LP-a-100-2	LP-a-100-3
18	LP-a-100-2	C-LP-a-100-1	C-LP-a-100-1	C-LP-a-100-1
19	LP-a-100-3	NS-400	LP-a-100-3	NS-400
20	LP-a-100-1	LP-a-100-1	LP-a-100-1	LP-a-100-1
21	C-HL-a-100-2	C-HL-a-100-2	C-HL-a-100-2	C-HL-a-100-2
22	C-HL-a-100-3	C-HL-a-100-3	C-HL-a-100-3	C-HL-a-100-3
23	NS-100	HL-a-100-2	HL-a-100-2	HL-a-100-2
24	HL-a-100-2	HL-a-100-3	NS-100	HL-a-100-3
25	HL-a-100-3	NS-100	HL-a-100-3	NS-100
26	Coastal	Coastal	Coastal	Coastal

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Planning Unit 2

Sample Data Rankings and Evaluation Criteria Tables

Planning Unit 2 - Metric Data Summary
(Scenario 1 - Low Relative Sea Level Rise, High Employment, Dispersed Population; Low Uncertainty)

Plan #	Alternative	Population Impacted	Residual Damages	Life Cycle Cost	Construction Time	Employment Impacted	Indirect Environmental Impact Score	Direct Wetland Impacts	Historic Properties Protected	Historic Districts Protected	Archeo. Sites Protected
		Ann. Equiv. #	Ann. Equiv. $ Millions	Ann. Equiv. $ Millions	Years	Ann. Equiv. #	Unit-less Scale -8 to +8	Acres	# Properties	# Districts	# Sites
1	No Action	31,156	2,164	0	15	9,054	0	0	12	0	42
2	Coastal	21,148	967	800	15	3,806	0	0	13	4	154
3	NS-100	19,187	649	1,017	15	2,611	0	0	13	4	154
4	NS-400	16,460	332	1,603	15	1,873	0	0	13	4	154
5	NS-1000	15,909	302	2,294	15	1,058	0	0	13	4	154
6	G-100-1	19,963	831	1,188	11	3,258	-8	1,000	24	8	396
7	G-100-4	17,697	782	1,541	11	3,040	-8	2,200	24	8	396
8	G-400-4	18,067	839	2,574	13	3,262	-8	7,400	25	8	396
9	G-1000-4	18,021	839	2,961	13	3,261	-8	9,500	25	8	396
10	R-100-2	20,398	1,017	1,194	11	4,056	4	700	14	6	160
11	R-100-3	19,537	993	1,318	11	3,967	4	1,000	14	6	160
12	R-100-4	19,105	980	1,481	11	3,849	4	1,600	14	6	171
13	R-400-2	19,489	916	2,097	13	3,570	4	4,400	25	8	160
14	R-400-3	17,898	821	2,246	11	3,173	4	4,700	25	8	160
15	R-400-4	18,233	879	2,406	13	3,366	4	5,300	25	8	171
16	R-1000-4	18,067	870	2,800	13	3,331	4	6,800	25	8	171
17	WBI-100-1	20,935	983	851	6	3,883	2	0	14	6	160
18	WBI-400-1	20,472	944	1,734	12	3,660	2	3,700	25	8	160
19	C-G-100-1	19,020	633	1,343	11	2,558	-8	1,000	24	8	396
20	C-G-100-4	16,755	611	1,671	11	2,484	-8	2,200	24	8	396
21	C-G-400-4	16,772	644	2,691	13	2,492	-8	7,400	25	8	396
22	C-G-1000-4	16,250	630	3,113	13	2,465	-8	9,500	25	8	396
23	C-R-100-2	19,510	821	1,366	11	3,367	4	700	14	6	160
24	C-R-100-3	18,650	814	1,471	11	3,340	4	1,000	14	6	160
25	C-R-100-4	18,217	810	1,626	11	3,307	4	1,600	14	6	171
26	C-R-400-2	18,227	642	2,233	13	2,481	4	4,400	25	8	160
27	C-R-400-3	16,679	573	2,373	11	2,188	4	4,700	25	8	160
28	C-R-400-4	17,014	645	2,523	13	2,522	4	5,300	25	8	171
29	C-R-1000-4	16,628	626	2,943	13	2,462	4	6,800	25	8	171
30	C-WBI-100-1	20,047	739	1,065	6	3,055	2	0	14	6	160
31	C-WBI-400-1	19,210	605	1,912	12	2,337	2	3,700	25	8	160

Planning Unit 2 - Relative Ranking of Alternatives Based On Individual Metrics
(Scenario 1 - Low Relative Sea Level Rise, High Employment, Dispersed Population; Low Uncertainty)

Rank	Population Impacted	Residual Damages	Life Cycle Cost	Construction Time	Employment Impacted	Indirect Environmental Impact Score	Direct Wetland Impacts	Historic Properties Protected	Historic Districts Protected	Archeo. Sites Protected
1	NS-1000	NS-1000	No Action	WBI-100-1	NS-1000	R-100-2	No Action	WBI-400-1	G-100-1	G-100-1
2	C-G-1000-4	NS-400	Coastal	C-WBI-100-1	NS-400	R-100-3	Coastal	C-WBI-400-1	C-G-100-1	C-G-100-1
3	NS-400	C-R-400-3	WBI-100-1	G-100-1	C-R-400-3	C-R-100-2	WBI-100-1	R-400-2	G-100-4	G-100-4
4	C-R-1000-4	C-WBI-400-1	NS-100	R-100-2	C-WBI-400-1	C-R-100-3	NS-100	C-R-400-2	C-G-100-4	C-G-100-4
5	C-R-400-3	C-G-100-4	C-WBI-100-1	R-100-3	C-R-1000-4	R-100-4	C-WBI-100-1	R-400-3	WBI-400-1	G-400-4
6	C-G-100-4	C-R-1000-4	G-100-1	C-G-100-1	C-G-1000-4	C-R-100-4	NS-400	C-R-400-3	C-WBI-400-1	C-G-400-4
7	C-G-400-4	C-G-1000-4	R-100-2	C-R-100-2	C-R-400-2	R-400-2	NS-1000	R-400-4	R-400-2	G-1000-4
8	C-R-400-4	C-G-100-1	R-100-3	C-R-100-3	C-G-100-4	C-R-400-2	R-100-2	C-R-400-4	C-R-400-2	C-G-1000-4
9	G-100-4	C-R-400-2	C-G-100-1	R-100-4	C-G-400-4	R-400-3	C-R-100-2	G-400-4	R-400-3	R-100-4
10	R-400-3	C-G-400-4	C-R-100-2	G-100-4	C-R-400-4	C-R-400-3	G-100-1	C-G-400-4	C-R-400-3	C-R-100-4
11	G-1000-4	C-R-400-4	C-R-100-3	C-R-100-4	C-G-100-1	R-400-4	R-100-3	R-1000-4	R-400-4	R-400-4
12	R-1000-4	NS-100	R-100-4	C-G-100-4	NS-100	C-R-400-4	C-G-100-1	C-R-1000-4	C-R-400-4	C-R-400-4
13	G-400-4	C-WBI-100-1	G-100-4	R-400-3	G-100-4	R-1000-4	C-R-100-3	G-1000-4	G-400-4	R-1000-4
14	C-R-100-4	G-100-4	NS-400	C-R-400-3	C-WBI-100-1	C-R-1000-4	R-100-4	C-G-1000-4	C-G-400-4	C-R-1000-4
15	C-R-400-2	C-R-100-4	C-R-100-4	WBI-400-1	R-400-3	WBI-100-1	C-R-100-4	G-100-1	R-1000-4	WBI-100-1
16	R-400-4	C-R-100-3	C-G-100-4	C-WBI-400-1	G-100-1	C-WBI-100-1	G-100-4	C-G-100-1	C-R-1000-4	C-WBI-100-1
17	C-R-100-3	R-400-3	WBI-400-1	R-400-2	G-1000-4	WBI-400-1	C-G-100-4	G-100-4	G-1000-4	R-100-2
18	C-G-100-1	C-R-100-2	C-WBI-400-1	C-R-400-2	G-400-4	C-WBI-400-1	WBI-400-1	C-G-100-4	C-G-1000-4	R-100-3
19	R-100-4	G-100-1	R-400-2	R-400-4	C-R-100-4	No Action	C-WBI-400-1	WBI-100-1	WBI-100-1	C-R-100-2
20	NS-100	G-1000-4	C-R-400-2	C-R-400-4	R-1000-4	Coastal	R-400-2	C-WBI-100-1	C-WBI-100-1	C-R-100-3
21	C-WBI-400-1	G-400-4	R-400-3	G-400-4	C-R-100-3	NS-100	C-R-400-2	R-100-2	R-100-2	WBI-400-1
22	R-400-2	R-1000-4	NS-1000	C-G-400-4	R-400-4	NS-400	R-400-3	R-100-3	R-100-3	C-WBI-400-1
23	C-R-100-2	R-400-4	C-R-400-3	R-1000-4	C-R-100-2	NS-1000	C-R-400-3	C-R-100-2	C-R-100-2	R-400-2
24	R-100-3	R-400-2	R-400-4	C-R-1000-4	R-400-2	G-100-1	R-400-4	C-R-100-3	C-R-100-3	C-R-400-2
25	G-100-1	WBI-400-1	C-R-400-4	G-1000-4	WBI-400-1	C-G-100-1	C-R-400-4	R-100-4	R-100-4	R-400-3
26	C-WBI-100-1	Coastal	G-400-4	C-G-1000-4	Coastal	G-100-4	R-1000-4	C-R-100-4	C-R-100-4	C-R-400-3
27	R-100-2	R-100-4	C-G-400-4	No Action	R-100-4	C-G-100-4	C-R-1000-4	Coastal	Coastal	Coastal
28	WBI-400-1	WBI-100-1	R-1000-4	Coastal	WBI-100-1	G-400-4	G-400-4	NS-100	NS-100	NS-100
29	WBI-100-1	R-100-3	C-R-1000-4	NS-100	R-100-3	C-G-400-4	C-G-400-4	NS-400	NS-400	NS-400
30	Coastal	R-100-2	G-1000-4	NS-400	R-100-2	G-1000-4	G-1000-4	NS-1000	NS-1000	NS-1000
31	No Action	No Action	C-G-1000-4	NS-1000	No Action	C-G-1000-4	C-G-1000-4	No Action	No Action	No Action

Planning Unit 2 - Multi-Criteria Decision Analysis (MCDA) Trend Analysis

(Scenario 1 - Low Relative Sea Level Rise, High Employment, Dispersed Population; Low Uncertainty)

Plan #	Alternative	Plan Rank By Each Respondant																											Total Ranking Score (All Respondants)
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	
30	C-WBI-100-1	1	1	1	19	1	1	1	1	1	2	1	1	8	1	1	1	1	1	1	1	1	1	1	1	1	1	1	53
23	C-R-100-2	3	2	3	20	3	3	3	3	3	5	3	4	3	9	2	6	3	5	4	4	3	3	4	2	2	3	3	111
17	WBI-100-1	2	4	2	22	2	5	6	2	5	8	2	2	11	4	3	2	2	3	2	3	6	2	2	3	4	2	2	113
24	C-R-100-3	5	3	4	21	4	4	5	4	4	10	4	3	5	8	4	5	4	4	5	5	2	4	5	4	3	4	5	138
27	C-R-400-3	12	12	8	5	9	2	10	8	2	1	6	7	1	17	11	9	5	2	3	2	5	11	11	6	10	10	4	189
10	R-100-2	4	7	5	23	5	11	9	5	6	13	8	9	4	14	5	14	8	14	6	9	9	5	7	7	6	6	6	225
25	C-R-100-4	7	5	7	25	7	6	7	9	9	15	5	5	13	10	7	10	6	6	10	13	4	6	12	5	5	5	9	228
11	R-100-3	6	8	6	24	6	10	11	6	8	16	9	8	7	13	6	12	9	10	9	12	7	7	9	8	7	7	7	248
4	NS-400	11	6	10	27	10	17	2	15	14	19	7	6	24	3	9	7	7	7	16	20	11	8	14	9	9	9	19	316
14	R-400-3	14	16	13	8	12	7	18	12	7	6	16	15	2	20	14	18	16	11	7	6	12	14	15	12	14	13	8	326
12	R-100-4	8	10	9	26	8	12	14	11	11	20	11	10	15	15	8	16	12	12	13	17	8	9	13	10	8	8	13	327
31	C-WBI-400-1	13	15	11	10	13	13	15	14	12	4	12	13	9	18	16	15	11	16	8	8	15	13	16	14	15	15	10	344
26	C-R-400-2	15	14	14	12	14	8	16	17	10	7	18	14	6	19	15	19	17	17	11	11	10	15	18	13	13	14	11	368
19	C-G-100-1	21	23	15	2	20	24	12	7	15	3	10	22	17	5	21	4	10	13	12	7	24	17	3	22	23	22	12	386
3	NS-100	9	9	12	29	11	21	8	18	24	22	14	12	23	6	10	13	13	19	20	24	17	10	17	16	11	12	20	420
5	NS-1000	19	11	16	28	15	18	4	19	16	23	15	11	26	2	12	17	14	9	23	23	14	12	20	11	12	11	23	424
20	C-G-100-4	24	24	20	1	23	23	13	13	17	9	13	23	19	7	24	3	15	8	15	10	23	19	8	23	24	24	18	443
28	C-R-400-4	18	17	18	13	19	9	20	21	13	12	20	16	10	21	18	20	20	15	14	15	13	18	22	15	16	16	14	443
6	G-100-1	22	25	17	4	22	26	17	10	21	11	17	26	18	11	22	11	18	21	18	14	26	21	6	25	25	25	15	494
18	WBI-400-1	16	19	19	15	17	20	22	20	20	17	21	20	14	22	19	22	21	24	17	18	21	20	19	20	20	19	16	518
13	R-400-2	17	18	22	17	18	16	23	22	18	18	23	19	12	24	17	25	23	23	19	19	19	22	23	17	18	18	17	527
7	G-100-4	26	26	23	3	25	25	19	16	23	14	19	25	21	12	26	8	19	18	21	16	25	23	10	26	26	26	21	542
2	Coastal	10	13	21	30	16	22	21	23	26	26	22	18	25	16	13	21	22	26	25	26	22	16	21	21	17	17	25	561
15	R-400-4	20	20	24	16	21	15	25	24	19	21	24	21	16	25	20	26	24	22	22	21	18	24	24	18	19	20	22	571
29	C-R-1000-4	23	21	25	14	24	14	24	25	22	24	25	17	20	23	23	23	25	20	24	22	16	25	25	19	21	21	24	589
16	R-1000-4	25	22	26	18	26	19	26	26	25	25	26	24	22	27	25	29	26	25	26	25	20	26	26	24	22	23	26	660
21	C-G-400-4	28	28	27	6	27	27	27	27	27	27	27	27	27	26	28	24	27	27	27	27	27	27	27	27	27	27	27	707
8	G-400-4	29	29	28	9	28	29	28	28	28	28	28	29	28	28	29	28	28	29	28	28	29	28	28	28	29	28	28	745
22	C-G-1000-4	30	30	29	7	30	28	29	29	29	29	29	28	29	29	30	27	29	28	29	29	28	29	29	29	30	29	29	760
9	G-1000-4	31	31	30	11	31	30	30	30	30	30	30	30	30	30	31	30	30	30	30	30	30	30	30	30	31	31	30	797
1	No Action	27	27	31	31	29	31	31	31	31	31	31	31	31	31	27	31	31	31	31	31	31	31	31	31	28	30	31	819

Planning Unit 2
MCDA Trend Analysis (Ranked by Total Ranking Scores - All Respondants)

Rank	Scenario 1 Low RSLR High Employment Dispersed Population	Scenario 2 High RSLR High Employment Dispersed Population	Scenario 3 Low RSLR Business-as-Usual Compact Population	Scenario 4 High RSLR Business-as-Usual Compact Population
1	C-WBI-100-1	C-WBI-100-1	C-WBI-100-1	C-WBI-100-1
2	C-R-100-2	WBI-100-1	C-R-100-2	C-R-100-2
3	WBI-100-1	C-R-100-2	WBI-100-1	WBI-100-1
4	C-R-100-3	C-R-100-3	C-R-100-3	C-R-100-3
5	C-R-400-3	C-R-400-3	C-R-400-3	C-R-400-3
6	R-100-2	R-100-3	R-100-2	R-100-2
7	C-R-100-4	C-R-100-4	C-R-100-4	C-R-100-4
8	R-100-3	R-100-2	R-100-3	PU2-R-100-3
9	NS-400	NS-400	R-400-3	R-400-3
10	R-400-3	R-400-3	R-100-4	R-100-4
11	R-100-4	C-WBI-400-1	C-WBI-400-1	C-WBI-400-1
12	C-WBI-400-1	R-100-4	C-R-400-2	C-R-400-2
13	C-R-400-2	C-R-400-2	C-G-100-1	C-G-100-1
14	C-G-100-1	C-G-100-1	NS-100	C-G-100-4
15	NS-100	NS-1000	C-G-100-4	NS-100
16	NS-1000	NS-100	C-R-400-4	NS-1000
17	C-G-100-4	C-G-100-4	NS-1000	C-R-400-4
18	C-R-400-4	C-R-400-4	G-100-1	NS-400
19	G-100-1	G-100-1	R-400-2	G-100-1
20	WBI-400-1	WBI-400-1	WBI-400-1	R-400-2
21	R-400-2	R-400-2	NS-400	WBI-400-1
22	G-100-4	G-100-4	G-100-4	G-100-4
23	Coastal	Coastal	Coastal	Coastal
24	R-400-4	R-400-4	R-400-4	R-400-4
25	C-R-1000-4	C-R-1000-4	C-R-1000-4	C-R-1000-4
26	R-1000-4	R-1000-4	R-1000-4	R-1000-4
27	C-G-400-4	C-G-400-4	C-G-400-4	C-G-400-4
28	G-400-4	G-400-4	G-400-4	G-400-4
29	C-G-1000-4	C-G-1000-4	C-G-1000-4	C-G-1000-4
30	G-1000-4	G-1000-4	G-1000-4	G-1000-4
31	No Action	No Action	No Action	No Action

Planning Unit 2
Evaluation Criteria Values
(Scenario 1, Low Relative Sea Level Rise, High Employment, Dispersed Population; Low Uncertainty)

Plan #	Alternative	Stakeholder (Multi-Criteria Decision Analysis)	Minimizing Environmental Impacts		Investment Decision (Efficiency)			Minimizing Remaining Risk (Effectiveness)			Year 2025 Present Value Life Cycle Costs (2010-2075) ($Millions)
Evaluation Criteria		Cumulative Ranking Score from MCDA Trend Analysis	Direct Wetland Impact	Indirect Impacts	Cost Efficiency	Total System Costs	Period of Analysis Cost Efficiency	Annualized Residual Damages	Period of Analysis Risk Reduction	Average % Risk Reduction	
(Units)		*(Unit-less Weight)*	*(Acres)*	*(Unit-less Scale)*	*Ratio: Risk Reduction / Present Value Life Cycle Costs (PV LCC)*	*Annualized Life Cycle Costs + EA Residual Damages ($Millions)*	*Cost Efficiency Ratio: Event Freq Risk Reduction X Probability of Occurrence (2010-2075) / PV LCC*	*Average Annual Remaining Risk (Millions)*	*Event Freq Risk Reduction X Probability (2010-2075) ($Millions)*	*2075: 100-yr to 2,000-yr Frequency Events (Avg % of No Action Damages)*	
2	**Coastal**	561	0	0	0.0765	1,766	1.29	44.7	20,199	26.51	15,657
3	**NS-100**	420	0	0	0.0760	1,666	1.16	30.0	23,148	30.80	19,920
4	**NS-400**	316	0	0	0.0583	1,935	1.08	15.3	33,818	79.20	31,419
5	**NS-1000**	424	0	0	0.0414	2,596	0.79	13.9	35,572	92.10	44,986
6	**G-100-1**	494	1,000	-8	0.0573	2,019	1.32	38.4	30,623	79.96	23,261
7	**G-100-4**	542	2,200	-8	0.0458	2,323	1.06	36.1	31,950	82.48	30,178
8	**G-400-4**	745	7,400	-8	0.0263	3,413	0.65	38.8	32,868	89.12	50,402
9	**G-1000-4**	797	9,500	-8	0.0229	3,800	0.57	38.8	32,899	89.45	57,992
10	**R-100-2**	225	700	4	0.0490	2,211	0.99	47.0	23,194	37.27	23,386
11	**R-100-3**	248	1,000	4	0.0454	2,311	0.92	45.9	23,684	38.13	25,803
12	**R-100-4**	327	1,600	4	0.0408	2,461	0.83	45.3	23,971	38.87	29,005
13	**R-400-2**	527	4,400	4	0.0304	3,013	0.74	42.3	30,241	72.53	41,066
14	**R-400-3**	326	4,700	4	0.0305	3,066	0.70	37.9	30,823	74.03	43,975
15	**R-400-4**	571	5,300	4	0.0273	3,285	0.66	40.6	31,173	75.12	47,123
16	**R-1000-4**	660	6,800	4	0.0236	3,670	0.59	40.2	32,131	87.01	54,831
17	**WBI-100-1**	113	0	2	0.0709	1,834	1.31	45.4	21,781	35.45	16,656
18	**WBI-400-1**	518	3,700	2	0.0359	2,678	0.84	43.6	28,568	69.26	33,951
19	**C-G-100-1**	386	1,000	-8	0.0582	1,976	1.25	29.2	32,923	83.93	26,315
20	**C-G-100-4**	443	2,200	-8	0.0474	2,282	1.03	28.2	33,870	85.87	32,737
21	**C-G-400-4**	707	7,400	-8	0.0288	3,335	0.67	29.8	35,549	94.49	52,704
22	**C-G-1000-4**	760	9,500	-8	0.0251	3,744	0.59	29.1	36,140	97.19	60,973
23	**C-R-100-2**	111	700	4	0.0502	2,187	0.95	37.9	25,484	41.09	26,756
24	**C-R-100-3**	138	1,000	4	0.0469	2,285	0.89	37.6	25,763	41.66	28,819
25	**C-R-100-4**	228	1,600	4	0.0425	2,436	0.81	37.4	25,938	42.24	31,843
26	**C-R-400-2**	368	4,400	4	0.0348	2,875	0.79	29.7	34,402	80.90	43,725
27	**C-R-400-3**	189	4,700	4	0.0342	2,946	0.74	26.5	34,534	81.54	46,485
28	**C-R-400-4**	443	5,300	4	0.0307	3,169	0.70	29.8	34,623	82.04	49,423
29	**C-R-1000-4**	589	6,800	4	0.0267	3,569	0.63	28.9	36,062	96.39	57,646
30	**C-WBI-100-1**	53	0	2	0.0683	1,804	1.18	34.2	24,698	39.73	20,874
31	**C-WBI-400-1**	344	3,700	2	0.0416	2,517	0.91	28.0	33,934	78.96	37,442

Planning Unit 2

Evaluation Criteria Data Ordinal Rankings

(Scenario 1, Low Relative Sea Level Rise, High Employment, Dispersed Population; Low Uncertainty)

Plan #	Alternative	Stakeholder (Multi-Criteria Decision Analysis)	Minimizing Environmental Impacts		Investment Decision (Efficiency)			Minimizing Remaining Risk (Effectiveness)			Year 2025 Present Value Life Cycle Costs (2010-2075) ($Millions)
Evaluation Criteria		Cumulative Ranking Score from MCDA Trend Analysis	Direct Wetland Impact	Indirect Impacts	Cost Efficiency	Total System Costs	Period of Analysis Cost Efficiency	Annualized Residual Damages	Period of Analysis Risk Reduction	Average % Risk Reduction	
(Units)		*(Unit-less Weight)*	*(Acres)*	*(Unit-less Scale)*	*Ratio: Risk Reduction / Present Value Life Cycle Costs (PV LCC)*	*Annualized Life Cycle Costs + EA Residual Damages ($Millions)*	*Cost Efficiency Ratio: Event Freq Risk Reduction X Probability of Occurrence (2010-2075) / PV LCC*	*Average Annual Remaining Risk (Millions)*	*Event Freq Risk Reduction X Probability (2010-2075) ($Millions)*	*2075: 100-yr to 2,000-yr Frequency Events (Avg % of No Action Damages)*	
2	Coastal	23	2	20	1	2	3	26	30	30	1
3	NS-100	15	1	19	2	1	6	12	28	29	3
4	NS-400	9	5	21	5	5	7	2	10	15	13
5	NS-1000	16	6	22	16	17	18	1	3	4	21
6	G-100-1	19	10	24	7	7	1	19	18	14	5
7	G-100-4	22	16	26	12	13	8	14	15	10	12
8	G-400-4	28	28	28	27	26	26	21	13	6	25
9	G-1000-4	30	30	30	30	30	30	20	12	5	29
10	R-100-2	6	8	2	9	9	10	30	27	27	6
11	R-100-3	8	12	4	13	12	12	29	26	26	7
12	R-100-4	11	14	6	17	15	16	27	25	25	11
13	R-400-2	21	20	9	23	21	21	24	19	19	18
14	R-400-3	10	22	10	22	22	22	17	17	18	20
15	R-400-4	24	24	12	25	24	25	23	16	17	23
16	R-1000-4	26	26	14	29	28	29	22	14	7	27
17	WBI-100-1	3	4	16	3	4	2	28	29	28	2
18	WBI-400-1	20	18	18	18	18	15	25	20	20	16
19	C-G-100-1	14	9	23	6	6	4	8	11	9	8
20	C-G-100-4	17	15	25	10	10	9	5	9	8	15
21	C-G-400-4	27	27	27	24	25	24	10	4	3	26
22	C-G-1000-4	29	29	29	28	29	28	7	1	1	30
23	C-R-100-2	2	7	1	8	8	11	18	23	23	9
24	C-R-100-3	4	11	3	11	11	14	16	22	22	10
25	C-R-100-4	7	13	5	14	14	17	15	21	21	14
26	C-R-400-2	13	19	7	19	19	19	9	7	13	19
27	C-R-400-3	5	21	8	20	20	20	3	6	12	22
28	C-R-400-4	18	23	11	21	23	23	11	5	11	24
29	C-R-1000-4	25	25	13	26	27	27	6	2	2	28
30	C-WBI-100-1	1	3	15	4	3	5	13	24	24	4
31	C-WBI-400-1	12	17	17	15	16	13	4	8	16	17

Planning Unit 2

Cost Efficiency Analysis

(Scenario 1- LRSLR, High Employment, Dispersed Population; Low Uncertainty)

Plan #	Alternative	Present Value Life-Cycle Costs ($ Millions)	Risk Reduction Annual Equivalent ($ Millions)	Cost Efficiency Factor Risk Red / PV LCC	Rank
2	Coastal	15,657	1,197	0.0765	1
3	NS-100	19,920	1,514	0.0760	2
17	WBI-100-1	16,656	1,181	0.0709	3
30	C-WBI-100-1	20,874	1,425	0.0683	4
4	NS-400	31,419	1,832	0.0583	5
19	C-G-100-1	26,315	1,531	0.0582	6
6	G-100-1	23,261	1,333	0.0573	7
23	C-R-100-2	26,756	1,343	0.0502	8
10	R-100-2	23,386	1,147	0.0490	9
20	C-G-100-4	32,737	1,553	0.0474	10
24	C-R-100-3	28,819	1,350	0.0469	11
7	G-100-4	30,178	1,382	0.0458	12
11	R-100-3	25,803	1,171	0.0454	13
25	C-R-100-4	31,843	1,354	0.0425	14
31	C-WBI-400-1	37,442	1,559	0.0416	15
5	NS-1000	44,986	1,862	0.0414	16
12	R-100-4	29,005	1,184	0.0408	17
18	WBI-400-1	33,951	1,219	0.0359	18
26	C-R-400-2	43,725	1,521	0.0348	19
27	C-R-400-3	46,485	1,591	0.0342	20
28	C-R-400-4	49,423	1,518	0.0307	21
14	R-400-3	43,975	1,343	0.0305	22
13	R-400-2	41,066	1,248	0.0304	23
21	C-G-400-4	52,704	1,520	0.0288	24
15	R-400-4	47,123	1,285	0.0273	25
29	C-R-1000-4	57,646	1,538	0.0267	26
8	G-400-4	50,402	1,325	0.0263	27
22	C-G-1000-4	60,973	1,533	0.0251	28
16	R-1000-4	54,831	1,294	0.0236	29
9	G-1000-4	57,992	1,325	0.0229	30

Planning Unit 2
Cost Efficiency Rankings

Rank	Scenario 1 Low RSLR High Employment Dispersed Population	Scenario 2 High RSLR High Employment Dispersed Population	Scenario 3 Low RSLR Business-as-Usual Compact Population	Scenario 4 High RSLR Business-as-Usual Compact Population
1	Coastal	NS-100	NS-100	NS-100
2	NS-100	Coastal	Coastal	Coastal
3	WBI-100-1	WBI-100-1	C-WBI-100-1	C-WBI-100-1
4	C-WBI-100-1	C-WBI-100-1	WBI-100-1	WBI-100-1
5	NS-400	NS-400	C-G-100-1	C-G-100-1
6	C-G-100-1	C-G-100-1	G-100-1	G-100-1
7	G-100-1	G-100-1	C-R-100-2	C-R-100-2
8	C-R-100-2	C-R-100-2	C-G-100-4	C-G-100-4
9	R-100-2	R-100-2	C-R-100-3	C-R-100-3
10	C-G-100-4	C-G-100-4	R-100-2	R-100-2
11	C-R-100-3	C-R-100-3	G-100-4	G-100-4
12	G-100-4	G-100-4	R-100-3	R-100-3
13	R-100-3	R-100-3	C-R-100-4	C-R-100-4
14	C-R-100-4	C-R-100-4	NS-400	NS-400
15	C-WBI-400-1	NS-1000	NS-1000	NS-1000
16	NS-1000	C-WBI-400-1	C-WBI-400-1	C-WBI-400-1
17	R-100-4	R-100-4	R-100-4	R-100-4
18	WBI-400-1	WBI-400-1	WBI-400-1	WBI-400-1
19	C-R-400-2	C-R-400-2	C-R-400-2	C-R-400-2
20	C-R-400-3	C-R-400-3	C-R-400-3	C-R-400-3
21	C-R-400-4	C-R-400-4	C-R-400-4	C-R-400-4
22	R-400-3	R-400-3	R-400-3	R-400-3
23	R-400-2	R-400-2	R-400-2	R-400-2
24	C-G-400-4	C-G-400-4	C-G-400-4	C-G-400-4
25	R-400-4	R-400-4	R-400-4	R-400-4
26	C-R-1000-4	C-R-1000-4	C-R-1000-4	C-R-1000-4
27	G-400-4	G-400-4	G-400-4	G-400-4
28	C-G-1000-4	C-G-1000-4	C-G-1000-4	C-G-1000-4
29	R-1000-4	R-1000-4	R-1000-4	R-1000-4
30	G-1000-4	G-1000-4	G-1000-4	G-1000-4

Planning Unit 2

Total System Costs Analysis

(Scenario 1- LRSLR, High Employment, Dispersed Population; Low Uncertainty)

Plan #	Alternative	Annual Equivalent Life-Cycle Costs ($Millions)	With Project Residual Damages ($ Millions)	Total System Costs ($ Millions)	Rank
3	NS-100	1,017	649	1,666	1
2	Coastal	800	967	1,766	2
30	C-WBI-100-1	1,065	739	1,804	3
17	WBI-100-1	851	983	1,834	4
4	NS-400	1,603	332	1,935	5
19	C-G-100-1	1,343	633	1,976	6
6	G-100-1	1,188	831	2,019	7
23	C-R-100-2	1,366	821	2,187	8
10	R-100-2	1,194	1,017	2,211	9
20	C-G-100-4	1,671	611	2,282	10
24	C-R-100-3	1,471	814	2,285	11
11	R-100-3	1,318	993	2,311	12
7	G-100-4	1,541	782	2,323	13
25	C-R-100-4	1,626	810	2,436	14
12	R-100-4	1,481	980	2,461	15
31	C-WBI-400-1	1,912	605	2,517	16
5	NS-1000	2,294	302	2,596	17
18	WBI-400-1	1,734	944	2,678	18
26	C-R-400-2	2,233	642	2,875	19
27	C-R-400-3	2,373	573	2,946	20
13	R-400-2	2,097	916	3,013	21
14	R-400-3	2,246	821	3,066	22
28	C-R-400-4	2,523	645	3,169	23
15	R-400-4	2,406	879	3,285	24
21	C-G-400-4	2,691	644	3,335	25
8	G-400-4	2,574	839	3,413	26
29	C-R-1000-4	2,943	626	3,569	27
16	R-1000-4	2,800	870	3,670	28
22	C-G-1000-4	3,113	630	3,744	29
9	G-1000-4	2,961	839	3,800	30

Planning Unit 2

Total System Costs Rankings

Rank	Scenario 1 Low RSLR High Employment Dispersed Population	Scenario 2 High RSLR High Employment Dispersed Population	Scenario 3 Low RSLR Business-as-Usual Compact Population	Scenario 4 High RSLR Business-as-Usual Compact Population
1	NS-100	NS-100	NS-100	NS-100
2	Coastal	Coastal	Coastal	Coastal
3	C-WBI-100-1	C-WBI-100-1	C-WBI-100-1	C-WBI-100-1
4	WBI-100-1	WBI-100-1	WBI-100-1	WBI-100-1
5	NS-400	NS-400	C-G-100-1	C-G-100-1
6	C-G-100-1	C-G-100-1	G-100-1	G-100-1
7	G-100-1	G-100-1	C-R-100-2	C-R-100-2
8	C-R-100-2	C-R-100-2	R-100-2	R-100-2
9	R-100-2	R-100-2	C-R-100-3	C-R-100-3
10	C-G-100-4	C-G-100-4	C-G-100-4	C-G-100-4
11	C-R-100-3	C-R-100-3	R-100-3	R-100-3
12	R-100-3	R-100-3	G-100-4	G-100-4
13	G-100-4	G-100-4	C-R-100-4	C-R-100-4
14	C-R-100-4	C-R-100-4	R-100-4	R-100-4
15	R-100-4	R-100-4	NS-400	NS-400
16	C-WBI-400-1	C-WBI-400-1	C-WBI-400-1	C-WBI-400-1
17	NS-1000	NS-1000	WBI-400-1	NS-1000
18	WBI-400-1	WBI-400-1	NS-1000	WBI-400-1
19	C-R-400-2	C-R-400-2	C-R-400-2	C-R-400-2
20	C-R-400-3	C-R-400-3	R-400-2	C-R-400-3
21	R-400-2	R-400-2	C-R-400-3	R-400-2
22	R-400-3	R-400-3	R-400-3	R-400-3
23	C-R-400-4	C-R-400-4	C-R-400-4	C-R-400-4
24	R-400-4	R-400-4	R-400-4	R-400-4
25	C-G-400-4	C-G-400-4	C-G-400-4	C-G-400-4
26	G-400-4	G-400-4	G-400-4	G-400-4
27	C-R-1000-4	C-R-1000-4	C-R-1000-4	C-R-1000-4
28	R-1000-4	R-1000-4	R-1000-4	R-1000-4
29	C-G-1000-4	C-G-1000-4	C-G-1000-4	C-G-1000-4
30	G-1000-4	G-1000-4	G-1000-4	G-1000-4

Planning Unit 2

Period of Analysis Cost Efficiency

(2075 Risk Reduction X Probablility (2010-2075) / Present Value Costs
For Frequency Events Included in Economic Evaluation)

(Scenario 1: Low RSLR, High Employment, Dispersed Population - Low Uncertainty)

Plan #	Alternative	Remaining Damages by Frequency ($ Billions) 10-yr	100-yr	400-yr	1000-yr	2000-yr	Total Risk Reduction X Probabilty 2010-2075 ($ Billions)	Present Value - Life-Cycle Costs ($ Billions)	Cost Efficiency Ratio - Total Risk Reduction / PV Costs	Rank
No Action Damages ($ Billions)		1.6	46.7	51.7	53.2	54.0				
6	**G-100-1**	1.5	4.3	8.5	13.6	15.6	30.6	23.3	1.32	1
17	**WBI-100-1**	1.8	6.1	40.3	44.1	45.4	21.8	16.7	1.31	2
2	**Coastal**	1.8	6.1	46.9	50.3	51.6	20.2	15.7	1.29	3
19	**C-G-100-1**	0.7	2.1	6.5	11.7	13.6	32.9	26.3	1.25	4
30	**C-WBI-100-1**	0.6	3.5	38.1	42.2	43.5	24.7	20.9	1.18	5
3	**NS-100**	0.6	3.5	44.8	48.3	49.6	23.1	19.9	1.16	6
4	**NS-400**	0.3	0.5	5.5	13.5	24.9	33.8	31.4	1.08	7
7	**G-100-4**	1.0	3.2	7.5	12.2	13.9	32.0	30.2	1.06	8
20	**C-G-100-4**	0.3	1.4	5.8	10.5	12.2	33.9	32.7	1.03	9
10	**R-100-2**	1.2	4.9	39.5	43.3	44.5	23.2	23.4	0.99	10
23	**C-R-100-2**	0.4	2.8	37.6	41.5	42.7	25.5	26.8	0.95	11
11	**R-100-3**	1.0	4.4	39.0	43.0	44.1	23.7	25.8	0.92	12
31	**C-WBI-400-1**	0.4	0.6	3.9	10.7	29.8	33.9	37.4	0.91	13
24	**C-R-100-3**	0.3	2.5	37.2	41.2	42.4	25.8	28.8	0.89	14
18	**WBI-400-1**	1.8	6.1	9.8	15.0	33.8	28.6	34.0	0.84	15
12	**R-100-4**	1.0	4.1	38.7	42.5	43.6	24.0	29.0	0.83	16
25	**C-R-100-4**	0.3	2.3	37.0	40.9	41.9	25.9	31.8	0.81	17
5	**NS-1000**	0.2	0.3	1.9	4.7	9.9	35.6	45.0	0.79	18
26	**C-R-400-2**	0.2	0.5	2.9	9.1	28.4	34.4	43.7	0.79	19
27	**C-R-400-3**	0.2	0.4	2.6	8.7	27.8	34.5	46.5	0.74	20
13	**R-400-2**	1.2	4.9	8.0	13.0	32.1	30.2	41.1	0.74	21
14	**R-400-3**	1.0	4.4	7.2	12.2	31.1	30.8	44.0	0.70	22
28	**C-R-400-4**	0.2	0.4	2.4	8.3	27.4	34.6	49.4	0.70	23
21	**C-G-400-4**	0.3	0.5	2.2	3.9	5.0	35.5	52.7	0.67	24
15	**R-400-4**	1.0	4.1	6.6	11.5	30.4	31.2	47.1	0.66	25
8	**G-400-4**	1.0	3.2	5.1	6.6	7.7	32.9	50.4	0.65	26
29	**C-R-1000-4**	0.2	0.3	0.7	2.3	4.4	36.1	57.6	0.63	27
22	**C-G-1000-4**	0.2	0.3	0.7	1.9	3.1	36.1	61.0	0.59	28
16	**R-1000-4**	1.0	4.1	6.5	7.3	9.0	32.1	54.8	0.59	29
9	**G-1000-4**	1.0	3.2	5.1	6.4	7.2	32.9	58.0	0.57	30

Planning Unit 2

Period of Analysis Cost Efficiency Rankings

(2075 Risk Reduction X Probability (2010 - 2075) / Present Value Costs Rankings
For Frequency Events Included in Economic Evaluation)

Rank	Scenario 1	Scenario 2	Scenario 3	Scenario 4
	Low RSLR High Employment Dispersed Population	High RSLR High Employment Dispersed Population	Low RSLR Business-as-Usual Compact Population	High RSLR Business-as-Usual Compact Population
1	G-100-1	G-100-1	G-100-1	G-100-1
2	WBI-100-1	WBI-100-1	Coastal	Coastal
3	Coastal	Coastal	WBI-100-1	C-G-100-1
4	C-G-100-1	C-G-100-1	C-G-100-1	WBI-100-1
5	C-WBI-100-1	C-WBI-100-1	NS-100	NS-100
6	NS-100	NS-100	C-WBI-100-1	C-WBI-100-1
7	NS-400	NS-400	G-100-4	G-100-4
8	G-100-4	G-100-4	C-G-100-4	C-G-100-4
9	C-G-100-4	C-G-100-4	R-100-2	R-100-2
10	R-100-2	R-100-2	C-R-100-2	C-R-100-2
11	C-R-100-2	C-R-100-2	R-100-3	R-100-3
12	R-100-3	R-100-3	C-R-100-3	C-R-100-3
13	C-WBI-400-1	C-WBI-400-1	C-WBI-400-1	C-WBI-400-1
14	C-R-100-3	C-R-100-3	WBI-400-1	R-100-4
15	WBI-400-1	R-100-4	R-100-4	C-R-100-4
16	R-100-4	C-R-100-4	C-R-100-4	WBI-400-1
17	C-R-100-4	WBI-400-1	NS-400	NS-1000
18	NS-1000	NS-1000	NS-1000	NS-400
19	C-R-400-2	C-R-400-2	C-R-400-2	C-R-400-2
20	C-R-400-3	C-R-400-3	R-400-2	R-400-2
21	R-400-2	R-400-2	C-R-400-3	C-R-400-3
22	R-400-3	C-R-400-4	R-400-3	R-400-3
23	C-R-400-4	R-400-3	C-R-400-4	C-R-400-4
24	C-G-400-4	C-G-400-4	C-G-400-4	C-G-400-4
25	R-400-4	G-400-4	R-400-4	R-400-4
26	G-400-4	R-400-4	G-400-4	G-400-4
27	C-R-1000-4	C-R-1000-4	C-R-1000-4	C-R-1000-4
28	C-G-1000-4	C-G-1000-4	R-1000-4	C-G-1000-4
29	R-1000-4	R-1000-4	C-G-1000-4	R-1000-4
30	G-1000-4	G-1000-4	G-1000-4	G-1000-4

Planning Unit 2

Residual Damages (Remaining Risk) Analysis

(Scenario 1: Low RSLR, High Employment, Dispersed Population - Low Uncertainty)

Plan #	Alternative	No Action Residual Damages ($Millions)	With Project Residual Damages ($ Millions)	% of No Action Damages	Rank
5	NS-1000	2,164	302	13.9	**1**
4	NS-400	2,164	332	15.3	**2**
27	C-R-400-3	2,164	573	26.5	**3**
31	C-WBI-400-1	2,164	605	28.0	**4**
20	C-G-100-4	2,164	611	28.2	**5**
29	C-R-1000-4	2,164	626	28.9	**6**
22	C-G-1000-4	2,164	630	29.1	**7**
19	C-G-100-1	2,164	633	29.2	**8**
26	C-R-400-2	2,164	642	29.7	**9**
21	C-G-400-4	2,164	644	29.8	**10**
28	C-R-400-4	2,164	645	29.8	**11**
3	NS-100	2,164	649	30.0	**12**
30	C-WBI-100-1	2,164	739	34.2	**13**
7	G-100-4	2,164	782	36.1	**14**
25	C-R-100-4	2,164	810	37.4	**15**
24	C-R-100-3	2,164	814	37.6	**16**
14	R-400-3	2,164	821	37.9	**17**
23	C-R-100-2	2,164	821	37.9	**18**
6	G-100-1	2,164	831	38.4	**19**
9	G-1000-4	2,164	839	38.8	**20**
8	G-400-4	2,164	839	38.8	**21**
16	R-1000-4	2,164	870	40.2	**22**
15	R-400-4	2,164	879	40.6	**23**
13	R-400-2	2,164	916	42.3	**24**
18	WBI-400-1	2,164	944	43.6	**25**
2	Coastal	2,164	967	44.7	**26**
12	R-100-4	2,164	980	45.3	**27**
17	WBI-100-1	2,164	983	45.4	**28**
11	R-100-3	2,164	993	45.9	**29**
10	R-100-2	2,164	1,017	47.0	**30**

Planning Unit 2

Residual Damages (Remaining Risk) Rankings

Rank	Scenario 1 Low RSLR High Employment Dispersed Population	Scenario 2 High RSLR High Employment Dispersed Population	Scenario 3 Low RSLR Business-as-Usual Compact Population	Scenario 4 High RSLR Business-as-Usual Compact Population
1	NS-1000	NS-1000	NS-1000	NS-1000
2	NS-400	NS-400	NS-400	NS-400
3	C-R-400-3	C-R-400-3	C-R-400-3	C-R-400-3
4	C-WBI-400-1	C-G-100-4	C-WBI-400-1	C-WBI-400-1
5	C-G-100-4	C-R-1000-4	C-G-100-4	C-G-100-4
6	C-R-1000-4	C-WBI-400-1	C-R-1000-4	C-R-1000-4
7	C-G-1000-4	C-G-1000-4	C-G-1000-4	C-G-1000-4
8	C-G-100-1	C-G-400-4	C-G-100-1	C-G-400-4
9	C-R-400-2	C-R-400-4	C-R-400-2	C-R-400-2
10	C-G-400-4	C-R-400-2	C-G-400-4	C-R-400-4
11	C-R-400-4	C-G-100-1	C-R-400-4	C-G-100-1
12	NS-100	NS-100	NS-100	NS-100
13	C-WBI-100-1	G-100-4	C-WBI-100-1	C-WBI-100-1
14	G-100-4	C-WBI-100-1	C-R-100-4	C-R-100-4
15	C-R-100-4	C-R-100-4	C-R-100-3	G-100-4
16	C-R-100-3	C-R-100-3	C-R-100-2	C-R-100-3
17	R-400-3	R-400-3	G-100-4	C-R-100-2
18	C-R-100-2	G-1000-4	R-400-3	R-400-3
19	G-100-1	G-400-4	G-1000-4	G-1000-4
20	G-1000-4	C-R-100-2	G-400-4	G-400-4
21	G-400-4	G-100-1	G-100-1	G-100-1
22	R-1000-4	R-1000-4	R-1000-4	R-1000-4
23	R-400-4	R-400-4	R-400-4	R-400-4
24	R-400-2	R-400-2	R-400-2	R-400-2
25	WBI-400-1	WBI-400-1	WBI-400-1	WBI-400-1
26	Coastal	R-100-4	Coastal	R-100-4
27	R-100-4	R-100-3	R-100-4	R-100-3
28	WBI-100-1	Coastal	R-100-3	Coastal
29	R-100-3	WBI-100-1	WBI-100-1	R-100-2
30	R-100-2	R-100-2	R-100-2	WBI-100-1

Planning Unit 2

Period of Analysis Risk Reduction

(2075 Risk Reduction X Probablility (2010-2075)

For Frequency Events Included in Economic Evaluation)

(Scenario 1: Low RSLR, High Employment, Dispersed Population - Low Uncertainty)

Plan #	Alternative	Remaining Damages by Frequency ($Millions)					Total Risk Reduction X Probabilty 2010-2075 ($Million)	Rank
		10-yr	100-yr	400-yr	1,000-yr	2,000-yr		
No Action Damages ($ Million)		1,583	46,652	51,671	53,208	53,965		
22	C-G-1000-4	185	323	651	1,926	3,063	36,140	1
29	C-R-1000-4	190	336	666	2,264	4,415	36,062	2
5	NS-1000	155	349	1,950	4,675	9,862	35,572	3
21	C-G-400-4	260	522	2,201	3,927	5,011	35,549	4
28	C-R-400-4	218	416	2,390	8,294	27,377	34,623	5
27	C-R-400-3	226	444	2,584	8,675	27,832	34,534	6
26	C-R-400-2	249	486	2,859	9,147	28,398	34,402	7
31	C-WBI-400-1	351	629	3,900	10,662	29,791	33,934	8
20	C-G-100-4	336	1,396	5,785	10,537	12,167	33,870	9
4	NS-400	256	517	5,548	13,451	24,867	33,818	10
19	C-G-100-1	702	2,148	6,471	11,684	13,601	32,923	11
9	G-1000-4	959	3,208	5,103	6,424	7,228	32,899	12
8	G-400-4	959	3,208	5,118	6,641	7,692	32,868	13
16	R-1000-4	956	4,126	6,541	7,328	8,995	32,131	14
7	G-100-4	959	3,227	7,521	12,199	13,855	31,950	15
15	R-400-4	956	4,126	6,628	11,468	30,382	31,173	16
14	R-400-3	1,012	4,431	7,165	12,156	31,126	30,823	17
6	G-100-1	1,477	4,303	8,510	13,630	15,564	30,623	18
13	R-400-2	1,155	4,916	7,969	13,049	32,054	30,241	19
18	WBI-400-1	1,805	6,097	9,802	15,047	33,812	28,568	20
25	C-R-100-4	288	2,293	36,990	40,879	41,942	25,938	21
24	C-R-100-3	309	2,475	37,178	41,243	42,415	25,763	22
23	C-R-100-2	361	2,783	37,566	41,457	42,668	25,484	23
30	C-WBI-100-1	650	3,493	38,149	42,170	43,451	24,698	24
12	R-100-4	956	4,136	38,704	42,529	43,620	23,971	25
11	R-100-3	1,012	4,440	38,985	42,957	44,131	23,684	26
10	R-100-2	1,155	4,924	39,518	43,310	44,520	23,194	27
3	NS-100	629	3,483	44,758	48,282	49,627	23,148	28
17	WBI-100-1	1,805	6,102	40,302	44,147	45,405	21,781	29
2	Coastal	1,805	6,117	46,912	50,259	51,581	20,199	30

Planning Unit 2

Period of Analysis Risk Reduction Rankings

(2075 Risk Reduction X Probability (2010 - 2075) Rankings

For Frequency Events Included in Economic Evaluation)

Rank	Scenario 1 Low RSLR High Employment Dispersed Population	Scenario 2 High RSLR High Employment Dispersed Population	Scenario 3 Low RSLR Business-as-Usual Compact Population	Scenario 4 High RSLR Business-as-Usual Compact Population
1	C-G-1000-4	C-G-1000-4	C-G-1000-4	C-G-1000-4
2	C-R-1000-4	C-R-1000-4	C-R-1000-4	C-R-1000-4
3	NS-1000	NS-1000	C-G-400-4	C-G-400-4
4	C-G-400-4	C-G-400-4	NS-1000	NS-1000
5	C-R-400-4	C-R-400-4	C-R-400-4	C-R-400-4
6	C-R-400-3	C-R-400-3	C-R-400-3	C-R-400-3
7	C-R-400-2	C-R-400-2	C-R-400-2	C-R-400-2
8	C-WBI-400-1	C-G-100-4	C-G-100-4	C-G-100-4
9	C-G-100-4	C-WBI-400-1	NS-400	NS-400
10	NS-400	NS-400	C-WBI-400-1	C-WBI-400-1
11	C-G-100-1	G-1000-4	C-G-100-1	G-1000-4
12	G-1000-4	G-400-4	G-1000-4	G-400-4
13	G-400-4	C-G-100-1	G-400-4	R-1000-4
14	R-1000-4	G-100-4	R-1000-4	C-G-100-1
15	G-100-4	R-1000-4	G-100-4	G-100-4
16	R-400-4	R-400-4	R-400-4	R-400-4
17	R-400-3	R-400-3	R-400-3	R-400-3
18	G-100-1	G-100-1	R-400-2	R-400-2
19	R-400-2	R-400-2	G-100-1	G-100-1
20	WBI-400-1	WBI-400-1	WBI-400-1	WBI-400-1
21	C-R-100-4	C-R-100-4	C-R-100-4	C-R-100-4
22	C-R-100-3	C-R-100-3	C-R-100-3	C-R-100-3
23	C-R-100-2	C-R-100-2	C-R-100-2	C-R-100-2
24	C-WBI-100-1	R-100-4	C-WBI-100-1	R-100-4
25	R-100-4	C-WBI-100-1	R-100-4	C-WBI-100-1
26	R-100-3	R-100-3	NS-100	R-100-3
27	R-100-2	R-100-2	R-100-3	NS-100
28	NS-100	NS-100	R-100-2	R-100-2
29	WBI-100-1	WBI-100-1	WBI-100-1	WBI-100-1
30	Coastal	Coastal	Coastal	Coastal

Planning Unit 2

Average % Risk Reduction of Total Damages

For 100-yr to 2,000-yr Frequency Event Range Based on 2075 Population / Land Use

(Scenario 1: Low RSLR, High Employment, Dispersed Population - 90% Confidence Level)

Plan #	Alternative	Average % Risk Reduction for 100-yr to 2,000-yr Frequency Events	Average Risk Reduction for 100-yr to 2,000-yr Frequency Events ($ Millions)	Life Cycle Costs Equiv. Annual ($ Millions)	Rank
Total No Action Residual Damages 100-yr to 2,000-yr Freq Events ($ Million)		**205,496**			
22	C-G-1000-4	97.19	199,717	3,113	**1**
29	C-R-1000-4	96.39	198,075	2,943	**2**
21	C-G-400-4	94.49	194,171	2,691	**3**
5	NS-1000	92.10	189,270	2,294	**4**
9	G-1000-4	89.45	183,806	2,961	**5**
8	G-400-4	89.12	183,139	2,574	**6**
16	R-1000-4	87.01	178,810	2,800	**7**
20	C-G-100-4	85.87	176,450	1,671	**8**
19	C-G-100-1	83.93	172,467	1,343	**9**
7	G-100-4	82.48	169,496	1,541	**10**
28	C-R-400-4	82.04	168,591	2,523	**11**
27	C-R-400-3	81.54	167,565	2,373	**12**
26	C-R-400-2	80.90	166,253	2,233	**13**
6	G-100-1	79.96	164,319	1,188	**14**
4	NS-400	79.20	162,750	1,603	**15**
31	C-WBI-400-1	78.96	162,269	1,912	**16**
15	R-400-4	75.12	154,366	2,406	**17**
14	R-400-3	74.03	152,124	2,246	**18**
13	R-400-2	72.53	149,046	2,097	**19**
18	WBI-400-1	69.26	142,320	1,734	**20**
25	C-R-100-4	42.24	86,795	1,626	**21**
24	C-R-100-3	41.66	85,605	1,471	**22**
23	C-R-100-2	41.09	84,433	1,366	**23**
30	C-WBI-100-1	39.73	81,638	1,065	**24**
12	R-100-4	38.87	79,871	1,481	**25**
11	R-100-3	38.13	78,357	1,318	**26**
10	R-100-2	37.27	76,583	1,194	**27**
17	WBI-100-1	35.45	72,855	851	**28**
3	NS-100	30.80	63,297	1,017	**29**
2	Coastal	26.51	54,486	800	**30**

Planning Unit 2

Average % Risk Reduction of Total Damages Rankings

For 100-yr to 2,000-yr Frequency Event Range Based on 2075 Population / Land Use

Rank	Scenario 1 Low RSLR High Employment Dispersed Population	Scenario 2 High RSLR High Employment Dispersed Population	Scenario 3 Low RSLR Business-as-Usual Compact Population	Scenario 4 High RSLR Business-as-Usual Compact Population
1	C-G-1000-4	C-G-1000-4	C-G-1000-4	C-G-1000-4
2	C-R-1000-4	C-R-1000-4	C-R-1000-4	C-R-1000-4
3	C-G-400-4	C-G-400-4	C-G-400-4	C-G-400-4
4	NS-1000	NS-1000	NS-1000	G-1000-4
5	G-1000-4	G-1000-4	G-1000-4	G-400-4
6	G-400-4	G-400-4	G-400-4	NS-1000
7	R-1000-4	R-1000-4	R-1000-4	R-1000-4
8	C-G-100-4	C-G-100-4	C-G-100-4	C-G-100-4
9	C-G-100-1	C-G-100-1	C-G-100-1	C-G-100-1
10	G-100-4	G-100-4	G-100-4	G-100-4
11	C-R-400-4	C-R-400-4	C-R-400-4	C-R-400-4
12	C-R-400-3	C-R-400-3	G-100-1	G-100-1
13	C-R-400-2	C-R-400-2	C-R-400-3	C-R-400-3
14	G-100-1	G-100-1	C-R-400-2	C-R-400-2
15	NS-400	NS-400	NS-400	NS-400
16	C-WBI-400-1	C-WBI-400-1	C-WBI-400-1	C-WBI-400-1
17	R-400-4	R-400-4	R-400-4	R-400-4
18	R-400-3	R-400-3	R-400-3	R-400-3
19	R-400-2	R-400-2	R-400-2	R-400-2
20	WBI-400-1	WBI-400-1	WBI-400-1	WBI-400-1
21	C-R-100-4	C-R-100-4	C-R-100-4	C-R-100-4
22	C-R-100-3	C-R-100-3	C-R-100-3	C-R-100-3
23	C-R-100-2	C-R-100-2	C-R-100-2	C-R-100-2
24	C-WBI-100-1	R-100-4	C-WBI-100-1	R-100-4
25	R-100-4	C-WBI-100-1	R-100-4	C-WBI-100-1
26	R-100-3	R-100-3	R-100-3	R-100-3
27	R-100-2	R-100-2	R-100-2	R-100-2
28	WBI-100-1	WBI-100-1	WBI-100-1	WBI-100-1
29	NS-100	NS-100	NS-100	NS-100
30	Coastal	Coastal	Coastal	Coastal

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Planning Unit 3a

Sample Data Rankings and Evaluation Criteria Tables

Planning Unit 3a - Metric Data Summary

(Scenario 1 - Low Relative Sea Level Rise, High Employment, Dispersed Population; Low Uncertainty)

Plan #	Alternative	Population Impacted	Residual Damages	Life Cycle Cost 1/	Construction Time	Employment Impacted	Indirect Environmental Impact Score	Direct Wetland Impacts	Historic Properties Protected	Historic Districts Protected	Archeo. Sites Protected
		Equiv. Annual #	Equiv. Annual $ Millions	Equiv. Annual $ Millions	Years	Equiv. Annual #	Unit-less Scale -8 to +8	Acres	# Properties	# Districts	# Sites
1	No Action	19,069	1,028	0	15	5,462	0	0	0	0	72
2	Coastal	19,115	1,027	1,189	15	5,451	0	0	3	0	111
3	NS-100	17,559	512	1,587	15	3,078	0	0	3	0	111
4	NS-400	15,858	365	1,733	15	1,805	0	0	3	0	111
5	NS-1000	14,544	330	1,786	15	1,457	0	0	3	0	111
6	M-100-1	9,106	474	2,282	10	2,444	-7	4,900	13	0	157
7	M-100-2	9,937	537	2,158	10	2,606	-4	4,200	10	0	128
8	G-400-2	9,659	514	2,476	10	2,489	-7	5,300	5	1	128
9	G-1000-2	9,493	506	2,599	10	2,442	-7	6,600	16	1	128
10	C-M-100-1	9,095	426	2,314	10	2,332	-7	4,900	13	0	157
11	C-M-100-2	9,925	483	2,193	10	2,490	-4	4,200	10	0	128
12	C-G-400-2	9,429	434	2,553	10	1,938	-7	5,300	5	1	128
13	C-G-1000-2	9,168	415	2,727	10	1,871	-7	6,600	16	1	128

1/ Equivalent Annual Costs shown include costs for construction of coastal landscape measures. The final array of alternatives, as presented elsewhere in the report, do not include these costs since sustaining the current coastal landscape in this area appears to provide minimal contribution, if any, to reduction of risk from hurricane surge. Since deleting the coastal landscape costs affects all alternatives equally, the relative ranking of alternatives remains the same.

Planning Unit 3a - Relative Ranking of Alternatives Based On Individual Metrics
(Scenario 1 - Low Relative Sea Level Rise, High Employment, Dispersed Population; Low Uncertainty)

Rank	Population Impacted	Residual Damages	Life Cycle Cost	Construction Time	Employment Impacted	Indirect Environmental Impact Score	Direct Wetland Impacts	Historic Properties Protected	Historic Districts Protected	Archeo. Sites Protected
1	C-M-100-1	NS-1000	No Action	M-100-2	NS-1000	No Action	No Action	G-1000-2	G-400-2	M-100-1
2	M-100-1	NS-400	Coastal	C-M-100-2	NS-400	Coastal	Coastal	C-G-1000-2	C-G-400-2	C-M-100-1
3	C-G-1000-2	C-G-1000-2	NS-100	M-100-1	C-G-1000-2	NS-100	NS-100	M-100-1	G-1000-2	M-100-2
4	C-G-400-2	C-M-100-1	NS-400	C-M-100-1	C-G-400-2	NS-400	NS-400	C-M-100-1	C-G-1000-2	C-M-100-2
5	G-1000-2	C-G-400-2	NS-1000	G-400-2	C-M-100-1	NS-1000	NS-1000	M-100-2	No Action	G-400-2
6	G-400-2	M-100-1	M-100-2	C-G-400-2	G-1000-2	M-100-2	M-100-2	C-M-100-2	Coastal	C-G-400-2
7	C-M-100-2	C-M-100-2	C-M-100-2	G-1000-2	M-100-1	C-M-100-2	C-M-100-2	G-400-2	NS-100	G-1000-2
8	M-100-2	G-1000-2	M-100-1	C-G-1000-2	G-400-2	M-100-1	M-100-1	C-G-400-2	NS-400	C-G-1000-2
9	NS-1000	NS-100	C-M-100-1	No Action	C-M-100-2	C-M-100-1	C-M-100-1	Coastal	NS-1000	Coastal
10	NS-400	G-400-2	G-400-2	Coastal	M-100-2	G-400-2	G-400-2	NS-100	M-100-2	NS-100
11	NS-100	M-100-2	C-G-400-2	NS-100	NS-100	C-G-400-2	C-G-400-2	NS-400	C-M-100-2	NS-400
12	No Action	Coastal	G-1000-2	NS-400	Coastal	G-1000-2	G-1000-2	NS-1000	M-100-1	NS-1000
13	Coastal	No Action	C-G-1000-2	NS-1000	No Action	C-G-1000-2	C-G-1000-2	No Action	C-M-100-1	No Action

Planning Unit 3a - Multi-Criteria Decision Analysis (MCDA) Trend Analysis

(Scenario 1 - Low Relative Sea Level Rise, High Employment, Dispersed Population; Low Uncertainty)

Plan #	Alternative	Plan Rank By Each Respondant																														Total Ranking Score (All Respondants)
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
5	NS-1000	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	5	1	1	9	1	8	1	1	50
4	NS-400	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	7	3	4	2	2	10	2	10	2	2	84
3	NS-100	3	3	5	3	3	3	5	3	3	5	3	3	3	3	3	3	3	3	3	3	11	4	2	3	9	11	3	11	3	3	126
11	C-M-100-2	6	4	3	4	6	4	3	4	4	3	4	4	4	6	4	5	4	4	4	4	4	6	6	4	4	6	5	4	6	5	134
7	M-100-2	7	5	4	5	7	5	4	5	5	4	5	5	5	7	5	7	5	5	5	5	6	7	7	5	6	7	6	7	7	6	169
10	C-M-100-1	8	6	6	6	8	6	6	7	7	6	6	6	8	8	6	8	6	7	7	7	5	8	8	6	3	2	7	2	8	7	191
6	M-100-1	9	7	7	7	9	7	7	8	8	7	7	7	9	9	7	9	8	8	8	8	10	9	9	7	5	4	9	3	9	8	229
2	Coastal	5	8	12	12	4	12	12	6	6	12	12	10	6	4	12	4	12	6	6	6	12	5	3	12	12	12	4	12	5	4	248
12	C-G-400-2	10	10	8	8	10	9	8	9	9	8	9	9	10	10	9	10	9	9	9	9	2	10	11	8	7	3	10	6	10	10	259
13	C-G-1000-2	12	9	9	10	12	8	9	10	11	9	8	8	12	12	8	12	7	11	11	11	3	13	13	9	8	1	12	1	12	11	282
1	No Action	4	13	13	13	5	13	13	11	13	13	13	13	7	5	13	6	13	12	10	12	13	1	1	13	13	13	8	13	4	9	303
8	G-400-2	11	11	10	9	11	11	10	12	10	10	11	12	11	11	11	11	11	10	12	10	8	11	10	10	10	8	11	9	11	12	315
9	G-1000-2	13	12	11	11	13	10	11	13	12	11	10	11	13	13	10	13	10	13	13	13	9	12	12	11	11	5	13	5	13	13	340

Planning Unit 3a

MCDA Trend Analysis (Ranked by Total Ranking Scores - All Respondants)

Rank	Scenario 1 Low RSLR High Employment Dispersed Population	Scenario 2 High RSLR High Employment Dispersed Population	Scenario 3 Low RSLR Business-as-Usual Compact Population	Scenario 4 High RSLR Business-as-Usual Compact Population
1	NS-1000	NS-1000	NS-1000	NS-1000
2	NS-400	NS-400	NS-400	NS-400
3	NS-100	C-M-100-2	NS-100	NS-100
4	C-M-100-2	NS-100	C-M-100-2	C-M-100-2
5	M-100-2	M-100-2	M-100-2	M-100-2
6	C-M-100-1	C-M-100-1	C-M-100-1	C-M-100-1
7	M-100-1	M-100-1	M-100-1	M-100-1
8	Coastal	C-G-400-2	Coastal	Coastal
9	C-G-400-2	C-G-1000-2	C-G-400-2	C-G-400-2
10	C-G-1000-2	Coastal	C-G-1000-2	C-G-1000-2
11	No Action	G-400-2	No Action	No Action
12	G-400-2	No Action	G-400-2	G-400-2
13	G-1000-2	G-1000-2	G-1000-2	G-1000-2

Planning Unit 3a

Evaluation Criteria Values

(Scenario 1, Low Relative Sea Level Rise, High Employment, Dispersed Population; Low Uncertainty)

Plan #	Alternative	Stakeholder (Multi-Criteria Decision Analysis)	Minimizing Environmental Impacts		Investment Decision (Efficiency) 1/			Minimizing Remaining Risk (Effectiveness)			Year 2025 Present Value Life Cycle Costs (2010-2075) ($Millions) 1/
Evaluation Criteria		Cumulative Ranking Score from MCDA Trend Analysis	Direct Wetland Impact	Indirect Impacts	Cost Efficiency	Total System Costs	Period of Analysis Cost Efficiency	Annualized Residual Damages	Period of Analysis Risk Reduction	Average % Risk Reduction	
(Units)		*(Unit-less Weight)*	*(Acres)*	*(Unit-less Scale)*	*Ratio: Risk Reduction / Present Value Life Cycle Costs (PV LCC)*	*Annualized Life Cycle Costs + EA Residual Damages ($Millions)*	*Cost Efficiency Ratio: Event Freq Risk Reduction X Probability of Occurrence (2010-2075) / PV LCC*	*Average Annual Remaining Risk (Millions)*	*Event Freq Risk Reduction X Probability (2010-2075) ($Millions)*	*2075: 100-yr to 2,000-yr Frequency Events (Avg % of No Action Damages)*	
2	**Coastal**	248	0	0	0.0000	2,216	-0.0003	99.9	-6	-0.20	23,276
3	**NS-100**	126	0	0	0.0166	2,099	0.1362	49.8	4,235	15.79	31,102
4	**NS-400**	84	0	0	0.0195	2,098	0.2543	35.5	8,634	49.33	33,959
5	**NS-1000**	50	0	0	0.0199	2,116	0.3041	32.1	10,644	72.92	34,999
6	**M-100-1**	229	4,900	-7	0.0124	2,756	0.2214	46.1	9,894	63.88	44,688
7	**M-100-2**	169	4,200	-4	0.0116	2,695	0.1992	52.2	8,417	52.03	42,258
8	**G-400-2**	315	5,300	-7	0.0106	2,990	0.1977	50.0	9,588	71.02	48,488
9	**G-1000-2**	340	6,600	-7	0.0103	3,105	0.1992	49.2	10,141	81.51	50,901
10	**C-M-100-1**	191	4,900	-7	0.0133	2,740	0.2291	41.4	10,383	65.26	45,319
11	**C-M-100-2**	134	4,200	-4	0.0127	2,676	0.2085	47.0	8,955	53.63	42,954
12	**C-G-400-2**	259	5,300	-7	0.0119	2,987	0.2132	42.2	10,663	77.68	50,008
13	**C-G-1000-2**	282	6,600	-7	0.0115	3,142	0.2155	40.4	11,508	91.02	53,405

1/ Present Value and Equivalent Annual Costs include costs for construction of coastal landscape measures. The final array of alternatives, as presented elsewhere in the report, do not include these costs since sustaining the current coastal landscape in this area appears to provide minimal contribution, if any, to reduction of risk from hurricane surge. Since deleting the coastal landscape costs affects all alternatives equally, the relative ranking of alternatives remains the same.

Planning Unit 3a

Evaluation Criteria Data Ordinal Rankings

(Scenario 1, Low Relative Sea Level Rise, High Employment, Dispersed Population; Low Uncertainty)

Plan #	Alternative	Stakeholder (Multi-Criteria Decision Analysis)	Minimizing Environmental Impacts		Investment Decision (Efficiency)			Minimizing Remaining Risk (Effectiveness)			Year 2025 Present Value Life Cycle Costs (2010-2075) ($Millions)
Evaluation Criteria		Cumulative Ranking Score from MCDA Trend Analysis	Direct Wetland Impact	Indirect Impacts	Cost Efficiency	Total System Costs	Period of Analysis Cost Efficiency	Annualized Residual Damages	Period of Analysis Risk Reduction	Average % Risk Reduction	
(Units)		*(Unit-less Weight)*	*(Acres)*	*(Unit-less Scale)*	*Ratio: Risk Reduction / Present Value Life Cycle Costs (PV LCC)*	*Annualized Life Cycle Costs + EA Residual Damages ($Millions)*	*Cost Efficiency Ratio: Event Freq Risk Reduction X Probability of Occurrence (2010-2075) / PV LCC*	*Average Annual Remaining Risk (Millions)*	*Event Freq Risk Reduction X Probability (2010-2075) ($Millions)*	*2075: 100-yr to 2,000-yr Frequency Events (Avg % of No Action Damages)*	
2	**Coastal**	8	4	4	12	4	12	12	12	12	1
3	**NS-100**	3	2	2	3	2	11	9	11	11	2
4	**NS-400**	2	1	1	2	1	2	2	9	10	3
5	**NS-1000**	1	3	3	1	3	1	1	3	4	4
6	**M-100-1**	7	8	8	6	8	4	6	6	7	7
7	**M-100-2**	5	6	6	8	6	9	11	10	9	5
8	**G-400-2**	11	10	10	10	10	10	10	7	5	9
9	**G-1000-2**	12	11	11	11	11	8	8	5	2	11
10	**C-M-100-1**	6	7	7	4	7	3	4	4	6	8
11	**C-M-100-2**	4	5	5	5	5	7	7	8	8	6
12	**C-G-400-2**	9	9	9	7	9	6	5	2	3	10
13	**C-G-1000-2**	10	12	12	9	12	5	3	1	1	12

Planning Unit 3a

Cost Efficiency Analysis

(Scenario 1 - LRSLR, High Employment, Dispersed Population; Low Uncertainty)

Plan #	Alternative	Present Value Life-Cycle Costs ($ Millions) 1/	Risk Reduction Annual Equivalent ($ Millions)	Cost Efficiency Factor Risk Red / PV Costs	Rank
5	NS-1000	34,999	698	0.0199	1
4	NS-400	33,959	663	0.0195	2
3	NS-100	31,102	516	0.0166	3
10	C-M-100-1	45,319	602	0.0133	4
11	C-M-100-2	42,954	545	0.0127	5
6	M-100-1	44,688	554	0.0124	6
12	C-G-400-2	50,008	594	0.0119	7
7	M-100-2	42,258	491	0.0116	8
13	C-G-1000-2	53,405	613	0.0115	9
8	G-400-2	48,488	514	0.0106	10
9	G-1000-2	50,901	522	0.0103	11
2	Coastal	23,276	1	0.0000	12

1/ Present Value Costs shown include costs for construction of coastal landscape measures. The final array of alternatives, as presented elsewhere in the report, do not include these costs since sustaining the current coastal landscape in this area appears to provide minimal contribution, if any, to reduction of risk from hurricane surge. Since deleting the coastal landscape costs affects all alternatives equally, the relative ranking of alternatives remains the same.

Planning Unit 3a

Cost Efficiency Rankings

Rank	Scenario 1 **Low RSLR High Employment Dispersed Population**	Scenario 2 **High RSLR High Employment Dispersed Population**	Scenario 3 **Low RSLR Business-as-Usual Compact Population**	Scenario 4 **High RSLR Business-as-Usual Compact Population**
1	NS-1000	NS-1000	NS-1000	NS-1000
2	NS-400	NS-400	NS-400	NS-400
3	NS-100	NS-100	NS-100	NS-100
4	C-M-100-1	C-M-100-1	C-M-100-1	C-M-100-1
5	C-M-100-2	C-M-100-2	C-M-100-2	C-M-100-2
6	M-100-1	M-100-1	M-100-1	M-100-1
7	C-G-400-2	M-100-2	C-G-400-2	M-100-2
8	M-100-2	C-G-400-2	M-100-2	C-G-400-2
9	C-G-1000-2	C-G-1000-2	C-G-1000-2	C-G-1000-2
10	G-400-2	G-400-2	G-400-2	G-400-2
11	G-1000-2	G-1000-2	G-1000-2	G-1000-2
12	Coastal	Coastal	Coastal	Coastal

Planning Unit 3a

Total System Costs Analysis

(Scenario 1 - LRSLR, High Employment, Dispersed Population; Low Uncertainty)

Plan #	Alternative	Equivalent Annual Life-Cycle Costs ($Millions) 1/	With Project Residual Damages ($ Millions)	Total System Costs ($ Millions)	Rank
4	NS-400	1,733	365	2,098	1
3	NS-100	1,587	512	2,099	2
5	NS-1000	1,786	330	2,116	3
2	Coastal	1,189	1,027	2,216	4
11	C-M-100-2	2,193	483	2,676	5
7	M-100-2	2,158	537	2,695	6
10	C-M-100-1	2,314	426	2,740	7
6	M-100-1	2,282	474	2,756	8
12	C-G-400-2	2,553	434	2,987	9
8	G-400-2	2,476	514	2,990	10
9	G-1000-2	2,599	506	3,105	11
13	C-G-1000-2	2,727	415	3,142	12

1/ Equivalent Annual Life-Cycle Costs shown include costs for construction of coastal landscape measures. The final array of alternatives, as presented elsewhere in the report, do not include these costs since sustaining the current coastal landscape in this area appears to provide minimal contribution, if any, to reduction of risk from hurricane surge. Since deleting the coastal landscape costs affects all alternatives equally, the relative ranking of alternatives remains the same.

Planning Unit 3a

Total System Costs Rankings

Rank	Scenario 1 Low RSLR High Employment Dispersed Population	Scenario 2 High RSLR High Employment Dispersed Population	Scenario 3 Low RSLR Business-as-Usual Compact Population	Scenario 4 High RSLR Business-as-Usual Compact Population
1	NS-400	NS-1000	NS-100	NS-400
2	NS-100	NS-400	NS-400	NS-1000
3	NS-1000	NS-100	NS-1000	NS-100
4	Coastal	Coastal	Coastal	Coastal
5	C-M-100-2	C-M-100-2	C-M-100-2	C-M-100-2
6	M-100-2	M-100-2	M-100-2	M-100-2
7	C-M-100-1	C-M-100-1	C-M-100-1	C-M-100-1
8	M-100-1	M-100-1	M-100-1	M-100-1
9	C-G-400-2	C-G-400-2	G-400-2	G-400-2
10	G-400-2	G-400-2	C-G-400-2	C-G-400-2
11	G-1000-2	G-1000-2	G-1000-2	G-1000-2
12	C-G-1000-2	C-G-1000-2	C-G-1000-2	C-G-1000-2

Planning Unit 3a

Period of Analysis Cost Efficiency

(2075 Risk Reduction X Probablility (2010-2075) / Present Value Costs For Frequency Events Included in Economic Evaluation)

(Scenario 1: Low RSLR, High Employment, Dispersed Population - Low Uncertainty)

Plan #	Alternative	Remaining Damages by Frequency ($Millions)					Total Risk Reduction X Probabilty 2010-2075 ($Million)	Present Value Life-Cycle Costs ($ Millions) 1/	Cost Efficiency Ratio - Total Risk Reduction / PV Costs	Rank
		10-yr	100-yr	400-yr	1,000-yr	2,000-yr				
No Action Damages ($ Million)		1,460	10,629	22,650	26,922	28,659				
5	**NS-1000**	79	717	3,068	8,156	16,545	10,644	34,999	0.3041	1
4	**NS-400**	123	1,271	8,151	19,436	23,655	8,634	33,959	0.2543	2
10	**C-M-100-1**	107	422	1,852	15,182	20,184	10,383	45,319	0.2291	3
6	**M-100-1**	347	873	2,015	15,270	20,250	9,894	44,688	0.2214	4
13	**C-G-1000-2**	102	977	1,651	2,272	3,156	11,508	53,405	0.2155	5
12	**C-G-400-2**	125	1,188	2,110	9,204	9,921	10,663	50,008	0.2132	6
11	**C-M-100-2**	152	1,548	5,133	20,469	20,694	8,955	42,954	0.2085	7
9	**G-1000-2**	403	2,080	3,476	5,200	5,655	10,141	50,901	0.1992	8
7	**M-100-2**	399	2,082	5,312	20,567	20,763	8,417	42,258	0.1992	9
8	**G-400-2**	403	2,080	3,483	10,993	11,503	9,588	48,488	0.1977	10
3	**NS-100**	179	5,111	20,976	26,215	28,308	4,235	31,102	0.1362	11
2	**Coastal**	1,466	10,574	22,760	27,034	28,781	-6	23,276	-0.0003	12

1/ Present Value Costs shown include costs for construction of coastal landscape measures. The final array of alternatives, as presented elsewhere in the report, do not include these costs since sustaining the current coastal landscape in this area appears to provide minimal contribution, if any, to reduction of risk from hurricane surge. Since deleting the coastal landscape costs affects all alternatives equally, the relative ranking of alternatives remains the same.

Planning Unit 3a

Period of Analysis Cost Efficiency

(2075 Risk Reduction X Probability (2010 - 2075) / Present Value Costs Rankings For Frequency Events Included in Economic Evaluation)

Rank	Scenario 1 Low RSLR High Employment Dispersed Population	Scenario 2 High RSLR High Employment Dispersed Population	Scenario 3 Low RSLR Business-as-Usual Compact Population	Scenario 4 High RSLR Business-as-Usual Compact Population
1	NS-1000	NS-1000	NS-1000	NS-1000
2	NS-400	C-M-100-1	NS-400	NS-400
3	C-M-100-1	NS-400	C-M-100-1	C-M-100-1
4	M-100-1	M-100-1	M-100-1	M-100-1
5	C-G-1000-2	C-M-100-2	C-G-1000-2	C-M-100-2
6	C-G-400-2	C-G-400-2	C-G-400-2	C-G-1000-2
7	C-M-100-2	C-G-1000-2	C-M-100-2	C-G-400-2
8	G-1000-2	M-100-2	M-100-2	M-100-2
9	M-100-2	G-400-2	G-1000-2	G-400-2
10	G-400-2	G-1000-2	G-400-2	G-1000-2
11	NS-100	NS-100	NS-100	NS-100
12	Coastal	Coastal	Coastal	Coastal

Planning Unit 3a

Residual Damages (Remaining Risk) Analysis

(Scenario 1: Low RSLR, High Employment, Dispersed Population - Low Uncertainty)

Plan #	Alternative	No Action Residual Damages ($Millions)	With Project Residual Damages ($ Millions)	% of No Action Damages	Rank
5	NS-1000	1,028	330	32.1	1
4	NS-400	1,028	365	35.5	2
13	C-G-1000-2	1,028	415	40.4	3
10	C-M-100-1	1,028	426	41.4	4
12	C-G-400-2	1,028	434	42.2	5
6	M-100-1	1,028	474	46.1	6
11	C-M-100-2	1,028	483	47.0	7
9	G-1000-2	1,028	506	49.2	8
3	NS-100	1,028	512	49.8	9
8	G-400-2	1,028	514	50.0	10
7	M-100-2	1,028	537	52.2	11
2	Coastal	1,028	1,027	99.9	12

Planning Unit 3a

Residual Damages (Remaining Risk) Rankings

Rank	Scenario 1 Low RSLR High Employment Dispersed Population	Scenario 2 High RSLR High Employment Dispersed Population	Scenario 3 Low RSLR Business-as-Usual Compact Population	Scenario 4 High RSLR Business-as-Usual Compact Population
1	NS-1000	NS-1000	NS-1000	NS-1000
2	NS-400	NS-400	NS-400	NS-400
3	C-G-1000-2	C-G-1000-2	C-G-1000-2	C-G-1000-2
4	C-M-100-1	C-M-100-1	C-M-100-1	C-M-100-1
5	C-G-400-2	C-G-400-2	C-G-400-2	C-G-400-2
6	M-100-1	M-100-1	M-100-1	M-100-1
7	C-M-100-2	C-M-100-2	C-M-100-2	C-M-100-2
8	G-1000-2	G-1000-2	NS-100	G-1000-2
9	NS-100	G-400-2	G-1000-2	G-400-2
10	G-400-2	M-100-2	G-400-2	M-100-2
11	M-100-2	NS-100	M-100-2	NS-100
12	Coastal	Coastal	Coastal	Coastal

Planning Unit 3a

Period of Analysis Risk Reduction

(2075 Risk Reduction X Probablility (2010-2075)

For Frequency Events Included in Economic Evaluation)

(Scenario 1: Low RSLR, High Employment, Dispersed Population - Low Uncertainty)

Plan #	Alternative	Remaining Damages by Frequency ($Millions)					Total Risk Reduction X Probabilty 2010-2075 ($Million)	Rank
		10-yr	100-yr	400-yr	1,000-yr	2,000-yr		
No Action Damages ($ Million)		1,460	10,629	22,650	26,922	28,659		
13	C-G-1000-2	102	977	1,651	2,272	3,156	11,508	1
12	C-G-400-2	125	1,188	2,110	9,204	9,921	10,663	2
5	NS-1000	79	717	3,068	8,156	16,545	10,644	3
10	C-M-100-1	107	422	1,852	15,182	20,184	10,383	4
9	G-1000-2	403	2,080	3,476	5,200	5,655	10,141	5
6	M-100-1	347	873	2,015	15,270	20,250	9,894	6
8	G-400-2	403	2,080	3,483	10,993	11,503	9,588	7
11	C-M-100-2	152	1,548	5,133	20,469	20,694	8,955	8
4	NS-400	123	1,271	8,151	19,436	23,655	8,634	9
7	M-100-2	399	2,082	5,312	20,567	20,763	8,417	10
3	NS-100	179	5,111	20,976	26,215	28,308	4,235	11
2	Coastal	1,466	10,574	22,760	27,034	28,781	-6	12

Planning Unit 3a

Period of Analysis Risk Reduction

(2075 Risk Reduction X Probability (2010 - 2075) Rankings
For Frequency Events Included in Economic Evaluation)

Rank	Scenario 1 Low RSLR High Employment Dispersed Population	Scenario 2 High RSLR High Employment Dispersed Population	Scenario 3 Low RSLR Business-as-Usual Compact Population	Scenario 4 High RSLR Business-as-Usual Compact Population
1	C-G-1000-2	C-G-1000-2	C-G-1000-2	C-G-1000-2
2	C-G-400-2	C-M-100-1	NS-1000	C-M-100-1
3	NS-1000	C-G-400-2	C-G-400-2	C-G-400-2
4	C-M-100-1	M-100-1	C-M-100-1	NS-1000
5	G-1000-2	NS-1000	G-1000-2	M-100-1
6	M-100-1	G-1000-2	M-100-1	G-1000-2
7	G-400-2	G-400-2	G-400-2	G-400-2
8	C-M-100-2	C-M-100-2	NS-400	C-M-100-2
9	NS-400	M-100-2	C-M-100-2	M-100-2
10	M-100-2	NS-400	M-100-2	NS-400
11	NS-100	NS-100	NS-100	NS-100
12	Coastal	Coastal	Coastal	Coastal

Planning Unit 3a

Average % Risk Reduction of Total Damages

For 100-yr to 2,000-yr Frequency Event Range Based on 2075 Population / Land Use

(Scenario 1: Low RSLR, High Employment, Dispersed Population - Low Uncertainty)

Plan #	Alternative	Average % Risk Reduction for 100-yr to 2,000-yr Frequency Events	Average Risk Reduction for 100-yr to 2,000-yr Frequency Events ($ Millions)	Present Value - Life Cycle Costs ($ Millions) 1/	Rank
Total No Action Residual Damages 100-yr to 2,000-yr Freq Events ($ Million)		**88,859**			
13	C-G-1000-2	91.02	80,877	53,405	**1**
9	G-1000-2	81.51	72,429	50,901	**2**
12	C-G-400-2	77.68	69,022	50,008	**3**
5	NS-1000	72.92	64,797	34,999	**4**
8	G-400-2	71.02	63,110	48,488	**5**
10	C-M-100-1	65.26	57,988	45,319	**6**
6	M-100-1	63.88	56,762	44,688	**7**
11	C-M-100-2	53.63	47,657	42,954	**8**
7	M-100-2	52.03	46,232	42,258	**9**
4	NS-400	49.33	43,835	33,959	**10**
3	NS-100	15.79	14,031	31,102	**11**
2	Coastal)	-0.20	-180	23,276	**12**

1/ Present Value Costs shown include costs for construction of coastal landscape measures. The final array of alternatives, as presented elsewhere in the report, do not include these costs since sustaining the current coastal landscape in this area appears to provide minimal contribution, if any, to reduction of risk from hurricane surge. Since deleting the coastal landscape costs affects all alternatives equally, the relative ranking of alternatives remains the same.

Planning Unit 3a

Average % Risk Reduction of Total Damages Rankings

For 100-yr to 2,000-yr Frequency Event Range Based on 2075 Population / Land Use

(Scenario 1: Low RSLR, High Employment, Dispersed Population - Low Uncertainty)

Rank	Scenario 1	Scenario 2	Scenario 3	Scenario 4
	Low RSLR High Employment Dispersed Population	**High RSLR High Employment Dispersed Population**	**Low RSLR Business-as-Usual Compact Population**	**High RSLR Business-as-Usual Compact Population**
1	C-G-1000-2	C-G-1000-2	C-G-1000-2	C-G-1000-2
2	G-1000-2	G-1000-2	G-1000-2	G-1000-2
3	C-G-400-2	C-G-400-2	C-G-400-2	C-G-400-2
4	NS-1000	G-400-2	NS-1000	G-400-2
5	G-400-2	C-M-100-1	G-400-2	C-M-100-1
6	C-M-100-1	M-100-1	C-M-100-1	NS-1000
7	M-100-1	NS-1000	M-100-1	M-100-1
8	C-M-100-2	C-M-100-2	C-M-100-2	C-M-100-2
9	M-100-2	M-100-2	NS-400	M-100-2
10	NS-400	NS-400	M-100-2	NS-400
11	NS-100	NS-100	NS-100	NS-100
12	Coastal	Coastal	Coastal	Coastal

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Planning Unit 3b

Sample Data Rankings and Evaluation Criteria Tables

Planning Unit 3b - Metric Data Summary
(Scenario 1 - Low Relative Sea Level Rise, High Employment, Dispersed Population; Low Uncertainty)

Plan No.	Alternative	Population Impacted	Residual Damages	Life Cycle Cost 1/	Construction Time	Employment Impacted	Indirect Environmental Impact Score	Direct Wetland Impacts	Historic Properties Protected	Historic Districts Protected	Archeo. Sites Protected
		Equiv. Annual #	Equiv. Annual $ Millions	Equiv. Annual $ Millions	Years	Equiv. Annual #	Unit-less Scale -8 to +8	Acres	# Properties	# Districts	# Sites
1	No Action	7,655	469	0	15	2,248	0	0	6	0	14
2	Coastal	7,655	469	243	15	2,247	0	0	2	0	106
3	NS-100	7,118	245	377	15	1,142	0	0	2	0	106
4	NS-400	7,117	183	475	15	781	0	0	2	0	106
5	NS-1000	7,016	166	533	15	705	0	0	2	0	106
6	G-100-1	3,227	210	1,020	10	1,000	-8	2,300	18	5	264
7	F-100-1	3,909	261	954	10	1,148	2	2,500	14	1	154
8	F-400-1	3,871	248	1,440	12	1,135	2	3,900	18	5	154
9	F-1000-1	4,201	267	1,830	14	1,236	2	5,200	18	5	154
10	RL-100-1	5,093	303	834	10	1,221	2	900	11	0	123
11	RL-400-1	4,988	299	1,162	12	1,238	2	1,700	15	3	123
12	C-G-100-1	3,191	191	1,032	10	928	-8	2,300	18	5	264
13	C-F-100-1	3,839	229	972	10	1,046	2	2,500	14	1	154
14	C-F-400-1	3,801	209	1,455	12	1,017	2	3,900	18	5	154
15	C-F-1000-1	4,128	224	1,853	14	1,104	2	5,200	18	5	154
16	C-RL-100-1	4,988	244	878	10	1,085	2	900	11	0	123
17	C-RL-400-1	4,882	213	1,213	12	1,037	2	1,700	15	3	123

1/ Equivalent Annual Costs shown include costs for construction of coastal landscape measures. The final array of alternatives, as presented elsewhere in the report, do not include these costs since sustaining the current coastal landscape in this area appears to provide minimal contribution, if any, to reduction of risk from hurricane surge. Since deleting the coastal landscape costs affects all alternatives equally, the relative ranking of alternatives remains the same.

Planning Unit 3b - Relative Ranking of Alternatives Based On Individual Metrics
(Scenario 1 - Low Relative Sea Level Rise, High Employment, Dispersed Population; Low Uncertainty)

Rank	Population Impacted	Residual Damages	Life Cycle Cost	Construction Time	Employment Impacted	Indirect Environmental Impact Score	Direct Wetland Impacts	Historic Properties Protected	Historic Districts Protected	Archeo. Sites Protected
1	C-G-100-1	NS-1000	No Action	RL-100-1	NS-1000	RL-100-1	No Action	G-100-1	G-100-1	G-100-1
2	G-100-1	NS-400	Coastal	C-RL-100-1	NS-400	C-RL-100-1	Coastal	C-G-100-1	C-G-100-1	C-G-100-1
3	C-F-400-1	C-G-100-1	NS-100	F-100-1	C-G-100-1	F-100-1	NS-100	F-400-1	F-400-1	F-100-1
4	C-F-100-1	C-F-400-1	NS-400	C-F-100-1	G-100-1	C-F-100-1	NS-400	C-F-400-1	C-F-400-1	C-F-100-1
5	F-400-1	G-100-1	NS-1000	G-100-1	C-F-400-1	RL-400-1	NS-1000	F-1000-1	F-1000-1	F-400-1
6	F-100-1	C-RL-400-1	RL-100-1	C-G-100-1	C-RL-400-1	C-RL-400-1	RL-100-1	C-F-1000-1	C-F-1000-1	C-F-400-1
7	C-F-1000-1	C-F-1000-1	C-RL-100-1	RL-400-1	C-F-100-1	F-400-1	C-RL-100-1	RL-400-1	RL-400-1	F-1000-1
8	F-1000-1	C-F-100-1	F-100-1	C-RL-400-1	C-RL-100-1	C-F-400-1	RL-400-1	C-RL-400-1	C-RL-400-1	C-F-1000-1
9	C-RL-400-1	C-RL-100-1	C-F-100-1	F-400-1	C-F-1000-1	F-1000-1	C-RL-400-1	F-100-1	F-100-1	RL-100-1
10	RL-400-1	NS-100	G-100-1	C-F-400-1	F-400-1	C-F-1000-1	G-100-1	C-F-100-1	C-F-100-1	C-RL-100-1
11	C-RL-100-1	F-400-1	C-G-100-1	F-1000-1	NS-100	No Action	C-G-100-1	RL-100-1	No Action	RL-400-1
12	RL-100-1	F-100-1	RL-400-1	C-F-1000-1	F-100-1	Coastal	F-100-1	C-RL-100-1	Coastal	C-RL-400-1
13	NS-1000	F-1000-1	C-RL-400-1	No Action	RL-100-1	NS-100	C-F-100-1	No Action	NS-100	Coastal
14	NS-400	RL-400-1	F-400-1	Coastal	F-1000-1	NS-400	F-400-1	Coastal	NS-400	NS-100
15	NS-100	RL-100-1	C-F-400-1	NS-100	RL-400-1	NS-1000	C-F-400-1	NS-100	NS-1000	NS-400
16	Coastal	Coastal	F-1000-1	NS-400	Coastal	G-100-1	F-1000-1	NS-400	RL-100-1	NS-1000
17	No Action	No Action	C-F-1000-1	NS-1000	No Action	C-G-100-1	C-F-1000-1	NS-1000	C-RL-100-1	No Action

Planning Unit 3b - Multi-Criteria Decision Analysis (MCDA) Trend Analysis

(Scenario 1 - Low Relative Sea Level Rise, High Employment, Dispersed Population; Low Uncertaintyl)

Plan #	Alternative	Plan Rank By Each Respondant																									Total Ranking Score (All Respondants)
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	
16	C-RL-100-1	3	2	1	1	4	2	11	8	1	1	9	1	1	2	1	7	1	3	4	1	1	1	2	1	2	71
13	C-F-100-1	5	1	3	2	3	1	5	5	2	2	5	2	3	1	2	4	3	5	3	8	5	3	1	3	1	78
7	F-100-1	7	4	4	4	5	3	8	7	5	3	8	4	6	5	5	8	4	7	5	9	6	4	4	4	3	132
10	RL-100-1	6	6	2	3	7	7	12	12	3	4	11	3	5	7	3	9	2	8	6	4	3	2	6	2	7	140
17	C-RL-400-1	8	7	5	5	8	4	6	6	4	5	3	7	9	6	4	5	7	4	7	10	7	5	7	6	5	150
12	C-G-100-1	15	3	13	11	1	6	1	1	8	7	10	9	7	3	12	1	10	1	1	5	2	12	3	13	4	159
6	G-100-1	17	5	14	12	2	8	2	2	10	8	12	11	10	4	13	2	11	2	2	6	4	13	5	14	8	197
14	C-F-400-1	10	8	10	10	6	5	3	3	6	6	1	12	12	8	9	3	12	6	8	13	12	10	8	10	6	197
5	NS-1000	1	11	6	6	11	11	13	13	11	11	13	5	2	11	7	13	5	11	11	2	9	6	11	5	11	216
11	RL-400-1	9	9	9	8	10	10	10	10	9	9	7	10	11	10	6	10	9	10	9	11	8	8	10	9	10	231
8	F-400-1	11	10	11	13	9	9	4	4	7	10	2	13	13	9	11	6	13	9	10	14	13	11	9	11	9	241
4	NS-400	2	12	7	7	12	12	14	14	12	12	14	6	4	12	8	14	6	12	12	3	10	7	12	7	12	243
3	NS-100	4	13	8	9	13	13	15	15	13	13	15	8	8	13	10	15	8	14	13	7	11	9	13	8	13	281
15	C-F-1000-1	14	14	16	14	14	14	7	9	14	14	4	15	15	14	14	11	15	13	14	16	15	15	14	15	14	334
9	F-1000-1	16	15	17	16	15	15	9	11	15	15	6	17	16	15	15	12	16	15	15	17	16	16	15	17	15	367
2	No Action	12	16	12	15	16	16	16	16	16	16	16	14	14	16	16	16	14	16	16	12	14	14	16	12	16	373
1	Coastal	13	17	15	17	17	17	17	17	17	17	17	16	17	17	17	17	17	17	17	15	17	17	17	16	17	415

Planning Unit 3b

MCDA Trend Analysis (Ranked by Total Ranking Scores - All Respondants)

Rank	Scenario 1 Low RSLR High Employment Dispersed Population	Scenario 2 High RSLR High Employment Dispersed Population	Scenario 3 Low RSLR Business-as-Usual Compact Population	Scenario 4 High RSLR Business-as-Usual Compact Population
1	C-RL-100-1	C-F-100-1	C-RL-100-1	C-F-100-1
2	C-F-100-1	C-RL-100-1	C-F-100-1	C-RL-100-1
3	F-100-1	F-100-1	F-100-1	F-100-1
4	RL-100-1	C-G-100-1	RL-100-1	RL-100-1
5	C-RL-400-1	RL-100-1	C-RL-400-1	C-G-100-1
6	C-G-100-1	C-RL-400-1	C-G-100-1	C-RL-400-1
7	G-100-1	G-100-1	C-F-400-1	C-F-400-1
8	C-F-400-1	C-F-400-1	G-100-1	G-100-1
9	NS-1000	NS-1000	RL-400-1	NS-1000
10	RL-400-1	NS-400	NS-1000	NS-400
11	F-400-1	F-400-1	NS-400	F-400-1
12	NS-400	RL-400-1	F-400-1	RL-400-1
13	NS-100	NS-100	NS-100	NS-100
14	C-F-1000-1	C-F-1000-1	C-F-1000-1	C-F-1000-1
15	F-1000-1	F-1000-1	F-1000-1	F-1000-1
16	Coastal	Coastal	Coastal	Coastal
17	No Action	No Action	No Action	No Action

Planning Unit 3b

Evaluation Criteria Values

(Scenario 1, Low Relative Sea Level Rise, High Employment, Dispersed Population; Low Uncertainty)

Plan #	Alternative	Stakeholder (Multi-Criteria Decision Analysis)	Minimizing Environmental Impacts		Investment Decision (Efficiency) 1/			Minimizing Remaining Risk (Effectiveness)			Year 2025 Present Value Life Cycle Costs (2010-2075) ($Millions) 1/
Evaluation Criteria		Cumulative Ranking Score from MCDA Trend Analysis	Direct Wetland Impact	Indirect Impacts	Cost Efficiency	Total System Costs	Period of Analysis Cost Efficiency	Annualized Residual Damages	Period of Analysis Risk Reduction	Average % Risk Reduction	
(Units)		*(Unit-less Weight)*	*(Acres)*	*(Unit-less Scale)*	*Ratio: Risk Reduction / Present Value Life Cycle Costs (PV LCC)*	*Annualized Life Cycle Costs + EA Residual Damages ($Millions)*	*Cost Efficiency Ratio: Event Freq Risk Reduction X Probability of Occurrence (2010-2075) / PV LCC*	*Average Annual Remaining Risk (Millions)*	*Event Freq Risk Reduction X Probability (2010-2075) ($Millions)*	*2075: 100-yr to 2,000-yr Frequency Events (Avg % of No Action Damages)*	
2	**Coastal**	373	0	0	0.0000	712	0.0004	100.0	2	0.01	4,756
3	**NS-100**	281	0	0	0.0304	622	0.2608	52.2	1,926	14.50	7,383
4	**NS-400**	243	0	0	0.0308	658	0.3812	38.9	3,550	41.13	9,313
5	**NS-1000**	216	0	0	0.0290	699	0.4276	35.4	4,471	67.43	10,457
6	**G-100-1**	197	2,300	-8	0.0130	1,230	0.2338	44.8	4,669	77.12	19,970
7	**F-100-1**	132	2,500	2	0.0112	1,215	0.1609	55.6	3,005	32.12	18,674
8	**F-400-1**	241	3,900	2	0.0079	1,688	0.1605	52.8	4,525	84.06	28,200
9	**F-1000-1**	367	5,200	2	0.0057	2,096	0.1266	56.8	4,538	84.78	35,830
10	**RL-100-1**	140	900	2	0.0102	1,138	0.1451	64.6	2,370	27.45	16,335
11	**RL-400-1**	231	1,700	2	0.0075	1,461	0.1332	63.7	3,031	45.06	22,752
12	**C-G-100-1**	159	2,300	-8	0.0138	1,224	0.2412	40.8	4,875	79.09	20,214
13	**C-F-100-1**	78	2,500	2	0.0126	1,201	0.1752	48.8	3,335	35.27	19,039
14	**C-F-400-1**	197	3,900	2	0.0092	1,664	0.1755	44.4	5,000	89.37	28,494
15	**C-F-1000-1**	334	5,200	2	0.0068	2,077	0.1408	47.8	5,108	91.90	36,288
16	**C-RL-100-1**	71	900	2	0.0131	1,122	0.1717	52.0	2,952	33.21	17,197
17	**C-RL-400-1**	150	1,700	2	0.0108	1,426	0.1800	45.4	4,276	61.63	23,754

1/ Present Value and Equivalent Annual Costs include costs for construction of coastal landscape measures. The final array of alternatives, as presented elsewhere in the report, do not include these costs since sustaining the current coastal landscape in this area appears to provide minimal contribution, if any, to reduction of risk from hurricane surge. Since deleting the coastal landscape costs affects all alternatives equally, the relative ranking of alternatives remains the same.

Planning Unit 3b

Evaluation Criteria Data Ordinal Rankings

(Scenario 1, Low Relative Sea Level Rise, High Employment, Dispersed Population; Low Uncertainty)

Plan #	Alternative	Stakeholder (Multi-Criteria Decision Analysis)	Minimizing Environmental Impacts		Investment Decision (Efficiency)			Minimizing Remaining Risk (Effectiveness)			Year 2025 Present Value Life Cycle Costs (2010-2075) ($Millions)
Evaluation Criteria		Cumulative Ranking Score from MCDA Trend Analysis	Direct Wetland Impact	Indirect Impacts	Cost Efficiency	Total System Costs	Period of Analysis Cost Efficiency	Annualized Residual Damages	Period of Analysis Risk Reduction	Average % Risk Reduction	
(Units)		*(Unit-less Weight)*	*(Acres)*	*(Unit-less Scale)*	*Ratio: Risk Reduction / Present Value Life Cycle Costs (PV LCC)*	*Annualized Life Cycle Costs + EA Residual Damages ($Millions)*	*Cost Efficiency Ratio: Event Freq Risk Reduction X Probability of Occurrence (2010-2075) / PV LCC*	*Average Annual Remaining Risk (Millions)*	*Event Freq Risk Reduction X Probability (2010-2075) ($Millions)*	*2075: 100-yr to 2,000-yr Frequency Events (Avg % of No Action Damages)*	
5	**NS-1000**	9	1	11	3	3	1	1	7	7	4
4	**NS-400**	12	1	11	1	2	2	2	9	10	3
12	**C-G-100-1**	6	11	15	4	9	4	3	3	5	10
6	**G-100-1**	7	5	15	6	10	5	5	4	6	9
3	**NS-100**	13	1	11	2	1	3	10	15	15	2
13	**C-F-100-1**	2	11	1	7	7	8	8	10	11	8
14	**C-F-400-1**	8	13	1	11	13	7	4	2	2	14
16	**C-RL-100-1**	1	15	1	5	5	9	9	13	12	6
7	**F-100-1**	3	5	1	8	8	10	12	12	13	7
17	**C-RL-400-1**	5	15	1	9	11	6	6	8	8	12
8	**F-400-1**	11	7	1	12	14	11	11	6	4	13
10	**RL-100-1**	4	9	1	10	6	12	15	14	14	5
15	**C-F-1000-1**	14	13	1	14	15	13	7	1	1	16
11	**RL-400-1**	10	9	1	13	12	14	14	11	9	11
9	**F-1000-1**	15	7	1	15	16	15	13	5	3	15
2	**Coastal**	16	1	11	16	4	16	16	16	16	1

Planning Unit 3b

Cost Efficiency Analysis

(Scenario 1 - LRSLR, High Employment, Dispersed Population; Low Uncertainty)

Plan #	Alternative	Present Value Life-Cycle Costs ($ Millions) 1/	Risk Reduction Equivalent Annual ($ Millions)	Cost Efficiency Factor Risk Red / PV Costs	Rank
4	NS-400	9,313	287	0.0308	1
3	NS-100	7,383	225	0.0304	2
5	NS-1000	10,457	303	0.0290	3
12	C-G-100-1	20,214	278	0.0138	4
16	C-RL-100-1	17,197	225	0.0131	5
6	G-100-1	19,970	259	0.0130	6
13	C-F-100-1	19,039	240	0.0126	7
7	F-100-1	18,674	209	0.0112	8
17	C-RL-400-1	23,754	256	0.0108	9
10	RL-100-1	16,335	166	0.0102	10
14	C-F-400-1	28,494	261	0.0092	11
8	F-400-1	28,200	221	0.0079	12
11	RL-400-1	22,752	170	0.0075	13
15	C-F-1000-1	36,288	245	0.0068	14
9	F-1000-1	35,830	203	0.0057	15
2	Coastal	4,756	0	0.0000	16

1/ Present Value Costs shown include costs for construction of coastal landscape measures. The final array of alternatives, as presented elsewhere in the report, do not include these costs since sustaining the current coastal landscape in this area appears to provide minimal contribution, if any, to reduction of risk from hurricane surge. Since deleting the coastal landscape costs affects all alternatives equally, the relative ranking of alternatives remains the same.

Planning Unit 3b

Cost Efficiency Rankings

Rank	Scenario 1 Low RSLR High Employment Dispersed Population	Scenario 2 High RSLR High Employment Dispersed Population	Scenario 3 Low RSLR Business-as-Usual Compact Population	Scenario 4 High RSLR Business-as-Usual Compact Population
1	NS-400	NS-400	NS-100	NS-400
2	NS-100	NS-1000	NS-400	NS-100
3	NS-1000	NS-100	NS-1000	NS-1000
4	C-G-100-1	C-G-100-1	C-G-100-1	C-G-100-1
5	C-RL-100-1	G-100-1	C-RL-100-1	C-RL-100-1
6	G-100-1	C-RL-100-1	G-100-1	G-100-1
7	C-F-100-1	C-F-100-1	C-F-100-1	C-F-100-1
8	F-100-1	F-100-1	F-100-1	F-100-1
9	C-RL-400-1	C-RL-400-1	C-RL-400-1	RL-100-1
10	RL-100-1	RL-100-1	RL-100-1	C-RL-400-1
11	C-F-400-1	C-F-400-1	C-F-400-1	C-F-400-1
12	F-400-1	F-400-1	F-400-1	F-400-1
13	RL-400-1	RL-400-1	RL-400-1	RL-400-1
14	C-F-1000-1	C-F-1000-1	C-F-1000-1	C-F-1000-1
15	F-1000-1	F-1000-1	F-1000-1	F-1000-1
16	Coastal	Coastal	Coastal	Coastal

Planning Unit 3b

Total System Costs Analysis

(Scenario 1 - LRSLR, High Employment, Dispersed Population; Low Uncertainty)

Plan #	Alternative	Equivalent Annual Life-Cycle Costs ($Millions) 1/	With Project Residual Damages ($ Millions)	Total System Costs ($ Millions)	Rank
3	NS-100	377	245	622	**1**
4	NS-400	475	183	658	**2**
5	NS-1000	533	166	699	**3**
2	Coastal	243	469	712	**4**
16	C-RL-100-1	878	244	1,122	**5**
10	RL-100-1	834	303	1,138	**6**
13	C-F-100-1	972	229	1,201	**7**
7	F-100-1	954	261	1,215	**8**
12	C-G-100-1	1,032	191	1,224	**9**
6	G-100-1	1,020	210	1,230	**10**
17	C-RL-400-1	1,213	213	1,426	**11**
11	RL-400-1	1,162	299	1,461	**12**
14	C-F-400-1	1,455	209	1,664	**13**
8	F-400-1	1,440	248	1,688	**14**
15	C-F-1000-1	1,853	224	2,077	**15**
9	F-1000-1	1,830	267	2,096	**16**

1/ Equivalent Annual Life-Cycle Costs shown include costs for construction of coastal landscape measures. The final array of alternatives, as presented elsewhere in the report, do not include these costs since sustaining the current coastal landscape in this area appears to provide minimal contribution, if any, to reduction of risk from hurricane surge. Since deleting the coastal landscape costs affects all alternatives equally, the relative ranking of alternatives remains the same.

Planning Unit 3b

Total System Costs Rankings

Rank	Scenario 1 Low RSLR High Employment Dispersed Population	Scenario 2 High RSLR High Employment Dispersed Population	Scenario 3 Low RSLR Business-as-Usual Compact Population	Scenario 4 High RSLR Business-as-Usual Compact Population
1	NS-100	NS-100	NS-100	NS-100
2	NS-400	NS-400	NS-400	NS-400
3	NS-1000	NS-1000	Coastal	NS-1000
4	Coastal	Coastal	NS-1000	Coastal
5	C-RL-100-1	C-RL-100-1	C-RL-100-1	C-RL-100-1
6	RL-100-1	RL-100-1	RL-100-1	RL-100-1
7	C-F-100-1	C-F-100-1	C-F-100-1	C-F-100-1
8	F-100-1	F-100-1	F-100-1	F-100-1
9	C-G-100-1	C-G-100-1	C-G-100-1	C-G-100-1
10	G-100-1	G-100-1	G-100-1	G-100-1
11	C-RL-400-1	C-RL-400-1	RL-400-1	RL-400-1
12	RL-400-1	RL-400-1	C-RL-400-1	C-RL-400-1
13	C-F-400-1	C-F-400-1	C-F-400-1	C-F-400-1
14	F-400-1	F-400-1	F-400-1	F-400-1
15	C-F-1000-1	C-F-1000-1	C-F-1000-1	C-F-1000-1
16	F-1000-1	F-1000-1	F-1000-1	F-1000-1

Planning Unit 3b

Period of Analysis Cost Efficiency

(2075 Risk Reduction X Probablility (2010-2075) / Present Value Costs For Frequency Events Included in Economic Evaluation)

(Scenario 1: Low RSLR, High Employment, Dispersed Population - Low Uncertainty)

Plan #	Alternative	Remaining Damages by Frequency ($Millions)					Total Risk Reduction X Probabilty 2010-2075 ($Million)	Present Value Life-Cycle Costs ($ Millions) 1/	Cost Efficiency Ratio Total Risk Reduction / PV Costs	Rank
		10-yr	100-yr	400-yr	1,000-yr	2,000-yr				
	No Action Damages ($ Million)	1,024	4,254	8,571	11,203	12,281				
5	**NS-1000**	103	433	817	3,928	9,274	4,471	10,457	0.4276	1
4	**NS-400**	116	537	3,643	9,691	11,524	3,550	9,313	0.3812	2
3	**NS-100**	141	2,344	7,954	10,805	11,993	1,926	7,383	0.2608	3
12	**C-G-100-1**	68	147	426	2,733	6,240	4,875	20,214	0.2412	4
6	**G-100-1**	158	318	567	2,867	6,368	4,669	19,970	0.2338	5
17	**C-RL-400-1**	95	291	1,827	6,161	8,635	4,276	23,754	0.1800	6
14	**C-F-400-1**	70	244	763	1,369	1,921	5,000	28,494	0.1755	7
13	**C-F-100-1**	83	418	5,300	10,720	11,245	3,335	19,039	0.1752	8
16	**C-RL-100-1**	107	1,038	6,486	9,360	10,261	2,952	17,197	0.1717	9
7	**F-100-1**	222	713	5,508	10,913	11,431	3,005	18,674	0.1609	10
8	**F-400-1**	222	711	1,238	1,679	2,167	4,525	28,200	0.1605	11
10	**RL-100-1**	316	1,664	6,800	9,637	10,525	2,370	16,335	0.1451	12
15	**C-F-1000-1**	65	153	556	1,125	1,507	5,108	36,288	0.1408	13
11	**RL-400-1**	316	1,628	3,993	6,852	9,058	3,031	22,752	0.1332	14
9	**F-1000-1**	222	711	1,236	1,652	1,844	4,538	35,830	0.1266	15
2	**Coastal**	1,022	4,253	8,576	11,197	12,280	2	4,756	0.0004	16

1/ Present Value Costs shown include costs for construction of coastal landscape measures. The final array of alternatives, as presented elsewhere in the report, do not include these costs since sustaining the current coastal landscape in this area appears to provide minimal contribution, if any, to reduction of risk from hurricane surge. Since deleting the coastal landscape costs affects all alternatives equally, the relative ranking of alternatives remains the same.

Planning Unit 3b

Period of Analysis Cost Efficiency Rankings

(2075 Risk Reduction X Probability (2010 - 2075) / Present Value Costs Rankings For Frequency Events Included in Economic Evaluation)

Rank	Scenario 1 Low RSLR High Employment Dispersed Population	Scenario 2 High RSLR High Employment Dispersed Population	Scenario 3 Low RSLR Business-as-Usual Compact Population	Scenario 4 High RSLR Business-as-Usual Compact Population
1	NS-1000	NS-1000	NS-1000	NS-1000
2	NS-400	NS-400	NS-400	NS-400
3	NS-100	C-G-100-1	NS-100	C-G-100-1
4	C-G-100-1	G-100-1	C-G-100-1	G-100-1
5	G-100-1	NS-100	G-100-1	NS-100
6	C-RL-400-1	C-F-100-1	C-RL-400-1	C-F-100-1
7	C-F-400-1	F-100-1	C-RL-100-1	C-RL-100-1
8	C-F-100-1	C-RL-400-1	C-F-400-1	F-100-1
9	C-RL-100-1	C-RL-100-1	C-F-100-1	C-RL-400-1
10	F-100-1	C-F-400-1	F-400-1	C-F-400-1
11	F-400-1	F-400-1	F-100-1	F-400-1
12	RL-100-1	RL-100-1	RL-100-1	RL-100-1
13	C-F-1000-1	C-F-1000-1	C-F-1000-1	RL-400-1
14	RL-400-1	RL-400-1	RL-400-1	C-F-1000-1
15	F-1000-1	F-1000-1	F-1000-1	F-1000-1
16	Coastal	Coastal	Coastal	Coastal

Planning Unit 3b

Residual Damages (Remaining Risk) Analysis

(Scenario 1: Low RSLR, High Employment, Dispersed Population - Low Uncertainty)

Plan #	Alternative	No Action Residual Damages ($Millions)	With Project Residual Damages ($ Millions)	% of No Action Damages	Rank
5	**NS-1000**	469	166	35.4	**1**
4	**NS-400**	469	183	38.9	**2**
12	**C-G-100-1**	469	191	40.8	**3**
14	**C-F-400-1**	469	209	44.4	**4**
6	**G-100-1**	469	210	44.8	**5**
17	**C-RL-400-1**	469	213	45.4	**6**
15	**C-F-1000-1**	469	224	47.8	**7**
13	**C-F-100-1**	469	229	48.8	**8**
16	**C-RL-100-1**	469	244	52.0	**9**
3	**NS-100**	469	245	52.2	**10**
8	**F-400-1**	469	248	52.8	**11**
7	**F-100-1**	469	261	55.6	**12**
9	**F-1000-1**	469	267	56.8	**13**
11	**RL-400-1**	469	299	63.7	**14**
10	**RL-100-1**	469	303	64.6	**15**
2	**Coastal**	469	469	100.0	**16**

Planning Unit 3b

Residual Damages (Remaining Risk) Rankings

Rank	Scenario 1 Low RSLR High Employment Dispersed Population	Scenario 2 High RSLR High Employment Dispersed Population	Scenario 3 Low RSLR Business-as-Usual Compact Population	Scenario 4 High RSLR Business-as-Usual Compact Population
1	NS-1000	NS-1000	NS-1000	NS-1000
2	NS-400	NS-400	NS-400	NS-400
3	C-G-100-1	C-G-100-1	C-G-100-1	C-G-100-1
4	C-F-400-1	G-100-1	C-F-400-1	C-F-400-1
5	G-100-1	C-F-400-1	G-100-1	G-100-1
6	C-RL-400-1	C-RL-400-1	C-RL-400-1	C-RL-400-1
7	C-F-1000-1	C-F-1000-1	C-F-1000-1	C-F-1000-1
8	C-F-100-1	C-F-100-1	C-F-100-1	C-F-100-1
9	C-RL-100-1	F-400-1	C-RL-100-1	F-400-1
10	NS-100	C-RL-100-1	NS-100	C-RL-100-1
11	F-400-1	F-100-1	F-400-1	F-100-1
12	F-100-1	NS-100	F-100-1	NS-100
13	F-1000-1	F-1000-1	F-1000-1	F-1000-1
14	RL-400-1	RL-400-1	RL-400-1	RL-400-1
15	RL-100-1	RL-100-1	RL-100-1	RL-100-1
16	Coastal	Coastal	Coastal	Coastal

Planning Unit 3b

Period of Analysis Risk Reduction

(2075 Risk Reduction X Probablility (2010-2075)

For Frequency Events Included in Economic Evaluation)

(Scenario 1: Low RSLR, High Employment, Dispersed Population - Low Uncertainty)

Plan #	Alternative	Remaining Damages by Frequency ($Millions)					Total Risk Reduction X Probabilty 2010-2075 ($Million)	Rank
		10-yr	100-yr	400-yr	1,000-yr	2,000-yr		
No Action Damages ($ Million)		1,024	4,254	8,571	11,203	12,281		
15	**C-F-1000-1**	65	153	556	1,125	1,507	5,108	1
14	**C-F-400-1**	70	244	763	1,369	1,921	5,000	2
12	**C-G-100-1**	68	147	426	2,733	6,240	4,875	3
6	**G-100-1**	158	318	567	2,867	6,368	4,669	4
9	**F-1000-1**	222	711	1,236	1,652	1,844	4,538	5
8	**F-400-1**	222	711	1,238	1,679	2,167	4,525	6
5	**NS-1000**	103	433	817	3,928	9,274	4,471	7
17	**C-RL-400-1**	95	291	1,827	6,161	8,635	4,276	8
4	**NS-400**	116	537	3,643	9,691	11,524	3,550	9
13	**C-F-100-1**	83	418	5,300	10,720	11,245	3,335	10
11	**RL-400-1**	316	1,628	3,993	6,852	9,058	3,031	11
7	**F-100-1**	222	713	5,508	10,913	11,431	3,005	12
16	**C-RL-100-1**	107	1,038	6,486	9,360	10,261	2,952	13
10	**RL-100-1**	316	1,664	6,800	9,637	10,525	2,370	14
3	**NS-100**	141	2,344	7,954	10,805	11,993	1,926	15
2	**Coastal**	1,022	4,253	8,576	11,197	12,280	2	16

Planning Unit 3b

Period of Analysis Risk Reduction

(2075 Risk Reduction X Probability (2010 - 2075) Rankings
For Frequency Events Included in Economic Evaluation)

Rank	Scenario 1 Low RSLR High Employment Dispersed Population	Scenario 2 High RSLR High Employment Dispersed Population	Scenario 3 Low RSLR Business-as-Usual Compact Population	Scenario 4 High RSLR Business-as-Usual Compact Population
1	C-F-1000-1	C-F-1000-1	C-F-1000-1	C-F-1000-1
2	C-F-400-1	C-F-400-1	C-F-400-1	C-F-400-1
3	C-G-100-1	C-G-100-1	C-G-100-1	C-G-100-1
4	G-100-1	G-100-1	G-100-1	G-100-1
5	F-1000-1	F-1000-1	F-1000-1	F-1000-1
6	F-400-1	F-400-1	F-400-1	F-400-1
7	NS-1000	NS-1000	NS-1000	C-RL-400-1
8	C-RL-400-1	C-RL-400-1	C-RL-400-1	NS-1000
9	NS-400	C-F-100-1	NS-400	C-F-100-1
10	C-F-100-1	F-100-1	C-F-100-1	F-100-1
11	RL-400-1	NS-400	RL-400-1	NS-400
12	F-100-1	RL-400-1	C-RL-100-1	RL-400-1
13	C-RL-100-1	C-RL-100-1	F-100-1	C-RL-100-1
14	RL-100-1	RL-100-1	RL-100-1	RL-100-1
15	NS-100	NS-100	NS-100	NS-100
16	Coastal	Coastal	Coastal	Coastal

Planning Unit 3b

Average % Risk Reduction of Total Damages

For 100-yr to 2,000-yr Frequency Event Range Based on 2075 Population / Land Use

(Scenario 1: Low RSLR, High Employment, Dispersed Population - Low Uncertainty)

Plan #	Alternative	Average % Risk Reduction for 100-yr to 2,000-yr Frequency Events	Average Risk Reduction for 100-yr to 2,000-yr Frequency Events ($ Millions)	Present Value Life Cycle Costs ($ Millions)	Rank
Total No Action Residual Damages 100-yr to 2,000-yr Freq Events ($ Million)		**36,309**			
15	**C-F-1000-1**	91.90	33,368	36,288	**1**
14	**C-F-400-1**	89.37	32,451	28,494	**2**
9	**F-1000-1**	84.78	30,783	35,830	**3**
8	**F-400-1**	84.06	30,520	28,200	**4**
12	**C-G-100-1**	79.09	28,717	20,214	**5**
6	**G-100-1**	77.12	28,000	19,970	**6**
5	**NS-1000**	67.43	24,482	10,457	**7**
17	**C-RL-400-1**	61.63	22,378	23,754	**8**
11	**RL-400-1**	45.06	16,360	22,752	**9**
4	**NS-400**	41.13	14,935	9,313	**10**
13	**C-F-100-1**	35.27	12,808	19,039	**11**
16	**C-RL-100-1**	33.21	12,057	17,197	**12**
7	**F-100-1**	32.12	11,663	18,674	**13**
10	**RL-100-1**	27.45	9,968	16,335	**14**
3	**NS-100**	14.50	5,266	7,383	**15**
2	**Coastal**	0.01	2	4,756	**16**

1/ Present Value Costs shown include costs for construction of coastal landscape measures. The final array of alternatives, as presented elsewhere in the report, do not include these costs since sustaining the current coastal landscape in this area appears to provide minimal contribution, if any, to reduction of risk from hurricane surge. Since deleting the coastal landscape costs affects all alternatives equally, the relative ranking of alternatives remains the same.

Planning Unit 3b

Average % Risk Reduction of Total Damages

For 100-yr to 2,000-yr Frequency Event Range Based on 2075 Population / Land Use

(Scenario 1: Low RSLR, High Employment, Dispersed Population - Low Uncertainty)

Rank	Scenario 1	Scenario 2	Scenario 3	Scenario 4
	Low RSLR High Employment Dispersed Population	**High RSLR High Employment Dispersed Population**	**Low RSLR Business-as-Usual Compact Population**	**High RSLR Business-as-Usual Compact Population**
1	C-F-1000-1	C-F-1000-1	C-F-1000-1	C-F-1000-1
2	C-F-400-1	C-F-400-1	C-F-400-1	C-F-400-1
3	F-1000-1	F-1000-1	F-1000-1	F-1000-1
4	F-400-1	F-400-1	F-400-1	F-400-1
5	C-G-100-1	C-G-100-1	C-G-100-1	C-G-100-1
6	G-100-1	G-100-1	G-100-1	G-100-1
7	NS-1000	C-RL-400-1	NS-1000	C-RL-400-1
8	C-RL-400-1	NS-1000	C-RL-400-1	NS-1000
9	RL-400-1	RL-400-1	RL-400-1	RL-400-1
10	NS-400	C-F-100-1	NS-400	C-F-100-1
11	C-F-100-1	F-100-1	C-F-100-1	F-100-1
12	C-RL-100-1	C-RL-100-1	C-RL-100-1	C-RL-100-1
13	F-100-1	NS-400	F-100-1	NS-400
14	RL-100-1	RL-100-1	RL-100-1	RL-100-1
15	NS-100	NS-100	NS-100	NS-100
16	Coastal	Coastal	Coastal	Coastal

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Planning Unit 4

Sample Data Rankings and Evaluation Criteria Tables

Planning Unit 4 - Metric Data Summary

(Scenario 1 - Low Relative Sea Level Rise, High Employment, Dispersed Population; Low Uncertainty)

Plan No.	Alternative	Population Impacted	Residual Damages	Life Cycle Cost 1/	Construction Time	Employment Impacted	Indirect Environmental Impact Score	Direct Wetland Impacts	Historic Properties Protected	Historic Districts Protected	Archeo. Sites Protected
		Equiv. Annual #	Equiv. Annual $ Millions	Equiv. Annual $ Millions	Years	Equiv. Annual #	Unit-less Scale -8 to +8	Acres	# Properties	# Districts	# Sites
1	No Action	4,752	373	0	15	996	0	0	0	0	29
2	Coastal	4,753	373	551	15	996	0	0	2	0	58
3	NS-100	4,106	206	660	15	505	0	0	2	0	58
4	NS-400	4,024	169	727	15	369	0	0	2	0	58
5	NS-1000	3,911	156	796	15	321	0	0	2	0	58
6	G-100-1	3,672	307	1,163	10	851	-5	2,200	3	0	91
7	G-100-2	3,800	324	1,152	10	959	-5	1,800	0	0	90
8	G-400-3	3,899	324	1,150	10	958	-6	2,500	1	0	90
9	G-1000-3	3,832	319	1,174	10	935	-6	2,500	1	0	90
10	RL-100-1	4,704	352	689	10	982	0	100	0	0	60
11	RL-400-1	4,590	352	728	12	978	0	100	1	0	60
12	RL-1000-1	4,539	349	742	14	958	0	100	1	0	60
13	C-G-100-1	3,197	182	1,237	10	490	-5	2,200	3	0	91
14	C-G-100-2	3,325	194	1,226	10	590	-5	1,800	0	0	90
15	C-G-400-3	3,282	174	1,226	10	404	-6	2,500	1	0	90
16	C-G-1000-3	3,089	152	1,357	10	337	-6	2,500	1	0	90
17	C-RL-100-1	4,221	201	786	10	515	0	100	0	0	60
18	C-RL-400-1	4,020	173	813	12	396	0	100	1	0	109
19	C-RL-1000-1	3,849	161	921	14	338	0	100	1	0	60

1/ Equivalent Annual Costs shown include costs for construction of coastal landscape measures. The final array of alternatives, as presented elsewhere in the report, do not include these costs since sustaining the current coastal landscape in this area appears to provide minimal contribution, if any, to reduction of risk from hurricane surge. Since deleting the coastal landscape costs affects all alternatives equally, the relative ranking of alternatives remains the same.

Planning Unit 4 - Relative Ranking of Alternatives Based On Individual Metrics
(Scenario 1 - Low Relative Sea Level Rise, High Employment, Dispersed Population; Low Uncertainty)

Rank	Population Impacted	Residual Damages	Life Cycle Cost	Construction Time	Employment Impacted	Indirect Environmental Impact Score	Direct Wetland Impacts	Historic Properties Protected	Historic Districts Protected	Archeo. Sites Protected
1	C-G-1000-3	C-G-1000-3	No Action	RL-100-1	NS-1000	No Action	No Action	G-100-1	---	C-RL-400-1
2	C-G-100-1	NS-1000	Coastal	C-RL-100-1	C-G-1000-3	Coastal	Coastal	C-G-100-1	---	G-100-1
3	C-G-400-3	C-RL-1000-1	NS-100	G-400-3	C-RL-1000-1	NS-100	NS-100	Coastal	---	C-G-100-1
4	C-G-100-2	NS-400	RL-100-1	G-100-2	NS-400	RL-100-1	NS-400	NS-100	---	G-400-3
5	G-100-1	C-RL-400-1	NS-400	G-100-1	C-RL-400-1	NS-400	NS-1000	NS-400	---	G-100-2
6	G-100-2	C-G-400-3	RL-400-1	G-1000-3	C-G-400-3	RL-400-1	RL-100-1	NS-1000	---	G-1000-3
7	G-1000-3	C-G-100-1	RL-1000-1	C-G-400-3	C-G-100-1	RL-1000-1	RL-400-1	RL-400-1	---	C-G-400-3
8	C-RL-1000-1	C-G-100-2	C-RL-100-1	C-G-100-2	NS-100	C-RL-100-1	RL-1000-1	RL-1000-1	---	C-G-100-2
9	G-400-3	C-RL-100-1	NS-1000	C-G-100-1	C-RL-100-1	NS-1000	C-RL-100-1	C-RL-400-1	---	C-G-1000-3
10	NS-1000	NS-100	C-RL-400-1	C-G-1000-3	C-G-100-2	C-RL-400-1	C-RL-400-1	C-RL-1000-1	---	RL-100-1
11	C-RL-400-1	G-100-1	C-RL-1000-1	RL-400-1	G-100-1	C-RL-1000-1	C-RL-1000-1	G-400-3	---	RL-400-1
12	NS-400	G-1000-3	G-400-3	C-RL-400-1	G-1000-3	G-100-2	G-100-2	G-1000-3	---	RL-1000-1
13	NS-100	G-400-3	G-100-2	RL-1000-1	G-400-3	G-100-1	C-G-100-2	C-G-400-3	---	C-RL-100-1
14	C-RL-100-1	G-100-2	G-100-1	C-RL-1000-1	RL-1000-1	C-G-100-2	G-100-1	C-G-1000-3	---	C-RL-1000-1
15	RL-1000-1	RL-1000-1	G-1000-3	No Action	G-100-2	C-G-100-1	C-G-100-1	No Action	---	Coastal
16	RL-400-1	RL-400-1	C-G-400-3	Coastal	RL-400-1	G-400-3	G-400-3	RL-100-1	---	NS-100
17	RL-100-1	RL-100-1	C-G-100-2	NS-100	RL-100-1	G-1000-3	G-1000-3	C-RL-100-1	---	NS-400
18	No Action	Coastal	C-G-100-1	NS-400	Coastal	C-G-400-3	C-G-400-3	G-100-2	---	NS-1000
19	Coastal	No Action	C-G-1000-3	NS-1000	No Action	C-G-1000-3	C-G-1000-3	C-G-100-2	---	No Action

Planning Unit 4 - Multi-Criteria Decision Analysis (MCDA) Trend Analysis

(Scenario 1 - Low Relative Sea Level Rise, High Employment, Dispersed Population; Low Uncertainty)

Plan #	Alternative	Plan Rank By Each Respondant																											Total Ranking Score (All Respondants)
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	
5	NS-1000	3	1	1	1	2	1	1	3	1	3	5	1	3	4	3	1	1	1	2	2	5	1	3	1	1	1	1	53
4	NS-400	1	2	2	2	3	2	2	4	2	5	4	3	4	3	4	2	2	2	3	3	7	2	4	2	2	2	2	76
18	C-RL-400-1	4	3	4	3	1	3	3	1	4	1	10	4	1	2	2	4	4	3	1	1	8	4	2	3	4	4	4	88
3	NS-100	2	4	3	4	6	4	4	5	3	6	3	5	6	5	5	3	3	4	7	4	9	3	5	4	3	3	3	116
17	C-RL-100-1	5	5	6	6	5	5	6	2	6	2	9	6	2	1	1	6	6	6	4	5	10	6	1	6	6	6	6	135
19	C-RL-1000-1	6	6	5	5	4	6	5	6	5	4	11	2	5	6	6	5	5	5	5	6	6	5	6	5	5	5	5	145
2	Coastal	7	7	8	11	14	8	7	9	7	10	2	7	9	9	9	8	7	8	15	8	17	11	9	7	8	7	7	236
10	RL-100-1	8	8	13	14	11	7	8	7	10	7	6	10	7	7	7	9	10	9	12	7	18	14	7	8	11	10	9	254
11	RL-400-1	9	9	12	13	13	9	9	8	9	8	7	9	8	8	8	11	9	10	13	9	15	13	8	9	9	9	8	262
13	C-G-100-1	12	12	7	7	7	11	12	11	12	12	15	12	13	13	13	13	8	7	9	13	2	7	11	12	7	8	11	277
12	RL-1000-1	11	10	15	15	15	10	10	10	11	9	8	8	10	10	10	10	11	13	16	10	16	15	10	10	13	11	10	307
14	C-G-100-2	13	13	9	10	10	13	13	12	13	11	13	13	12	12	12	12	12	11	10	12	4	9	12	13	10	12	12	308
16	C-G-1000-3	16	14	10	8	8	14	14	13	15	14	19	14	14	15	15	14	13	12	6	14	1	8	13	14	12	13	15	338
1	No Action	10	11	17	19	19	12	11	15	8	13	1	11	11	11	11	7	16	16	19	11	19	17	16	11	16	15	13	356
15	C-G-400-3	15	15	11	9	9	15	15	14	14	15	18	15	15	14	14	15	14	14	8	15	3	10	14	15	14	14	16	360
6	G-100-1	14	16	14	12	12	16	16	16	16	16	14	16	17	17	17	17	15	15	11	17	11	12	15	16	15	16	14	403
7	G-100-2	17	17	16	16	16	17	17	17	17	17	12	17	16	16	16	16	17	17	14	16	12	16	17	17	17	17	17	437
9	G-1000-3	19	18	18	17	17	18	18	18	19	18	17	18	18	19	19	19	18	18	17	19	13	18	19	18	18	18	19	485
8	G-400-3	18	19	19	18	18	19	19	19	18	19	16	19	19	18	18	18	19	19	18	18	14	19	18	19	19	19	18	494

Planning Unit 4

MCDA Trend Analysis (Ranked by Total Ranking Scores - All Respondants)

Rank	Scenario 1 Low RSLR High Employment Dispersed Population	Scenario 2 High RSLR High Employment Dispersed Population	Scenario 3 Low RSLR Business-as-Usual Compact Population	Scenario 4 High RSLR Business-as-Usual Compact Population
1	NS-1000	NS-1000	NS-1000	NS-1000
2	NS-400	NS-400	NS-400	NS-400
3	C-RL-400-1	C-RL-400-1	C-RL-400-1	NS-100
4	NS-100	NS-100	NS-100	C-RL-400-1
5	C-RL-100-1	C-RL-1000-1	C-RL-100-1	C-RL-1000-1
6	C-RL-1000-1	C-RL-100-1	C-RL-1000-1	C-RL-100-1
7	Coastal	RL-100-1	Coastal	RL-100-1
8	RL-100-1	C-G-100-1	RL-100-1	C-G-100-1
9	RL-400-1	Coastal	RL-400-1	RL-400-1
10	C-G-100-1	RL-400-1	C-G-100-1	Coastal
11	RL-1000-1	RL-1000-1	RL-1000-1	RL-1000-1
12	C-G-100-2	C-G-100-2	C-G-100-2	C-G-100-2
13	C-G-1000-3	C-G-1000-3	C-G-1000-3	C-G-1000-3
14	No Action	C-G-400-3	No Action	C-G-400-3
15	C-G-400-3	No Action	C-G-400-3	No Action
16	G-100-1	G-100-1	G-100-1	G-100-1
17	G-100-2	G-100-2	G-100-2	G-100-2
18	G-1000-3	G-1000-3	G-1000-3	G-1000-3
19	G-400-3	G-400-3	G-400-3	G-400-3

Planning Unit 4

Evaluation Criteria Values

(Scenario 1, Low Relative Sea Level Rise, High Employment, Dispersed Population; Low Uncertainty)

Plan #	Alternative	Stakeholder (Multi-Criteria Decision Analysis)	Minimizing Environmental Impacts		Investment Decision (Efficiency) 1/			Minimizing Remaining Risk (Effectiveness)			Year 2025 Present Value Life Cycle Costs (2010-2075) ($Millions) 1/
Evaluation Criteria		Cumulative Ranking Score from MCDA Trend Analysis	Direct Wetland Impact	Indirect Impacts	Cost Efficiency	Total System Costs	Period of Analysis Cost Efficiency	Annualized Residual Damages	Period of Analysis Risk Reduction	Average % Risk Reduction	
(Units)		*(Unit-less Weight)*	*(Acres)*	*(Unit-less Scale)*	*Ratio: Risk Reduction / Present Value Life Cycle Costs (PV LCC)*	*Annualized Life Cycle Costs + EA Residual Damages ($Millions)*	*Cost Efficiency Ratio: Event Freq Risk Reduction X Probability of Occurrence (2010-2075) / PV LCC*	*Average Annual Remaining Risk (Millions)*	*Event Freq Risk Reduction X Probability (2010-2075) ($Millions)*	*2075: 100-yr to 2,000-yr Frequency Events (Avg % of No Action Damages)*	
2	Coastal	236	0	0	0.0000	923	0.0007	99.9	8	0.22	10,783
3	NS-100	116	0	0	0.0129	866	0.1136	55.2	1,468	24.18	12,925
4	NS-400	76	0	0	0.0144	895	0.1702	45.2	2,423	47.40	14,238
5	NS-1000	53	0	0	0.0139	952	0.1943	41.9	3,030	68.83	15,590
6	G-100-1	403	2,200	-5	0.0029	1,470	0.0547	82.4	1,245	30.95	22,773
7	G-100-2	437	1,800	-5	0.0022	1,476	0.0435	86.8	981	26.62	22,568
8	G-400-3	494	2,500	-6	0.0022	1,474	0.0393	86.8	884	19.06	22,515
9	G-1000-3	485	2,500	-6	0.0023	1,493	0.0523	85.6	1,203	33.81	22,989
10	RL-100-1	254	100	0	0.0016	1,041	0.0320	94.4	431	14.87	13,485
11	RL-400-1	262	100	0	0.0015	1,079	0.0217	94.2	309	5.49	14,254
12	RL-1000-1	307	100	0	0.0017	1,091	0.0432	93.5	628	20.24	14,540
13	C-G-100-1	277	2,200	-5	0.0079	1,419	0.0981	48.8	2,375	50.14	24,224
14	C-G-100-2	308	1,800	-5	0.0075	1,420	0.0903	52.0	2,170	46.67	24,021
15	C-G-400-3	360	2,500	-6	0.0083	1,399	0.1033	46.6	2,478	48.62	24,004
16	C-G-1000-3	338	2,500	-6	0.0083	1,509	0.1192	40.7	3,167	73.78	26,575
17	C-RL-100-1	135	100	0	0.0112	987	0.1189	53.9	1,829	37.75	15,391
18	C-RL-400-1	88	100	0	0.0125	986	0.1496	46.5	2,382	44.95	15,924
19	C-RL-1000-1	145	100	0	0.0117	1,082	0.1719	43.2	3,103	73.72	18,049

1/ Present Value and Equivalent Annual Costs include costs for construction of coastal landscape measures. The final array of alternatives, as presented elsewhere in the report, do not include these costs since sustaining the current coastal landscape in this area appears to provide minimal contribution, if any, to reduction of risk from hurricane surge. Since deleting the coastal landscape costs affects all alternatives equally, the relative ranking of alternatives remains the same.

Planning Unit 4

Evaluation Criteria Data Rankings

(Scenario 1, Low Relative Sea Level Rise, High Employment, Dispersed Population; Low Uncertainty)

Plan #	Alternative	Stakeholder (Multi-Criteria Decision Analysis)	Minimizing Environmental Impacts		Investment Decision (Efficiency) 1/			Minimizing Remaining Risk (Effectiveness)			Year 2025 Present Value Life Cycle Costs (2010-2075) ($Millions) 1/
Evaluation Criteria		Cumulative Ranking Score from MCDA Trend Analysis	Direct Wetland Impact	Indirect Impacts	Cost Efficiency	Total System Costs	Period of Analysis Cost Efficiency	Annualized Residual Damages	Period of Analysis Risk Reduction	Average % Risk Reduction	
(Units)		*(Unit-less Weight)*	*(Acres)*	*(Unit-less Scale)*	*Ratio: Risk Reduction / Present Value Life Cycle Costs (PV LCC)*	*Annualized Life Cycle Costs + EA Residual Damages ($Millions)*	*Cost Efficiency Ratio: Event Freq Risk Reduction X Probability of Occurrence (2010-2075) / PV LCC*	*Average Annual Remaining Risk (Millions)*	*Event Freq Risk Reduction X Probability (2010-2075) ($Millions)*	*2075: 100-yr to 2,000-yr Frequency Events (Avg % of No Action Damages)*	
5	NS-1000	1	1	1	2	4	1	2	3	3	8
4	NS-400	2	1	1	1	2	3	4	5	6	4
3	NS-100	4	1	1	3	1	7	10	10	13	2
19	C-RL-1000-1	6	5	15	5	9	2	3	2	2	10
18	C-RL-400-1	3	5	15	4	5	4	5	6	8	9
17	C-RL-100-1	5	5	15	6	6	6	9	9	9	7
16	C-G-1000-3	13	15	15	7	18	5	1	1	1	18
15	C-G-400-3	14	15	11	8	11	8	6	4	5	15
13	C-G-100-1	10	13	11	9	12	9	7	7	4	17
2	Coastal	7	1	1	18	3	18	18	18	18	1
10	RL-100-1	8	5	1	16	7	16	17	16	16	3
14	C-G-100-2	12	11	11	10	13	10	8	8	7	16
6	G-100-1	15	13	1	11	14	11	11	11	11	13
11	RL-400-1	9	5	1	17	8	17	16	17	17	5
12	RL-1000-1	11	5	11	15	10	14	15	15	14	6
7	G-100-2	16	11	1	14	16	13	14	13	12	12
9	G-1000-3	17	15	1	12	17	12	12	12	10	14
8	G-400-3	18	15	1	13	15	15	13	14	15	11

Planning Unit 3b

Cost Efficiency Analysis

(Scenario 1 - LRSLR, High Employment, Dispersed Population; Low Uncertainty)

Plan #	Alternative	Present Value Life-Cycle Costs ($ Millions) 1/	Risk Reduction Equivalent Annual ($ Millions)	Cost Efficiency Factor Risk Red / PV Costs	Rank
4	NS-400	14,238	204	0.0144	1
5	NS-1000	15,590	217	0.0139	2
3	NS-100	12,925	167	0.0129	3
18	C-RL-400-1	15,924	200	0.0125	4
19	C-RL-1000-1	18,049	212	0.0117	5
17	C-RL-100-1	15,391	172	0.0112	6
16	C-G-1000-3	26,575	221	0.0083	7
15	C-G-400-3	24,004	199	0.0083	8
13	C-G-100-1	24,224	191	0.0079	9
14	C-G-100-2	24,021	179	0.0075	10
6	G-100-1	22,773	66	0.0029	11
9	G-1000-3	22,989	54	0.0023	12
8	G-400-3	22,515	49	0.0022	13
7	G-100-2	22,568	49	0.0022	14
12	RL-1000-1	14,540	24	0.0017	15
10	RL-100-1	13,485	21	0.0016	16
11	RL-400-1	14,254	22	0.0015	17
2	Coastal	10,783	0	0.0000	18

1/ Present Value Costs shown include costs for construction of coastal landscape measures. The final array of alternatives, as presented elsewhere in the report, do not include these costs since sustaining the current coastal landscape in this area appears to provide minimal contribution, if any, to reduction of risk from hurricane surge. Since deleting the coastal landscape costs affects all alternatives equally, the relative ranking of alternatives remains the same.

Planning Unit 4

Cost Efficiency Rankings

Rank	Scenario 1 Low RSLR High Employment Dispersed Population	Scenario 2 High RSLR High Employment Dispersed Population	Scenario 3 Low RSLR Business-as-Usual Compact Population	Scenario 4 High RSLR Business-as-Usual Compact Population
1	NS-400	NS-400	NS-400	NS-400
2	NS-1000	NS-1000	NS-1000	NS-1000
3	NS-100	NS-100	NS-100	NS-100
4	C-RL-400-1	C-RL-400-1	C-RL-400-1	C-RL-400-1
5	C-RL-1000-1	C-RL-1000-1	C-RL-1000-1	C-RL-1000-1
6	C-RL-100-1	C-RL-100-1	C-RL-100-1	C-RL-100-1
7	C-G-1000-3	C-G-400-3	C-G-1000-3	C-G-1000-3
8	C-G-400-3	C-G-1000-3	C-G-400-3	C-G-400-3
9	C-G-100-1	C-G-100-1	C-G-100-1	C-G-100-1
10	C-G-100-2	C-G-100-2	C-G-100-2	C-G-100-2
11	G-100-1	G-100-1	G-100-1	G-100-1
12	G-1000-3	G-1000-3	G-1000-3	G-1000-3
13	G-400-3	G-400-3	RL-1000-1	RL-1000-1
14	G-100-2	G-100-2	G-400-3	G-400-3
15	RL-1000-1	RL-1000-1	G-100-2	G-100-2
16	RL-100-1	RL-100-1	RL-400-1	RL-400-1
17	RL-400-1	RL-400-1	RL-100-1	RL-100-1
18	Coastal	Coastal	Coastal	Coastal

Planning Unit 4

Total System Costs Analysis

(Scenario 1 - LRSLR, High Employment, Dispersed Population; Low Uncertainty)

Plan #	**Alternative**	**Equivalent Annual Life-Cycle Costs** ($Millions) 1/	**With Project Residual Damages** ($ Millions)	**Total System Costs** ($ Millions)	**Rank**
3	**NS-100**	660	206	866	**1**
4	**NS-400**	727	169	895	**2**
2	**Coastal**	551	373	923	**3**
5	**NS-1000**	796	156	952	**4**
18	**C-RL-400-1**	813	173	986	**5**
17	**C-RL-100-1**	786	201	987	**6**
10	**RL-100-1**	689	352	1,041	**7**
11	**RL-400-1**	728	352	1,079	**8**
19	**C-RL-1000-1**	921	161	1,082	**9**
12	**RL-1000-1**	742	349	1,091	**10**
15	**C-G-400-3**	1,226	174	1,399	**11**
13	**C-G-100-1**	1,237	182	1,419	**12**
14	**C-G-100-2**	1,226	194	1,420	**13**
6	**G-100-1**	1,163	307	1,470	**14**
8	**G-400-3**	1,150	324	1,474	**15**
7	**G-100-2**	1,152	324	1,476	**16**
9	**G-1000-3**	1,174	319	1,493	**17**
16	**C-G-1000-3**	1,357	152	1,509	**18**

1/ Equivalent Annual Life-Cycle Costs shown include costs for construction of coastal landscape measures. The final array of alternatives, as presented elsewhere in the report, do not include these costs since sustaining the current coastal landscape in this area appears to provide minimal contribution, if any, to reduction of risk from hurricane surge. Since deleting the coastal landscape costs affects all alternatives equally, the relative ranking of alternatives remains the same.

Planning Unit 4

Total System Costs Rankings

Rank	Scenario 1 Low RSLR High Employment Dispersed Population	Scenario 2 High RSLR High Employment Dispersed Population	Scenario 3 Low RSLR Business-as-Usual Compact Population	Scenario 4 High RSLR Business-as-Usual Compact Population
1	NS-100	NS-100	NS-100	NS-100
2	NS-400	NS-400	NS-400	NS-400
3	Coastal	NS-1000	Coastal	NS-1000
4	NS-1000	Coastal	NS-1000	Coastal
5	C-RL-400-1	C-RL-400-1	C-RL-100-1	C-RL-100-1
6	C-RL-100-1	C-RL-100-1	C-RL-400-1	C-RL-400-1
7	RL-100-1	RL-100-1	RL-100-1	RL-100-1
8	RL-400-1	C-RL-1000-1	C-RL-1000-1	C-RL-1000-1
9	C-RL-1000-1	RL-400-1	RL-400-1	RL-400-1
10	RL-1000-1	RL-1000-1	RL-1000-1	RL-1000-1
11	C-G-400-3	C-G-400-3	C-G-100-1	C-G-400-3
12	C-G-100-1	C-G-100-1	C-G-100-2	C-G-100-1
13	C-G-100-2	C-G-100-2	C-G-400-3	C-G-100-2
14	G-100-1	G-100-1	G-400-3	C-G-1000-3
15	G-400-3	G-400-3	G-100-1	G-100-1
16	G-100-2	G-100-2	G-100-2	G-400-3
17	G-1000-3	G-1000-3	C-G-1000-3	G-100-2
18	C-G-1000-3	C-G-1000-3	G-1000-3	G-1000-3

Planning Unit 4

Period of Analysis Cost Efficiency

(2075 Risk Reduction X Probablility (2010-2075) / Present Value Costs
For Frequency Events Included in Economic Evaluation)

(Scenario 1: Low RSLR, High Employment, Dispersed Population - Low Uncertainty)

Plan #	Alternative	Remaining Damages by Frequency ($Millions)					Total Risk Reduction X Probabilty 2010-2075 ($Millions)	Present Value Life-Cycle Costs ($ Millions) 1/	Cost Efficiency Ratio Total Risk Reduction / PV Costs	Rank
		10-yr	100-yr	400-yr	1,000-yr	2,000-yr				
No Action Damages ($ Million)		472	3,034	6,592	10,316	12,755				
5	**NS-1000**	121	458	935	3,146	8,278	3,030	15,590	0.19	1
19	**C-RL-1000-1**	154	456	836	2,456	6,837	3,103	18,049	0.17	2
4	**NS-400**	142	504	2,214	7,707	10,905	2,423	14,238	0.17	3
18	**C-RL-400-1**	175	502	1,585	8,801	12,031	2,382	15,924	0.15	4
16	**C-G-1000-3**	122	304	864	3,220	6,445	3,167	26,575	0.12	5
17	**C-RL-100-1**	183	1,012	4,739	7,608	8,928	1,829	15,391	0.12	6
3	**NS-100**	151	1,249	5,340	9,206	11,720	1,468	12,925	0.11	7
15	**C-G-400-3**	173	469	1,384	8,519	11,032	2,478	24,004	0.10	8
13	**C-G-100-1**	157	520	3,172	7,198	8,213	2,375	24,224	0.10	9
14	**C-G-100-2**	207	713	3,488	7,412	8,298	2,170	24,021	0.09	10
6	**G-100-1**	394	1,867	4,220	8,170	9,113	1,245	22,773	0.05	11
9	**G-1000-3**	469	2,137	3,628	6,998	9,115	1,203	22,989	0.05	12
7	**G-100-2**	464	2,113	4,588	8,435	9,247	981	22,568	0.04	13
12	**RL-1000-1**	504	2,661	4,990	7,735	10,289	628	14,540	0.04	14
8	**G-400-3**	469	2,137	3,645	10,277	12,551	884	22,515	0.04	15
10	**RL-100-1**	504	2,666	5,958	8,701	9,937	431	13,485	0.03	16
11	**RL-400-1**	504	2,661	5,007	11,014	13,725	309	14,254	0.02	17
2	**Coastal**	472	3,023	6,577	10,304	12,731	8	10,783	0.00	18

1/ Present Value Costs shown include costs for construction of coastal landscape measures. The final array of alternatives, as presented elsewhere in the report, do not include these costs since sustaining the current coastal landscape in this area appears to provide minimal contribution, if any, to reduction of risk from hurricane surge. Since deleting the coastal landscape costs affects all alternatives equally, the relative ranking of alternatives remains the same.

Planning Unit 4

Period of Analysis Cost Efficiency

(2075 Risk Reduction X Probability (2010 - 2075) / Present Value Costs Rankings For Frequency Events Included in Economic Evaluation)

Rank	Scenario 1 Low RSLR High Employment Dispersed Population	Scenario 2 High RSLR High Employment Dispersed Population	Scenario 3 Low RSLR Business-as-Usual Compact Population	Scenario 4 High RSLR Business-as-Usual Compact Population
1	NS-1000	NS-1000	NS-1000	NS-1000
2	C-RL-1000-1	C-RL-1000-1	NS-400	NS-400
3	NS-400	NS-400	C-RL-1000-1	C-RL-1000-1
4	C-RL-400-1	C-RL-400-1	C-RL-400-1	C-RL-400-1
5	C-G-1000-3	C-G-1000-3	NS-100	C-G-1000-3
6	C-RL-100-1	C-RL-100-1	C-RL-100-1	C-RL-100-1
7	NS-100	C-G-400-3	C-G-1000-3	NS-100
8	C-G-400-3	C-G-100-1	C-G-400-3	C-G-400-3
9	C-G-100-1	NS-100	C-G-100-1	C-G-100-1
10	C-G-100-2	C-G-100-2	C-G-100-2	C-G-100-2
11	G-100-1	G-100-1	RL-1000-1	G-100-1
12	G-1000-3	G-1000-3	G-1000-3	G-1000-3
13	G-100-2	G-100-2	G-100-1	RL-1000-1
14	RL-1000-1	G-400-3	RL-100-1	G-100-2
15	G-400-3	RL-1000-1	G-100-2	G-400-3
16	RL-100-1	RL-100-1	G-400-3	RL-100-1
17	RL-400-1	RL-400-1	RL-400-1	RL-400-1
18	Coastal	Coastal	Coastal	Coastal

Planning Unit 4

Residual Damages (Remaining Risk) Analysis

(Scenario 1: Low RSLR, High Employment, Dispersed Population - Low Uncertainty)

Plan #	Alternative	No Action Residual Damages ($Millions)	With Project Residual Damages ($ Millions)	% of No Action Damages	Rank
16	C-G-1000-3	373	152	40.7	1
5	NS-1000	373	156	41.9	2
19	C-RL-1000-1	373	161	43.2	3
4	NS-400	373	169	45.2	4
18	C-RL-400-1	373	173	46.5	5
15	C-G-400-3	373	174	46.6	6
13	C-G-100-1	373	182	48.8	7
14	C-G-100-2	373	194	52.0	8
17	C-RL-100-1	373	201	53.9	9
3	NS-100	373	206	55.2	10
6	G-100-1	373	307	82.4	11
9	G-1000-3	373	319	85.6	12
8	G-400-3	373	324	86.8	13
7	G-100-2	373	324	86.8	14
12	RL-1000-1	373	349	93.5	15
11	RL-400-1	373	352	94.2	16
10	RL-100-1	373	352	94.4	17
2	Coastal	373	373	99.9	18

Planning Unit 4

Residual Damages (Remaining Risk) Rankings

Rank	Scenario 1 Low RSLR High Employment Dispersed Population	Scenario 2 High RSLR High Employment Dispersed Population	Scenario 3 Low RSLR Business-as-Usual Compact Population	Scenario 4 High RSLR Business-as-Usual Compact Population
1	C-G-1000-3	NS-1000	NS-1000	NS-1000
2	NS-1000	C-G-1000-3	C-G-1000-3	C-G-1000-3
3	C-RL-1000-1	C-RL-1000-1	C-RL-1000-1	NS-400
4	NS-400	NS-400	NS-400	C-RL-1000-1
5	C-RL-400-1	C-G-400-3	C-RL-400-1	C-G-400-3
6	C-G-400-3	C-RL-400-1	C-G-400-3	C-RL-400-1
7	C-G-100-1	C-G-100-1	C-G-100-1	C-G-100-1
8	C-G-100-2	C-G-100-2	C-G-100-2	C-G-100-2
9	C-RL-100-1	NS-100	NS-100	NS-100
10	NS-100	C-RL-100-1	C-RL-100-1	C-RL-100-1
11	G-100-1	G-100-1	G-100-1	G-100-1
12	G-1000-3	G-1000-3	G-1000-3	G-1000-3
13	G-400-3	G-400-3	G-400-3	G-400-3
14	G-100-2	G-100-2	G-100-2	G-100-2
15	RL-1000-1	RL-1000-1	RL-1000-1	RL-1000-1
16	RL-400-1	RL-400-1	RL-400-1	RL-400-1
17	RL-100-1	RL-100-1	RL-100-1	RL-100-1
18	Coastal	Coastal	Coastal	Coastal

Planning Unit 4

Period of Analysis Risk Reduction

(2075 Risk Reduction X Probablility (2010-2075)

For Frequency Events Included in Economic Evaluation)

(Scenario 1: Low RSLR, High Employment, Dispersed Population - Low Uncertainty)

Plan #	Alternative	Remaining Damages by Frequency ($Millions)					Total Risk Reduction X Probabilty 2010-2075 ($Million)	Rank
		10-yr	100-yr	400-yr	1,000-yr	2,000-yr		
No Action Damages ($ Million)		472	3,034	6,592	10,316	12,755		
16	**C-G-1000-3**	122	304	864	3,220	6,445	3,167	1
19	**C-RL-1000-1**	154	456	836	2,456	6,837	3,103	2
5	**NS-1000**	121	458	935	3,146	8,278	3,030	3
15	**C-G-400-3**	173	469	1,384	8,519	11,032	2,478	4
4	**NS-400**	142	504	2,214	7,707	10,905	2,423	5
18	**C-RL-400-1**	175	502	1,585	8,801	12,031	2,382	6
13	**C-G-100-1**	157	520	3,172	7,198	8,213	2,375	7
14	**C-G-100-2**	207	713	3,488	7,412	8,298	2,170	8
17	**C-RL-100-1**	183	1,012	4,739	7,608	8,928	1,829	9
3	**NS-100**	151	1,249	5,340	9,206	11,720	1,468	10
6	**G-100-1**	394	1,867	4,220	8,170	9,113	1,245	11
9	**G-1000-3**	469	2,137	3,628	6,998	9,115	1,203	12
7	**G-100-2**	464	2,113	4,588	8,435	9,247	981	13
8	**G-400-3**	469	2,137	3,645	10,277	12,551	884	14
12	**RL-1000-1**	504	2,661	4,990	7,735	10,289	628	15
10	**RL-100-1**	504	2,666	5,958	8,701	9,937	431	16
11	**RL-400-1**	504	2,661	5,007	11,014	13,725	309	17
2	**Coastal**	472	3,023	6,577	10,304	12,731	8	18

Planning Unit 4

Period of Analysis Risk Reduction

(2075 Risk Reduction X Probability (2010 - 2075) Rankings For Frequency Events Included in Economic Evaluation)

Rank	Scenario 1 Low RSLR High Employment Dispersed Population	Scenario 2 High RSLR High Employment Dispersed Population	Scenario 3 Low RSLR Business-as-Usual Compact Population	Scenario 4 High RSLR Business-as-Usual Compact Population
1	C-G-1000-3	C-G-1000-3	C-G-1000-3	C-G-1000-3
2	C-RL-1000-1	C-RL-1000-1	C-RL-1000-1	C-RL-1000-1
3	NS-1000	NS-1000	NS-1000	NS-1000
4	C-G-400-3	C-G-400-3	NS-400	C-G-400-3
5	NS-400	C-G-100-1	C-G-400-3	C-RL-400-1
6	C-RL-400-1	C-RL-400-1	C-RL-400-1	NS-400
7	C-G-100-1	NS-400	C-G-100-1	C-G-100-1
8	C-G-100-2	C-G-100-2	C-G-100-2	C-G-100-2
9	C-RL-100-1	C-RL-100-1	C-RL-100-1	C-RL-100-1
10	NS-100	G-100-1	NS-100	NS-100
11	G-100-1	G-1000-3	G-1000-3	G-100-1
12	G-1000-3	NS-100	G-100-1	G-1000-3
13	G-100-2	G-100-2	G-100-2	G-100-2
14	G-400-3	G-400-3	RL-1000-1	G-400-3
15	RL-1000-1	RL-1000-1	G-400-3	RL-1000-1
16	RL-100-1	RL-100-1	RL-100-1	RL-100-1
17	RL-400-1	RL-400-1	RL-400-1	RL-400-1
18	Coastal	Coastal	Coastal	Coastal

Planning Unit 4
Average % Risk Reduction of Total Damages
For 100-yr to 2,000-yr Frequency Event Range Based on 2075 Population / Land Use
(Scenario 1: Low RSLR, High Employment, Dispersed Population - Low Uncertainty)

Plan #	Alternative	Average % Risk Reduction for 100-yr to 2,000-yr Frequency Events	Average Risk Reduction for 100-yr to 2,000-yr Frequency Events ($ Millions)	Present Value Life Cycle Costs ($ Millions) 1/	Rank
Total No Action Residual Damages 100-yr to 2,000-yr Freq Events ($ Million)		32,697			
16	C-G-1000-3	73.78	24,124	26,575	1
19	C-RL-1000-1	73.72	24,103	18,049	2
5	NS-1000	68.83	22,506	15,590	3
13	C-G-100-1	50.14	16,395	24,224	4
15	C-G-400-3	48.62	15,896	24,004	5
4	NS-400	47.40	15,500	14,238	6
14	C-G-100-2	46.67	15,259	24,021	7
18	C-RL-400-1	44.95	14,696	15,924	8
17	C-RL-100-1	37.75	12,343	15,391	9
9	G-1000-3	33.81	11,054	22,989	10
6	G-100-1	30.95	10,119	22,773	11
7	G-100-2	26.62	8,702	22,568	12
3	NS-100	24.18	7,906	12,925	13
12	RL-1000-1	20.24	6,616	14,540	14
8	G-400-3	19.06	6,233	22,515	15
10	RL-100-1	14.87	4,863	13,485	16
11	RL-400-1	5.49	1,795	14,254	17
2	Coastal	0.22	71	10,783	18

1/ Present Value Costs shown include costs for construction of coastal landscape measures. The final array of alternatives, as presented elsewhere in the report, do not include these costs since sustaining the current coastal landscape in this area appears to provide minimal contribution, if any, to reduction of risk from hurricane surge. Since deleting the coastal landscape costs affects all alternatives equally, the relative ranking of alternatives remains the same.

Planning Unit 4
Average % Risk Reduction of Total Damages
For 100-yr to 2,000-yr Frequency Event Range Based on 2075 Population / Land Use
(Scenario 1: Low RSLR, High Employment, Dispersed Population - Low Uncertainty)

Rank	Scenario 1 Low RSLR High Employment Dispersed Population	Scenario 2 High RSLR High Employment Dispersed Population	Scenario 3 Low RSLR Business-as-Usual Compact Population	Scenario 4 High RSLR Business-as-Usual Compact Population
1	C-G-1000-3	C-G-1000-3	C-RL-1000-1	C-G-1000-3
2	C-RL-1000-1	C-RL-1000-1	C-G-1000-3	C-RL-1000-1
3	NS-1000	NS-1000	NS-1000	NS-1000
4	C-G-100-1	C-G-100-1	NS-400	C-G-400-3
5	C-G-400-3	C-G-400-3	C-G-400-3	C-G-100-1
6	NS-400	C-G-100-2	C-RL-400-1	C-RL-400-1
7	C-G-100-2	C-RL-400-1	C-G-100-1	C-G-100-2
8	C-RL-400-1	NS-400	C-G-100-2	NS-400
9	C-RL-100-1	G-1000-3	C-RL-100-1	C-RL-100-1
10	G-1000-3	G-100-1	NS-100	NS-100
11	G-100-1	C-RL-100-1	G-1000-3	G-1000-3
12	G-100-2	G-100-2	G-100-1	G-100-1
13	NS-100	G-400-3	RL-1000-1	G-100-2
14	RL-1000-1	RL-1000-1	G-100-2	RL-1000-1
15	G-400-3	RL-100-1	RL-100-1	G-400-3
16	RL-100-1	NS-100	G-400-3	RL-100-1
17	RL-400-1	RL-400-1	RL-400-1	RL-400-1
18	Coastal	Coastal	Coastal	Coastal

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Secondary Evaluation Criteria

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Participation in Nonstructural Measures

All Planning Units

Sample Plan Rankings with Various Levels of Participation

Planning Unit 1

Residual Damages (Remaining Risk) Rankings - Based on Varying Levels of Nonstructural Participation

(Scenario 1 - Low Relative Sea Level Rise, High Employment, Dispersed Population; Low Uncertainty)

Rank	100%	90%	80%	70%	60%	50%	40%	30%	20%	10%
1	NS-1000	NS-1000	NS-1000	NS-1000	NS-1000	NS-1000	C-LP-1b-1000-2	C-LP-1b-1000-2	C-LP-1b-1000-2	C-LP-1b-1000-2
2	NS-0400	NS-0400	NS-0400	NS-0400	NS-0400	C-LP-1b-1000-2	C-HL-1b-0400-2	C-HL-1b-0400-2	C-HL-1b-0400-2	C-HL-1b-0400-2
3	C-LP-1b-1000-1	C-LP-1b-1000-1	C-LP-1b-1000-1	C-LP-1b-1000-2	C-LP-1b-1000-2	C-HL-1b-0400-2	C-HL-1b-0400-3	C-HL-1b-0400-3	C-HL-1b-0400-3	LP-1b-1000-2
4	C-LP-1b-0400-1	C-LP-1b-0400-1	C-LP-1b-1000-2	C-LP-1b-1000-1	C-HL-1b-0400-2	C-HL-1b-0400-3	C-LP-1b-0400-3	C-LP-1b-0400-3	C-LP-1b-0400-3	HL-1b-0400-2
5	C-LP-1b-1000-2	C-LP-1b-1000-2	C-LP-1b-0400-1	C-HL-1b-0400-2	C-HL-1b-0400-3	C-LP-1b-0400-3	C-LP-1b-1000-1	LP-1b-1000-2	LP-1b-1000-2	C-HL-1b-0400-3
6	C-HL-1b-0400-3	C-HL-1b-0400-3	C-HL-1b-0400-3	C-HL-1b-0400-3	C-LP-1b-0400-3	C-LP-1b-1000-1	LP-1b-1000-2	HL-1b-0400-2	HL-1b-0400-2	C-LP-1b-0400-3
7	C-LP-1b-0400-3	C-LP-1b-0400-3	C-LP-1b-0400-3	C-LP-1b-0400-3	C-LP-1b-1000-1	C-LP-1b-0400-1	HL-1b-0400-2	HL-1b-0400-3	HL-1b-0400-3	HL-1b-0400-3
8	C-HL-1b-0400-2	C-HL-1b-0400-2	C-HL-1b-0400-2	C-LP-1b-0400-1	C-LP-1b-0400-1	NS-0400	C-LP-1b-0400-1	LP-1b-0400-3	LP-1b-0400-3	LP-1b-0400-3
9	NS-0100	C-LP-1a-0100-3	C-LP-1a-0100-2	C-LP-1a-0100-2	C-LP-1a-0100-2	LP-1b-1000-2	C-LP-1a-0100-2	C-LP-1b-1000-1	C-LP-1a-0100-2	C-LP-1a-0100-2
10	C-LP-1a-0100-1	C-LP-1a-0100-2	C-LP-1a-0100-3	C-LP-1a-0100-3	C-LP-1a-0100-3	C-LP-1a-0100-2	HL-1b-0400-3	C-LP-1a-0100-2	C-LP-1a-0100-3	C-LP-1a-0100-3
11	C-LP-1a-0100-3	C-LP-1a-0100-1	C-LP-1a-0100-1	C-LP-1a-0100-1	LP-1b-1000-2	HL-1b-0400-2	C-LP-1a-0100-3	C-LP-1a-0100-3	C-LP-1b-1000-1	LP-1a-0100-2
12	C-LP-1a-0100-2	NS-0100	LP-1b-1000-2	LP-1b-1000-2	HL-1b-0400-2	C-LP-1a-0100-3	LP-1b-0400-3	C-LP-1b-0400-1	C-LP-1b-0400-1	LP-1a-0100-3
13	LP-1b-1000-2	LP-1b-1000-2	HL-1b-0400-2	HL-1b-0400-2	C-LP-1a-0100-1	HL-1b-0400-3	NS-1000	LP-1a-0100-2	LP-1a-0100-2	C-LP-1b-1000-1
14	HL-1b-0400-2	HL-1b-0400-2	NS-0100	HL-1b-0400-3	HL-1b-0400-3	LP-1b-0400-3	C-LP-1a-0100-1	LP-1a-0100-3	LP-1a-0100-3	C-LP-1b-0400-1
15	HL-1b-0400-3	HL-1b-0400-3	HL-1b-0400-3	LP-1b-0400-3	LP-1b-0400-3	C-LP-1a-0100-1	LP-1a-0100-2	C-LP-1a-0100-1	C-LP-1a-0100-1	LP-1b-1000-1
16	LP-1b-0400-3	LP-1b-0400-3	LP-1b-0400-3	LP-1a-0100-2	LP-1a-0100-2	LP-1a-0100-2	NS-0400	LP-1b-1000-1	LP-1b-1000-1	LP-1b-0400-1
17	LP-1a-0100-2	LP-1a-0100-2	LP-1a-0100-2	NS-0100	LP-1a-0100-3	LP-1a-0100-3	LP-1a-0100-3	LP-1b-0400-1	LP-1b-0400-1	C-LP-1a-0100-1
18	LP-1a-0100-3	LP-1a-0100-3	LP-1a-0100-3	LP-1a-0100-3	LP-1b-1000-1	LP-1b-1000-1	LP-1b-1000-1	NS-1000	LP-1a-0100-1	LP-1a-0100-1
19	C-HL-1a-0100-3	LP-1b-1000-1	LP-1b-1000-1	LP-1b-1000-1	LP-1b-0400-1	LP-1b-0400-1	LP-1b-0400-1	LP-1a-0100-1	C-HL-1a-0100-2	C-HL-1a-0100-2
20	C-HL-1a-0100-2	LP-1b-0400-1	LP-1b-0400-1	LP-1b-0400-1	NS-0100	LP-1a-0100-1	LP-1a-0100-1	NS-0400	C-HL-1a-0100-3	HL-1a-0100-2
21	LP-1b-1000-1	C-HL-1a-0100-3	C-HL-1a-0100-3	C-HL-1a-0100-2	C-HL-1a-0100-2	C-HL-1a-0100-2	C-HL-1a-0100-2	C-HL-1a-0100-2	HL-1a-0100-2	C-HL-1a-0100-3
22	LP-1b-0400-1	C-HL-1a-0100-2	C-HL-1a-0100-2	C-HL-1a-0100-3	LP-1a-0100-1	C-HL-1a-0100-3	C-HL-1a-0100-3	C-HL-1a-0100-3	HL-1a-0100-3	HL-1a-0100-3
23	LP-1a-0100-1	LP-1a-0100-1	LP-1a-0100-1	LP-1a-0100-1	C-HL-1a-0100-3	NS-0100	HL-1a-0100-2	HL-1a-0100-2	NS-1000	NS-1000
24	HL-1a-0100-2	HL-1a-0100-2	HL-1a-0100-2	HL-1a-0100-2	HL-1a-0100-2	HL-1a-0100-2	NS-0100	HL-1a-0100-3	NS-0400	NS-0400
25	HL-1a-0100-3	HL-1a-0100-3	HL-1a-0100-3	HL-1a-0100-3	HL-1a-0100-3	HL-1a-0100-3	HL-1a-0100-3	NS-0100	NS-0100	NS-0100
26	Coastal	Coastal	Coastal	Coastal	Coastal	Coastal	Coastal	Coastal	Coastal	Coastal

Planning Unit 1

Residual Damages (Remaining Risk) - Based on Varying Levels of Nonstructural Participation

(Scenario 1 - Low Relative Sea Level Rise, High Employment, Dispersed Population; Low Uncertainty)

Plan #	Alternative	Equivalent Annual Residual Damages ($ Millions) Based on % Participation in Nonstructural Plans or Plan Components									
		100%	90%	80%	70%	60%	50%	40%	30%	20%	10%
2	Coastal	1,106	1,106	1,106	1,106	1,106	1,106	1,106	1,106	1,106	1,106
3	NS-0100	732	770	807	844	882	919	957	994	1,031	1,069
4	NS-0400	463	527	591	656	720	784	849	913	977	1,042
5	NS-1000	384	456	528	600	673	745	817	889	961	1,034
6	HL-1a-0100-2	950	950	950	950	950	950	950	950	950	950
7	HL-1a-0100-3	961	961	961	961	961	961	961	961	961	961
8	HL-1b-0400-2	797	797	797	797	797	797	797	797	797	797
9	HL-1b-0400-3	810	810	810	810	810	810	810	810	810	810
10	LP-1a-0100-1	904	904	904	904	904	904	904	904	904	904
11	LP-1a-0100-2	842	842	842	842	842	842	842	842	842	842
12	LP-1a-0100-3	850	850	850	850	850	850	850	850	850	850
13	LP-1b-0400-1	878	878	878	878	878	878	878	878	878	878
14	LP-1b-0400-3	811	811	811	811	811	811	811	811	811	811
15	LP-1b-1000-1	874	874	874	874	874	874	874	874	874	874
16	LP-1b-1000-2	796	796	796	796	796	796	796	796	796	796
17	C-HL-1a-0100-2	873	880	888	896	903	911	919	927	934	942
18	C-HL-1a-0100-3	870	879	888	897	906	915	924	934	943	952
19	C-HL-1b-0400-2	708	717	726	735	744	753	761	770	779	788
20	C-HL-1b-0400-3	704	715	725	736	746	757	768	778	789	799
21	C-LP-1a-0100-1	744	760	776	792	808	824	840	856	872	888
22	C-LP-1a-0100-2	751	760	769	778	787	797	806	815	824	833
23	C-LP-1a-0100-3	750	760	770	780	790	800	810	820	830	840
24	C-LP-1b-0400-1	684	704	723	743	762	781	801	820	840	859
25	C-LP-1b-0400-3	705	715	726	737	747	758	769	779	790	800
26	C-LP-1b-1000-1	667	688	709	729	750	771	791	812	833	853
27	C-LP-1b-1000-2	697	707	717	727	737	746	756	766	776	786

Planning Unit 2

Residual Damages (Remaining Risk) Rankings - Based on Varying Levels of Nonstructural Participation

(Scenario 1 - Low Relative Sea Level Rise, High Employment, Dispersed Population; Low Uncertainty)

Rank	100%	90%	80%	70%	60%	50%	40%	30%	20%	10%
1	NS-1000	NS-1000	NS-1000	NS-1000	NS-1000	NS-1000	NS-1000	C-G-100-4	C-G-100-4	C-G-100-4
2	NS-400	NS-400	NS-400	NS-400	NS-400	NS-400	NS-400	C-R-400-3	C-R-400-3	G-100-4
3	C-R-400-3	C-R-400-3	C-R-400-3	C-R-400-3	C-R-400-3	C-G-100-4	C-G-100-4	NS-1000	G-100-4	C-R-400-3
4	C-WBI-400-1	C-G-100-4	C-G-100-4	C-G-100-4	C-G-100-4	C-R-400-3	C-R-400-3	C-G-100-1	C-G-100-1	C-G-100-1
5	C-G-100-4	C-WBI-400-1	C-G-1000-4	C-G-100-1	C-G-100-1	C-G-100-1	C-G-100-1	C-G-1000-4	C-G-1000-4	C-G-1000-4
6	C-R-1000-4	C-R-1000-4	C-G-100-1	C-G-1000-4	C-G-1000-4	C-G-1000-4	C-G-1000-4	NS-400	C-G-400-4	C-G-400-4
7	C-G-1000-4	C-G-1000-4	C-WBI-400-1	C-R-1000-4	C-G-400-4	C-G-400-4	C-G-400-4	C-G-400-4	R-400-3	R-400-3
8	C-G-100-1	C-G-100-1	C-R-1000-4	C-G-400-4	C-R-1000-4	C-R-1000-4	C-R-1000-4	G-100-4	C-R-1000-4	G-100-1
9	C-R-400-2	C-G-400-4	C-G-400-4	C-WBI-400-1	C-R-400-4	C-R-400-4	G-100-4	C-R-1000-4	G-100-1	G-1000-4
10	C-G-400-4	C-R-400-4	C-R-400-4	C-R-400-4	C-WBI-400-1	C-WBI-400-1	C-R-400-4	C-R-400-4	C-R-400-4	G-400-4
11	C-R-400-4	C-R-400-2	C-R-400-2	C-R-400-2	C-R-400-2	C-R-400-2	C-R-400-2	R-400-3	NS-1000	C-R-1000-4
12	NS-100	NS-100	NS-100	NS-100	NS-100	G-100-4	C-WBI-400-1	G-100-1	G-1000-4	C-R-400-4
13	C-WBI-100-1	C-WBI-100-1	G-100-4	G-100-4	G-100-4	NS-100	R-400-3	C-R-400-2	G-400-4	R-1000-4
14	G-100-4	G-100-4	C-WBI-100-1	C-WBI-100-1	R-400-3	R-400-3	G-100-1	G-1000-4	NS-400	R-400-4
15	C-R-100-4	R-400-3	R-400-3	R-400-3	G-100-1	G-100-1	G-1000-4	G-400-4	C-R-400-2	C-R-400-2
16	C-R-100-3	C-R-100-4	G-100-1	G-100-1	C-WBI-100-1	G-1000-4	G-400-4	C-WBI-400-1	R-1000-4	NS-1000
17	R-400-3	G-100-1	G-1000-4	G-1000-4	G-1000-4	G-400-4	NS-100	R-1000-4	C-WBI-400-1	NS-400
18	C-R-100-2	C-R-100-3	G-400-4	G-400-4	G-400-4	C-WBI-100-1	R-1000-4	NS-100	R-400-4	C-WBI-400-1
19	G-100-1	G-1000-4	C-R-100-4	C-R-100-4	R-1000-4	R-1000-4	R-400-4	R-400-4	NS-100	R-400-2
20	G-1000-4	G-400-4	C-R-100-3	C-R-100-3	C-R-100-4	R-400-4	C-WBI-100-1	C-WBI-100-1	R-400-2	NS-100
21	G-400-4	C-R-100-2	C-R-100-2	R-1000-4	R-400-4	C-R-100-4	C-R-100-4	R-400-2	C-WBI-100-1	WBI-400-1
22	R-1000-4	R-1000-4	R-1000-4	R-400-4	C-R-100-3	C-R-100-3	R-400-2	C-R-100-4	WBI-400-1	C-WBI-100-1
23	R-400-4	R-400-4	R-400-4	C-R-100-2	C-R-100-2	R-400-2	C-R-100-3	C-R-100-3	C-R-100-4	C-R-100-4
24	R-400-2	R-400-2	R-400-2	R-400-2	R-400-2	C-R-100-2	C-R-100-2	WBI-400-1	C-R-100-3	Coastal
25	WBI-400-1	WBI-400-1	WBI-400-1	WBI-400-1	WBI-400-1	WBI-400-1	WBI-400-1	C-R-100-2	Coastal	C-R-100-3
26	Coastal	Coastal	Coastal	Coastal	Coastal	Coastal	Coastal	Coastal	C-R-100-2	R-100-4
27	R-100-4	R-100-4	R-100-4	R-100-4	R-100-4	R-100-4	R-100-4	R-100-4	R-100-4	WBI-100-1
28	WBI-100-1	WBI-100-1	WBI-100-1	WBI-100-1	WBI-100-1	WBI-100-1	WBI-100-1	WBI-100-1	WBI-100-1	R-100-3
29	R-100-3	R-100-3	R-100-3	R-100-3	R-100-3	R-100-3	R-100-3	R-100-3	R-100-3	C-R-100-2
30	R-100-2	R-100-2	R-100-2	R-100-2	R-100-2	R-100-2	R-100-2	R-100-2	R-100-2	R-100-2

Planning Unit 2

Residual Damages (Remaining Risk) - Based on Varying Levels of Nonstructural Participation

(Scenario 1 - Low Relative Sea Level Rise, High Employment, Dispersed Population; Low Uncertainty)

Plan #	Alternative	Equivalent Annual Residual Damages ($ Millions) Based on % Participation in Nonstructural Plans or Plan Components									
		100%	90%	80%	70%	60%	50%	40%	30%	20%	10%
2	Coastal	967	967	967	967	967	967	967	967	967	967
3	NS-100	649	681	713	745	776	808	840	871	903	935
4	NS-400	332	396	459	522	586	649	713	776	840	903
5	NS-1000	302	368	435	501	568	634	701	767	834	900
6	G-100-1	831	831	831	831	831	831	831	831	831	831
7	G-100-4	782	782	782	782	782	782	782	782	782	782
8	G-400-4	839	839	839	839	839	839	839	839	839	839
9	G-1000-4	839	839	839	839	839	839	839	839	839	839
10	R-100-2	1,017	1,017	1,017	1,017	1,017	1,017	1,017	1,017	1,017	1,017
11	R-100-3	993	993	993	993	993	993	993	993	993	993
12	R-100-4	980	980	980	980	980	980	980	980	980	980
13	R-400-2	916	916	916	916	916	916	916	916	916	916
14	R-400-3	821	821	821	821	821	821	821	821	821	821
15	R-400-4	879	879	879	879	879	879	879	879	879	879
16	R-1000-4	870	870	870	870	870	870	870	870	870	870
17	WBI-100-1	983	983	983	983	983	983	983	983	983	983
18	WBI-400-1	944	944	944	944	944	944	944	944	944	944
19	C-G-100-1	633	653	673	692	712	732	752	772	791	811
20	C-G-100-4	611	628	645	662	679	696	713	730	748	765
21	C-G-400-4	644	663	683	702	722	741	761	781	800	820
22	C-G-1000-4	630	651	672	693	714	735	755	776	797	818
23	C-R-100-2	821	840	860	880	899	919	939	958	978	998
24	C-R-100-3	814	831	849	867	885	903	921	939	957	975
25	C-R-100-4	810	827	844	861	878	895	912	929	946	963
26	C-R-400-2	642	670	697	725	752	779	807	834	861	889
27	C-R-400-3	573	598	622	647	672	697	722	746	771	796
28	C-R-400-4	645	669	692	715	739	762	786	809	832	856
29	C-R-1000-4	626	650	675	699	724	748	773	797	821	846
30	C-WBI-100-1	739	763	788	812	837	861	886	910	934	959
31	C-WBI-400-1	605	639	673	707	741	775	809	843	877	911

Planning Unit 3a

Residual Damages (Remaining Risk) Rankings - Based on Varying Levels of Nonstructural Participation

(Scenario 1 - Low Relative Sea Level Rise, High Employment, Dispersed Population; Low Uncertainty)

Rank	100%	90%	80%	70%	60%	50%	40%	30%	20%	10%
1	NS-1000	NS-1000	C-G-1000-2	C-M-100-1	C-M-100-1	C-M-100-1	C-M-100-1	C-M-100-1	C-M-100-1	C-M-100-1
2	NS-400	C-G-1000-2	C-M-100-1	C-G-1000-2	C-G-1000-2	C-G-1000-2	C-G-1000-2	M-100-1	M-100-1	M-100-1
3	C-G-1000-2	C-M-100-1	C-G-400-2	C-G-400-2	C-G-400-2	C-G-400-2	M-100-1	C-G-1000-2	C-G-1000-2	C-G-1000-2
4	C-M-100-1	NS-400	NS-1000	M-100-1	M-100-1	M-100-1	C-G-400-2	C-G-400-2	C-G-400-2	C-G-400-2
5	C-G-400-2	C-G-400-2	M-100-1	C-M-100-2	C-M-100-2	G-1000-2	G-1000-2	G-1000-2	G-1000-2	G-1000-2
6	M-100-1	M-100-1	C-M-100-2	G-1000-2	G-1000-2	C-M-100-2	G-400-2	G-400-2	G-400-2	G-400-2
7	C-M-100-2	C-M-100-2	NS-400	G-400-2	G-400-2	G-400-2	C-M-100-2	C-M-100-2	C-M-100-2	C-M-100-2
8	G-1000-2	G-1000-2	G-1000-2	M-100-2	M-100-2	M-100-2	M-100-2	M-100-2	M-100-2	M-100-2
9	NS-100	G-400-2	G-400-2	NS-1000	NS-1000	NS-1000	NS-1000	NS-1000	NS-1000	NS-1000
10	G-400-2	M-100-2	M-100-2	NS-400	NS-400	NS-400	NS-400	NS-400	NS-400	NS-400
11	M-100-2	NS-100	NS-100	NS-100	NS-100	NS-100	NS-100	NS-100	NS-100	NS-100
12	Coastal	Coastal	Coastal	Coastal	Coastal	Coastal	Coastal	Coastal	Coastal	Coastal

Planning Unit 3a

Residual Damages (Remaining Risk) - Based on Varying Levels of Nonstructural Participation

(Scenario 1 - Low Relative Sea Level Rise, High Employment, Dispersed Population; Low Uncertainty)

Plan #	Alternative	Equivalent Annual Residual Damages ($ Millions) Based on % Participation in Nonstructural Plans or Plan Components									
		100%	90%	80%	70%	60%	50%	40%	30%	20%	10%
2	Coastal	1,027	1,027	1,027	1,027	1,027	1,027	1,027	1,027	1,027	1,027
3	NS-100	512	563	615	666	718	769	821	872	924	975
4	NS-400	365	431	497	563	630	696	762	828	895	961
5	NS-1000	330	400	469	539	609	678	748	818	888	957
6	M-100-1	474	474	474	474	474	474	474	474	474	474
7	M-100-2	537	537	537	537	537	537	537	537	537	537
8	G-400-2	514	514	514	514	514	514	514	514	514	514
9	G-1000-2	506	506	506	506	506	506	506	506	506	506
10	C-M-100-1	426	431	435	440	445	450	455	460	464	469
11	C-M-100-2	483	488	494	499	504	510	515	521	526	531
12	C-G-400-2	434	442	450	458	466	474	482	490	498	506
13	C-G-1000-2	415	425	434	443	452	461	470	479	488	497

Planning Unit 3b

Residual Damages (Remaining Risk) Rankings - Based on Varying Levels of Nonstructural Participation

(Scenario 1 - Low Relative Sea Level Rise, High Employment, Dispersed Population; Low Uncertainty)

Rank	100%	90%	80%	70%	60%	50%	40%	30%	20%	10%
1	NS-1000	C-G-100-1	C-G-100-1	C-G-100-1	C-G-100-1	C-G-100-1	C-G-100-1	C-G-100-1	C-G-100-1	C-G-100-1
2	NS-400	NS-1000	G-100-1	G-100-1	G-100-1	G-100-1	G-100-1	G-100-1	G-100-1	G-100-1
3	C-G-100-1	G-100-1	C-F-400-1	C-F-400-1	C-F-400-1	C-F-400-1	C-F-400-1	C-F-400-1	C-F-400-1	C-F-400-1
4	C-F-400-1	NS-400	NS-1000	C-F-1000-1	C-F-1000-1	C-F-100-1	F-400-1	F-400-1	F-400-1	F-400-1
5	G-100-1	C-F-400-1	C-RL-400-1	C-F-100-1	C-F-100-1	C-F-1000-1	C-F-100-1	C-F-100-1	C-F-100-1	C-F-100-1
6	C-RL-400-1	C-RL-400-1	C-F-1000-1	C-RL-400-1	C-RL-400-1	F-400-1	C-F-1000-1	C-F-1000-1	C-F-1000-1	F-100-1
7	C-F-1000-1	C-F-1000-1	C-F-100-1	F-400-1	F-400-1	C-RL-400-1	F-100-1	F-100-1	F-100-1	C-F-1000-1
8	C-F-100-1	C-F-100-1	NS-400	NS-1000	F-100-1	F-100-1	C-RL-400-1	F-1000-1	F-1000-1	F-1000-1
9	C-RL-100-1	F-400-1	F-400-1	F-100-1	F-1000-1	F-1000-1	F-1000-1	C-RL-400-1	C-RL-400-1	C-RL-400-1
10	NS-100	C-RL-100-1	C-RL-100-1	C-RL-100-1	C-RL-100-1	C-RL-100-1	C-RL-100-1	C-RL-100-1	C-RL-100-1	C-RL-100-1
11	F-400-1	F-100-1	F-100-1	F-1000-1	NS-1000	RL-400-1	RL-400-1	RL-400-1	RL-400-1	RL-400-1
12	F-100-1	F-1000-1	F-1000-1	NS-400	NS-400	RL-100-1	RL-100-1	RL-100-1	RL-100-1	RL-100-1
13	F-1000-1	NS-100	NS-100	RL-400-1	RL-400-1	NS-1000	NS-1000	NS-1000	NS-1000	NS-1000
14	RL-400-1	RL-400-1	RL-400-1	RL-100-1	RL-100-1	NS-400	NS-400	NS-400	NS-400	NS-400
15	RL-100-1	RL-100-1	RL-100-1	NS-100	NS-100	NS-100	NS-100	NS-100	NS-100	NS-100
16	Coastal	Coastal	Coastal	Coastal	Coastal	Coastal	Coastal	Coastal	Coastal	Coastal

Planning Unit 3b

Residual Damages (Remaining Risk) - Based on Varying Levels of Nonstructural Participation

(Scenario 1 - Low Relative Sea Level Rise, High Employment, Dispersed Population; Low Uncertainty)

Plan #	Alternative	Equivalent Annual Residual Damages ($ Millions) Based on % Participation in Nonstructural Plans or Plan Components									
		100%	90%	80%	70%	60%	50%	40%	30%	20%	10%
2	Coastal	469	469	469	469	469	469	469	469	469	469
3	NS-100	245	267	290	312	335	357	380	402	425	447
4	NS-400	183	211	240	269	297	326	355	383	412	441
5	NS-1000	166	196	227	257	287	318	348	378	409	439
6	G-100-1	210	210	210	210	210	210	210	210	210	210
7	F-100-1	261	261	261	261	261	261	261	261	261	261
8	F-400-1	248	248	248	248	248	248	248	248	248	248
9	F-1000-1	267	267	267	267	267	267	267	267	267	267
10	RL-100-1	303	303	303	303	303	303	303	303	303	303
11	RL-400-1	299	299	299	299	299	299	299	299	299	299
12	C-G-100-1	191	193	195	197	199	201	203	205	207	208
13	C-F-100-1	229	232	236	239	242	245	248	251	255	258
14	C-F-400-1	209	213	216	220	224	228	232	236	240	244
15	C-F-1000-1	224	228	233	237	241	246	250	254	258	263
16	C-RL-100-1	244	250	256	262	268	274	280	286	292	298
17	C-RL-400-1	213	222	230	239	248	256	265	273	282	291

Planning Unit 4

Residual Damages (Remaining Risk) Rankings - Based on Varying Levels of Nonstructural Participation

(Scenario 1 - Low Relative Sea Level Rise, High Employment, Dispersed Population; Low Uncertainty)

Rank	100%	90%	80%	70%	60%	50%	40%	30%	20%	10%
1	C-G-1000-3	C-G-1000-3	C-G-1000-3	C-G-1000-3	C-G-1000-3	C-G-1000-3	C-G-1000-3	C-G-1000-3	C-G-100-1	C-G-100-1
2	NS-1000	NS-1000	C-RL-1000-1	C-RL-1000-1	C-G-100-1	C-G-100-1	C-G-100-1	C-G-100-1	C-G-1000-3	C-G-1000-3
3	C-RL-1000-1	C-RL-1000-1	NS-1000	C-G-400-3	C-G-400-3	C-G-400-3	C-G-400-3	C-G-400-3	C-G-400-3	G-100-1
4	NS-400	C-G-400-3	C-G-400-3	C-G-100-1	C-RL-1000-1	C-RL-1000-1	C-G-100-2	C-G-100-2	C-G-100-2	C-G-400-3
5	C-RL-400-1	NS-400	C-G-100-1	NS-1000	NS-1000	C-G-100-2	C-RL-1000-1	C-RL-1000-1	G-100-1	C-G-100-2
6	C-G-400-3	C-RL-400-1	C-RL-400-1	C-RL-400-1	C-RL-400-1	C-RL-400-1	C-RL-400-1	C-RL-400-1	C-RL-1000-1	G-1000-3
7	C-G-100-1	C-G-100-1	NS-400	NS-400	C-G-100-2	NS-1000	NS-1000	C-RL-100-1	C-RL-400-1	G-400-3
8	C-G-100-2	C-G-100-2	C-G-100-2	C-G-100-2	NS-400	NS-400	NS-400	G-100-1	G-1000-3	G-100-2
9	C-RL-100-1	C-RL-100-1	C-RL-100-1	C-RL-100-1	C-RL-100-1	C-RL-100-1	C-RL-100-1	NS-1000	C-RL-100-1	C-RL-1000-1
10	NS-100	NS-100	NS-100	NS-100	NS-100	NS-100	NS-100	NS-400	G-400-3	C-RL-400-1
11	G-100-1	G-100-1	G-100-1	G-100-1	G-100-1	G-100-1	G-100-1	G-1000-3	G-100-2	C-RL-100-1
12	G-1000-3	G-1000-3	G-1000-3	G-1000-3	G-1000-3	G-1000-3	G-1000-3	NS-100	NS-1000	RL-1000-1
13	G-400-3	G-400-3	G-400-3	G-400-3	G-400-3	G-400-3	G-400-3	G-400-3	NS-400	NS-1000
14	G-100-2	G-100-2	G-100-2	G-100-2	G-100-2	G-100-2	G-100-2	G-100-2	NS-100	RL-400-1
15	RL-1000-1	RL-1000-1	RL-1000-1	RL-1000-1	RL-1000-1	RL-1000-1	RL-1000-1	RL-1000-1	RL-1000-1	RL-100-1
16	RL-400-1	RL-400-1	RL-400-1	RL-400-1	RL-400-1	RL-400-1	RL-400-1	RL-400-1	RL-400-1	NS-400
17	RL-100-1	RL-100-1	RL-100-1	RL-100-1	RL-100-1	RL-100-1	RL-100-1	RL-100-1	RL-100-1	NS-100
18	Coastal	Coastal	Coastal	Coastal	Coastal	Coastal	Coastal	Coastal	Coastal	Coastal

Planning Unit 4

Residual Damages (Remaining Risk) - Based on Varying Levels of Nonstructural Participation

(Scenario 1 - Low Relative Sea Level Rise, High Employment, Dispersed Population; Low Uncertainty)

Plan #	Alternative	Equivalent Annual Residual Damages ($ Millions) Based on % Participation in Nonstructural Plans or Plan Components									
		100%	90%	80%	70%	60%	50%	40%	30%	20%	10%
2	Coastal	373	373	373	373	373	373	373	373	373	373
3	NS-100	206	223	239	256	273	289	306	323	339	356
4	NS-400	169	189	210	230	250	271	291	312	332	352
5	NS-1000	156	178	200	221	243	265	286	308	330	351
6	G-100-1	307	307	307	307	307	307	307	307	307	307
7	G-100-2	324	324	324	324	324	324	324	324	324	324
8	G-400-3	324	324	324	324	324	324	324	324	324	324
9	G-1000-3	319	319	319	319	319	319	319	319	319	319
10	RL-100-1	352	352	352	352	352	352	352	352	352	352
11	RL-400-1	352	352	352	352	352	352	352	352	352	352
12	RL-1000-1	349	349	349	349	349	349	349	349	349	349
13	C-G-100-1	182	195	207	220	232	245	257	270	282	295
14	C-G-100-2	194	207	220	233	246	259	272	285	298	311
15	C-G-400-3	174	189	204	219	234	249	264	279	294	309
16	C-G-1000-3	152	169	185	202	219	236	252	269	286	303
17	C-RL-100-1	201	216	231	246	261	277	292	307	322	337
18	C-RL-400-1	173	191	209	227	245	263	280	298	316	334
19	C-RL-1000-1	161	180	199	218	236	255	274	293	311	330

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Participation in Nonstructural Measures
All Planning Units

Remaining Structures at Risk with Various Levels of Participation

Planning Unit 1

Number of Structures Remaining at Risk in Nonstructural Alternatives

For 100-yr, 400-yr and 1,000-yr Frequency Events

Based on Varying Levels of Participation in Nonstructural Measures

Business-as-Usual, Compact Population

Nonstructural Alternative	Level of Participation	# Structures Included in Nonstructural Measures For Alternative	# Structures Remaining at Risk for Various Storm Frequency Events		
			100-year	400-year	1,000-year
NS-100 Buyouts 5,037 Raise-in-Place 16,735	100%	21,772	0	155,687	200,236
	90%	19,595	2,177	156,191	200,740
	80%	17,418	4,354	156,694	201,243
	70%	15,240	6,532	157,198	201,747
	60%	13,063	8,709	157,702	202,251
	50%	10,886	10,886	158,206	202,755
	40%	8,709	13,063	158,709	203,258
	30%	6,532	15,240	159,213	203,762
	20%	4,354	17,418	159,717	204,266
	10%	2,177	19,595	160,220	204,769
NS-400 Buyouts 8,453 Raise-in-Place 152,271	100%	160,724	0	0	196,820
	90%	144,652	2,177	16,072	197,665
	80%	128,579	4,354	32,145	198,511
	70%	112,507	6,532	48,217	199,356
	60%	96,434	8,709	64,290	200,201
	50%	80,362	10,886	80,362	201,047
	40%	64,290	13,063	96,434	201,892
	30%	48,217	15,240	112,507	202,737
	20%	32,145	17,418	128,579	203,582
	10%	16,072	19,595	144,652	204,428
NS-1000 Buyouts 23,776 Raise-in-Place 181,497	100%	205,273	0	0	0
	90%	184,746	2,177	16,072	20,527
	80%	164,218	4,354	32,145	41,055
	70%	143,691	6,532	48,217	61,582
	60%	123,164	8,709	64,290	82,109
	50%	102,637	10,886	80,362	102,637
	40%	82,109	13,063	96,434	123,164
	30%	61,582	15,240	112,507	143,691
	20%	41,055	17,418	128,579	164,218
	10%	20,527	19,595	144,652	184,746

Planning Unit 1

Number of Structures Remaining at Risk in Nonstructural Alternatives

For 100-yr, 400-yr and 1,000-yr Frequency Events

Based on Varying Levels of Participation in Nonstructural Measures

High Employment, Dispersed Population

Nonstructural Alternative	Level of Participation	# Structures Included in Nonstructural Measures For Alternative	# Structures Remaining at Risk for Various Storm Frequency Events		
			100-year	400-year	1,000-year
NS-100 Buyouts 10,472 Raise-in-Place 15,763	100%	26,235	0	208,909	275,915
	90%	23,612	2,624	209,956	276,962
	80%	20,988	5,247	211,003	278,009
	70%	18,365	7,871	212,051	279,057
	60%	15,741	10,494	213,098	280,104
	50%	13,118	13,118	214,145	281,151
	40%	10,494	15,741	215,192	282,198
	30%	7,871	18,365	216,239	283,245
	20%	5,247	20,988	217,287	284,293
	10%	2,624	23,612	218,334	285,340
NS-400 Buyouts 15,649 Raise-in-Place 203,732	100%	219,381	0	0	270,738
	90%	197,443	2,624	21,938	272,303
	80%	175,505	5,247	43,876	273,868
	70%	153,567	7,871	65,814	275,433
	60%	131,629	10,494	87,752	276,998
	50%	109,691	13,118	109,691	278,563
	40%	87,752	15,741	131,629	280,127
	30%	65,814	18,365	153,567	281,692
	20%	43,876	20,988	175,505	283,257
	10%	21,938	23,612	197,443	284,822
NS-1000 Buyouts 44,296 Raise-in-Place 242,091	100%	286,387	0	0	0
	90%	257,748	2,624	21,938	28,639
	80%	229,110	5,247	43,876	57,277
	70%	200,471	7,871	65,814	85,916
	60%	171,832	10,494	87,752	114,555
	50%	143,194	13,118	109,691	143,194
	40%	114,555	15,741	131,629	171,832
	30%	85,916	18,365	153,567	200,471
	20%	57,277	20,988	175,505	229,110
	10%	28,639	23,612	197,443	257,748

Planning Unit 2

Number of Structures Remaining at Risk in Nonstructural Alternatives

For 100-yr, 400-yr and 1,000-yr Frequency Events

Based on Varying Levels of Participation in Nonstructural Measures

Business-as-Usual, Compact Population

Nonstructural Alternative	Level of Participation	# Structures Included in Nonstructural Measures For Alternative	# Structures Remaining at Risk for Various Storm Frequency Events		
			100-year	400-year	1,000-year
NS-100 Buyouts 4,215 Raise-in-Place 12,356	100%	16,571	0	124,547	127,505
	90%	14,914	1,657	124,969	127,927
	80%	13,257	3,314	125,390	128,348
	70%	11,600	4,971	125,812	128,770
	60%	9,943	6,628	126,233	129,191
	50%	8,286	8,286	126,655	129,613
	40%	6,628	9,943	127,076	130,034
	30%	4,971	11,600	127,498	130,456
	20%	3,314	13,257	127,919	130,877
	10%	1,657	14,914	128,341	131,299
NS-400 Buyouts 16,621 Raise-in-Place 112,141	100%	128,762	0	0	115,099
	90%	115,886	1,657	12,876	116,761
	80%	103,010	3,314	25,752	118,423
	70%	90,133	4,971	38,629	120,085
	60%	77,257	6,628	51,505	121,747
	50%	64,381	8,286	64,381	123,410
	40%	51,505	9,943	77,257	125,072
	30%	38,629	11,600	90,133	126,734
	20%	25,752	13,257	103,010	128,396
	10%	12,876	14,914	115,886	130,058
NS-1000 Buyouts 22,975 Raise-in-Place 108,745	100%	131,720	0	0	0
	90%	118,548	1,657	12,876	13,172
	80%	105,376	3,314	25,752	26,344
	70%	92,204	4,971	38,629	39,516
	60%	79,032	6,628	51,505	52,688
	50%	65,860	8,286	64,381	65,860
	40%	52,688	9,943	77,257	79,032
	30%	39,516	11,600	90,133	92,204
	20%	26,344	13,257	103,010	105,376
	10%	13,172	14,914	115,886	118,548

Planning Unit 2

Number of Structures Remaining at Risk in Nonstructural Alternatives

For 100-yr, 400-yr and 1,000-yr Frequency Events

Based on Varying Levels of Participation in Nonstructural Measures

High Employment, Dispersed Population

Nonstructural Alternative	Level of Participation	# Structures Included in Nonstructural Measures For Alternative	# Structures Remaining at Risk for Various Storm Frequency Events		
			100-year	400-year	1,000-year
NS-100 Buyouts 5,777 Raise-in-Place 11,756	100%	17,533	0	162,347	166,218
	90%	15,780	1,753	162,925	166,796
	80%	14,026	3,507	163,502	167,373
	70%	12,273	5,260	164,080	167,951
	60%	10,520	7,013	164,658	168,529
	50%	8,767	8,767	165,236	169,107
	40%	7,013	10,520	165,813	169,684
	30%	5,260	12,273	166,391	170,262
	20%	3,507	14,026	166,969	170,840
	10%	1,753	15,780	167,546	171,417
NS-400 Buyouts 23,085 Raise-in-Place 145,039	100%	168,124	0	0	148,910
	90%	151,312	1,753	16,812	151,219
	80%	134,499	3,507	33,625	153,527
	70%	117,687	5,260	50,437	155,836
	60%	100,874	7,013	67,250	158,144
	50%	84,062	8,767	84,062	160,453
	40%	67,250	10,520	100,874	162,761
	30%	50,437	12,273	117,687	165,070
	20%	33,625	14,026	134,499	167,378
	10%	16,812	15,780	151,312	169,687
NS-1000 Buyouts 34,357 Raise-in-Place 137,638	100%	171,995	0	0	0
	90%	154,796	1,753	16,812	17,200
	80%	137,596	3,507	33,625	34,399
	70%	120,397	5,260	50,437	51,599
	60%	103,197	7,013	67,250	68,798
	50%	85,998	8,767	84,062	85,998
	40%	68,798	10,520	100,874	103,197
	30%	51,599	12,273	117,687	120,397
	20%	34,399	14,026	134,499	137,596
	10%	17,200	15,780	151,312	154,796

Planning Unit 3a

Number of Structures Remaining at Risk in Nonstructural Alternatives

For 100-yr, 400-yr and 1,000-yr Frequency Events

Based on Varying Levels of Participation in Nonstructural Measures

Business-as-Usual, Compact Population

Nonstructural Alternative	Level of Participation	# Structures Included in Nonstructural Measures For Alternative	# Structures Remaining at Risk for Various Storm Frequency Events		
			100-year	400-year	1,000-year
NS-100 Buyouts 614 Raise-in-Place 30,617	100%	31,231	0	52,613	58,870
	90%	28,108	3,123	52,674	58,931
	80%	24,985	6,246	52,736	58,993
	70%	21,862	9,369	52,797	59,054
	60%	18,739	12,492	52,859	59,116
	50%	15,616	15,616	52,920	59,177
	40%	12,492	18,739	52,981	59,238
	30%	9,369	21,862	53,043	59,300
	20%	6,246	24,985	53,104	59,361
	10%	3,123	28,108	53,166	59,423
NS-400 Buyouts 6,184 Raise-in-Place 47,043	100%	53,227	0	0	53,300
	90%	47,904	3,123	5,323	53,918
	80%	42,582	6,246	10,645	54,537
	70%	37,259	9,369	15,968	55,155
	60%	31,936	12,492	21,291	55,774
	50%	26,614	15,616	26,614	56,392
	40%	21,291	18,739	31,936	57,010
	30%	15,968	21,862	37,259	57,629
	20%	10,645	24,985	42,582	58,247
	10%	5,323	28,108	47,904	58,866
NS-1000 Buyouts 9,748 Raise-in-Place 49,736	100%	59,484	0	0	0
	90%	53,536	3,123	5,323	5,948
	80%	47,587	6,246	10,645	11,897
	70%	41,639	9,369	15,968	17,845
	60%	35,690	12,492	21,291	23,794
	50%	29,742	15,616	26,614	29,742
	40%	23,794	18,739	31,936	35,690
	30%	17,845	21,862	37,259	41,639
	20%	11,897	24,985	42,582	47,587
	10%	5,948	28,108	47,904	53,536

Planning Unit 3a

Number of Structures Remaining at Risk in Nonstructural Alternatives

For 100-yr, 400-yr and 1,000-yr Frequency Events

Based on Varying Levels of Participation in Nonstructural Measures

High Employment, Dispersed Population

Nonstructural Alternative	Level of Participation	# Structures Included in Nonstructural Measures For Alternative	# Structures Remaining at Risk for Various Storm Frequency Events		
			100-year	400-year	1,000-year
NS-100 Buyouts 734 Raise-in-Place 30,643	100%	31,377	0	62,765	68,845
	90%	28,239	3,138	62,838	68,918
	80%	25,102	6,275	62,912	68,992
	70%	21,964	9,413	62,985	69,065
	60%	18,826	12,551	63,059	69,139
	50%	15,689	15,689	63,132	69,212
	40%	12,551	18,826	63,205	69,285
	30%	9,413	21,964	63,279	69,359
	20%	6,275	25,102	63,352	69,432
	10%	3,138	28,239	63,426	69,506
NS-400 Buyouts 7,695 Raise-in-Place 55,804	100%	63,499	0	0	61,884
	90%	57,149	3,138	6,350	62,654
	80%	50,799	6,275	12,700	63,423
	70%	44,449	9,413	19,050	64,193
	60%	38,099	12,551	25,400	64,962
	50%	31,750	15,689	31,750	65,732
	40%	25,400	18,826	38,099	66,501
	30%	19,050	21,964	44,449	67,271
	20%	12,700	25,102	50,799	68,040
	10%	6,350	28,239	57,149	68,810
NS-1000 Buyouts 12,747 Raise-in-Place 56,832	100%	69,579	0	0	0
	90%	62,621	3,138	6,350	6,958
	80%	55,663	6,275	12,700	13,916
	70%	48,705	9,413	19,050	20,874
	60%	41,747	12,551	25,400	27,832
	50%	34,790	15,689	31,750	34,790
	40%	27,832	18,826	38,099	41,747
	30%	20,874	21,964	44,449	48,705
	20%	13,916	25,102	50,799	55,663
	10%	6,958	28,239	57,149	62,621

Planning Unit 3b

Number of Structures Remaining at Risk in Nonstructural Alternatives

For 100-yr, 400-yr and 1,000-yr Frequency Events

Based on Varying Levels of Participation in Nonstructural Measures

Business-as-Usual, Compact Population

Nonstructural Alternative	Level of Participation	# Structures Included in Nonstructural Measures For Alternative	# Structures Remaining at Risk for Various Storm Frequency Events		
			100-year	400-year	1,000-year
NS-100 Buyouts 903 Raise-in-Place 10,248	100%	11,151	0	21,455	29,932
	90%	10,036	1,115	21,545	30,022
	80%	8,921	2,230	21,636	30,113
	70%	7,806	3,345	21,726	30,203
	60%	6,691	4,460	21,816	30,293
	50%	5,576	5,576	21,907	30,384
	40%	4,460	6,691	21,997	30,474
	30%	3,345	7,806	22,087	30,564
	20%	2,230	8,921	22,177	30,654
	10%	1,115	10,036	22,268	30,745
NS-400 Buyouts 957 Raise-in-Place 21,401	100%	22,358	0	0	29,879
	90%	20,122	1,115	2,236	29,975
	80%	17,886	2,230	4,472	30,070
	70%	15,651	3,345	6,707	30,166
	60%	13,415	4,460	8,943	30,262
	50%	11,179	5,576	11,179	30,358
	40%	8,943	6,691	13,415	30,453
	30%	6,707	7,806	15,651	30,549
	20%	4,472	8,921	17,886	30,645
	10%	2,236	10,036	20,122	30,740
NS-1000 Buyouts 1,307 Raise-in-Place 29,528	100%	30,835	0	0	0
	90%	27,752	1,115	2,236	3,084
	80%	24,668	2,230	4,472	6,167
	70%	21,585	3,345	6,707	9,251
	60%	18,501	4,460	8,943	12,334
	50%	15,418	5,576	11,179	15,418
	40%	12,334	6,691	13,415	18,501
	30%	9,251	7,806	15,651	21,585
	20%	6,167	8,921	17,886	24,668
	10%	3,084	10,036	20,122	27,752

Planning Unit 3b

Number of Structures Remaining at Risk in Nonstructural Alternatives

For 100-yr, 400-yr and 1,000-yr Frequency Events

Based on Varying Levels of Participation in Nonstructural Measures

High Employment, Dispersed Population

Nonstructural Alternative	Level of Participation	# Structures Included in Nonstructural Measures For Alternative	# Structures Remaining at Risk for Various Storm Frequency Events		
			100-year	400-year	1,000-year
NS-100 Buyouts 846 Raise-in-Place 10,003	100%	10,849	0	23,532	32,124
	90%	9,764	1,085	23,617	32,209
	80%	8,679	2,170	23,701	32,293
	70%	7,594	3,255	23,786	32,378
	60%	6,509	4,340	23,870	32,462
	50%	5,425	5,425	23,955	32,547
	40%	4,340	6,509	24,040	32,632
	30%	3,255	7,594	24,124	32,716
	20%	2,170	8,679	24,209	32,801
	10%	1,085	9,764	24,293	32,885
NS-400 Buyouts 907 Raise-in-Place 23,471	100%	24,378	0	0	32,063
	90%	21,940	1,085	2,438	32,154
	80%	19,502	2,170	4,876	32,244
	70%	17,065	3,255	7,313	32,335
	60%	14,627	4,340	9,751	32,426
	50%	12,189	5,425	12,189	32,517
	40%	9,751	6,509	14,627	32,607
	30%	7,313	7,594	17,065	32,698
	20%	4,876	8,679	19,502	32,789
	10%	2,438	9,764	21,940	32,879
NS-1000 Buyouts 1,307 Raise-in-Place 31,663	100%	32,970	0	0	0
	90%	29,673	1,085	2,438	3,297
	80%	26,376	2,170	4,876	6,594
	70%	23,079	3,255	7,313	9,891
	60%	19,782	4,340	9,751	13,188
	50%	16,485	5,425	12,189	16,485
	40%	13,188	6,509	14,627	19,782
	30%	9,891	7,594	17,065	23,079
	20%	6,594	8,679	19,502	26,376
	10%	3,297	9,764	21,940	29,673

Planning Unit 4

Number of Structures Remaining at Risk in Nonstructural Alternatives

For 100-yr, 400-yr and 1,000-yr Frequency Events

Based on Varying Levels of Participation in Nonstructural Measures

Business-as-Usual, Compact Population

Nonstructural Alternative	Level of Participation	# Structures Included in Nonstructural Measures For Alternative	# Structures Remaining at Risk for Various Storm Frequency Events		
			100-year	400-year	1,000-year
NS-100 Buyouts 2,250 Raise-in-Place 6,138	100%	8,388	0	14,707	23,091
	90%	7,549	839	14,932	23,316
	80%	6,710	1,678	15,157	23,541
	70%	5,872	2,516	15,382	23,766
	60%	5,033	3,355	15,607	23,991
	50%	4,194	4,194	15,832	24,216
	40%	3,355	5,033	16,057	24,441
	30%	2,516	5,872	16,282	24,666
	20%	1,678	6,710	16,507	24,891
	10%	839	7,549	16,732	25,116
NS-400 Buyouts 2,509 Raise-in-Place 14,448	100%	16,957	0	0	22,832
	90%	15,261	839	1,696	23,083
	80%	13,566	1,678	3,391	23,334
	70%	11,870	2,516	5,087	23,585
	60%	10,174	3,355	6,783	23,836
	50%	8,479	4,194	8,479	24,087
	40%	6,783	5,033	10,174	24,337
	30%	5,087	5,872	11,870	24,588
	20%	3,391	6,710	13,566	24,839
	10%	1,696	7,549	15,261	25,090
NS-1000 Buyouts 3,150 Raise-in-Place 22,191	100%	25,341	0	0	0
	90%	22,807	839	1,696	2,534
	80%	20,273	1,678	3,391	5,068
	70%	17,739	2,516	5,087	7,602
	60%	15,205	3,355	6,783	10,136
	50%	12,671	4,194	8,479	12,671
	40%	10,136	5,033	10,174	15,205
	30%	7,602	5,872	11,870	17,739
	20%	5,068	6,710	13,566	20,273
	10%	2,534	7,549	15,261	22,807

Planning Unit 4

Number of Structures Remaining at Risk in Nonstructural Alternatives

For 100-yr, 400-yr and 1,000-yr Frequency Events

Based on Varying Levels of Participation in Nonstructural Measures

High Employment, Dispersed Population

Nonstructural Alternative	Level of Participation	# Structures Included in Nonstructural Measures For Alternative	# Structures Remaining at Risk for Various Storm Frequency Events		
			100-year	400-year	1,000-year
NS-100 Buyouts 2,248 Raise-in-Place 6,160	100%	8,408	0	17,140	27,658
	90%	7,567	841	17,365	27,883
	80%	6,726	1,682	17,590	28,108
	70%	5,886	2,522	17,814	28,332
	60%	5,045	3,363	18,039	28,557
	50%	4,204	4,204	18,264	28,782
	40%	3,363	5,045	18,489	29,007
	30%	2,522	5,886	18,714	29,232
	20%	1,682	6,726	18,938	29,456
	10%	841	7,567	19,163	29,681
NS-400 Buyouts 2,547 Raise-in-Place 16,841	100%	19,388	0	0	27,359
	90%	17,449	841	1,939	27,614
	80%	15,510	1,682	3,878	27,868
	70%	13,572	2,522	5,816	28,123
	60%	11,633	3,363	7,755	28,378
	50%	9,694	4,204	9,694	28,633
	40%	7,755	5,045	11,633	28,887
	30%	5,816	5,886	13,572	29,142
	20%	3,878	6,726	15,510	29,397
	10%	1,939	7,567	17,449	29,651
NS-1000 Buyouts 3,146 Raise-in-Place 26,760	100%	29,906	0	0	0
	90%	26,915	841	1,939	2,991
	80%	23,925	1,682	3,878	5,981
	70%	20,934	2,522	5,816	8,972
	60%	17,944	3,363	7,755	11,962
	50%	14,953	4,204	9,694	14,953
	40%	11,962	5,045	11,633	17,944
	30%	8,972	5,886	13,572	20,934
	20%	5,981	6,726	15,510	23,925
	10%	2,991	7,567	17,449	26,915

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Evaluation of Alternatives
Future Degraded Coast Conditions
All Planning Units

Sample Plan Rankings and Evaluation Criteria Tables

Planning Unit 1

Comparison of Total System Costs

Alternatives w/ Sustaining Coastal Landscape vs. w/ Future Degraded Coastal Landscape
(Scenario 1 - LRSLR, High Employment, Dispersed Population; Low Uncertainty)

With Future Degraded Coastal Landscape Analysis						
Plan #	**Alternative**	**Equivalent Annual Life-Cycle Costs** ($Millions)	**With Project Residual Damages** ($ Millions)	**Total System Costs** ($ Millions)	**Rank**	**Total System Costs Sustaining Coastal Landscape** ($ Millions)
3	NS-0100	329	755	1,084	1	1,606
10	LP-1a-0100-1	363	910	1,272	2	1,807
21	C-LP-1a-0100-1	560	751	1,311	3	1,845
4	NS-0400	1,216	468	1,684	4	2,224
7	HL-1a-0100-3	813	985	1,798	5	2,317
18	C-HL-1a-0100-3	971	888	1,859	6	2,384
12	LP-1a-0100-3	1,080	856	1,936	7	2,472
6	HL-1a-0100-2	982	964	1,946	8	2,475
23	C-LP-1a-0100-3	1,231	755	1,986	9	2,523
11	LP-1a-0100-2	1,160	844	2,004	10	2,533
17	C-HL-1a-0100-2	1,129	882	2,011	11	2,545
22	C-LP-1a-0100-2	1,303	752	2,056	12	2,586
13	LP-1b-0400-1	1,300	883	2,183	13	2,727
24	C-LP-1b-0400-1	1,599	688	2,286	14	2,832
5	NS-1000	1,991	388	2,378	15	2,919
15	LP-1b-1000-1	1,714	879	2,592	16	3,121
26	C-LP-1b-1000-1	2,045	670	2,715	17	3,246
14	LP-1b-0400-3	2,311	817	3,127	18	3,658
9	HL-1b-0400-3	2,334	829	3,163	19	3,647
25	C-LP-1b-0400-3	2,472	709	3,181	20	3,713
20	C-HL-1b-0400-3	2,508	710	3,218	21	3,715
8	HL-1b-0400-2	2,573	808	3,381	22	3,873
19	C-HL-1b-0400-2	2,735	711	3,445	23	3,946
16	LP-1b-1000-2	3,059	797	3,857	24	4,373
27	C-LP-1b-1000-2	3,236	698	3,934	25	4,451

Planning Unit 1

Total System Costs Rankings

(Alternatives With Future Degraded Coastal Landscape)

Rank	Scenario 1 Low RSLR High Employment Dispersed Population	Scenario 2 High RSLR High Employment Dispersed Population	Scenario 3 Low RSLR Business-as-Usual Compact Population	Scenario 4 High RSLR Business-as-Usual Compact Population
1	NS-0100	NS-0100	NS-0100	NS-0100
2	LP-1a-0100-1	LP-1a-0100-1	LP-1a-0100-1	LP-1a-0100-1
3	C-LP-1a-0100-1	C-LP-1a-0100-1	C-LP-1a-0100-1	C-LP-1a-0100-1
4	NS-0400	NS-0400	HL-1a-0100-3	HL-1a-0100-3
5	HL-1a-0100-3	HL-1a-0100-3	C-HL-1a-0100-3	C-HL-1a-0100-3
6	C-HL-1a-0100-3	C-HL-1a-0100-3	NS-0400	NS-0400
7	LP-1a-0100-3	LP-1a-0100-3	LP-1a-0100-3	HL-1a-0100-2
8	HL-1a-0100-2	HL-1a-0100-2	HL-1a-0100-2	LP-1a-0100-3
9	C-LP-1a-0100-3	C-LP-1a-0100-3	C-LP-1a-0100-3	C-HL-1a-0100-2
10	LP-1a-0100-2	C-HL-1a-0100-2	C-HL-1a-0100-2	C-LP-1a-0100-3
11	C-HL-1a-0100-2	LP-1a-0100-2	LP-1a-0100-2	LP-1a-0100-2
12	C-LP-1a-0100-2	C-LP-1a-0100-2	C-LP-1a-0100-2	C-LP-1a-0100-2
13	LP-1b-0400-1	NS-1000	LP-1b-0400-1	LP-1b-0400-1
14	C-LP-1b-0400-1	LP-1b-0400-1	C-LP-1b-0400-1	C-LP-1b-0400-1
15	NS-1000	C-LP-1b-0400-1	NS-1000	NS-1000
16	LP-1b-1000-1	LP-1b-1000-1	LP-1b-1000-1	LP-1b-1000-1
17	C-LP-1b-1000-1	C-LP-1b-1000-1	C-LP-1b-1000-1	C-LP-1b-1000-1
18	LP-1b-0400-3	LP-1b-0400-3	LP-1b-0400-3	LP-1b-0400-3
19	HL-1b-0400-3	C-LP-1b-0400-3	C-LP-1b-0400-3	C-LP-1b-0400-3
20	C-LP-1b-0400-3	HL-1b-0400-3	HL-1b-0400-3	HL-1b-0400-3
21	C-HL-1b-0400-3	C-HL-1b-0400-3	C-HL-1b-0400-3	C-HL-1b-0400-3
22	HL-1b-0400-2	HL-1b-0400-2	HL-1b-0400-2	HL-1b-0400-2
23	C-HL-1b-0400-2	C-HL-1b-0400-2	C-HL-1b-0400-2	C-HL-1b-0400-2
24	LP-1b-1000-2	LP-1b-1000-2	LP-1b-1000-2	LP-1b-1000-2
25	C-LP-1b-1000-2	C-LP-1b-1000-2	C-LP-1b-1000-2	C-LP-1b-1000-2

Planning Unit 2

Comparison of Total System Costs

Alternatives w/ Sustaining Coastal Landscape vs. w/ Future Degraded Coastal Landscape

(Scenario 1 - LRSLR, High Employment, Dispersed Population; Low Uncertainty)

With Future Degraded Coastal Landscape Analysis						Total System Costs Sustaining Coastal Landscape ($ Millions)
Plan #	**Alternative**	**Equivalent Annual Life-Cycle Costs** ($Millions)	**With Project Residual Damages** ($ Millions)	**Total System Costs** ($ Millions)	**Rank**	
3	**NS-100**	217	678	896	**1**	1,666
30	**C-WBI-100-1**	270	782	1,052	**2**	1,804
17	**WBI-100-1**	55	1,022	1,076	**3**	1,834
4	**NS-400**	803	360	1,163	**4**	1,935
19	**C-G-100-1**	555	671	1,226	**5**	1,976
6	**G-100-1**	400	867	1,267	**6**	2,019
23	**C-R-100-2**	570	846	1,416	**7**	2,187
10	**R-100-2**	399	1,040	1,439	**8**	2,211
24	**C-R-100-3**	675	838	1,513	**9**	2,285
20	**C-G-100-4**	886	631	1,517	**10**	2,282
11	**R-100-3**	521	1,015	1,537	**11**	2,311
7	**G-100-4**	756	800	1,556	**12**	2,323
25	**C-R-100-4**	833	832	1,665	**13**	2,436
12	**R-100-4**	688	1,000	1,688	**14**	2,461
31	**C-WBI-400-1**	1,116	637	1,753	**15**	2,517
5	**NS-1000**	1,494	314	1,808	**16**	2,596
18	**WBI-400-1**	938	973	1,911	**17**	2,678
26	**C-R-400-2**	1,441	665	2,107	**18**	2,875
27	**C-R-400-3**	1,584	597	2,182	**19**	2,946
13	**R-400-2**	1,306	938	2,243	**20**	3,013
14	**R-400-3**	1,457	843	2,300	**21**	3,066
28	**C-R-400-4**	1,737	667	2,404	**22**	3,169
15	**R-400-4**	1,620	898	2,517	**23**	3,285
21	**C-G-400-4**	1,898	664	2,562	**24**	3,335
8	**G-400-4**	1,781	856	2,637	**25**	3,413
29	**C-R-1000-4**	2,181	638	2,819	**26**	3,569
16	**R-1000-4**	2,038	889	2,927	**27**	3,670
22	**C-G-1000-4**	2,322	640	2,962	**28**	3,744
9	**G-1000-4**	2,170	856	3,026	**29**	3,800

Planning Unit 2

Total System Costs Rankings

(Alternatives With Future Degraded Coastal Landscape)

Rank	Scenario 1	Scenario 2	Scenario 3	Scenario 4
	Low RSLR High Employment Dispersed Population	High RSLR High Employment Dispersed Population	Low RSLR Business-as-Usual Compact Population	High RSLR Business-as-Usual Compact Population
1	NS-100	NS-100	NS-100	NS-100
2	C-WBI-100-1	C-WBI-100-1	C-WBI-100-1	C-WBI-100-1
3	WBI-100-1	WBI-100-1	WBI-100-1	WBI-100-1
4	NS-400	NS-400	C-G-100-1	C-G-100-1
5	C-G-100-1	C-G-100-1	G-100-1	G-100-1
6	G-100-1	G-100-1	C-R-100-2	C-R-100-2
7	C-R-100-2	C-R-100-2	R-100-2	R-100-2
8	R-100-2	R-100-2	C-R-100-3	C-R-100-3
9	C-R-100-3	C-G-100-4	C-G-100-4	C-G-100-4
10	C-G-100-4	C-R-100-3	R-100-3	R-100-3
11	R-100-3	R-100-3	G-100-4	G-100-4
12	G-100-4	G-100-4	C-R-100-4	C-R-100-4
13	C-R-100-4	C-R-100-4	R-100-4	R-100-4
14	R-100-4	R-100-4	NS-400	NS-400
15	C-WBI-400-1	C-WBI-400-1	C-WBI-400-1	C-WBI-400-1
16	NS-1000	NS-1000	WBI-400-1	NS-1000
17	WBI-400-1	WBI-400-1	NS-1000	WBI-400-1
18	C-R-400-2	C-R-400-2	C-R-400-2	C-R-400-2
19	C-R-400-3	C-R-400-3	R-400-2	R-400-2
20	R-400-2	R-400-2	C-R-400-3	C-R-400-3
21	R-400-3	R-400-3	R-400-3	R-400-3
22	C-R-400-4	C-R-400-4	C-R-400-4	C-R-400-4
23	R-400-4	R-400-4	R-400-4	R-400-4
24	C-G-400-4	C-G-400-4	C-G-400-4	C-G-400-4
25	G-400-4	G-400-4	G-400-4	G-400-4
26	C-R-1000-4	C-R-1000-4	C-R-1000-4	C-R-1000-4
27	R-1000-4	R-1000-4	R-1000-4	R-1000-4
28	C-G-1000-4	C-G-1000-4	C-G-1000-4	C-G-1000-4
29	G-1000-4	G-1000-4	G-1000-4	G-1000-4

Planning Unit 3a

Comparison of Total System Costs

Alternatives w/ Sustaining Coastal Landscape vs. w/ Future Degraded Coastal Landscape

(Scenario 1 - LRSLR, High Employment, Dispersed Population; Low Uncertainty)

With Future Degraded Coastal Landscape Analysis							Total System Costs Sustaining Coastal Landscape ($ Millions)
Plan #	**Alternative**	**Equivalent Annual Life-Cycle Costs** ($Millions)	**With Project Residual Damages** ($ Millions)	**Total System Costs** ($ Millions)	**Rank**		
4	**NS-400**	544	365	909	**1**		2,098
3	**NS-100**	399	512	911	**2**		2,099
5	**NS-1000**	597	330	927	**3**		2,116
11	**C-M-100-2**	1,005	484	1,489	**4**		2,676
7	**M-100-2**	969	538	1,507	**5**		2,695
10	**C-M-100-1**	1,126	427	1,552	**6**		2,740
6	**M-100-1**	1,093	475	1,568	**7**		2,756
12	**C-G-400-2**	1,365	434	1,799	**8**		2,987
8	**G-400-2**	1,287	515	1,802	**9**		2,990
9	**G-1000-2**	1,411	507	1,918	**10**		3,105
13	**C-G-1000-2**	1,538	416	1,954	**11**		3,142

Planning Unit 3a

Total System Costs Rankings

(Alternatives With Future Degraded Coastal Landscape)

Rank	Scenario 1 Low RSLR High Employment Dispersed Population	Scenario 2 High RSLR High Employment Dispersed Population	Scenario 3 Low RSLR Business-as-Usual Compact Population	Scenario 4 High RSLR Business-as-Usual Compact Population
1	NS-400	NS-1000	NS-100	NS-400
2	NS-100	NS-400	NS-400	NS-1000
3	NS-1000	NS-100	NS-1000	NS-100
4	C-M-100-2	C-M-100-2	C-M-100-2	C-M-100-2
5	M-100-2	M-100-2	M-100-2	M-100-2
6	C-M-100-1	C-M-100-1	C-M-100-1	C-M-100-1
7	M-100-1	M-100-1	M-100-1	M-100-1
8	C-G-400-2	C-G-400-2	G-400-2	G-400-2
9	G-400-2	G-400-2	C-G-400-2	C-G-400-2
10	G-1000-2	G-1000-2	G-1000-2	G-1000-2
11	C-G-1000-2	C-G-1000-2	C-G-1000-2	C-G-1000-2

Planning Unit 3b

Comparison of Total System Costs

Alternatives w/ Sustaining Coastal Landscape vs. w/ Future Degraded Coastal Landscape

(Scenario 1 - LRSLR, High Employment, Dispersed Population; Low Uncertainty)

With Future Degraded Coastal Landscape Analysis						
Plan #	**Alternative**	**Equivalent Annual Life-Cycle Costs** ($Millions)	**With Project Residual Damages** ($ Millions)	**Total System Costs** ($ Millions)	**Rank**	**Total System Costs Sustaining Coastal Landscape** ($ Millions)
3	**NS-100**	134	245	379	**1**	622
4	**NS-400**	232	183	415	**2**	658
5	**NS-1000**	290	166	457	**3**	699
16	**C-RL-100-1**	635	244	880	**4**	1,122
10	**RL-100-1**	591	304	895	**5**	1,138
13	**C-F-100-1**	729	229	959	**6**	1,201
7	**F-100-1**	711	261	972	**7**	1,215
12	**C-G-100-1**	789	191	981	**8**	1,224
6	**G-100-1**	777	210	987	**9**	1,230
17	**C-RL-400-1**	970	213	1,183	**10**	1,426
11	**RL-400-1**	919	299	1,218	**11**	1,461
14	**C-F-400-1**	1,212	209	1,421	**12**	1,664
8	**F-400-1**	1,197	248	1,445	**13**	1,688
15	**C-F-1000-1**	1,610	224	1,834	**14**	2,077
9	**F-1000-1**	1,587	267	1,854	**15**	2,096

Planning Unit 3b

Total System Costs Rankings

(Alternatives With Future Degraded Coastal Landscape)

Rank	Scenario 1 Low RSLR High Employment Dispersed Population	Scenario 2 High RSLR High Employment Dispersed Population	Scenario 3 Low RSLR Business-as-Usual Compact Population	Scenario 4 High RSLR Business-as-Usual Compact Population
1	NS-100	NS-100	NS-100	NS-100
2	NS-400	NS-400	NS-400	NS-400
3	NS-1000	NS-1000	NS-1000	NS-1000
4	C-RL-100-1	C-RL-100-1	C-RL-100-1	C-RL-100-1
5	RL-100-1	RL-100-1	RL-100-1	RL-100-1
6	C-F-100-1	C-F-100-1	C-F-100-1	C-F-100-1
7	F-100-1	F-100-1	F-100-1	F-100-1
8	C-G-100-1	C-G-100-1	C-G-100-1	C-G-100-1
9	G-100-1	G-100-1	G-100-1	G-100-1
10	C-RL-400-1	C-RL-400-1	RL-400-1	RL-400-1
11	RL-400-1	RL-400-1	C-RL-400-1	C-RL-400-1
12	C-F-400-1	C-F-400-1	C-F-400-1	C-F-400-1
13	F-400-1	F-400-1	F-400-1	F-400-1
14	C-F-1000-1	C-F-1000-1	C-F-1000-1	C-F-1000-1
15	F-1000-1	F-1000-1	F-1000-1	F-1000-1

Planning Unit 4

Comparison of Total System Costs

Alternatives w/ Sustaining Coastal Landscape vs. w/ Future Degraded Coastal Landscape

(Scenario 1 - LRSLR, High Employment, Dispersed Population; Low Uncertainty)

With Future Degraded Coastal Landscape Analysis							Total System Costs Sustaining Coastal Landscape ($ Millions)
Plan #	Alternative	Equivalent Annual Life-Cycle Costs ($Millions)	With Project Residual Damages ($ Millions)	Total System Costs ($ Millions)	Rank		
3	**NS-100**	109	206	316	**1**		866
4	**NS-400**	176	169	345	**2**		895
5	**NS-1000**	245	156	401	**3**		952
18	**C-RL-400-1**	262	174	436	**4**		986
17	**C-RL-100-1**	235	201	436	**4**		987
10	**RL-100-1**	138	352	490	**6**		1,041
11	**RL-400-1**	177	352	529	**7**		1,079
19	**C-RL-1000-1**	371	161	532	**8**		1,082
12	**RL-1000-1**	192	349	541	**9**		1,091
15	**C-G-400-3**	675	174	849	**10**		1,399
13	**C-G-100-1**	686	182	869	**11**		1,419
14	**C-G-100-2**	676	194	870	**12**		1,420
6	**G-100-1**	612	308	920	**13**		1,470
8	**G-400-3**	599	324	923	**14**		1,474
7	**G-100-2**	602	324	926	**15**		1,476
9	**G-1000-3**	623	320	943	**16**		1,493
16	**C-G-1000-3**	806	152	958	**17**		1,509

Planning Unit 4

Total System Costs Rankings

(Alternatives With Future Degraded Coastal Landscape)

Rank	Scenario 1 Low RSLR High Employment Dispersed Population	Scenario 2 High RSLR High Employment Dispersed Population	Scenario 3 Low RSLR Business-as-Usual Compact Population	Scenario 4 High RSLR Business-as-Usual Compact Population
1	NS-100	NS-100	NS-100	NS-100
2	NS-400	NS-400	NS-400	NS-400
3	NS-1000	NS-1000	NS-1000	NS-1000
4	C-RL-400-1	C-RL-400-1	C-RL-100-1	C-RL-100-1
5	C-RL-100-1	C-RL-100-1	C-RL-400-1	C-RL-400-1
6	RL-100-1	RL-100-1	RL-100-1	RL-100-1
7	RL-400-1	C-RL-1000-1	C-RL-1000-1	C-RL-1000-1
8	C-RL-1000-1	RL-400-1	RL-400-1	RL-400-1
9	RL-1000-1	RL-1000-1	RL-1000-1	RL-1000-1
10	C-G-400-3	C-G-400-3	C-G-100-1	C-G-400-3
11	C-G-100-1	C-G-100-1	C-G-100-2	C-G-100-1
12	C-G-100-2	C-G-100-2	C-G-400-3	C-G-100-2
13	G-100-1	G-100-1	G-400-3	C-G-1000-3
14	G-400-3	G-400-3	G-100-1	G-100-1
15	G-100-2	G-100-2	G-100-2	G-400-3
16	G-1000-3	G-1000-3	C-G-1000-3	G-100-2
17	C-G-1000-3	C-G-1000-3	G-1000-3	G-1000-3