VIRGINIA COASTAL RESILIENCE MASTER PLAN

Task 2: Development of the Study Conceptual Model

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Dewberry

FINAL REPORT

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1. BACKGROUND

INTRODUCTION

The Virginia Coastal Resilience Master Planning Framework (hereinafter referred to as the "Framework") lays out the core principles of the Commonwealth's approach to coastal adaptation and protection, and the process by which the Commonwealth will develop and begin implementing Virginia's first Coastal Resilience Master Plan by the end of 2021. Development of a Study Conceptual Model is the critical first step for clarifying the broad objectives and desired outcomes presented in the Framework and the December 1, 2020 Request for Proposals (RFP), to drive towards the creation of a full, project-focused Coastal Resilience Master Plan (CRMP).

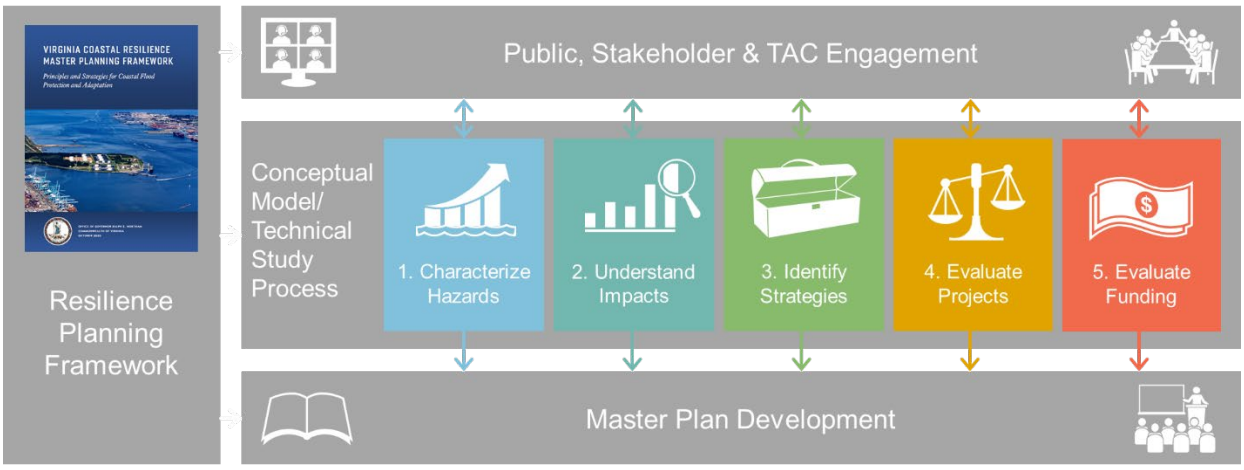
This Technical Memorandum provides an overview of the initial Study Conceptual Model, accompanied by an Excel spreadsheet intended to be iteratively refined through engagement with the Commonwealth's Chief Resilience Officer (CRO), the Special Assistant to the Governor for Coastal Adaptation and Protection (SACAP), and the Technical Advisory Committee (TAC).

WHAT IS CONCEPTUAL MODELING?

Conceptual modeling is an intellectual exercise that identifies study questions and the analytical framework needed to address them. The purpose of the conceptual model is to:

- Clarify objectives for the development of the CRMP;
- Identify questions to be answered through study analysis and products;
- Determine dates when feedback is needed from the TAC and subcommittees in alignment with milestone deliverable dates;
- Identify and resolve approaches and metrics for study products; and,
- Identify inter-relationships of data inputs and outputs.

The initial Study Conceptual Model presented in this technical memorandum lays the foundation for aligning the Technical Study Process with the guiding principles of the Framework and desired outcomes from the RFP, and provides a mechanism for stakeholder-driven refinement of desired study outcomes to inform development of the CRMP.



As illustrated in Figure 1, the conceptual modeling effort provides a framework to work with the leadership and TAC to refine the objectives and desired outcomes of the Technical Study Process, with priority being placed on resolving metrics, analytical inputs and approach, and resulting study products that will serve as inputs to the database and CRMP.

2. CONCEPTUAL MODEL ELEMENTS

The Conceptual Model builds upon the Framework goals, actions, and desired outcomes. Specifically, the conceptual modeling effort was conducted under the umbrella of the first two goals of the Framework including:

1. Identification of priority projects to increase the resilience of coastal communities, including both built and natural assets at risk due to sea level rise and flooding.
2. Establishment of a financing strategy, informed by regional differences and equity considerations, to support execution of the plan.

Additionally, the Conceptual Model builds upon the desired outcomes of the RFP listed below:

1. A prioritized (based on core principles and TAC input) list by region of built infrastructure critical for national security, public health and safety, and/or the economy that informs all coastal resilience planning and funding.
2. A prioritized (based on core principles and TAC input) list by region of natural infrastructure critical for flood and storm protection, water quality management, and/or wildlife habitat that informs all coastal resilience planning and funding.
3. A project database, supporting a list of projects by region, including strategies for adaptation and relocation, as well as structural solutions, to protect and sustain the functions of prioritized built and natural infrastructure.
4. A detailed funding needs assessment and list of recommended funding sources to support Plan implementation.

The major elements of Conceptual Model include:

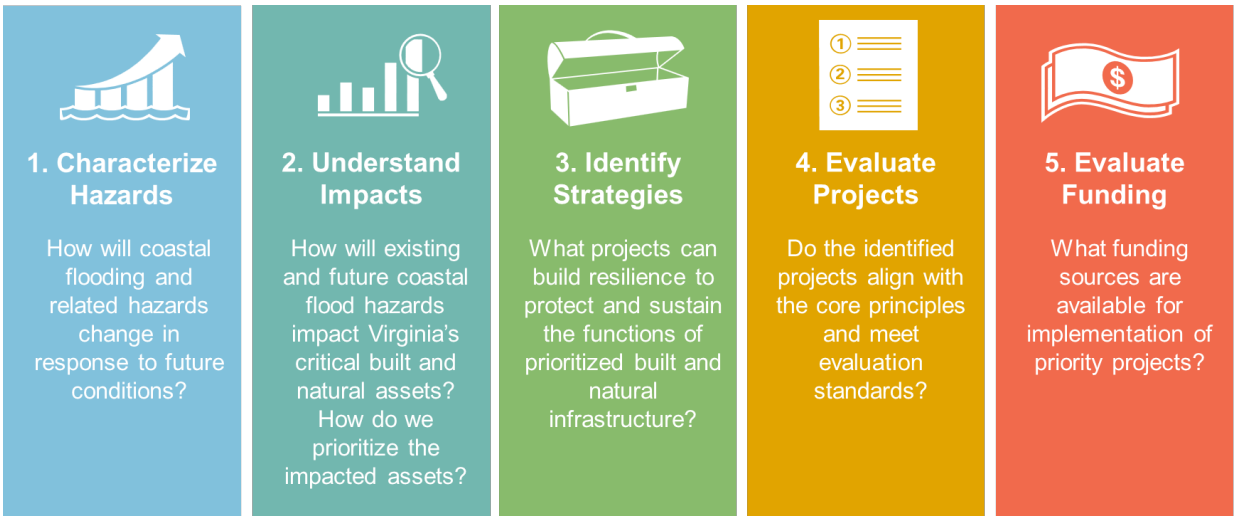
- Overarching objectives
- Detailed analytical steps
- Questions that need to be answered by Dewberry's Study Technical Process
- Feedback requests (for CRO/SACAP/TAC)
- Dates when requested feedback is needed from CRO/SACAP/TAC in alignment with the milestone deliverable schedule
- Analysis metrics
- Analysis inputs
- Analytical approach
- Output linkages
- Timing (date analysis needs to be complete for the November deadline, or future enhancement)

- Products (to feed into the database/CRMP)
- Commonwealth leadership team comments and Dewberry responses

These elements are described in more detail in the following sections.

OVERARCHING OBJECTIVES

To drive towards the aforementioned Framework goals, the Study Conceptual Model poses five overarching objectives with associated questions to organize and inform the study's analytical process, as presented in Figure 2.



The linkages between these overarching objectives, and example analysis metrics, are illustrated in Figure 3 and described below:

1. The analysis will start with a **Hazard Assessment** of the coast, including producing future flood extents, depths, and frequency under the adopted sea level rise (SLR) scenarios. The outputs will yield a valuable sample of the hazard probability space from frequent, nuisance/tidal flood events (~50% chance of annual exceedance) to extreme events (0.2% chance of annual exceedance), produced for the four time horizons.

2. The products of the hazard assessment will serve as the input to the **Impact Assessment** phase where a range of impact types will be evaluated including impacts on the community fabric, underserved populations, the built environment, critical infrastructure, and natural infrastructure (ecosystems). Using literature sources and existing data investments from the Commonwealth, the team will employ quantitative and qualitative methods to assess how the hazard will impact populations and impair function of the built environment and natural systems. Outputs will include summarization and visualization by a nested geographic

hierarchy (state, regional, etc. breakouts) to reveal assets to prioritize for protection/adaptation.

3. The next step is the **Prioritization Assessment** where the assets identified as being vulnerable to future flood conditions will be screened for their criticality to long-term resilience. The outcome will be two-fold: 1) a prioritized list of vulnerable, built infrastructure critical for natural security, public health and safety, and/or the economy, and 2) a prioritized list of vulnerable, natural infrastructure critical for flood and storm protection, water quality management, and or wildlife habitat.

4. The prioritized lists of built and natural infrastructure will inform **Project Identification**. The project inventory process involves establishment of baseline criteria to screen existing and new projects for inclusion in the project database and, most importantly, their ability to mitigate risk to the prioritized built and natural infrastructure. A standardized schema will provide a consistent approach for categorizing projects, such as grouping by project type (e.g. structural, non-structural, nature-based, planning/policy, and recovery/capacity-building projects), project owner, status (identified, conceptual design, in implementation), implementation timeframe (e.g., short-term, mid-term, long-term, ongoing), costs, useful life, etc.

5. Projects that pass through the project inventory process will enter the **Project Evaluation** phase, where they will be evaluated under a multi-factor evaluation framework. The evaluation framework will likely be structured as a combination of quantitative analysis, and qualitative participatory engagement with the TAC and community stakeholders to score projects.

6. The **Funding Strategy** is critical to identify and understand potential funding programs and mechanisms that can be leveraged to support implementation of the CRMP. The funding stream analysis will capture a range of aspects including eligibility, application requirements, grant/loan amount, matching needs, and equity/underserved community considerations. The project database can then be aligned with the identified funding sources.

7. The final analytical step is **Aggregation** where the list of projects is holistically reviewed and refined to verify equity of recommended adaptation efforts across Master Planning Regions.

DETAILED ANALYTICAL STEPS & QUESTIONS

Under each of the overarching study objectives, the Study Conceptual Model captures the more detailed analytical steps required and associated factors (or detailed questions) that need to be answered. Each question was related back to the overarching study questions

to verify that it was relevant to the study objectives. The project team also included feedback requests for consideration by the leadership team and the TAC, to help refine the Conceptual Model.

METRICS, INPUTS, & OUTPUTS.

For each question listed, a general metric and/or possible evaluation criteria were identified where appropriate. Analysis input and output linkages were identified to map out the inter-relationships of the data to inform critical path needs. Finally, the analysis approach and products for each question were explicitly identified to help envision outcomes of the analysis to feed into the CRMP. An example of how these elements work together is provided in Table 1.

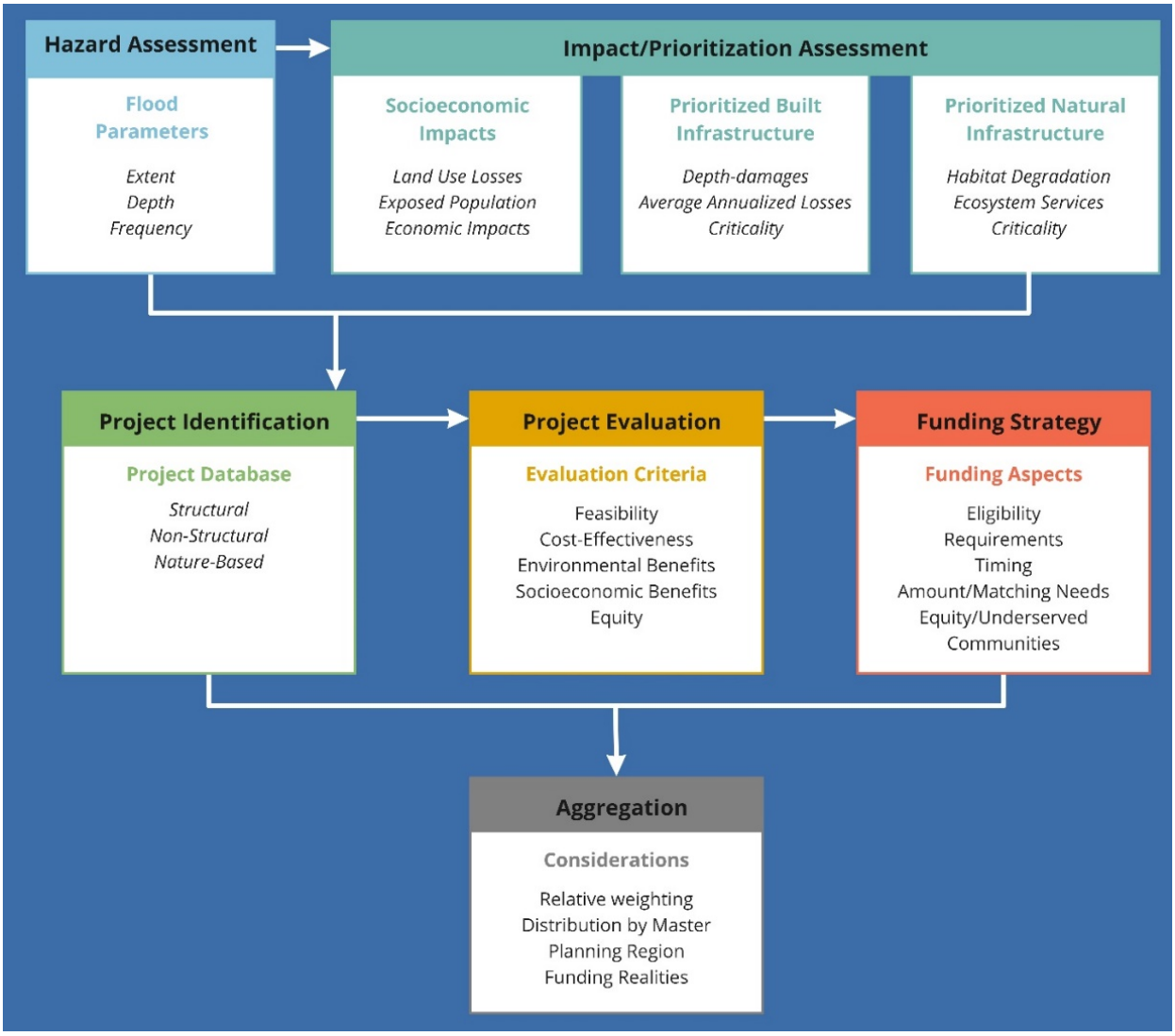


Figure 3: Study Conceptual Model process diagram.

Table 1: Example of Study Conceptual Model Elements

Conceptual Model Elements	Description
Overarching Goal/Question	2 – What built and natural assets should be prioritized for adaptation?
Detailed Analytical Step	2.3 – Assess impacts of future flooding on buildings
Detailed Factor/Question	2.3.1 – What buildings are subject to damage due to inundation, and what are the estimated losses (direct and indirect) under the range of hazard types and scenarios?
Metrics	Count and spatial distribution Direct losses (building and content) Average Annualized Losses (AALs) Indirect losses (e.g. loss of service)
Inputs to Analysis	Flood hazard mapping outputs Building footprints with first floor elevations (FFEs) Depth-damage curves
Approach	Direct losses will be based on depth-damage function calculations and indirect losses associated with loss of services will employ federally promulgated unit values or peer-reviewed literature sources
Output Linkages	3 – Identify Projects 4 – Evaluate Projects
Products	Spatial, tabular, narrative summaries, categorized by use type (e.g. residential, commercial, government) and Master Planning Region.