DELTA STEWARDSHIP COUNCIL

Delta Levees Investment Strategy

Interim Progress Report

Peer Review (Draft Revision 0)

April 15, 2015

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ACRONYMS AND ABBREVIATIONS

ARCADIS	ARCADIS U.S., Inc.
Council	Delta Stewardship Council
CVFPB	Central Valley Flood Protection Board
Delta	Sacramento-San Joaquin Delta
DLIS	Delta levees investment strategy
DPC	Delta Protection Commission
DWR	California Department of Water Resources
EAALL	expected annual agricultural land loss
EAD	expected annual damages
EAF	expected annual fatalities
F-N curves	Cumulative Frequency-Fatality curves
Planning Tool	Delta Levees Investment Strategy Planning Tool
State	State of California

1. INTRODUCTION

1.1 Project Background

Levees in the Sacramento-San Joaquin Delta (Delta) help protect people, property, natural resources, and numerous infrastructure systems of statewide importance. Levee failure (such as a levee breach) could cause devastating flooding, potentially causing injury or loss of life and possibly damaging property, water supply, infrastructure, and environmental resources of statewide significance.

Levee maintenance and improvement over the past 30 years have helped strengthen the Delta levees. However, the State of California (State) does not currently have a long-term strategy to guide future investments of its limited funding. The 2009 Delta Reform Act directed the Delta Stewardship Council (Council) to lead the effort to develop and recommend priorities for State investments in Delta levees to reduce flood risk to people, property, and State interests; and to advance the coequal goals of water supply reliability and restoring the Delta ecosystem. Therefore, coordinating closely with other agencies and the public, the Council is developing a Delta levees investment strategy (DLIS) to establish priorities for State investments in the Delta levee system to reduce the likelihood and consequences of levee failures.

For the DLIS, the Council is developing a comprehensive methodology that considers the assets protected by Delta levees, the threats to Delta levees, and the multiple beneficiaries of Delta levee investments. The work is building on the results of previous Delta levee planning efforts and will collect and use the best available data and information from numerous existing federal, State, and local reports, plans, and analyses. To assist in developing the DLIS, the Council has retained a project team consisting of ARCADIS U.S., Inc. (ARCADIS) and ARCADIS subcontractors Catalyst Group, Convey Inc., ESA Associates, RAND Corporation, RiverSmith Engineering, and Shannon & Wilson.

1.2 Interim Progress Report

Work on the DLIS project was initiated in June 2014. The overall effort is expected to take 24 months, as shown on Figure 1. This Interim Progress Report has been prepared to summarize the work conducted during the first 9 months of the DLIS project. As such, it is a work-in-process; although some results/conclusions are included, the report primarily presents the methodologies that will be employed to complete the DLIS. The purpose of providing the Interim Progress Report is to facilitate an independent “mid-course” review of the project. The ARCADIS team will use the comments received during this mid-course review to adapt the proposed methodologies and complete the DLIS. This review strategy will enable the DLIS project team (including the Council and California Department of Water Resources [DWR], working in consultation with the Department of Fish and Wildlife, the Central Valley Flood Protection Board [CVFPB], and the Delta Protection Commission [DPC]) to incorporate external input into the DLIS while it is still being developed. This review strategy ensures that this input will have the maximum possible influence on the final work products, conclusions, and recommendations.

The technical content of this report is presented in the five technical memoranda included in Appendices A through E. Section 2 describes the content of these memoranda and how they begin to fulfill the overall scope of the DLIS.

2. TECHNICAL MEMORANDA

The DLIS project team has prepared five technical memoranda documenting the work completed to date developing the DLIS. Specifically, these memoranda address work completed to date on DLIS project tasks 1(a), 1(b), 1(c), and 1(d). [Elements of Task 1(b) are addressed in two technical memoranda.] Each technical memorandum:

- Presents methodologies that will be used to conduct the DLIS analysis,
- Identifies existing data that will be incorporated into the DLIS,
- Identifies assumptions and uncertainties, and
- Describes data gaps and limitations, and the effect those gaps and limitations may have in applying the methodologies.

Although the technical memoranda primarily focus on presenting methodologies, they also present the results and conclusions that have been developed during the initial DLIS project work, where applicable.

The content of each technical memorandum is described in the following subsections. Each subsection is organized to summarize the scope of the relevant project tasks and illustrate how the content of the technical memoranda relate to that scope.

2.1 Technical Memorandum 2.1

Technical Memorandum 2.1: *Baseline Information on Islands and Tracts, Assets, Hazards, and Beneficiaries* summarizes the work completed to date on DLIS Project Task 1(a), *Asset and Impact Exposure*. The key scope elements of Task 1(a) and the corresponding content of Technical Memorandum 2.1 are summarized in the following table.

Key Scope Elements of Task 1(a)	Work Completed to Date and Summarized in Technical Memorandum 2.1
Obtain data on assets	The methodology for defining the islands and tracts within the geographic scope of the DLIS was developed; a list of islands and tracts was prepared.
	The methodology for creating the asset inventory was defined; assets were identified with available data; and an asset inventory database was created and populated.
	The methodology for establishing asset categories was defined; asset categories have been identified.
Identify and classify beneficiaries of levee protection	The methodology for identifying beneficiaries was established; beneficiaries have been identified and classified.
Prepare asset exposure spreadsheets	The methodology for identifying hazards that threaten levees was established; hazards have been identified.
	Asset exposure spreadsheets have been prepared for each island and tract.

Technical Memorandum 2.1 is presented in Appendix A.

2.2 Technical Memorandum 2.2

Technical Memorandum 2.2: *Levee Hazards, Risks, and Consequences* summarizes a portion of the work completed to date on DLIS Project Task 1(b), *Gather Data for Risk and Consequences Analysis*. [The remaining work completed to date on Task 1(b) is presented in Technical Memorandum 3.1.] The key scope elements of Task 1(b) addressed in Technical Memorandum 2.2, and the corresponding content of the memorandum, are summarized in the following table.

Key Scope Elements of Task 1(b)	Work Completed to Date and Summarized in Technical Memorandum 2.2
Review data and relationships to calculate expected annual damages (EAD) due to levee failure	Available data sources have been identified.
	Methodologies for calculating EAD, expected annual fatalities (EAF), and expected annual agricultural land loss (EAALL) that address identified hazards have been developed. [The methodology to calculate island / tract-specific EAD will be applied after input on the methodology has been received from the mid-course review.]
Review data and relationships to calculate EAD for levee operation, maintenance, and improvement options	The methodologies for calculating project-related EAD, EAF, and EAALL have been developed. [The methodologies to calculate island/tract-specific EAD, EAF, and EAALL will be applied after input on the methodologies has been received from the mid-course review.]
Define the progression from hazard, to levee vulnerability, to failure, to asset consequences, and to beneficiaries	The methodologies noted above establish the progression from hazard, to levee vulnerability, to failure, to asset consequences. [The methodology for allocating damages to beneficiaries is still being developed and is not available for the mid-course review.]

Technical Memorandum 2.2 is presented in Appendix B.

2.3 Technical Memorandum 2.3

Technical Memorandum 2.3: *Tolerable Risk* summarizes the work completed to date on DLIS Project Task 1(c), *Appropriate Level of Flood Protection*. The key scope elements of Task 1(c) and the corresponding content of Technical Memorandum 2.3 are summarized in the following table.

Key Scope Elements of Task 1(c)	Work Completed to Date and Summarized in Technical Memorandum 2.3
Meet with stakeholders to identify and integrate objectives of partner agencies	[This is a future work item. It will be informed by the results of the mid-course review.]
Review guidance in existing regulations and legislation	Existing regulations and legislation have been reviewed.
Develop and communicate understanding of risk from flooding	A tolerable risk methodology to assess risk from flooding has been developed. [The methodology will be applied after input has been received from the mid-course review.]
Develop draft vision for State/local priorities in flood risk reduction	[This is a future work item. It will be informed by the results of the mid-course review.]
Meet with key stakeholders to identify vision, goals, objectives, and criteria to assess current risk to islands/assets	[This is a future work item. It will be informed by the results of the mid-course review.]
Meet with stakeholders to communicate risk to each island	[This is a future work item. It will be informed by the results of the mid-course review.]

Technical Memorandum 2.3 is presented in Appendix C.

2.4 Technical Memorandum 3.1

One of the principal products that will be generated as part of the DLIS will be the Delta Levees Investment Strategy Planning Tool (Planning Tool), a computer-based, interactive decision support tool that will assist the Council in evaluating levee investments and developing an investment strategy. The Planning Tool will take into account a wide array of economic and non-economic factors to evaluate a range of investments and investment strategies, including identifying portfolios of investment options based on projects proposed by local agencies and other stakeholders. These projects will be evaluated using the Planning Tool through iterative interaction with State planning partners, reclamation districts, local agencies, water users, and non-governmental organizations.

The Planning Tool will evaluate typical levee improvements (such as changes in levee cross section or elevation, seepage controls, setbacks, and foundation improvements) that are informed by State law and guidelines, U.S. Army Corps of Engineers reports, regional flood management plans for project levees, and reclamation district 5-year plans.

The Planning Tool will also support:

- Establishing priorities for maintenance subventions,
- Proposing cost allocations among beneficiaries, and
- Development of recommendations for complementary non-structural flood risk reduction measures (such as improved flood warnings, evacuation plans, prepositioning flood fight and emergency response material and equipment, flood insurance, and floodproofing).

Based on the DLIS project, the Council will prepare revisions to risk-reduction policies and recommendations in the Delta Plan (Council 2013) regarding implementation of the Delta levees investment strategy. The recommended policy changes will be assessed in compliance with the California Environmental Quality Act. The final product will be adopted as an amendment to the Delta Plan, along with implementing regulations that will provide programmatic guidance to the DWR and CVFPB as they grant funds for specific improvements and maintenance of the Delta's project and non-project levees. The Council envisions that the Planning Tool will remain available for updates of the Delta Plan's levee investment strategy, which would likely occur as part of periodic reviews of the Delta Plan that are scheduled to occur at 5-year intervals.

The Planning Tool incorporates and integrates methods and data derived in prior tasks, including:

- Assets and hazards identified using the methodologies presented in Technical Memorandum 2.1.
- Risks and consequences derived using the methodologies presented in Technical Memorandum 2.2.
- Tolerable Risk thresholds based on Cumulative Frequency-Fatality curves (F-N curves) derived using the methodologies presented in Technical Memorandum 2.3.

Technical Memorandum 3.1: *Methodology* summarizes work completed to date on the Planning Tool as part of DLIS Project Task 1(b), *Define Methodology for Risk and Consequence Analysis*. Specifically, Technical Memorandum 3.1 provides an overall description of the Planning Tool, describes the Planning Tool methodology in detail, and presents the risk models and calculations that will be used to evaluate risks and the impacts of investments. The key scope elements of the Planning Tool in Task 1(b) and the corresponding contents of Technical Memorandum 3.1 are summarized in the following table.

Key Scope Elements of Task 1(b)	Work Completed to Date and Summarized in Technical Memorandum 3.1
Develop prototype investment ranking tool AND Develop prototype portfolio planning tool	Metrics to assess baseline conditions and estimate the effects of future levee investments were established.
	Future risk drivers were identified.
	The methodology for calculating baseline risk and estimating the effects on risk of future levee investments was developed. [The methodology will be applied after input has been received from the mid-course review.]
	The input parameters needed by the Planning Tool to evaluate future levee investment alternatives were defined.
	The methodology for evaluating water supply disruption was developed. [The methodology will be applied after input has been received from the mid-course review.]
	The methodology for evaluating habitat impacts was developed. [The methodology will be applied after input has been received from the mid-course review.]
	The methodology for evaluating expected annual rehabilitation cost was developed. [The methodology will be applied after input has been received

Key Scope Elements of Task 1(b)	Work Completed to Date and Summarized in Technical Memorandum 3.1
	from the mid-course review.]
	The structure, function, inputs, and outputs of the Planning Tool were established. [The Planning Tool will be utilized to calculate baseline and future with- and without-investment conditions after input has been received from the mid-course review.]
	A preliminary version of the Planning Tool interactive visualizations was developed. [The interactive visualizations will be finalized after input has been received from the mid-course review.]

Technical Memorandum 3.1 is presented in Appendix D.

2.5 Technical Memorandum 3.2

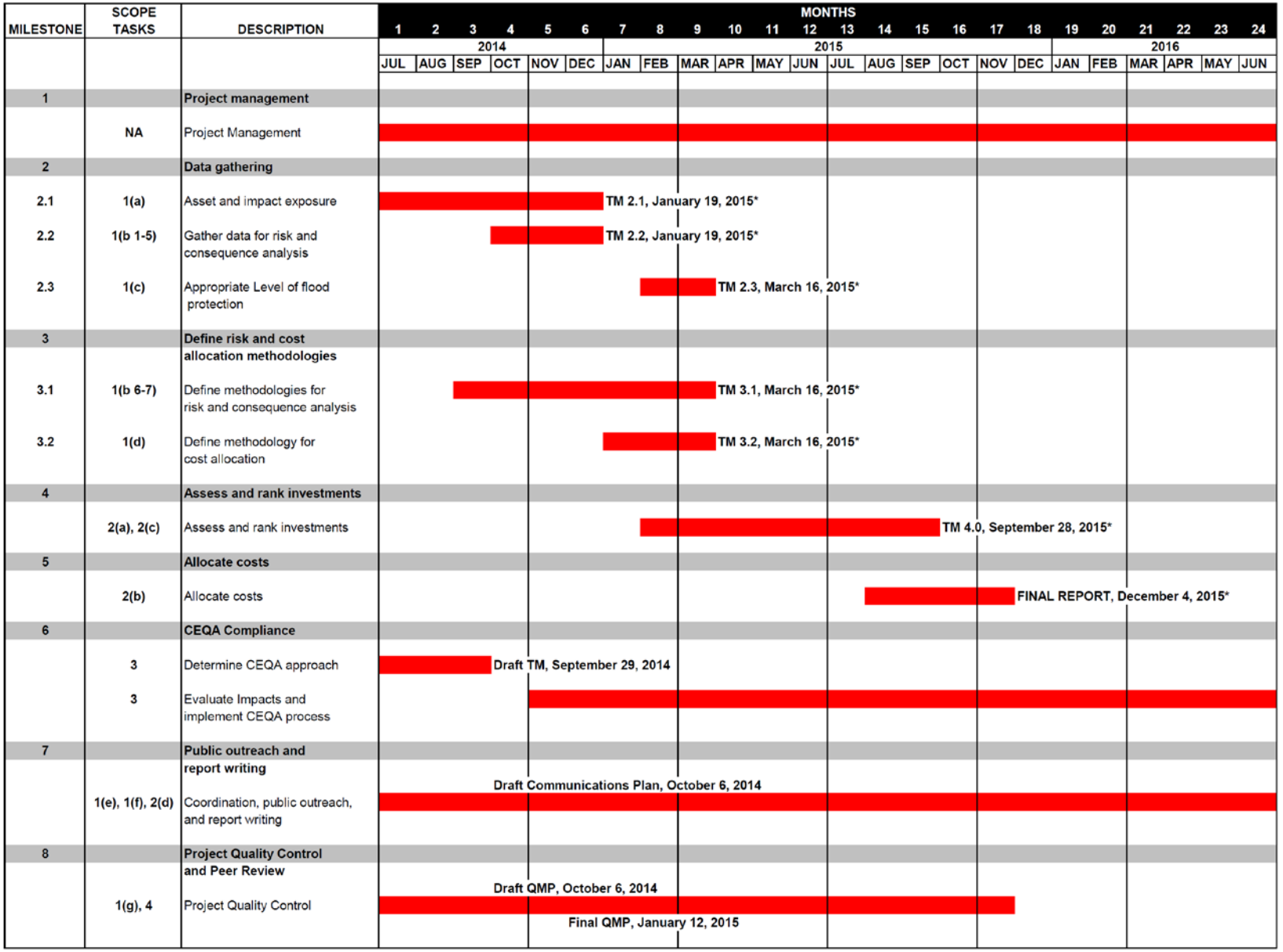
Technical Memorandum 3.2: *Cost Allocation Methodology* summarizes the work completed to date on DLIS Project Task 1(d), *Define Methodology for Cost Allocation*. The key scope elements of Task 1(d) and the corresponding content of Technical Memorandum 3.2 are summarized in the following table.

Key Scope Elements of Task 1(d)	Work Completed to Date and Summarized in Technical Memorandum 3.2
Obtain guidance from the Assessment District Feasibility Study to be prepared by the DPC	The Assessment District Feasibility Study (by others) is just getting started and efforts are being coordinated with the DPC. [The cost allocation methodology will incorporate relevant information from the feasibility study when it is available.]
Apply methodologies and tools to allocate the investment costs to beneficiaries	The recommended methodology for allocating the investment costs to beneficiaries was developed. [The methodology will be applied after input has been received from the mid-course review.]
Review sources and uses of funds applicable to each beneficiary to investigate ability-to-pay for public entities	[This is a future work item. It will be informed by the results of the mid-course review.]

Technical Memorandum 3.2 is presented in Appendix E.

3. REFERENCES

Delta Stewardship Council (Council). 2013. The Delta Plan. Available from: http://deltacouncil.ca.gov/sites/default/files/documents/files/DeltaPlan_2013_CHAPTERS_COMBINED.pdf.



*** NOTE:** **Draft for review by Council staff due one week prior to date shown.**

DELTA STEWARDSHIP COUNCIL

Appendix A

Technical Memorandum 2.1:

Baseline Information on Islands, Tracts, Assets, Hazards, and Beneficiaries

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Appendix B

Technical Memorandum 2.2:

Levee Hazards, Risks, and Consequences

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Appendix C

Technical Memorandum 2.3:

Tolerable Risk

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Appendix D

Technical Memorandum 3.1:

Methodology

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Appendix E

Technical Memorandum 3.2:

Cost Allocation Methodology