Guidelines for Developing a Coastal Hazard Assessment

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VICTORIA State Government | Environment, Land, Water and Planning

Acknowledgements

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Photo credit

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Introduction

The assessment of coastal hazards is a first step towards improving our ability to plan, manage and prepare for the impacts of these hazards now and in the future. A coastal hazard assessment will increase our understanding of coastal processes and potential hazards.

A key component of the former DSE's Future Coasts Program was the delivery of four pilot Local Coastal Hazard Assessments (LCHA) developed between 2011 and 2016. The program aimed to increase awareness and build the capacity of coastal land managers to assess and understand the relationship between climate change impacts and coastal hazards. It included developing and testing coastal hazard assessment methodologies for representative coastal landform systems in Victoria and developing datasets to inform improved and more consistent coastal planning and management practices.

DELWP is currently evaluating the learnings from three components of the four pilot LCHA studies:

1. The technical methodologies used.
2. Project management and governance approaches.
3. The engagement strategies and methods used.

These guidelines are the product of the technical methodologies review. Evaluation of the other components will form a separate publication.

Purpose

These guidelines aim to help in the planning and delivery of inundation and erosion coastal hazard assessments. The method outlined is not intended to be prescriptive: it is a reference document to inform discussion and decisions by the project team and service providers.

The document provides an overview of the general approach to undertaking a coastal hazard assessment and identifies key decision points in the process. It also provides a technical specification outline and guidance to develop the Project Brief.

This is intended to be a 'living document' that will be updated as the department and its partners gain more experience in doing coastal hazard assessments

Pilot Coastal Hazard Assessments

Four pilot Coastal Hazard Assessments (CHA) were undertaken at Port Fairy, Westernport Bay, Bellarine Peninsula/Corio Bay and Gippsland Lakes/90 Mile Beach after The Victorian Coastal Inundation Data Set (VCIDS) was released in 2013.

This document was developed following a review of the pilot assessments and subsequent technical and peer reviews of the methodology of the four final reports and data generated from the assessments. The complete report is available at www.delwp.vic.gov.au coast and marine section.

Structure

This document consists of four sections:

4. Narrative on how to implement a Coastal Hazard Assessment (CHA)
5. Table listing the CHA steps
6. Sample Project Brief and Technical Specifications for:
   - Inundation Assessment
   - Erosion Assessment.
7. Glossary

Background/context

The VCIDS was one of the key products of the former Victorian Future Coasts Program. The data set was developed using bathtub or static modelling techniques and provides maps that show coastal inundation extents for the entire Victorian coastline under a range of sea level rise scenarios. (www.data.vic.gov.au/data/dataset/victorian-coastal-inundation). The project that produced this mapping was known as the 2nd Pass Assessment.

The 1st Pass Assessment, undertaken by the Federal Government in 2010, assigned vulnerability ratings to the entire Australian coastline based purely on the geomorphological characteristics of the coastline. (www.ozcoasts.gov.au/coastal/smartline.jsp)

Some councils know the four pilot Coastal Hazard Assessments undertaken after the release of the Victorian Coastal Inundation Data Set as 3rd Pass Assessments.

An explanation of the three passes is contained in: C. Sharples, C. Attwater and J. Carley 2008. Three Pass Approach to Coastal Risk Assessments. Paper presented at IPWEA National Conference on Climate Change 'responding to sea level rise', Coffs Harbour, NSW, 35 August 2008. This paper is available at: www.ipwea.org/sustainability/librarydocuments/library/conferencepapers

The four pilots aimed to add value to the VCIDS by producing more detailed inundation and erosion mapping that could be applied at a property level. Different inundation and erosion modelling techniques was trialled for a range of coastline types under a range of sea level rise scenarios. The four pilot locations contain a range of representative geomorphic landforms typically found across Victoria, including high-energy open sandy and rocky/cliffed coasts, and low-energy coastal embayments and estuaries with varying levels of development. A number of locations demonstrate the intercept between fluvial/catchment processes and coastal processes.

Note: The CHAs (3rd Pass Assessments) employed hydrodynamic inundation modelling to generate inundation mapping; the 2nd Pass Assessment employed bathtub or static modelling.

Section 1 – Implementing a CHA

Undertaking a CHA

A Coastal Hazard assessment (CHA) project generally has three stages:
1. Initiation
2. Implementation
3. Review (lessons learned).

Stage 1 – Initiation

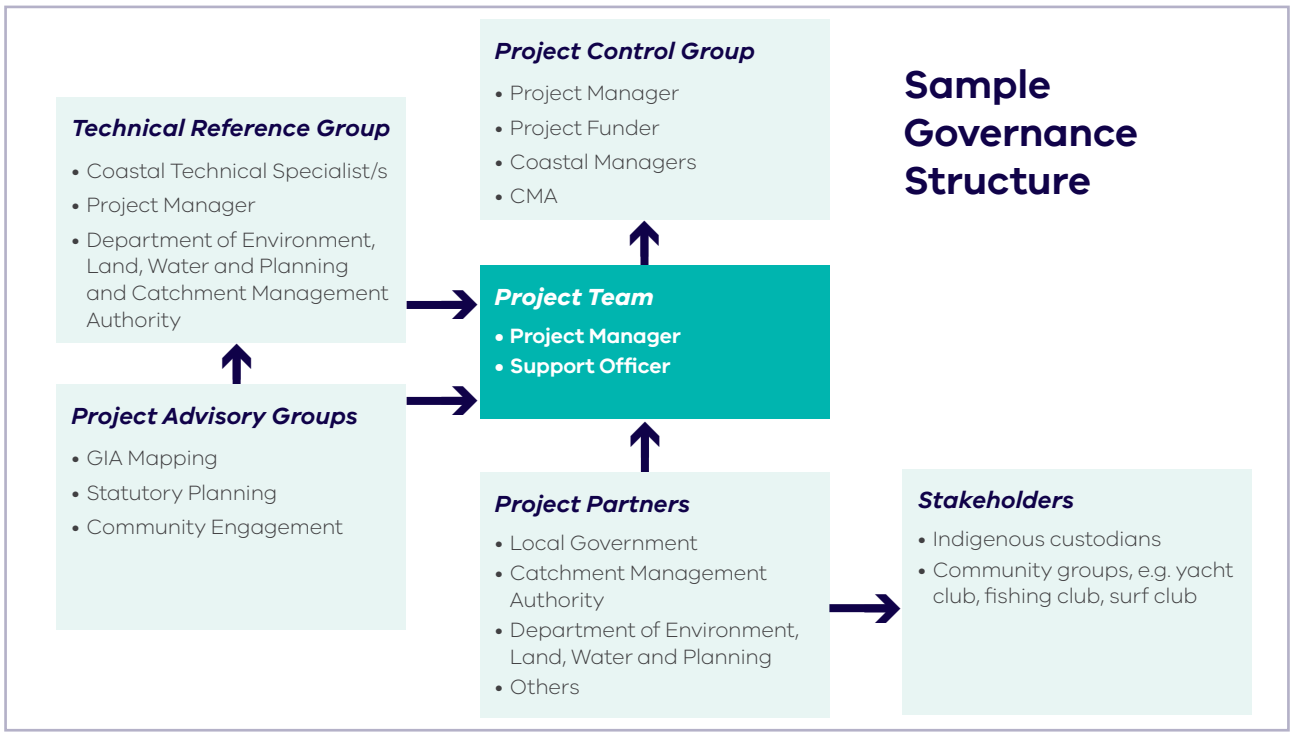
Step 1 – Articulate the problem: why is a CHA required?

The client, in consultation with stakeholders/ partners, articulates the coastal hazard problem, including why a CHA is required for a particular location. This will include explanation of:

- the physical extents of the area to consider
- the potential assets at risk (public/private/cultural/ environmental)
- what the hazard mapping will provide or be used for.

A broad representation of the client/partner interests should be considered to ensure the project covers all the requirements and the deliverables meet required statutory tests. The end use needs of asset owners, land managers, statutory planners and other key partners should inform the development of the Project Brief, including the modelling design requirements.

Key partners may be Local Government, DELWP, CMAs, coastal CoMs. Key stakeholders may be other asset managers, including VicRoads, water authorities, power and telecommunication providers and Indigenous custodians.



Step 2 – Establish governance/ management structures to assist the Project Manager

Identify membership of internal project team, project partners, Project Control Group (PCG), Technical Reference Group (TRG), project advisers (as needed) and key stakeholders.

After the Project Team has been assembled, the Project Manager should:

- Appoint members for the Project Control Group (generally Project Partners).
- Appoint members for the Technical Reference Group and identify the skills they require, such as coastal asset management, community engagement, coastal planning, statutory/ strategic planning, coastal engineering and GIS mapping.
- Identify a Technical Specialist to prepare a scoping paper and assist the Project Team though the course of the project. The Technical Specialist should have high level skills in coastal geomorphology and coastal processes, coastal hazard assessment in relation to inundation, erosion (and potentially landslip, groundwater intrusion) and a good working knowledge of GIS systems.

Budget for a communication/community engagement strategy, possibly delivered through an additional consultancy/specialist. The CHA final report, including the hazard mapping, will attract significant interest from both affected and non-affected landholders. An effective community engagement program will provide the foundation for successfully implementing future planning scheme controls and help identify community values and priorities for longer-term adaptation plans.

Step 3 – Engage Technical Specialist (for Phase 1 & 2) and Peer Reviewers (for Phase 2 only)

The Technical Specialist assists the project team make critical technical decisions and assess the quality of outputs.

The Peer Reviewer's role is to assess quality of outputs in relation to the intended end use, e.g. local planning decisions.

Step 4 – Prepare scoping paper

A key role/deliverable for the Technical Specialist is the preparation of a scoping paper that:

- identifies and maps study area coastal compartments
- describes key features in those compartments, e.g. coastal processes, assets, landform type, sub-locations, existing risks
- recommends the details for modelling in each compartment, e.g. how many scenarios to model, considering regional and Local Government priorities
- gives indicative costings for Phase 1 and 2 work itemised by Local Government area
- identifies the specific consultancy skill sets required to deliver the project, e.g. geology, coastal geomorphology, sediment transport, coastal morphodynamics, groundwater
- drafts Project Brief and Technical Specification for Phase 1 (Data accumulation and gap analysis) and Phase 2 (CHA)
- provides information for Step 5.

Step 5 – Assemble baseline information using project partner internal resources

For example, this could include coastal process reports, dredging reports, erosion reports, flood study reports, bathymetry maps, etc. The Technical Specialist can help partners identify relevant internal reports.

Step 6 – Finalise Project Brief and Technical Specifications

The Project Brief must clearly identify the two phases of implementation.

Phase 1 – Data accumulation and gap analysis

The consultant identifies and compiles existing data from a range of sources (external to project partners' libraries) that can provide background context and inform project outputs. Once compiled, the data sets should be analysed to identify any critical data gaps. This data includes:

- previous coastal process reports that may have been required to support dredging works, asset construction, sand re-nourishment and planning permit applications involving coastal development
- historical storm tide data
- historical wave/swell data
- historical and current day bathymetry maps
- previous catchment flood studies (where estuaries are involved)
- historical photographs
- historical newspaper reports of high-impact events.

Phase 2 – Coastal Hazard Assessment

The consultant uses the data sets compiled in Phase 1 to contextualise the study area, undertake inundation/erosion modelling, prepare hazard mapping and prepare the final report.

The following notes will assist with the preparation of the Project Brief and Technical Specifications.

- A Project Brief and Technical Specifications should be prepared in consultation with the Technical Specialist and the Technical Reference Group.
- The sample Project Brief and Technical Specifications (Section 3 of this document) includes the background Data accumulation and gap analysis (Phase 1) and the CHA (Phase 2).
- The Project Brief and Technical Specifications must list the data sets and information that will be provided by the client.
- It is important to develop the Project Brief and Technical Specifications before the Expression of Interest (EOI) stage as it will provide greater context and clarity for prospective tenderers.
- Separating the Project Brief section from the Technical Specification, which outlines the tender and evaluation process, provides a more efficient modular system for compiling an EOI.
- Local government statutory planners, asset managers and GIS staff should be involved in developing the Project Brief and Technical Specification to help identify those sections of coastline where a high detail/high effort assessment is required and to provide appropriate specification of required outputs, such as mapping.

Key decision point

The Technical Specialist consults with local government statutory planners, asset managers and GIS staff to identify those sections of coastline requiring high, moderate and low detailed assessments. The Technical Specialist also helps identify regional and local priority modelling locations.

Not all sections/compartments of coastline will require the same level/detail of assessment, so the quality of baseline information required will vary. The detail and investment effort of the assessment must meet the needs of end users. For example, if the end product is to be used for local-scale statutory planning decisions, high detail/high effort assessments are required.

Step 7 – Pre-qualification/Expression of Interest

Due to the specialist nature of the work, consider a pre-qualification process with a request for an Expression of Interest (EOI) followed by a tender process (Step 8) for shortlisted consultants.

The EOI request should:

- describe the project scope and requirements (i.e. the Project Brief and Technical Specifications)
- identify the information (track record, relevant experience, etc) required from the consultants
- identify the need for a collaborative team across disciplines
- specify skills and weightings that respond to the local context (geology, coastal geomorphology, coastal sediment transport/coastal morphodynamics, groundwater)
- outline the selection process and anticipated program.

The review of the EOIs should evaluate the proposed consultant team's skills, experience and composition.

Limit the EOI stage to track record, relevant experience, quality and health and safety. Indicative methodology statements are typically of little value and do not necessarily demonstrate sufficient knowledge or skills.

Key decision point

With assistance from the Technical Specialist/s, shortlist the consultants who lodged EOIs.

Step 8 – Tendering and selection of consultant

Provide short-listed consultants with a Project Brief and Technical Specifications and request a detailed methodology, program and detailed costings for Phase 1 and 2 works (see Section 3).

The methodology, program and costing must consider any important data gaps identified in Phase 1 and clearly articulate the potential impact of such gaps on the Phase 2 scope, cost and milestones. If the work required to address the gaps is significantly outside the original budget and Project Brief, the Project Manager will need to halt the project. The contract should clearly identify the potential for the project to stop at this point.

There is significant benefit in having the same consultant involved in Phase 1 (Data accumulation and gap analysis) and Phase 2 (Coastal Hazard Assessment).

Key decision point

Check that required skill sets identified by Technical Specialist/s are present in the consultant's proposed team

Through a full review and analysis of the proposed methodology, assess whether the consultants have prioritised project team members' time contributions appropriately, demonstrated a clear understanding of the project requirements, and developed a clear methodology to achieve the project requirements.

Use the inception meeting with the preferred consultants to further fine tune the project methodology.

Stage 2 – Project implementation

Phase 1 – Data accumulation and gap analysis

Step 1 – Inception meeting

This meeting includes the consultant, Project Manager and Technical Specialist.

Step 2 – Implement Phase 1

Compile all relevant reports / information into a single data base

All relevant baseline information (i.e. past coastal process reports/studies, technical reports supporting infrastructure developments, bathymetry maps, photographs, media articles, wave/swell data, storm data including impact data) for the particular hazard assessment and location should be assimilated into an easily accessible data base.

If the baseline information is of poor quality or contains significant gaps, the level of assessment – and therefore the reliability and usability of the output – will be reduced. This does not, in itself, rule out the value of carrying out an assessment, but does inform both the 'stage' of the assessment – and therefore its scale (i.e. high level/regional or refined/detailed) – and the likely work required in the study to develop an understanding of the geomorphology and physical processes to enable a hazard assessment to be completed.

Note: A communication/community engagement strategy should be prepared early in Phase 1. A community 'open house' during Phase 1 can be a valuable source of information including historic photographs, charts and newspaper articles, all of which can be included in Phase 1 outputs.

Assess data sets and identify critical data gaps

The consultant's detailed draft report will cover the existing site context based on the baseline information and site inspections, geomorphic processes and observed historical changes. The report should include:

- An easily accessible data base of all relevant identified information, including instructions/guidance on the filing system used to compile the data base.
- Analysis and critical assessment of the data base and background information supplied to the consultant with the Project Brief and Technical Specifications and augmented by the consultant's team through site visits, field investigations and other methods as outlined in the consultant's methodology.
- A description of the relevant coastal processes and geomorphology from baseline information and preliminary investigations with details and justification of the sub-cell delineation.
- Identification and ranking of potential data gaps and their possible consequences for the project outcomes. Where the gap is significant and has a material effect on the hazard assessment, approaches to address the gap should be described, with indicative costs.

Step 3 – Finalise Phase 1 report

Comments on the draft report from the client, Technical Specialist/s (and potentially peer reviewers) need to be considered and addressed in the final draft report before implementing Phase 2. The final report should provide a detailed itemised budget to complete Phase 1 (if required) and Phase 2. The contract should provide for hold points and the options to proceed as outlined below.

At this point, the Technical Reference Group needs to advise the Project Control Group on the best option to proceed.

HOLD POINT AND DECISION POINT

There should be a hold point at the end of Phase 1 to:

1. **Review the findings and recommendations of the Phase 1 final report.**
2. **Decide whether to proceed immediately to Phase 2 or whether to hold the project (if significant data gaps have been identified).**
3. **If a decision is made to hold the project, identify funding sources to carry out recommended additional works.**
4. **Identify the sea-level rise (SLR) scenarios, storm tide and catchment flooding events to be modelled in Phase 2.**

These decisions will require advice/support from the Technical Specialist in consultation with the Project Control Group. A Peer Reviewer may also be engaged to assist.

The options to proceed include:

1. **If no significant data gaps have been identified, progress to Phase 2 with the incumbent consultant.**
2. **If significant data gaps have been identified, stop all work. Technical Reference Group and Project Control Group decide whether additional works to address data gaps can be achieved through:**
   - **a contract variation with the incumbent consultant**
   - **a secondary specialist consultant.**
3. **Incumbent consultant proceeds to Phase 2 when additional works have been completed.**

Phase 2 – Coastal Hazard Assessment

Step 1 – Inception meeting

At the inception meeting, the Project Manger, Technical Specialist and consultant review the outputs of phase 1 and discuss the proposed method to deliver phase 2.

Step 2 – Prepare detailed final project plan

The consultant prepares a detailed project plan/ methodology. This is reviewed by the Technical Reference Group and endorsed by the Project Control Group.

A detailed final project plan should include:

- Identification of all of the different coastal shoreline types required to be assessed and detailed descriptions of the methodologies to derive hazard types for each coastal shoreline type.
- Identification of the scenarios to be assessed and how the proposed methodologies take into account knowledge and data gaps identified from the baseline data review.
- Detailed description on how the hazard mapping will be carried out for each coastal shoreline type and what will be delivered.
- Quantification of all initial assumptions and proposed approaches, and the practical implications of those assumptions and uncertainties on the hazard assessment (with a sensitivity analysis on key parameters).
- Confirmation that the data and methodologies proposed will meet the desired outcomes – or recommendations on essential work required to achieve the desired outcomes.

Step 3 – Implement the CHA

The consultant implements the endorsed final project plan.

Step 4 – Produce draft report

The consultant submits the draft report to the Project Manager. The Technical Reference Group (which includes the Technical Specialist) and the Project Manager provide feedback to the consultant. The contract should provide for two iterations of the draft. A draft report should include:

- A comprehensive description of the relevant coastal processes and geomorphology with details and justification of the sub-cell delineation. This is likely to be a refinement of the assessment in the scoping report, updated with the findings from the completed study.
- Identification of all the coastal shoreline types assessed and detailed descriptions of the methodologies used to derive hazard types for each type.
- Identification of the scenarios assessed and how the methodologies took into account knowledge and data gaps identified from the baseline data review.
- Quantification of all assumptions and proposed approaches, their practical implications for the resulting hazard assessment, and a sensitivity analysis on key parameters.
- The results of the hazard assessment including likely future changes taking into account climate change effects for the identified scenarios.
- An assessment of the residual information and knowledge gaps and specific recommendations on future requirements for monitoring, including locations and methods.
- An executive summary that includes commentary on how this work could be used to inform future adaptation plans and strategies.
- Detailed modelling and hazard mapping for identified representative locations can be included as appendices to the main report.The following map and data information is to be provided by the consultant team:
  - Digital geo-referenced data, including shape files of inundation hazard areas and erosion lines for current situation and for future sea level rise events combined with agreed joint probability events (presented in Arc View and Map Info).
  - A PMF file including all baseline information (LiDAR and high resolution aerial photographs) together with all GIS data derived from the study, including shoreline cell delineation, the coastal erosion hazard origin and resulting coastal hazard maps to enable information to be viewed in ESRI's ARC reader.
  - GIS data and metadata descriptions in accordance with the required GIS technical specification.
  - Digital field data acquired for the study, including location, elevation and summary output suitable for inclusion in GIS database. The standard of information delivery should be clearly set out in a schedule to the contract.
  - Model set-up and run files for the numerical models used to inform the hazard assessment. The standard of the format requirements should be clearly set out in a schedule to the contract

Note: Community engagement activities should occur throughout Phase 2, particularly when the final report and mapping outputs are delivered. Specialist skills are required to present technical outputs in a format that the general public can understand.

Step 5 – Produce final report

The final draft report is submitted to the Project Manager who requests that a Peer Reviewer provides critical feedback on the final draft report. The Peer Reviewer will:

- assess the methods used to deliver the outputs
- assess the quality of the outputs in relation to the intended end use.
- check that the output (mapping) formats meet those specified in the technical specifications / contract
- check how the consultant quantified the assumptions used to inform the modelling method, and the commentary on the practical implications for the resulting hazard assessment.
- provide comment on sensitivity analysis on key parameters.

HOLD POINT AND DECISION POINT

At this step, there should be a hold point to assess the Peer Reviewer's comments. The Project Manager, in consultation with the Technical Reference Group and Project Control Group, may decide to use the Peer Reviewer's comments to negotiate additional work by the consultant and/or the completion of the final report.

Stage 3 – Project review/reflection

After the project is completed an After Action Review (AAR) should be carried out. AARs reflect on project experiences and lessons, and identify where change is required. The three areas typically covered are:

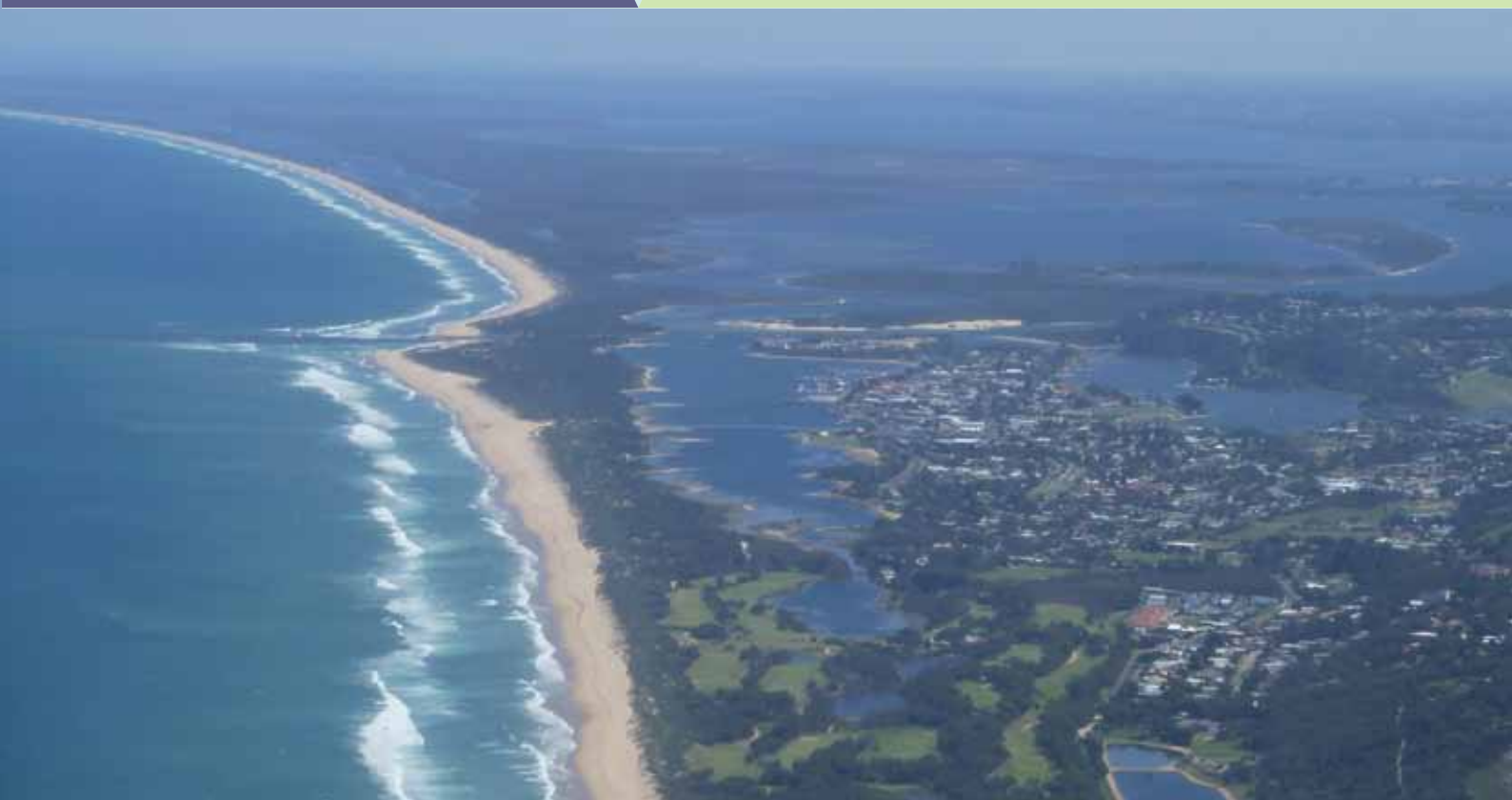
- What worked well?
- What was planned or should have happened but didn't?
- What really happened and why?
- What have we learnt from this and could do differently next time?

Section 2 – Coastal Hazard Assessment Process

Stage 1. Project Initiation		Notes
Step 1	Articulate the problem: Why is a CHA required? Why do it, where we do it and who will do it. Determine project scope and detail level for assessment, i.e. 2nd or 3rd pass.	Identify the physical setting, extent, specific issues, critical locations, specifications including outputs, time frame, sea-level rise (SLR) scenarios, partners.
Step 2	Establish the governance/ project management structures to assist the Project Manager.	Include key partners, technical advisers and decision authorisers (highest level available).
Step 3	Engage Technical Specialist (for Phase 1 and 2) and Peer Reviewer (for Phase 2 only).	The Technical Specialist assists the project team make critical technical decisions and assess quality of outputs. The Peer Reviewer's role is to assess quality of outputs in relation to the intended end use, e.g. for local planning decisions.
Step 4	Technical Specialist prepares scoping paper.	Scoping paper includes: Identification and mapping of study area coastal compartments Descriptors of key features in compartments, i.e. coastal processes, assets, landform type, sub-locations, existing risks. Recommendations for detail of modelling for each compartment, i.e. how many scenarios to model. Consider regional and Local Government priorities. Advice on partners' internal data capture. Identification of the specific consultancy skill sets required to deliver the project (i.e. geology, coastal geomorphology, sediment transport, coastal morphodynamics, groundwater). Indicative costings for Phase 1 and 2 work itemised by Local Government area. Draft Project Brief and Technical Specification for Phase 1 (Data accumulation and gap analysis) and Phase 2 (CHA).
Step 5	Assemble relevant baseline information using project partners internal resources.	Coastal process reports, flood studies, bathymetry maps, etc.
Step 6	Finalise the Project Brief and Technical Specifications for Phase 1 (Data accumulation and gap analysis) and Phase 2 (CHA).	Technical Specialist; Project Manager; GIS, planning and asset management staff
Step 7	Test Expression of Interest; pre-qualification of consultants.	Can be an effective way of shortlisting consultants.
Step 8	Tender works and appoint consultant.	

Stage 2. Project Implementation		
Note	**In Phase 1, a Communication and Engagement (C&E) Strategy should be developed and the early part of that strategy (e.g. a community forum) implemented. Engagement activities should ideally run throughout both Phase 1 and 2 with an increased effort when the final report and mapping outputs are released. Specialist engagement skills will be required to develop and deliver the C&E strategy. The Project Manager will need to identify and recruit internal skills or otherwise procure a consultant's services.**	
PHASE 1		
Step 1	Inception meeting for Data accumulation and gap analysis (Phase 1). Phase 2 also discussed.	Consultant, Project Manager and Technical Specialist.
Step 2	Implement Phase 1 Assess data sets and identify any critical data gaps	 Will the data gap have significant implications for the reliability and usability of the hazard mapping? The Technical Specialist or Peer Reviewer to do this.
Step 3	Finalise Phase 1 Report If no significant data gaps proceed to Phase 2. If significant data gaps put project on hold	Contract should provide for 2 draft iterations. To address data gap use the incumbent consultant if possible (with contract variation). Otherwise use additional specialist contractor.
PHASE 2		
Step 1	Inception meeting for Phase 2.	Project Manager, consultant and Technical Specialist. Review Phase 1 outputs and discuss Phase 2 method.
Step 2	Consultant submits detailed project plan/methodology.	Technical Reference Group and Project team provide feedback. Project Control Group endorses final project plan.
Step 3	Implement Coastal Hazard Assessment.	
Step 4	Finalise draft report.	Contract should provide for two draft iterations. Technical Reference Group has a key role in checking that all outputs have been delivered to the required standard.
Step 5	Produce final report. Peer review of final draft report.	The Peer Reviewer is usually an academic and must be independent of the organisation and consultant. Their role is to: • assess methods and assumptions used to deliver outputs • assess quality of outputs in relation to the intended end use • check that output formats meet those specified in technical specification/contract.
Step 6	Finalise report	Project Manager negotiates with consultant.
Stage 3. Project Review and Reflection		
	Implement an After Action Review.	*What worked well?* *What was planned or should have happened but didn't?* *What really happened and why?* *What have we learnt from this and could do differently next time?*

Section 3 – Project Brief and Technical Specifications



Guidance is provided in brown italics with recommended text wording in black.

This section provides separate project briefs/technical specifications for:

a. *Coastal Inundation Assessment – Catchment Management Authorities have extensive experience in delivering catchment flood studies. Here, the Glenelg-Hopkin CMA's template catchment flood study project brief/technical specifications document has been modified to account for flooding from the sea (coastal inundation).*

b. *Coastal Erosion Assessment – The project brief/technical specifications for the erosion study have been derived from those used in the four Coastal Hazard Assessment pilot projects.*

A coastal hazard assessment is generally a two-phase process. The outputs of Phase 1 inform and ultimately determine the quality of Phase 2 outputs. Experience with the four pilot CHAs has shown that there are a number of advantages in using the same consultant to deliver Phase 1 and 2 under the same contract.

Phase 1: *Data accumulation and gap analysis*

Phase 2: *Coastal Hazard Assessment Modelling and Mapping*

Phase 2 outputs (for both inundation and erosion assessments) can be used to:

- *define coastal erosion and flood related controls in the relevant council's planning scheme*
- *design coastal erosion and flood mitigation works and activities*
- *develop coastal erosion and flood intelligence products and inform emergency response planning*
- *assist in the preparation of community coastal erosion and flood awareness and education products*
- *identify options for improved coastal erosion and flood warning arrangements*
- *inform coastal asset maintenance and renewal schedules.*

The contract to deliver Phase 1 and 2 may include delivering part/all these points.

The level of assessment (i.e. 2nd Pass or 3rd Pass) that can be delivered using current information/data sources should be identified in the final report of the project's first Phase (Data accumulation and gap analysis). While the client may want a 3rd Pass assessment, the initial data may not be sufficient to deliver this without more specific studies and building a more comprehensive data base.

If a significant data gap is identified in Phase 1, put the project on hold and make provision to address the data gap before Phase 2 begins. A significant data gap, if not addressed, will compromise the accuracy of the modelling, and the reliability and usability of the mapping outputs and other project products.

Before Phase 1 begins, the project partners should identify previous studies, baseline information and data sets, (and the formats they are available in) they currently hold include them as a separate schedule to the Project Brief and Technical Specifications.

An overview of the types of assessments is set out in the paper of Sharples et al (2008).

Section 3a: Coastal Inundation Hazard Assessment Project Brief and Technical Specifications

Project purpose

The first step is to articulate the coastal hazard problem: why a coastal hazard assessment is required for this particular location, including a description of key assets or values. This helps define the aims, scale and extent of the assessment.

This section of the Project Brief needs to succinctly explain the physical setting, the potential assets at risk (public/private/cultural/environmental) and what hazard mapping will provide or be used for. This helps determine the scale of assessment. Use the scoping document prepared by the Technical Specialist. See Stage 1, Step 4 in the CHA Process Table (Section 2).

The purpose of the project is to identify key coastal/estuarine processes and coastal/estuarine hazards for the entire coastal system and to assess and map the existing and potential extents of the coastal hazards, both at a regional scale for the full project extent and in detail at critical locations including hard and soft coasts within the project area.

The project contract may also include the development of additional products that will address:

- mitigation works
- planning scheme amendments
- the Municipal Emergency Management Plan
- community awareness and preparedness.

Background/context

This section should:

- ***describe the client organisation, including project partners and their relationship and the origin and context of this specific work package***
- ***identify the policy and strategic drivers for this work, i.e. coastal management plan, coastal precinct plan, regional coastal action plan, council planning scheme***
- ***provide commentary on existing critical local issues whose management will be informed by the CHA outputs (critical local issues include coastal inundation and erosion in or adjacent to activity nodes and identified weaknesses in dune systems that could exacerbate flooding).***

Project aims

The Coastal Hazard Assessment aims to:

- improve understanding of the coastal and geomorphic processes that are shaping a coastline
- quantify the coastal hazards, considering the potential consequences of climate change.
- provide comprehensive data sets that will help predict the coast's susceptibility to recession, erosion and inundation
- provide data sets that can be readily incorporated into the Victorian Datamart and the Victorian Flood Database
- provide data sets that will directly inform regional, township and local strategic planning, adaptation/mitigation planning, emergency response planning and community engagement
- identify knowledge and data gaps and additional works that are required to improve future refinements of coastal hazard assessments.

Hydrodynamic modelling data files derived from the project must be in a format that is readily incorporated into the Victorian Datamart and the Victorian Flood Database (see Technical Specification Section).

Study area

Show the full project extent on a map and spell out key assets and/or values. Describe critical locations within the study area and identify them on the map:

Supply a shape file of the project extents to the successful tenderer at the initiation of the project.

Scope and method

The project scope and method must account for the processes and environmental conditions that can result in variable flood hazards along the subject area, which includes factors such as landform, topography, natural and build barriers, bathymetry, wave exposure, and anthropogenic factors.

The investigation will:

- review the available data and obtain necessary data to complete the investigation
- develop best practice hydrological and hydraulic models (hydrodynamic) for the study area and other high-priority activity nodes as decided by the Project Control Group
- consider the coincidence of catchment and extreme sea events (include if relevant)
- determine coastal flood information for a range of flood modelling scenarios (see Technical Specifications).

Optional works:

- develop draft coastal flood intelligence and response documentation for inclusion in the flood sub-plan of the Municipal Emergency Management Plan
- analyse options for structural and non-structural mitigation to alleviate coastal flooding
- analyse existing coastal flood warning arrangements and provide options for improvement in the context of a total coastal flood warning system
- deliver draft mapping (potentially UFZ, FO and LSIO) for amendment of the planning scheme reflecting the investigation results
- provide a complete and concise final report outlining the process and deliverables of the investigation
- clearly identify information gaps and limitations of the methodology and the effect of these on the hazard assessment and the reliability and usability of the project mapping outputs
- recommend future information requirements to improve understanding of coastal inundation hazards and enable refinement of the coastal hazard extents
- respond to the independent Peer Reviewer/s on the draft outputs of the CHA.

Available data

The following data will be provided where it exists and where it is relevant to the stated contract outputs:

- copies of relevant previous studies/investigations
- previous hydrologic model
- previous hydraulic model
- coastal flood frequency analyses
- coincidental coastal and catchment frequency analyses.
- storm tide data
- wave run up/set up data.
- observed coastal flood level data
- historical coastal flood records including written accounts, photography and video/film footage
- GIS tables (Mapinfo or ArcGis) including:
  - contour and survey information, including LiDAR
  - floor level data (this data may need to be collected by the consultant if existing data is incomplete or inadequate)
  - drainage and road infrastructure data
  - cadastral information (such as properties/ parcels, roads)
  - previous mapping data
  - non-flood aerial photography
  - coastal flood aerial photography
  - relevant catchment flood data and historical levels.

- limited hard copy/scanned maps of drains, channels, road crossings/bridges may be available, however the tenderer will need to undertake site survey to confirm accuracy and completeness (the inception meeting will include an opportunity to inspect the study area with Council representatives)
- a summary of existing information held by project partners in an agreed format
- planning scheme information is available at www.delwp.vic.gov.au/planning/planningschemes

There may be further data available that will benefit the project that is not held by the council. The consultant is required to undertake their own enquiries to seek additional data and information that may advance this project.

All digital files will be provided to the successful tenderer.

Project milestone outputs

1. Phase 1 (Data Assimilation and Gap Analysis) Final Report.
2. Project Plan for Phase 2 work (outputs 3 to 8)
3. LiDAR Data Validation Report
4. Topographic and Contruction Survey Report
5. Hydrologic Analysis Report (including sensitivity analysis)
6. Hydraulic Modelling Results Report (including sensitivity analysis)
7. Hydrodynamic Modelling Mapping (for selected scenarios) and Report.
8. Final consolidated report containing outputs 3 to 7.

Value adding to project outputs

Project outputs can be used to:

- develop coastal erosion and flood intelligence products and inform emergency response planning
- identify options for improved coastal erosion and flood warning arrangements
- design coastal erosion and flood mitigation works and activities
- define coastal erosion and flood related controls in the council planning scheme
- assist in the preparation of community coastal erosion and flood awareness and education products
- inform coastal asset maintenance and renewal schedules.

Additional value-adding milestone outputs (depending on the scope of works specified in the contract:

- flood intelligence report
- flood damage and mitigation report
- planning scheme amendment documentation
- visual media to be used for community engagement.

The study outputs will be subject to independent technical review at the discretion of the Project Control Group. Reviews of outputs are likely to occur at key 'hold' points. Subsequent stages of work may not be accepted by the Project Control Group until each 'hold' point milestone has been reviewed and formally approved.

Project inception

The council will provide all relevant data on execution of the contract and data share agreements where applicable.

The successful tenderer will be required to attend an inception meeting to consolidate the project methodology and agree on any variations to the tender.

A study area tour will give the consultant a better understanding of the area. Of particular interest are:

- land use types and variation across the study area
- coastal protection structures and key coastal assets
- hydraulic structures
- historic flood marks
- possible mitigation concepts.

Phase 1 – Data accumulation and gap analysis

The first Phase involves:

1. A detailed analysis of background data and information identifying knowledge or data gaps, discussing the effect these gaps will have on the inundation hazard assessment. The consequence of the knowledge or data gap should be assessed and, where critical to the outcomes of the inundation hazard assessment, effective measures to fill in these gaps should be described as recommended activities to be carried out before Phase 2 begins. Where knowledge or data gaps are not critical, their potential effect on the outcome of the hazard assessment should be defined.
2. The delineation of the shoreline into logical cells based on geology, landform, exposure and coastal/estuarine processes.
3. A project plan for Phase 2.

The project plan should describe the proposed methodologies for assessing the coastal inundation hazard for each cell including the effects of future sea level rise. Appropriate methods should be used to model future inundation scenarios under the assumption that future areas exposed to inundation will partly be determined by topographic changes due to shoreline erosion and recession. The methodologies developed should:

- be specifically tailored for the study area and take into account previous, data and information sets, the topography, geomorphology, coastal processes and geology of the subject site
- take into account protective structures, assuming these will be present and maintained for the next 100 years and the erosion/inundation effects of these being not present
- clearly identify and quantify uncertainty in each of the parameters used to assess the hazard and the implications of uncertainty on the resulting hazard extent through a sensitivity assessment
- provide for detailed assessments and modelling at the specified critical locations within the study area, specifics of the scenarios and assessment methods to be used should:
  - be based on a finer resolution digital elevation modelling than used for the regional assessment and that includes critical features, such as levees, flood control works, etc
  - include wave climate consideration and its variability, incorporating swell and fetch modelling as appropriate, together with impact modelling for extreme events in the combinations set out in Table 1 (see below).
  - include typical tidal and storm surge variability (including consideration of inter-annual and inter-decadal sea-level variability for the region, insofar as available data allows), together with extreme events in the combinations set out in the Technical Specifications section
  - include near-shore processes of wave set-up/run-up and overtopping, where appropriate, with extreme events in the combinations set out Technical Specifications section
  - include ground level survey data of past storm tide events where available.

A draft data accumulation and gap analysis report and draft Phase 2 project plan are needed for the final report.

The report should contain:

1. A detailed Phase 1 final report that provides commentary on the existing study area context based on a review of the baseline information provided to the consultant, additional data sets/ information identified by the consultant, and site inspections/field investigations, including:

- analysis and a critical assessment of the baseline data and background information supplied with the tender documents and augmented by the consultant's team through site visits, specific field investigations and identification of externally held data sets
- a description of the relevant hydrologic, hydraulic processes and geomorphology (landform) derived from baseline information and preliminary investigations with details and justification of the sub-cell delineation
- identifying potential data gaps and the possible consequence these data gaps will have on the project outcomes; this should include a ranking of the gaps in terms of potential consequence on the outputs
- descriptions of approaches to address significant gaps that will affect the quality of the outputs; this may include recommendations for additional works
- identification of all of the different coastal shoreline types required to be assessed and detailed descriptions of the methodologies to derive hazard assessment for each coastal shoreline type
- identification of the scenarios to be assessed
- quantification of all assumptions and proposed approaches and the practical implications of those assumptions and uncertainties on the resulting hazard assessment with a sensitivity analysis on key parameters.

2. Project Plan for Phase 2.

3. A proposed Phase 2 final report structure

This is a hold point

The project should not proceed until the Data accumulation and gap analysis report has been approved/endorsed by the Project Control Group.

Phase 2 – Inundation modelling and mapping

Phase 2 cannot begin until the Project Control Group has endorsed the Phase 1 final report and addressed any critical identified data gaps. Phase 2 has a number of hold points where the Project Control Group will review and analyse milestone outputs for endorsement.

Work elements for Phase 2 include:

Topographic data validation

Field survey is required to confirm the accuracy of LiDAR data used for the investigation. Consultants are to identify locations where survey alignments are required to validate the accuracy of the LiDAR. The consultant must prepare a brief for a topographic data validation survey and return to the Project Manager. Tenderers are not required to cost the survey component of the topographic data validation as part of their proposal.

Other topographic and construction survey

A survey of available flow area at road crossings, waterway cross sections, drainage infrastructure and building floors within the 1% Annual Exceedance Probability flood extent is likely to be required, depending on the amount of suitable data already available.

Tenderers are required to nominate a reasonable number of survey tasks to deliver the required Investigation outputs. Tenderers are *not* required to cost the topographic and construction survey as part of their proposal.

This is a hold point

Do not proceed with the project until these first two steps have been reviewed and approved in writing by the Project Control Group and Technical Reference Group.

Hydrologic analysis

A flood frequency analysis and hydrological model is to be developed (or amended) for the study area coastline/estuary. Tender submissions should detail the methods to determine and calibrate hydrology for the coastline/estuary.

A hydrology modelling results report is needed and will be inserted into the final report. The report will be reviewed by the Project Control Group and Technical Review Group.

This is a hold point

Do not proceed with the project until the hydrologic analysis has been reviewed and approved in writing by the Project Control Group.

Hydrologic model

The hydraulic model will be developed (or amended) for the study area. For riverine flood investigations, tender submissions should detail the method to construct a TUFLOW model and how calibration will be achieved and measured. For example, the Glenelg Hopkins CMA uses TUFLOW and requires hydraulic models for riverine flooding to be completed using this software.

There is not currently a preferred hydraulic model package for coastal flood investigations and this is open to recommendations from tenderers. Recommendations for hydraulic modelling packages suited to coastal inundation investigations must be accompanied by evidence supporting the use of the recommended application in the context of coastal flood mapping.

A hydraulic modelling results report will be inserted into the final report. All hydraulic model input and run files are to be provided to the council when the project is completed.

This is a hold point

Do not proceed with the project until the hydrology and hydraulics report has been reviewed and approved in writing by Project Control Group.

Sensitivity analysis

The sensitivity analyses shall be undertaken which will include, but not limited to, the following model parameters:

- overtopping of foredune and protective structures
- catchment storage
- roughness coefficients
- blockage factors
- boundary conditions.

Sensitivity analysis results will be required in the relevant hydrologic or hydraulic modelling report.

A sensitivity analysis should also be undertaken on assumptions that have informed the modelling method.

Technical specifications for Phase 2 outputs

Table 1: Technical specifications for inundation modelling.

Sea level rise (m)	Tide	Coastal Storm (year AEP)	Catchment Flow (Year AEP)
0	MHWS	20%, 10%, 5%, 2%, 1%, 0.5% and 0.2% AEP	
		1%	1% and 10%
0.2	MHWS	20%, 10%, 5%, 2%, 1%, 0.5% and 0.2% AEP	
		1%	1% and 10%
0.4	MHWS	20%, 10%, 5%, 2%, 1%, 0.5% and 0.2% AEP	
		1%	
0.8	MHWS	20%, 10%, 5%, 2%, 1%, 0.5% and 0.2% AEP	
		1%	1% and 10%
1.2	MWHS	20%, 10%, 5%, 2%, 1%, 0.5% and 0.2% AEP	
		1%	1% and 10%

Scenario modelling

Scenarios to be modelled include:

- 20%, 10%, 5%, 2%, 1%, 0.5% and 0.2% annual exceedance probabilities (AEP) for coastal storm event
- 1% AEP coastal storm event coincidental with 1% and 10% AEP catchment flow
- historic calibration and verification events
- present day, 0.2, 0.4, 0.8 and 1.2m rise in mean sea level scenarios
- storm surge scenarios for the full range of design flood for existing mean sea level and sea level rise scenarios (as listed above)
- provide all modelled scenarios in VFD-compliant format (specifications available from DELWP)

Distinguish each output using specific naming conventions:

Town_Year_Parameter_Event_SeaLevelRise_IncreaseRainfallIntensity_StormSurge

Format for maps and data outputs

Partner GIS/data storage specialists should be consulted when preparing this section of the technical specifications. The mapping output files must be in format that can be readily incorporated into:

- ***partners' existing GIS***
- ***the Victorian Datamart and the Victorian Flood Database.***

Specifications generally required by local government and CMA partners include:

- Digital geo-referenced data, including shape files of inundation hazard areas and erosion lines for current situation and for future sea level rise events combined with agreed joint probability events (presented in ArcGIS and Map Info format). All baseline information (LiDAR and high resolution aerial photographs) together with all GIS data derived from the study, including shoreline cell delineation, the coastal erosion hazard origin and resulting coastal hazard maps.
- GIS data and metadata descriptions in accordance with the required GIS technical specification
- Digital field data acquired for the study, including location, elevation and summary output suitable for inclusion in GIS database. The standard of the format requirements should be clearly set out in a schedule to the contract.
- Model set-up and run files for the numerical models used to inform the hazard assessment.

Specifications required by the funder (DELWP) (for incorporation into the Victorian Datamart) include:

- comprehensive documentation of metadata
- ArcGIS format (not Mapinfo)
- vector attribute headings (column headings) should be 10 characters or less
- at least one attribute column that has a unique identifier number
- the project report on an externally hosted website, i.e. local government
- project report copyright/disclaimer statement consistent with the terms of the consultant's contract (ideally creative commons)
- clarity on which project outputs are original products, not a subset of an existing data set (e.g. a state-wide data set).

Specifications required by the funder (DELWP) (for incorporation into the Victorian Flood Database), include:

- All inundation data sets provided in VFD2 format (latest specs available on request), including:
  - Data tables
  - Rasters:
    - Depth
    - Water Surface Elevation
    - DTM
  - Vectors:
    - study area
    - flood extents
    - water velocity
    - historic spot heights (are these being collected as part of model calibration/verification?)
    - levees
    - photo points.

The following tables outline the parameters and outputs required for modelling and the formats and naming conventions.

Parameter

Output Parameters	Output Type	Naming Convention	Format
Water Surface Elevation	Grid	WSE	.ers and ESRI Ascii
Depth	Grid	DEP	.ers and ESRI Ascii
Velocity	Grid	VEL	.ers and ESRI Ascii
Hazard	Grid	HAZ	.ers and ESRI Ascii
Flood Extent	Polygon	EXT	.tab and .shp
Velocity Vectors	Polyline	FLO	.tab and .shp
Flood Level Contours	Line	FLC	.tab and .shp

Event

Event	Naming Convention
Historic Flood Events (e.g. 1946)	#### (e.g. 1946)
20% AEP Flood Event	5y
10% AEP Flood Event	10y
5% AEP Flood Event	20y
2% AEP Flood Event	50y
1% AEP Flood Event	100y
0.5% AEP Flood Event	200y
0.2% AEP Flood Event	500y
0.1% AEP Flood Event	1000y
Probable Maximum Flood	PMF

Sea level rise

Scenario	Naming Convention
0.0m Sea Level Rise	0-0SLR
0.2m Sea Level Rise	0-2SLR
0.4m Sea Level Rise	0-4SLR
0.8m Sea Level Rise	0-8SLR
1.2m Sea Level Rise	1-2SLR

Storm surge

Scenario	Naming Convention
10% AEP storm surge	10ySS
1% AEP storm surge	100ySS

Climate change – increased rainfall intensity

The following table gives naming conventions for increased rainfall intensity scenarios, however, the consultant is required to investigate best practice in modelling climate change scenarios and recommend scenarios for approval by the Project Manager before climate change modelling is undertaken.

Scenario	Naming Convention
10% increase in intensity	10IRI
20% increase in intensity	20IRI
30% increase in intensity	30IRI

All relevant details regarding scenarios modelled are to be provided in a metadata README.txt file.

This is a hold point

Do not proceed with the project until the modelling report has been approved in writing by the Project Manager.

Optional outputs, depending on contract requirements

Community engagement and consolidation

The consultant will accompany the relevant CMA and Council in engagement and consultation with the community. They will provide guidance and support in collecting local knowledge and information relating to flooding (coastal, stormwater and riverine) and collating community views on potential mitigation options. This will include producing surveys to collect information and documenting the information received. The consultant will be required to provide presentations on project progress and output development at up to four community consultation sessions. The CMA's Project Manager will be responsible for organising community consultation sessions and relevant media releases.

Formal community consultation is to be undertaken at the following stages:

- during the project data review – introduction of the project and initial data collection – community survey
- at the completion of the scenario modelling – review of results produced and results of community surveys and community input into mitigation options
- at the completion of the flood damage and mitigation analysis – presentation of outcomes of mitigation options and assessment
- at the completion of the investigation – presentation of results and discussion of further work.

Flood intelligence documentation

Flood intelligence information is to be recorded for each scenario modelled with the exception of 0.2% AEP, PMF and climate change scenarios. This may include:

- properties affected
  - depth of flooding over floor – linked to gauge and and/or event
  - depth of flooding on property – linked to gauge and/or event
  - likely duration of flooding during 1%AEP events
- roads affected
  - depth of flooding over floor – linked to gauge and/or event
  - depth of flooding on property – linked to gauge and/or event
  - likely duration of flooding during 1%AEP events
- warning time available for each scenario
- No Flood/Flood Tool – rainfall intensity and flooding indicator (riverine)
- flood peak calculator - river gauge correlations (riverine)
- flood peak travel time calculator (riverine)
- draft documentation for insertion in the Municipality Flood Emergency Plan.
- flood intelligence cards for affected properties
- compilation of information for a local flood guide.

Current specifications for Municipal Flood Emergency Plans (MFEPs) and Local Flood Guides (LFGs) and flood mapping specifications are available from the Victoria State Emergency Service website www.ses.vic.gov.au/prepare/em-planning/flood-planning or contact ems@ses.vic.gov.au

This is a hold point

Do not proceed with the project until the flood intelligence report has been approved in writing by the Project Manager.

Flood damage and mitigation analysis

Current conditions damage assessment

The investigation will include an estimate of the annual average damages cost likely to result from a:

- 1% AEP present day storm tide
- 1% AEP storm tide combined with a 10% AEP catchment flood.

Structural options

The investigation will include an assessment of three modelled structural mitigation options to alleviate flooding in the Study Area. For all modelled scenarios, it will produce a report and map showing:

- the range of potential structural mitigation options including concept costings
- the potential change in flood extent post implementation of the option
- the potential change in flood parameters (WSE, VEL, DEP, HAZ) post implementation of the mitigation option.

Flood warning options

The investigation will include an assessment of all existing flood warning arrangements, and recommend potential improvements for the study area.

In consultation with the community and Project Control Group, the consultant will:

- assess the area's flood warning service needs
- assess the potential benefits of a Total Flood Warning System (TFWS) to reduce flood impacts for the community.

The consultant is to evaluate the potential effectiveness of each element of a TFWS to reducte flood impacts. The flood impacts examined should include direct and indirect impacts, and social/ intangible aspects. The consultant should assess the range of potential benefits for various TFWS configurations. A cost-benefit analysis of potential flood warning improvement options is needed.

Through discussions with the Project Control Group, the consultant is to propose and document a preferred TFWS configuration.

Recommended concepts

The investigation will assess the results of the structural mitigation options and flood warning options and provide recommendations on the best option or combination of options to reduce damages of flooding. This will include a cost-benefit analysis and discussion of each option to support the recommendations.

A report on the flood damage and mitigation options will be developed showing the Annual Average Damages, structural mitigation options, flood warning options and recommended concepts.

This is a hold point

Do not proceed with the project until the Flood Damage and Mitigation report has been approved in writing by the Project Manager.

Model review

When the flood damage and mitigation analysis is completed, the hydrologic and hydraulic models will be required to undergo an independent review with a particular focus on the Mannings N Coefficient. The review will increase confidence in the final outputs and validate the model runs.

The consultant will be required to provide the following for each model:

- completed model, including input and output files
- report stating input parameters that were used by the consultant and mapping of outputs (if applicable).

This is a hold point

Do not proceed with the project until the review has been completed and approved in writing by the Project Manager.

Planning Scheme amendment

Based on the outcomes of flood extent and flood level mapping, consultant will make recommendations regarding appropriate flood-related controls for inclusion in the council Planning Scheme.

A draft explanatory report is required that outlines the flood history, the results of the average annual damages analysis, the rationale for floodway delineation and rationale for application of the recommended zone and/or overlays.

Refer to the *Preparing Planning Scheme Amendment Documentation Guidelines* at the Department of Transport, Planning and Local Infrastructure for information (www.planning.vic.gov.au/planning-schemes/amending-a-planning-scheme)

This is a hold point

Do not proceed with the project until the explanatory report has been approved in writing by the Project Manager.

Visual media

Visual media provides resources for community consultation and information purposes. Avoid technical terminology and/or information that assumes prior knowledge of flooding. The visual media should include:

- animations of the design flood events for community consultation and flood responses are to be provided for the 1% AEP, the largest flood event on record and PMF flood events
- A video summarising the outcome of the project that will be uploaded to a webpage and YouTube channel at the completion of the investigation.

This is a hold point

Do not proceed with the project until the visual media has been approved in writing by the Project Manager.

Requirements for final report

Along with visual media produced, templates populated and mapping outputs, the following reports are required:

- Summary Report – stand-alone report outlining the outputs of the investigation
- Final Report – detailed information on each output
- Explanatory Report – stand-alone report providing the reasoning as to why the planning scheme amendment to include the flood information is required.

The final investigation report will be a compilation of the reports reviewed throughout the study. The final report, produced after the Project Manager gives written approval of the final draft, requires the following chapters:

- Executive summary – non-technical language
- Study introduction
  - scope
  - study area
  - community engagement process (optional, depending on contract)
- Data review
  - historical flood data
  - topography
  - data validation
- Hydrological model
- Hydraulic model
- Scenario modelling
  - provisional items
  - media
- Flood intelligence information (optional, depending on contract)
- Flood damage and mitigation analysis (optional, depending on contract)
- Planning scheme amendment (optional, depending on contract)
- Conclusions/recommendations.

Section 3b: Coastal Erosion Hazard Assessment Project Brief and Technical Specifications

Guidance is provided in brown italics with recommended text in black.

Project purpose

The first step is to articulate the coastal hazard problem: why a coastal hazard assessment is required for this particular location, including a description of key assets or values. This helps define the aims, scale and extent of the assessment.

This section of the project brief needs to succinctly explain the physical setting, the potential assets at risk (public/private/cultural/environmental) and what hazard mapping will provide or be used for. This helps determine the scale of assessment. Use the scoping document prepared by the Technical Specialist. See Stage 1, Step 4 in the CHA Process Table (Section 2).

The purpose of the project is to identify key coastal/estuarine processes and coastal/estuarine hazards for the entire coastal system and to assess and map the existing and potential extents of the coastal hazards, both at a regional scale for the full project extent and in detail at critical locations, including hard and soft coasts within the project area.

The project contract may also include the development of additional products that address:

- mitigation works
- planning scheme amendments
- the Municipal Emergency Management Plan
- community awareness and preparedness.

Background/context

This section should:

- ***describe the client organisation, including project partners and their relationship and the origin and context of this specific work package***
- ***identify the policy and strategic drivers for this work, i.e. coastal management plan, coastal precinct plan, regional coastal action plan, council planning scheme***
- ***provide commentary on existing critical local issues whose management will be informed by the CHA outputs (e.g. coastal inundation and erosion in or adjacent to activity nodes and identified weaknesses in dune systems that could exacerbate flooding).***

Project aims

The Coastal Hazard Assessment aims to:

- provide an improved understanding of the coastal and geomorphic processes that are shaping a coastline
- quantify the coastal hazards, considering the potential consequences of climate change.
- provide comprehensive data sets that will help predict the coast's susceptibility to recession, erosion and inundation
- provide data sets that can be readily incorporated into the Victorian Datamart and the Victorian Flood Database
- provide data sets that will directly inform regional, township and local strategic planning, adaptation/mitigation planning, emergency response planning and community engagement
- identify knowledge and data gaps and additional works that are required to improve future refinements of coastal hazard assessments.

Hydrodynamic modelling data files derived from the project must be in a format that is readily incorporated into the Victorian Datamart and the Victorian Flood Database (see Technical Specifications).

Study area

Show the full project extent on a map and spell out key assets and/or values. Describe critical locations within the study area and identify them on the map:

Supply a shape file of the project extents to the successful tenderer at the initiation of the project.

Scope and method

The project scope and method must account for the processes and environmental conditions that can result in variable flood hazards along the subject area, including factors such as landform, topography, natural and build barriers, bathymetry, wave exposure and anthropogenic factors. Define the range of coastal exposures, land uses and landforms where specific attention will be required to understand and consider the implication of these differences.

The investigation will:

- review the available data and obtain necessary data to complete the investigation
- consider the coincidence of catchment and extreme sea events (include if relevant).
- determine coastal erosion information for a range of storm tide modelling scenarios in the Technical Specifications
- develop draft coastal erosion intelligence and response documentation for inclusion in the Municipal Emergency Management Plan (optional, depending on need and budget)
- analyse options for structural and non-structural mitigation to alleviate coastal erosion. (optional, depending on need and budget)
- analyse existing coastal erosion warning arrangements and provide options for improvement in the context of a total coastal erosion warning system. (optional, depending on need and budget)
- deliver draft mapping (potentially UFZ, FO and LSIO) for amendment of the planning scheme reflecting the investigation results (optional, depending on need and budget)
- provide a complete and concise final report outlining the process and deliverables of the investigation.
- clearly identify information gaps and limitations of the methodology and the effect of these on the hazard assessment and the reliability and useability of the project mapping outputs
- recommend future information requirements to improve understanding of coastal erosion hazards and to enable refinement of the coastal hazard extents.
- respond to the independent Peer Review of the draft outputs of the coastal hazard assessment.

Available data

The following data will be provided where it exists and is relevant to the stated contract outputs.

- geological/geomorphological field study results
- copies of relevant previous coastal process and sediment transport studies/investigations
- storm tide data
- wave run up/set up data
- beach/near shore monitoring data
- historical coastal erosion records including written accounts, photography and video/film footage
- GIS tables (Mapinfo or ArcGis) including:
  - contour and survey information, including LiDAR
  - cadastral information (such as properties/ parcels, roads, coastal assets)
  - previous mapping data
  - historical and present day aerial photography of the coastline
- limited hard copy/scanned maps of drains, channels, road crossings/bridges may be available, however the tenderer will need to undertake a site survey to confirm accuracy and completeness (the inception meeting will include an opportunity to inspect the study area with Council representatives)
- a summary of existing information held by project partners and the format of the information to be provided to the consultant
- Planning Scheme information is available at www.delwp.vic.gov.au/planning/planningschemes

There may be further data available that will benefit the project that is not held by the council. The consultant is required to undertake their own enquiries to seek additional data and information that may advance this project.

All digital files will be provided to the successful tenderer.

Project milestone outputs

1. Phase 1 (Data Assimiation and Gap Analysis) Final Report.
2. Submission of Project Plan for Phase 2 work (outputs 3-6)
3. Submission of detailed report which describes the relevant coastal processes and geomorphology applying to each sub-coastal compartment in the study area.
4. Submission of assumptions made, approaches used, and sensitivity analysis of key parameters.
5. Draft and final erosion hazard mapping.
6. Draft and Final consolidated report containing outputs 2-5.

Value adding to project outputs

Project outputs can be used to:

- develop coastal erosion and flood intelligence products and inform emergency response planning
- identify options for improved coastal erosion and flood warning arrangements
- design coastal erosion and flood mitigation works and activities
- define coastal erosion and flood-related controls in the council planning scheme
- assist in the preparation of community coastal erosion and flood awareness and education products
- inform coastal asset maintenance and renewal schedules.

Phase 1 – Data accumulation and gap analysis

The first phase involves:

1. A detailed analysis of background data and information identifying knowledge or data gaps, discussing the effect these gaps will have on the hazard assessment. The consequence of the knowledge or data gap should be assessed and, where critical to the outcomes of the hazard assessment, effective measures to fill in these gaps should be recommended. Where knowledge or data gaps are not critical, their potential effect on the outcome of the hazard assessment should be defined.
2. An assessment of the coastal processes acting within the project area. A good understanding of the different geomorphic processes dominating different cells is essential to identify the most appropriate methods for assessing erosion hazards in each particular cell and to identify limitations and assumptions in the approaches used and the potential consequence of these assumptions.
3. The delineation of the shoreline into logical cells based on geology, exposure and coastal processes
4. A project plan for Phase 2.

The project plan should describe the proposed methodologies for assessing the coastal erosion hazard for each cell including the effects of future sea level rise (i.e., appropriate methods should be used to model future inundation scenarios under the assumption that future areas exposed to inundation will partly be determined by topographic changes due to shoreline erosion and recession).

Phase 2 – Coastal erosion hazard assessment

Phase 2 involves completing the coastal erosion hazard assessment work for the region and specified critical locations as outlined in the project plan as developed in Phase 1.

The methodologies should:

- be specifically tailored for the study area and take into account previous knowledge, data and information sets, the topography, geomorphology, coastal processes and geology of the subject site
- take into account protective structures, assuming these will be present and maintained for the next 100 years and the erosion/inundation effects of these not being present
- use a sensitivity assessment to clearly identify and quantify uncertainty in each of the parameters used to assess the hazard and the implications on the resulting hazard extent.

For detailed assessments and modelling at the specified critical locations within the study area, the scenarios and assessment methods should:

- be based on a finer resolution digital elevation model than used for the regional assessment and include critical features, such as levees, flood control works, etc (include wave climate consideration and its variability, incorporating swell and fetch modelling as appropriate, together with impact modelling for extreme events in the combinations set out in the Technical Specifications)
- include typical tidal and storm surge variability (including consideration of inter-annual and inter-decadal sea-level variability for the region, insofar as available data allows), together with extreme events in the combinations set out in the Technical Specifications
- include near-shore processes of wave set-up/run-up and overtopping, where appropriate, with extreme events in the combinations set out in Technical Specifications

A range of methods – including empirical, analytical and/or modelling – for both current situation and future climate change scenarios are expected. For each methodology, the consultant is required to identify uncertainty and how this uncertainty has been accounted for in the determination of the hazard extent. A sensitivity analysis should be applied to any assumptions made to account for uncertainty and used in the modelling work.

Detailed description of deliverables

Phase 1 –Data accumulation and gap analysis

- An outline of the proposed Phase 1 final report structure
- A detailed Phase 1 final report that provides commentary on the existing site context based on a review of the baseline information and site inspections, geomorphic processes and observed historic changes. The report should also include:
  - analysis and a critical assessment of the baseline data and background information supplied with the request for quote (RFQ) and augmented by the consultant's team through site visits and specific field investigations or analysis identified to be completed in the RFQ or in the consultant's methodology.
  - A description of the relevant coastal processes and geomorphology from baseline information and preliminary investigations with details and justification of the sub-cell delineation.
  - identifying potential data gaps and the possible consequence these data gaps will have on the project outcomes (including a ranking of the gaps in terms of potential consequence on the coastal hazard outcome; where the gap is significant and has a material effect on the hazard assessment, approaches to address the gap should be described)
  - a revised program of work including indicative costings, if additional data needs to be produced before Phase 2 begins.
- Draft Project Plan for Phase 2 to include:
  - identification of the different coastal shoreline types to be assessed and detailed descriptions of the methodologies to derive hazard types for each coastal shoreline type
  - identification of the scenarios to be assessed and how the proposed methodologies take into account knowledge and data gaps identified from the baseline data review
  - detailed description on how the hazard mapping will be carried out for each coastal shoreline type and what will be delivered
  - quantification of all assumptions and proposed approaches and the practical implications of those assumptions and uncertainties on the resulting hazard assessment with a sensitivity analysis on key parameters
  - confirmation that the data and methodologies proposed will meet the desired outcomes, or recommendations on essential work required to achieve the desired outcomes.
- A proposed Phase 2 final report structure.

A draft report is to be supplied and comments addressed from the client, reviewers and Peer Reviewers in the final scoping report before proceeding to the implementation stage.

Phase 2: Coastal erosion hazard assessment

Outputs

- A detailed final report (consistent with the final report structure identified in the Phase 1 report) that includes:
  - a comprehensive description of the relevant coastal processes and geomorphology with details and justification of the sub-cell delineation. It is anticipated that this will be a refinement of the assessment in the scoping report, updated with the findings from the completed study.
  - an identification of outcomes of the assumptions and approaches used with a sensitivity analysis of the key parameters; detailed modelling and hazard mapping for identified representative locations can be included as appendices to the main report
  - the results of the hazard assessment including likely future changes taking into account climate change effects for the identified scenarios
  - an assessment of the residual information and knowledge gaps and specific recommendations on future requirements for monitoring, including locations and methods of monitoring and requirement for assessments.
  - a stand-alone executive summary that includes commentary on how this work will be used to inform future adaptation plans and strategies.
  - maps and data; see format requirements in the Technical Specifications.

The council to specify the format (electronic and paper) required for delivery of the reports.

Technical Specifications

(from the erosion modelling scenarios used for the Port Fairy Coastal Erosion Hazard Assessment

Erosion modelling

The Technical Specialist in consultation with other members of the Technical Reference Group should determine the most appropriate SLR/coastal storm to be used in modelling scenarios.

- ***There may be benefits in modelling each of the SLR scenarios with and without coastal storm contributions.***
- ***A single 100 ARI (1% AEP) storm events or a number of consecutive 10 ARI (10% AEP) storm events could also be selected.***
- ***Statutory planners and the CMA will generally require that SLR scenarios used in Victorian planning policy benchmarks (i.e. 0.2 and 0.8) are modelled.***

Example:

Technical Specifications for Erosion Modelling

SLR (m)	Tide	Coastal Storm (2 consecutive)
0	MHWS	2 x 50 ARI or 2 x 2% AEP
0.4	MHWS	2 x 50 ARI or 2 x 2% AEP
0.8	MHWS	2 x 50 ARI or 2 x 2% AEP
1.2	MWHS	2 x 50 ARI or 2 x 2% AEP

2 x 2 AEP, 0CMSLR EXTENT

PORT FAIRY 2 x 2% AEP 0.0M SLR EROSION

This data represents the extent of storm tide erosion for 2 consecutive 2% AEP storm tides with the +0.0 m sea level rise scenario.

2 x 2 AEP, 40CMSLR EXTENT

PORT FAIRY 2 x 2% AEP 0.4M SLR EROSION

This data represents the extent of storm tide erosion for 2 consecutive 2% AEP storm tides with the +0.4 m sea level rise scenario.

2 x 2 AEP, 80CMSLR EXTENT

PORT FAIRY 2 x 2% AEP 0.8M SLR EROSION

This data represents the extent of storm tide erosion for 2 consecutive 2% AEP storm tides with the +0.8 m sea level rise scenario.

2 x 2 AEP, 120CMSLR EXTENT

PORT FAIRY 2 x 2% AEP 1.2M SLR EROSION

This data represents the extent of storm tide erosion for 2 consecutive 2% AEP storm tides with the +1.2 m sea level rise scenario.

Format for maps and data outputs

Partner GIS/data storage specialists should be consulted when preparing this section of the technical specifications. The mapping output files must be in format which can be readily incorporated into:

- ***partners' existing GIS***
- ***in the Victorian Datamart and the Victorian Flood Database.***

1. Specifications generally required by local government and Catchment Management Authority partners include:

- Digital geo-referenced data, including shape files of inundation hazard areas and erosion lines for current situation and for future sea level rise events combined with agreed joint probability events (presented in ArcGIS and Map Info format). All baseline information (LiDAR and high resolution aerial photographs) together with all GIS data derived from the study, including shoreline cell delineation, the coastal erosion hazard origin and resulting coastal hazard maps.
- GIS data and meta data descriptions in accordance with the required GIS technical specification.
- Digital field data acquired for the study, including location, elevation and summary output suitable for inclusion in GIS database. The standard of information delivery is Arc GIS and Map Info).
- Model set-up and run files for the numerical models used to inform the hazard assessment.

2. Specifications required by the funder (DELWP) to provide for incorporation into the Victorian Datamart.

- Comprehensive documentation of metadata
- ArcGIS format (not Mapinfo)
- Vector attribute headings (column headings) should be 10 characters or less
- There should be at least one attribute column that has a unique identifier number
- Project report available on an externally hosted website, i.e. local government
- Project report copyright/disclaimer statement should be consistent with the terms of the consultant's contract (ideally creative commons)
- Should be clear which project outputs are original products, not a subset of an existing data set (e.g. a state-wide data set)

3. Specifications required by the funder (DELWP) to provide for incorporation into the Victorian Flood Database.

- All inundation data sets provided in VFD2 format (latest specs available on request)
- Including:
  - Data tables
  - Rasters:
    - depth
    - water surface elevation
    - digital terrain model (DTM)
  - Vectors:
    - study area
    - flood extents
    - water velocity
    - historical spot heights (are these being collected as part of model calibration/ verification?)
    - levees
    - photo points.

GLOSSARY

Bathymetry

The depth and shape of underwater terrain.

Cadastral

A cadastral plan shows the surveyed property boundaries within a defined area.

Coastal Compartment

A section of coastline which is defined by its landform and sediment transportation processes. Primary secondary and tertiary compartments are identified for different planning and management purposes.

Coastal Morphodynamics

The study of the interactive shaping forces between wave, tidal and wind induced influences on beach / seabed topography.

ESRI

Environmental Systems Research Institute, which has created a suit of mapping software products (including ArcMap or ArcView) under the umbrella product of ArcGIS.

LiDar

LiDAR – Light Detection and Ranging – uses pulsed laser light emitted from a device mounted in /on an airplane or helicopter to generate precise, three-dimensional information about the shape of the Earth and its surface characteristics. Can use LiDAR to map land and seabed / river bed surfaces.

Mannings N Coefficient

A value applied in a mathematical formula to quantify the roughness of different materials. It is used to determine water velocities in flood situations.

Peer Reviewer

A suitably qualified specialist (often an academic) who provides critical feedback on research / study reports.

PMF

A type of file generated by ArcMap or ArcView software.

Soft and Hard coastlines

A general term to distinguish sandy, fine sediment, and weathered rock coastlines from hard rock coastlines.

Sub-cell

Secondary or tertiary compartment.

LINKS

Victorian Coastal Inundation Data Set:

www.data.vic.gov.au/data/dataset/victorian-coastal-inundation

Smartline Mapping:

www.ozcoasts.gov.au/coastal/smartline.jsp