



## 1 Harvey CHRMAP Project Summary

The Shire of Harvey Coastal Hazard Risk Management and Adaptation Plan (Harvey CHRMAP) has been developed by a project team comprised of:

- Damara WA Pty Ltd                                      Project Direction / Coastal Hazard Assessment
- Land Insights Pty Ltd                                      Planning / Consultation & Engagement
- Evaluate Environmental Pty Ltd                                      Project Management / Consultation & Engagement

The CHRMAP was developed in association with the Peron-Naturaliste Partnership (PNP) as the first complete CHRMAP within the PNP region. As such, it was envisaged at the project outset that developing the CHRMAP would provide learning experiences that are relevant for other members of the PNP. This document provides a summary of some aspects of the Harvey CHRMAP development which may be taken forward.

It is noted that some parts of the Harvey CHRMAP were presented at a moderately technical level to better support implementation and assist with potential knowledge transfer to other PNP members. For this reason, the CHRMAP contains more detail 'why' components have been included than is necessary for a plan to be used solely by the Shire of Harvey.

A key aim of the project was to ensure that the CHRMAP provided practical guidance that could realistically be implemented. The objectives and intended use of the CHRMAP are summarised in Section 1.2. In this regard, key lessons learned from previous CHRMAP and adaptation assessments around Western Australia included the importance of targeting the scopes of the hazard assessment and monitoring to subsequent decision-making; and considering the interactions between short and long-term coastal management.

### 1.1 Project Outcomes

The Harvey CHRMAP provides a management pathway for the Shire's coast for future decades, with monitoring and adaptation plans identified for individual coastal assets and an implementation plan for the next 10 years. The approach of to provide stand-alone information for each asset was identified as a means to succinctly convey information without requiring users to engage with the technical detail of the CHRMAP. The plan is integrated with the PNP Coastal Monitoring Action Plan, and indicates how the recommended CMAP monitoring framework can support adaptive decision-making.

The CHRMAP was delivered late, due to a combination of project and external issues. Minor project delays were introduced by the timing issues for consultation and information provision. More substantial project delays were caused by inadequacies of the original approach, including:

- The stakeholder and community engagement process provided limited value to prioritisation of assets and selection of preferred adaptation pathways;
- Application of the WAPC framework for coastal adaptation assessment failed to provide a meaningful plan of action for the Shire;
- The link between monitoring and adaptive decision-making required a more targeted level of coastal hazard assessment to provide meaningful decision-triggers.



These complications were progressively worked through, requiring additional project time to ensure that the CHRMAP was meaningful and able to be implemented by the Shire. The cost of additional staff time was borne by the lead consultant.

Although in this instance the project was completed without a budget variation, this situation highlights a substantial project risk to other LGAs in the PNP when developing CHRMAP. Other possible outcomes include retention of the original methodology resulting in a dysfunctional plan, budget blowout through variations, or internal budget reallocation, which is likely to lead to reduced effort in the adaptation and management assessment. Similar situations have occurred for the majority of CHRMAP prepared within Western Australia. A plausible approach is to develop a staged assessment, although this may potentially increase costs if there are changes in staff between phases, requiring 'relearning', undertaking revision, or repeating previously completed tasks.

## 1.2 CHRMAP Objectives and Intended Use

Key objectives of the CHRMAP framework are to assist statutory decision makers to:

- Consider coastal hazard and to evaluate the risk for specific assets;
- Identify realistic and effective management and adaptation responses to those risks; and
- Prioritise the management and adaptation responses.

The CHRMAP is a non-statutory document, intended to provide guidance to the Shire and other decision-makers over time in regards to the consideration of coastal risk and management when decisions are being made regarding:

- Development, subdivision, rezoning or other planning and environmental approvals;
- The prioritisation of coastal management efforts;
- Provision of support to the community to ensure that recreational needs are maintained;
- Property, infrastructure and beach user/resident safety.

Within this context, the CHRMAP should be taken into account when regional and local planning instruments are reviewed; when capital works programs are being considered; and in the more immediate term, to provide a context for the consideration of day-to-day functions of the Shire (including the consideration of planning/building applications).

## 1.3 CHRMAP Components

The CHRMAP developed four main documents:

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|--|--------------------|
| • Stakeholder and Community Engagement Strategy    | Document 246-00-05 |
| • Coastal Hazard Assessment                        | Document 246-00-07 |
| • Summary of Key Issues                            | Document 246-00-08 |
| • Coastal Hazard Risk Management & Adaptation Plan | Document 246-00-09 |

An objective for the *Stakeholder and Community Engagement Strategy* was to improve involvement of the community and stakeholders in assessment of values and selection of preferred coastal management actions. The approach used was considered to have limited success in this regard (see Section 8) although it achieved the aim of raising community interest.



The *Coastal Hazard Assessment* was developed with an objective to consider the effect of changing scale from the regional hazard assessment<sup>1</sup> to a local scale application. Originally, the planned scope for this item was revision of erosion and inundation hazard lines developed as part of the regional study. However, in order to more appropriately understand the implications of management actions, the scope was expanded to develop increased understanding of spatial contexts, connectivity and locally relevant processes (dune mobility). This information was revised from an internal document to an external document at the request of the Shire, to ensure that information was available to support use of the CHRMAP.

The approach to the coastal hazard assessment included:

- Collation of previous data and studies for the area. Much of this information was available from previous unpublished studies, or used in a different context;
- Review of the role of geology across the area;
- Review of coastal change behaviour, by looking at the full history of aerial imagery in the context of sediment cells, geological controls and corresponding metocean history;
- Identification of the apparent spatial connectivity of coastal changes;
- The potential for coastal dune mobility was evaluated in detail using high resolution LIDAR topography and bathymetry, as this represents a significant coastal hazard that had not been considered in previous studies, and is deemed to be already highly active.

The *Summary of Key Issues* was developed to outline the identification of values and describe the potential coastal planning and management issues that may result from coastal hazards. A review of the planning instruments available for coastal management was incorporated in the document. The information contained therein supported a basic risk assessment within the CHRMAP. Outcomes from the Stakeholder and Community Engagement Strategy process were incorporated in the Summary of Key Issues.

The *Coastal Hazard Risk Management & Adaptation Plan* is intended as a stand-alone document to support the management of the Harvey coast. Brief summaries of information from the Coastal Hazard Assessment and Summary of Key Issues are included, as it is envisaged that readers requiring reference to more detail will be able to access the preceding documents. The structure of the CHRMAP is further outlined in Section 4. The CHRMAP has been developed around an asset-based adaptation framework, where potential management is considered for each individual asset. Progressive changes of coastal management pressures from existing conditions through to projected future scenarios were used to determine a sequence of adaptation actions.



## 2 How does the Harvey CHRMAP provide a template for other PNP members?

The scope of each assessment needs to be tailored to the problems faced by each LGA and the available budget. However, it is anticipated that the Harvey CHRMAP may provide useful approaches, frameworks and information that can support future PNP assessments, along with lessons learned regarding project aspects that were less than optimal.

A key aspect of the project was a focus upon implementation, with an approach developed to consider changing coastal management needs over time, from existing problems through to long-term projections. This was done through consideration of coastal management and adaptation at decision-making scales up to town site scale. Presentation of the coastal monitoring needs, decision-triggers and expected adaptation pathways for each separate asset is intended to support extraction by managers and use on an asset-by-asset basis.

Potential value of the Harvey CHRMAP has been suggested relative to the following subsequent uses:

- §3 Replicated Approach – situations in which the method may be largely replicated due to similar geomorphology, values and coastal management requirements;
- §4 Replicated Elements – those components of the project which are considered likely to be widely applicable or useful to most PNP areas;
- §5 Modified Framework – how the assessment method could be modified or extended to provide effective use along a different section of coast;
- §6 Modified Elements – how components of the assessment could be modified or extended to provide effective application elsewhere;
- §7 Removed Elements – those components which were removed or substantially reduced in scope compared with other CHRMAP evaluations;
- §8 Lessons Learned – those aspects of the project which provided barriers to developing the CHRMAP, provided limited value for effort, or suggested potential risks to developing practical management actions.

These uses are discussed separately in the sections following.



### 3 Replicated Approach

The Shire of Harvey coast is not highly developed and has been planned with the knowledge of dune instability and expectation of ongoing coastal erosion. This has led to reasonable coastal setbacks for the majority of facilities, which provides considerable scope for effective coastal management. This also determines that the majority of community interest relates to management of beach access rather than land-use or infrastructure. A key result is that there are few coastal assets and amenity within the Shire of Harvey for which management will affect adjacent assets. These characteristics influenced the methodology developed for the Harvey CHRMAP, including:

- Consideration of a wide range of assets and amenity, with lower cost assets having more immediate need for management and high community value;
- Use of asset-based adaptation assessments;
- Focus on the potential sequence of management actions in response to progressive coastal change (erosion and sea level rise).

The issues faced by Harvey are most closely comparable to those experienced along the Waroona and Capel coasts, as suggested by comparison of foreshore infrastructure and active coastal processes (Table 1).

**Table 1: Aspects considered regarding LGA similarity for CHRMAP preparation**

LGA	Foreshore Infrastructure	Inundation Hazard	Dune Mobility	Estuary Entrance Mobility
Rockingham	High	Moderate	Low	Low
Mandurah	High	Moderate	Low	Moderate
Murray	High	High	Low	High
Waroona	Low	Low	High	Low
Harvey	Low	Moderate	High	Moderate
Dardanup	Moderate	Moderate	Low	Moderate
Bunbury	High	High	Moderate	Moderate
Capel	Low	High	High	Moderate
Busselton	High	High	Moderate	High

In the Shire of Dardanup, foreshore areas are subject to estuarine or riverine processes, with different responses to future change and therefore a different management focus. Consequently, although aspects of the study could be replicated, the underlying assessment of coastal hazards, monitoring and decision-triggers will be substantially different.

For those LGAs with greater coastal infrastructure, there is a higher need to consider trade-offs associated with management actions. In particular, the potential for stabilisation works to transfer erosion pressure to adjacent coast must be considered.



## 4 Replicated Elements

Components of the CHRMAP project are summarised in Section 1.3, with pros and cons of the approach used discussed in Sections 8 and 9. The mixture of positives and negatives suggests that it may be beneficial for PNP members to only replicate parts of the Harvey CHRMAP.

It is not recommended to replicate the approach used for community and stakeholder engagement. Although good communication is necessary and engagement is a key means of developing support for the CHRMAP, significant project effort is required to bring stakeholder knowledge to a suitable level for informed and meaningful decision-making.

Identification of key issues is required to provide context for any CHRMAP. Replication of the Harvey CHRMAP Summary of Key Issues document for other sections of PNP coast could broadly follow the headings used. However, due to the variation between LGAs, it is generally recommended that it be reviewed in the context of factors involved in coastal management decision-making (see Section 6).

The coastal hazard assessment represents a moderately complex assessment of coastal dynamics along the Harvey coast. This level of information was considered appropriate to develop meaningful decision-triggers based on simplified coastal monitoring. The equivalent need to understand spatial context, connectivity and locally relevant processes is important along all sections of the PNP coast, although its complexity varies (Table 2). Replication of the Harvey CHRMAP coastal hazard assessment at another site would require careful scoping and consultant selection, as much of the work was achieved cost-effectively due to previous work by the project team near or along the Harvey coast, including Harvey Coastal Management Plan <sup>2</sup>, coastal studies for the Southern Seawater Desalination Plant <sup>3</sup>, Bunbury Port Authority <sup>4</sup> and the PNP regional coastal hazard assessment <sup>5</sup>.

**Table 2: Aspects considered regarding LGA similarity for replication of hazard assessment**

LGA	Data / Studies	Geology	Connectivity*	Dune Mobility
Rockingham	Moderate	High	High	Low
Mandurah	High	Moderate	High	Low
Murray	Low	Low	Moderate	Low
Waroona	Low	Moderate	Low	High
Harvey	Low	High	Moderate	High
Dardanup	Low	Low?	Low?	Low
Bunbury	Moderate	High	Low?	Moderate
Capel	Low	High	Low	High
Busselton	High	Low	High	Moderate

\* connectivity refers to the apparent capacity for coastal management actions to transfer stress (particularly erosion stress) to adjacent sections of coast. The presence of compartmentalised sections of coast has been used as an indicator, considering tertiary scale sediment cells <sup>6</sup> and smaller segments.



The Harvey CHRMAP has been developed around an asset-based adaptation framework, where potential management is considered for each individual asset. This approach is largely viable for Shire of Harvey because previous planning has acknowledged the threats of coastal erosion and dune mobility. Combined with the overall low development density, the resultant development buffers ensure that there are few management actions which are likely to directly involve trade-offs between economic values or amenity of existing assets. For the coasts of other PNP members, particularly those with greater foreshore infrastructure, the approach is expected to require extension to better balance situations where trade-offs may occur (see Section 6).

The structure of the CHRMAP includes:

- CHRMAP §1. An introduction describing the scope and structure of the CHRMAP;
- CHRMAP §2. A brief summary of the coastal hazards and key issues, intended to support the reader's use of the supporting documents if required;
- CHRMAP §3. A description of the Management Framework applicable within the Shire of Harvey, which sets the context within which adaptation options are developed;
- CHRMAP §4. A summary of Coastal Hazard Decision Making that is relevant for management of the majority of coastal assets;
- CHRMAP §5. Asset-based Adaptation Assessments for each of the key identified assets, outlining the existing and future coastal management pressures, adaptation sequence or options, and the monitoring triggers and actions;
- CHRMAP §6. A Summary of Overall Management, which draws together the actions recommended within the asset-based adaptation assessments;
- CHRMAP §7. A summary of Implementation actions, primarily focusing on the next 5-10 years.

For different LGAs, Sections 2, 6 and 7 are expected to contain substantially different content, and therefore it is unlikely that the Harvey CHRMAP should be directly replicated, although equivalent sections and information are crucial for use of the CHRMAP by the local coastal managers. The general frameworks described in Section 3 are relevant to all LGAs and are considered to provide a basis to work with.

Section 4 is considered to be generally relevant to all of the PNP members. Information contained in this section should be considered supplementary to the PNP Coastal Monitoring Action Plan <sup>7</sup>.

The steps used for adaptation assessment for each asset in Section 5 are relevant to all PNP members. The approach of providing succinct stand-alone information regarding adaptation for each asset is strongly recommended, as extraction of individual sections may be used by a wider audience without requiring users to have been engaged with the technical detail in the larger report. However, information relevant to individual assets is not generally transferable between LGAs, and on more developed coastlines, there may be difficulty identifying discrete assets for which an adaptation assessment stands alone (see Section 6).



## 5 Modified Framework

The original scope for Harvey CHRMAP was built around the WAPC guidelines for CHRMAP preparation<sup>8</sup>, with a deliberate focus on the use of community and stakeholder input to valuation and selection of adaptation options. The framework was modified in the course of the project to account for:

- A high valuation of non-infrastructure assets (such as beach access) that are likely to be affected by coastal hazards within a short time-frame;
- Limited consensus developed through stakeholder and community input (different parties were interested in different things), resulting in a ‘consequences’ assessment that provided limited discrimination between assets; and
- Recognition that the use of development setbacks had significantly deferred the majority of management actions with high financial costs, therefore extending the time frame that the CHRMAP must consider to evaluate the corresponding assets.

The combination of interest in short and long time frames within the same assessment provides a challenge for CHRMAP structuring and scope control. For the majority of studies, it has either been dealt with by a risk-based ‘prioritisation’, focusing on the limit to which existing management may be extended<sup>9</sup>, or by focusing only on those long-term management elements which may require trade-offs<sup>10,11</sup>. In some previous studies an additional step is undertaken before the prioritisation to capture ‘normal’ management or ‘no regrets’ actions which may otherwise not be identified within the CHRMAP process. For the Harvey CHRMAP an asset-based adaptation assessment was used, but this was only practical due to the limited number of trade-offs between assets likely to be caused by management actions.

Some considerations for the selection of a CHRMAP framework are outlined in the CVS discussion paper contained in Appendix A<sup>12</sup>. This describes how the spatial scale, complexity of interactions and the range of time scales of interest affect the CHRMAP detail, and implicitly (in combination with available budget) determine whether it will be effectively strategic, targeted or detailed in nature. This has corresponding implications for the end use of the CHRMAP.

The Harvey CHRMAP combined a mixture of simple and complex components of the CHRMAP framework, with a key aim to develop a plan that could be implemented effectively (see Figure 1). The use of some simple components was considered a necessary approach to reach this aim, without substantially extending the project costs and scope.

The objective of reaching a CHRMAP that can be directly implemented has been repeatedly challenged in projects across WA by the use of high detail in the coastal vulnerability component compared with the adaptation and implementation aspects. The opportunity to be useful for a wide range of applications tends to draw the hazard assessment towards a detailed level, often not commensurate to the adaptation and implementation aspects. In the context of high uncertainty regarding climate change and future behaviour, this has potentially resulted in low value for money towards coastal planning and management decision-making.





It is recommended that modification of the CHRMAP framework should be undertaken on a case-by-case basis. Generally, a careful focus on either short or long time frames is required to control the project budget, although an understanding of the relationship of management decisions over time is an important consideration. The principle of recognising whether a strategic, targeted or detailed assessment is appropriate should be carefully used to define the scope, with study elements directed towards a commensurate level of detail. As a crucial aspect of the CHRMAP is its ability to be implemented, ensuring that the project has developed sufficient knowledge in the preceding stages yet retained sufficient budget and time to develop the adaptation and implementation phases requires careful attention (see Section 1.1).

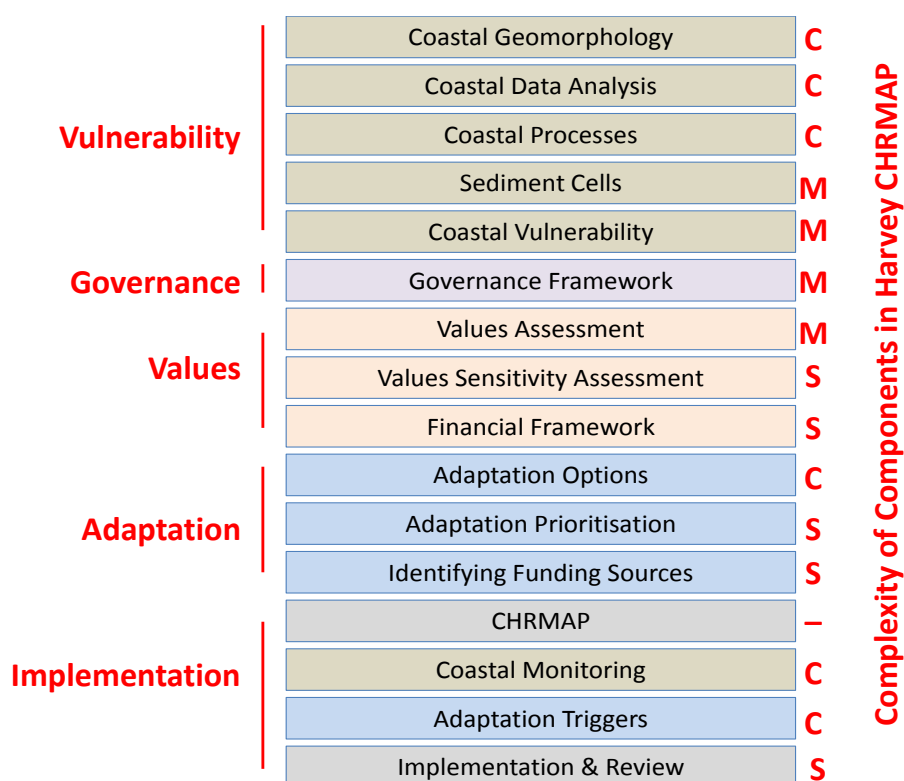


Figure 1: Harvey CHRMAP Project Components

A measure of the complexity of each component within the Harvey CHRMAP is suggested by the codes S: simple, M: moderate, C: complex. The complexity was largely determined in the course of the project by the objective to identify realistic and effective management and adaptation responses to coastal risks.



## 6 Modified Elements

As discussed in Section 4, project work equivalent to the Summary of Key Issues is expected to vary substantially between LGAs from that presented in the Harvey CHRMAP. It is recommended that both scoping for a new CHRMAP and the study itself be cognisant of the factors involved in coastal management decision-making within the LGA. A schematic diagram illustrating some the factors considered for Harvey is presented, which may provide a preliminary point of focus (Figure 2).

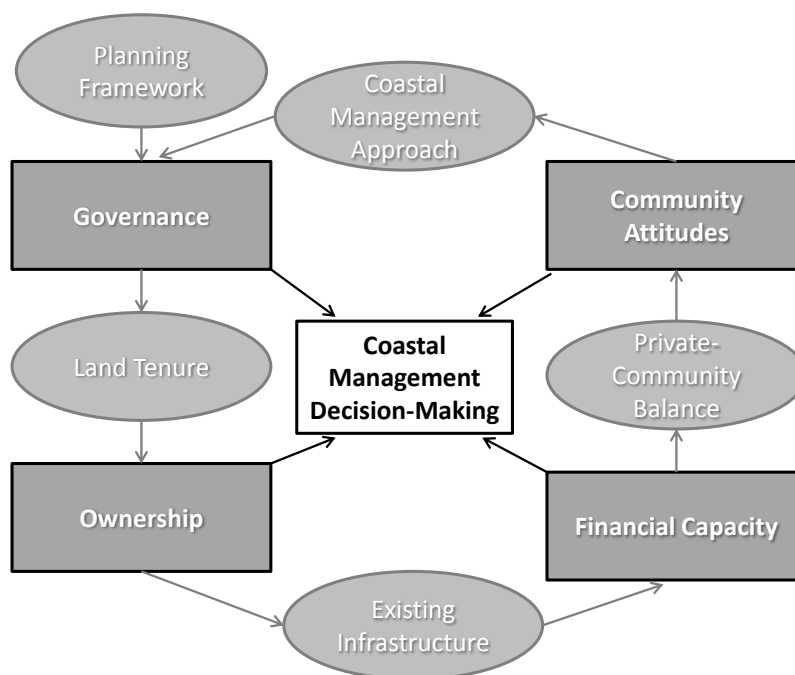


Figure 2: Some Factors Involved in Coastal Management Decision-making

As noted in Section 5, the complexity of the project components comprising the Harvey CHRMAP (see Figure 1) was selected with a key objective to develop a plan that could be meaningfully implemented. In order to tailor the scope for future CHRMAP or cater for local needs, other LGAs may wish to amend the relative complexity of the different components. However, in order to achieve a useful plan, it is necessary that relationships between information, decision-making, site characteristics, costs and uncertainty be recognised (Figure 3). For example, application of a simple decision-making framework usually requires only a small amount of information and comes at a low cost. However, it will inherently contain high uncertainty, which is increased in areas of complex geomorphology. The relative degree of stakeholder and community involvement in valuing assets and determining adaptation pathways is a major factor influencing the complexity of decision-making.

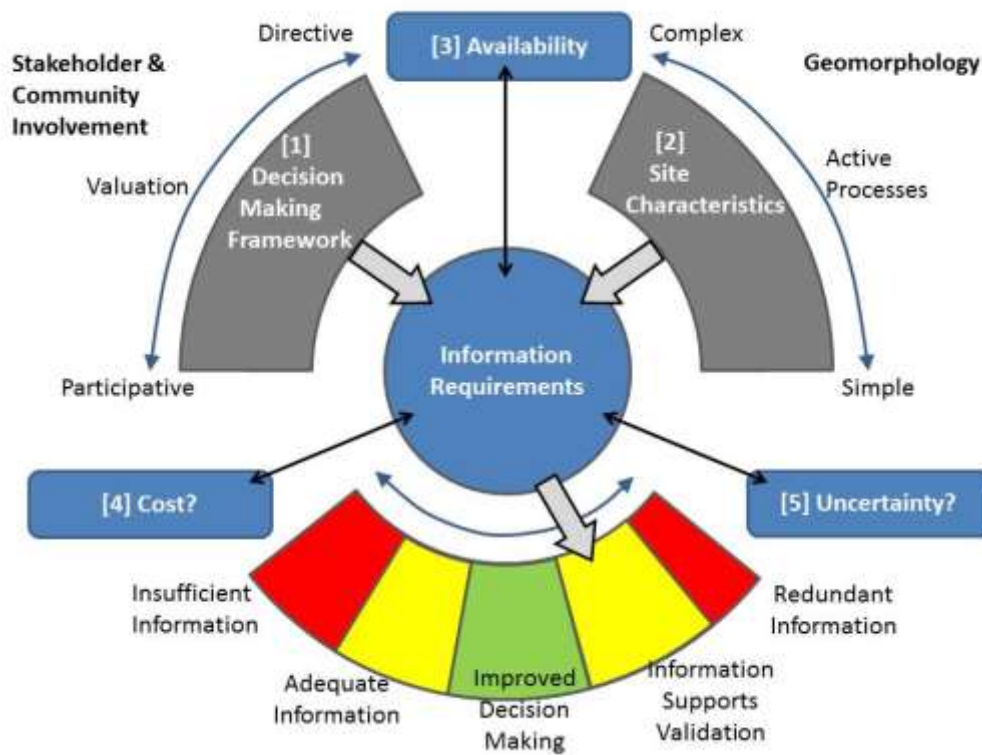


Figure 3: Schematic illustration of some relationships affecting information requirements



## 7 Removed Elements

Two major components present in the majority of previous CHRMAP evaluations were largely removed from the Harvey CHRMAP:

- Hazard lines; and
- Risk-based prioritisation of adaptation actions.

Coastal hazard lines were not presented – these were effectively made redundant by considering a wide range of possible scenarios for coastal change, with sequential management actions considered for progressive change. Erosion setbacks based on policy (following SPP 2.6 schedule one) were derived simply, following recognition that dune mobility determines practical controls on land-use and building development along the majority of the coast.

The approach of developing a risk-based prioritisation of adaptation actions, using likelihoods and consequences was originally a key component of the study methodology, and followed from the WAPC guidelines for CHRMAP preparation. Stakeholder and community based values for coastal assets within Harvey did not effectively discriminate between assets, and therefore provided a weak basis for prioritisation. This was further weakened by the dispersed nature of coastal assets along the Harvey coast, which meant that future management of individual assets can be largely independent.



## 8 Lessons Learned

Major lessons learned through developing the Harvey CHRMAP included:

- The flexibility of the WAPC guidelines for preparing CHRMAP presents a potential challenge to developing effective and meaningful plans for LGAs. Feedback between the hazard assessment and the adaptation plan makes it difficult to scope properly at project inception, and provides potential for budget blowout or provision of a weak adaptation plan;
- The focus on risk-based prioritisation of adaptation actions recommended by WAPC had limited value when applied to the Harvey coast. In this case, there was greater value obtained through consideration of increasingly severe scenarios for change and corresponding adaptive management sequences; and
- The approach of using community and stakeholder engagement to help guide the CHRMAP development was ineffective. Community feedback is generally focused on the short-term and places high value on existing assets and amenity (i.e. preservation of status quo). The importance of immediate issues to community reduces the interest in adaptation pathways that are seen as ‘far future’ decisions.

The community and stakeholder engagement process cost in the order of \$40,000. It provided very limited value to the CHRMAP assessment – equivalent outcomes could have been obtained with a 2 hour workshop between the consultants and LGA staff, with further input from the project steering group. Despite this negative outcome, it is worth acknowledging that it is appropriate to represent interests other than those of the LGA, due to likely biases in study findings (Figure 4)

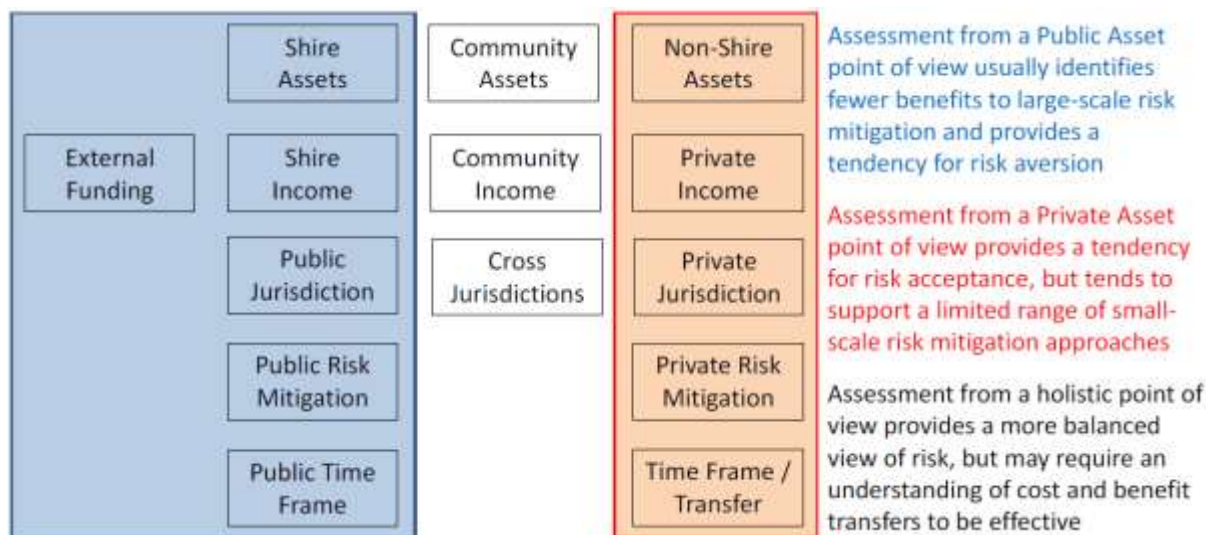


Figure 4: Implications of considering Shire and Non-Shire Assets



## 9 Budget Implications

The Harvey CHRMAP was completed with a project budget of \$100,000 (ex-GST). This was split for budget purposes between the three consultant groups of the project team with approximately:

- 20% Coastal Hazard Assessment
- 20% Stakeholder & Community Engagement
- 20% Coastal Planning
- 20% Coastal Adaptation
- 20% Project Management

This budget distribution was partly determined by negotiation internal to the project team, although it also reflected the balance of the RFQ scope. Project ownership was undertaken by the coastal engineering consultant, due to greater staff resources and previous experience in development of CHRMAP.

It was acknowledged at the outset that the budget left limited scope for the Shire to support variations. Internal variation of the scope and budget was identified as a key tool for budget management.

During the first two-thirds of the project (prior to the coastal adaptation assessment), it was apparent that:

- Accrual of multiple minor project delays, particularly associated with scheduling of consultation and information provision, effectively decreased the functional scope of the stakeholder and community engagement and extended the project management requirements;
- The complexity of the Leschenault-Yalgroup coast warranted detailed coastal hazard analysis to provide suitable information for decision-making; and
- Although substantial coastal planning information is available for the area, there is no single clear and apparent pathway for resolution. This requires dialogue between the Shire and State Government, which is beyond the practical scope of the CHRMAP preparation.

The resultant study elements therefore included a bias towards coastal hazard assessment. This was exacerbated by project ownership by the coastal engineering consultant and the substantially more developed available information base (compared to planning or stakeholder engagement).

The project management and engagement consultant identified at this point that they had reached their budget limit and would require either a project variation or increased proportion of the budget to complete the project. Due to the apparently limited contribution of the stakeholder and community engagement process to adaptation planning, it was determined not to include further involvement of the consultant in the project.

Early application of the coastal adaptation assessment based on the WAPC framework demonstrated that the approach failed to provide a meaningful plan of action for the Shire. In particular, the community valuation of beach access and recreational amenity provided a focus which was dissimilar to the Shire's greater interest in infrastructure and governance of coastal land-use.



A substantial effort was undertaken by the coastal engineering consultant to develop an alternative assessment approach which could potentially support improved coastal management by the Shire. This demonstrated that the originally conceived scope for the coastal adaptation assessment was inadequate. In order to achieve the project objective of a functional CHRMAP \$50,000-80,000 worth of consultant time was written off. This was done with recognition of the increasing role of CHRMAP in Western Australian coastal management and a desire of the project team members to remain leading practitioners for CHRMAP development.

Preparation of Section 4 of the CHRMAP included development of refined techniques for monitoring and decision-making in the context of coastal erosion and inundation, which built upon Damara WA (2015) *PNP Coastal Monitoring Action Plan*. This refinement involved academic dialogue with national and international experts, with a focus on how to use simple and cost-effective monitoring techniques to provide effective coastal management triggers.

Overall, the budget of \$100,000 (ex-GST) is considered insufficient if this study were to be directly replicated, and a budget of \$150,000 is considered more appropriate. Some opportunities to reduce the scope include:

- Elements of the coastal hazard assessment undertaken to consider management triggers may be deferred until monitoring commences (with estimated scope reduction of \$20,000). This runs a risk of developing a monitoring program that is not targeted towards decision-making;
- Reducing the stakeholder and community engagement process (estimated scope reduction of \$15,000);
- Simplifying the adaptation scope before project commencement, to exclude active coastal management of assets and amenity likely to be affected by hazards within 1-2 decades (estimated scope reduction \$30,000); and
- Separating the study into two stages, with a hazard and planning assessment, followed by an adaptation assessment (estimated scope reduction \$15,000).

Of these opportunities, only study staging provides a scope reduction which is not considered to reduce the applicability of the CHRMAP. Staging has a potential further benefit to limit the opportunity for internal scope reallocation, as completed CHRMAP, including this one, have demonstrated a tendency for increased detail in the process/vulnerability assessment at the expense of detail in the decision-making and adaptation components. The benefits of staging may be offset, or even turned into a negative by increased project length and the potential for personnel changes if the stages are treated as discrete projects. Although a change of staff may provide 'peer review', it may also lead to extensive relearning and reworking unless managed carefully.

It is worth acknowledging that the extensive familiarity and experience of the consultants with this section of coast supported the delivery of much of the content. For those with less knowledge, a higher budget for coastal processes assessment or a simpler analysis for the same budget would be required.



## 10 References

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- <sup>1</sup> Acil-Tasman Pty Ltd. (2012) *Climate Change Adaptation Options Assessment - Developing Flexible Adaptation Pathways for the Peron-Naturaliste Coastal Region of Western Australia*. Prepared for the Peron-Naturaliste Partnership.
- <sup>2</sup> Belton-Taylforth Pty Ltd. (2006) *Shire of Harvey. Coastal Management Plan*.
- <sup>3</sup> School of Environmental Systems and Engineering UWA & Damara WA Pty Ltd (2007) *Binningup Coastal Process Study*. Draft Final Report.
- <sup>4</sup> Global Environmental Modelling Systems Pty Ltd. (2008) *Metocean Data Summary for Bunbury Port Expansion*. Technical Report. Prepared for Evans & Peck Pty Ltd and Bunbury Port Authority.
- <sup>5</sup> Damara WA Pty Ltd. (2012) *Coastal Hazard Mapping for Economic Analysis of Climate Change Adaptation in the Peron-Naturaliste Region*. Report 169-01.
- <sup>6</sup> Stul T, Gozzard JR, Eliot IG & Eliot MJ. (2015) *Coastal Sediment Cells for the Vlamingh Region between Cape Naturaliste and Moore River, Western Australia*. Report prepared by Seashore Engineering Pty Ltd and Geological Survey of Western Australia for the Western Australian Department of Transport, Fremantle. Report Number: M2012 (60001).
- <sup>7</sup> Damara WA Pty Ltd. (2015) *PNP Coastal Monitoring Action Plan*. Report 245-02-Rev 0
- <sup>8</sup> Western Australian Planning Commission and Department of Planning. (2014) *Coastal hazard risk management and adaptation planning guidelines*.
- <sup>9</sup> Shore Coastal Pty Ltd. (2015) *Shire of Augusta Margaret River. Coastal Hazard Risk Management and Adaptation Plan*. SCR1507.
- <sup>10</sup> Coastal Zone Management Pty Ltd & Damara WA Pty Ltd. (2008) *Vulnerability of the Cottesloe Foreshore to the Potential Impacts of Climate Change*, Prepared for Town of Cottesloe.
- <sup>11</sup> Coastal Zone Management Pty Ltd & Damara WA Pty Ltd. (2010) *Scarborough Beach Climate Change Risk Assessment Project*, Prepared for City of Stirling.
- <sup>12</sup> Damara WA Pty Ltd. (2014) *Scope Definition for Coastal Hazard Risk Management and Adaptation Planning: Strategic, Targeted or Detailed assessment?* Unpublished discussion paper.