End of Project Report

Managing Coastal Vulnerability

Version: 2.1

Prepared by: Ralph Talbot-Smith

June 2016

Cover Photo - from left: Helen Tait, Jai Denda, Chris Barber and Ralph Talbot-Smith

PROJECT COMPLETION AND SIGN OFF

Project Manager	
Name: Ralph Talbot-Smith Governing Organisation: WALIS Marine Group – WALIS - Landgate	Signature Date: 28/10/2016
Project Sponsor	
Name: Steve Jenkins Position: General Manager, Coastal Infrastructure Business Unit (CIBU) Organisation: Department of Transport	Signature Date: 28.10.2016
Project Director 1	
Name: Rodney Hoath Position: Director, Coastal Information, Coastal Infrastructure Business Unit (CIBU) Organisation: Department of Transport	Signature Date: 25/10/2016
Project Director 2	
Name: Jenny-Lana Smith Position: Manager: WALIS Projects Organisation: Western Australian Land Information System (WALIS)	Signature Date: 25/10/2016

Table 1 - Project Sign Off

DOCUMENT CONTROL

Version.	Status	Date	Author	Description of Version
Version 1.0	Draft	14/3/2016	R. Talbot-Smith	Initial Draft
Version 1.1	Review	24/5/2016	C. Barber	Proof Reading and Review
Version 1.2	Edit	25/5/2016	C. Barber	Editing and Second Draft
Version 1.3	Edit	27/6/2016	C. Barber	Final Check and Complete
Version 1.4	Review	29/7/2016	R Hoath	Edit and Review
Version 2.0	Review	21/9/2016	D Shepherd	Review, Edit and Finalise
Version 2.1	Review	29/9/2016	J Smith	Final Review

Table 2 - Document Control

Organisation	Description
WALIS	Western Australian Land Information System – Strategic LIS Manager(MCV Position Employer)
WMG	WALIS Marine Group – MCV Controlling Body
LISIG	Location Information Strategy Implementation Group - Project Executive
RUSP	Regional Urban Scenario Planning – Senior Project

Table 3 - Governance Report Structure

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EXECUTIVE SUMMARY

The Managing Coastal Vulnerability (MVC) project was conducted as a Sub-Program of the Regional and Urban Scenario Planning (RUSP) Priority Project of Stage 1 of the Location Information Strategy (LIS) for Western Australia.

This report provides a detailed account of how the objectives of the project were addressed, progress towards the realisation of the expected benefits of the project, and lessons learned to assist any future effort and investment in this area.

The objectives of the MCV project were:

- State government marine and coastal spatial datasets that are of high use and value are to be reviewed, packaged and formatted for ease of use.
- Increase efficiencies in the way state government organisations access and manage marine spatial information.
- Increase inter-agency and inter-governmental collaboration of marine data maintenance and distribution.

Key Deliverables of the project, as defined in the Business Case, were:

- A ‘one-stop shop’ for the discovery of, and access to, all authoritative Western Australian coastal and marine information; and
- Delivery of key information to support coastal engineering and modelling of storm event and development impacts.

Expected benefits of the project, as defined in the Business Case, are:

- More current and reliable advice to support planning for coastal infrastructure and environmental issues;
- Improved value-for-money for coastal management, providing forward savings to the community;
- A better informed community; reducing anxiety and confusion regarding the impacts of major climatic events;
- More transparent Government decision-making;
- Improved collaboration across sectors on coastal and marine projects;
- Increased support for research / modelling of coastal and marine planning scenarios; and
- Western Australia will be better placed to meet evolving, national strategies for coastal vulnerability.

The following key stakeholders endorsed the business case for the MCV project:

- The Western Australian Local Government Association;
- Engineers Australia, the largest professional body for engineers in Australia;
- The West Australian Marine Science Institute;
- The Marine Parks and Reserves Authority;
- The Department for Transport;
- City of Mandurah; and
- City of Rockingham.

Twenty new and/or improved datasets were generated through the MCV project. Datasets made available to-date are:

- Vegetation Line – Coastline Movements – Department of Transport
- Marine Habitats – Broad and Local Scale – Department of Parks and Wildlife
- Coastal Protection - Facilities and Structures – Department of Transport
- Geological and Geophysical Sediment Cells – Department of Transport
- Maritime Services - Navigation Aids – Department of Transport
- Shipping and Pilotage – Department of Transport
- Point Survey Index – Bathymetry – Department of Transport
- Composite Surface Index – Bathymetry – Department of Transport
- Composite Surfaces – Bathymetry – Department of Transport
- Marine and Harbours Act Areas – Department of Transport
- Coastal Compartments – Primary, Secondary, Tertiary – Department of Transport
- Coastal Regions – Department of Parks and Wildlife
- Coastal Planning Regions – Department of Planning
- New Coastal Imagery and Base Maps – Landgate
- Oceanography – Tides - Department of Transport
- Oceanography – Waves – Department of Transport

Seven of the datasets are undergoing final review prior to release later in 2016:

- Marine Habitat Catalogue Index – Marine Habitat Projects – Department of Parks and Wildlife
- Coastal Plan Index – Locations and Extents – Department of Planning
- Coastal Land Use – Department of Planning
- Risk Level - Primary, Secondary and Tertiary Compartment Levels – Department of Planning
- Coastal Infrastructure – Department of Transport
- Geological and Geophysical WA Landforms – Beaches, Geomorphology, Oblique Imagery – Department of Mines and Petroleum

These datasets have largely been published to data.wa.gov.au in accordance with the WA Whole-of-Government Open Data Policy via the Shared Location Information Platform (SLIP) and are available to coastal and marine engineers, local government and other stakeholders.

Improved access to these data has also been achieved through the Australia Oceans Data Network (AODN) via linkage to SLIP and data.wa.gov.au.

The MCV project generated the first comprehensive dataset of Coastal Infrastructure for WA. The dataset provides a valuable asset to prepare for and manage the impacts of adverse events and conditions across the vast coastline of WA; including estimating the costs involved. For example, those responsible for responding to oil spills will find this dataset a useful asset in preparation and planning for oil spills in terms of assets in place (jetties, wharves, boat ramps etc.) and also potential logistical base sites with all coastal car parking captured along the whole WA coast. The dataset redesign also provided a means to complete a full Coastal Infrastructure definitions listing for WA which did not exist before. This dataset now forms the basis of Department of Transport's Coastal Strategic Asset Management System (SAM).

The Coastal Movements datasets generated through the project is an important new source of information for assessing coastal developments, and has been accessed and used widely by the coastal and marine management community. The accessibility of the data through data.wa.gov.au and the Shared Location Information Platform (SLIP) has significantly reduced the time and effort required for the Department of Transport to share the data, and for customers to access the data.

Following publication of consolidated bathymetry and oceanographic data (including tidal and wave movement data) to SLIP, almost 90% of requests to the Department of Transport have been able to be directed to this service. Non-GIS users are now able to visualise the Point Cloud Surveys (Multibeam, Lidar & Laser) in a colour coded viewer without any special software. The community is now able to access and explore oceanographic records spanning the last 100 years and is able to immediately download the data that they required.

Standardising sediment cells reporting has removed uncertainties in interpretation and understanding of Sediment reports for WA. As the bathymetry and other coastal processes data (wave rider, AWAC etc.) is accumulated for the coastline, sediment transport definition can be more readily completed.

The new Department of Parks and Wildlife habitat catalogue will reduce duplication of effort and investment of projects across State and Commonwealth agencies, and private enterprise; and prevent waste of valuable money and resources. The catalogue and associated data also significantly contributes to knowledge about the location and value of important natural assets by making the data more readily accessible to the public and those involved in planning for and managing adverse events in coastal and marine areas, such as oil spills.

Release of more coastal planning data will significantly reduce the amount of time that it takes to find reports relating to management and conditions for any one part of the coastline. The data also lends itself to be further enhanced by the addition of other reports related to the coastal and marine environment such as engineering coastal reports, environmental reports and Fisheries reports.

This dataset represents important component of a “one-stop-shop” solution for finding and accessing report information. This has the potential across the public and private sectors to save significant time and resources in researching existing studies rather than reproducing new work that is essentially a copy of previous unknown work.

1 PROJECT PURPOSE AND FUNDING

The Managing Coastal Vulnerability (MCV) project was conducted as a Sub-Program Four of the Regional and Urban Scenario Planning (RUSP) Priority Project of Stage 1 of the Location Information Strategy (LIS) for Western Australia.

The objectives of the project, as defined in the Business Case for the LIS Stage 1, were as follows:

- Improve decision-making by assisting State and Local Governments to better plan for the impact of severe climatic events:
- Enhance the way State Government agencies and Local Government locate, access and manage coastal/marine spatial information;
- Increase collaboration and engagement between all stakeholders involved in the coastal and marine environment; and
- Better align our substantial information assets with national directions and strategies.

These objectives were refined and consolidated in the Project Initiation stage of the MCV project as follows:

- State government marine and coastal spatial datasets that are of high use and value are to be reviewed, packaged and formatted for ease of use.
- Increase efficiencies in the way state government organisations access and manage marine spatial information.
- Increase inter-agency and inter-governmental collaboration of marine data maintenance and distribution.

Key Deliverables of the project were:

- A ‘one-stop shop’ for the discovery of, and access to, all authoritative Western Australian coastal and marine information; and
- Delivery of key information to support coastal engineering and modelling of storm event and development impacts.

Expected benefits of the project are:

- More current and reliable advice to support planning for coastal infrastructure and environmental issues;
- Improved value-for-money for coastal management, providing forward savings to the community;

- A better informed community; reducing anxiety and confusion regarding the impacts of major climatic events;
- More transparent Government decision-making;
- Improved collaboration across sectors on coastal and marine projects;
- Increased support for research / modelling of coastal and marine planning scenarios; and
- Western Australia will be better placed to meet evolving, national strategies for coastal vulnerability

The MCV project was allocated $1.282 million within the overall program of work funded under Stage 1 of the LIS. The table below sets out funding approved and actual expenditure up to 30 June 2016 (shaded) within the context of funding for the broader RUSP Priority Project.

Approved RfR funding Items	**Cost ($'000)**	**Actual Expenditure as at 30 June 2016**	**Cost ($'000)**
Regional and Urban Scenario Planning – Planning systems enhancement	977	Regional and Urban Scenario Planning – Planning systems enhancement	400
Regional and Urban Scenario Planning – Regional scenario models and enhancement of location information	1,309	Regional and Urban Scenario Planning – Regional scenario models and enhancement of location information	0
Regional and Urban Scenario Planning – Coastal Vulnerability	1,282	Regional and Urban Scenario Planning – Coastal Vulnerability	1,114
TOTAL	**8,371**		**6,111**

Note: *The $8.371M is as per the State Cabinet approved funding on 07/05/2012.*

2 ACHIEVEMENT OF OBJECTIVES

This section of the report provides a summary of the overall achievement of the objectives of the project in Section 3.1; and a detailed assessment of achievement of the objectives and realisation of the benefits to-date for key datasets in the remainder of Section 3.

2.1 Overall achievement of objectives

The three objectives of the project were:

1. State government marine and coastal spatial datasets that are of high use and value are to be reviewed, packaged and formatted for ease of use.
2. Increase efficiencies in the way state government organisations access and manage marine spatial information.
3. Increase inter-agency and inter-governmental collaboration of marine data maintenance and distribution.

As the project focussed on improving the efficiency of the way marine and coastal data is managed across the public sector, and then shared with the broader community, the project adopted an innovative approach to building ownership of the responsibility of managing and sharing the data across the agencies responsible for most of the data.

A project implementation team was formed at the Department of Transport drawing on personnel with detailed knowledge and well established networks across the relevant agencies. This team was formally engaged by Landgate, providing finance and human resource management resources to simplify the administration of the project, eliminating any potential duplication of administrative overheads. The team was then deployed into the Department of Transport and subsequently the Department of Parks and Wildlife to undertake the work in order to work closely with personnel at these agencies responsible for the data after the completion of the project. This has enabled a thorough hand-over process for ongoing management of the data in which the program has invested.

With regard to each of the specific objectives, the following statements provide a summary of what was achieved.

1. State government marine and coastal spatial datasets that are of high use and value are to be reviewed, packaged and formatted for ease of use.

A range of datasets important in identifying coastal and marine assets (both human-made and natural) and the vulnerability of these assets to the impact of adverse events and conditions were identified in preparing the business case for the MCV project under the LIS Stage 1. This work built on the previous efforts of the Marine Working Group of the WA Land Information System (WALIS), a cross-agency reference group that represents the interests of organisations that generate much of the location-based data used by the community, as well as the consumers of these data across the coastal engineering and marine and coastal research sectors.

The knowledge of this reference group and its network partners, such as the WA Marine Science Institution (WAMSI) enabled a priority list of datasets that are of high use and value to stakeholders across the public, private and research sectors to be identified; and then reviewed with regards to the best outcomes for investment through the project. Preference was given to datasets that are frequently requested from the agency that creates and maintains the data, data that could add value to existing information used by the community, and for which there was a commitment to maintenance and updates beyond the life of the project. From an original list of over 60 datasets from 10 agencies, a priority list of 20 datasets from 5 agencies met the preferred criteria as outlined above.

Twenty new and/or improved datasets were generated through the MCV project. Datasets made available to-date are:

- Vegetation Line – Coastline Movements – Department of Transport
- Marine Habitats – Broad and Local Scale – Department of Parks and Wildlife
- Coastal Protection - Facilities and Structures – Department of Transport
- Geological and Geophysical Sediment Cells – Department of Transport
- Maritime Services - Navigation Aids – Department of Transport
- Shipping and Pilotage – Department of Transport
- Point Survey Index – Bathymetry – Department of Transport
- Composite Surface Index – Bathymetry – Department of Transport
- Composite Surfaces – Bathymetry – Department of Transport
- Marine and Harbours Act Areas – Department of Transport
- Coastal Compartments – Primary, Secondary, Tertiary – Department of Transport
- Marine Habitats – Department of Parks and Wildlife
- Coastal Planning Reports – Department of Planning
- New Coastal Imagery and Base Maps - Landgate

Seven of the datasets are undergoing final review prior to release later in 2016:

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- Coastal Infrastructure – Department of Transport
- Geological and Geophysical WA Landforms – Beaches, Geomorphology, Oblique Imagery – Department of Mines and Petroleum

These datasets have largely been published to data.wa.gov.au in accordance with the WA Whole-of-Government Open Data Policy via the Shared Location Information Platform (SLIP) and are available to coastal and marine engineers, local government and other stakeholders.

Improved access to these data has also been achieved through the Australia Oceans Data Network (AODN) via linkage to SLIP and data.wa.gov.au.

2. ***Increase efficiencies in the way state government organisations access and manage marine spatial information.***

The MCV project has significantly improved the quality of, and access to, location-based data critical for coastal and marine management. In many cases data management processes were improved, which will lead to sustained improvements in data quality over the longer-term. These data are now accessible through multiple access points – data.wa.gov.au, SLIP and the Australian Oceans Data Network (AODN) – meaning the data is more easily discoverable by the broader community. An illustration of how access has been simplified is provided in Figure 1. The data is also now made available in more formats, including in a form that can be used by non-expert users. Section 2 of this report provides a detailed account of these achievements.

3. ***Increase inter-agency and inter-governmental collaboration of marine data maintenance and distribution.***

The MCV project has expanded the level of collaboration across the public, private and research sectors in terms of sharing and use of location-based data for coastal and marine data management. Building on long-standing arrangements through WALIS and WAMSI, increases in the use of data, and increased satisfaction with access to data are clearly indicated in data collected for key performance indictors collected by Landgate. Section 2 of this report also provides a detailed account of broader benefits in terms of improved inter-agency and cross-sector collaboration in marine data management and sharing.

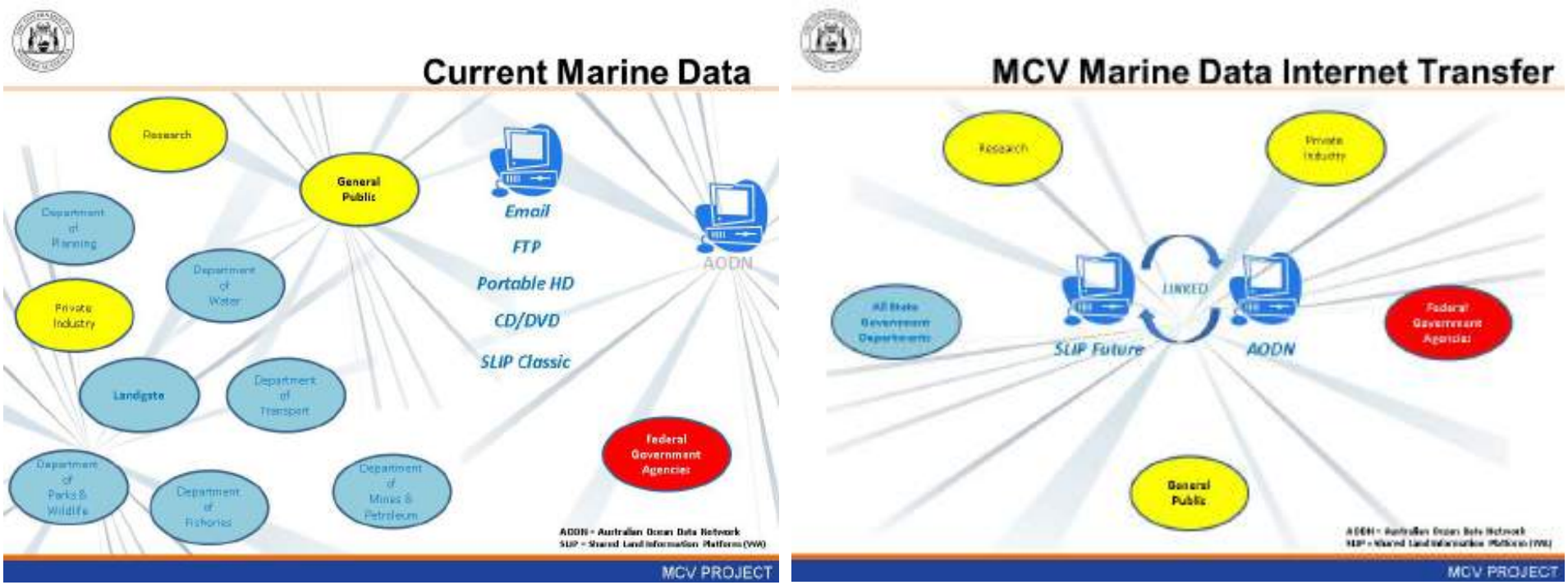


Figure 1. Simplification of data management and access through the MCV project.

Prior to the MCV project data only accessible from a range of largely unconnected systems run by a number of different data custodians. The MCV project has simplified access to improved versions of the source data by connecting a wide range of data sources together though data services via the Shared Location Information Platform (SLIP), data.wa.gov.au and the Australian Oceans Data Network (AODN).

2.2 Coastal Infrastructure (Department of Transport)

Coastal infrastructure (including boat docking facilities and associated structures) represents an important foundational dataset for human-made assets in WA; and was the first dataset to be addressed through this project. The data used to generate the Coastal Infrastructure datasets was drawn from six source datasets in which the Department of Transport had previously invested significant time and effort to maintain separately.

A significant challenge for the project was that there was no clear definition of what constituted coastal infrastructure. The project enabled staff from various branches of the Department of Transport and coastal engineers to reach agreement on what is defined as coastal infrastructure. Principally everything that was deemed as infrastructure that was with 500 metres of the ocean was captured. Rules and definitions were all documented for use in the capture process.

The separate source datasets were then able to be integrated into a single coastal infrastructure that is easier and more cost effective to maintain. Up-to-date aerial photography and satellite imagery, also funded through the Royalties for Regions program for regional areas was critical in updating this record of coastal infrastructure assets.

At hand-over to the Department of Transport the MCV team prepared a series of documents developed to add control to the management of each individual data project:

1. Initial Project Plan
2. End User Requirements Capture
3. UAT(User Acceptance Testing) Completion Record
4. Dataset Acceptance and Handover

MCV team also constructed a number of process schematics. These process diagrams formed the basis for all future project requirements capture, data management workflows and project delivery to agencies during the lifecycle of the MCV project. Examples of these products are included in APPENDIX F.

Full documentation regarding the datasets structure, update procedures, metadata compilation was prepare and completion and final handover to the Department of Transport was achieved in February 2014. An illustration of the completed datasets in provide in Figure 2.

Benefits

To our knowledge this is the first comprehensive dataset of Coastal Infrastructure for WA that has the ability to have multiple attributes assigned to them as details and data become available into the future.

All Department of Transport infrastructure data includes ownership details, construction drawing references, unique Identifiers, Local government jurisdiction data and many other attributes. All other data not belonging to Department of Transport has the ability to have this information loaded also.

The dataset provides a valuable asset to prepare for and manage the impacts of adverse events and conditions across the vast coastline of WA; including estimating the costs involved. For example, those responsible for responding to oil spills will find this dataset a useful asset in preparation and planning for oil spills in terms of assets in place (jetties, wharves, boat ramps etc.) and also potential logistical base sites with all coastal car parking captured along the whole WA coast. The dataset redesign also provided a means to complete a full Coastal Infrastructure definitions listing for WA which did not exist before. This dataset now forms the basis of Department of Transport's Coastal Strategic Asset Management System (SAM).

2.3 Coastal Compartments (Department of Planning)

Coastal compartments are a classification of coastal geomorphology that coastal engineers use in accessing risk of coastal erosion.

Compilation of the WA Coastal Compartments dataset was originally commissioned by the Department of Planning before the MCV project was implemented and was undertaken by Ian Eliot (Geomorphologist). It was subsequently agreed that the Coastal compartments dataset ownership should be transferred to the Department of Transport and aligned with a new Sediment Cell dataset for WA. The WA Coastal Compartments dataset was transferred in February 2014.

Shortly after this time Geoscience Australia completed work on a national Coastal Compartments dataset. Discussions with the parties revealed that the two datasets were quite dissimilar; however it was agreed that the WA and national datasets could be at least aligned. In consultation with Geoscience Australia and marine engineers the MCV team undertook significant work to edit the dataset.

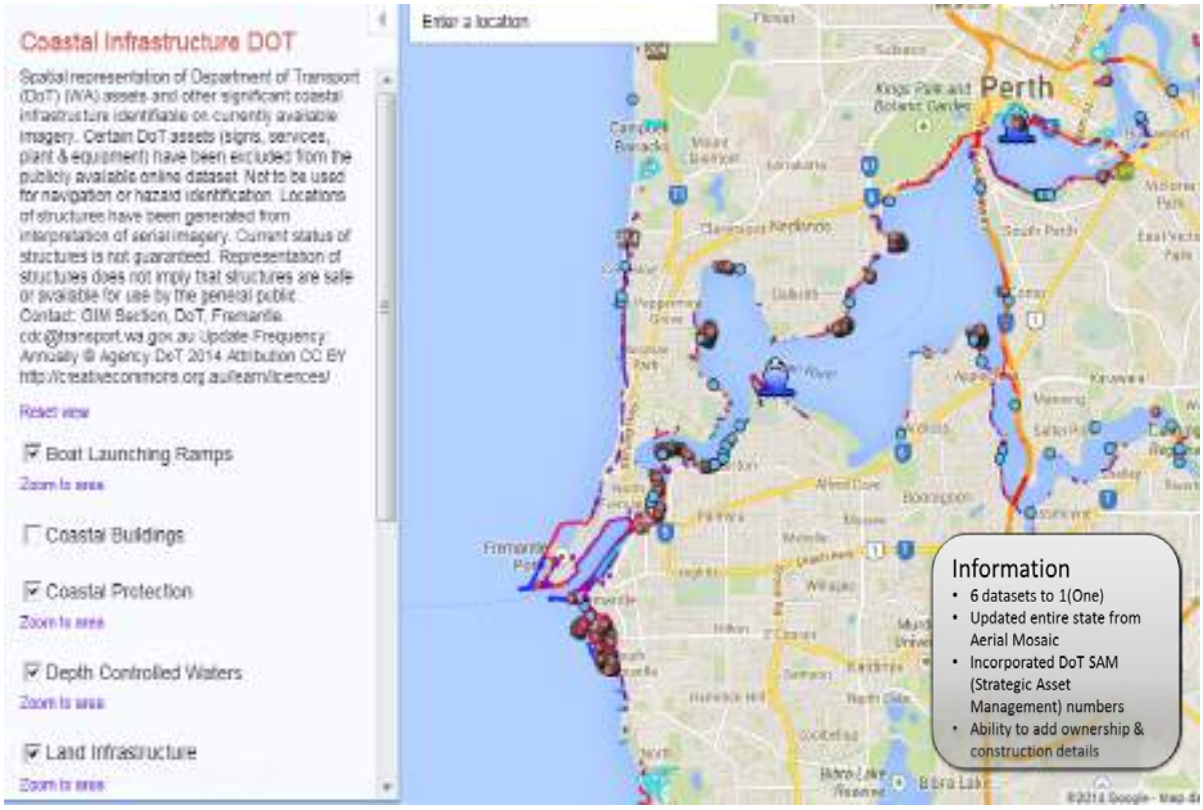


Figure 2. An illustration of the Coastal Infrastructure dataset displayed through the Shared Location Information Platform (SLIP).

Benefits

This data provides a standard division system for the whole of WA coastline that is based on Geomorphological compartments. These compartments align with many Marine subjects such as Habitats, Wave Action, Tides and Currents etc.

WA Oil Spill Response uses this system as a reference theme for interaction with all International, National and State authorities. It is also a primary system for Sediment Transport and Coastal Landform information and is instrumental in accessing risk with Coastal Erosion.

An illustration of the completed datasets is provided in Figure 3.

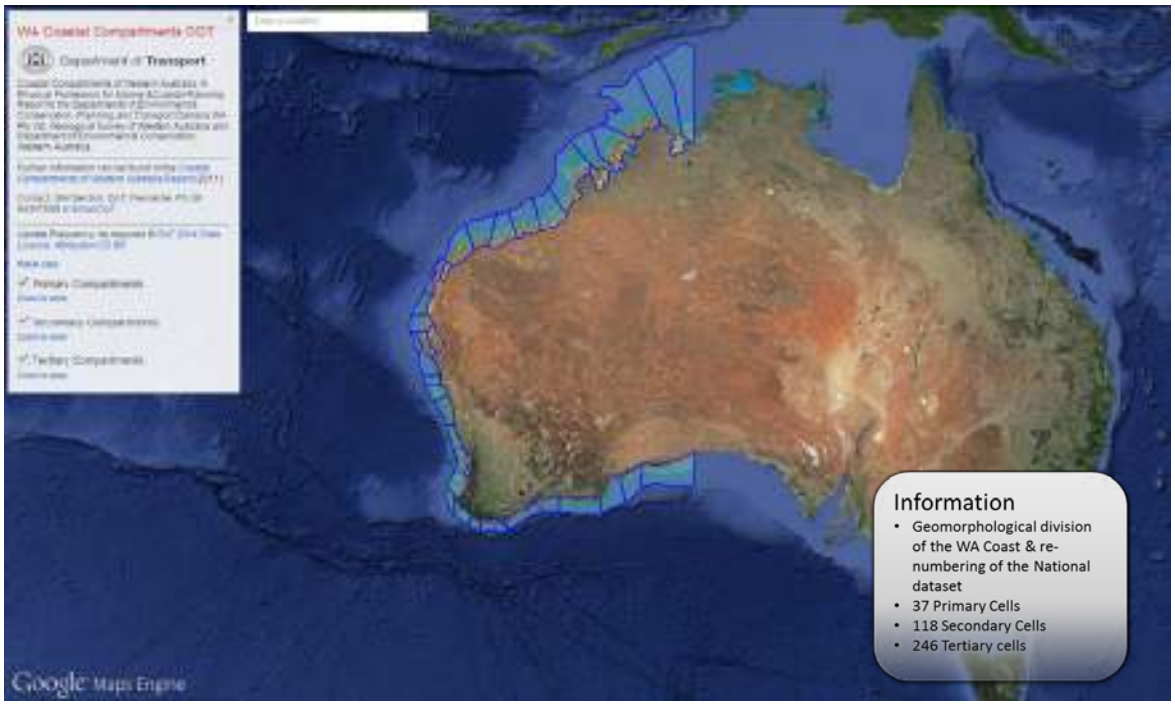


Figure 3. An illustration of the Coastal Compartments dataset displayed through the Shared Location Information Platform (SLIP).

2.4 Coastline Movements (Department of Transport)

Coastline Movement lines are interpreted lines depicting vegetation line, water lines, sand drift and various other topographical features. The vegetation line represents a line of stability along the coast. An understanding of the current and historical positions of the coastline is important in assessing the risks and impacts of coastal erosion and accretion over time, particularly with regard to development along the WA coast.

Historically these lines have been captured at regular intervals from aerial photography dating back to 1945 and some data from original coastal drawings data back to 1875. These lines have been used to study the movement of the coastline and to study natural coastline movement and also the effects of man-made marine structures (e.g. groynes, jetties) have had upon natural movement of sand and seaweed materials.

There were multiple issues with the original dataset. More than 600 individual files, diverse capture systems have elaborate and costly processes in place to manage the data. Multiple duplicate files had to be formatted and brought together into one single dataset, and frequently attribution had to be gathered from hard copy drawings.

The MCV project team invested significant effort in sorting and then integrating these data into a single dataset, and establishing improved processes for ongoing management of the data. The new coastline movement dataset was completed in July 2014. An illustration of the completed datasets is provided in Figure 4.

Figure 4. An illustration of the Coastal Movements dataset displayed through the Shared Location Information Platform (SLIP).

Benefits

The coastline movement dataset is a key dataset used in assessing all coastal developments, and is used regularly by both government and industry. The feedback on the datasets published to SLIP in Figure 4 provides an illustration of the time savings and efficiencies realised through the publication of the data.

I wanted to pass on some positive feedback received from Andre Bartels a consultant from PRDW and myself regarding the coastline movement's dataset.

Andre requested availability of coastline movements from Hillary's to Two Rocks in order to tender on a project at Quinns Rock. Usually the task of searching MARIS for existing coastline movements and providing the information to the consultant would take about 2/3 hours in addition to the time the consultant would take to travel to Fremantle and view the drawings (another 2/3 hours). Instead I was able to refer Andre to the new link to coastline movements web map where he could see all available data and download specific datasets if required from SLIP. This took about 20 minutes. The availability of the new Coastline Movements dataset has saved me about 3-4 hours of work. It has also saved the spatial information team time in that only the relevant data sets will be requested if Andre needs them after viewing them online. They will no longer have to search for data sets that may not be available for certain parts of the coastline or that may have limited application.

Andre was really impressed with the new Coastline Movements dataset. He was very happy that he didn't have to spend time travelling to Fremantle to view the data sets and have the waiting times associated with requesting to view and receive coastline movements data through previous methods. He said that this data set is going to be very valuable for his future projects and enable him to use his time more effectively in delivering projects to clients.

Feedback provided by Cristina Da Silva from the Coastal Infrastructure Team at DoT:

"We often receive requests from consultants and local governments about the availability of coastline movements, the new online data set will greatly improve our efficiency in answering their requests and give us more time to work on more urgent tasks. I look forward to the availability of other data sets online, they will streamline our work even further."

Wednesday 13 Aug 2014
Cristina Da Silva
Coastal Scientist | Coastal Infrastructure | Department of Transport
1 Essex St, Fremantle WA 6160

Figure 5. Feedback on the benefits of the Coastal Movements dataset.

2.5 Bathymetry (Department of Transport)

Bathymetry is a representation of the depth and form of land under water i.e. marine equivalent of topography. These data are essential for understanding the behaviour of water bodies and the ocean, and its interaction with the coastline and associated infrastructure.

This dataset incorporates separate products for Point Survey Index, Composite Surface Index and Composite Surfaces.

The bathymetry datasets were the most difficult data to work with encountered during the project and took approximately eight months to complete. The initial planning for work with these data had anticipated some of the difficulties encountered due to the size and complexity of the data; however, additional challenges also arose with a number of the software systems used to manipulate the data.

The compilation and re-projection of surveys was a MCV project team and data custodian team effort. The MCV project team members were principally converting surveys, compiling metadata and loading surveys into business systems.

Problems encountered by the MCV team were logged with a Joint MCV/Transport team of experts that proceeded to solve the problem (datum errors, incorrect information, missing information, sloping datums, or other complex issues).

The data has been made available in two forms:

- An index of Multibeam, Lidar & Laser Surveys.
- An index of Single Beam Surveys from 1965 onwards.

These data are large datasets and have been made available as downloads via SLIP from the Amazon Cloud. An illustration of the published data in provided in Figure 6.

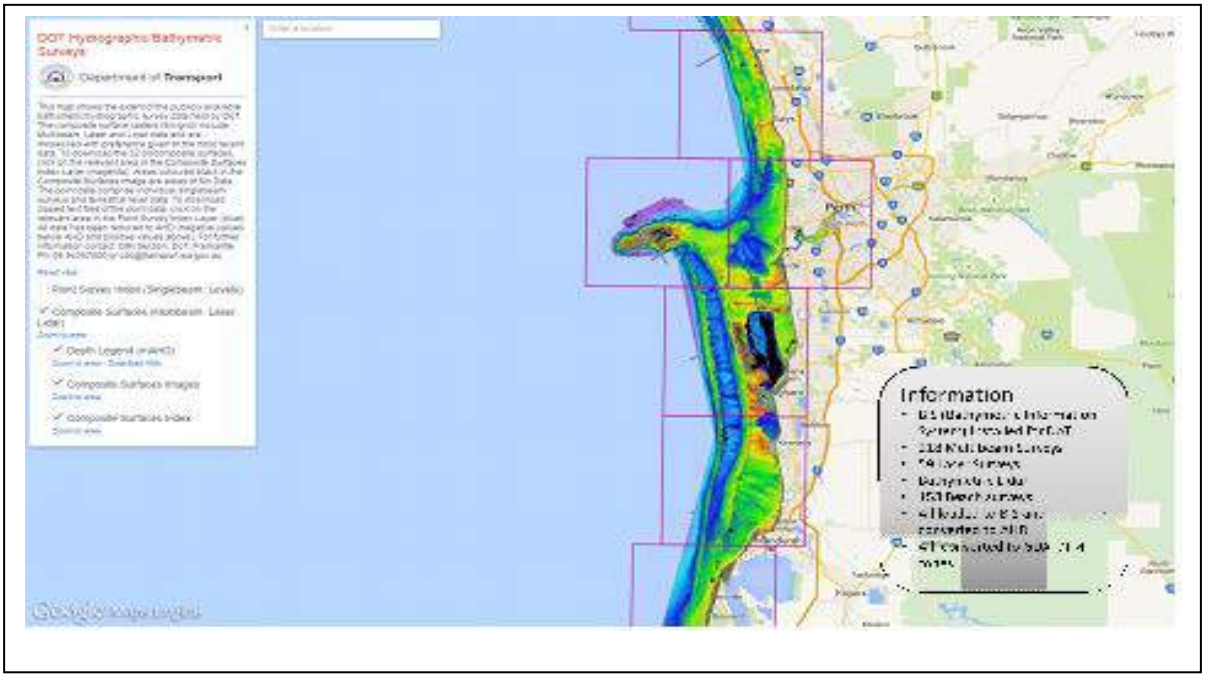


Figure 6. An illustration of the Bathymetry datasets displayed through the Shared Location Information Platform (SLIP).

Benefits

Following publication of the data to SLIP the Department of Transport experienced a significant decline in manual requests for this data and it allowed almost 90% of requests to be serviced by simply directing them to SLIP. Customers have been able to explore data in a simple map form in SLIP before deciding whether to download the data, rather than having to invest time in downloading full datasets they may not need.

The data has also been made available with a consistent horizontal and vertical datum (MGA94 & AHD).

Non-GIS users are able to visualise the Point Cloud Surveys (Multibeam, Lidar & Laser) in a colour coded viewer with a depth legend that providdes a very good indication of depth without any special software.

2.6 Oceanography (Department of Transport)

Oceanographic datasets, including data on tidal movements and waves is essential for understanding the behaviour of water bodies and the ocean, and its interaction with the coastline and associated infrastructure.

There is a considerable amount of historic tide data ranging back to the early 1900's. Over this period there have been established more than 28 permanent tidal recording stations along the WA coastline from Wyndham to Esperance. There have also been many temporary tides stations and corresponding records in the last 50 years. Many of the early tide data was recorded in hardcopy graph format. These data have, in most cases, been converted to digital format and is stored in a specific text format.

Tide data is processed monthly, and at the end of each calendar year it undergoes further processing and quality checks before it is added to the historical dataset.

Historic Wave data has also been accumulated since the initial employment of a single Waverider buoy in 1974. There are currently 6 DoT Waverider buoys in operation at various locations around the coast. Records for these devices are currently stored in Excel format.

Acoustic Wave and Current (AWAC) Data is a combination of multiple data records including currents, deployment details, status, temperature, tide and wave data. AWAC's are predominantly deployed at locations that require coastal engineering investigations. Data is normally downloaded and stored on a three-monthly basis.

The MCV project team started to conduct the investigation process into the oceanographic dataset held by the Department of Transport in April 2014. The MCV team looked at data collected by tide gauges, wave buoys and AWAC (Acoustic Wave and Current) instruments.

An initial issue that confronted the MCV team was that although data produced by the Department of Transport Oceanographic team is location based, existing systems did not incorporate spatial attribution and functionality. Working with the Oceanographic team, the MCV project team developed an integrated record of the metadata for every sensor that had or was employed by the Oceanographic team, including coordinates of its location. This enabled a process to be established to extract the location-based data and metadata and publish these data to SLIP.

The other oceanographic data for these sensors was also reformatted and published to a cloud-based (Amazon) archive.

As per the bathymetric data, simple hyperlinks were then added to public SLIP Maps to enable customers to more easily explore and then download these data as required. This replaced a previously complex process for the Department of Transport staff to manually extract the data for each data request.

A significant effort was required by the MCV team to format the Oceanographic data and publish it to the Amazon archive. The thousands of data files were not in a consistent format, especially with regard to vertical datum information.

Figure 7. An illustration of the Oceanographic datasets displayed through the Shared Location Information Platform (SLIP).

1. Tides(Current/Historical)
2. AWAC(Acoustic Wave and Current)meters
3. Waverider
4. Pressure sensors(sub surface)
5. Current Meters

Benefits

The benefits to the community are similar to the bathymetric database dataset. The Department of Transport was able to reduce the resources required for data requests by almost 90%. The community is able to access and explore what is available from Department of Transport in terms of oceanographic records spanning the last 100 years and is able to immediately download the data that they required. Data management systems at the Department of Transport have been significantly more efficient.

2.7 Sediment Cells (Department of Transport)

Sediment cells are natural management units with a physical basis, identifying sections of the coast within which sediment transport processes are strongly related.

They provide an elegant format for summarising coastal data and can be used to:

- Conceptualise the spatial context for coastal evaluations;
- Provide a visual framework for communicating about the coast;
- Support coastal management decision-making;
- Support a range of technical uses largely relating to coastal stability assessment;
- Reduce problems caused by selection of arbitrary or jurisdictional boundaries.

The Department of Transport and the Geological Survey of WA have conducted several studies of coastal sediment cells for 4 of 13 Coastal Regions in WA. The aim of work on these data was to identify a hierarchy of sediment cells for planning, management, engineering, science and governance of the WA coast.

Coastal Regions include:

1. Kimberley
2. Canning
3. Pilbara
4. Exmouth
5. Shark Bay
6. Northampton
7. Mid-West
8. Vlamingh
9. Naturaliste
10. Flinders
11. Baudin
12. Thijssen
13. Giles

Each sediment cell is a collection of marine and terrestrial landforms, inter-related by sediment transport between them. They include areas of sediment supply (sources), sediment loss (sinks) and areas through which sediment is moved between sources and sinks (pathways). Sediment transport pathways include both alongshore and cross-shore processes and therefore cells are best represented in two-dimensions.

Sediment cells have been mapped as a hierarchy of primary, secondary and tertiary levels to incorporate three spatial-temporal scales. The hierarchical nature of the cells gives a basis for comparison of planning and management at a number of scales, from small-scale engineering works, through to large-scale natural resource management.

Preliminary investigation into Sediment cells dataset revealed that there was only one existing dataset at the Department of Tranaport for the Vlamingh (Two Rocks to Cape Naturaliste) Sediment project. There were three other projects (Mid-West, Northampton and Pilbara region) that were in the final stages of the report being released. All four of these project areas had been analysed and reported on using a slightly different methodology and representation process. The most markedly different project was the Vlamingh project which had been completed a number of years before (2012) and was the first of its kind for WA.

Amalgamation of all of the projects into one integrated dataset meant that the MCV team had to understand the technicalities of sediment transport and be able to negotiate between various experts to arrive at a final dataset that encompassed all methodologies for past, present and future determination.

An data management plan was devised and the data was aligned throughout all of the four regional determinations to produce a single dataset for WA. One of the goals was to reduce the amount of working involved in entering the consultant data, providing specifications and guidelines to consultants before Sediment Projects that outline final data and metadata structure. The MCV team provided a considerable amount of assistance to custodians of the data to ensure practices were refined and embedded into business process into the future.

The final dataset is considered an industry standard. The Department of Transport and consultants revised the project report for Vlamingh (Two Rocks to Cape Naturaliste) and the improved result was published to SLIP in October 2015.

An illustration of the completed and published data is provided in Figure 8.

Figure 8. An illustration of the Sediment Cells datasets displayed through the Shared Location Information Platform (SLIP).

At this stage reports have been completed for 4 of the 13 regions. The MCV has provided a platform to build this important dataset and be able to provide information to coastal communities so that they can help avoid erosion issues and understand that construction of infrastructure in the marine and coastal environment can have long-term impacts.

Benefits

Standardising sediment cells reporting has removed uncertainties in interpretation and understanding of Sediment reports for WA. As the bathymetry and other coastal processes data (wave rider, AWAC etc.) is accumulated for the coastline, sediment transport definition can be more readily completed. The reason only these 4 out of 13 areas is completed is because there is insufficient data for the other areas.

2.8 Marine Use Boundaries (Department of Transport)

This dataset was generated and is published to SLIP by the Department of Transport. The data incorporates:

1. Marine & Harbours Act Areas
2. Shipping & Pilotage Act Areas
3. Navigable waters regulation boundaries

2.9 Navigation Aids (Department of Transport)

This dataset incorporates information about the location, attributes and status of Marine Navigation Aids for the State. The Navigation Aid information maintained in the dataset reports on navigation aids from 47 owners in the state.

A dataset that integrates existing data sources was also generated and is published to SLIP by the Department of Transport. An illustration of the data published to SLIP is provided in Figure 10.

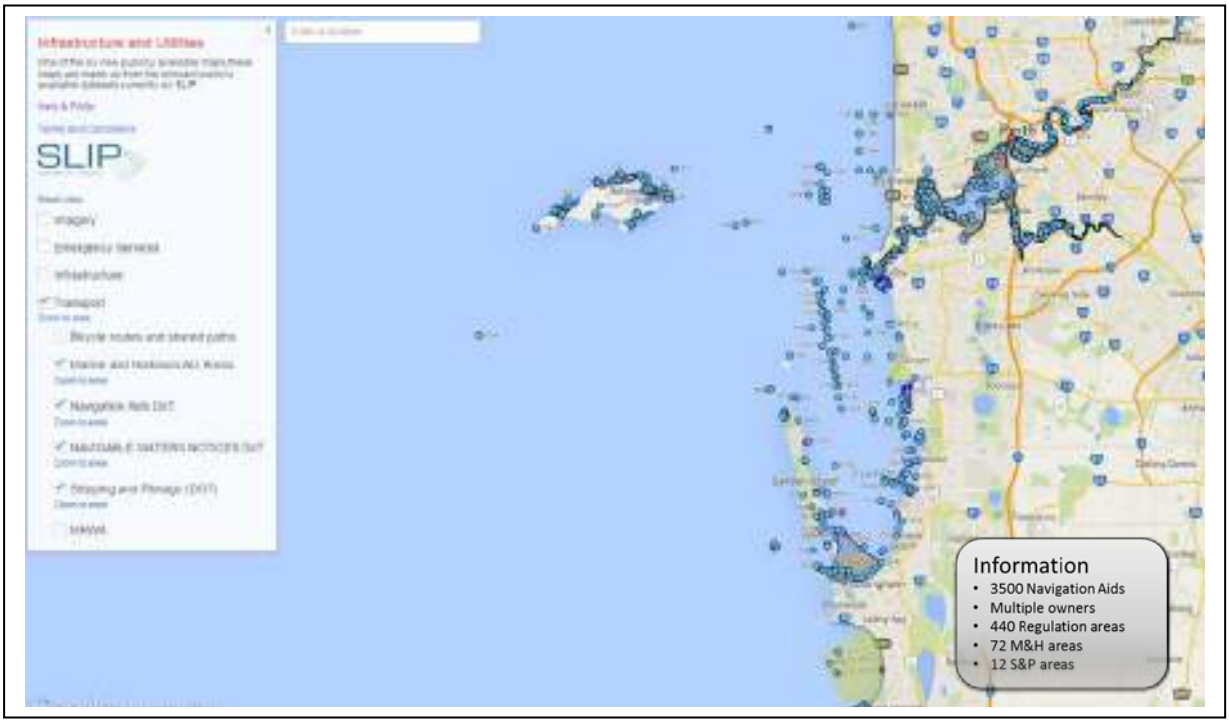


Figure 10. An illustration of the Navigation Aids dataset displayed through the Shared Location Information Platform (SLIP).

2.10 Waterlines (Landgate and Department of Transport)

In addition to monitoring changes in the coastline over time (See Section 2.4) it is important for WA to have a standard set of reference waterlines that provide a baseline against which to measure change and set administrative boundaries. Waterlines commonly referred to include high and low waterlines – based on tidal ranges. The need for a more consistent approach to defining and sharing data on waterlines was raised by a number of agencies.

The project team conducted a number of workshops with stakeholders involved in coastal management. The MCV team also compiled information from a survey through which stakeholders prioritised the need for improved data around the WA coast according to coastal compartments. A summary of the outcomes of this work is provided in Appendix C.

The two key actions agreed through the workshop process were:

1. The MCV project team would assist agency personnel to compile a set of photos and standards for each Coastal Compartment to serve as a prototype for future interpretation.

2. Landgate would investigate the feasibility of removing the waterline information from the State Cadastral Database (SCDB) and integrating the data with the Topographic database (TGDB). Implementing this solution, if feasible, would avoid issues where waterlines are also tagged as cadastral boundaries.

Both tasks were completed. Landgate advised that it would not be feasible to remove waterline information from the State Cadastral Database (SCDB) and integrate the data with the Topographic database (TGDB). As an alternative, the Landgate SCDB team agreed to review and seek to improve their aerial photographic determination procedures with the aim of improving the storage of waterlines within the SCDB. To assist, the MCV team provided the Landgate SCDB team with the priority documents derived through the workshops.

Through the course of other work on the project, the MCV project team also leveraged an opportunity to work with the Department of Transport on the development of a semi-automatic process to determine waterlines by tracking debris trails on beaches captured through laser scanning. These debris lines can indicate the highest waterline for that point in time. Coincidently Landgate was capturing improved aerial imagery with support from Royalties for Regions under the LIS program. There were opportunities to trial this technique at various locations. The team had some success with the technique at Busselton.

Results of this work have been reviewed with coastal engineers and the methodology refined with their assistance. Waterline determination using debris lines has proven a valuable addition to the update process of WA waterlines when used in conjunction with more traditional approaches. This semi-automated technique is quicker and more consistent than existing methods.

An illustration of the approach is provided in Figure 11.

Benefits

Waterlines can be regenerated for sandy beaches from high resolution aerial photography. The process is not wholly dependent upon individual interpretation of aerial imagery by individuals which tend to produce an inconsistent product.

It provides recognition that the coastline moves and that a High Water Mark level is not solely dependent on tidal values.

Figure 11. An illustration of the debris line waterline capture methodology developed through the MCV project.

2.11 Marine and Coastal Habitats (Department of Parks and Wildlife)

Knowledge of the extent and nature of natural habitats in marine and coastal environments is critical for planning for and managing the impacts of adverse events and conditions on these natural assets.

For this work the MCV project team was embedded at the offices of the Department of Parks and Wildlife. Preliminary investigation involved the MCV project team understanding how remote sensing of Marine and Coastal habitats was undertaken at the Department of Parks and Wildlife. A number of small projects were partially completed including Shoalwater Marine Park-Seagrass study. This included a site visit to partake in the habitat sample-drop camera from a Department of Parks and Wildlife patrol vessel.

The MCV project team consulted with the Department of Parks and Wildlife Marine Science and Planning groups to understand what habitat data was available. Integrating these data faced was challenging as the data was collected at different scales using different methodologies. The Department of Parks and Wildlife is also one of at least six State and Commonwealth agencies undertaking marine habitat determination.

Habitat sample data, including video and photographic imagery, had been collected by different agencies in often overlapping areas. Much of these data were not readily accessible.

The work of the MCV project team with the Department of Parks and Wildlife focussed on two activities:

1) Compilation of a marine and coastal data catalogue (index). This would clearly list Department of Parks and Wildlife habitat projects and identify important metadata associated with these data to understand the differences between the data. The catalogue would also act as an internal DPaW guide as to the physical location of those projects on the DPaW digital IT network.

2) Formation of a habitat sample working group that would formulate a cross agency system for storage of habitat sample data that could initially be accessed by all of the member agencies. The group would also act as a reference group for the Department of Parks and Wildlife beyond the life of the project to facilitate ongoing improvements to data management.

The marine and coastal data catalogue was delivered to the Department of Parks and Wildlife in June 2016; and included a compilation of ‘footprints’ of Department of Parks and Wildlife projects with attributes (where available). The catalogue is under review,

but it is hoped to be shared with the other State and Commonwealth involved in capturing habitat data so that they can contribute to a common data resource.

An illustration of habitat mapping and characterisation datasets is provided in Figure 12.

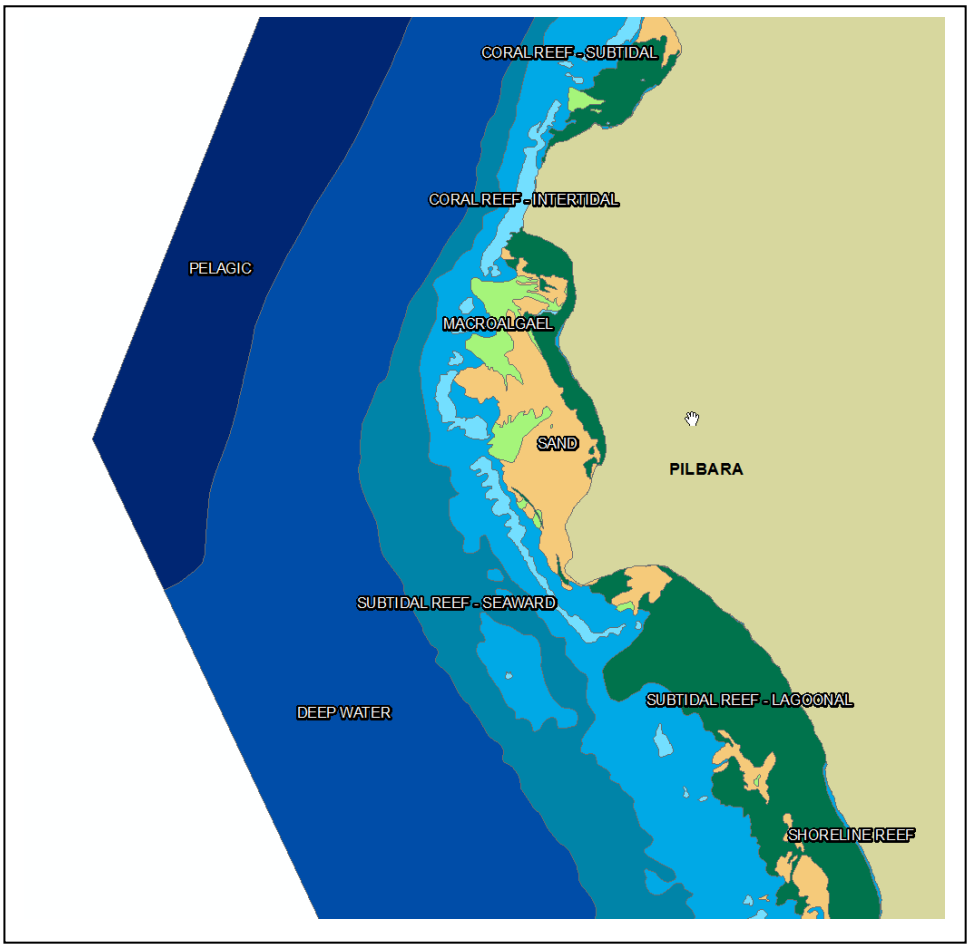


Figure 12. An illustration of marine habitat mapping displayed through the Shared Location Information Platform (SLIP).

Benefits

The Department of Parks and Wildlife habitat catalogue will reduce duplication of effort and investment of projects across State and Commonwealth agencies, and private enterprise; and prevent waste of valuable money and resources. The catalogue and associated data also significantly contributes to knowledge about the location and value of important natural assets by making the data more readily accessible to the public and those involved in planning for and managing adverse events in coastal and marine areas, such as oil spills.

2.12 Coastal Landforms and Oblique Photography (Department of Mines and Petroleum)

The Department of Mines and Petroleum generates and is the custodian for a range of data important for marine and coastal management.

Compilation of the WA Coastal Landforms dataset was originally commissioned through the Geological Survey of WA with funding made available through the Department of Planning. These data had been useful for improvement of Sediment Cells and Coastal Compartments datasets managed by the Department of Transport.

Oblique aerial photography, managed part of the Coastal Landforms data, provides useful contextual information between Cape Naturaliste to Broome. For example an oblique view of the coast provides an important reference when identifying fearures using other aerial and satellite imagery. Oblique Imagery that is taken with a time stamp also enables users to directly associate the water level in the photo with relevant tide tables for high/low water determination.

The MCV project team, in liaison with the Department of Mines and Petroleum, amalgamated the Coastal Landforms data into a single dataset. The MCV team also developed a system to link the oblique imagery to the photo centres in the database in such a way that when viewing the landforms data the individual oblique image centre can be selected to display the photo.

An illustration of the data consolidated through the MCV project is illustrated in Figure 13.

Benefits

Data on Coastal Landforms is an important data source for Coastal Engineers and Planners assessing the vulnerability of the coastline and associated assets, and for engineering, or planning applications.

Figure 13. An illustration of coastal landform mapping and the locations of oblique imagery displayed through the Shared Location Information Platform (SLIP).

2.13 Coastal Planning Datasets (Department of Planning)

State Planning Policy 2.6 State Coastal Planning Policy provides for the long term sustainability of Western Australia's coast. The Department of Planning undertakes a range of activities to support the implementation of State Planning Policy 2.6. A range of datasets have been generated, and are managed, by the Department of Planning through an integrated coastal planning and management program.

The MCV project focussed on improving the accessibility of data associated with the Department of Planning publication "Status of Coastal Planning in WA 2012". Maps, for the purposes of the publication, were originally created in a Computer Aided Design (CAD) format. This format limits the ability to integrate the data with other information used for coastal management. These data include the locations and extents of management plans.

The MCV team invested significant effort in converting the original data into a more versatile spatial (GIS) format. Attribute information was scanned from the original paper-based format with Optical Character Recognition (OCR) software and then transferred into the GIS datasets.

The data can now be queried to identify the location and extend of management plans across the state based on a range of attributes, including plan date, plan type or agency for example

The data was handed-over to the Department of Planning in October 2015 and as of June 2016 the Department of Planning were undertaking a review of the data prior to public release.

An illustration of the data enhanced through the MCV project is provided in Figure 14.

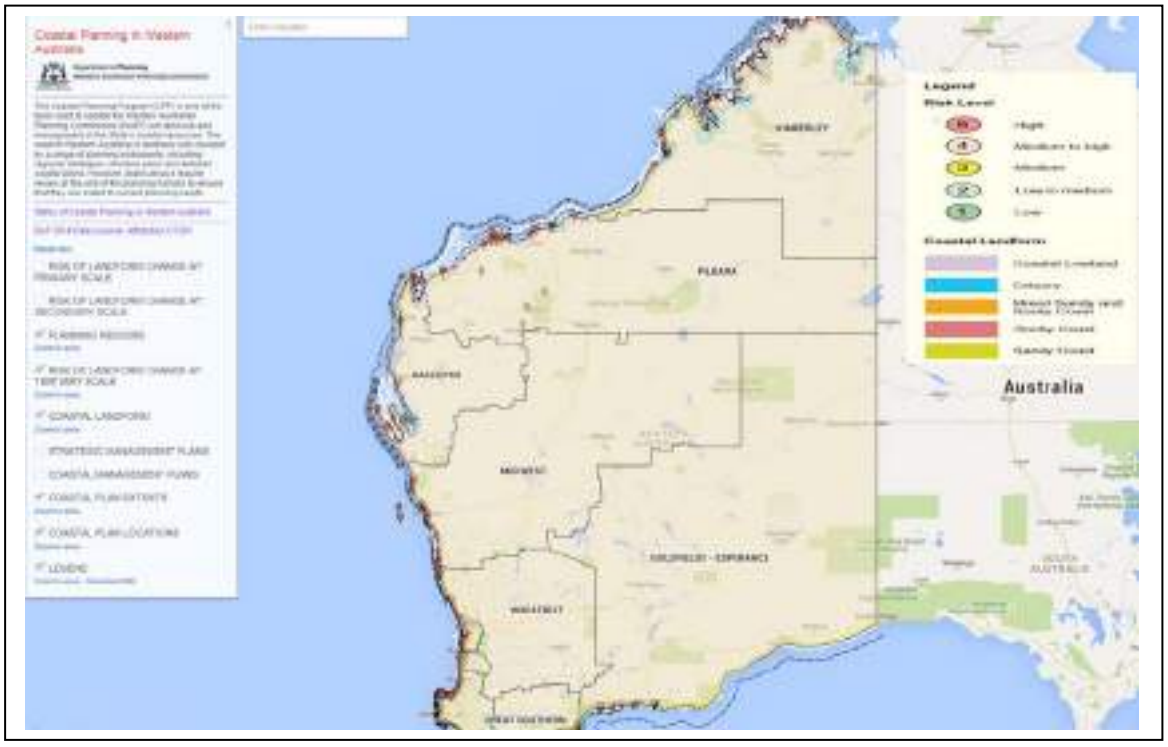


Figure 14. An illustration of coastal planning datasets displayed through the Shared Location Information Platform (SLIP).

Benefits

This dataset provides a valuable source of information for coastal managers throughout the state. Release of the data will significantly reduce the amount of time that it takes to find reports relating to management and conditions for any one part of the coastline. Use of the data, as illustrated in Figure 14, lends itself to be further enhanced by the addition of other reports related to the coastal and marine environment such as engineering coastal reports, environmental reports and Fisheries reports.

This dataset represents important component of a “one-stop-shop” solution for finding and accessing report information. This has the potential across the public and private sectors to save significant time and resources in researching existing studies rather than reproducing new work that is essentially a copy of previous unknown work.

3 PROJECT PERFORMANCE

Throughout the project, quarterly returns and annual reports were submitted as per the requirements of the MoU and provided information on on-going progress with the major expenditure items.

All major expenditure items for the MCV project met milestone dates with disbursements being made at regular intervals. A summary of the project expenditure and reasons for variances are as follows:

Major Item of Expenditure	**Budget ($'000)**	**Expenditure ($'000)**	**Comments**
Regional and Urban Scenario Planning - Coastal Vulnerability	1,282	1,114	All milestones were met within budget. Twenty-one new and/or improved datasets have been generated through the Managing Coastal Vulnerability (MCV) component of RUSP. These datasets have largely been published to SLIP and made available to coastal and marine engineers, local government and other stakeholders. *In addition to the $1.114 million spent through to 30 June 2015, a further $4,000 was expended in early 2015-16 during close-out for the project and will be reported in the next quarterly return (Q1 2016-17).*

Delivery of the Royalties for Regions – funded component of the Location Information Strategy for WA (LIS) was structured into a series of three elements. The following summary highlights deliverables required of, or essential to, the MCV project and those achieved under the LIS Stage 1 program of work.

Element One - Project Definition

Project Deliverable	MCV Deliverable	Achieved
Signing of the MoU by both Parties.		✓
Establishment of governance arrangements, including relevant committees/groups described in the business case	✓	✓
Development of a critical stakeholder list to the satisfaction of the Department and the Regional Development Council (the Council).	✓	✓
Completion of pre-planning stakeholder engagement to ensure alignment between stakeholder expectations and Project deliverables.	✓	✓
Determine initial requirements for scenario planning (planning questions, processes, information requirements to prioritise investment) with regional stakeholders		✓
Development of a detailed capture plan for aerial imagery for first priority sites to include: 24 town sites captured at 10cm resolution over the 2012/13 Program Year (outlined in Schedule 5 of this Agreement).		✓

Element Two - Project Commencement

Project Deliverable	MCV Deliverable	Achieved
Evidence of the establishment of Memoranda of Understanding with critical delivery agencies for the Project.	✓	✓
Evidence of continued stakeholder engagement and consultation on end user requirements, including Agency and industry input to Project delivery and priorities via LIS governance arrangements.	✓	✓
Regional and Urban Scenario Planning: Commence data standardisation and preparation for publishing of priority datasets onto SLIP		✓
Coastal Vulnerability: Develop infrastructure for delivery of coastal and marine information; and commence data standardisation and preparation for publishing of priority datasets onto SLIP.	✓	✓
Strategic Capture: Commence procurement of satellite imagery, Development of a detailed capture plan for the second and third high resolution aerial imagery priority sites to the satisfaction of the Department; and complete capture of high resolution aerial imagery for first priority sites.		✓

Project Deliverable	MCV Deliverable	Achieved
Evidence to the satisfaction of the Department of a Satellite Procurement Agreement for an ongoing supply for three years which includes: Product specifications and capability (high resolution satellite imagery coverage for the entire State at 2.5m per pixel and update frequency).		✓
Development of Project Plans to the satisfaction of the Department and the Council for priority projects: Regional and Urban Scenario Planning and Coastal Vulnerability.	✓	✓

Element Three – Project Delivery

Project Deliverable	MCV Deliverable	Achieved
Continued stakeholder engagement and consultation on end user requirements and Agency and industry input to Project delivery and priorities.	✓	✓
Regional and Urban Scenario Planning: Test, refine and complete customised scenario planning tools for improved capability; publish all data and planning capabilities to SLIP; final round of training for regional stakeholders for customised scenario planning tools; and Final Report on the RUSP Project.		
Coastal Vulnerability: Finalise infrastructure for delivery of coastal and marine information; complete data standardisation and publishing of priority datasets; publish priority datasets to State Land Information Platform (SLIP) and the Australian Ocean Data Network (AODN).	✓	✓
Strategic Capture: Complete capture of high resolution aerial imagery for the second and third priority sites as per the agreed capture plan; completion of the Satellite Procurement Agreement scope of works, including procurement and upload of high resolution satellite imagery for the whole state.	✓	✓
Project Stakeholder Review: Post Project stakeholder consultation and engagement, delivery of improved and updated access to priority datasets, imagery and scenario planning tools to stakeholders through SLIP and AODN.	✓	✓

4 COST MANAGEMENT

Managing costs effectively across a project that involved direct engagement with multiple agencies required an innovative approach to financial management and a high level of coordination between agencies – particularly the Department of Transport, Landgate and Department of Parks and Wildlife. The general success of this approach leveraged existing long-standing collaboration between these agencies through the WA Land Information System (WALIS). The project has further enhanced the level of collaboration between these agencies and others; with the potential to drive further efficiencies in data management and coordination of coastal and marine management into the future.

A project implementation team was formed at the Department of Transport drawing on personnel with detailed knowledge and well established networks across the relevant agencies through WALIS. This team was formally engaged by Landgate, providing finance and human resource management resources to simplify the administration of the project, eliminating any potential duplication of administrative overheads. The team was then deployed into the Department of Transport and subsequently the Department of Parks and Wildlife to undertake the work in order to work closely with personnel at these agencies responsible for the data. This has enabled a thorough hand-over process for ongoing management of the data in which the program has invested.

The funding for the MCV project was managed by Landgate in consultation with the Department of Regional Development. MCV project team members were employed and managed through the Landgate Payroll system. Purchase of equipment and other operational costs were also approved and managed through Landgate. Specific arrangements were made under this system for particular items of expenditure.

In all cases requests for purchases were raised to Landgate for approval in consultation with the MCV team and relevant host agencies as per the following examples:

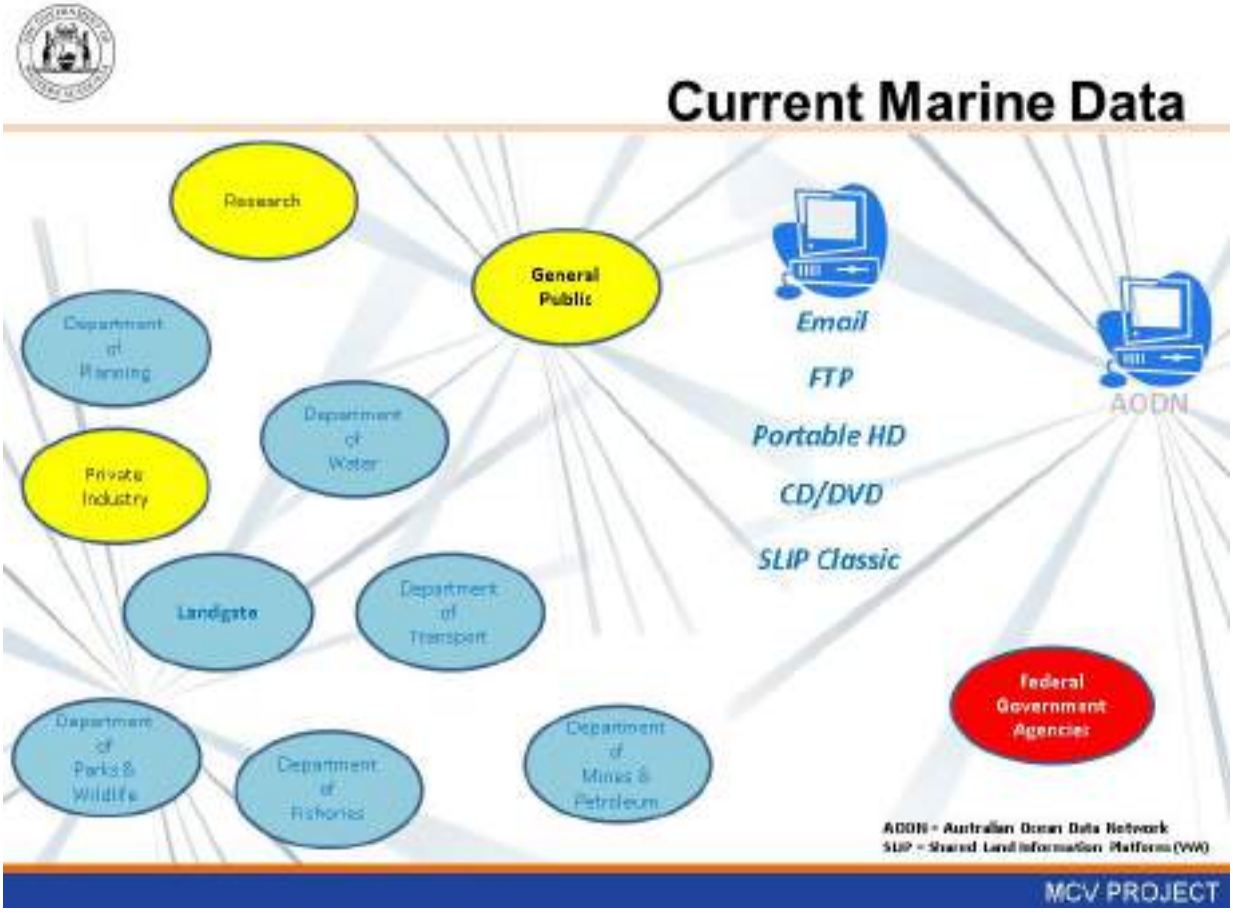
Bathymetric Information System (BIS)

- Purchased by the Department of Transport via the Department of Transport tender system. Final invoices presented to the MCV project.
- The MCV project team arranged a Department of Transport invoice addressed to Landgate with summary & invoice copies.
- Payment made to the Department of Transport from Landgate.

Computer hardware

- Purchased by the Department of Parks and Wildlife for the MCV project. Final invoices presented to the MCV project.
- MCV arranged Department of Parks and Wildlife invoice addressed to Landgate with summary & invoice copies.
- Payment made to Department of Parks and Wildlife from Landgate.

Copies of all invoices and management files are attached in Appendix A.



5 HUMAN RESOURCE MANAGEMENT

As the project focussed on improving the efficiency of the way marine and coastal data is managed across the public sector, and then shared with the broader community, the project adopted an innovative approach to building ownership of the responsibility of managing and sharing the data across the agencies responsible for the data.

A project implementation team was formed at the Department of Transport drawing on personnel with detailed knowledge and well established networks across the relevant agencies. This team was formally engaged by Landgate, providing finance and human resource management resources to simplify the administration of the project, eliminating any potential duplication of administrative overheads. The team was then deployed into the Department of Transport and subsequently the Department of Parks and Wildlife to undertake the work in order to work closely with personnel at these agencies responsible for the data after the completion of the project.

6 COMMUNICATIONS MANAGEMENT

Effective communications for the MCV project were critical in successfully managing a team that moved between organisations throughout the project, and in working with a diverse range of public and private sector stakeholders across State and Local Government, and coastal and marine engineers and researchers.

The MCV project was able to leverage an existing network and relationships between these parties through WALIS, and contributed to Key Performance Indicators (KPI) tracked by WALIS and used for reporting on the performance of the broader LIS program. The MCV project augmented these existing arrangements with specific communications for the stakeholders more directly involved in coastal and marine management – specifically through a newsletter, and presentations at relevant conferences and other events hosted by these stakeholders.

Working with Data Custodians

Productive relationships with the organisations and personnel that are responsible for capturing, managing and sharing data used by the broader coastal and marine management community was essential to the success of the project.

Although more complex to establish, relationships with host agencies for the project – Department of Transport, Department of Parks and Wildlife and Landgate – were the most productive as a significant commitment from these agencies was required to support the project team and contribute to the deliverables.

The ability to positively influence other data custodians and stakeholders, such as the Department of Planning and Department of Mines and Petroleum, and achieve a legacy beyond the life of the project was more challenging. In some cases the project aimed to achieve more with these agencies, but had to compromise on the scope of some work in order to achieve an outcome within the timeframe for the project. In some cases, Landgate through the WALIS Office will need to continue to work closely with these agencies to ensure the full benefits of new and improved data produced through the project is realised.

Newsletters & Presentations

Newsletters were prepared about the projects progress bi-monthly and shared through the WALIS mailing list and project partners such as WAMSI. The MCV team delivered 16 presentations about the project to a diverse range of organisations, including participants and stakeholders in WAMSI including Local Government, the Spatial Industries Business Association, Surveying and Spatial Sciences Institute and WA Universities.

7 RISK MANAGEMENT

Upon commencement of the project the MCV Project Manager engaged the Landgate Risk management team to advise the project on the correct risk documentation for the project.

This work was useful in scoping the range of risks, their likelihood and potential impacts. Most risks were classified as Minor, with a low or moderate likelihood of occurring and a low impact on the success of the project. A detailed Daily Log of issues and activities was maintained by the Project Manager, which provided a useful and pragmatic method of monitoring risks to the project.

8 LESSONS LEARNT

Building and Maintaining Relationships

Informing Senior Management and other staff across the agencies in which we worked about how the project would be implemented, inviting them to participate and keeping them well informed as the project rolled-out was critical in building and maintaining trust with the personnel on which the project depended on for success. We found that an introduction and lead from a senior manager within each organisation was critical.

These personnel needed evidence from the MCV team that what we were doing was going to add value to their business and not going to make more work for them. We found that delivering and sharing project outputs at an early stage helped reassure people that the project was producing something of value to the organisation.

Champions and Mentors

Identifying and then working closely with champions in each of the organisations we worked across was critical. These champions assisted the team in connecting to resources across each organisation – including Administration, Building Management, Finance, HR and ICT. For example, the project team was initially to be located in Fremantle but the HR team were located in Landgate – Midland. This was difficult in some ways because the passing and amendments of documents had to be done by emails and telephone. Having a champion in Landgate HR ensured that many of the mundane issues could be addressed more easily.

Mentors also helped the MCV team maintain a broad perspective on the priorities and impacts of the program. They also assisted with lateral thinking about solutions to sometimes complex problems.

Human Resource Management

We engaged an HR consultant to assist with the critical process of the employment of staff. Having an external consultant, who was familiar with Landgate processes and reporting requirements, made this work flow smoothly.

Understanding Management Structure

We found that briefing senior management and executive at the organisations with which we worked most closely helped streamline approvals required for work during the course of the project. Through these briefings, we were able to put the project in the context of the objectives of each organisation and address any concerns or uncertainty regarding the project.

Remote Network Access

Remote access to system was a significant consideration for this project, which took place across multiple organisations. With the team residing in two agencies, but working on datasets from several other organisations, it was necessary to occasionally gain remote access into agencies networks. For the MCV team remote access proved a big time saver and gave us the ability to quickly assess a problem and then help when we were not in that agencies office.

The Importance of Data Custodianship

It is critical that data custodians be identified early and commit to ongoing management of data assets. We found it difficult to complete datasets at some agencies when there was no clear existing process for management of the datasets.

On occasions the MCV project team was caught in internal organisational disputes over responsibilities regarding the ongoing management of data. This was sometimes difficult to help resolve, particularly where existing data management policies and procedures were not well established, or needed to be updated. However, it is critical that these are resolved in order for the data enhanced through projects like this one to have value into the future.

9 OPPORTUNITIES FOR FUTURE INVESTMENT

Through the course of the project a number of opportunities were identified for improvement of data that would likely have significant value to regional WA, but which could not be addressed within the scope and timeframe of the MCV project. These opportunities have been summarised below for potential consideration in the future.

Coastal Oblique Imagery

After viewing the WA Coast dataset that has been created by the Department of Mines and Petroleum, talking with a number of custodians about their datasets, and coastal and marine engineers it has become evident that the use of oblique aerial photography across regional WA could assist in improving other data and providing a valuable record of change across the state.

Tidal & Wave Data

During the initial determination of the MCV Project datasets and consultation with stakeholders, it became evident that because the WA coast is so extensive and tides so variable, it would be an extremely useful long term project to establish a number of temporary tide stations and AWAC recorders to extend coverage around the coast. This information would greatly assist in many projects and future development opportunities related to environmental, tourism, aquaculture, or coastal infrastructure.

Major Bathymetric Survey and Marine Habitat Mapping Program

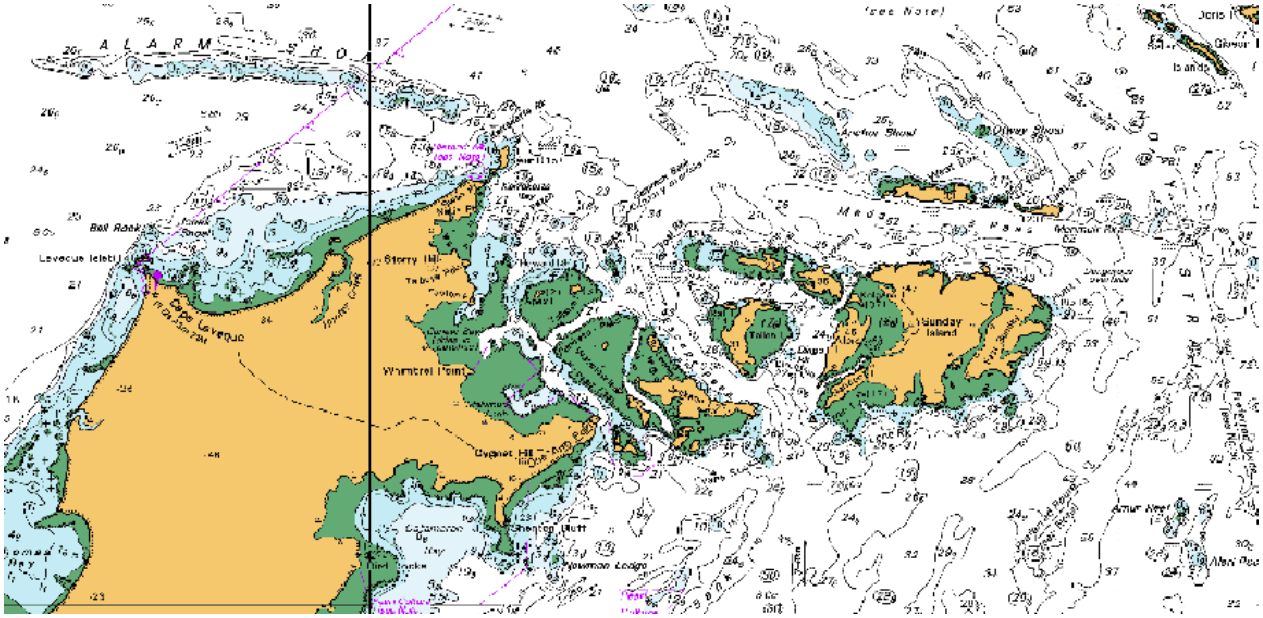
The MCV project has provided a new insight into the progress and use of marine mapping in WA. Consideration could be given to further improving coordination and use of data collected in this area.

Kimberley Region

A significant investment has been made by government in research on the marine environment in the Kimberley region. Hydrographic surveying coverage for the region is somewhat patchy, but has been extremely valuable to coastal and marine management stakeholders. Extending the coverage of large scale mapping would provide an important baseline dataset that could be used to build our knowledge base to ensure we are able to regulate the long term preservation of the valuable marine assets in the region.

Investigation shows that the complexities of the Kimberley's marine region make large scale mapping challenging. However, newer spatial technology is likely to make this feasible and more cost effective.

Using existing marine nautical charts, areas that are suitable for Airborne Lidar Mapping (30 metres) can be readily identified; and the smaller areas and channels that are deeper than this could be captured using vessel based mapping systems.



Both of these data capture technologies are now commercially available and are able to provide seabed classification (Lidar Reflectance & Multibeam Backscatter).

The habitat sample process being developed through the Pawsey Supercomputing Centre may make it feasible to determine individual marine habitats from their Lidar Reflectance and Multibeam Backscatter data.

South Coast Region

There is a relatively poor coverage of bathymetric data in this region. Bathymetric Lidar capture of shallower areas along the Coast from Cape Naturaliste to Eucla covers a smaller area than other regions because of the rapid drop-off into deeper waters (> 30metres), yet would be of high value for coastal and marine management.

10 METADATA – A MARINE COMMUNITY PROFILE

In order to more effectively manage coastal and marine datasets into the future, the MCV project initiated a programme of work to develop and build a plug-in for spatial data management in Esri-based data systems for the Marine Community metadata profile with support from the Australian Ocean Data Network (AODN) and private companies such as BHP Billiton. This profile (MCP 1.4) conforms to the international metadata standard ISO 19115.

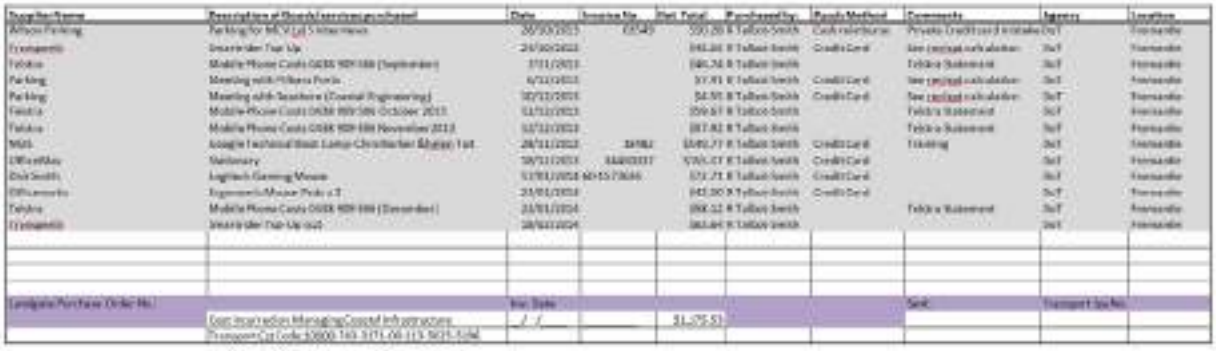
The MCP Esri plugin will enable the production of metadata by data custodians using the Esri based GIS suite. The metadata will be data driven using Esri ArcCatalog application, which in turn would allow the output of XML based metadata records conforming to the Marine Community Profile metadata standard. This metadata would then be ready to be shared across a number of metadata search applications such as the AODN Portal with minimal effort from the data custodian.

The AODN has released version 2.0 of the Marine Community Profile and confirmed that it will take over ongoing implementation of the plug-in including future development and maintenance costs.

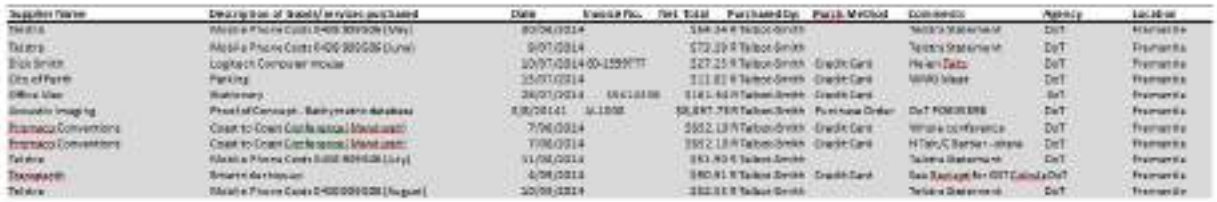
11 APPENDICES

APPENDIX A - EXPENDITURE

Finance – Expenditure & cost recovery summary



Supplier Name	Description of Goods/services purchased	Date	Invoice No.	Net Total	Purchased by:	Purch Method	Comments	Agency	Location
Parking	Meet UWA - Vdeo conference with AODN	31/01/2014		$4.55	R Talbot-Smith	Credit Card	See reciept calculation	DoT	Fremantle
Parking	Meet Mt Lawley Campus - WAODN Metadata Hosting meet	25/03/2014		$4.73	R Talbot-Smith	Credit Card	See reciept calculation	DoT	Fremantle
Sheperds News	2 x Startrider travel cards + $50.00 Credit on each	28/03/2014		$109.09	R Talbot-Smith	Credit Card	See reciept calculation	DoT	Fremantle
Parking	Meet Geoscience & AMSA	8/04/2014		$8.41	R Talbot-Smith	Credit Card	See reciept calculation	DoT	Fremantle
1Spatial	FME Software Licence & Training	31/03/2014	SIN001016	$24,030.00	R Talbot-Smith	Purchase Order	Float License & 6 training	DoT	Fremantle
Softwarecasa	3 x Snagit (screen capture) Software	1/05/2014	81233	$128.85	R Talbot-Smith	Credit Card	For project documentation	DoT	Fremantle
Telstra	Mobile Phone Costs 0438 909 506 (February)	15/05/2014		$47.15	R Talbot-Smith		Telstra Statement	DoT	Fremantle
Telstra	Mobile Phone Costs 0438 909 506 (March)	15/05/2014		$61.56	R Talbot-Smith		Telstra Statement	DoT	Fremantle
Telstra	Mobile Phone Costs 0438 909 506 (April)	15/05/2014		$46.88	R Talbot-Smith		Telstra Statement	DoT	Fremantle
1Spatial	FME Training venue hire	26/05/2014	SIN001209	$2,772.00	R Talbot-Smith	Credit Card	FME Training-6 DoT staff	DoT	Fremantle
Landgate Purchase Order No.:		Inv. Date					Sent:	Transport Inv No.	
57474	Cost incurred on Managing Coastal Infrastructure	29/05/2014		$27,213.22			29/05/2014	172061	
	Transport Cst Code: 10000-743-3171-00-113-5025-5196								



Supplier Name	Description of Goods/services purchased	Date	Invoice No.	Net Total	Purchased by:	Purch Method	Comments	Agency	Location
Acoustic Imaging	Implementation & training BIS Bathydatabase	19/09/2014	AI-1025	$14,067.27	R.Talbot-Smith	DoT Tender & PO	50% of Training & Implementation	DoT	Fremantle
Acoustic Imaging	Licenses for bathydatabase, Fledermaus, ArcGIS BIS	19/09/2014	AI-1024	$34,260.00	R.Talbot-Smith	DoT Tender & PO		DoT	Fremantle
Coles Australia	1 x Powerboard, 1x3m Extension cord	1/10/2014		$28.66	R.Talbot-Smith	Credit Card		DoT	Fremantle
Telstra	Mobile Phone Costs 0438 909 506 (September)	9/10/2014		$58.20	R Talbot-Smith		Telstra Statement	DoT	Fremantle
Landgate Purchase Order No.:		Inv. Date					Sent:	Transport Inv No.	
58282	Cost incurred on Managing Coastal Infrastructure	14/10/2014		$48,414.13			14/10/2014	403262	
	Transport Cst Code:10000-743-3171-00-113-5025-5196								

Supplier Name	Description of Goods/services purchased	Date	Invoice No.	Net Total	Purchased by:	Purch Method	Comments	Agency	Location
Sheppards News	2 x Smartrider top-up	6/03/2015		$100.00	R. Talbot-Smith	Credit card	$50 each card	DoT	Fremantle
Telstra	Mobile Phone Costs 0438 909 506 (February)	17/03/2015		$41.14	R Talbot-Smith		Telstra Statement	DoT	Fremantle
Telstra	Mobile Phone Costs 0438 909 506 (March)	13/04/2015		$51.53	R Talbot-Smith		Telstra Statement	DoT	Fremantle
Citipark	parking for Soacial resources Oilspill workshop	5/05/2015		$8.43	R Talbot-Smith	Credit card		DoT	Fremantle
Telstra	Mobile Phone Costs 0438 909 506 (April)	19/05/2015		$47.21	R Talbot-Smith		Telstra Statement	DoT	Fremantle
City of Subiaco	UWA Parking	21/05/2015		$4.55	R Talbot-Smith	Credit card		DoT	Fremantle
City of Fremantle	Fremantle Parking	21/05/2015		$5.45	R Talbot-Smith	Credit card		DoT	Fremantle
Officeworks	Toshiba 2TB portable Hardrive & case	27/05/2015		$125.91	R Talbot-Smith	Credit card	Transfer data to DPaW	DoT	Fremantle
Landgate Purchase Order No.:		Inv. Date					Sent:	Transport Inv No.	
NEW	Cost incurred on Managing Coastal Infrastructure	__/ /____	_____	$384.22					
	Transport Cst Code:10000-743-3420-08-113-5025-5196								

Supplier Name	Description of Goods/services purchased	Date	Invoice No.	Net Total	Purchased by:	Purch Method	Comments	Agency	Location
ESRI Australia	Marine Community Profile (MCP) Metadata Template	11/06/2015	90054309	$29,999.60	Steve James	PO 608261	Learning & Services is DoT services term	DoT	Fremantle
Landgate Purchase Order No.:		Inv. Date					Sent:	Transport Inv No.	
58282	Cost incurred on Managing Coastal Infrastructure	__/__/____	_____	$29,999.60					
	Transport Cst Code: 10000-743-3420-08-113-5025-5196								

Supplier Name	Description of Goods/services purchased	Date	Invoice No.	Net Total	Purchased by:	Purch Method	Comments	Agency	Location
Telstra	Mobile Phone Costs 0438 909 506 (May)	18/06/2015		56.33	R Talbot-Smith		Telstra Statement	DoT	Fremantle
Officeworks	Stationary	3/07/2015		$63.66	R Talbot-Smith	Credit Card		DoT	Fremantle
Telstra	Mobile Phone Costs 0438 909 506 (June)	27/07/2015		54.22	R Talbot-Smith		Telstra Statement	DoT	Fremantle
London Court News	Transperth Smartrider top-up	24/07/2015		$50.00	R Talbot-Smith	Credit Card		DoT	Fremantle
City of Perth	Parking -Planning& WALIS Council meets	12/08/2015		$24.82	R. Talbot-Smith	Credit Card		DoT	Fremantle
Citipark	Seagrass Determination seminar	10/08/2015		$10.30	R. Talbot-Smith	Credit Card		DoT	Fremantle
Officeworks	Portable Hardrive	14/08/2015		$71.82	R. Talbot-Smith	Credit Card	Transfer between departments	DoT	Fremantle
City of Perth	Parking-Ian Eliot Meet	13/08/2015		$7.09	R. Talbot-Smith	Credit Card		DoT	Fremantle
City of Perth	Parking-ESRI & DoPlanning	24/08/2015		$14.18	R. Talbot-Smith	Credit Card		DoT	Fremantle
Advance Press	Business Cards for MCV team	25/08/2015		$130.00	R. Talbot-Smith	Credit Card		DoT	Fremantle
City of Fremantle	Parking	18/09/2015		$4.09	R. Talbot-Smith	Credit Card		DoT	Fremantle
Telstra	Mobile Phone Costs 0438 909 506 (July)	29/09/2015		$82.82	R Talbot-Smith		Telstra Statement	DoT	Fremantle
Telstra	Mobile Phone Costs 0438 909 506 (August)	29/09/2015		$68.72	R Talbot-Smith		Telstra Statement	DoT	Fremantle
Landgate Purchase Order No.:		Inv. Date					Sent:	Transport Inv No.	
NEW	Cost incurred on Managing Coastal Infrastructure	__/__/____	_____	$638.05					
	Transport Cst Code: 10000-743-3420-08-113-5025-5196								

Supplier Name	Description of Goods/services purchased	Date	Invoice No.	Net Total	Purchased by:	Purch Method	Comments	Agency	Location
City of Perth	Parking -Planning& Eliot meets	7/10/2015		10.64	R. Talbot-Smith	Credit Card		DoT	Fremantle
City of Fremantle	Parking - DoT meet & Admin	7/10/2015		4.91	R. Talbot-Smith	Credit Card		DoT	Fremantle
City of Perth	Parking - Planning Meet	12/10/2015		10.64	R. Talbot-Smith	Credit Card		DoT	Fremantle
Curtin University Bentley Campus	Parking -Lidar Meeting	22/10/2015		4.71	R. Talbot-Smith	Credit Card		DoT	Fremantle
City of Fremantle	Parking - DoT meet & Admin	29/10/2015		4.09	R. Talbot-Smith	Credit Card		DoT	Fremantle
Wilson Parking	Parking - meeting	30/10/2015		2.81	R. Talbot-Smith	Credit Card		DoT	Fremantle
Town of Cambridge	Parking - meeting	4/11/2015		2.73	R. Talbot-Smith	Credit Card		DoT	Fremantle
City of Perth	Parking - Meet	18/10/2015		10.64	R. Talbot-Smith	Credit Card		DoT	Fremantle
City of Fremantle	Parking - Meeting DoT	20/11/2015		3.64	R. Talbot-Smith	Credit Card		DoT	Fremantle
Curtin University Bentley Campus	Parking - Meeting	23/11/2015		7.85	R. Talbot-Smith	Credit Card		DoT	Fremantle
City of Fremantle	Parking - Meeting DoT	8/12/2015		4.91	R. Talbot-Smith	Credit Card		DoT	Fremantle
Landgate Purchase Order No.:		Inv. Date					Sent:	Transport Inv No.	
NEW	Cost incurred on Managing Coastal Infrastructure	__/__/____	_____	$67.57					
	Transport Cst Code: 10000-743-3420-08-113-5025-5196								
	Contact Hans Chen 0 6551 6621 for phone instructions of Invoice creation								
	Alternative: Kerry Robshaw								

Supplier Name	Description of Goods/services purchased	Date	Invoice No.	Net Total	Purchased by:	Purch Method	Comments	Agency	Location
City ofFremantle	Parking - Meeting DoT	22/12/2015		2.27	R. Talbot-Smith	Credit Card		DoT	Fremantle
City ofFremantle	Parking - Meeting DoT	29/01/2016		4.91	R. Talbot-Smith	Credit Card		DoT	Fremantle
Telstra	Mobile Phone Costs 0438 909 506 (Sep 2015)	29/01/2016		53.52	R Talbot-Smith		Telstra Statement	DoT	Fremantle
Telstra	Mobile Phone Costs 0438 909 506 (Oct 2015)	29/01/2016		71.24	R Talbot-Smith		Telstra Statement	DoT	Fremantle
Telstra	Mobile Phone Costs 0438 909 506 (Nov 2015)	29/01/2016		75.47	R Talbot-Smith		Telstra Statement	DoT	Fremantle
Telstra	Mobile Phone Costs 0438 909 506 (Dec 2015)	29/01/2016		43.60	R Talbot-Smith		Telstra Statement	DoT	Fremantle
Office Works	Names Labells	10/02/2016		22.95	R. Talbot-Smith	Credit Card		DoT	Fremantle
City of Perth	Parking -Meeting DoP., DPC	10/02/2016		7.09	R. Talbot-Smith	Credit Card		DoT	Fremantle
City of Perth	Parking - Meeting Damara	4/03/2016		7.27	R. Talbot-Smith	Credit Card		DoT	Fremantle
City of Perth	Parking -Meeting DoP., DPC	16/03/2016		7.27	R. Talbot-Smith	Credit Card		DoT	Fremantle
Telstra	Mobile Phone Costs 0438 909 506 (Jan 2016)	16/03/2016		51.78	R Talbot-Smith		Telstra Statement	DoT	Fremantle
Telstra	Mobile Phone Costs 0438 909 506 (Feb 2016)	16/03/2016		58.76	R Talbot-Smith		Telstra Statement	DoT	Fremantle
Landgate Purchase Order No.:		Inv. Date					Sent:	Transport Inv No.	
NEW	Cost incurred on Managing Coastal Infrastructure	__/__/____	_____	$406.13					
	Transport Cst Code:10000-743-3420-08-113-5025-5196								
	Contact Hans Chen 0 6551 6621 for phone instructions of Invoice creation								
	Alternative: Kerry Robshaw								

Supplier Name	Description of Goods/services purchased	Date	Invoice No.	Net Total	Purchased by:	Purch Method	Comments	Agency	Location
Edith Cowan University	Parking	11/04/2016		1.91	R. Talbot-Smith	Credit Card		DoT	Fremantle
City of Perth	Parking -Meeting DoP., DPC	20/04/2016		7.27	R. Talbot-Smith	Credit Card		DoT	Fremantle
Telstra	Mobile Phone Costs 0438 909 506 (Mar 2016)	27/04/2016		59.22	R Talbot-Smith		Telstra Statement	DoT	Fremantle
City of Fremantle	Parking	28/04/2016		2.27	R. Talbot-Smith	Credit Card		DoT	Fremantle
City of Perth	Parking - meet DoP & Esri	29/04/2016		10.64	R. Talbot-Smith	Credit Card		DoT	Fremantle
Curtin University	Parking -Meet Spatial Science	9/05/2016		4.71	R. Talbot-Smith	Credit Card		DoT	Fremantle
City of Perth	Parking - meet DoP	11/05/2016		7.09	R. Talbot-Smith	Credit Card		DoT	Fremantle
City of Perth	Parking - meet WMG	17/05/2016		17.73	R. Talbot-Smith	Credit Card		DoT	Fremantle
Cut-off Date for Invoices =	21/06/2016								
Landgate Purchase Order No.:		Inv. Date					Sent:	Transport Inv No.	
NEW	Cost incurred on Managing Coastal Infrastructure	__/__/____	_____	$110.84					
	Transport Cst Code:10000-743-3420-08-113-5025-5196								
	Contact Hans Chen 0 6551 6621 for phone instructions of Invoice creation								
	Alternative: Kerry Robshaw								

APPENDIX B – DAILY ACTIVITY AND ISSUES LOG

	28	Thursday	MS Project Course				
March	1	Friday					
	2	Saturday					
	3	Sunday					
Labour Day	4	Monday					
	5	Tuesday					
	6	Wednesday					
	7	Thursday					
	8	Friday					
	9	Saturday					
	10	Sunday					
	11	Monday					
	12	Tuesday	Investigate Travel Canberra-Wollongong				
	13	Wednesday	Submit Travel Proposal-Canberra				
	14	Thursday	Contacted Doug White AHB				
	15	Friday	CARIS Bathydatabase Webinar				
	16	Saturday					
	17	Sunday					
	18	Monday	Bathy Database - Doug White AHB see Emails				
	19	Tuesday					
	20	Wednesday	Hydrography Society-Esplanade And	Established Daily Log & Contacts			
	21	Thursday	Hydrographic Surveyors Meet				
	22	Friday	Travel Proposal Canberra Approved				
	23	Saturday					
	24	Sunday		Email Stuart Cale-LINZ @ Olivia - Geoscience Aust			
	25	Monday					
	26	Tuesday	CARIS-Christian Fellinger Phone Conf				
	27	Wednesday	Booked flights and accom-Canberra &	Port Melb-Paul Downie			
	28	Thursday					
Good Friday	29	Friday					
	30	Saturday					
	31	Sunday					
April Easter Monday	1	Monday					
	2	Tuesday					
	3	Wednesday					
	4	Thursday					
	5	Friday					
	6	Saturday					
	7	Sunday					
	8	Monday					
	9	Tuesday	Oracle Costs - Steve James				
	10	Wednesday	Project budgets Forecasting				
	11	Thursday					
	12	Friday					
	13	Saturday					
	14	Sunday	Fly Canberra				

Daily Log 2013

	15	Monday	CARIS-Ping to Chart Workshop - Can	Contact with Geoscience Aust			
	16	Tuesday	AHS Standards workshop				
	17	Wednesday	Port of Melbourne- BDB visit 7.30am				
	18	Thursday					
	19	Friday					
	20	Saturday					
	21	Sunday		Private CARIS session			
	22	Monday					
	23	Tuesday					
	24	Wednesday					
Anzac Day	25	Thursday					
	26	Friday					
	27	Saturday					
	28	Sunday					
	29	Monday					
	30	Tuesday					
May	1	Wednesday					
	2	Thursday					
	3	Friday					
	4	Saturday					
	5	Sunday					
	6	Monday					
	7	Tuesday					
	8	Wednesday					
	9	Thursday					
	10	Friday					
	11	Saturday					
Mothers Day	12	Sunday					
	13	Monday					
	14	Tuesday					
	15	Wednesday					
	16	Thursday					
	17	Friday					
	18	Saturday					
	19	Sunday					
	20	Monday					
	21	Tuesday					
	22	Wednesday					
	23	Thursday					
	24	Friday					
	25	Saturday					
	26	Sunday					
	27	Monday					
	28	Tuesday					
	29	Wednesday					
	30	Thursday					
	31	Friday					
June	1	Saturday					
	2	Sunday					
Foundation Day	3	Monday					
	4	Tuesday					
	5	Wednesday					
	6	Thursday	Calls - Daniel Krulmel visit				
	7	Friday					
	8	Saturday					
	9	Sunday					
	10	Monday					
	11	Tuesday					
	12	Wednesday					
	13	Thursday					
	14	Friday	Project Manager Position Advertised - Landgate				
	15	Saturday					
	16	Sunday					
	17	Monday					
	18	Tuesday					
	19	Wednesday					
	20	Thursday					
	21	Friday					
	22	Saturday					
	23	Sunday					
	24	Monday	Project Manager Position Advertising Closes - Landgate				
	25	Tuesday					
	26	Wednesday					
	27	Thursday	Interviews - Project Manager				
	28	Friday					
	29	Saturday					
	30	Sunday					
July	1	Monday					
	2	Tuesday					
	3	Wednesday					
	4	Thursday					
	5	Friday	Project Manager (Ralph Talbot-Smith)	appointed pending appeals			
	6	Saturday					
	7	Sunday					
	8	Monday					
	9	Tuesday					
	10	Wednesday					
	11	Thursday	Proj Manag appeals end 4.00pm				
	12	Friday	No appeals, Spoke Jenny Smith about startup, ID photo, Timesheet. Start 22 July 2013. Meeting Rodney, Initial planning & Scheduling				
	13	Saturday					
	14	Sunday					
	15	Monday					
	16	Tuesday	Rodney asked Jenn to get 2xsLvl5 recruit process started. Liais with sarah Trice re my employ. Re-org Freo office.				
	17	Wednesday					
	18	Thursday					
	19	Friday					
	20	Saturday					
	21	Sunday					
	22	Monday	Ralph- first day as PM. All day at Landgate				
	23	Tuesday	WMG Meet				
	24	Wednesday	Meet Coastal Engineering team, Transport.				
	25	Thursday	Contacted AODN (Luke). Arranged meet Transport Custodians. Arranged puchase of PC's & printers for team. Parking for PM.				
	26	Friday	Review Lvl5 staff JDFs etc.Contacted Elias-IB about project.				
	27	Saturday					
	28	Sunday					
	29	Monday	Review Lvl 5 Document				
	30	Tuesday					

	31	Wednesday	Visit Planning, Matt Devlin & Deavi. Meet Transport IS Systems, Elias about MCV. Meeting Transport, Steve James , Tony				Iamberto, Rodney Hoath
August	1	Thursday	Landgate, Begin Lvl 5 recruitment. Visit Dept Of Water sarah and Goran Allbegovic. Visit Luke Edwards AODN Invec.				
	2	Friday	Contact & App with Cathy Murray & Mark Sheridan. Email to Roger Procter AODN.				
		3	Saturday				
		4	Sunday				
	5	Monday	Project Plans. Office Chairs				
	6	Tuesday	Landgate-Meeting Damien, RUSP Regional. Meet John Fenner & AllanCampbell.				
	7	Wednesday	Chairs Ordered. Workstations Ordered				
	8	Thursday	Meet Kathy Murray - Benthic. SLIP Future Presentation, Darren Motolini & Emirfa				
	9	Friday	Spoke AMSA. Spoke Matt Elliot.				
		10	Saturday				
		11	Sunday				
	12	Monday	Met DMP Bob and Neville. Delayed recruit 2xSpatial Officers until end September. Engaged Esther Croote, HR consultant.				
	13	Tuesday	Engaged Esther Croote HR consul. - 2 x Spatial Offices, Advertise 27 Sept 2013				
	14	Wednesday	LISIG Meet				
	15	Thursday	Langate - Allan Campbell Water lines. Chris Hartley Dicussion. Matthew McGregor discussion - phone				
	16	Friday	Meet Mark Sheridan DPAW(Dept of Parks & Wildlife)				
		17	Saturday				
		18	Sunday				
	19	Monday	Discussion Rod, Ric Waterlines				
	20	Tuesday					
	21	Wednesday	Landgate Meet Marty Stamatis & Allan Campbell.				
	22	Thursday	Meet Brett Harrison, Tia Byrd. SLIP Info session. Meet Esther Croode, Staff recuitment pre-meet.				
	23	Friday					
		24	Saturday				
		25	Sunday				
	26	Monday	PM Leave				
	27	Tuesday	PM Leave				
	28	Wednesday	PM Leave				
	29	Thursday	PM Leave				
	30	Friday	PM Leave				
	31	Saturday					
September Fathers Day	1	Sunday					
	2	Monday	Move to New Office, chairs arrived				
	3	Tuesday					
	4	Wednesday	Meet Planning & Landgate Remote sensing				
	5	Thursday	Quote for ArcGIS Standard				
	6	Friday	Meet Chairs arrived. PO Arc GIS standard.				
		7	Saturday				
		8	Sunday				
	9	Monday	PM Leave				
	10	Tuesday	PM Leave				
	11	Wednesday	PM Leave				
	12	Thursday	PM Leave				
	13	Friday	PM Leave				
		14	Saturday				
		15	Sunday				
	16	Monday	PM Leave				
	17	Tuesday	PM Leave				
	18	Wednesday	PM Leave				
	19	Thursday	PM Leave				
	20	Friday	PM Leave				
		21	Saturday				
		22	Sunday				
	23	Monday	Sarah Tice request to advertise Lvl 5's.				
	24	Tuesday	Stuart Field-DPAW contact. PO for Acr Lic to ESRI				
	25	Wednesday	Customer survey drafts compiled				
	26	Thursday	Desks arrive. Meet Jenny & Damien.				
	27	Friday	2x lvl 5 advertising. Wrong info - rectified.				
		28	Saturday				
		29	Sunday				
Queens Birthday	30	Monday					
October	1	Tuesday	Invoice Authority sent. Wrong pay scales Lvl5 advert.				
	2	Wednesday	Meet with Planning Tia Byrd. Spoke with Steve Bandy-DMP about "BEEK"				
	3	Thursday					
	4	Friday	First aid training				
		5	Saturday				
		6	Sunday				
	7	Monday	Meet Stuart Fields-DPAW.				
	8	Tuesday					
	9	Wednesday					
	10	Thursday	Finalise Newsletter and Customer survey				
	11	Friday	Applications review				
		12	Saturday				
		13	Sunday				
	14	Monday	Level 5 Advertising finishes, Meet DPAW, Stuart & Luke Smith.				
	15	Tuesday	WMG Meet				
	16	Wednesday	LVl5 Shortlist meet				
	17	Thursday	Risk workship, Midland				
	18	Friday	Hydrographic meet - Bathy Database				
		19	Saturday				
		20	Sunday				
	21	Monday	LISIG Meet - Brief about Private Ent. Interest				
	22	Tuesday					
	23	Wednesday					
	24	Thursday	Interviews - Level 5. LISIG meet & Present				
	25	Friday					
		26	Saturday				
		27	Sunday				
	28	Monday	Interviews - Level 5. Meet Agi Gedeon - AODN				
	29	Tuesday	Appea Meet today				
	30	Wednesday					
	31	Thursday	Landgate Pre-Forum				
November	1	Friday	Daren Motolini Meet Freo.				
		2	Saturday				
		3	Sunday				
	4	Monday	Final Selection Report Sign				
	5	Tuesday	Melbourne Cup				
	6	Wednesday	NGIS & WALIS stall setup				
	7	Thursday	WALIS Forum				
	8	Friday	WALIS Forum				
		9	Saturday				
		10	Sunday				
	11	Monday	Selection Report Approved. WALIS followup.				
	12	Tuesday	Waterlines Reference group outline.				
	13	Wednesday	WMG Newsletter				
	14	Thursday					

		15	Friday				
		16	Saturday				
		17	Sunday				
	18	Monday	Lvl 5 Staff objection period finishes 4.00pm. No objections				
	19	Tuesday	Chris Barber starts at Transport offices. WMG meet, pm at Landgate office CBD.				
	20	Wednesday	Janahan Karunaharan rang about feedback for position.				
	21	Thursday	AODN meet, Roger Proctor.				
	22	Friday	Helen Tait Visit. Sophie edgar feedback				
		23	Saturday				
		24	Sunday				
	25	Monday					
	26	Tuesday	ESRI Webinar				
	27	Wednesday	Helen tait start. Bathy database tender requirements				
	28	Thursday					
	29	Friday					
	30	Saturday					
December	1	Sunday					
	2	Monday	WAMSI EO Meet-Patrick Beares				
	3	Tuesday	CARIS Webinar				
	4	Wednesday	CARIS Webinar. MCV Morning Tea.				
	5	Thursday	Team Development				
	6	Friday	Meet Pilbara Ports-Hydro Surveys				
		7	Saturday				
		8	Sunday				
	9	Monday					
	10	Tuesday	NSIS Google Bootcamp. Meet Damaris-Oblique photos. Request Tech Specs-ESRI & CARIS				
	11	Wednesday	SLIP Future Tech session. Topography meet-Landgate				
	12	Thursday	Risk Workshop. WALIS Christmas lunch. Coastal Infrastructure present-Steve James				
	13	Friday	Waterlines Reference Group invites sent				
		14	Saturday				
		15	Sunday				
	16	Monday	Coastal Infrastructure(CI) capture determination				
	17	Tuesday	FBH tour-Field Ident CI				
	18	Wednesday					
	19	Thursday	Oblique phots - Letetis from Karl Illich				
	20	Friday	CIBU Christmas lunch				
		21	Saturday				
		22	Sunday				
	23	Monday					
	24	Tuesday	CI Capture begins				
Christmas Day	25	Wednesday					
Boxing Day	26	Thursday					
		27	Friday				
		28	Saturday				
		29	Sunday				
	30	Monday					
	31	Tuesday	!!!!				

			Item 1					
		Saturday						
		Sunday						
		Monday						
		Tuesday						
January	1	Wednesday						
	2	Thursday	ArcGIS License issue					
	3	Friday						
	4	Saturday						
	5	Sunday						
	6	Monday						
	7	Tuesday						
	8	Wednesday	Waterlines Workshop facilitator Darryl Sherman confirmed					
	9	Thursday	AODN Agenda-Video workshop					
	10	Friday	Lidar indexes-Additional issue, Google Pro licences-WALIB received					
	11	Saturday						
	12	Sunday						
	13	Monday						
	14	Tuesday	City of Cockburn-Nathan Sharp					
	15	Wednesday	Lidar ESPERANCE - Justin Redgewell-JFA					
	16	Thursday	Marty Stamatis - Coastal Infrastructure					
	17	Friday	Meet Doug Bergenson - ESRI Bathydatabase.					
	18	Saturday						
	19	Sunday						
	20	Monday						
	21	Tuesday						
	22	Wednesday	Meet Darryl Sherman Waterlines workshop facilitator. Nathan Eaton -NGIS meet. New PM note book					
	23	Thursday	AODN Video agenda					
	24	Friday	PME & Bathydatabasee discussion Rodney & Steve James					
	25	Saturday						
	26	Sunday						
Australian Day	27	Monday						
	28	Tuesday						
	29	Wednesday	Ralph Moore - definitions of infrastructure					
	30	Thursday	landgate, organise Waterlines workshop catering & details with Brett					
	31	Friday	AODN video workshop at UWA					
February	1	Saturday						
	2	Sunday						
	3	Monday						
	4	Tuesday	Waterlines Workshop					
	5	Wednesday	Ralph Moore, Oceanica meet					
	6	Thursday	Waterline Comments posted					
	7	Friday						
	8	Saturday						
	9	Sunday						
	10	Monday						
	11	Tuesday						
	12	Wednesday	PME Software request to IT and Procurement					
	13	Thursday	Prepare Project Plan Historic Tides & Waves					
	14	Friday						
	15	Saturday						
	16	Sunday						
	17	Monday	bathymetric Database IT approval trail begins					
	18	Tuesday	ESRI Visit re 19115MCP compilation					
	19	Wednesday	AAM Direction seminar					
	20	Thursday						
	21	Friday	LIBIG Report					
	22	Saturday						
	23	Sunday						
	24	Monday	Bathy database - Heng Farms questions					
	25	Tuesday						
	26	Wednesday	Enews Article.					
	27	Thursday	Waterlines Information Session - Midland	AODN Travel App Chris- Approved				
	28	Friday	Coastal compartment directory structure for Waterlines procedure					
March	1	Saturday						
	2	Sunday						
Labour Day	3	Monday						
	4	Tuesday	Chris Barber to AODN Hobart					
	5	Wednesday						
	6	Thursday	atabase tender signed by R Hoath for prep by procurement					
	7	Friday						
	8	Saturday						
	9	Sunday						
	10	Monday	MCV Data program to Roger Proctor AODN					
	11	Tuesday	WMG Meet					
	12	Wednesday	Breakfast -Damara, Planning					
	13	Thursday	Oceanography Station spreadsheets					
	14	Friday	Visit by University of Texas A & M					
	15	Saturday						
	16	Sunday						
	17	Monday						
	18	Tuesday						
	19	Wednesday						
	20	Thursday						
	21	Friday						
	22	Saturday						
	23	Sunday						
	24	Monday	RUSP - Treasury money transfer signed	LIB Benefits seminar				
	25	Tuesday	Luke Edwards WAODN - metadata					
	26	Wednesday	Microstation Training					
	27	Thursday	Meet ESRI about 19115MCP	Australian Coastal Compartments fromGeoscience				
	28	Friday	PME Purchase order & training organised					
	29	Saturday						

	30	Sunday						
	31	Monday	OBRA Web map release & Steve Rowlands DPAW meet.					
April	1	Tuesday	Coastal Compartments meet with Ian Elliot & Vivienne Pannitza, ESRI roadshow. First meeting of Marine Science Advisory Group at Dumas House.					
	2	Wednesday	MCV Presentationat Port Hedland PTMBL. Organise FME Training.					
	3	Thursday	Visit mark Case at AIMS (UWA)					
	4	Friday	FME License server installed & operating OK. Teleconference with Keith mackay at NIWA New Zealand RE ESRI & metadata					
	5	Saturday						
	6	Sunday						
	7	Monday	ESRI Visit , Tom Gelrdner & Levin Lee. FME invoice Reclepting.					
	8	Tuesday						
	9	Wednesday						
	10	Thursday	GME training Helen & Chris					
	11	Friday	Project Plan for Historic Tides & Waves signed					
	12	Saturday						
	13	Sunday						
	14	Monday						
	15	Tuesday						
	16	Wednesday						
	17	Thursday						
Good Friday	18	Friday						
	19	Saturday						
	20	Sunday						
Easter Monday	21	Monday						
	22	Tuesday						
	23	Wednesday						
	24	Thursday						
Anzac Day	25	Friday						
	26	Saturday						
	27	Sunday						
	28	Monday	Compile Waterlines, Contours Images, Carnarvon Ka					
	29	Tuesday	Chris Network Coastlines corruption & recovery					
	30	Wednesday	Tim Moltmann - IMOS visit					
May	1	Thursday	Chrome & Firefox Install					
	2	Friday	FME Training Postphoned, Not able to havee at Dot					
	3	Saturday						
	4	Sunday						
	5	Monday						
	6	Tuesday	Waterline Meet with Paul Dean Allan					
	7	Wednesday	DPaW meet with Staurt Field, Mark Sheridan, Flona					
	8	Thursday	Ralph Sick					
	9	Friday	Ralph sick					
	10	Saturday						
Mothers Day	11	Sunday						
	12	Monday						
	13	Tuesday	Chris Helen Sick. WMG Meeting					
	14	Wednesday	Chris Helen Sick					
	15	Thursday	SNAGIT Install					
	16	Friday	DPaW Mark Sheridan Visit					
	17	Saturday						
	18	Sunday						
	19	Monday						
	20	Tuesday	WALIS - Try Amazon Cloud site for Data & Photos					
	21	Wednesday	PPP Helen Talt. Bathymetric Database Tender Close					
	22	Thursday	PPP Chris Barber					
	23	Friday	Coastal Infrastructure FINAL on GME					
	24	Saturday						
	25	Sunday						
	26	Monday	Coastal Infrastructure Released. Bathy database Tender Eval Kickoff					
	27	Tuesday	FME Training					
	28	Wednesday	FME Training					
	29	Thursday	FME Training					
	30	Friday	Budget Forecast-Rusp MOU					
	31	Saturday						
June	1	Sunday						
WA(Foundation) Day	2	Monday						
	3	Tuesday	Waterlines Into Topo DB in jeopardy-Compile benefits, damien Shep. Amazon Cloud space looks good for tide data.					
	4	Wednesday	Sort FME proxy to GME					
	5	Thursday						
	6	Friday	Bathy databasee tender evaluation - ESRI to d 1st PoC.					
	7	Saturday						
	8	Sunday						
	9	Monday						
	10	Tuesday	Field Trip to BecherPoint & Rockingham					
	11	Wednesday						
	12	Thursday						
	13	Friday						
	14	Saturday						
	15	Sunday						
	16	Monday						
	17	Tuesday						
	18	Wednesday						
	19	Thursday						
	20	Friday						
	21	Saturday						
	22	Sunday						
	23	Monday						
	24	Tuesday						
	25	Wednesday						
	26	Thursday						
	27	Friday						
	28	Saturday						
	29	Sunday						
	30	Monday						
July	1	Tuesday						
	2	Wednesday	LIBIG presentation-Coastline Move & Coast Infrastruture. Coastal Compartments at DMP-sign off.					
	3	Thursday						
	4	Friday						
	5	Saturday						

	6	Sunday						
	7	Monday	National Coastal Compartments sent to Geoscience					
	8	Tuesday						
	9	Wednesday						
	10	Thursday						
	11	Friday						
	12	Saturday						
	13	Sunday						
	14	Monday	Helen Talt Leave - Ball					
	15	Tuesday	WMG Meet					
	16	Wednesday	Bathy Database - Proof of Concept					
	17	Thursday						
	18	Friday	BIBA presentation breakfast presentation					
	19	Saturday						
	20	Sunday						
	21	Monday						
	22	Tuesday						
	23	Wednesday	Contact Acoustic Imagery - bathy Database supplier					
	24	Thursday	Add Shipwrecks to datasets (WA Museum). Tom Gairdner & Levin					
	25	Friday						
	26	Saturday						
	27	Sunday						
	28	Monday	Tides Station permission emails					
	29	Tuesday	Coastline Movements Signoff by DoT					
	30	Wednesday	Augusta-Pt Geographe Visit					
	31	Thursday	Acoustic Imaging-Bathydatabase kickoff. Ed Owens (USA) - OSRA Info					
August	1	Friday						
	2	Saturday						
	3	Sunday						
	4	Monday						
	5	Tuesday						
	6	Wednesday						
	7	Thursday	Registration for Coast 2 Coast 2014 conference					
	8	Friday	Bathy Database project plans signed					
	9	Saturday						
	10	Sunday						
	11	Monday	Coastal Compartmments Project plan & Requirements signed					
	12	Tuesday						
	13	Wednesday						
	14	Thursday	Museum Shipwreck meeting. Satellite bathymentry investigation					
	15	Friday						
	16	Saturday						
	17	Sunday						
	18	Monday	Project Manager on leave -2 weeks.					
	19	Tuesday						
	20	Wednesday						
	21	Thursday						
	22	Friday						
	23	Saturday						
	24	Sunday						
	25	Monday						
	26	Tuesday						
	27	Wednesday	SLIP Tech release					
	28	Thursday						
	29	Friday						
	30	Saturday						
September Fathers Day	31	Sunday						
	1	Monday						
	2	Tuesday						
	3	Wednesday						
	4	Thursday						
	5	Friday	Prep PC's for BIB Traing x5					
	6	Saturday						
	7	Sunday						
	8	Monday	BIB Implementation begins at DoT					
	9	Tuesday	WALIS Office & AuScope Seminar kensington. ESRI BIS-Oracle database idsuue. Implementation of Oracle stops					
	10	Wednesday	Invoice to Landgate					
	11	Thursday	Piedermaus Training. Network Hub Issues					
	12	Friday	Piedermaus Training					
	13	Saturday						
	14	Sunday						
	15	Monday	BIB Training. License server down					
	16	Tuesday	BIB Training. WMG Meeting					
	17	Wednesday						
	18	Thursday						
	19	Friday	BathyDatbase Meet-Internal BIB shortfalls to Al. Ryan Fraser from CSIRO - programming resource					
	20	Saturday						
	21	Sunday						
	22	Monday						
	23	Tuesday						
	24	Wednesday	Meet Landgate Floreat - Metadata. Sent Russel Teede data as agreed. Invoice to Lnadgate					
	25	Thursday	Marine Simulator visit - MCV team, data sent to FMSC-Roiy.					
	26	Friday	Issues with BIB - Oracle patch for 10.2, contingency planning discussed Rodney H Steve J & Ralph T8.					
	27	Saturday						
	28	Sunday						
Queens Birthday	29	Monday						
	30	Tuesday	Pilbara port Tide data license fix by Rodney H.					
October	1	Wednesday						
	2	Thursday	Monica McCormick starts catalogueing Hydro backup drives.					
	3	Friday						
	4	Saturday						
	5	Sunday						
	6	Monday						
	7	Tuesday						
	8	Wednesday						
	9	Thursday	Coastal Compartment ts Dataset released					
	10	Friday						
	11	Saturday						

	12	Sunday							
	13	Monday	HydrographicSurvey Vessel Excursion						
	14	Tuesday	Landgate invoice sent						
	15	Wednesday							
	16	Thursday							
	17	Friday							
	18	Saturday							
	19	Sunday							
	20	Monday	**Bathy Database- Testing complete, Loading begins**						
	21	Tuesday							
	22	Wednesday							
	23	Thursday	Visit to Jeremy at WA Museum re Shipwrecks						
	24	Friday							
	25	Saturday							
	26	Sunday							
	27	Monday	Coast to Coast Conference-Mandurah						
	28	Tuesday							
	29	Wednesday							
	30	Thursday							
	31	Friday							
November	1	Saturday							
	2	Sunday							
	3	Monday							
	4	Tuesday							
	5	Wednesday	CRCSI Conference - Pan Pacific Perth						
	6	Thursday							
	7	Friday							
	8	Saturday							
	9	Sunday							
	10	Monday							
	11	Tuesday	WMG Meet						
	12	Wednesday	Dept of Water, Flood data						
	13	Thursday	WAMSI meet						
	14	Friday							
	15	Saturday							
	16	Sunday							
	17	Monday	DMP WA Coast testing, Prelim investigate Oblique in GME						
	18	Tuesday							
	19	Wednesday	DPAW Preliminary meet						
	20	Thursday							
	21	Friday							
	22	Saturday							
	23	Sunday							
	24	Monday							
	25	Tuesday	Hydro Survey Bags - Begin loading into BIB Geodatabase						
	26	Wednesday	CSIRO Marine Seminar						
	27	Thursday							
	28	Friday	SLIP API Training, Keith Moss.						
	29	Saturday							
	30	Sunday							
December	1	Monday	Prompt DoT to send letters to Ports/Owners of Hydro Surveys.						
	2	Tuesday	ESRI 10.3 released. Bathy stage 2 IMPLEMENT programmed JANUARY						
	3	Wednesday							
	4	Thursday	Met Bob Gozzard DMP to demo SLIP landforms.						
	5	Friday	PAWSEY supercomputer opening						
	6	Saturday							
	7	Sunday							
	8	Monday	DPaW meeting to discuss MCV move Kensington						
	9	Tuesday							
	10	Wednesday							
	11	Thursday	Meet UAV operators(Ultimate)						
	12	Friday							
	13	Saturday							
	14	Sunday							
	15	Monday	Contractor(Monica McCormick) starts and assists data entry.						
	16	Tuesday	MCV GPS						
	17	Wednesday	Met Barry Carbon						
	18	Thursday	Compile Hydro Metadata spreadsheet for DPaW						
	19	Friday	Bathy survey adjustments continue						
	20	Saturday							
	21	Sunday							
	22	Monday							
	23	Tuesday							
	24	Wednesday							
Christmas Day	25	Thursday							
Boxing Day	26	Friday							
	27	Saturday							
	28	Sunday							
	29	Monday							
	30	Tuesday							
	31	Wednesday							

January - New	1	Thursday					
	2	Friday					
	3	Saturday					
	4	Sunday					
	5	Monday					
	6	Tuesday					
	7	Wednesday					
	8	Thursday					
	9	Friday					
	10	Saturday					
	11	Sunday					
	12	Monday					
	13	Tuesday					
	14	Wednesday					
	15	Thursday					
	16	Friday	ESRI ArcGIS 10.3 loaded and discovered Fledermaus edition not compatible.				
	17	Saturday					
	18	Sunday					
	19	Monday	Bathy database implementation Stage 2 postphoned(again) until Feb2015				
	20	Tuesday	UAV test with Landgate at Cottesloe				
	21	Wednesda	Met Steve Bandy DMP - Tough meet about Landforms dataset				
	22	Thursday	Teleconference UAV altitude about test data supplied. Pat Gethin discussion about Google cesing support of GME and implications				
	23	Friday					
	24	Saturday					
	25	Sunday					
Australia Day	26	Monday					
	27	Tuesday	Contact DPaW about MCV move and next meet.				
	28	Wednesda	DPaW computers specs sent Katherine				
	29	Thursday					
	30	Friday	ArcGIS Open Data demo-Levin Lee				
	31	Saturday					
February	1	Sunday					
	2	Monday					
	3	Tuesday	Discuss Bill Andrews - waterline setbacks				
	4	Wednesday					
	5	Thursday					
	6	Friday	Ian Elliot - Extreme Events data fix				
	7	Saturday					
	8	Sunday					
	9	Monday					
	10	Tuesday					
	11	Wednesda	AESRI ArcGIS Online seminar - Western Power Wellington St				
	12	Thursday	Bathymetry(BIS) stage 2 Implementation & Oracle setup				
	13	Friday	Bathymetry(BIS) stage 2 Implementation & Oracle setup				
	14	Saturday					
	15	Sunday					
	16	Monday	Bathymetry(BIS) stage 2 Traing - Aaron & Doug				
	17	Tuesday					
	18	Wednesday					
	19	Thursday	BIS meeting - Steve James				
	20	Friday					
	21	Saturday					
	22	Sunday					
	23	Monday	FME anounces ESRI Google treaty				
	24	Tuesday					
	25	Wednesda	Meeting with Damara - sediment cells				
	26	Thursday					
	27	Friday	BIS meeting with DoT - outputs. Invoice to Landgate				
	28	Saturday					
Maroh	1	Sunday					
Labour Day	2	Monday					
	3	Tuesday					
	4	Wednesda	DPaW meeting - Kensington				
	5	Thursday					
	6	Friday					
	7	Saturday					
	8	Sunday					
	9	Monday					
	10	Tuesday	Initiate 6 onth contract position - Landgate.Coast run 2015 - Chris hartley				
	11	Wednesday					
	12	Thursday	Trevor Ward, Jal Denda meet				
	13	Friday	Fugro visit re Lidar Two rocks -Oakajee				
	14	Saturday					
	15	Sunday					
	16	Monday					
	17	Tuesday	WALIS Marine group meet -Patrick Seares WAMSI				
	18	Wednesday					
	19	Thursday					
	20	Friday					
	21	Saturday					
	22	Sunday					
	23	Monday					
	24	Tuesday					
	25	Wednesday					
	26	Thursday					
	27	Friday					
	28	Saturday					
	29	Sunday					
	30	Monday	WAMSI Conference - Pilbara Dredge Node & Kimberley				
	31	Tuesday	WAMSI Conference - Pilbara Dredge Node & Kimberley				
April	1	Wednesda	WAMSI Conference - Pilbara Dredge Node & Kimberley				
	2	Thursday	DPaW technical presentation meeting				
Good Friday	3	Friday					
	4	Saturday					
	5	Sunday					
Easter Monday	6	Monday					
	7	Tuesday					
	8	Wednesda	ESRI Meet - MCV Funding available to build Marine Community profile template for ESRI				

	9	Thursday					
	10	Friday					
	11	Saturday					
	12	Sunday					
	13	Monday					
	14	Tuesday					
	15	Wednesday					
	16	Thursday					
	17	Friday					
	18	Saturday					
	19	Sunday					
	20	Monday	Jal Denda Start				
	21	Tuesday					
	22	Wednesday					
	23	Thursday					
	24	Friday					
Anzac Day	25	Saturday					
	26	Sunday					
Anzac Day* Of	27	Monday					
	28	Tuesday					
	29	Wednesda	FME World tour. RUBP Meeting				
	30	Thursday	ESRI World Tour. Kimberley Lidar meet.				
May	1	Friday					
	2	Saturday					
	3	Sunday					
	4	Monday					
	5	Tuesday					
	6	Wednesday					
	7	Thursday					
	8	Friday	Bob Gozzard Visit re Coastal Landforms				
	9	Saturday					
	10	Sunday					
	11	Monday					
	12	Tuesday					
	13	Wednesda	DPaW meeting - Kensington				
	14	Thursday					
	15	Friday					
	16	Saturday					
	17	Sunday					
	18	Monday					
	19	Tuesday	CSIRO & DoF Hillarys				
	20	Wednesda	DPaW travel test				
	21	Thursday	DMP - Project Plan etc				
	22	Friday					
	23	Saturday					
	24	Sunday					
	25	Monday					
	26	Tuesday	WMG Meet				
	27	Wednesda	DPaW Invoice				
	28	Thursday	DoT Invoice				
	29	Friday					
	30	Saturday					
	31	Sunday					
June - WA (Fo	1	Monday					
	2	Tuesday					
	3	Wednesda	Dave Abdoo Fisheries at DoT Fremantle				
	4	Thursday					
	5	Friday					
	6	Saturday					
	7	Sunday					
	8	Monday					
	9	Tuesday	BAD Flu- Chris& Jal				
Mother's Day	10	Wednesda	Rusp meet, ESRI Cocktails				
	11	Thursday					
	12	Friday	DPaW moved delayed 1 week because of FLU, SLIP Cloisters session. Lidar Session for WMG with Alex FUGRO				
	13	Saturday					
	14	Sunday					
	15	Monday	MCV Presentation to DoT CIBU. GM Morning tea. Stuart Edwards - CSIRO Hydro Surveyor Hobart chat. Email for Hydro/Bathy release				
	16	Tuesday	SLIP Meet. GPS Landgate. Customer service, Rob & Emilia.				
	17	Wednesda	Styling with MXD's for new SLIP				
	18	Thursday	John Collins Tourism regionalbounds. Matt Adams Meet Floreat. WAMSI presentation invitations.				
	19	Friday					
	20	Saturday					
	21	Sunday					
	22	Monday	Move to DPaW schedule session.				
	23	Tuesday	MCP 2.0 John Bushel ESRI				
	24	Wednesda	GPS LandgateHelen & Chris. Dave Abdo Fisheries & DoT Multibeam backscatter				
	25	Thursday	Presenatation at Planning. 32 bit laptop for helen to process Tides data.Timesheets toMelissa Landgate.				
	26	Friday	MCV Move toDPaW offices.				
	27	Saturday					
	28	Sunday					
	29	Monday	Day 1 at DPaW, HUGE.				
	30	Tuesday					
July	1	Wednesday					
	2	Thursday	Ntwrk Access at last. DoTEmailscoming				
	3	Friday	Nathan Quadros contact about Lidar 2rocktoDekajee				
	4	Saturday					
	5	Sunday					
	6	Monday					
	7	Tuesday	Habitat Sampling initiative outline				
	8	Wednesday					
	9	Thursday					
	10	Friday	Steve James - MXD,s & Layers. See Ryan Douglas and understand habitat classifying.				
	11	Saturday					
	12	Sunday					
	13	Monday	Coastline Movements presentation david McClenna for Vivienne. Drop cameras with Kim Freldan.				
	14	Tuesday					
	15	Wednesda	Videolink test AODN. Dirk Slawinski CSIRO chat again				

	16	Thursday					
	17	Friday	Geodatabases, Coastal-Mangrove-Marine. Presentation practice.				
	18	Saturday					
	19	Sunday					
	20	Monday	WAMBI Presentation at CSIRO auditorium				
	21	Tuesday	AODN Weblink about MCP2.0. Aleta -WAMBI article				
	22	Wednesda	Point Peron-DPAwseminar - good				
	23	Thursday	Ian Elliotcoffeat Boatshed.				
	24	Friday	Planning presentation - like WAMBI about DoT datasets				
	25	Saturday					
	26	Sunday					
	27	Monday					
	28	Tuesday					
	29	Wednesday					
	30	Thursday	Seagrass at Bent st ramp. Organise triptp Penguinisland				
	31	Friday	Meet with Luke edwards about Habitat initiative.				
August	1	Saturday					
	2	Sunday					
	3	Monday					
	4	Tuesday	EOI Documentation				
	5	Wednesda	Fisheries dave Abdo - see Rick Fletcher for permission.				
	6	Thursday					
	7	Friday	Habitat initiative - AIMS good, CSIRO about Lidar reflectivity and Multibeam Backscatter.				
	8	Saturday					
	9	Sunday					
	10	Monday	Seagrass presentation DoW auditorium.				
	11	Tuesday					
	12	Wednesda	Planning presentation of mockup. WALIS Council presentation				
	13	Thursday	DoT and Floreat Backscatter data				
	14	Friday					
	15	Saturday					
	16	Sunday					
	17	Monday	CSIRO Test data from Dirk Slawinski - Habitat asmple				
	18	Tuesday	Pawsey Centremeet - Habitat sampling				
	19	Wednesday					
	20	Thursday					
	21	Friday					
	22	Saturday					
	23	Sunday					
	24	Monday	MCV Morning Tea for DPaW GIS. ESRI Meet about MCP. Planning meet re Coastal dataset.				
	25	Tuesday					
	26	Wednesda	Luke Edwards & Marcel from Woodside about MCP. Chris - on leave				
	27	Thursday	Visit DoT Fleo. Presentation practice. Newsletter forWALIS Marine Group.				
	28	Friday	Discussion Femina Metcalfe (DPaW IT boss), DPaW Presentation. Kim Freidman Farewell. Ralph - on leave				
	29	Saturday					
	30	Sunday					
	31	Monday					
September	1	Tuesday					
	2	Wednesda	Meeting at Midland re SLIP, Chris & Jai.				
	3	Thursday	V drive at DPaW failure, 3 days lost				
	4	Friday	Meet with DPaW Marine science about Turtle data				
	5	Saturday					
	6	Sunday					
Father's Day	7	Monday					
	8	Tuesday					
	9	Wednesday					
	10	Thursday					
	11	Friday	DoT Oceanography to finish 1 week no extensions				
	12	Saturday					
	13	Sunday					
	14	Monday					
	15	Tuesday					
	16	Wednesday					
	17	Thursday					
	18	Friday					
	19	Saturday					
	20	Sunday					
	21	Monday	Matt Holt -Oil spill(Stuart Fields)				
	22	Tuesday					
	23	Wednesday					
	24	Thursday					
	25	Friday					
	26	Saturday					
	27	Sunday					
Queens Birthd	28	Monday					
	29	Tuesday					
	30	Wednesday					
October	1	Thursday	Release of DoT Sediment Cells Dataset onto GME				
	2	Friday					
	3	Saturday					
	4	Sunday					
	5	Monday	Release of DoT Oceanographic Dataseton to GME. DoT invoice created				
	6	Tuesday	Chris ESRI Portal Training midalnd 2 days. Jai EOI signoff				
	7	Wednesday					
	8	Thursday	Discussion Ian Elliot re Sediment cells for whole state and lider for South Coast & Pilbara				
	9	Friday	DPaW Planning session 2 hours.				
	10	Saturday					
	11	Sunday					
	12	Monday	DoP final dataset meetand data handover for UAT. Rodney Hoath to DPaW office, Oceanography issues plans and MCV presentation transfer				
	13	Tuesday	WAMBI Proposal for MCV and Geoscience release of BAD Coastal compartment dataset -Bruce Thom & Ian Elliot.				
	14	Wednesda	Meeting with Daniel Then & John Kirk for DMP Dataset. Dirk Slawinski Pawsey Login.				
	15	Thursday	Meeting with Patrick Beares & Rodney Hoath , Floreat.				
	16	Friday	Geoscience Coastal Compartments - comments.				
	17	Saturday					
	18	Sunday					
	19	Monday	Geoscience Coastal Compartments - Teleconference(andrew)				
	20	Tuesday					
	21	Wednesday					

	22	Thursday	Meeting Iain Pamum - CurtinUni					
	23	Friday	ESRI Offices - Open data presentation					
	24	Saturday						
	25	Sunday						
	26	Monday						
	27	Tuesday	Discussion Steve Rowlands re Oils spill response					
	28	Wednesday						
	29	Thursday	Visit DoT Freo. Rottnest Island Authority meet- reaction to DoT Bathy release					
	30	Friday						
	31	Saturday						
November	1	Sunday						
	2	Monday	Megadata meet -Curtin CSIRO offices					
	3	Tuesday						
	4	Wednesday	Lunch with Trevor Ward & Ian Elliot.MCV Newsletter					
	5	Thursday	Chris & Ralph on Leave.					
	6	Friday						
	7	Saturday						
	8	Sunday						
	9	Monday						
	10	Tuesday	Wells Marine Group meet - Jal					
	11	Wednesday						
	12	Thursday						
	13	Friday						
	14	Saturday						
	15	Sunday						
	16	Monday	Meet Phil Kindleysides BMT					
	17	Tuesday						
	18	Wednesday						
	19	Thursday						
	20	Friday						
	21	Saturday						
	22	Sunday						
	23	Monday	Meeting Peter Fearns - Curtin University -NCB submission QLD 1943 Imagery					
	24	Tuesday	MCV Presentation @ Curtin University					
	25	Wednesday						
	26	Thursday						
	27	Friday	FMETraining for DPaW GIS branch -Chris Barber					
	28	Saturday						
	29	Sunday						
	30	Monday						
December	1	Tuesday						
	2	Wednesday						
	3	Thursday	Contact with Graham Johnston - Director at AGO(Australian Geospatial/Organisation) re Pilbara mapping & Photography 1980's (Graham is and old army collegue)					
	4	Friday						
	5	Saturday						
	6	Sunday						
	7	Monday						
	8	Tuesday	AIIA Geospatial SIG teleconference					
	9	Wednesday						
	10	Thursday						
	11	Friday	Knowledge Broker seminar - DPaW -Chris Cvitanovic UTAS					
	12	Saturday						
	13	Sunday						
	14	Monday	1st Habitat Sample Workshop - planning					
	15	Tuesday	WALIS Christmas party					
	16	Wednesday						
	17	Thursday	Shoalwater Bay - Habitat sampling with DPaW					
	18	Friday	1st Habitat Sample Workshop					
	19	Saturday						
	20	Sunday						
	21	Monday	Workshop followup. Meeting Steve Rowlands& Katherine Zdudnic re MCV. Meeting - ChrisNutt DPaW Planner					
	22	Tuesday						
	23	Wednesday	MCV Christmas lunch @Tradewinds					
	24	Thursday						
Christmas Day	25	Friday						
Boxing Day	26	Saturday						
	27	Sunday						
Boxing Day* O	28	Monday						
	29	Tuesday						
	30	Wednesday						
	31	Thursday						

Managing Coastal Vulnerability
Daily Log 2015

January - New Year's Day	1	Friday		
	2	Saturday		
	3	Sunday		
	4	Monday		
	5	Tuesday		
	6	Wednesday		
	7	Thursday		
	8	Friday		
	9	Saturday		
	10	Sunday		
	11	Monday		
	12	Tuesday		
	13	Wednesday		
	14	Thursday		
	15	Friday		
	16	Saturday		
	17	Sunday		
	18	Monday	Habitat Workshop - compilerecommendations. NationalArtchives rand re Pilbara 1980's Army 1:50000 Imagery, cant find yet	
	19	Tuesday		
	20	Wednesday	Meeting with DPaW Marine Science re TurtleSurvey 2014 data and evaluation.	
	21	Thursday		
	22	Friday	Schedule hnext Habitat workshop for late February	
	23	Saturday		
	24	Sunday		
	25	Monday		
Australia Day	26	Tuesday		
	27	Wednesday		
	28	Thursday	Tim Moltman, Director IMOS - presentation at DPaW - reference MCV 5 times. Doug Bergensen rang re Multibeam Backscatter research	
	29	Friday	DoT GM Morning Tea	
	30	Saturday		
	31	Sunday		
February	1	Monday	1:50000 Topo from Maree Wilson at Geoscience. Meeting with Patrick Beares WAMSI - re MCV project continuation	
	2	Tuesday	Organise HydrographicCharts license for Steve Rowlands @ DPaW.Organise morning teafor DPaW Marine Science & GIS	
	3	Wednesday		
	4	Thursday	Discuss Brett Harrison about Fisheries and Habitat Sample Admin with PAWSEY centre	
	5	Friday		
	6	Saturday		
	7	Sunday		
	8	Monday		
	9	Tuesday	Organise logins for Chris Barber with new SLIP Portal	
	10	Wednesday		
	11	Thursday		
	12	Friday		
	13	Saturday		
	14	Sunday		
	15	Monday		
	16	Tuesday		
	17	Wednesday		
	18	Thursday		
	19	Friday		
	20	Saturday		
	21	Sunday		
	22	Monday	Meeting with Damara re Coastal Compartmens and NCARF meeting in Brisbane	
	23	Tuesday		
	24	Wednesday	2nd Habitat Sample Workshop	
	25	Thursday	Saw CSIRO Presentation by Simon Collings re Lidar Reflectivity and Multibeam Backscatter	
	26	Friday	DPaW Marine Science & GIS morning tea	
	27	Saturday		
	28	Sunday		
	29	Monday	Start research on Waterlines semi-auto generation	
March	1	Tuesday	Meeting withMick Cleary, Jeff Hansen and Nikki Brown reNCB pilbara project and data management needs. Chris Barber to Brief Manager DPaW GIS re MCV	
	2	Wednesday		
	3	Thursday	Trying to reestablish transports SLIP services, Chris & Jai	
	4	Friday		
	5	Saturday		
	6	Sunday		
Labour Day	7	Monday		
	8	Tuesday	WALIS Marine Group Meeting. Landgate reorganisation may have ramifications onWMG.	
	9	Wednesday	DPaW Habitat catalogue timeline meeting.	
	10	Thursday		
	11	Friday	Habitat Catalogue - Interagency meeting	
	12	Saturday		
	13	Sunday		
	14	Monday	FinalProject report layout. Begin transfer of Habitat group to WAMSI & Patrick Beares	
	15	Tuesday		
	16	Wednesday		
	17	Thursday	Scitech- Galaxy stand for WALIS	
	18	Friday	Waterlines Relative Averagingmethodology	
	19	Saturday		
	20	Sunday		
	21	Monday	Megadata Cluster @ECU Mt LaWley, Landgate . Petty cash claim forMorning tea DPaW	
	22	Tuesday	WAMSI Meet, Patrick Beares re Habitat Sample group	
	23	Wednesday	Emma Jackson fromNorthern Agriculture Catchment Council- NACC.Time line forHabitat Catalogue, John Dunn.	
	24	Thursday		
Good Friday	25	Friday		
	26	Saturday		
	27	Sunday		
Easter Monday	28	Monday		
	29	Tuesday		
	30	Wednesday	Waterline/Debris line met with Ian Elliot, Matt Elliot & Tanya Stul	
	31	Thursday	ChrisBarber toFremantle reCoastline Movements issue resolution/solution.	
April	1	Friday	Discussion Michelle Spinzola(Geoscience) about Bathymetry	
	2	Saturday		
	3	Sunday		
	4	Monday	Dotinvoice to Landgate Jan-Mar Landgate GPB's completion.	
	5	Tuesday	Landgate, organise Chris tocomplete Marine Map.	
	6	Wednesday	Meet Stuart Field DPaW re update forOils Spill and Habitat Catalogue	
	7	Thursday	Marine Catalogue meet with GIS Management. Invite List for MCV Wrap-upJune.	

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	17	Sunday	
	18	Monday	
	19	Tuesday	
	20	Wednesday	
	21	Thursday	
	22	Friday	
	23	Saturday	
	24	Sunday	
Anzac Day	25	Monday	
	26	Tuesday	
	27	Wednesday	
	28	Thursday	
	29	Friday	
	30	Saturday	
May	1	Sunday	
	2	Monday	
	3	Tuesday	
	4	Wednesday	
	5	Thursday	
	6	Friday	
	7	Saturday	
Mother's Day	8	Sunday	
	9	Monday	
	10	Tuesday	
	11	Wednesday	
	12	Thursday	
	13	Friday	
	14	Saturday	
	15	Sunday	
	16	Monday	
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	29	Sunday	
	30	Monday	
	31	Tuesday	
	1	Wednesday	
	2	Thursday	
	3	Friday	
	4	Saturday	
	5	Sunday	
June - WA Foundation Day	6	Monday	
	7	Tuesday	
	8	Wednesday	
	9	Thursday	
	10	Friday	
	11	Saturday	
	12	Sunday	
	13	Monday	
	14	Tuesday	
	15	Wednesday	
	16	Thursday	
	17	Friday	
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	29	Wednesday	
	30	Thursday	

APPENDIX C – WATERLINES INVESTIGATION

Waterlines Auto Update Scenario

Ralph Talbot-Smith
December 2014

Issues

The determination of High water marks and Low water marks for the Western Australian coast is in a poor state. Understanding about how frequently these marks change is badly misunderstood by most people that are involved with their determination and concurrent usage.

The usage of these waterlines is tightly locked into legislation that are severely limiting about change in their determination and their use.

There is no regular program to update these lines and as a result of shoreline movement many of these older captured areas are vastly incorrect. This has repercussions with regard to gazetted cadastral lots and reserves and quite often there are disputes regarding Ownership, Native title and even prosecution and management authority are issues that arise.

Legacy roadblocks

Legislation has loosely used various watermarks to define different boundaries(e.g. LWM, LAT, MHW, MHWS. See link for complete listing http://www.icsm.gov.au/publications/tidal_interface/compendium_full_may03.pdf).
There is now better understanding of the variability of water marks and their inadequacy in being used as a boundary determiner. There needs to be changes in the legislation (over a 10 year period) that removes watermarks as a boundary.
Inadequate data is still a factor influencing the variability of watermarks for much of Western Australia. There are small sections of WA coast where there is reasonable understanding and there are a small group of professionals that have a good overall knowledge about processes along the coast. The vast distance of coastline and the wide environmental differences (e.g. Tide, Weather, swell, wind, El Nino, tropics) that make waterline determination for the state as a whole, almost certainly impossible.

The size of the WA coastline also makes any solution difficult. A solution for one section of coast will not fit with another section of coast and there has been a reluctance to use any particular boundary system that can divide the coastline into manageable sections.
There have been numerous working groups working on this issue over the years that have not come to any firm solutions that can be applied into the long term.
Definition of waterlines using aerial photography is very difficult.

Busselton Jetty

Dampier Boat Harbour

Science and the coastline

In recent years there have been considerable advances in the spatial science industry that could go towards mapping the coastline and waterlines in a much more efficient manner.

Aerial Imagery

Since the year 2000 digital aerial imagery has become a vital tool for mapping. This advancement has built to the stage whereby WA is almost completely covered by Digital Aerial imagery. Large part of WA and particularly the Mid and lower WA are regularly recaptured as part of the Landgate / WALIS aerial capture program. A recent development (last 2 years) is that for all digital imagery captured there is now a DEM(Digital Elevation Model). This DEM creation is part of the Aero triangulation process of the photography. Creation of the DEM for high resolution (1 metre) can be quite labour intensive as the DEM has to be edited to make it 'Bare Earth'. This means that all Trees, Buildings and other feature defined in the point cloud have to be removed. The resultant product is now labelled as a DTM(Digital Terrain Model)

Current status(Dec 2014) indicates that the majority of the WA coastline is Aerial DEM & DTM complete although the Kimberley region is not complete because the Aerial Photography program is a 10 year cycle and this area is not due to be reflown for a number of years.

Satellite Imagery

Another development in the spatial industry is the growing emergence of remote sensing particularly from Satellite imagery. With resolution of imagery increasing and the frequency of satellites, orbiting WA, increasing then there is a large amount of Multi-resolution products from a number of different companies available on the market.

In terms of value for money the Landsat 7 imagery has now been replaced by Landsat 8 and is providing some interesting developments because of its ability to provide more bands relating to ocean and increases in the number of scenes per day that it can acquire. There has also been an increase in cartographic accuracy.

Comparing High- and Medium-Resolution Commercial Imaging Satellites

Satellite	Launch Date	Swath Width (kilometers) [1]	Native GSD (meters)[2]	Output Resolution (meters)	Max View Scale[3]	Native Accuracy (meters)[4]	Bands	Bit Depth	Stereo
IKONOS	Sept. 24, 1999	11.3	0.82 x 3.20	1 x 4 [5]	1:2,500	15	pan + 4 MS	11	yes
QuickBird	Oct. 18, 2001	18[6]	0.65 x 2.62	0.6 x 2.4	1:1,500	23	pan + 4 MS	11	no
SPOT-5	May 3, 2002	60	5 x 10 x 20	2.5 x 5 x 10 x 20[7]	1:5,000	48	pan + 4 MS	8	yes
WorldView-1	Sept. 18, 2007	17.7	0.5	0.5	1:1,250	5	pan only	11	yes
RapidEye	Aug. 29, 2008	77	6.5	5	1:12,500	23- 45[8]	5 MS (no pan)	12	no
GeoEye-1	Sept. 6, 2008	15.2	0.41 x 1.65	0.5 x 2	1:1,250	5	pan + 4 MS	11	yes
WorldView-2	Oct. 8, 2009	17.7	0.46 x 1.85	0.5 x 2	1:1,250	5	pan + 8 MS	11	yes
Pléiades 1	Dec. 16, 2011	20	0.70 x 2.4	0.5 x 2	1:1,250	to be determined	pan + 4 MS	12	yes

Pricing varies per product depending upon Quality & usage.

WA Marine Datasets - SLIP

Another development relates to a project called MCV(Managing Coastal Vulnerability) which is being funded as part of the LIS(Location Information Strategy).

The task of this project is to help 7 state government departments to manage there marine spatial data and make it discoverable on the internet. Assisting with the issue of waterlines is part of the MCV project brief. As part of the MCV evaluation of the waterlines issue a part conclusion was that the states coastline needed to be divided into regular segments to enable the formulation of different rules that fitted that segments differing criteria in terms of Tide, wave run-up, wind etc.

As part of the MCV project the project team has already assisted with a Geological Coastal compartments dataset and a Sediments cells datasets for the Department of Transport. The team is also assisting with Tidal data for the state and bathymetric Survey data reorganisation and standards alignment.

Solution scenario

Coastal Compartments -

With 36 Primary compartments, 118 Secondary & 245 tertiary compartments, we have an excellent division system for the WA Coast whereby we can Group or separate waterline determination rules/procedure depending upon the complexities of the coast in any particular area or region.

High Water Mark

A possible solution for quick determination of High water marks is to define a high water mark value for each tertiary coastal compartment along the coast. Then using DEM's, to set the base contour for that compartment in an auto contour creation tool and let the software compile a High Water mark guide.

Northern WA

For the northern part of the state because of the relative lack of swell then it may be feasible to adopt the MHWS (Mean High Water Springs) from permanent and temporary tide gauge information.

One issue for this region is that out of 108 tertiary compartments from Carnarvon to the WA-NT border there are only 14 temp & permanent tide gauges (comb.). The issue comes, because of the complexity of the coastline and the extreme variations of tide, is how to define the MHWS value for the missing compartments. It is possible that we could use photogrammetry to evaluate the coastal compartments in a "Random spot location" method rather than do a visual interpretation of the High Water/Debris line. This could be done as a stop-gap measure and we could state that this how the figure was derived.
We have tried a similar method using Multibeam/laser scan data at Broome. The debris line value arrived at was 0.07 different to the Tidal submergence curve. This difference could be explained by wind wave difference. This suggests that either methodology would be reasonably close.

As more laser scans are completed by the department of Transport then coastal compartment values could be populated. There may be other sources of data that should be investigated.

Southern WA

For the southern region of the state(start definition for this area could be Shark Bay - southwards) the still water(tide) values are not a sufficient indicator of Mean High Water(MHW).
Use of these values in testing with DEM's has been most unsatisfactory.
Using Multibeam /Laser data and determining debris lines from aerial photography from the same date has given a better value.
However it must be remembered that different seasons will give different values and the high water marks will change as the shoreline constantly evolves from day-to-day, month-to-month, Year-to-year.
The update frequency of waterlines for this coast would be high
Seasonal averages may be the suitable path to arrive at a value for DEM contouring.
We should remember that every time we take aerial photography then a new DEM will be created. The value should not vary much unless we are having increases in sea level.
The tide values will indicate if there has been sea level rises and that in turn may necessitate redefining the debris line values for particular compartments or regions. Contouring the MHW using the DEM would involve very low resource allocation and time.
Increases in storm severity would possibly mean higher debris lines. This could be monitored relatively easily by remote means

Lower Water Mark

The definition of Mean Low Water Mark (MLWM) is not possible using DEMS as the DEMS seaward depths are not bathymetrically corrected.
A proposed methodology is to use Landsat 8 satellite imagery.
By choosing satellite images that correspond to LOW water according to tide prediction/records we may be able to expose large areas of the WA coast at low water. With this imagery and the fact that it is Landsat 8 and has enhanced water orientated attributes we could use remote sensing technology to define the point of change between Water & Land. Preliminary testing has been done by DPaW on the Kimberley coast with reasonably good results.

There are a number of difficulties, predominantly with getting the right image that corresponds to LOW water in any particular area. Remembering that in the northern part of the state the Low water could occur at significantly different times of the day although the actual locations may not be too distant from one another.

The difficulties in the southern areas are once again the weather conditions at the time of image capture. Selecting an image when it is LOW water and also relatively calm and seasonally consistent could be difficult.

It may be that satellite imagery would have to be purchased to satisfy all of the criteria if they could not be fulfilled by Landsat 8.

Benefits

One of the current issues with waterlines is having the resources to recapture as the coastline changes.
We have listed possible scenarios here that require considerable planning and monitoring, whereas actual capture of the data/guides is being completed for the most part by the computer.
There would be considerable effort to compile the DEMs for the coast but the project is entirely possible. Once the template is created then it should not be too onerous. Every coastal Photography project would be completed as captures progress.
The satellite remote sensing would require some setup but is very feasible.
This system could reduce resources, reduce costs. Allow for very fast updating of the Coastline to keep pace with its never ending cyclic change.

Scenario Appendix A

Source: https://s3-ap-southeast-2.amazonaws.com/transport.wa/CoastalCompartments/Eliot+et+al+(2011)+WA+Compartments+Final+Report.pdf

Executive Summary

Western Australia boasts a truly enviable diversity of coastal landforms along approximately 24,000 km of coastline, estimated along the mainland Mean High Water line and discounting the shores of its numerous islands. The diversity is a daunting prospect for planning and management. It encompasses a wide variety of geology and coastal landforms subject to a very wide range of weather and ocean conditions. The coast includes areas of outstanding beauty such as the World Heritage Area at Shark Bay, the low lying areas in the Pilbara, the estuaries of the south-west coast, the spectacular Zuytdorp cliffs and the Kimberley coast. The values of the coast and its inherent sensitivity to change have been acknowledged through formulation and adoption of the State Coastal Planning Policy SPP2.6 (Western
Australian Planning Commission: WAPC 2003) and the Coastal Protection Policy (Department for Planning and Infrastructure: DPI 2008). At a broad level the policies are designed to encourage consideration and use of building codes, zoning laws and local government policies that encourage best use of the land and nearshore waters. Essentially they apply principles of natural systems management to land use. However, questions of how they are to be applied in an equitable way from place to place remain. This report provides a framework to help assess such questions.

Available descriptions of geologic features and landforms comprising the coast have been used to identify compartments around Western Australia at strategic, regional and local scales currently used for coastal planning and management. The hierarchy of 36 primary, 118 secondary and 245 tertiary compartments (Summary Figure 1) provides a network of nested planning units. In principle, the network provides a systematic approach to State planning in the coastal environment, including natural resource management and marine conservation planning.

It is a multi-scalar framework that facilitates comparison and analyses of environmental data across and within each compartment level as well as between different levels within the hierarchy. In the first instance, the hierarchical framework of coastal compartments enables comparative assessment of information available and planning for future research/surveys of marine and coastal resources. It is a first step in coastal risk analysis and has wider relevance due to the diversity of coastal landforms around the State and the need to assign resources to address issues of resource sustainability.

Several steps were used to identify the three interrelated levels of compartments. First, major changes rock type along the coast were identified from the 1:500,000 Geological Map. Second, the boundaries of the primary compartments were then adjusted to accommodate apparent changes in the orientation of the coast as well as to incorporate complete landforms of regional significance. This was done with reference to the 1:250,000 Geological Map, the 1:100,000 Topographical Map Series and satellite imagery available on Google Earth 2008 ®. Third, once boundaries for the primary (strategic planning) compartments were determined, each compartment was further subdivided into secondary (regional planning) compartments based predominantly on landform associations such as extensive tracts of coast with continuous beach or dune field formations. Fourth, the secondary compartments were then subdivided into a suite of tertiary (local planning) compartments based on the individual coastal landforms present. The seaward and landward boundaries integrate marine and terrestrial components of the coast as well as the meteorological and oceanographic processes affecting them at each scale.

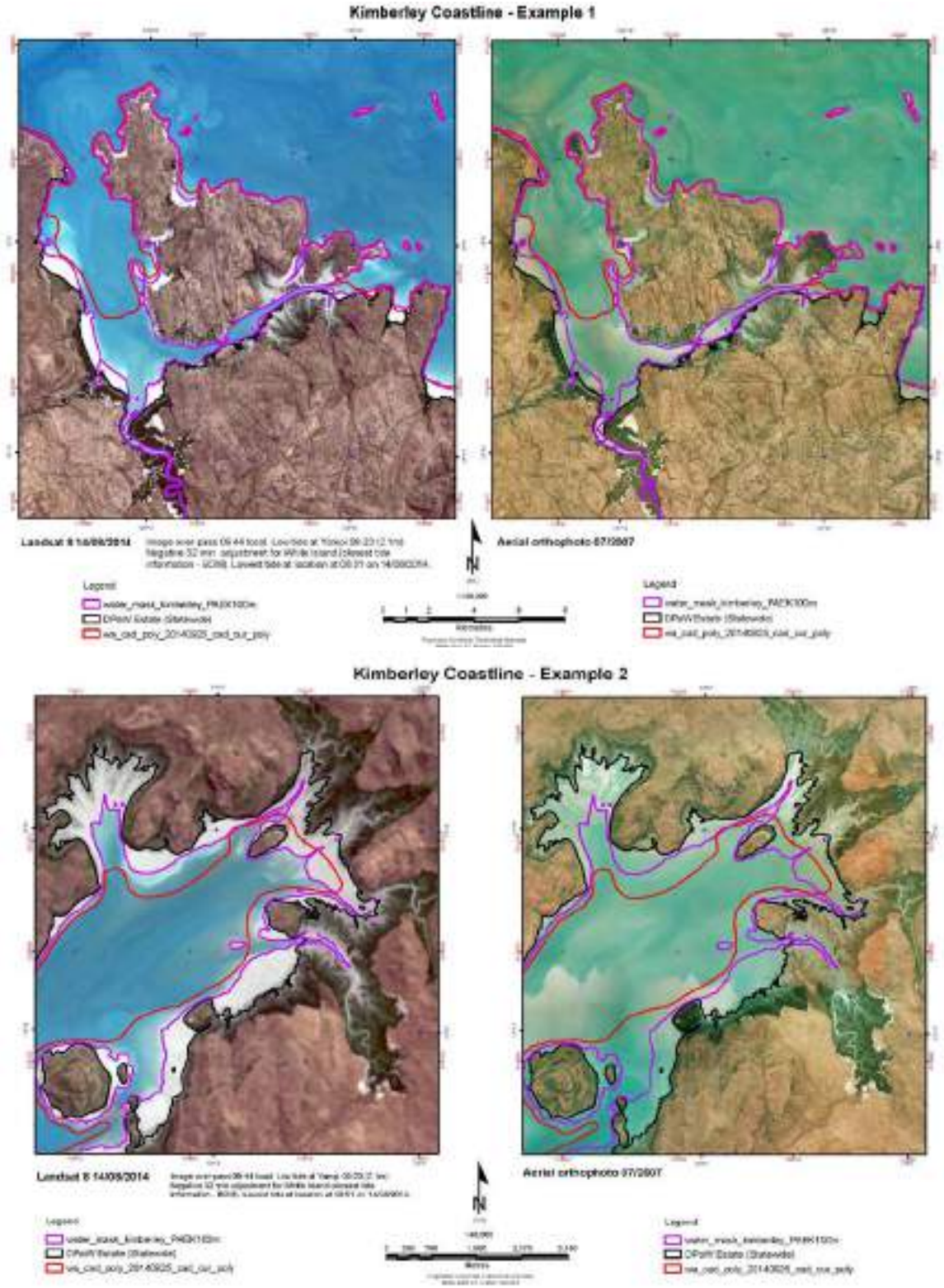
Boundaries of the primary compartments describe the long-term development of the coast. They are based on sea level approximately 18,000 years ago, at the start of the rise in sea level to its present position, as well as the landward extent of sediment accumulation over the past 6,000 years, from when sea level has been relatively stable. In contrast to the boundaries of the primary compartments, tertiary compartment boundaries define the nearshore to backshore zones, the marine and terrestrial areas close to shore where coastal processes are highly active.

The hierarchy of coastal compartments is intended to have applications consistent with those of the land system hierarchy used agricultural planning and management. Similar frameworks have been used in the United Kingdom and the USA as well as in New South Wales and South Australia. Several potential uses for the Western Australian coastal compartments have been briefly outlined in the report. These include planning for marine natural resource and conservation planning; protection of essential life habitats; ecosystem based fisheries management; terrestrial coastal planning and management; and assessment of coastal vulnerability to projected rise in sea level and change in climate. At present the compartments are being used as a framework to assess the vulnerability of coastal landforms to changing weather and ocean conditions, particularly rise in sea level. Whether any of the others are implemented is the business of the relevant State and Local Government agencies, catchment management councils and community interest groups. Full use of the framework is a challenge for the future.

Scenario Appendix B

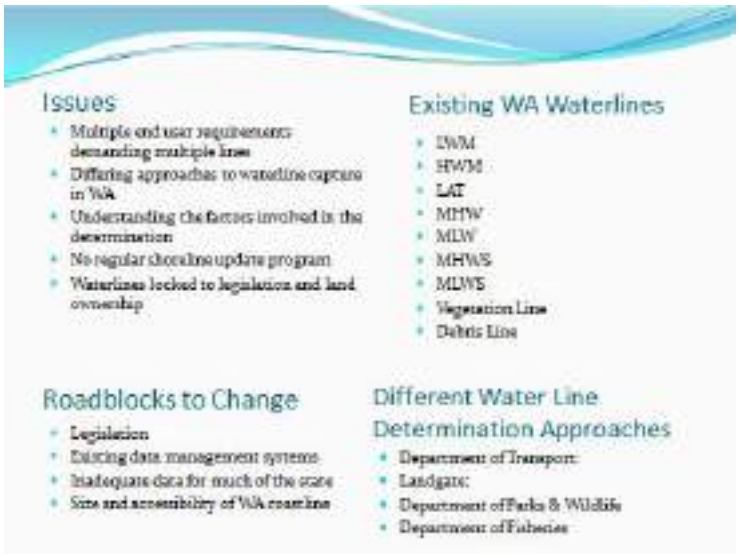
The 2 examples shown below show comparisons between

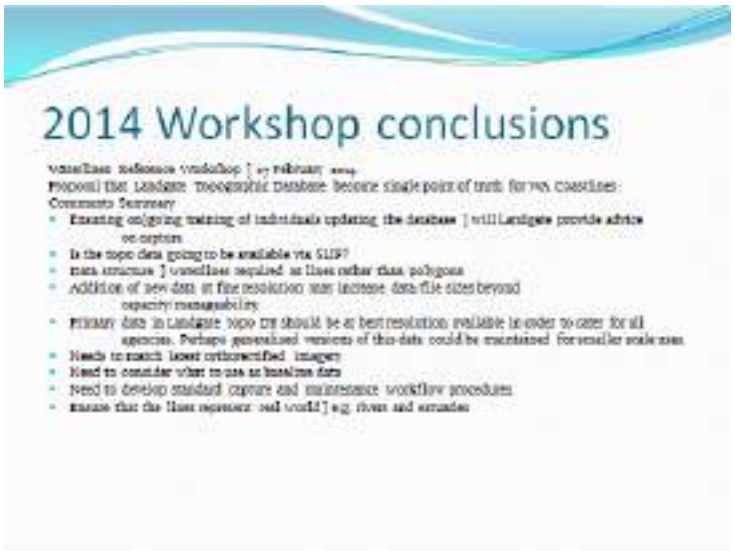
Landsat 8 **Aerial Imagery**



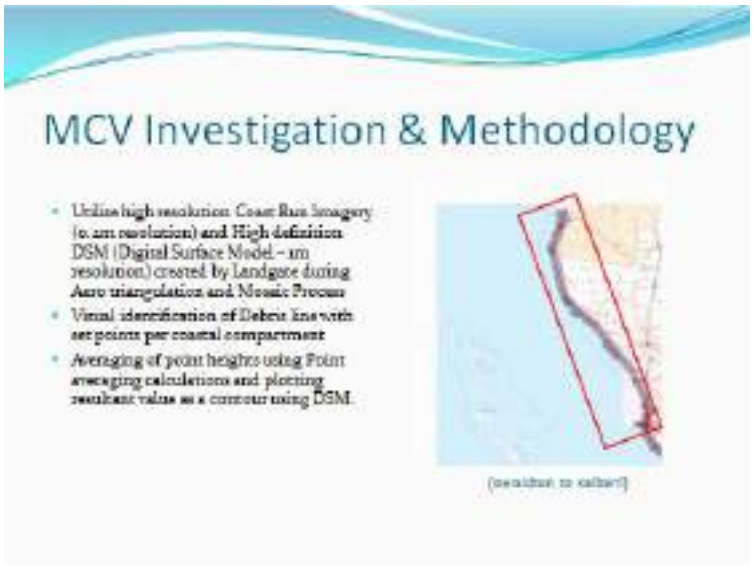
Compiled by: Kathy Murray, Department of Parks & Wildlife

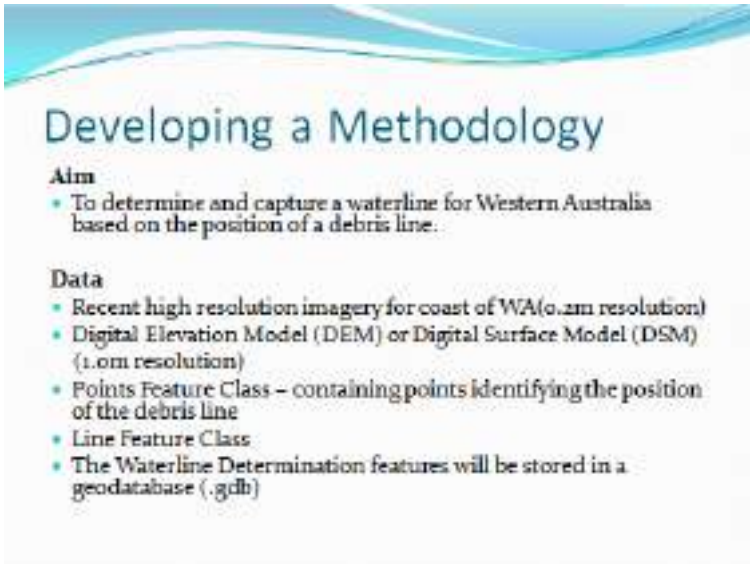
Waterlines Auto Update Results

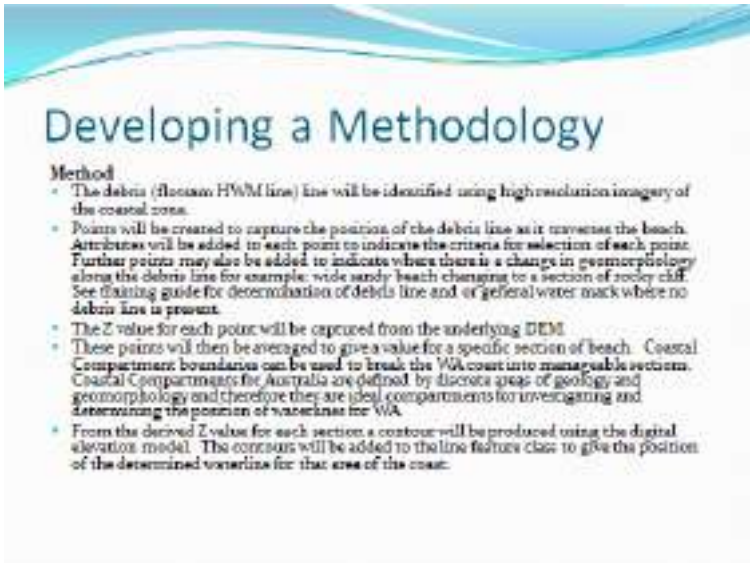


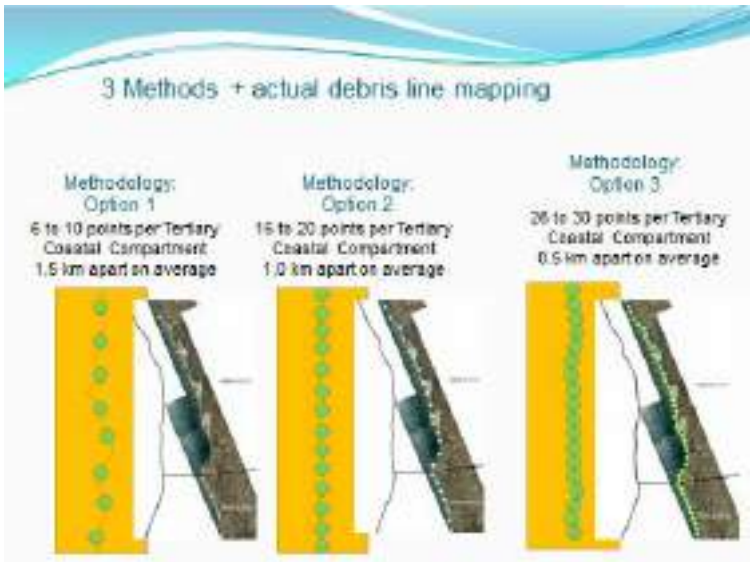



Coast run Aerial Imagery
Kalbarri to Israelite Bay 2016

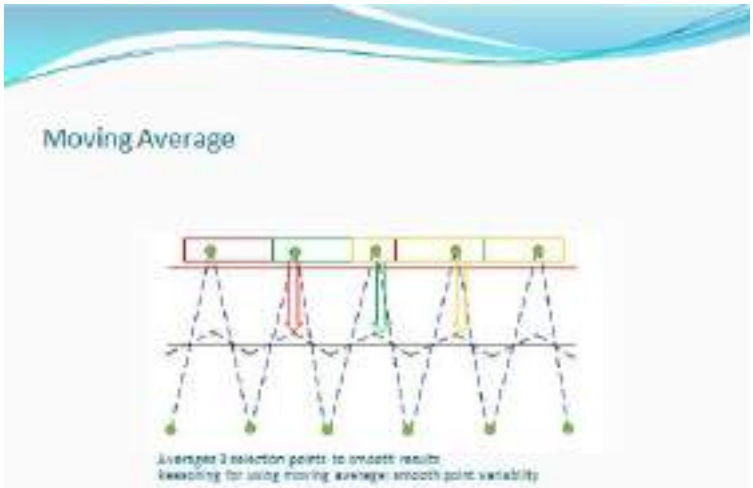

MCV Investigation & Methodology
Online high resolution Coast Run Imagery (0.2m resolution) and High definition DSM (Digital Surface Model – 1m resolution) created by Landgate during Aero triangulation and Mosaic Process
Visual identification of Debris line with set points per coastal compartment
Averaging of point heights using Point averaging calculations and plotting resultant value as a contour using DSM.

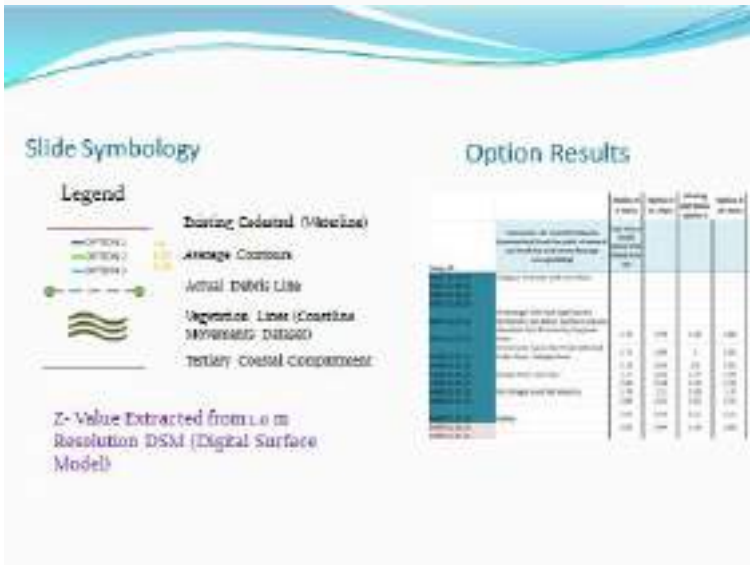

Developing a Methodology
Aim
To determine and capture a waterline for Western Australia based on the position of a debris line.
Data
Recent high resolution imagery for coast of WA(0.2m resolution)
Digital Elevation Model (DEM) or Digital Surface Model (DSM) (1.0m resolution)
Points Feature Class – containing points identifying the position of the debris line
Line Feature Class
The Waterline Determination features will be stored in a geodatabase (.gdb)


Developing a Methodology
Method
The debris (flotsam HWM line) line will be identified using high resolution imagery of the coastal zone.
Points will be created to capture the position of the debris line as it traverses the beach. Attributes will be added to each point to indicate the criteria for selection of each point. Further points may also be added to indicate where there is a change in geomorphology along the debris line for example: wide sandy beach changing to a section of rocky cliff. See tidining guide for determination of debris line and of general water mark where no debris line is present.
The Z value for each point will be captured from the underlying DEM.
These points will then be averaged to give a value for a specific section of beach. Coastal Compartment boundaries can be used to break the WA coast into manageable sections. Coastal Compartments for Australia are defined by discrete areas of geology and geomorphology and therefore they are ideal compartments for investigating and determining the position of vaselines for WA.
From the derived Z value for each section a contour will be produced using the digital elevation model. The contours will be added to the line feature class to give the position of the determined waterline for that area of the coast.

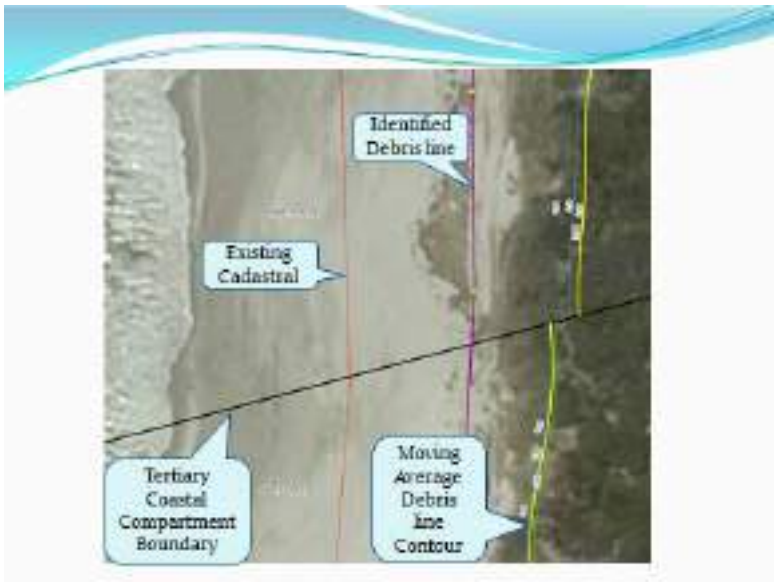

3 Methods + actual debris line mapping
Methodology: Option 1
6 to 10 points per Tertiary Coastal Compartment
1.5 km apart on average
Methodology: Option 2
16 to 20 points per Tertiary Coastal Compartment
1.0 km apart on average
Methodology: Option 3
26 to 30 points per Tertiary Coastal Compartment
0.5 km apart on average


Actual Base Waterline depiction – 20m points
Only where debris line identifiable


Moving Average


Slide Symbology
Option Results
Legend
Z- Value Extracted from 1.0 m Resolution DSM (Digital Surface Model)


Bias associated with Waterline Bias
Waterline - Low
Debris - Low or High
Vegetation - Very High
Quality of the Digital Elevation Model - Variable



Summary

The testing was very successful and provided a quick, efficient and entirely duplicable method of waterline determination for the state. The concept and results were presented to the WALIS Marine group in May 2016. Further action with these results remain for the WALIS Marine groups action in the future.

APPENDIX D – DOCUMENT TEMPLATES

Documentation Templates

Link – *MCV-Coastal_Vulnerability\Overall_Project_Management\Project_Delivery\Templates*

1. MCV Project Plan

Document Management

Distribution List

Record the details of all project stakeholders accessing this document.

Name	Position	Signature	Date
Ralph Talbot-Smith	Project Manager		
Rodney Hoath	Director Coastal Information (Transport)		
Steve James	Manager Geographic Information (Transport)		
Jenny Smith	Manager WALIS Projects		
Kumar Balakrishnan	Manager Program & Governance		

Version Control

Record all approved changes to this document.

Revision #	Change Description	Approval Date	Author
1.0	Initial	3/8/2013	RT-S

Data Set Name

Location Information Strategy – Managing Coastal Vulnerability – Navigation Aids Data Set

1 Data Set Information

Refer to MCV Project Plan_Rev1.0.doc

This document details the actions required to bring the Navigation Aids data set to a quality state that will see it achieve the goals of the MCV project.

Considerable work has almost been completed transitioning the Navigation Aids database to and IBM Maximo database by DoT.

The navigation aids within the database contain information about all DoT navigation aids (excess of 1000) and also information for ALL other navigation aids within the state to the best of DoT's knowledge..

The database is a key source of active information that is relied upon by multiple state and Federal agencies. The complexity of the data is such that it would probably be unwise for the Project team to become too involved in the procedure and intricacies of the database operation and reporting mechanisms. Current procedures for this data call for periodic extractions of the data

2 Scope Management

2.1 Deliverables

A finalised set of Navigation Aids that have a standardised categorization.

A comprehensive procedure that ensures that all future Navigation Aid data is completed in a consistent manner and added to the overall dataset.

This data set to be maintained and added to on a regular time schedule.

Metadata in the agreed format is added to the data and the total package is delivered to the final data broadcast medium (eg SLIP Future, AODN).

2.2 Inclusions

All existing Navigation Aids records held by the Department of Transport.

2.2 Work Details

At this point it is difficult to envisage what-if any-work would need completion by th project group. There will be some metadata compilation and some procedures for metadata updates.

Currently the database operator compiles a Microstation DGN and Google Earth KMZ file every 3-6 months. The process involved is somewhat cumbersome but effective.

The advantages between a Google Earth file and a standard Shape file is that the correct symbology can be created when the file is created in Microstation –Google. It should be possible to create a better Google file from ArcGIS f the symbology was created . This will need some investigation.

Testing to make the appropriate data available may be required

2.3 Metadata Management

Metadata to be collected is:

- Date of currency
- Contact details

.3 Time Management

3.1 Schedule

This data set is classified as "High Priority".

3.2 Milestones

Estimated milestones are:

- Data clean and in order
- Metadata complete
- Procedures for future capture in place
- Data loaded onto SLIP & AODN

5 Human Resource Management

5.1 Stakeholders

Key stakeholders/ custodians

Department of Transport
Fremantle WA 6160
Steve James (08)9435 7663
Rod Laves (08)9435 7644

5.2 Resources required

Time for Project manager
0 week
Time for Project officers
1 weeks

9 Quality Management

All data compiled by the project team will be checked by Transport staff for quality and completeness

Upon completion all datasets will have a quality statement compiled and signed off by custodian officers.

These statements will be compiled and presented with Project closure report.

2. End User Requirements

Managing Coastal Vulnerability Project
End User Requirements Capture Document

Agency: Department of Transport
Dataset: Coastal Infrastructure **MCV Annex:** Annex 4.7
Data Custodian: Steve James

Purpose of Final Dataset

Dataset(s)	Format	Purpose / Use

Outline purpose / use for final dataset(s) and required format e.g. a dataset that represents the location and extent of coastal infrastructure features for WA as a Shapefile (.SHP).

Existing Data Sources

Data Source (File Name including data path where available)	Description / Comments	Format	Key Attributes e.g. a primary key or data ID that must be maintained

Provide list of all existing datasets that will need to be examined / processed as part of this data management exercise.

Specific Project Deliverables and Expected Outcomes

Specific Project Deliverable
1.
2.
3.
4.
5.

Data Custodian to provide detail of any specific elements of work that MUST be undertaken as part of this project.

Desired Data Custodian Requirements

Requirement	Description
1.	
2.	
3.	

WISHLIST Requirements – Data custodian to list any additional / desired requirements that COULD be investigated as part of this work by MCV project team.

Final Dataset

Dataset(s)	Description / Comments	Format	Key Attributes

Detail where possible any specific details required of final dataset(s) if known at this stage such as any naming conventions, formats or database integration that will need to be adhered to.

Licensing and Restrictions

Creative Commons Licence	Licence Description	Licence Selected
Attribution ***CC BY***	This licence allows users to distribute, remix and build upon a work, and create Derivative Works – even for commercial use - provided they credit the original creator.	
Attribution - Share Alike ***CC BY-SA***	This licence allows users to distribute, remix and build upon the work, and create Derivative Works – even for commercial purposes - as long as they credit the original creator and license any new creations based on the work under the same terms.	
Attribution - No Derivatives ***CC BY-ND***	This licence allows others to distribute the work, even for commercial purposes, as long as the work is unchanged, and the original creator is credited.	
Attribution - Non Commercial ***CC BY-NC***	This licence lets others distribute, remix and build upon the work, but only if it is for non-commercial purposes and they credit the original creator. They don't have to license their Derivative Works on the same terms.	
Attribution – Non Commercial - Share Alike ***CC BY-NC-SA***	This licence lets others distribute, remix and build upon the work, but only if it is for non-commercial purposes, they credit the original creator and they license their derivative works under the same terms.	

 Attribution – Non Commercial – No Derivatives ***CC BY-NC-ND***	This licence is the most restrictive of the six main licences, allowing redistribution of the work in its current form only. This licence is often called the 'free advertising' licence because it allows others to download and share the work as long as they credit the original creator, they don't change the material in any way and they don't use it commercially.	

Data custodian is required to consider and select the appropriate Creative Commons Licence for the dataset. See Appendix A.

Project Initiation Requirements Capture Complete

Data Custodian Signature		**Date**	
MCV Project Manager Signature		**Date**	

3. UAT Completion Record

Managing Coastal Vulnerability Project
User Acceptance Test Completion Record

Agency: Department of Transport

Dataset: Coastal Infrastructure **MCV Annex:** Annex 4.7

Data Custodian: Steve James

Specific User Acceptance Test (UAT) Activities

User Acceptance Test	Comments	UAT Completed	Data Custodian (Initial)
1.		✓	
2.			
3.			
4.		x	
5.			
6.			

Detail specific user acceptance tests to be completed – data custodian to provide comment on test where issues arise.

Additional Feedback on UAT

General Comment / Feedback

Detail issues arising from UAT / further work required.

UAT Completion Signoff

Data Custodian Signature		**Date**	
MCV Project Manager Signature		**Date**	

4. Data acceptance and Handover Template

Managing Coastal Vulnerability Project
Dataset Acceptance and Handover Document

Agency: Department of Transport

Dataset: Coastal Infrastructure **MCV Annex:** Annex 4.7

Data Custodian: Steve James

Data Location: L:\WALIS\LIS\Coastal Vulnerability Project\Transport\Coastal_Infrastructure

Data Transmittal

Item (File Name)	Description	Format	Enclosed (Initial) Project Manager	Received (Initial) Data Custodian
Infrastructure_Lines.shp	This ESRI Shapefile contains polyline features that are a geographical representation of coastal infrastructure.	ESRI .SHP		
Infrastructure_Points.shp	This ESRI Shapefile contains point features that are a geographical representation of coastal infrastructure.	ESRI .SHP		
Infrastructure_Polygons.shp	This ESRI Shapefile contains polygon features that are a geographical representation of coastal infrastructure.	ESRI .SHP		
Attribute_Data_Definitions.xls	All attributes will be clearly defined and be provided in the supporting information contained within the data packet.	Excel		

Infrastructure_Procedure.doc	Detailed documentation of work procedures undertaken by MCV spatial officers will be provided as part of the handover process. This document will also detail the recommended procedures.	Word		
Infrastructure_Metadata.xml	Metadata will be provided in an ANZLIC template as XML / PDF with the data. In the future it is hoped that a Marine Community Profile will be used. For ESRI datasets the metadata will be viewable / editable in ArcCatalog.	.XML		

Data Custodian Signature		**Date**	

The Data Transmittal table details all datasets and supporting information documents that have been provided to the data custodian.

Caveats

Caveat	Details	Data Custodian Acceptance (Initial)
Data Issues	Dataset provides a geographical representation of key coastal infrastructure in WA. Features have been digitised using the latest available imagery from Landgate. Please see individual structure attributes for specific image tiles and their resolution.	
Restrictions		
Licence and Copyright	Land Information/Imagery or part of is provided for personal or internal use. Prior written permission from Landgate must be sought for other uses.	

The caveats listed in this document detail any conditions, restrictions or notes of caution associated with this dataset(s).

Supporting Information

Caveat	Details	Data Custodian Acceptance (Initial)
Data Attribution	The Maximo ID has been protected in this dataset.	
Data Definitions		
Restrictions		
Metadata	Metadata has been provided using the ANZLIC template.	

Key elements of supporting information associated with this data have been highlighted in the table above. More detailed information can be found in the project procedures document.

Data Distribution

Data Distribution Platform	Agreed Publication By Data Custodian (Initial)
Dataset available for download via SLIP Future	
Dataset and associated layers viewable as WMS through SLIP Future	
Dataset and associated layers viewable as WMS through AODN / IMOS 123	
Metadata available for Dataset via AODN / IMOS 123	

Permission for Data / Metadata distribution to named platforms / media is required from the Data Custodian.

Data Acceptance and Handover Completion

MCV Project Manager Signature		**Date**	
Data Custodian Signature		**Date**	

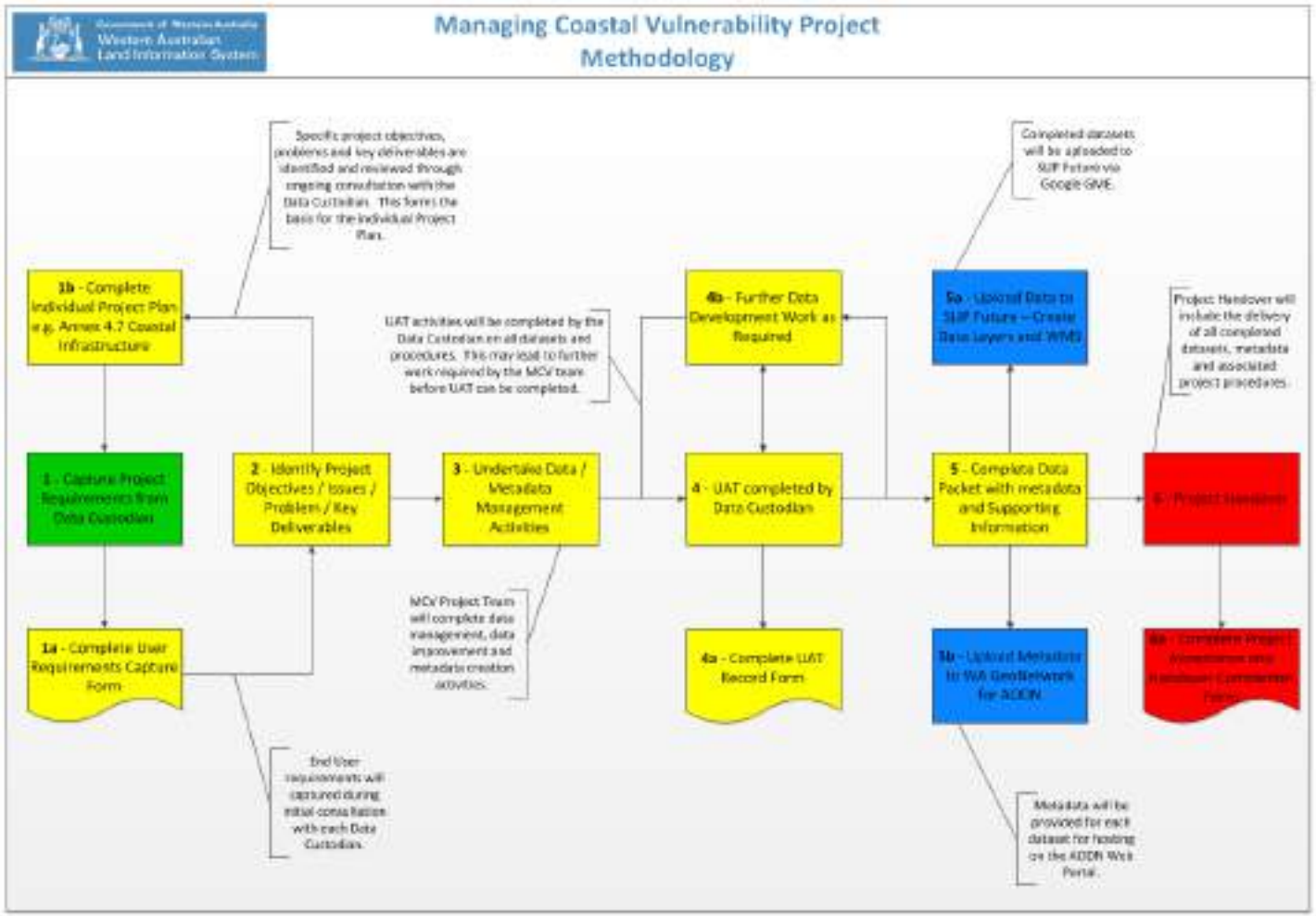
APPENDIX E - GLOSSARY

Glossary

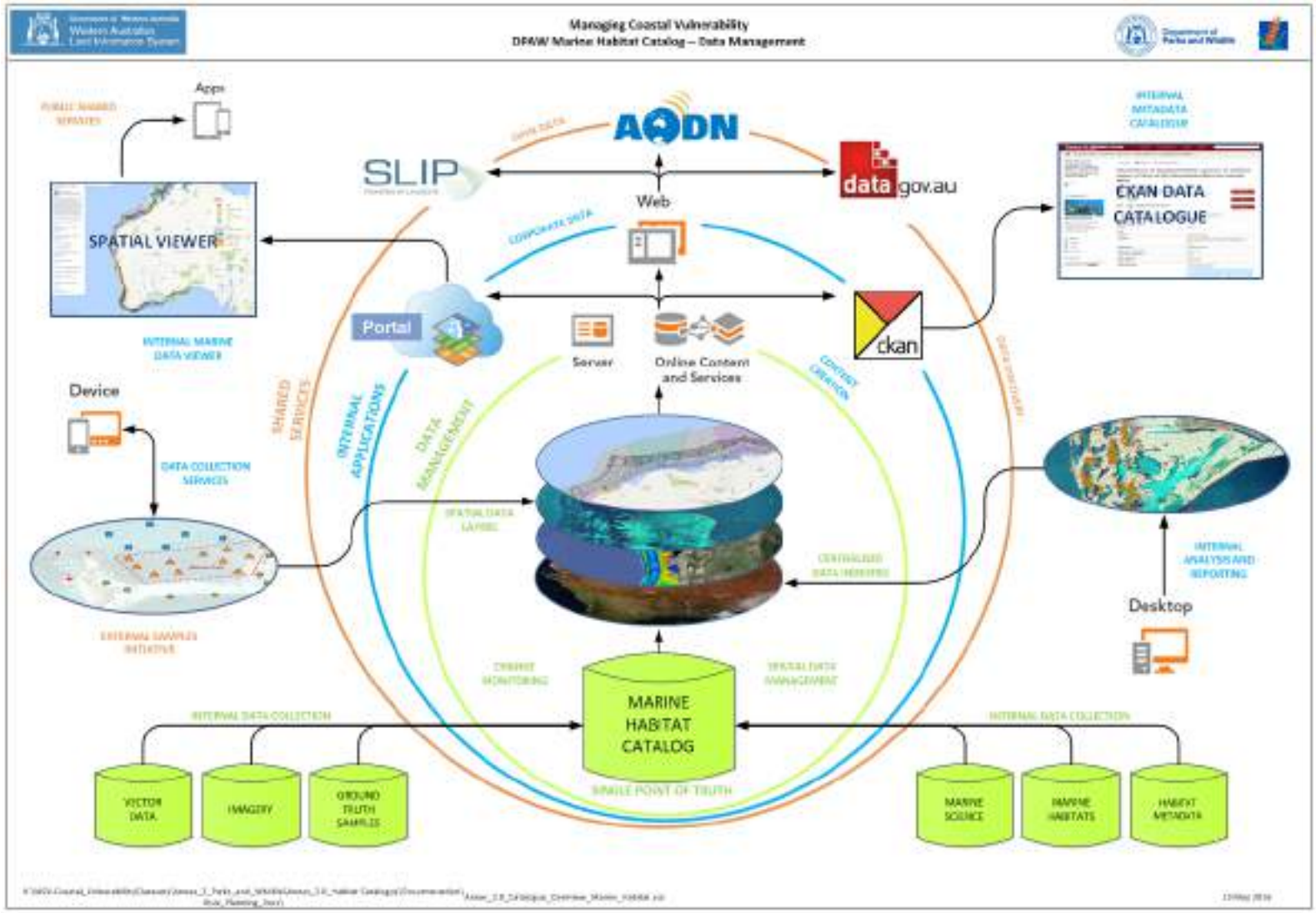
DoT	Department of Transport WA
DoP	Department of Planning WA
DPaW	Department of Parks & Wildlife WA
DMP	Department of Mines & Petroleum WA
DoW	Department of Water WA
DoF	Department of Fisheries
WALIS	Western Australian Land Information System WA
GA	Geoscience Australia
WAMSI	Western Australian Marine Science Institute
PAWSEY	Pawsey Supercomputing Centre
CURTIN	Curtin University
UWA	University of Western Australia

APPENDIX F - PROCEDURES

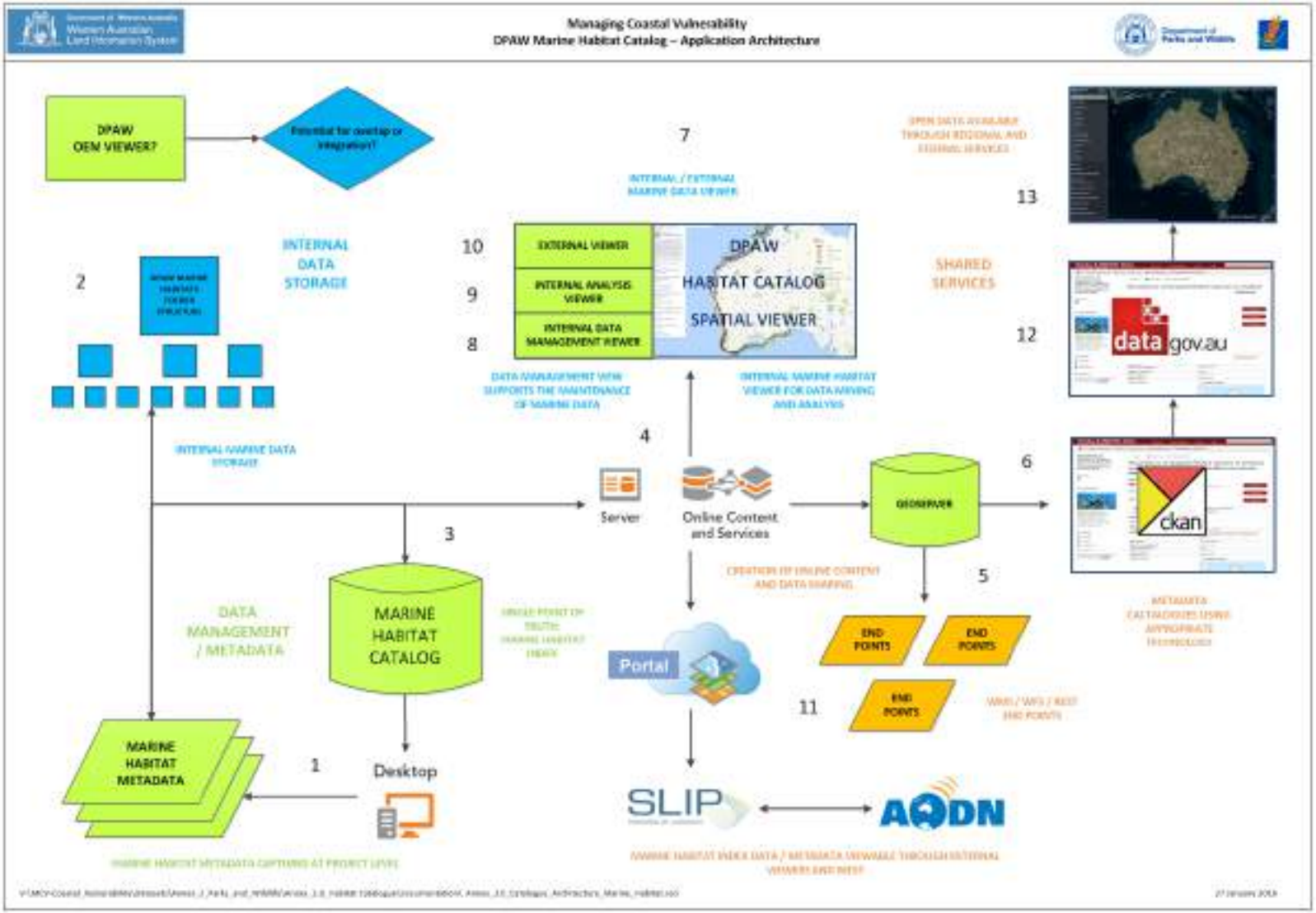
Managing Coastal Vulnerability Procedures - MCV Methodology



Managing Coastal Vulnerability Procedures – Example Project: Marine Habitat Catalogue – High Level Planning



Managing Coastal Vulnerability Procedures – Example Project: Marine Habitat Catalogue – End to End Process Mapping



Department of Parks and Wildlife

Marine Habitat Catalog – Application Architecture

Data Management

1. Marine Habitat Metadata

- Metadata is recorded at a project level to an agreed standard utilising the core elements of the Marine Community Profile (MCP) ISO19115 . Core metadata elements include: Title; Summary; Description; Link to Resource; Scale; Citation; Contact; Tags.
- A new metadata record is created for each data entry to the habitat catalog.
- Metadata is currently entered into a spreadsheet to an agreed schema.
- Spatial data can then be generated from the XLS format data using coordinates contained within the metadata.
- Metadata can be manually uploaded to the internal CKAN metadata entry and search tool (MEST) as appropriate.

2. DPAW Internal Data Storage

- A folder is created for a new set of marine habitat project data. Sub-folders include: Data; Imagery; Aerial Photography; Analysis; Classification; Products
- Project folders are linked to their corresponding record in the Marine Habitat Catalog by a unique ID. The unique ID could be made up of some locational reference, date, deployment number for example.
- The data storage for the Marine Habitat Catalog spatial data and associated data folders could either be hosted on a DPAW corporate server, PAWSEY Centre or Amazon Cloud.

3. Marine Habitat Catalog Spatial Data

- Marine Habitat Catalog metadata is represented spatially as point, line or polygon features. These shapes are attributed with the marine project metadata held in the catalog. These features can be stored as individual shapes files to mark the extent or coverage of a particular entry to the catalog. However a complete spatial catalog is preferred where records are stored as features in either an ESRI geodatabase or SDE (spatial data engine). Thus providing an index to marine habitat data stored at project level.
- This marine habitat catalog can viewed in a MXD using the ESRI ArcMap application or as layers in a web browsers using ESRI Portal technology.
- The entry of new records and or attribution could be directly done within the GIS environment if preferred. An AOI could be imported into the features and appropriate metadata added as attributes. Metadata would then be data driven from the GIS data. This geospatial metadata could then be exported in XML format to ISO19139.

Online Content and Services

4. Content Creation

- The spatial data of the marine habitat catalogue can be symbolised as appropriate to represent different habitats and associated project data such a line feature representing a survey transect.
- Create content for sharing on the web or in spatial browsers can be created using ArcGIS for desktop, ArcGIS Online or ArcGIS Portal tools.
- Create appropriate layers to visually represent the habitat data contained in the Marine Catalog.
- Apply appropriate symbology to map layers to produce a corporate spatial browser for the DPAW Marine Habitat Catalog.
- Add tools to the spatial browser to allow for basic data analysis and geoprocessing.

5. Publishing Services

- Publish map centric data and map layers via ESRI ArcGIS Portal as part of ArcGIS Server or GeoServer.
- Online services such as WMS, WFS or REST web services can be published using ArcGIS Server or GeoServer.
- These same services can be viewed internally by DPAW staff or viewed by external agencies and the public using the SLIP platform through Landgate or an external facing DPAW web browser.
- Create custom Apps for data collection through Collector for ArcGIS. Applications could be deployed on handheld devices used by park rangers / scientists in the field and data could be synced back to the master data stores.

Habitat Catalog Spatial Viewer

6. CKAN MEST

- CKAN technology is already utilised by DPAW for the existing Parks and Wildlife Data Catalogue. This facility stores information about the Science and Conservation division's digital knowledge assets, including metadata, datasets, images, documents and other resources. This service could be utilised by the Marine Habitat Catalog to share metadata that can then be harvested by regional and federal metadata services.

7. Spatial Viewer

- ESRI Portal / ESRI ArcGIS Online technology can be used to produce content, maps that can be hosted in a spatial viewer and shared via platforms such as SLIP.
- The view, level of access to data and functionality of tools could be set to the user's individual login and work area. For example: Data managers or admin, scientists and analysts to external agencies and the public.
- Contextual layers with locational information could also be added to the browser to improve navigation and understanding of the marine habitat catalog data.
- Data layers from external agencies could also be brought into the viewer as appropriate to support the work of research scientists, analysts and decision makers.

8. Data Management View

- A data management view of the Marine Habitat Catalog would exist to allow access to the GIS data managers to undertake maintenance on the browser; refresh datasets; receive triggers to perform data updates or data distribution tasks; semi automate workflows.

9. Internal Browser – DPAW Spatial Analysis

- A view of the Marine Habitat Catalog spatial browser would be created for DPAW employees. This could be part of the OEM viewer, be generated using the CKAN platform similar to the CKAN MEST that already exists at DPAW or utilising the ESRI technology that DPAW has access to such as ArcServer.

10. External Browser – Public View of Habitat Resources

- Public facing view of the marine habitat catalog data held by DPAW. Authorised data, attribution and metadata can be readily controlled and shared as appropriate as Open Data to the public and other organisations. Creative Commons data licensing can be applied to such data distribution http://creativecommons.org.au/.

Shared Services

11. Creation of End Points

- Publishing of services and providing end points using GeoServer that can be consumed by other data sharing applications, MESTs or spatial browsers such as OSRA.
- The URLs of these end points can be used to connect directly into government platforms such as SLIP or the internal spatial browsers of other government or non-government agencies.

12. Regional Services

- Metadata from the internal DPAW Habitat Catalog can be directly harvested into regional platforms such as http://data.wa.gov.au/. This application uses CKAN technology already utilised by DPAW for the existing Parks and Wildlife data catalogue http://internal-data.dpaw.wa.gov.au/.
- Spatial representation of data on a regional service such as SLIP http://slip.landgate.wa.gov.au/ (Shared Location Information Platform). The current SLIP Future system is being migrated from a Google based application to an ESRI based platform which can readily be integrated with existing DPAW IT systems and data policy. It is understood that services will be able to be connected to the new SLIP utilising ESRI Portal technology.

13. Federal Metadata Services and Web Browsers

- Federal marine metadata search tools such as the Australian Ocean Data Network (AODN) http://portal.aodn.org.au/aodn/ or the Integrated Marine Observing System (IMOS) https://imos.aodn.org.au/imos123/ can harvest metadata directly from the Marine Habitat Catalog end points.
- Metadata records in XML format can also be produced via the ArcCatalog metadata management tool. These can be packed with data for distribution to end users or uploaded to metadata entry and search tools (MEST) as appropriate.