

10. MONITORING PLAN

10.1 MONITORING PLAN

This chapter outlines a framework for coastal monitoring within the study area based on the CHRMAP implementation recommendations, while providing a better knowledge base to inform longer term management strategies.

The City has a long history of coastal monitoring and an established coastal monitoring and management program. The updated monitoring framework takes into consideration the already extensive body of information collected for the study area (refer to EvoCoast, 2017) to ensure a consistent long term record is maintained.

10.2 MONITORING INTENSITY

The level of monitoring recommended for each asset is based on its risk of being impacted by coastal hazards and the likely requirement for management actions to be required over the next 10 years. The CHRMAP has identified a number of individual assets which are vulnerable in the short-term and require specific attention. For these assets, specific management triggers were identified in the Implementation Plan (Section 9), which when reached, flag the requirement for immediate management actions. For beaches and dunes, the trigger points are reference lines or buffer widths, for structures they relate to the condition of the structure (refer to Table 10.1).

In addition to monitoring at specific locations, to inform management triggers, monitoring across the wider study area is recommended for a broader understanding of the coastal system. This is necessary to inform future coastal processes studies and (where required) the future design of coastal structures.

Table 10.1 - Management Triggers

MU/Asset	Trigger	Management Actions	Monitoring Required
MU1: Beach	Beach width of less than 20m at high water. Measured from the mean water level (MWL).	Minor erosion - beach scraping from the local beaches to reinstate the beach profile. Erosion beyond trigger – sand nourishment likely using sand from outside the local beaches to reinstate the beach profile.	<ul style="list-style-type: none"> Beach survey profiles collected 6 monthly (pre/post winter). 3D beach scan and hydrographic survey collected periodically (every 2-4 years) or after a severe storm event
MU2: Foreshore	Offset of 35m from the back of the beach. Measured from the 1.15m AHD* contour or the vegetation line identified in aerial photographs.	Within the buffer area, construction of new assets should be avoided and planning should be undertaken to relocate or remove existing assets.	<ul style="list-style-type: none"> 3D beach scan and hydrographic survey collected periodically (every 2-4 years) or after a severe storm event. Aerial photography and digitalisation of the coastline position. Collected every 5 years. Beach survey profiles collected 6 monthly (pre/post winter) (Optional). Note: Beach profiles are optional as although they will provide an early indication of change they will not be sufficient to cover the large area required.
MU2: Big4 Holiday Park Middleton Beach	Offset of 35m from the back of the beach. Measured from the 1.15m AHD* contour.	Within the buffer area, construction of new assets should be avoided and planning should be undertaken to relocate or remove existing assets.	<ul style="list-style-type: none"> Beach survey profiles collected 6 monthly (pre/post winter) and post a significant erosion event. Note: Three (3) new survey profiles have been recommended for this location. 3D beach scan and hydrographic survey collected periodically (every 2-4 years) or after a severe storm event.

MU/Asset	Trigger	Management Actions	Monitoring Required
MU3: Griffiths St Properties	Offset of 35m from the back of the beach. Measured from the 1.15m AHD* contour or the vegetation line identified in aerial photographs.	Within the buffer area, planning should be undertaken to relocate or remove existing assets.	<ul style="list-style-type: none"> 3D beach scan and hydrographic survey collected periodically (every 2-4 years) or after a severe storm event. Aerial photography and digitalisation of the coastline position. Collected every 5 years. Note: Monitoring intensity and frequency
MU3: Big4 Holiday Park Emu Beach	Offset of 35m from the back of the beach. Measured from the 1.15m AHD* contour.	Within the buffer area construction of new assets should be avoided and existing assets should be planned relocated or removed.	<ul style="list-style-type: none"> Beach survey profiles collected 6 monthly (pre/post winter) and post a significant erosion event. Note: Three (3) new survey profiles have been recommended for this location. 3D beach scan and hydrographic survey collected periodically (every 2-4 years) or after a severe storm event.
MU4: Foreshore Reserve	Revetment condition poor or very poor. Required repairs exceed routine maintenance.	Reconstruction of revetment	<ul style="list-style-type: none"> Condition inspection by coastal engineer collected annually (post winter).
MU5: Southeast Beach	Maximum beach width of less than 20m at high water. Measured from the mean water level (MWL) at peak of beach profile, behind swimming structure.	<p>Minor erosion - beach scraping from the local beaches to reinstate the beach profile.</p> <p>Erosion beyond trigger – sand nourishment likely using sand from outside the local beaches to reinstate the beach profile.</p>	<ul style="list-style-type: none"> Beach survey profiles collected 6 monthly (pre/post winter).

Note: The 1.15m AHD level is based on the work by RHDHV (2017a). It is the estimated peak steady water level (PSWL) expected to occur offshore during a 500 year ARI storm event. (Note: during a storm event, wave breaking may cause the water levels at the beach to increase higher/beyond this level.) On an eroding shoreline this is expected to be approximately the toe of the dune, or the back of the beach.

10.3 MONITORING REQUIREMENTS

The recommended monitoring activities are summarised in Table 10.2, which lists:

- Monitoring type
- Spatial extent
- Description
- Collection frequency
- Collected by
- Data review schedule

Although recommendation for data collection by organisations other than the City (e.g. Southern Ports Authority, Bureau of Meteorology and DoT) is based on existing monitoring programs, it is acknowledged that these organisations are only able to collect and share coastal information and data, when and where resources permit.

A summary of the key monitoring actions, including details of any recommended changes to the existing monitoring program, is as follows:

Metocean

- a. Continue acoustic wave and current (AWAC) meter deployment. The continued deployment of a single AWAC instrument (or similar) to record waves and currents is recommended. It is recommended that the position at Lockyer Shoal be maintained to ensure a recording length of 2 years in order to improve the understanding of wave driven currents on the formation of the shoal. Following completion of monitoring at Lockyer Shoal, the benefits of monitoring in the vicinity of Ellen Cove should be considered to evaluate the off-shore sediment transport budget.

- b. Continue wind recordings at Emu Point. The continuation of wind recordings at Emu Point is recommended to establish a local dataset. It is recommended that a minimum of 5 to 6 years of continuous recordings be collected. Following which a comparison be undertaken to the global wind models to determine the benefit for ongoing data collection.

Structures

- a. Condition inspections. Given the current fair or poor condition of some structures within the study area, an annual condition inspection by consultant engineers is recommended. It is recommended that this be complimented by post storm event inspections by City officers. As repairs/upgrades are undertaken and condition improves, monitoring frequency can be reduced accordingly. Annual condition inspections should identify: condition rating, remaining life, and replacement cost with information added to the City's asset database. For consistency the simple methodology and rating scales detailed in letter report EVO-AL-002-L-001-A, 21 June 2017 is recommended. This details a structure condition rating consistent with the rating scale used for all asset management across the City.

Storm events

- a. In the event a significant storm event is to occur the following monitoring items are recommended:
 - a. If there is sufficient time available undertake pre-storm beach profiles and beach photos.
 - b. Post storm beach profiles and beach photos. If there is a significant change in the profiles, consideration should be given to undertaking full hydrographic survey and 3D beach scan.

- c. Post storm coastal structures inspection. This can be undertaken initially by a City officer, if any significant damage is evident a full condition inspect by a coastal engineer is recommended.

Beach

- a. Beach profiles. It is recommended beach profile surveys continue every 6-months, with the objective of capturing pre and post winter profiles. These are required to inform a number of short-term triggers. The following additional profiles are recommended to be added to the existing monitoring program (also shown in Figure 10.1):
 - a. Two (2) additional beach profiles MB-01 A & B in front of the Big 4 Middleton Beach Caravan Park (MB-01 A - Easting 583552.7m, Northing 6124094m & MB-01 B - Easting 583580., Northing E 6124321.1m).
 - b. Relocation of MB-05 profile south to be directly in front of Griffiths Street (Easting 584926.0m, Northing 6125965.8m).
 - c. One (1) additional profile MB-10 at the southern end of the Emu Point revetment (Easting 585777m, Northing 6126430m).
- b. Hydrographic survey. It is recommended that the City continues to obtain nearshore surveys to ~10m water depth, currently undertaken by DoT, as and when undertaken. A nominal frequency of 2-3 years would be desirable. The priority survey area remains Lockyer Shoal. CoA to liaise with DoT.
- c. Scanning beach survey. It is recommended that the City continue to obtain detailed 3D scanning beach surveys undertaken by DoT when available, nominally on a 2 - 3 year frequency, to fill in the gaps between the more regular beach profiles. Consideration should be given to the use of drone surveys as they become more readily available. These can be a cost-effective option and can provide a more detailed coverage of both the dunes and beach.

- d. Aerial photography. Vertical aerial photography, captured by Landgate, and associated photogrammetry to plot shoreline change is recommended as an important tool for evaluating long-term changes in the position of the coast. It is recommended that the minimum collection frequency of 5 years be continued with the next collection scheduled for 2020.
- e. Aerial photography (water penetrating). Water penetrating aerial photography and associated seagrass surveys are recommend to continue nominally every 3 years in order to record and understand the regrowth of seagrass through the study area.
- f. Beach Photos. The continued use of the fixed camera to monitor the beach and structures at Emu Point is recommended, but with a reduced collection frequency of 3 hours. It is recommended that staff/volunteer field photo monitoring continue.

Data management and sharing

- a. Data storage – It is recommended that GIS metadata summaries of collected coastal zone data be created to ensure information is well-archived. There is also the opportunity for increased coordination with DoT regarding the collection of coastal photography and hydrographic survey to seek synergies with Southern Ports, DoT and the City's spatial data team where data sets are shared. The GIS metadata summaries should be updated annual with any additional information collected.

Figure 10.1 - Beach transects Ellen Cove to Oyster Harbour Beach

Source: John Kinnear and Associates



Table 10.2 - Recommended Monitoring Activities for Ellen Cove to Oyster Harbour Beach

ITEM	MONITORING TYPE	SPATIAL EXTENT	DESCRIPTION	COLLECTION FREQUENCY	COLLECTED BY	DATA REVIEW SCHEDULE
1	Offshore Wave Buoy	Outside study area, ~60m water depth 35°11'53" S 117°43'19" E	Offshore wave height, period & direction. Baseline metocean information for future investigations.	Hourly, ongoing	DoT	No regular review required by City
2	AWAC	M/Unit 3/4 Lockyer Shoal	Nearshore wave height, period direction; and current speed, direction. Local baseline metocean information for future investigations.	Hourly, ongoing	Consultant organised by CoA	No regular review required by City
3	Water levels at Port	Outside study area 35°02'02"S 117°53'41"E	Tide gauge recording ocean water levels. Baseline metocean information for future investigations.	5 mins, ongoing	Southern Ports Authority/DoT	No regular review required by City
4	Water levels at Emu Point Boat Harbour	M/Unit 5 34°59'38"S 117°56'39"E	Tide gauge recording water levels within Oyster Harbour. Local baseline information to link Oyster Harbour water levels with ocean levels.	5 mins, ongoing	DoT	No regular review required by City
5	Wind data - Airport	Outside study area 34°56'24"S 117°49'10"E	Anemometer recording wind speed & direction. Baseline metocean information for future investigations.	Half-hourly, ongoing	BOM	No regular review required by City
6	Wind data – Emu Point	M/Unit 4 - Located on Port navigation aid 34°59'56"S 117°56'45"E	Anemometer recording wind speed & direction. Local baseline metocean to characterise study area wind climate; and link to long-term datasets.	10 mins, ongoing	CoA with assistance by consultant Ecotech	Weekly quality control check by City or consultant to ensure data is being collected/received intact

ITEM	MONITORING TYPE	SPATIAL EXTENT	DESCRIPTION	COLLECTION FREQUENCY	COLLECTED BY	DATA REVIEW SCHEDULE
7	Hydrographic Survey	Whole study area Ellen Cove to Oyster Harbour through Emu Point channel, and out to ~10m water depth	Water depths collected by boat. To provide a broad understanding of changes in offshore morphology. Identify whole scale reductions in seabed/ sediment movement.	Every two years (same time as 3D beach survey)	CoA	No regular review required by City
8	3D scanning beach survey	Whole study area, will vary. Generally, beach and foredune from Ellen Cove to Emu Point	Beach topography collected by different methods. To identify volumetric rates of beach change, and; assist with identification of erosion hazard to assets.	Every two years (same time as hydrographic survey)	DoT & CoA	No regular review required by City
9	Beach survey profiles	Whole study area 22 historic profile lines between Ellen Cove and the north side of the Emu Point Boat Harbour (4 new profile lines)	Beach topography collected along single lines by traditional survey methods. Early detection of reduction in buffer widths; to assist in linking coastal change to storm events, and; detection of shoreline trends.	6-monthly ongoing; AND Triggered by significant storm forecast; OR Post-storm erosion scarp over 1.5m	CoA / local contractor	Post collection review against triggers. Data to be provided to City and plotted into x, y overlay plots for each transect against previous survey data.
10	Aerial Photo	Whole study area Variable, generally whole study area covered	Vertical aerial photographs. Identify shoreline change and larger scale changes in coastal features, primarily by informing photogrammetry process.	5-yearly ongoing Last capture 2016. Next capture in 2021	Landgate	Consultation in 2020 by City with Landgate and possibly DoT/WALIS Marine Group to confirm their capture scheduled for coastal photography

ITEM	MONITORING TYPE	SPATIAL EXTENT	DESCRIPTION	COLLECTION FREQUENCY	COLLECTED BY	DATA REVIEW SCHEDULE
11	Digitisation of Coastline Positions	Whole study area	Digitisation of State Government aerial photography vegetation lines using photogrammetry. To identify shoreline change, reduction in buffer widths and larger scale changes in coastal features.	Occasional – approximately every 5 years.	DoT	After aerial photo collection, consultation by City with DoT to confirm photogrammetry completed
12	Aerial Photo - Water penetrating	Whole study area	Collected using local aeroplane and contractor. To identify changes to seagrass distribution and density to inform relationship with sediment transport.	Approximately every 3 years in Autumn. Next collection Autumn 2020	Sampling organised by CoA and Geoff Bastyan.	Post collection review Changes in seagrass distribution
13	Beach Photos - Fixed camera	M/Unit 3 35°00'03"S 117°56'27"E	Remote camera with fixed field of view. To identify short-term changes in beach level/width; to assist in linking coastal change to storm events.	3 hourly	Sampling organised by CoA and photos managed by BMT Oceanica	2-weekly quality control check by City or consultant to ensure data is being received intact and any review against triggers
14	Beach Photos –Staff / Volunteers	Whole study area. 23 locations from Ellen Cove to Emu Point Boat Harbour totalling 45 fields of view	Regular photos taken by City staff and community members. To identify short term changes to beach and structures. To assist in linking coastal change to storm events.	Monthly	Organised by CoA	Post collection review quality control check by City staff to ensure photos are collected and archived properly and any review against triggers

ITEM	MONITORING TYPE	SPATIAL EXTENT	DESCRIPTION	COLLECTION FREQUENCY	COLLECTED BY	DATA REVIEW SCHEDULE
15	Seagrass monitoring	Whole study area Nearshore water	Diving inspection of seagrass and comparison with aerial photo. To identify changes to seagrass distribution and density to inform relationship with sediment transport.	Approximately every 3 years in Autumn. Next collection Autumn 2020	Sampling organised by CoA and Geoff Bastyan.	Post collection review
16	Structure condition inspection	M/Unit 1, 3, 5 Various structures	Visual walk-over inspection with recorded photo locations. To assess the current condition & identify future maintenance requirements. Information to be stored in asset database and include condition rating, remaining life and replacement cost consistent with EVO-AL-002-L-001-A, 21 June 2017.	Annually before winter for key areas of concern; OR Triggered by observed structure damage Every 3 years for detailed inspections of all structures (Autumn 2019 and 2022)	Coastal engineer	Part of condition inspection
17	GIS metadata	Whole study area	Create metadata summaries which capture key coastal zone information and datasets and include details about their filing/archiving so that they can be more easily found into the future. Archive important datasets and their metadata for easy future use.	Once off	CoA or consultant	Scheduled annual update of metadata to include data collected over previous year