

**R1003 Rev 3**

**June 2018**

**City of Joondalup**

**Joondalup Coastal Monitoring  
2017/18 Data Report**

marinas  
boat harbours  
canals  
breakwaters  
jetties  
seawalls  
dredging  
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## K1477, Report R1003 Rev 3

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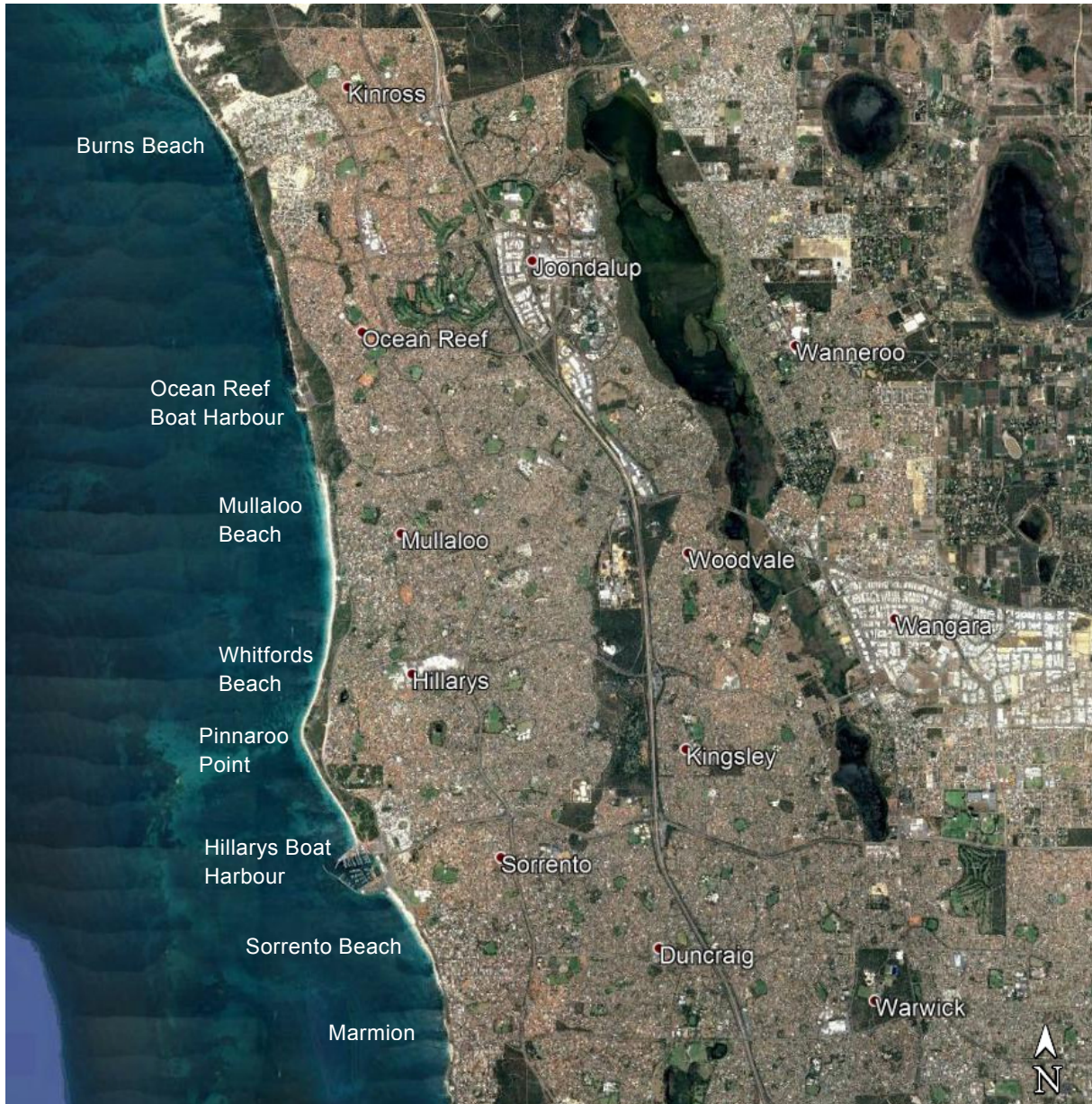
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## 1. Introduction

The City of Joondalup (City) has established a coastal monitoring program for the shoreline within its boundaries. The City's shoreline extends from Marmion in the south, to Burns Beach in the north (Figure 1.1).



**Figure 1.1 Joondalup Monitoring Study Area**

The Joondalup coastal monitoring program has been set up to monitor changes to the shoreline within the study area, and to assist the City in managing their coastal assets. The monitoring program was established under a Coastal Adaptation and Protection grant from the Department of Transport (DoT) in 2015 and includes the following elements.

- Beach and hydrographic surveys conducted every 2 years, from behind the primary dune to several hundred metres offshore. 22 profiles are completed over approximately 15 km.



- Inspections and photographic monitoring of the beaches within the study area every six months.
- Mapping of the shoreline from aerial photographs taken every year.
- Analysis of the monitoring surveys by experienced and professional coastal engineers, identifying areas of accretion or erosion.
- Establishment of a fixed monitoring camera to monitor the shoreline in Marmion.
- A report on the monitoring results and analysis each year, highlighting notable variations in shoreline movements and estimating the sediment movement within the study area.

Data and assessment is used to identify areas of concern and inform decision making for development and maintenance of coastal assets.

The City has engaged M P Rogers & Associates Pty Ltd (MRA) to complete the coastal monitoring of the shoreline within the study area.

This report presents the analysis and summary of the monitoring results from October 2017 to March 2018. A comparative analysis between the monitoring data collected in 2017/18 and the baseline monitoring data collected in 2015/2016 has also been completed and discussed in the following sections.

## 2. Monitoring Activities

The Joondalup coastal monitoring program includes the following monitoring activities:

- Beach profiles (survey).
- Shoreline mapping (coastal vegetation line mapped from aerial photographs).
- Photographic monitoring (seasonal).
- Fixed camera monitoring (Marmion).

The results of the monitoring will be presented in Coastal Monitoring Data reports. Table 2.1 presents the completed and future planned monitoring activities.

**Table 2.1 Proposed Monitoring Frequency**

Activity	Frequency	2015	2016		2017		2018	
		October	March	October	March	October	March	October
Beach profiles survey	Biennial	✓				✓		
Shoreline mapping	Annual	✓		✓		✓		✓
Photographic monitoring	6 monthly	✓	✓	✓	✓	✓	✓	✓
Fixed camera monitoring	Continuous		✓	✓	✓	✓	✓	✓

Notes: 1. Completed works have been highlighted in green.

The surveyed beach profiles will notionally be completed in October every 2 years, following winter. It is important that they are completed at the same time each period (following winter) to minimise the impact of seasonal changes on the shoreline data.

The shoreline mapping will be completed by mapping the position of the coastal vegetation line from ortho-rectified aerial photography. The shoreline mapping will be used to assess shoreline movement and monitor large scale trends in movement. The mapping should be completed annually and use aerial photographs from consistent times of the year to remove any seasonal variations from the record.

Photographic monitoring will be completed at 21 fixed sites notionally in March (end of summer) and October (end of winter) each year. Fixed camera monitoring is also being completed at the new carpark north of the Mullaloo Angling and Aquatic Club (MAAC). The photographic monitoring and fixed camera monitoring will assist in highlighting seasonal movements on the shoreline and visually show any changes to beaches, as well as providing a long term reference of shoreline condition.

The monitoring activities carried out in the October 2017 to March 2018 monitoring period will be discussed in the coming sections, including a comparison to the 2015/2016 baseline dataset.



### 3. Beach Survey Profiles

A beach monitoring program has been established to monitor the shoreline within the City's boundaries. Beach and hydrographic surveys will be collected and analysed to allow long-term changes in shoreline position and coastal processes to be monitored.

The beach monitoring program consists of 22 profiles across the full extent of the City's coastline, approximately 15 km. The location of the profiles are shown in Figure 3.1.



**Figure 3.1 Location of Beach Monitoring Surveys**

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The locations of the profiles are shown along with the surveyed beach profiles on the survey plans in Appendix B.

An additional profile (18A) was added in the 2017 surveys to specifically monitor the bank in front of the MAAC car park. This will be retained in future monitoring surveys.

All of the surveyed profiles extend from behind the coastal dune to approximately 1 km offshore to capture the extent of sediment movement and accurately assess the shoreline changes and coastal processes.

## 4. Beach Monitoring Data

### 4.1 Investigation Triggers

The trigger values for investigation of shoreline recession in the area have been set at:

- 5 m recession of the Mean Sea Level (MSL), approximated as 0 mAHD contour.
- 5 m recession of vegetation line, approximated as +3.5 mAHD contour.

The MSL contour or waterline is a short term indicator of shoreline change, but is susceptible to fluctuations and short term movements. The vegetation line is a commonly used indicator of longer term change and trends. Discussion of these triggers is presented in MRA (2016).

### 4.2 Movement of MSL Contour (0 mAHD)

Table 4.1 presents the positions of the shoreline at the end of winter (October). The relative movements over the past 2 years are also shown. Profiles where the MSL contour has receded by more than the trigger value are highlighted grey in the table. Figure 4.1 presents the change to the MSL since 2015 graphically. Beach survey profiles are provided in Appendix B.

Note that there is no information presented for Profile 8 as this profile runs directly over the Ocean Reef Boat Harbour breakwaters.

**Table 4.1 Position of the MSL**

Survey Profile	Nov 2015	Oct 2017	Oct 2019	Oct 2021	Change in Past 2 Years (m)	Change from Baseline (m)
16	66.9	73.7			6.8	6.8
15	46.9	58.3			11.4	11.4
14	56.5	56.9			0.4	0.4
13	34.2	32.2			-2.0	-2.0
12	75.2	71.8			-3.4	-3.4
11	55.1	53.3			-1.8	-1.8
10	183.7	184.6			0.9	0.9
9	146.9	147.2			0.3	0.3
8	OCEAN REEF BOAT HARBOUR					
7	207.2	207.2			0.0	0.0
6	201.8	231.2			29.4	29.4
5	141.3	127.5			-13.8	-13.8
4	187.4	192.5			5.1	5.1
3	170.3	163.3			-7.0	-7.0
2	108.8	100.1			-8.7	-8.7
1	142.2	137.4			-4.8	-4.8
21	80.6	80.0			-0.6	-0.6
20	93.6	100.5			6.9	6.9
19	44.8	43.2			-1.6	-1.6
18	33.2	33.0			-0.2	-0.2
17	38.0	36.3			-1.7	-1.7

- Notes: 1. Values in table are position in metres, relative to a nominal baseline.  
 2. Positive values indicate accretion, negative values (in red) indicate recession  
 3. The MSL is approximated by the 0 mAHD contour.  
 4. Changes that have exceeded the trigger value have been highlighted in grey.

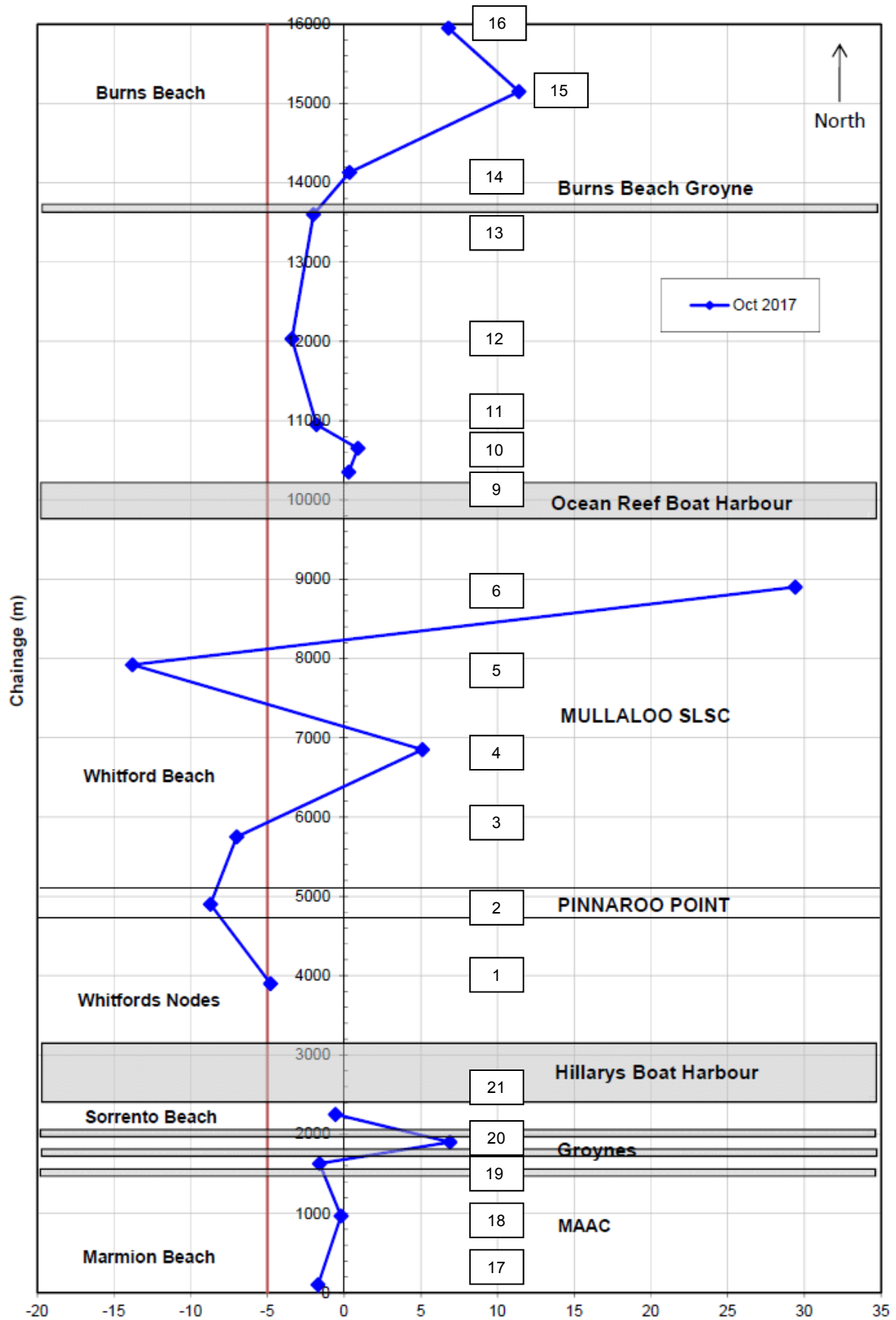


Figure 4.1 Position of 0 m AHD Relative to 2015 Baseline

The following observations are noted for the past 2 years.

- There were some large changes in the position of the MSL around Pinnaroo Point. This included two profiles (2 and 3) which exceeded the trigger value.
- An area just north of the Mullaloo SLSC (Profile 5) showed large recession, which exceeded the trigger value.
- Further north along Mullaloo Beach, there was substantial accretion on the shoreline (Profile 6).

These shoreline changes will be discussed in more detail later in the report.

### **4.3 Movement of the Vegetation Line (+3.5 mAHD)**

Table 4.2 presents the position of the vegetation line at the end of winter (October). The relative movements over the past 2 years are also shown. The +3.5 mAHD contour is used as a representation of the coastal vegetation line from the surveys.

Profiles where the +3.5 mAHD contour have receded by more than the trigger value are highlighted grey in the table. Figure 4.2 presents the change to the vegetation line since 2015 graphically.

Note that there is no information presented for Profile 8, as this profile runs directly over the Ocean Reef Boat Harbour breakwaters, or Profile 20 as the rear of the beach in this area consists of a limestone block retaining wall. No assessment of change at these contours can be made.

**Table 4.2 Position of the Vegetation Line**

Survey Profile	Nov 2015	Oct 2017	Oct 2019	Oct 2021	Change in Past 2 Years (m)	Change from Baseline (m)
16	28.6	28.1			-0.5	-0.5
15	15.0	16.0			1.0	1.0
14	22.0	21.8			-0.3	-0.3
13	7.4	8.0			0.6	0.6
12	49.3	49.8			0.5	0.5
11	35.2	36.5			1.3	1.3
10	165.0	165.5			0.5	0.5
9	122.8	122.6			-0.2	-0.2
8	OCEAN REEF BOAT HARBOUR					
7	140.3	140.2			-0.1	-0.1
6	187.8	187.9			0.1	0.1
5	90.8	91.3			0.5	0.5
4	159.5	162.8			3.3	3.3
3	135.8	135.9			0.1	0.1
2	71.5	71.3			-0.2	-0.2
1	121.0	116.0			-5.0	-5.0
21	6.7	16.2			9.5	9.5
20	SORRENTO SLSC					
19	16.0	17.8			1.8	1.8
18	7.6	8.6			1.0	1.0
17	16.5	17.1			0.6	0.6

- Notes: 1. Values in table are position in metres, relative to a nominal baseline.  
 2. Positive values indicate accretion, negative values (in red) indicate recession  
 3. The vegetation line is approximated by the +3.5 mAHD contour.  
 4. Changes that have exceeded the trigger value have been highlighted in grey.



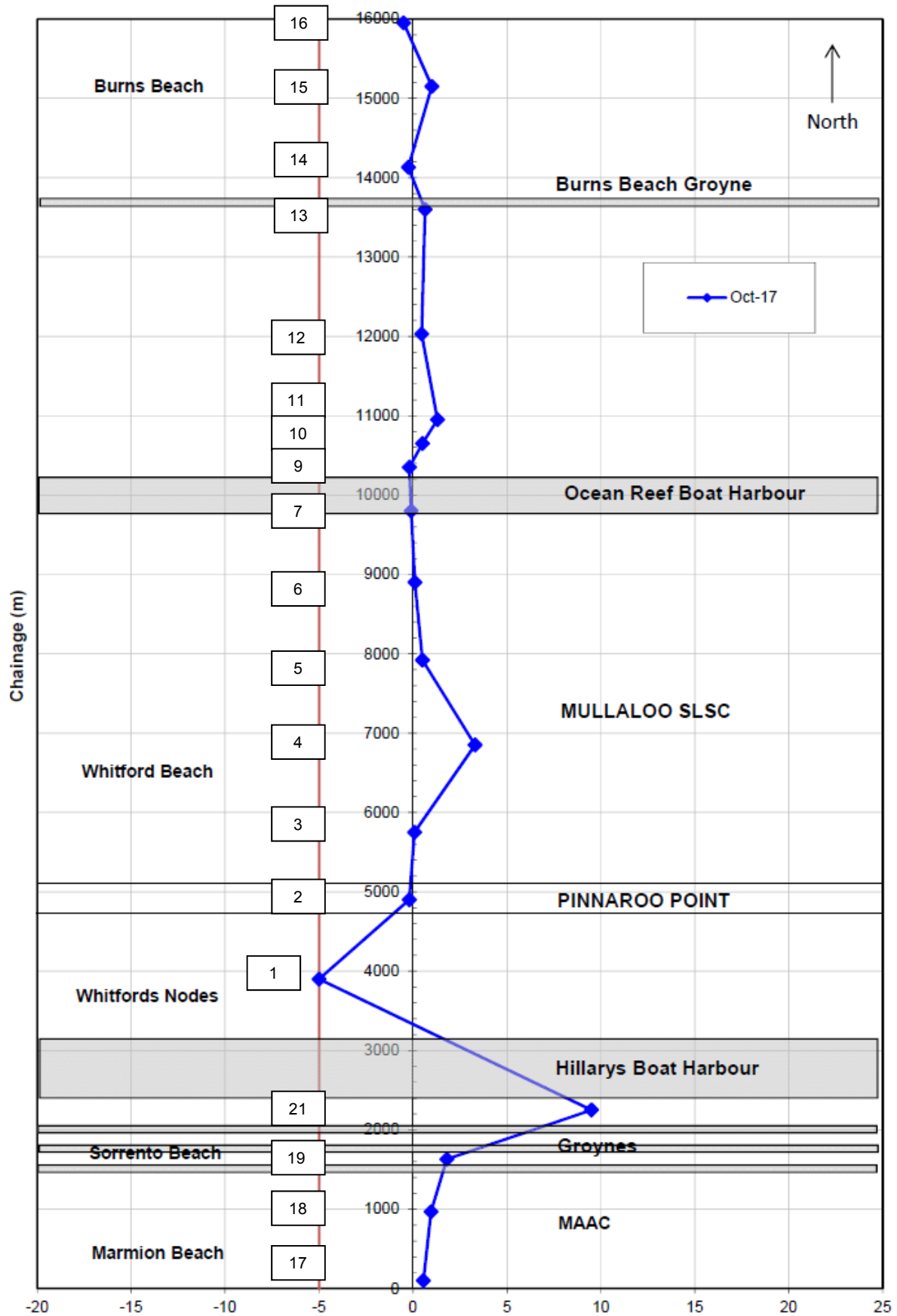


Figure 4.2 Position of Vegetation Line Relative to 2015 Baseline

As expected, changes to the vegetation line are not as large as the MSL, as it is a longer term indicator of shoreline change and therefore less susceptible to fluctuation and short term changes. Changes in the position of the vegetation line were both positive and negative. All profiles fall below the trigger value for erosion. The greatest erosion was approximately 5 m immediately on the northern side of Hillarys Boat Harbour.

It is noted that there was continued accretion at Sorrento Beach, of up to 10 m from 2015.

## 5. Changes in Volume

### 5.1 October 2017 Volumes

The volume of change on each of the beach survey profiles was estimated from the surveys. Analysis of the 2017 survey data showed significant accretion and erosion over the study area. These large changes are not reflected in the movement of either the 0 mAHD or the 3.5 mAHD contours. These large fluctuations are likely due to the short duration of the collected data.

Due to the short term record and uncertainties, the volumes are not presented here. It is recommended they continue to be estimated and are presented once a longer term data set is developed.

## 6. Shoreline Movement

### 6.1 Mapping

The movement of a shoreline can be estimated through mapping the position of the coastal vegetation line from aerial photography. The vegetation line is a good indicator of the shoreline position, as it generally represents the limit of coastal processes and is less susceptible to short term fluctuations than other markers such as the waterline. By mapping the historical position of the vegetation line, changes to the shoreline can therefore be estimated.

For the Joondalup coastal monitoring program, mapping of the coastal vegetation line provides a continuous estimate of the shoreline position for the study area. This expands upon the beach survey profiles used to represent the various shoreline sectors.

Shoreline movement plans covering the study area were previously prepared and presented in the baseline monitoring data report (MRA 2016). The historical vegetation lines from 1942 to 2004 were taken from DoT's database, while vegetation lines from 2000 to 2013 were taken from MRA's database. These were captured from Landgate's ortho-rectified aerial images in accordance with DoT (2009). A detailed description of the source of the aerial images used for shoreline mapping has been presented in MRA (2016).

These have been updated with the 2017 vegetation line, determined by mapping the vegetation line on an ortho-rectified aerial image in accordance with DoT (2009) provided to MRA by the City. The estimated accuracy of these vegetation lines is believed to be in the order of  $\pm 5$  m, depending on the resolution of the aerial photographs and the rectification process. The updated shoreline movement plan is presented in Appendix A.

### 6.2 Shoreline Movement Analysis

The shoreline movements between September 2015 and September 2017 have been generally assessed from the shoreline movement plans. Overall, the net changes to the shoreline position between 2015 and 2017 were generally less than 5 m, except at Whitfords Nodes - north of Hillarys Boat Harbour - and at the northern end of Burns Beach, where shoreline recession exceeded 5 m.

The net movements were in some cases made up of varying inter-annual changes. The following annual movements were noted in the

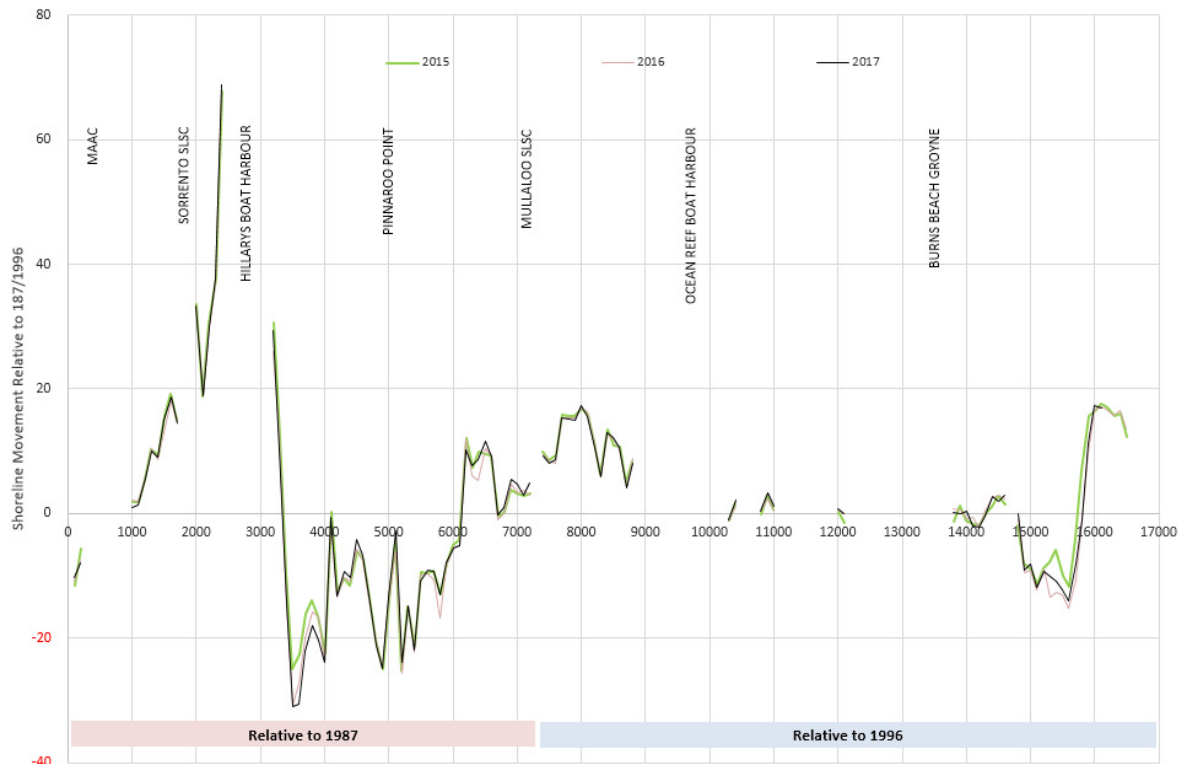
- From 2015 to 2016, the changes to shoreline position are generally less than 5 m, except at Whitfords Nodes and at the northern end of Burns Beach, where the shoreline generally receded more than 5 m.
- There were generally only minor (<5 m) changes to the shoreline position between August 2016 and September 2017.

The movement in the shoreline positions is presented in the following figure. While historical vegetation lines date back to 1942, significant changes to the sediment movement dynamics in the area were caused by the following developments:

- Construction of Ocean Reef Boat Harbour.
- Construction of Hillarys Boat Harbour.

- Construction of the Sorrento groyne field.

The first available vegetation lines after these developments (1987 and 1996) are therefore used as the baseline for analysis in Figure 6.1. This has been discussed in detail in previous monitoring reports and assessments for the City (MRA 2016 & MRA 2017).



**Figure 6.1 Shoreline Movement 2015 - 2017**

The shoreline movement trend for three areas which were previously identified as having experienced erosion (Whitfords Nodes, Pinnaroo Point and Burns Beach) have also been assessed with the updated shoreline movement data. The findings are summarised below.

- The shoreline along Whitfords Nodes, north of Hillarys Boat Harbour, experienced some additional recession up to 3 m in the last year. This continued an erosion trend that was identified in the previous monitoring reports.
- There was continued accretion at Sorrento Beach, of about 1 m from 2015.
- The shoreline near Pinnaroo Point and along Burns Beach has generally accreted over the past year, halting or reversing the erosion trend identified in the previous monitoring report.

These areas are discussed further below.

### 6.2.1 Whitfords Nodes

The erosion of the shoreline to the immediate north of Hillarys Boat Harbour has continued from 2016 (refer to Figure 6.1). This was identified in MRA (2017) and the latest monitoring data indicate that the dune is continuing to erode, although at a slower rate. The shoreline in this area has experienced an erosion of up to 3 m over the last year, and a net erosion of up to 8 m between 2015 and 2017.



**Figure 6.2 Shoreline Movement at Whitfords Nodes**

The construction of Hillarys Boat Harbour has interrupted the longshore sediment transport in this area and altered the coastal dynamics, trapping sediment south of the Hillarys Boat Harbour at the Sorrento Beach and cut off sediment supply to the shoreline north of the boat harbour. Without intervention this erosion trend is likely to continue. Based on historical shoreline movement, it is estimated that the long term erosion rate for this area may be up to 1 m/year. The accretion trend at Sorrento Beach is also likely to continue as sediment accumulates at the southern side of the boat harbour.

As this area has been highlighted in several consecutive monitoring reports and the trend appears to be established, MRA recommend the City should consider bypassing the accumulated sediment from the southern side to the northern side of the Harbour.



### 6.2.2 Pinnaroo Point

The shoreline at this location experienced noticeable erosion between 2015 and 2016, particularly on the southern side of the point where the vegetation line has receded up to 5 m. The updated shoreline mapping indicates that there has been some noticeable accretion in this area from 2016 to 2017, particularly on the northern side of the point, where the vegetation line has accreted up to 5 m. The net movement of the vegetation line between 2015 and 2017 at Pinnaroo Point is a minor accretion of up to 2 m. This appears to be a halt to the erosion trend that has been identified in MRA (2017). The shoreline movement in this area should continue to be monitored, as the buffer may quickly reduce with further erosion. The shoreline movement between 2015 and 2017 in this area is presented in Figure 6.3.



**Figure 6.3 Shoreline Movement at Pinnaroo Point**



### 6.2.3 Burns Beach

The shoreline in this area has generally experienced minor accretion of up to 5 m in the past year. This is a halt of the erosion trend noted in MRA (2017), which indicated an erosion of up to 10 m in this area between 2015 and 2016. The net movement of the vegetation line between 2015 and 2017 indicate an erosion of up to 8 m. Given the proposed subdivisions and foreshore development in this area, it is recommended that the shoreline in this area should continue to be monitored. The shoreline movement between 2015 and 2017 in this area is presented in Figure 6.4.

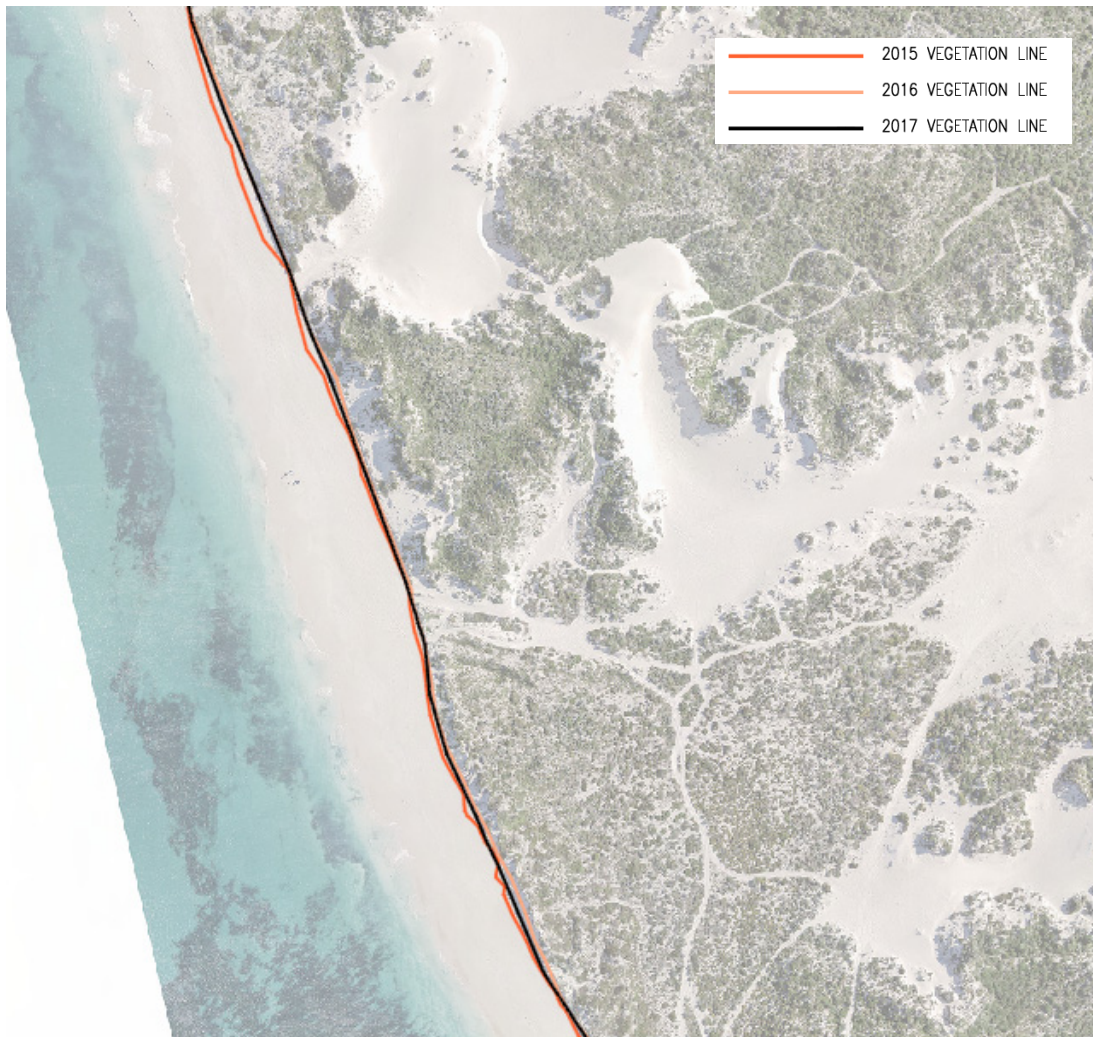
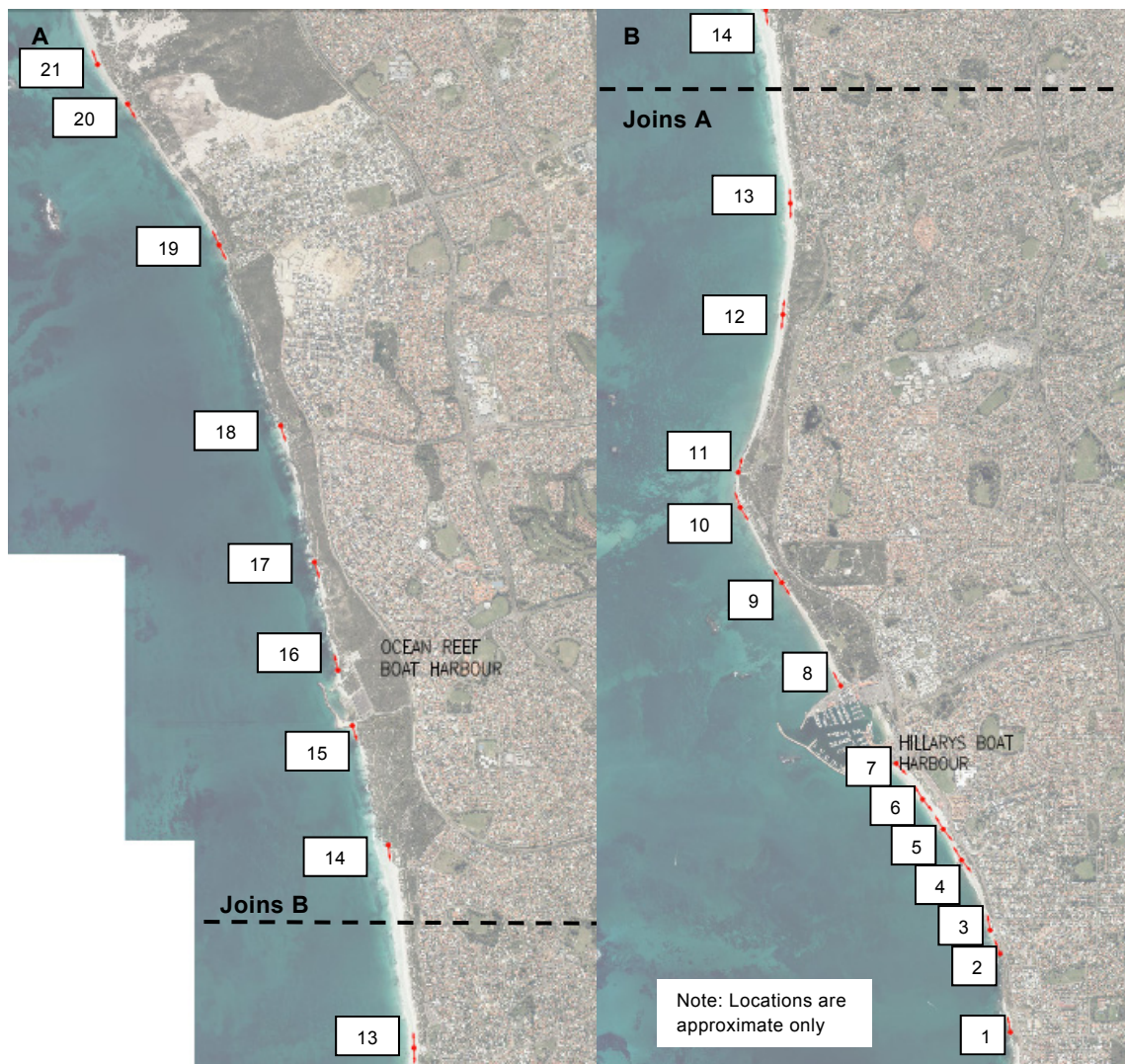


Figure 6.4 Shoreline Movement at Burns Beach

## 7. Photographic Monitoring

### 7.1 Periodic Photographic Monitoring

The coastal monitoring program includes seasonal (March and October) photographic monitoring of specific locations within the study area. Through the use of a specific field of view (FOV), photographic monitoring programs can be used to obtain visual estimates of the changes occurring on the coast. Erosion and accretion trends can be observed, while photos taken at more frequent intervals can capture seasonal movements or the changes due to storm events. Figure 7.1 presents the location and orientation for all the points used in the photographic monitoring program.



**Figure 7.1 Photographic Monitoring Locations**

A drawing presenting the photographic monitoring locations and survey profile location is included in Appendix C.

A summary of the photos taken at each monitoring location are included as Appendix D.



## 7.2 Fixed Camera Monitoring

In addition to periodic photographic monitoring at fixed points, the coastal monitoring program also includes monitoring using a time lapse camera. Following discussion with the City, it was agreed that the camera be installed at the new carpark north of the MAAC. The fixed camera was installed in February 2016 to assist with the following.

- Monitoring the bank in front of the new carpark and the protection offered to the carpark.
- Providing qualitative and quantitative information on seasonal/storm changes in shoreline position.

Photographs are taken daily at 9am and 3pm and stored by MRA.

The fixed camera was replaced with a Spartan Time Lapse camera in April 2017, and the monitoring continued. The new camera system allows wireless transmission of the photographs to a web based system where they can be viewed.

Some example photographs taken between April 2017 and March 2018 are shown in Figure 7.2 to 7.4.

Overall, the photographs indicate that there are some seasonal fluctuations such that the beach level and width varies over time. However there does not appear to be any significant changes to the shoreline position between April 2017 and March 2018.



**Figure 7.2 April 2017**



Figure 7.3 October 2017

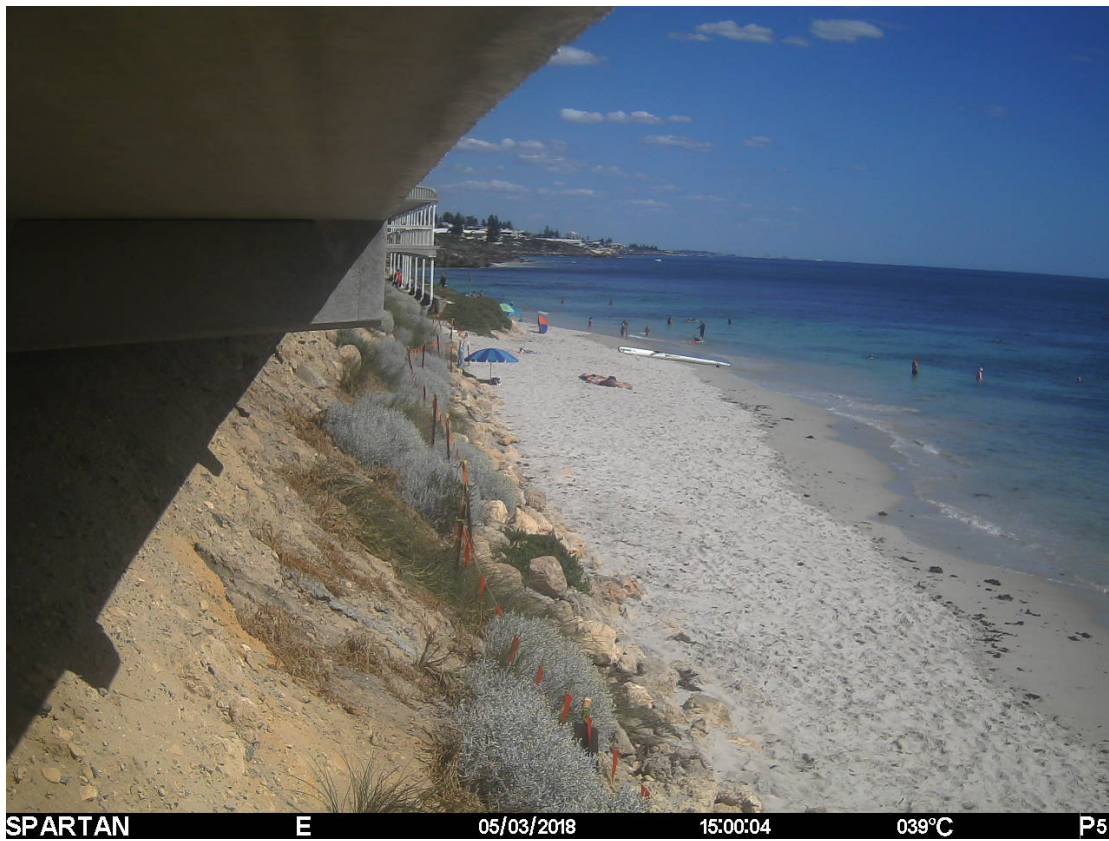


Figure 7.4 March 2018

## 8. Discussion of Changes

The 2017/18 monitoring program included beach survey profiles, shoreline mapping and photographic monitoring. The assessed changes to the shoreline from this data are discussed further below.

### 8.1 Beach Survey Profiles

#### 8.1.1 Profiles Exceeding the Trigger Values

The previous sections presented the analysis of the 2017 monitoring surveys and comparison with the 2015 baseline surveys. Profiles with changes greater than the monitoring trigger values were highlighted. A summary of these profiles is presented in the table below.

**Table 8.1 Summary of Profiles Exceeding Trigger Values**

Profile	Location	Trigger
2	Pinnaroo Point	Recession of MSL greater than 5 m
3	Pinnaroo Point	Recession of MSL greater than 5 m
5	Shoreline north of Mullaloo SLSC	Recession of MSL greater than 5 m

#### 8.1.2 Profiles 2 & 3 (Pinnaroo Point)

Profiles 2 and 3 are located near Pinnaroo Point and have exceeded the trigger value for recession of the MSL. However, the vegetation line from the surveyed profiles showed no notable change relative to 2015.

The movement of the vegetation line is also indicated on the shoreline movement mapping, where noticeable erosion was observed between 2015 and 2016 and accretion between 2016 and 2017, resulting in minor difference between the 2015 and 2017 vegetation lines. The beach profiles survey indicated that there has been some beach erosion in this area over the last 2 years. It is likely that the majority of this change occurred between 2015 and 2016, and remained reasonably stable between 2016 and 2017. However, since the survey is undertaken every 2 years, this may have not yet be reflected in the profile survey.

This profile should continue to be monitored at this stage. MRA recommends that coastal management in the form of sand bypassing is considered past Hillarys Boat Harbour. If completed, this would assist in addressing the erosion observed at Pinnaroo Point.

#### 8.1.3 Profile 5 (Mullaloo)

Profile 5 is located just north of the Mullaloo SLSC and has exceeded the trigger for recession of the MSL. The vegetation line showed a minor accretion relative to 2015.

The accretion of the vegetation line at this location suggests that the recession of the MSL may be an abnormal or seasonal change. The accretion of the shoreline observed either side, at Profiles 4 and 6, suggest this is an isolated occurrence only.

This area should continue to be monitored at this stage. It is not likely any management action will be required unless the vegetation line starts retreating significantly.



## 8.2 Shoreline Mapping

As discussed in Section 6, there were generally only minor (< 5 m) changes to the shoreline position between August 2016 and September 2017. The main trends in movement are summarised below:

- The shoreline along Whitfords Nodes, north of Hillarys Boat Harbour, experienced general recession up to 3 m in the past year. This continued an erosion trend that was identified in MRA (2017). The net erosion between the 2015 and 2017 vegetation line is in the order of up to 8 m.
- The shoreline near Pinnaroo Point has shown minor accretion up to 5 m between 2016 and 2017. This appears to be a halt to the erosion trend that has been identified in MRA (2017). The net movement between the 2015 and 2017 vegetation line indicate a minor accretion of up to 2 m.
- The shoreline along Burns Beach has generally accreted up to 5 m between 2016 and 2017. This is a halt of the erosion trend noted in MRA (2017), which indicated an erosion of up to 10 m. The net movement between the 2015 and 2017 vegetation line is an erosion of up to 8 m.

## 8.3 Photographic Monitoring

The photographs collected from the 21 photographic monitoring locations were inspected and compared to the photographs from previous monitoring periods. These show seasonal and inter-annual changes to the beach at a number of locations, however no noticeable ongoing change. Figure 8.1 presents seasonal changes between October 2017 and March 2018 at Location 8, immediately north of Hillarys Boat Harbour.

There were no significant areas of change identified from the monitoring photographs. They will continue to be inspected for trends in movement and changes in key areas.

October 2017



March 2018



**Figure 8.1 Monitoring Photographs North of Hillarys Boat Harbour**



## 8.4 Summary of Changes

The changes that have occurred between 2015 and 2017 at each of the survey locations are summarised in the following table.

**Table 8.2 Summary of Changes**

Survey Profile	Change in MSL from Survey (m)	Change in 3.5 mAHD from Survey (m)	Change in Veg Line from Mapping (m)	Comment
16	6.8	-0.5	-1.3	Burns Beach, generally erosion of the vegetation line
15	11.4	1.0	0.0	
14	0.4	-0.3	-1.5	
13	-2.0	0.6	0.0	South of Burns Beach groyne. Minor change.
12	-3.4	0.5	3.3	General recession of MSL and accretion of the vegetation line. Likely short term fluctuation.
11	-1.8	1.3	1.0	
10	0.9	0.5	0.0	Rock shoreline.
9	0.3	-0.2	0.1	North of Ocean Reef Harbour.
8	OCEAN REEF BOAT HARBOUR			
7	0.0	-0.1	0.0	Southern Breakwater of Ocean Reef BH
6	29.4	0.1	0.0	Rock cliff
5	-13.8	0.5	0.0	North of Mullaloo SLSC. Negligible change to vegetation line. Some beach erosion near MSL.
4	5.1	3.3	0.0	South of Mullaloo SLSC. Negligible change to vegetation line. Accretion on the beach.
3	-7.0	0.1	0.3	Pinnaroo Point. Minor change to vegetation line and erosion near the MSL in the last 2 years.
2	-8.7	-0.2	0.1	
1	-4.8	-5.0	-5.4	Whitfords Nodes. Continued erosion.
21	-0.6	9.5	0.6	Sorrento beach. Significant accretion.
20	SORRENTO SLSC			
19	-1.6	1.8	-0.4	South Sorrento beach. Minor change.
18	-0.2	1.0	0.0	Beach in front of MAAC. Minor change.
17	-1.7	0.6	1.3	South of MAAC. Minor change.

## 8.5 Recommended Coastal Management

The monitoring data collected in 2017/18 has shown that section of the shoreline at Whitfords Nodes has continued to erode over the past year. The beach survey profiles also indicate some recent erosion at Pinnaroo Point. While there is reasonable buffer to infrastructure at these locations, continuing erosion will require the following:

- Management of dune fencing.
- Management of beach access ways.

It is recommended the City make allowances to actively manage these in the coming year. This may require removal or relocation of dune fencing following storm events and regrading of access ways.

It is likely that the erosion on the north side of Hillarys Boat Harbour is a result of a deficit in longshore transport in this area, due to the Harbour. MRA recommend that the City should consider bypassing some of the sand accumulating at Sorrento Beach to this area. This would address the ongoing erosion along this section of shoreline and result in the following:

- Increased buffer to storm erosion.
- Address the deficit in longshore transport and reduce or halt the ongoing erosion.
- Provide an increased width of recreational beach along the Whitfords Nodes to Pinnaroo Point shoreline.

Sections of shoreline at Burns Beach had previously experienced erosion, as identified in MRA (2017). The 2017/18 monitoring data has shown that the erosion in these areas appeared to have slowed down or reversed to minor accretion. Therefore, no coastal management for this area is recommended at this stage.

The coastal monitoring should continue and future reports should specifically consider movements in the areas highlighted in this report.

## 9. Summary & Recommendations

This report presents the monitoring data of the third year of the Joondalup coastal monitoring program between October 2017 and March 2018 and the changes that had occurred from the baseline monitoring data collected in 2015/16. The monitoring data collected in 2017/18 includes:

- Beach survey profiles
- Shoreline movement plans.
- Photographic monitoring (seasonal).
- Fixed camera monitoring (Marmion).

Based on review, analysis and comparison of the monitoring data collected to date, the following are recommended in their order of priority:

- The monitoring data has showed continued erosion across the profile at Whitfords Nodes and some continued beach erosion at Pinnaroo Point. It is recommended that the City make allowances to actively manage these areas in the coming year, which may require removal or relocation of dune fencing following storm events and regrading of beach access ways.
- The erosion on the shoreline (Whitfords Nodes to Pinnaroo Point) north of Hillarys Boat Harbour is likely a result of a deficit of longshore transport due to the construction of the harbour. It is recommended the City should consider bypassing some of the sand accumulating at Sorrento Beach to this area to offset the ongoing erosion issue along this shoreline.
- Continue coastal monitoring of the City's shoreline, with specific focus on the changes of the following areas as identified in the report:
  - Shoreline from Whitford Nodes to Pinnaroo Point.
  - Shoreline along Burns Beach.

## 10. References

Department of Transport 2009. *Coastal Demarcation Lines for Administrative & Engineering Purposes. Delineation Methodology & Specification*. Government of Western Australia, Perth.

Department of Transport, 2012. *How to photo monitor beaches*. Coastal Infrastructure Department, Government of Western Australia, Perth.

MRA 2016. *Joondalup Coastal Monitoring – Baseline Monitoring Report, R733 Rev 1*. Prepared for City of Joondalup.

MRA 2017. *Joondalup Coastal Monitoring – Data Report, R893 Rev 1*. Prepared for City of Joondalup.

## **11. Appendices**

**Appendix A Shoreline Movement Plans**

**Appendix B Beach Survey Profiles**

**Appendix C Photographic Monitoring & Survey Locations**

**Appendix D Photographic Monitoring**