

Coastal Infrastructure

How to photo monitor beaches

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Introduction

The Department of Transport (DoT) identified a need for a simple and inexpensive tool to assist coastal managers wanting to better understand beach change in specific locations. This photo monitoring guide is designed for use by local governments, coastal managers, coastal engineers, community groups and community members for coastal monitoring. Photo monitoring involves taking photos of the coast with a specific field of view (FOV) over a set time period to show naturally occurring processes. This guide provides information on selecting and establishing photo monitoring points, guidance on the FOV for various beach types and frequency of photo monitoring.

This guideline is applicable to the WA coast between Kalbarri and Eucla. This stretch of coast consists of mainly wave dominated beaches with some low energy beaches where the tidal range is less than 1.5m. This guide may not be suitable for the central and north west coast of WA as the tidal environment and landform features are more variable.

Monitoring of coastal environments can assist coastal managers to identify trends in beach change, identify beach management issues and assist in developing strategic directions for coastal planning. The movement of the shoreline is influenced by weather, climate, tides, sea levels, waves and currents. The coast is highly dynamic and capturing these changes is difficult, yet fundamental to understanding coastal environments. Photo monitoring enables short term trends such as the impacts of severe storms and midterm seasonal variations to be captured that would not be identified in less frequent monitoring programs, i.e. aerial photography. Photo monitoring can complement more comprehensive datasets to monitor changes on the coast and help understand beach response to coastal processes.

A Guide to photo monitoring

Equipment

Equipment recommended for photo monitoring:

- Camera - single-lens 35mm digital camera, resolution ≥ 6 megapixels
- Handheld GPS
- Tape measure
- Notebook to record information on location of monitoring point and site observations.

Tips

For consistency and quality of photos, use the same camera.

Utilise the time and date stamp function of the camera.

Cameras with geotagging and orientation capabilities are preferable.

It's recommended a standardised field data sheet is created to record information about the monitoring point (i.e. site name, GPS coordinates and description of location).

Establishing photo monitoring points and field of view

The following guidelines should be followed when selecting and creating a photo monitoring point.

- The monitoring point should be an easily identifiable fixed point landward of the active zone. Suitable monitoring points include an established tree, fence post, corner of a car park, a stable rock on a structure such as seawall or groyne, or an easily identifiable rocky outcrop.
- The photo monitoring point should provide an approximately 45° field of view (FOV) of the beach. An up-coast and down-coast FOV should be established at each monitoring point where relevant.
- The FOV must be easily repeatable by including the same features (e.g. trees, buildings) at the edges of the FOV.
- The FOV should provide coverage of the zone between the low water mark (or further offshore) and the backshore (prominent rear dune or equivalent).

Tips

Consult with local governments, coastal managers and community groups for coastal areas of concern.

Use satellite images and/or aerial photos to identify areas of interest for monitoring and suitable monitoring points.

Number of photo monitoring points

Consider the following information:

- As a minimum there should be a monitoring point at the northern and southern extent of the beach.
- If the FOV from the northern and southern monitoring points do not capture the entire beach establish a monitoring point in the centre of the beach.
- Create additional monitoring points if a minimum of two monitoring points does not capture the entire beach in the photo.
- For engineered coasts there should be an additional FOV along the structure being monitored.
- Additional reference points should be included where there are assets and infrastructure immediately behind the beach zone.
- The recommended distance between photo monitoring points is dependant on beach type, beach length and presence of coastal protection features. A rough guide would be:

sandy beach - monitoring points should be approximately 200-500m apart;

embayed rocky coast - establish monitoring point at each headland and in the centre of the embayment. If additional monitoring points are required space them 200-500m apart;

straight rocky coast - monitoring points should be approximately 200-500m apart;

engineered coast - monitoring points should be approximately 200-500m apart excluding photos taken of the structure.

Recording information

Give each monitoring point a name using site name and a number for the FOV e.g. Busselton Town Beach FOV1.

It is recommended that the following information is recorded for the monitoring points:

- GPS coordinates of the site
- Height of the camera from the ground when the photo was taken
- Description of permanent features that frame the FOV of the photo
- Comments that will aid future users to relocate the photo monitoring point.

Record photo monitoring points on an aerial photo.



Taking the photos

When taking photos:

- Locate the photo monitoring points and take a photo with the specified FOV
- The date and time of the photos must be recorded (captured on the image if possible)
- Generally, take photos between 9am and 3pm (to minimise sun glint off the water) and at low tide if possible
- If aerial images are being collected, take a set of field photos at the same time as the aerial images
- If possible record site observations and some brief observations about any noticeable beach characteristics, e.g. erosion scarp at the back of the beach.

How frequent?

The frequency of photo monitoring is dependant on the rate of change of coastal processes and weather conditions. The goal of monitoring is to capture the level of variation in the coastal landscape at a seasonal scale and any major event. As a guide:

- Monitoring should be undertaken monthly in summer and fortnightly in winter for 12 months
- It is ideal to monitor before and after severe weather events i.e. storms and flooding. Taking photos immediately after a severe weather event should be given priority
- Frequency should reflect the value of assets; high value assets may require more frequent monitoring
- A beach of less interest can be monitored less frequently, perhaps quarterly or even annually.

Archiving

Upload photos into a database.

The following naming convention and file storage is recommended:

- Album folder - named by site e.g. Busselton Town Beach
- Within album, series of folders named by monitoring point & FOV e.g. Busselton Town Beach FOV 1
- Within monitoring point folder upload all photos for specified FOV. They will automatically be stored by date and time.

Burn photos onto a disc every three to six months and provide them to the DoT for archiving.

The key requirements of a database for beach monitoring photos are:

- High capacity of data storage
- Capacity to upload and view photos
- One account accessible to all participants in the monitoring program
- Photos can be viewed in chronological order for a single FOV
- Photos can be placed and viewed on an interactive map in chronological order
- Albums can be downloaded as a zipped file that has the same file storage configuration as the database
- Mechanism to upload observations of site conditions recorded when photos were taken.

Tips

Websites such as Flickr and Picasa are free photo sharing sites. Flickr has an additional option to place photos on an interactive map.

There are photo sharing sites that require annual subscription fees. However, they can have more functionality than free sites, for example DPhoto.

More comprehensive photo storage servers exist that may be suited to large organisations e.g. PhotoMapper 3.



(Source: GSWA, WA Coast, 2011)

Beach types

There are different beach types and important features of each to monitor.

Sandy beach

Figure 1 shows a common sandy beach profile, the area between the dune and shoreline should be captured in the FOV. Table 1 provides guidance on where to establish monitoring points and what to include in the FOV.

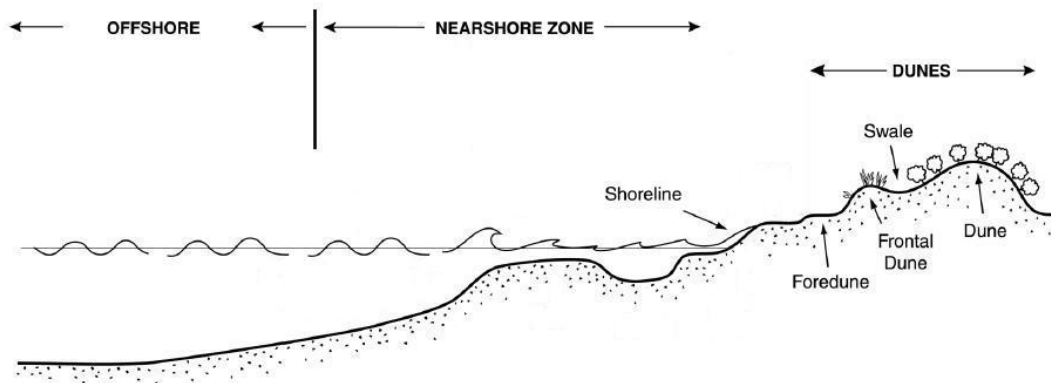


Figure 1: Components of a sandy beach profile (Source: adapted from *Coastal Planning and Management Manual* (2003).

Key changes in beach state to observe include accretion or erosion and accumulation of wrack (accumulation of detached seagrass and seaweed on the shore). Figure 2 shows erosion of Midalia Beach and accumulation of wrack.

Table 1: Guidance on location of monitoring points and FOV for a sandy beach

Type	Beach Type	Location of Monitoring Points (MP)	FOV Guidance
1	Sandy beach	<ul style="list-style-type: none"> Elevated north and south boundary MP (where possible) Reference points should be 200 - 500m apart 	<ul style="list-style-type: none"> Include area between frontal dune and shoreline Northern boundary MP - view down coast Southern boundary MP - view up coast MP within site boundaries - view up coast and down coast

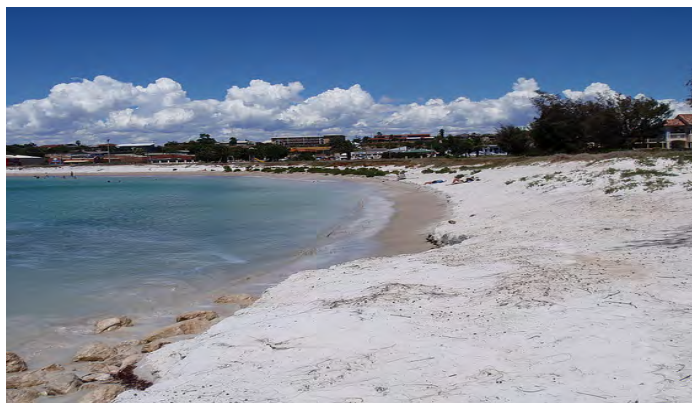





Figure 2: Monitoring photos of Midalia Beach, Geraldton. Photo on the left (taken 14/1/2012) is before beach erosion occurred. Photo on the right (taken 5/2/2012) shows erosion of the beach and accumulation of wrack.

Next page shows an example of established monitoring points and FOV for Mullaloo Beach.

Type 1: Sandy beach - Mullaloo Beach

Site	Location Monitoring Point	Field of View Description
	Top of the first tier of the rocky headland at the northern end (Mullaloo Point) of the beach (see reference point photo for exact location)	<p>a) Line up left side of FOV to see dune north of car park/footpath entrance to beach</p> <p>b) the right side of the FOV to include the water line and ocean</p>
	Pole at path entrance to beach from Korella Street (see reference point photo for exact location)	<p>a) Northwards FOV with left side looking seaward perpendicular to shore</p> <p>b) Southwards FOV with right side looking seaward perpendicular to shore</p>
	Pole at path entrance to beach from Mullaloo SLSC access ways (see reference point photo for exact location)	<p>a) Northwards FOV with left side looking seaward perpendicular to shore</p> <p>b) Southwards FOV with right side looking seaward perpendicular to shore</p>



Rocky coast

Rocky coasts are usually interrupted by beaches that lack sand or where erosion has exposed underlying rock. The key to photo monitoring of rocky coasts is to monitor when and where sand is present.

The FOV of photos should include the area between the dune/cliff face and the shoreline to capture the sediment relative to exposed rock, where possible take advantage of beach elevation to take photos. In some cases it may be relevant to take photos along rock structures on the beach. Table 2 provides guidance on location of monitoring points and FOV.







(Source: GSWA, WA Coast, 2011)

Table 2: Guidance on location of monitoring points and FOV for rocky coast

Type	Beach Type	Location of Monitoring Points (MP)	FOV Guidance
2	Rocky coast - embayed beach	<ul style="list-style-type: none"> Elevated MP at north and south boundary of embayment Elevated MP at the back of the beach in the centre of embayment (e.g. at footpath or road level) 	<ul style="list-style-type: none"> Boundary photo - area between frontal dune/cliff face to water line Photo from central point - edge of both headlands and beach to water line If FOV does not capture all of the embayment take 2 photos Two photos from central point - up coast and down coast with the line perpendicular to the beach as the central reference to edge of headland
	Rocky coast - straight cliffed coast	<ul style="list-style-type: none"> The MP should be set up as for sandy beaches 	<ul style="list-style-type: none"> The FOV should be as is for sandy beaches

Next page shows an example of established monitoring points and FOV for an embayed rocky beach.

Type 2: Rocky coast – Trigg to Sorrento

Site	Location Monitoring Point	Field of View Description
	<p>a) Top of the first tier of the rocky headland at the northern end of the area of interest</p> <p>b) Top of a fence post or wall section adjacent to the footpath above the central part of the beach on West Coast Hwy</p>	<p>a) FOV is along the water line and the left side of the FOV should include the back area of the embayment</p> <p>b) FOV is perpendicular to the beach (out to sea) from the elevated shoreward position that can fit both ends of the embayment in the photo</p>
	<p>a) Top of the first tier of the rocky headland at the northern end of the second embayment</p> <p>b) Top of a fence post or wall section adjacent to the footpath above the central part of the beach (at Bailey Street)</p>	<p>a) FOV is along the water line and the left side of the FOV should include the back area of the embayment</p> <p>b) FOV is perpendicular to the beach from the elevated shoreward position that can fit both ends of the embayment in the photo</p>
	<p>a) Top of the first tier of the rocky headland at the northern end of the third embayment</p> <p>b) Top of a fence post from the end of the Bennion Street beach car park that is above the central part of the beach</p>	<p>a) FOV is along the water line and the left right side of the FOV should include the back area of the embayment</p> <p>b) FOV is perpendicular to the beach from the elevated shoreward position that can fit both ends of the embayment in the photo</p>
	<p>a) Top of the first tier of the rocky headland at the northern end of the fourth embayment</p> <p>b) Top of a fence post or wall section adjacent to the footpath above the central part of the beach (at Bennion Street)</p>	<p>a) FOV is along the water line and the left side of the FOV should include the back area of the embayment</p> <p>b) FOV is perpendicular to the beach from the elevated shoreward position that can fit both ends of the embayment in the photo</p>



Engineered Coast

Engineered coasts are coastlines with man made structures including groynes, seawalls and breakwaters. Monitoring around coastal structures is important because they influence the immediate and adjacent beaches. The condition of the structure (appearance and structural integrity, independent of beach state) and its function (the effect of the structure on the beach i.e. is the beach eroding or accreting next to or near the structure etc.) should be monitored. Table 3 lists the key elements to be included in the FOVs for different type of coastal structures.

Table 3: Key elements to be included in the FOV

Type of structure	Key elements to be included
Groynes	Amount of sand on both sides of the groyne
Seawalls	The ends of the seawall
Breakwaters	The beach connecting to the breakwater

Table 4 below provides guidance on monitoring points and FOV for engineered coasts. When photographing engineered coasts the FOV should include the area between the dune and shoreline, as well as photos with a FOV along the structure shown in Figure 3.

Table 4: Guidance on location of monitoring points and FOV for engineered coast




Type	Beach Type	Location of Monitoring Points (MP)	FOV Guidance
3	Engineered coast - groyne/ breakwater	<ul style="list-style-type: none"> Elevated MP at northern and southern boundary MP should be 200 - 500m apart MP at tie in of beach protection structure MP at seaward end of structure (as far offshore as possible) 	<ul style="list-style-type: none"> Include area between frontal dune and water line Northern boundary MP - view down coast Southern boundary MP - view up coast MP within site boundaries - view up coast and down coast Two photos from elevated point on tie in of beach protection structure - one directly down line of structure, second to include beach and structure Photo looking onshore towards beach protection structure from the indicative end point of its direct influence Onshore photo requirements to be determined site by site. Apply a reversal of the “tie in” FOVs Breakwater - FOV pulled back enough to see crest height and condition
	Engineered coast - seawall	<ul style="list-style-type: none"> Elevated MP at northern and southern boundary MP should be 200 - 500m apart MP at each end of the structure at base and top of the structure Depending on length of structure establish monitoring point halfway along the base and top of seawall 	<ul style="list-style-type: none"> Include area between seawall crest and waterline MP along structure: FOV pulled back enough to see crest height and condition



Figure 3: Busselton Town Beach seawall, example FOV looking down seawall

Below is an example of engineered beach types where monitoring points and FOV have been established.

Type 3: Engineered coast - South Beach Groynes, South Fremantle

Site	Location Monitoring Point	Field of View Description
	Rock or pole on the elevated point of the tie in of the South St groyne (provide reference point photo for exact location)	<p>a) Line up right hand side of first FOV with the dune vegetation along the backshore</p> <p>b) Line up the left hand side of the second FOV with the line of the structure so that beach in its immediate lee is clear</p>
	Pole at path entrance to beach from the mid point of the beach (see reference point photo for exact location)	<p>a) Northwards FOV with left side looking seaward perpendicular to shore</p> <p>b) Southwards FOV with right side looking seaward perpendicular to shore</p>
	Rock or pole on the elevated point of the tie in of the Island St groyne (provide reference point photo for exact location)	<p>a) Line up right hand side of first FOV with the dune vegetation along the backshore</p> <p>b) Line up the left hand side of the second FOV with the line of the structure so that beach in its immediate lee is clear</p>



Further reading

City of Geraldton and National Agricultural Catchment Council

<http://www.nacc.com.au/Programs/Current-programs/Caring-for-our-Country/Coastcare/PROJECTS/NACC-Support-Projects/Geraldton-Coastal-Mon-Prog-.aspx>

<http://www.flickr.com/groups/gbmp/pool/map?mode=group>

Gero Sunset's Photostream, Available from: <http://www.flickr.com/photos/61296717@N06/>
[Accessed on 13 February 2012].

Perth Region Natural Resource Management (NRM)

<http://www.perthregionnrm.com/pr-nrm-programs/coastal/coastcare-projects-and-events/coastal-photo-monitoring-project.aspx>

Southgates Photostream, Available from: <http://www.flickr.com/photos/61239956@N05/>
[Accessed on 13 February 2012].

Surf Lifesaving Australia

<http://www.beachsafe.org.au/>

Wilson, C, 2011, Southern Metropolitan Coastcare Program Coastal Photo Monitoring Project 2006-201, Available from: <http://www.perthregionnrm.com/pr-nrm-programs/coastal/coastcare-projects-and-events/coastal-photo-monitoring-project.aspx> [Accessed on 13 February 2012].

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Cover photo: Sorrento Beach, Perth WA. (Source: GSWA, WA Coast, 2011)

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