

MONITORING OF THE PALM BEACH ARTIFICIAL REEF

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INTRODUCTION

Palm Beach is located on the Gold Coast, Queensland, Australia.

Infrastructure along Palm Beach is exposed to high coastal hazard risks. The City of Gold Coast (City) delivered the Palm Beach Shoreline Project (PBSP) in 2019, involving beach nourishment stabilised by an artificial reef, as a sustainable solution to coastal hazards threats and provide improved surfing amenity.

This Paper presents the results of post-construction monitoring of the PBSP, assessing the project benefits against the project objectives.

PALM BEACH SHORELINE PROJECT OBJECTIVES

The objectives of the PBSP included the following:

- increase the beach width to improve the buffer to infrastructure along Palm Beach;
- retain beach nourishment sand along the most vulnerable central section of Palm Beach;
- improve surfing amenity at Palm Beach; and,
- provide addition marine habitat values.

MONITORING OF GEOMORPHOLOGY AND BEACH CONDITIONS

The Palm Beach Artificial Reef (PBAR) was designed to work with nature and influences the waves and nearshore currents to promote a long-term increase in sand along Palm Beach.

The City regularly surveys the beach and nearshore zone to assess beach movement. The monitoring has shown an increased beach width and sand volume within the surf zone. This increase in sand across the beach profile acts as a protective buffer from erosion into the future.

The monitoring program has examined the changes in beach morphology and how this has influenced the delivery of project objectives related to retention of beach nourishment sand and increase of the beach width. The monitoring has also quantified the benefit provided by the project to protection of coastal infrastructure.

SURFING AMENITY

Surfing amenity has been monitored using Wave Peel Tracking (WPT) technology. This novel approach identifies and tracks wave breaking from a permanent shore-based CCTV camera. Since October 2020, WPT data has been collected from 10-minute video clips sampled at 10 frames per second during daylight hours.

Over 3,500 hours of WPT data from October 2020 to October 2021 has been analysed in this paper.

The WPT data demonstrates that surfing conditions over the reef become desirable when easterly or southerly swells with significant wave heights over 0.8m and peak period over 7s, with average ride lengths that are significantly greater than in the natural surf zone (see Figure 1).

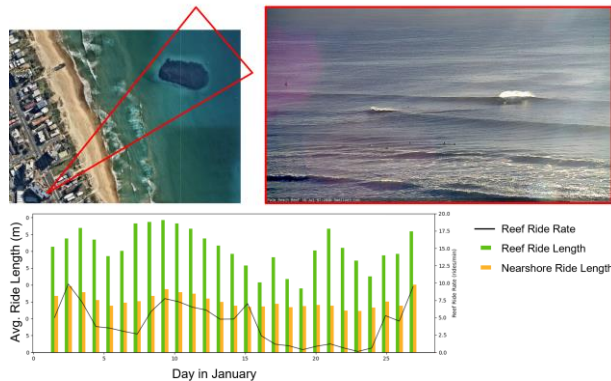


Figure 1 - CCTV camera view (top) and wave ride length (bottom) for month of January 2021.

ECOLOGICAL MONITORING

The City engaged Ecological Service Professionals to undertake post-construction monitoring of the marine ecology over the PBAR, and compare it to the natural rocky Palm Beach Reef and adjacent sand habitat. The PBAR has provided structure for seaweed and bottom-dwelling invertebrates to attach and grow. The artificial reef also provides shelter and food for a variety of fish that swim around the reef and among the large boulders.

ASSET CONDITION INSPECTIONS

The PBAR is constructed of basalt and greenstone rock, both chosen for being particularly durable, heavy and dense. The rocks were classed into four sizes, with smaller rocks making up the core of the structure, and progressively larger rocks making up the armour layer. The crest of the reef is 1.5m below mean sea level and consists of 6 to 8 tonne rocks.

Since completion of the artificial reef in 2019, the City has undertaken regular inspections to determine if there has been movement of armour rocks or settlement of the structure. The inspection program includes hydrographic survey and visual inspections. The inspection program has shown that the artificial reef has been stable with insignificant movement or settlement.

CONCLUSIONS

The City has been monitoring sand movement, surf amenity and ecology on an ongoing basis as part of the PBSP. The monitoring results are positive and have exceeded the project objectives, with an observed:

- increased volume of sand in the beach profile immediately south of the structure;
- increased surf quality and amenity; and
- increased marine habitat and ecological diversity.