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Hinchinbrook Shire Council

Report for Forrest Beach Boat Ramp

Options Report

August 2010

INFRASTRUCTURE | MINING & INDUSTRY | DEFENCE | PROPERTY & BUILDINGS | ENVIRONMENT

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1. Introduction

1.1 Background

In recent years, Forrest Beach has experienced a considerable amount of urban development and as a result is experiencing an increase in recreational boating. There are currently 2 boat ramps that serve the Forrest Beach community. One (She-Oak Street) is located on the beach in the township and the other (Cassady Creek) is located on a small tributary of Cassady Creek south of Forrest Beach. Both of these are tidally restricted and the She-Oak Street boat ramp is exposed to wave action.

Hinchinbrook Shire Council would like to improve the standard of boat launching and retrieval at Forrest Beach. It has initiated this consultation process to investigate;

- The options available;
- The requirements of the boat ramp users;
- The indicative costs associated with proposed options; and
- Any applicable constraints.

1.2 Scope of Works

The scope of work as set out in the initial brief was to investigate the solutions to improve the boat launching and retrieval for Forrest Beach and included considering both Cassady Creek and She-Oak boat ramps. The scope of the brief was amended following each of the Community Consultation meetings and these amendments are described in more detail in Section 3.

2. Study Parameters

2.1 Location

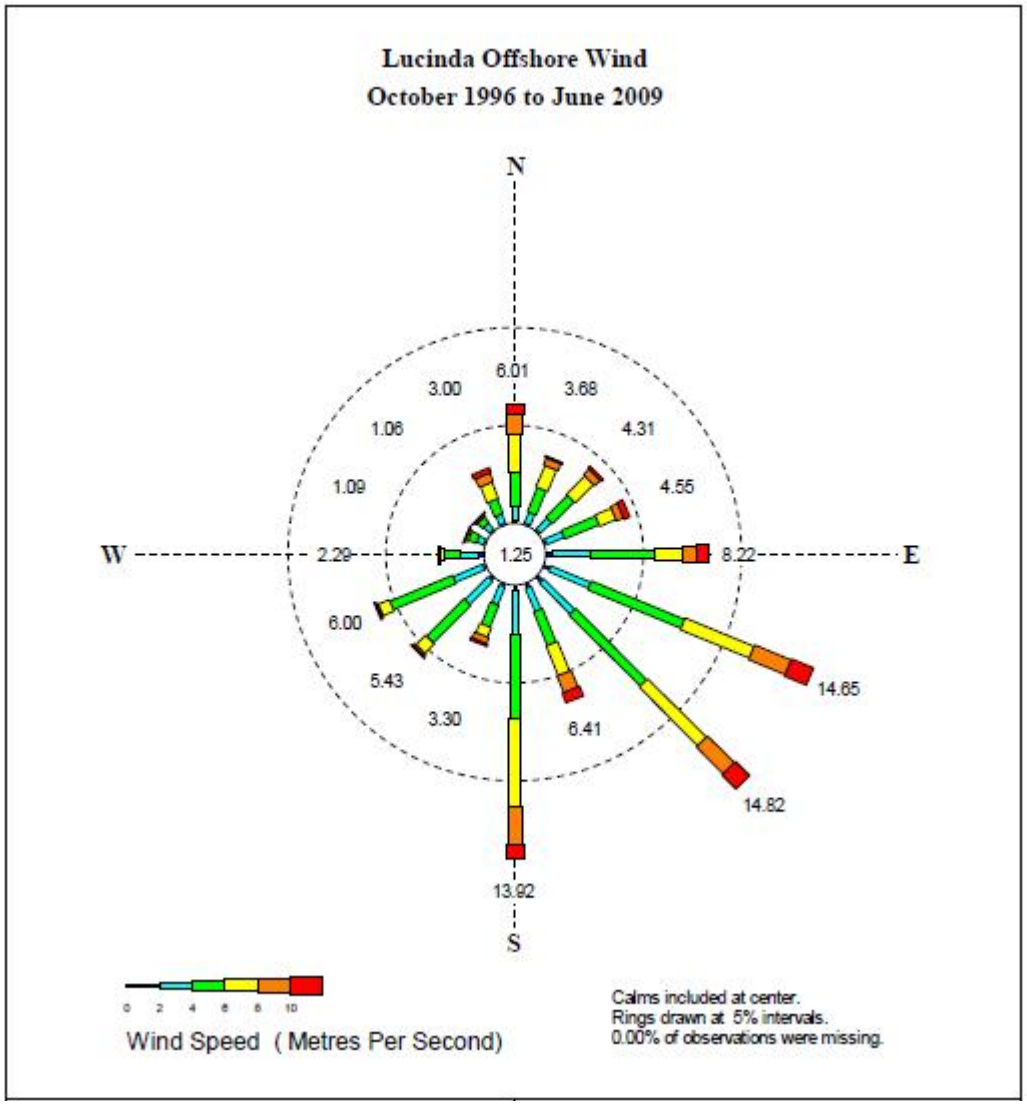
Figure 1 Location of Forrest Beach Boat Ramp

2.2 Environmental Data

2.2.1 Wind Data

Wind data recorded at Lucinda between October 1996 and June 2009 was sourced from the Australian Bureau of Meteorology. From the data a wind rose was plotted and a frequency table calculated, refer Figure 2.

Figure 2 Wind Rose



2.2.2 Tide Data

The Tidal Planes for Lucinda (Offshore) were sourced from the Queensland Tide Tables 2010 and are reported in Table 1.

Table 1 Tidal Planes – Lucinda (Offshore)

TIDAL PLANES		AHD	LAT	Source
Highest Astronomical Tide	HAT	2.12 m	3.96 m	Queensland Tide Tables 2010
Mean High Water Springs	MHWS	1.14 m	2.98 m	
Mean High Water Neaps	MHWN	0.34 m	2.18 m	
Mean Sea Level	MSL	0.05 m	1.89 m	
Australian Height Datum	AHD	0.00 m	1.84 m	
Mean Low Water Neaps	MLWN	-0.24 m	1.60 m	
Mean Low Water Springs	MLWS	-1.04 m	0.80 m	
Lowest Astronomical Tide	LAT	-1.84 m	0.00 m	

2.3 Physical Data

2.3.1 Boat Ramp Drawings

As Constructed drawings were sourced from Hinchinbrook Shire Council. These drawings detailed construction details of the She-Oak Street boat ramp including:

- Dimensions of the ramp;
- Levels of the ramp; and
- Position of the ramp.

2.3.2 Bathymetric Data

Hinchinbrook Shire Council engaged Conics to undertake a bathymetric and topographic survey of the beach adjacent to the She-Oak Street boat ramp and a survey of the mouth of Cassidy Creek. A plot of each survey can be found in Appendix A.

2.4 Longshore Transport

It is recognised that longshore transport occurs in a northerly direction and evidence of this can be seen as build up on the southern side of the ramp, refer Figure 3 and Figure 4.

Longshore transport potential was calculated using methodology outlined in the Coastal Engineering Manual and developed by Kamphius, 1991. The wave climate developed in section 4.1.2 and the probability analysis undertaken in section 2.2.1 were used to calculate the longshore transport potential. An estimated 36,000 m^3/year moves north and 13,000 m^3/year moves south, giving an averaged net longshore transport potential of 23,000 m^3 moving north each year.

WBM are currently preparing a Shoreline Erosion Management Plan for Hinchinbrook Shire Council. This study includes Forrest Beach and thus WBM have also calculated the nearshore wave conditions for the area. WBM calculated the wave climate using the numerical wave model SWAN which is a third generation spectral wave model that estimates wave parameters in coastal regions from given wind, wave and current conditions. WBM's wave climate was also used in the above longshore transport calculation to validate the results calculated from WAVEGEN. The longshore transport calculated from WBM's wave climate was in general agreement with the figures reported above.

Figure 3 North Side of Ramp

Figure 4 South Side of Ramp

3. Community Consultation

Three Community Consultation meetings were held during the study period. The first one was held at the start of the study to get input from the Community about the direction of the study and the second was held at the end of the study to explain the findings. A third was held following the issue of a draft report incorporating changes resulting from the second meeting.

3.1 Consultation Meeting 1

A community consultation meeting was held at the beginning of the study period. GHD outlined the relevant constraints and issues and Hitchinbrook Shire Council asked the group to outline their preference for the direction of the study.

- It was agreed at this meeting that the overall preference was for the study to be focussed on the main ramp at She-Oak Street.
- Cassady Creek boat ramp was not considered further for reasons discussed in Section 11.

Furthermore, it was agreed that with the knowledge of the wind and wave climate at the site, the scope was revised to consider a wave calming structure at She-Oak Street boat ramp to protect against the north east waves only. Protection against waves from the south east was excluded from the scope as the boating community generally do not use the boat ramp in these conditions.

3.2 Consultation Meeting 2

The second community consultation meeting was held after GHD had completed its initial study and provided an opportunity for GHD to explain the different options considered and to present the preferred option for wave calming at the boat ramp.

The options that were considered and the resulting recommendations form the basis of this report (Section 4 to Section 8). However during the study it was apparent that the amenity of the boat ramp could be increased by simply lengthening the boat ramp. This prospect was tabled at the second Community Consultation Meeting and it was agreed that further work should be carried out to consider lengthening the ramp and installing a wave calming structure for safety reasons. This is covered in Section 10.

3.3 Consultation Meeting 3

The third consultation meeting was held to present the updated cost estimates for the lengthened boat ramp and wave calming structure and to seek agreement from the consultees that this option had their support. During the meeting it was suggested that a 2 lane ramp should be installed in addition to the existing ramp and that support from Palm Island and Dungeness should be encouraged to assist with the justification to provide additional funding.

4. Current usage of Boat Ramp

The main boat ramp at She Oak Street is not an all tide access ramp and is located on an open beach so is exposed to the wave climate at the site, refer Figure 5.

Figure 5 She Oak Street Boat Ramp

This section considers the amount of time that the ramp can currently be used. This will form a basis for assessing the improved usage of the ramp due to strategies put forward in this report.

There are 2 considerations when assessing the useability of the ramp. The first is the tide level and the second is wave climate. Both need to be favourable for the ramp to be useable and it is assumed that the tide and wave height are independent of each other, ie the tide does not influence the wave height and vice versa.

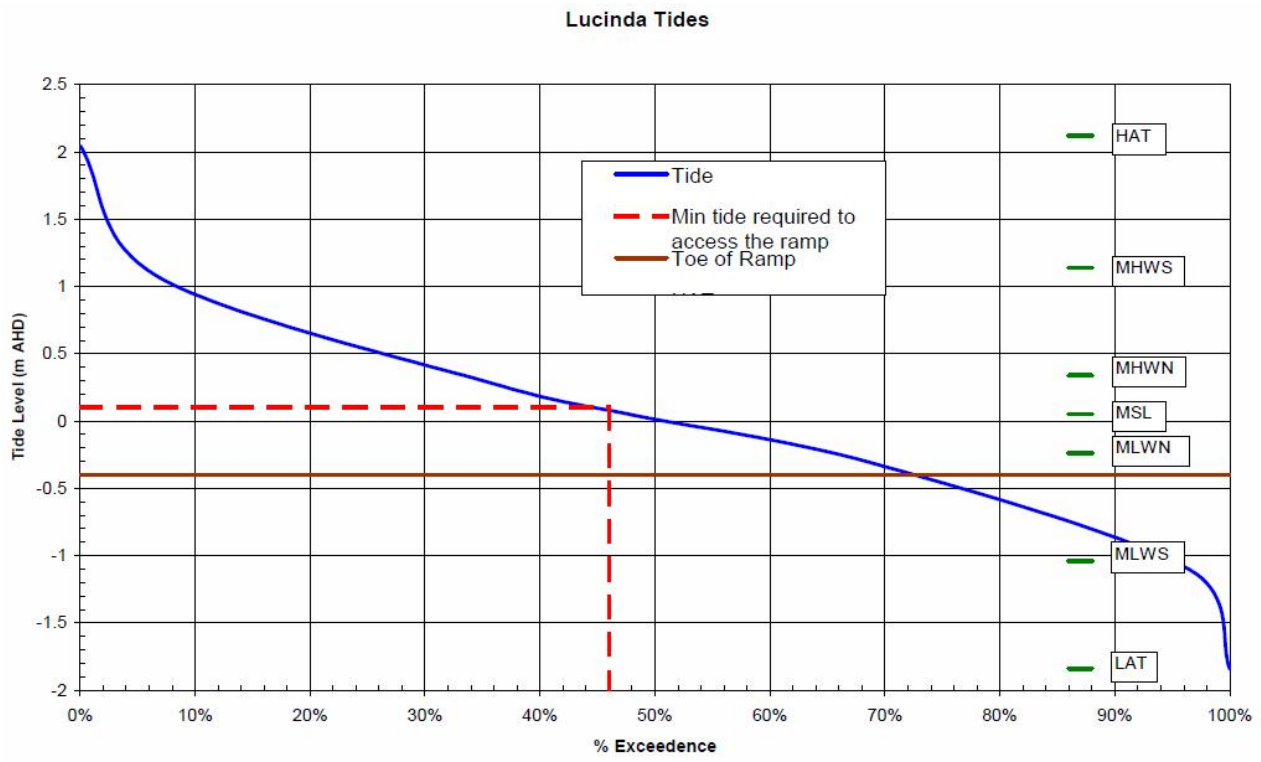
4.1 Estimation of Existing Ramp Usage

4.1.1 Tidal Constraints

The toe of the main concrete boat ramp is at -0.4 m AHD. It has been assumed that 500 mm of water is required to launch and retrieve the majority of boats. It is recognised that some boats will need less than this and that some boat users will be able to launch their vessels from the sand when the water is below the level of the ramp. However this figure has been used as a conservative depth to accommodate the majority of users.

Predicted tide levels for 2009 were extracted from JTIDES, (a free web based tidal predictor) and an exceedance probability graph was plotted to estimate the usage of the current boat ramp, refer Figure 6. (Note: JTIDES is not an official source and should not be used for detailed design). This method predicted that the boat ramp would have a depth of at least 500 mm at the toe for approximately 46 % of the time ie there would only be sufficient water depth at the ramp for this proportion of the total time.

Figure 6 Tide Exceedance Probability



4.1.2 Wave Height Constraints

Wind

The dominant wind direction at Forrest Beach is from the south east. South east winds tend to blow for the duration of the day and increase in the afternoon. For this reason boat owners generally do not go out in these conditions or tend to opt for more protected boat ramps which offer safe conditions for retrieving their boats.

The majority of boat owners at Forrest Beach use the ramp in the morning if a westerly wind is blowing. The usual weather pattern is for the wind to change direction in the afternoon to blow from the north east which potentially creates unsafe conditions at the boat ramp.

Furthermore an assessment of the winds from the westerly sector (i.e. from the land) indicates that no significant waves are created at the boat ramp under these conditions.

Wave Height Estimation

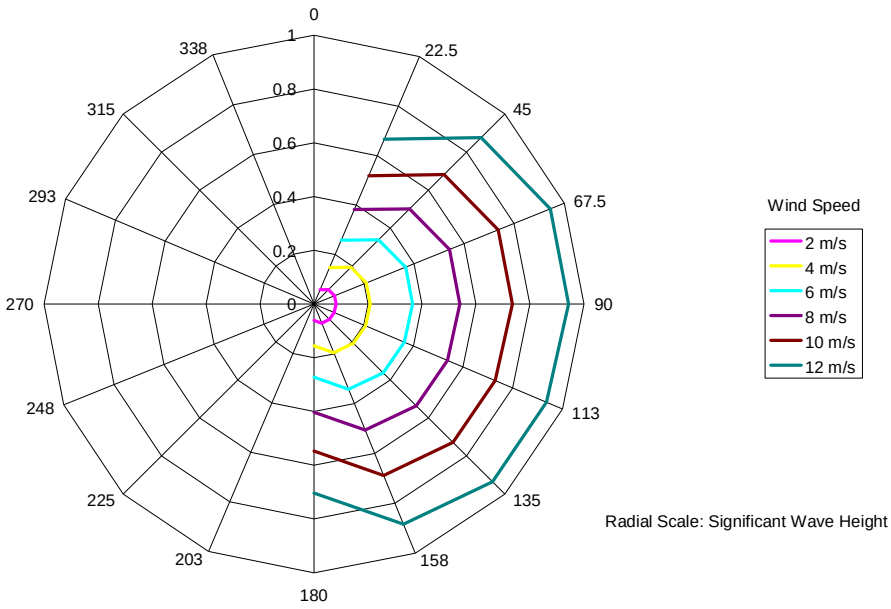
For the purposes of this study it was assumed that an acceptable wave height at the ramp during launching and retrieving of boats was 200 mm or less. This is a subjective assessment and some boat owners will be able to cope safely in conditions where the waves are bigger than 200 mm. This figure has been adopted as a height that will accommodate the majority of users.

The wind climate described in section 2.2.1 was used to develop an offshore wave climate using hindcasting techniques, refer Figure 7. For this project, hindcast of wave conditions has been undertaken using WAVEGEN, an in-house programme which has proven to be a robust tool for preliminary design.

For the purposes of preliminary design, wave conditions have been assessed at a single data point.

Offshore waves estimated by WAVEGEN were then brought into shallow water allowing for shoaling and refraction using techniques outlined in GODA, 2000 and Sorensen, 2006.

Figure 7 Offshore Wave Climate



The outcome of this analysis showed that wind speeds above approximately 4 m/s (8 knots) (from the easterly sector) produced wave heights above 200 mm at the ramp. Analysis of the wind data revealed that wind speeds from directions capable of producing waves bigger than 200 mm occurred 45% of the time. Therefore wind conditions that resulted in waves less than 200 mm at the ramp and consequently useable conditions, occurred for about 55% of the time.

4.1.3 Combined Wave and Tidal Constraints

The percentage of time that the ramp can be used because the tide is favourable is 46% and the percentage of time the ramp can be used when wind conditions are favourable is 55%. The combined effect of these constraints means that the ramp can be used for approximately 25% of the time. This is summarised in the table below.

Table 2 Current Combined Usage of the She-Oak Boat Ramp

% usage due to favourable tide	% usage due to favourable wind / waves	% usage due to combination of wind/waves AND tide
46%	55%	25% (55 % x 46 %)

Since tide and wind/waves are independent of each other the combined effect of the tidal constraint and the wave constraint are simply combined together to determine an overall percentage constraint. It is determined that boat users can safely use the ramp about 25% of the time.

5. Wave Calming Concepts

This section outlines the structures that were considered to provide protection at the boat ramp from waves generated by north-east winds.

5.1 Type of Wave Attenuator

Three types of wave attenuators were considered to protect the boat ramp from the north east waves; a rock breakwater, a piled wave screen and a floating structure.

5.1.1 Rock Breakwater

A rock breakwater would be formed by creating a structure from rocks on the foreshore to the north of the existing boat ramp. It would have a cross section shown in Figure 8 and would be built remote from the boat ramp.

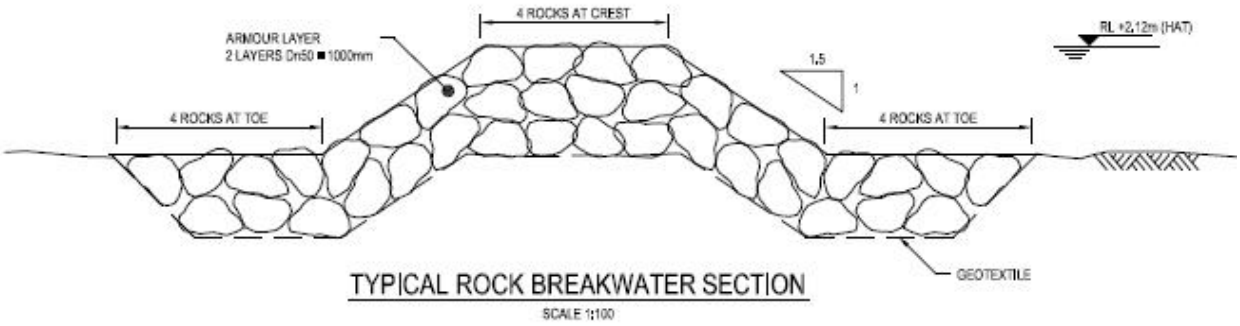


Figure 8 Cross Section of Breakwater

Figure 9 Typical Breakwater

5.1.2 Piled Wave Screen

The piled wave screen is a smaller structure and could be built either directly alongside the ramp or remote from the ramp. The screen that protects the boat ramp from the incident waves would be supported on piles and a typical cross section is shown in Figure 10.

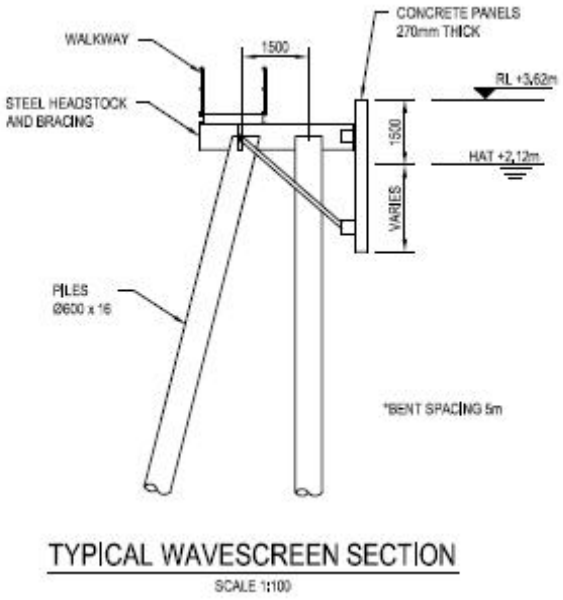


Figure 10 Cross Section of Typical Wave Screen

Figure 11 Photo of Typical Wave Screen

5.1.3 Floating Wave Attenuator

A floating wave attenuator is a pontoon that would be installed alongside the boat ramp and would rise and fall with the tide. A typical structure is shown in Figure 12.

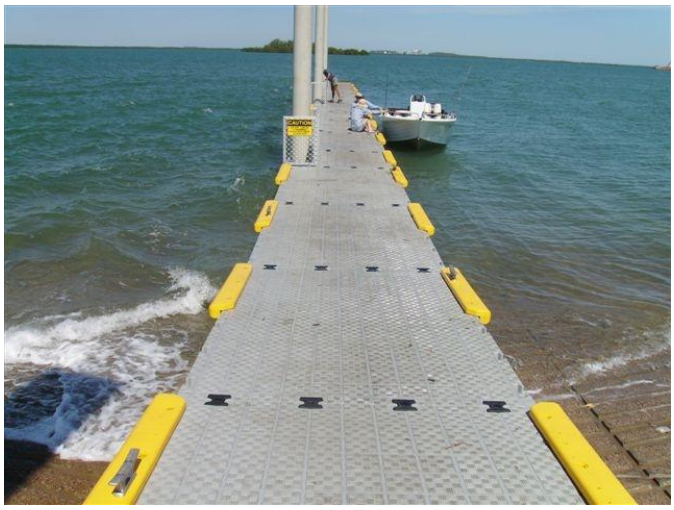


Figure 12 Floating Wave Attenuator

This type of structure would be less suited to being located on the open coast, especially in a cyclonic region. The pontoons would be subject to movement and would provide a lower level of protection compared to other options.

5.2 Location of Wave Calming Structures

The structures would either be directly adjacent to the boat ramp or situated some distance to the north of the ramp. If the attenuator is positioned adjacent to the boat ramp then a minimal structure length is required. However it is more likely to interfere with the longshore drift processes and cause a build up of sand in the vicinity of the boat ramp.

The further the attenuator is away from the boat ramp the longer the structure needs to be to provide a sufficient wave shadow at the boat ramp. However the interruption to longshore transport should also be considered when considering the location the wave attenuator.

If the wave attenuator is attached to the shoreline then longshore transport will be blocked and sand build up against the structure is inevitable. By detaching the wave attenuator from the shoreline offshore form the beach a sediment path is maintained and a proportion of the longshore sand transport is able to continue uninterrupted. This path does not need to be maintained for the full tide cycle however a sufficient passage needs to exist at least at high tide. In this case longshore transport will only be maintained at high tide meaning localised or seasonal sand build up is likely. For this reason a wave attenuator detached from the shoreline is recommended. Although locating the attenuator adjacent to the boat ramp is the most economic solution, the boat ramp would act as a connection to the shoreline and sand build up against the ramp is inevitable.

5.3 Alignment of the Wave Calming Structure

5.3.1 Remote Structure (Breakwater and Piled Wave Screen)

Generally the alignment of a wave attenuator protecting a structure is solely dependent on the direction of the incoming wave from which the structure needs protection. However in this case, another aspect governing the alignment is to minimise the interruption to littoral drift.

To minimise the effect on net littoral drift the wave attenuator should be aligned in the direction of the dominant wave direction causing the littoral drift. For Forrest Beach this is from the south east. Refining this alignment by incorporating wave refraction in the shallow water gives an alignment for the wave attenuator at 103^{o} from north. By aligning the wave attenuator to the dominant wave direction the attenuator will cause a minimal shadow and thus have a minimal effect on the adjacent beach for the dominant wave direction. Notwithstanding, any structure built on or near the beach will have some localised or seasonal effects on the beach.

An alignment of 103^{o} will provide a wave shadow that is close to the maximum given its alignment is nearly 60 degrees from the north east waves.

5.3.2 Adjacent Structure (Piled Wave Screen and Floating Structure)

Any structure built adjacent to the boat ramp would follow the alignment of the boat ramp and therefore will not be optimised to minimise interruption to the littoral drift, which will lead to long term erosion problems on the beach north of the site and regular build up of sand on the ramp.

5.4 Length of Wave Calming Structure

The extent of the wave attenuator is dependent on the length required to provide a sufficient wave shadow to reduced wave heights at the boat ramp.

The length of the wave attenuator was determined using diffraction diagrams detailed in Goda, 1985. Protection of the boat ramp is required for the range of tide where the boat ramp is accessible (Mean High Water Neaps to Highest Astronomical Tide). The other variable determining the length of the attenuator is the height of waves which need to be protected. Waves generated from both the 8 m/s (~15 knot) and 12 m/s (~25 knot) wind speeds were used to calculate the length of attenuator required.

5.5 Developed Concepts

Based on the constraints detailed in the previous sections Table 3 provides a summary of the developed options. Drawings in Appendix B depict the details of each option.

Table 3 Concept Options

Type of Structure	Location of Structure	Length of Structure	Reference Sketches in Appendix B
Floating Breakwater	Adjacent to boat ramp	35 m: Protection provided in conditions up to 25 knots	
Piled Wave Screen	Adjacent to boat ramp	35 m: Protection provided in conditions up to 25 knots	Sketch 1
	Remote from boat ramp	45 m: Protection provided in conditions up to 15 knots	Sketch 2
	Remote from boat ramp	75 m: Protection provided in conditions up to 25 knots	Sketch 3
Rock Revetment	Remote from boat ramp	55 m: Protection provided in conditions up to 15 knots	Sketch 4
	Remote from boat ramp	85 m: Protection provided in conditions up to 25 knots	Sketch 5

6. Increased Amenity

6.1.1 Tide

The addition of a wave calming structure would not change the tidal constraints of the boat ramp and therefore the boat ramp would continue to have a depth of water at the toe of at least 500 mm for 46 % of the time.

6.1.2 Wind / Waves

The wave calming structures would increase the time the wave climate at the boat ramp is at an acceptable level. The developed concepts provide protection in winds up to 15 knots or 25 knots from the NE and the percentage of time that winds less than these limits occurs is 63% and 65% respectively.

6.1.3 Combined Wave and Tidal Constraints

The percentage of time that the ramp can be used because the tide is favourable is 46% and the percentage of time the ramp can be used when wind conditions are favourable is 63% (up to 15 knot winds) or 65% (up to 25 knot winds). The combined effect of these constraints means that the ramp usage is 29% (15 Knot wind) or 30% (25 knot wind). This is summarised in the table below.

Table 4 Increased Usage of the She-Oak Boat Ramp due to Wave Calming Device

Wind Speed	% usage due to favourable tide	% usage due to favourable wind / waves	% usage due to combination of wind/waves AND tide
15 knot	46%	63%	29% (63 % x 46 %)
25 Knot	46%	65%	30% (65 % x 46 %)

The existing boat ramp usage was estimated to be 25% (refer Section 4.1) and therefore by installing a wave calming structure the usage of the ramp will only increase by 4 or 5 %.

7. Costs

The wave calming structures adjacent to the boat ramp have not been costed since it is considered that they would interrupt the coastal processes and the result would be a build up of sand adjacent to the ramp and possible loss of the amenity and erosion of the beach to the north.

The concept costs developed in this report exclude GST and are for comparison purposes only. The following allowances are included:

- 20% for preliminaries and contractors overhead's and profit;
- 20% contingency.

The concept costs for the structures are set out in Table 5.

Table 5 Concept Cost Estimates

Structure	Length (m)	% usage	Cost / m	Cost
Breakwater (15 knt)	55	29%	$14,500	$800,000
Breakwater (25 knt)	85	30%	$14,500	$1,200,000
Wave Screen (15 knt)	45	29%	$33,000	$1,500,000
Wave Screen (25 knt)	75	30%	$33,000	$2,500,000

7.1 Notes on Budget Costs

Although the budget rates used are deemed to be adequate for the purposes of comparison, GHD has no control over the cost of labour, equipment or services furnished by others, neither has it control over contractors' methods for determining prices, competitive bidding or market conditions. The opinion of probable construction cost produced by GHD has been made on the basis of judgement as an experienced engineering consultant familiar with the construction industry. As GHD is not a Quantity Surveyor, nor does it employ quantity surveyors, GHD cannot and will not guarantee that any tenders or actual construction costs will not vary from this opinion of construction cost.

8. Environmental Approval Requirements

The statutory provisions that apply to works below HWM at Forrest Beach are:

- Prescribed Tidal Works Development Application (DA) under Sustainable Planning Act (SPA). Assessment Manager Hinchinbrook Shire Council (Council). Concurrence Agencies: DERM, DPI (DEEDI) and MSQ (Harbour Master;
- DERM will assess against the policies in the State Coastal Management Plan and the Cardwell-Hinchinbrook Regional Coastal Management Plan; and
- Marine Parks Permit for works in the GBRMP.

GHD confirmed with DERM (Townsville office) that the following coastal approval requirements for a structure at Forrest Beach was correct and relevant:

- There is no prohibition on structures in the coastal zone;
- Any proposal would need to satisfy the policies of the State Coastal Management Plan which in this case would consist of:
  - Describing the coastal processes at the site;
  - Demonstrating the effect of the proposal on coastal processes;
  - Describe how the effects on the adjacent coastline would be mitigated; or
  - Demonstrate that the effects are not significant and will not adversely affect the coastal environment.
- The area is in the Great Barrier Reef Marine Park - Townsville Whitsunday Management Area as shown on MPZ8 Townsville zoning map;
- The zone at Forrest Beach is "General Use" and a Marine Parks Permit for construction of the works will be required (a Construction Environmental Management Plan would also be required as part of the permit);
- The area seaward of Forrest Beach is not in a Fish Habitat Area (FHA), however the Palm Creek FHA northern boundary is at the southern boundary of Forrest Beach township at Rosewood Street;
- A prescribed tidal works development approval under SPA will be required for the works. This will be prescribed tidal works with:
  - Assessment Manager: Hinchinbrook Shire Council (HSC) (unless it is deemed to be public marine facility constructed by or for QT, in which case the Assessment Manager is DERM)
  - Concurrence Agencies: DERM - coastal policies in State Coastal Management Plan, DPI (DEEDI) - damage / destruction of marine plants (if present), MSQ - maritime safety
  - Referral Agency; DPI (DEEDI) - works in vicinity of Fish Habitat Area

9. Summary and Recommendation

9.1 Structures

9.1.1 Floating Structure

The floating structure would need to be directly along side the boat ramp and would therefore interrupt the longshore drift. This could result in the build up of sand adjacent to the ramp and the consequent reduction in the use of the boat ramp. This type of structure is not suited to the open coast, especially in a cyclonic area. Furthermore the movement of the individual pontoons under wave loading may reduce the implied safety aspects. For these reasons this type of breakwater was discounted from further analysis.

9.1.2 Rock Breakwater

The rock breakwater would be a large structure built on the sand above low water. Although it would be aligned to minimise interruption to the longshore transport, the width of the structure would increase the risk that sand would not bypass the structure completely and would build up between the structure and the shore. This would then create a blockage and the whole structure would then act as a groyne.

It would not be ideal as a community amenity structure as the concept design proposes that the crest is slightly above the high tide level.

The rock breakwater is the cheaper option with indicative costs of approximately $14,500 / m.

9.1.3 Piled Wave Screen Structure

The piled wave screen is the most expensive option but has the smallest footprint. It is the least likely to interrupt the sand movement and therefore the usage of the boat ramp should not be affected and the potential for erosion of the beach to the north of the ramp is minimised. It could be designed to incorporate a walkway or similar along the tops of the piles and so would have the higher community amenity value.

9.2 Length of the Structure

The protection that is gained at the breakwater is a function of the length of the wave calming structure. Two scenarios were considered. The first scenario provided protection in winds up to 15 knots and the second scenario provided protection in winds up to 25 knots. The calculated resulting usage for each of these two scenarios was 29% and 30% respectively.

9.3 Recommended Wave Calming Structure

The recommended wave attenuator to protect the Forrest Beach boat ramp is the 45 m piled wave screen. The 45 m wave screen provides protection in conditions up to 15 knots and is a relatively less obtrusive option. Providing protection against conditions up to 15 knots gives protection during the majority of north east winds while minimising the length of the attenuator and therefore the cost. Longshore transport should be maintained under most conditions. However there will be times when sand build up is inevitable but the distance between the structure and the boat ramp should provide enough insurance such that maintenance work is not required.

10. Alternative Considerations

During the study process it became apparent that the increase in amenity from constructing a wave calming structure only would not increase the amount of usage at the boat ramp by a significant amount. This was because the main factor determining the usage was the tide which restricted usage to less than half of the available time. Therefore an additional alternative was considered and presented to the second Community Consultation meeting.

10.1 Increase the Length of the Boat Ramp

Tidal restrictions at the boat ramp mean that the boat ramp can only be used 46% of the time and combining this percentage with calm conditions gives a total usability of the ramp of 25%. As stated in Section 2.2.1 the dominant wind direction at Forrest Beach is from the south east, therefore providing protection from only the north east waves can only improve amenity marginally. Alternatively, the amenity of the boat ramp can be increased significantly by providing better tidal access. It is therefore proposed that an alternative to provide increased useability is to build a longer ramp to allow use over a wider range of tide levels.

In the second public consultation meeting with the residents of Forrest Beach held on 30 September 2009, the boat ramp extension was discussed and it was agreed that this option would give the best overall increase in useability. However the residents decided that a wave calming structure would still be needed in order to provide safe conditions to launch and retrieve their boats during north easterly waves.

A ramp length optimisation analysis was completed which compared ramp length and construction cost of the boat ramp with the increased useability of the ramp. This analysis showed that a linear (approx) relationship exists between the ramp length and the useability of the ramp, meaning that an optimised ramp length cannot be found as it is in direct proportion with the potential utilisation of the ramp. Therefore the length of the boat ramp should be determined based on council/public requirements as well as budget constraints.

For this study a nominal ramp extension of 35 m has been used, to give a median result. With the ramp extended by 35m, a 68m wave calming structure will need to be constructed to provide protection against north eastern waves in conditions up to 15 knots, refer Sketch 6 in Appendix B.

By combining the increased usability provided by the ramp extension and protection against north eastern waves the total potential useability of the ramp increases by approximately 20%, giving a total useability of 50%.

Table 6 Current Combined Usage of Extended Ramp

Wind Speed	% usage due to favourable tide	% usage due to favourable wind / waves	% usage due to combination of wind/waves AND tide
15 knot	79%	63%	50% (63% x 79%)

10.1.1 Concept Cost Estimate

The concept costs developed in this report exclude GST are for comparison purposes only. They include the following allowances:

- 20% of Construction Cost for preliminaries and contractors overhead's and profit;
- 20% of Construction Cost as contingency.

The concept costs for the structures are set out in Table 7.

Table 7 Concept Cost Estimate – Boat Ramp Replacement with Longer Ramp

Structure	Length (m)	Cost / m	Cost
Breakwater (15 knt)	67	$14,500	$970,000
Wave Screen (15 knt)	67	$33,000	$2,300,000
Extend boat ramp (including demolishing existing ramp)	75	$20,000	$1,500,000
Total (New Ramp plus Breakwater)			$2,470,000
Total (New Ramp plus Wavescreen)			$3,800,000

10.2 Keep Existing Ramp and Install New 2 Lane Boat Ramp

At the third community consultation meeting it was recognised that the cost of the ramp lengthening may be difficult for the Council / State Government to justify based on the current restricted usage of the ramp. However if both the useability and the capacity of the ramp could be increased then potential boat owners from Dungeness and the Palm Islands could be approached to support the ramp and provide the necessary justification for additional funding.

To provide additional capacity a 2 lane boat ramp would be considered and some additional conceptual costing has been estimated. This ramp would be separate from the existing ramp and both could be used concurrently in favourable conditions.

Table 8 Concept Cost Estimate Additional Two Lane Ramp

Structure	Length (m)	Cost / m	Cost
Breakwater (15 knt)	67	$14,500	$970,000
Wave Screen (15 knt)	67	$33,000	$2,300,000
Build new boat ramp (2 Lane)	85	$28,250	$2,400,000
Total (New ramp plus Breakwater)			$3,370,000
Total (New ramp plus Wavescreen)			$4,700,000

10.3 Notes on Budget Costs

Although the budget rates used are deemed to be adequate for the purposes of comparison, GHD has no control over the cost of labour, equipment or services furnished by others, neither has it control over contractors' methods for determining prices, competitive bidding or market conditions. The opinion of probable construction cost produced by GHD has been made on the basis of judgement as an experienced engineering consultant familiar with the construction industry. As GHD is not a Quantity Surveyor, nor does it employ quantity surveyors, GHD cannot and will not guarantee that any tenders or actual construction costs will not vary from this opinion of construction cost.

11. Cassady Creek

There is an existing boat ramp at Cassady Creek. This boat ramp is tidally restricted, both at the ramp and at the entrance to the creek. A hydrographic survey was commissioned to survey the creek mouth and this survey is included as Appendix A.

Figure 13 Cassady Creek

Figure 14 Cassady Creek Boat Ramp

The boat ramp was excluded from the study at the first Community Consultation Meeting because the tidal restrictions at the mouth could not be easily improved without dredging. Therefore it was recognised that there was limited scope to increase the amenity of this boat ramp.

12. References

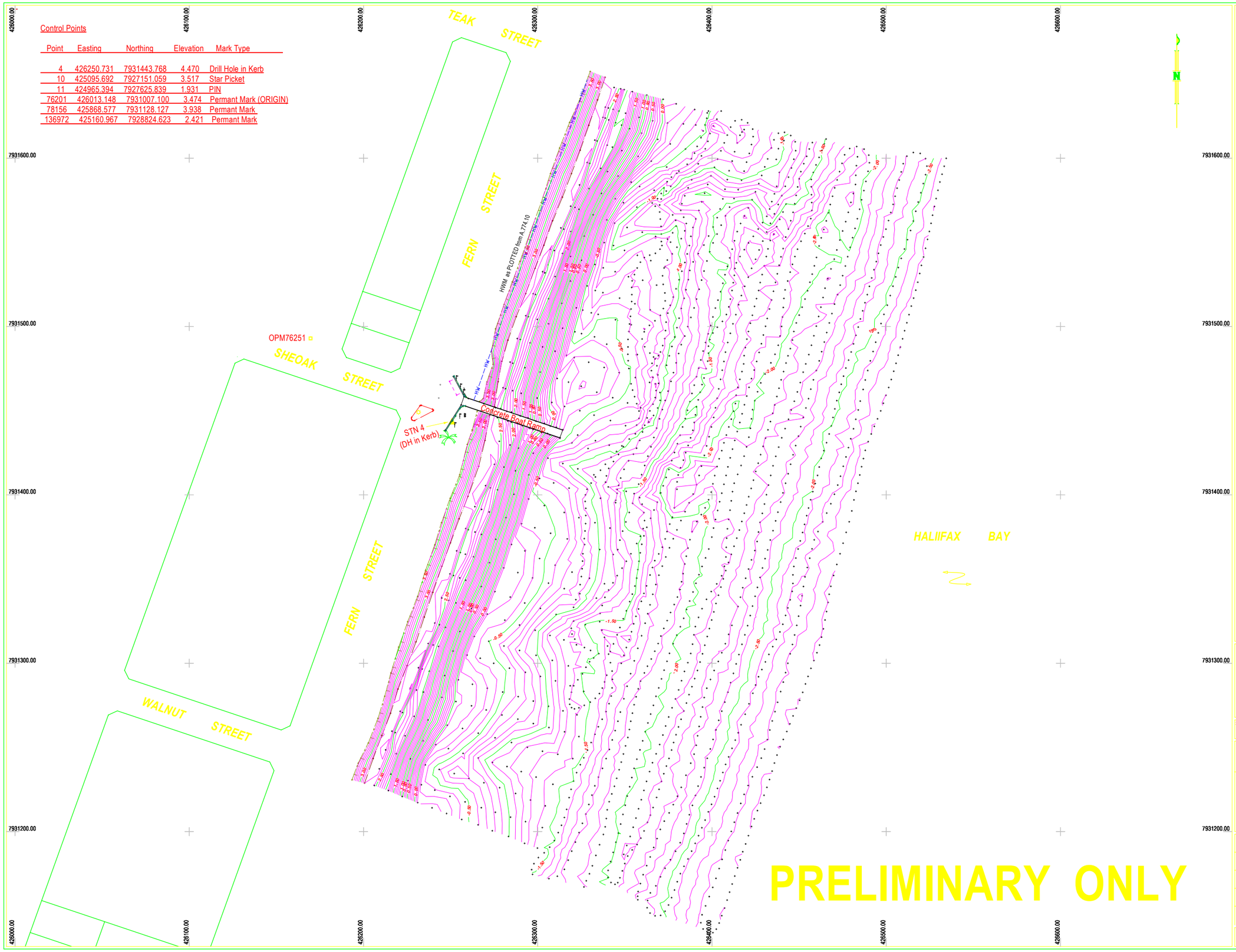
- "Basic Coastal Engineering", Robert M. Sorensen, 3rd edition, 2006, Springer Science.
- "Coastal Engineering Manual – Part 3", US Army Corps of Engineers, 2002.
- "Hinchinbrook Shoreline Erosion Management Plan", BMT WBM, 2009.
- "Random Seas and Design of Maritime Structures", Y.Goda, 2000, World Scientific.
- "Random Seas and Design of Maritime Structures", Y.Goda, 1985, University of Tokyo Press.
- Queensland Tide Table 2010, Maritime Safety Queensland, 2010.

Appendix A

Bathymetric Surveys

Control Points

Point	Easting	Northing	Elevation	Mark Type
4	426250.731	7931443.768	4.470	Drill Hole in Kerb
10	425095.692	7927151.059	3.517	Star Picket
11	424965.394	7927625.839	1.931	PIN
76201	426013.148	7931007.100	3.474	Permant Mark (ORIGIN)
78156	425868.577	7931128.127	3.938	Permant Mark
136972	425160.967	7928824.623	2.421	Permant Mark



IMPORTANT NOTE

1. This plan was prepared for the sole purposes of the client for the specific purpose of producing a detail plan. This plan is strictly limited to the Purpose and does not apply directly or indirectly and will not be used for any other application, purpose, use or matter. The plan is presented without the assumption of a duty of care to any other person (other than the Client) ("Third Party") and may not be relied on by Third Party.

2. Conics will not be liable (in negligence or otherwise) for any direct or indirect loss, damage, liability or claim arising out of or incidental to:
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b. Conics relying on information provided to it by the Client or a Third Party where the information is incorrect, incomplete, inaccurate, out-of-date or unreasonable;
c. any inaccuracies or other faults with information or data sourced from a Third Party;
d. Conics relying on surface indicators that are incorrect or inaccurate;
e. the Client or any Third Party not verifying information in this plan where recommended by Conics;
f. lodgement of this plan with any local authority against the recommendation of Conics;
g. the accuracy, reliability, suitability or completeness of any approximations or estimates made or referred to by C&B in this plan.

3. Without limiting paragraph 1 or 2 above, this plan may not be copied, distributed, or reproduced by any process unless this note is clearly displayed on the plan.

4. The title boundaries as shown hereon were not marked at the time of survey and have been determined by plan dimensions only and not by field survey. If not able to be so located, services have been plotted from the records of relevant authorities where available and have been noted accordingly on this plan. Where such records either do not exist or are inadequate a notation has been made hereon.

5. Prior to any demolition, excavation or construction on the site, the relevant authority should be contacted for possible location of further underground services and detailed locations of all services.

NOTES

Level Datum: AHD
Origin of Levels: OPM 76201
RL: 3.474 AHD "D"
Contour Interval: 0.1m
Index: 0.5m

Origin of Coordinates: OPM76201 (2nd Order)
East: 426013.148
North: 7931007.100

Meridian: GDA 94 (Zone 55) Vide GNSS

Ground Scale factor: 1.0003423499

0 10 20 30 40 50
metres

SCALE 1:1000 IS APPLICABLE ONLY TO THE ORIGINAL SHEET SIZE (A1).

CONICS
DESIGN : PLANNING : SURVEYING
ECONOMICS + ADVISORY

INNISFAIL OFFICE PO Box 59 INNISFAIL QLD 4860
Tel: (07) 4061 2211 Fax: (07) 4061 4631
innisfail@conics.com.au www.conics.com.au

GHD Pty. Ltd
(Hinchinbrook Regional Council)

TITLE
Plan of Details & Contours
Forrest Beach Boat Ramp
She Oak Street / Fern Street
Forrest Beach

PROJECT MANAGER/SURVEYOR: PETER STENZEL	DESIGNED	
CHECKED	SURVEYED: PHS 19-25/8/09	
DRAWN: PHS 27/8/09	FIELD BK.	LEVEL DATUM: AHD
DRAFTING CHECKED	SHEET SIZE: A1	SHEET OF SHEETS: 1 OF 1
CAD: 5090900_Overall Merged Files.ccx	SCALE: 1:1000	
AMENDED	ISSUE	DRAWING NO.: 50909-1

IMPORTANT NOTE

1. This plan was prepared for the sole purposes of the client for the specific purpose of producing a detail plan. This plan is strictly limited to the Purpose and does not apply directly or indirectly and will not be used for any other application, purpose, use or matter. This plan is presented without the assumption of a duty of care to any other person (other than the Client) ("Third Party") and may not be relied on by Third Party.

2. Conics will not be liable (in negligence or otherwise) for any direct or indirect loss, damage, liability or claim arising out of or incidental to:
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c. any inaccuracies or other faults with information or data sourced from a Third Party;
d. Conics relying on surface indicators that are incorrect or inaccurate;
e. the Client or any Third Party not verifying information in this plan where recommended by Conics;
f. lodgement of this plan with any local authority against the recommendation of Conics;
g. the accuracy, reliability, suitability or completeness of any approximations or estimates made or referred to by CAB in this plan.

3. Without limiting paragraph 1 or 2 above, this plan may not be copied, distributed, or reproduced by any process unless this note is clearly displayed on the plan.

4. The title boundaries as shown hereon were not marked at the time of survey and have been determined by plan dimensions only and not by field survey. If not able to be so located, services have been plotted from the records of relevant authorities where available and have been noted accordingly on this plan. Where such records either do not exist or are inadequate a notation has been made hereon.

5. Prior to any demolition, excavation or construction on the site, the relevant authority should be contacted for possible location of further underground services and detailed locations of all services.

NOTES

Level Datum: AHD
Origin of Levels: OPM76201
RL: 3.474 AHD "D"
Contour Interval: 0.1m
Index: 0.5m

Origin of Coordinates: OPM76201 (2nd Order)
East: 426013.148
North: 7931007.100

Meridian: GDA 94 (Zone 55) Vide GNSS

Ground Scale factor: 1.0003423499

HAT = AHD +2.116

LAT = AHD - 1.844

MHWS = AHD + 1.136

MLWS = AHD - 1.044

Class of Survey "D"

Survey Echo Sounder: The Hydrolite-TM
Frequency 200-kHz, Beam Width 9-degrees
Ping Rate: 6 Hz, Depth Accuracy 1cm/0.1% of Depth

Horizontal Tolerances: As per Scope of Works
Topographic Horizontal: +/-0.50m
Vertical: +/-0.10m
Features Hoizontal: +/-0.05m
Vertical: +/-0.05m
Derived Survey Depth Tolerance: 1cm/0.1% of Depth

0 25 50 75 100 125
metres

SCALE 1:2500 IS APPLICABLE ONLY
TO THE ORIGINAL SHEET SIZE (A1).
(1:2000 @ A3)

AMENDMENTS	
A: INIT: AMEND DESCRIPTION	
PROJECT MANAGER: PETER STENZEL	CHECKED:
SURVEYED: PHS 19-25/8/09	DRAFTING CHECKED:
DRAWN: PHS 9/8/2010	CAD REF: 5090900_Overall Merged Files.cxx
SHEET SIZE: A1	SHEET 1 OF SHEETS 1

RPS
RPS Australia East Pty Ltd
ACN 140 292 762
15 Ernest Street
PO Box 59
INNISFAIL QLD 4860
T +61 7 4061 2211
F +61 7 4061 4631
W rpsgroup.com.au

GHD Pty. Ltd
(Hinchinbrook Regional Council)

Plan of Details & Contours

Survey Area 2

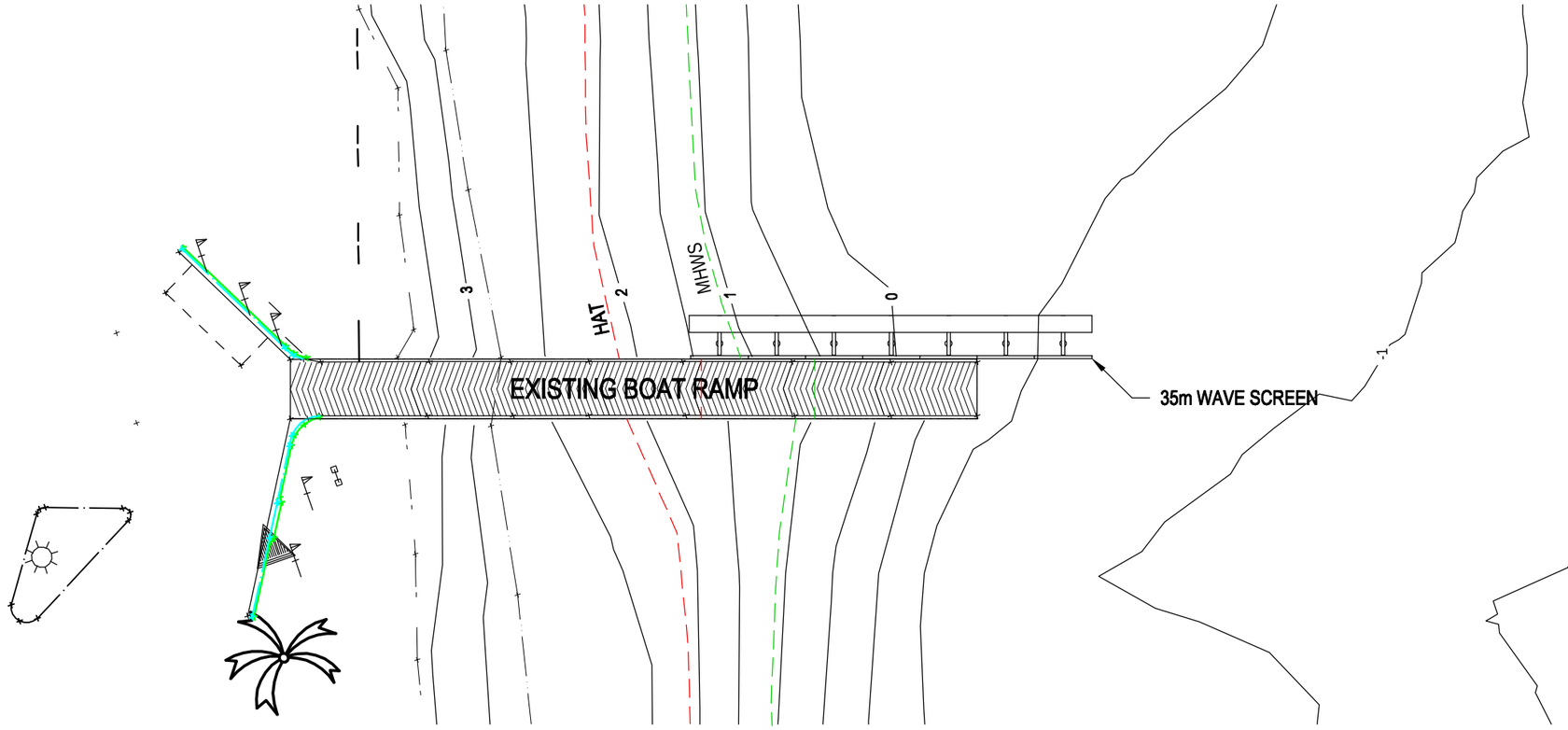
Cassady Creek

Forrest Beach

SCALE	DATE	DRAWING NO.	ISSUE
1:2500	9/8/2010	50909-2	

Appendix B

Figures



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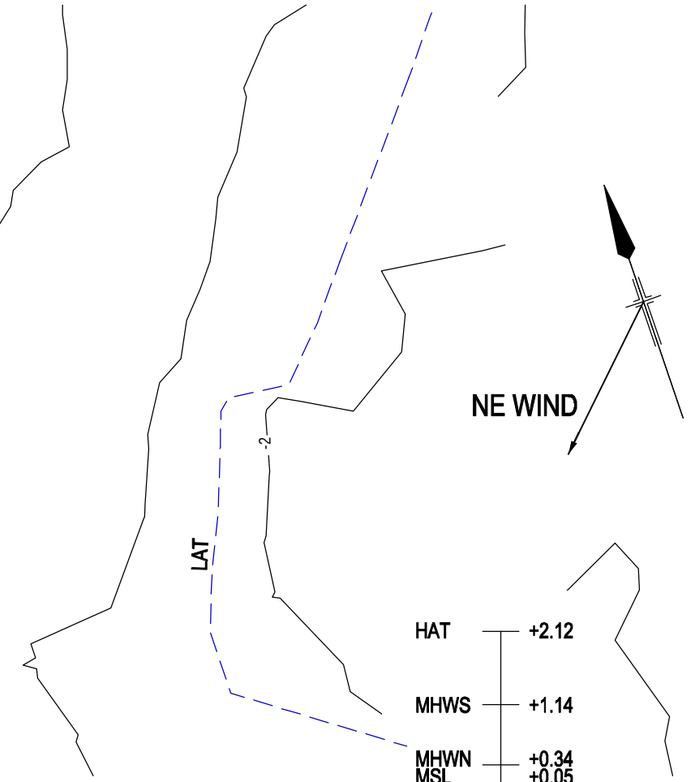
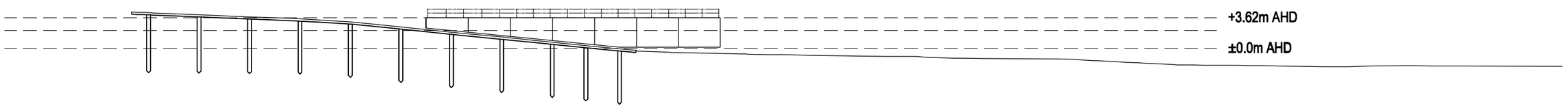


TIDAL PLANES LUCINDA (OFFSHORE)
(QUEENSLAND TIDE TABLES 2010)



ELEVATION
SCALE 1:500

NOTES:
1. LEVELS ARE IN METRES TO AUSTRALIAN HEIGHT DATUM.
2. PROTECTION PROVIDED IN CONDITIONS UP TO 25 KNOTS FROM NE.
3. BOAT RAMP USEABILITY 30%.

0 5 10 15 20 25m
SCALE 1:500 AT ORIGINAL SIZE

GHD
CLIENTS | PEOPLE | PERFORMANCE

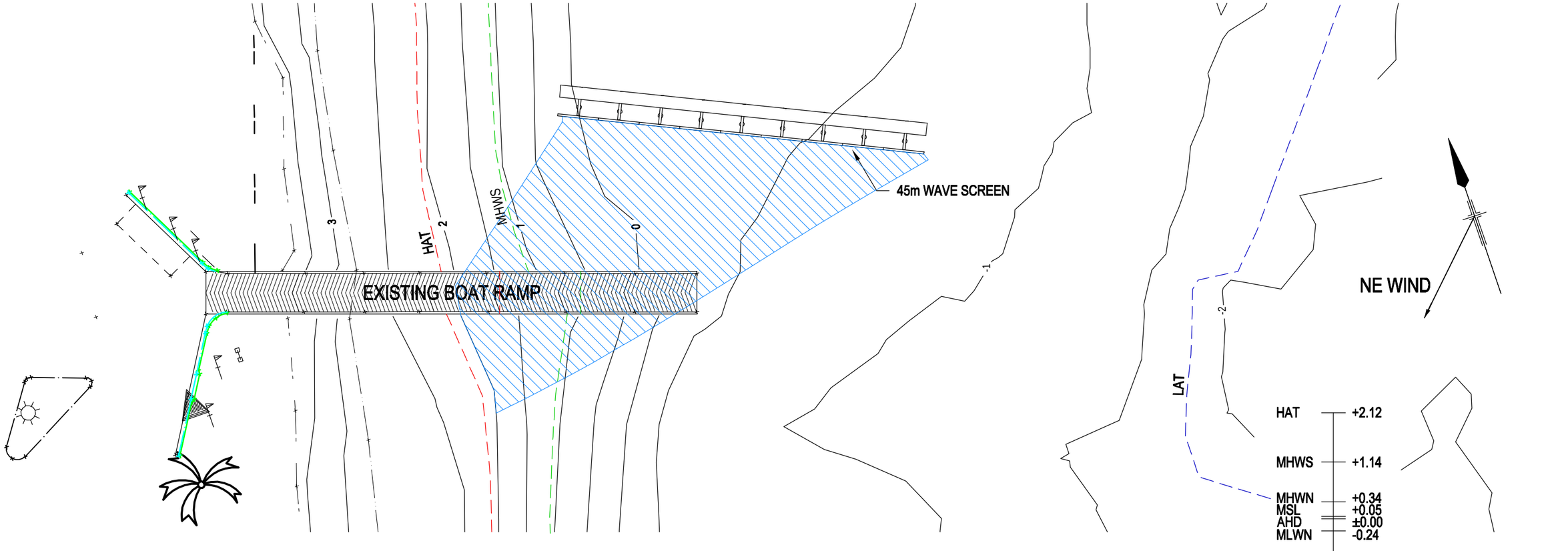
Hinchinbrook Shire Council
Forrest Beach Boat Ramp
RAMP PROTECTION CONCEPT
PARALLEL 35m WAVESCREEN
PLAN & ELEVATION

Job Number 41-21629
Revision B
Date july 10

Figure 01

Level 4, 201 Charlotte St Brisbane QLD 4000 Australia T 61 7 3316 3000 F 61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

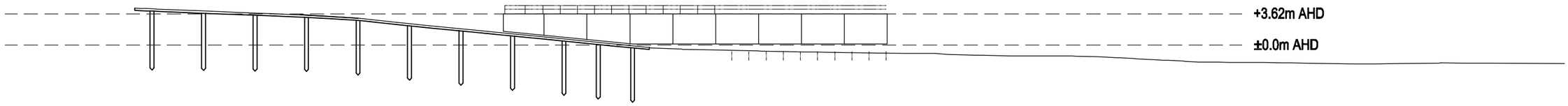
Plot Date: 12 July 2010 - 1:24 PM Plotted by: Liam Houghton/Brisbane/GHD/AU Cad File No: G:\41\21629\CADD\Drawings\41-21629-FIG05-10.dwg



HAT +2.12
MHWS +1.14
MHWN +0.34
MSL +0.05
AHD ±0.00
MLWN -0.24
MLWS -1.04
LAT -1.84

TIDAL PLANES LUCINDA (OFFSHORE)
(QUEENSLAND TIDE TABLES 2010)

PLAN
SCALE 1:500



ELEVATION
SCALE 1:500

LEGEND

WAVE SHADOW

NOTES:
1. LEVELS ARE IN METRES TO AUSTRALIAN HEIGHT DATUM.
2. PROTECTION PROVIDED IN CONDITIONS UP TO 15 KNOTS FROM NE.
3. BOAT RAMP USEABILITY: 29%.

0 5 10 15 20 25m

SCALE 1:500 AT ORIGINAL SIZE

GHD

CLIENTS | PEOPLE | PERFORMANCE

Hinchinbrook Shire Council
Forrest Beach Boat Ramp
RAMP PROTECTION CONCEPT
45m WAVESCREEN
PLAN & ELEVATION

Job Number 41-21629
Revision B
Date July 10

Figure 02

Level 4, 201 Charlotte St Brisbane QLD 4000 Australia T 61 7 3316 3000 F 61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

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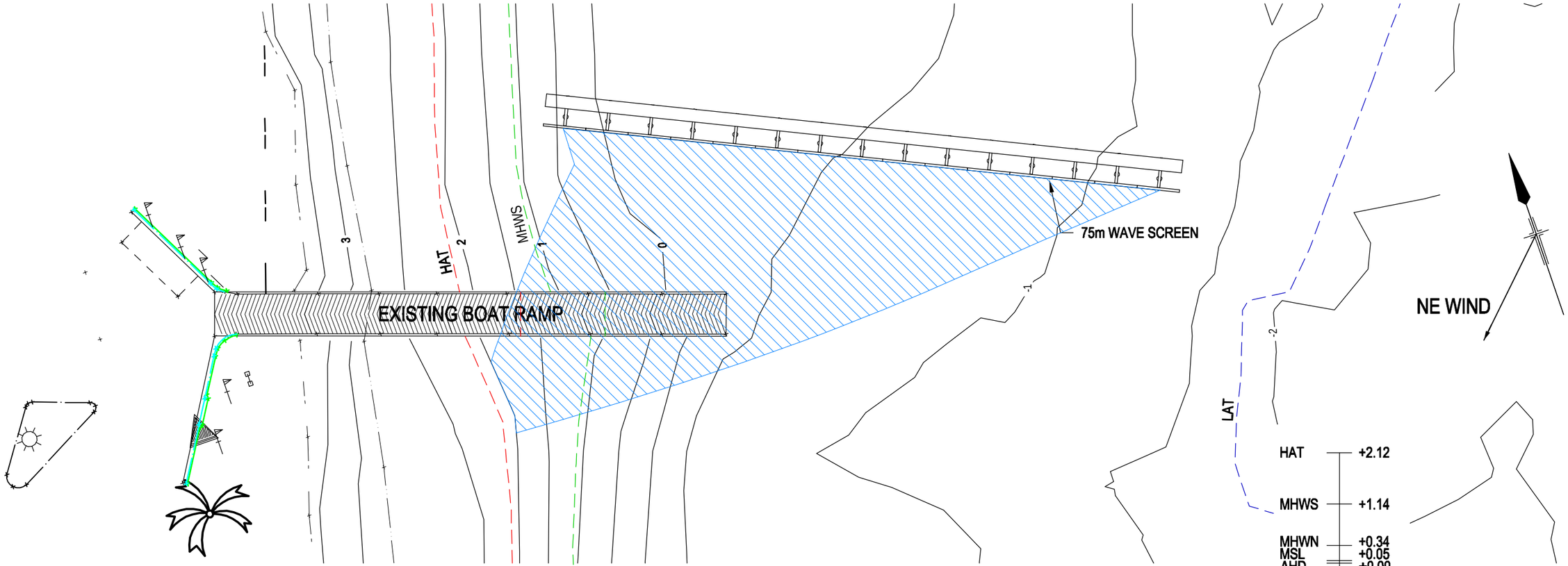

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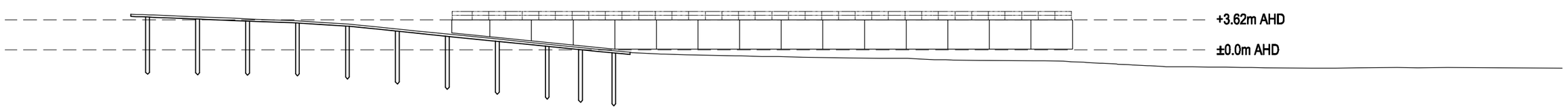

ELEVATION
SCALE 1:500

LEGEND

WAVE SHADOW

NOTES:
1. LEVELS ARE IN METRES TO AUSTRALIAN HEIGHT DATUM.
2. PROTECTION PROVIDED IN CONDITIONS UP TO 25 KNOTS FROM NE.
3. BOAT RAMP USEABILITY: 30%.

0 5 10 15 20 25m

SCALE 1:500 AT ORIGINAL SIZE

CLIENTS | PEOPLE | PERFORMANCE

Hinchinbrook Shire Council
Forrest Beach Boat Ramp
RAMP PROTECTION CONCEPT
75m WAVESCREEN
PLAN & ELEVATION

Job Number 41-21629
Revision B
Date July 10

Figure 03

Level 4, 201 Charlotte St Brisbane QLD 4000 Australia T 61 7 3316 3000 F 61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

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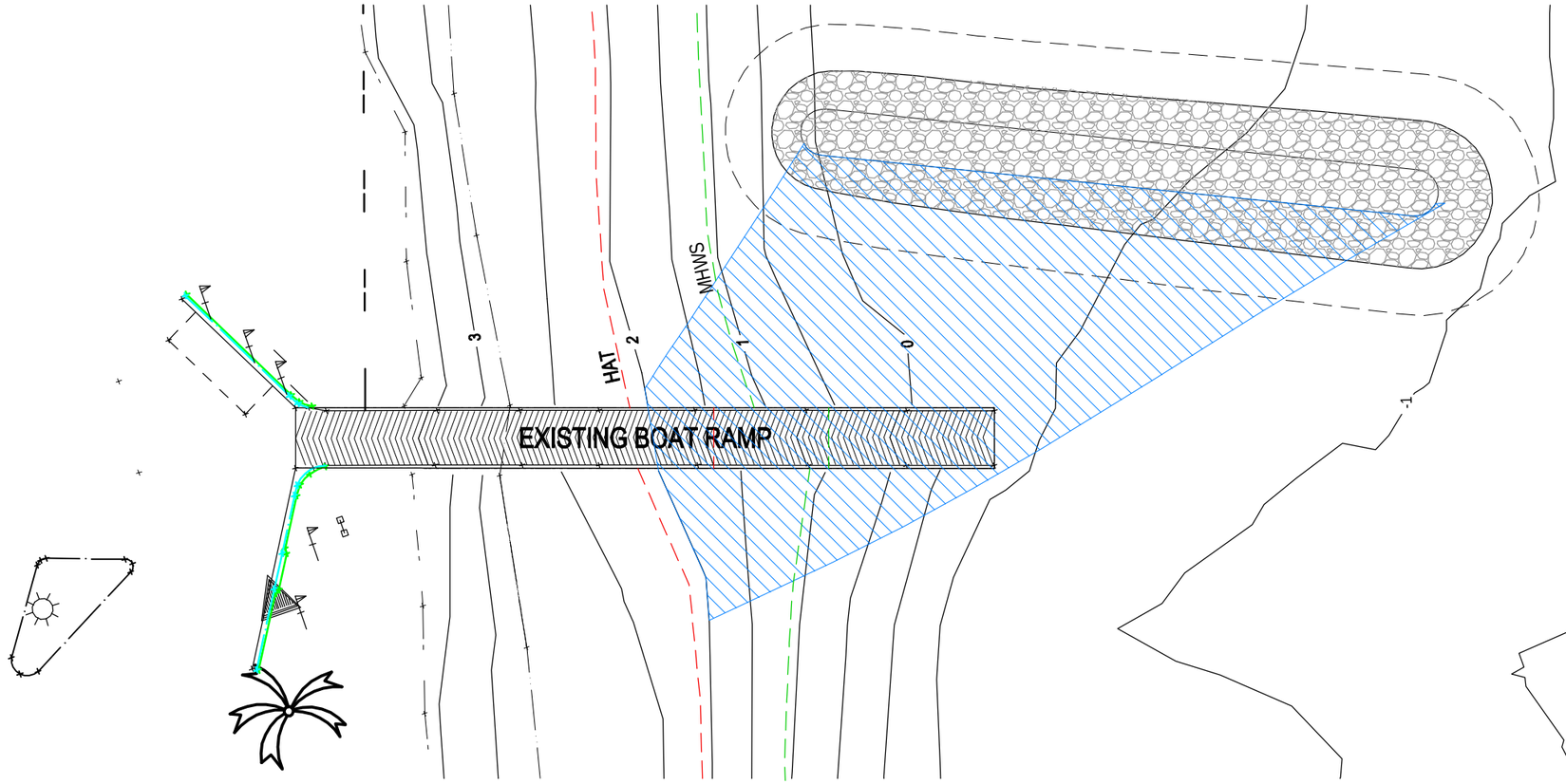

PLAN
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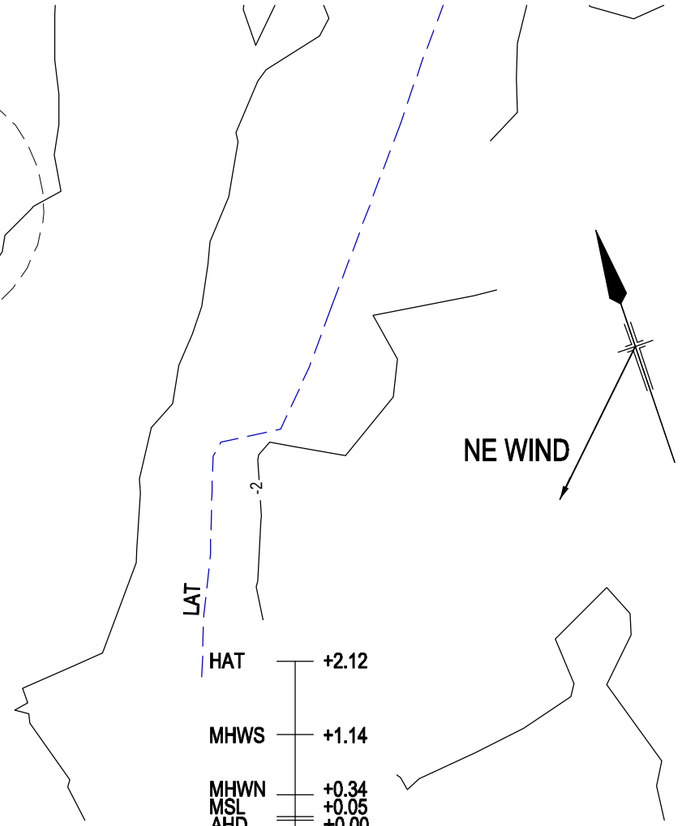
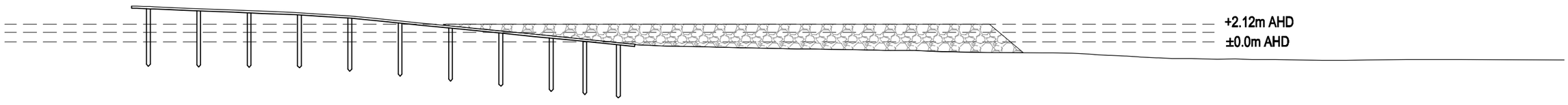


TIDAL PLANES LUCINDA (OFFSHORE)
(QUEENSLAND TIDE TABLES 2010)



ELEVATION
SCALE 1:500

LEGEND

WAVE SHADOW

NOTES:
1. LEVELS ARE IN METRES TO AUSTRALIAN HEIGHT DATUM.
2. PROTECTION PROVIDED IN CONDITIONS UP TO 15 KNOTS FROM NE.
3. BOAT RAMP USEABILITY: 29%.

0 5 10 15 20 25m
SCALE 1:500 AT ORIGINAL SIZE

GHD
CLIENTS | PEOPLE | PERFORMANCE

Hinchinbrook Shire Council
Forrest Beach Boat Ramp
RAMP PROTECTION CONCEPT
55m ROCK BREAKWATER
PLAN & ELEVATION

Job Number 41-21629
Revision B
Date July 10
Figure 04

Level 4, 201 Charlotte St Brisbane QLD 4000 Australia T 61 7 3316 3000 F 61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

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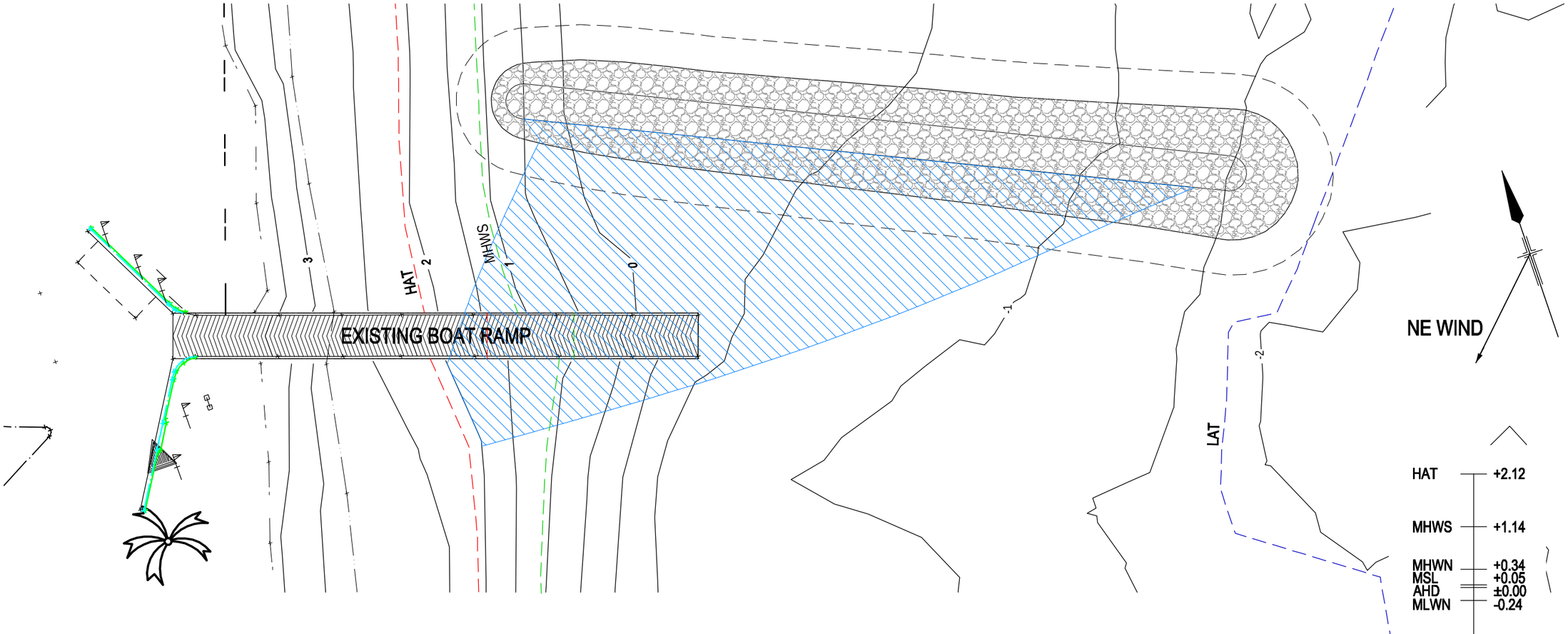
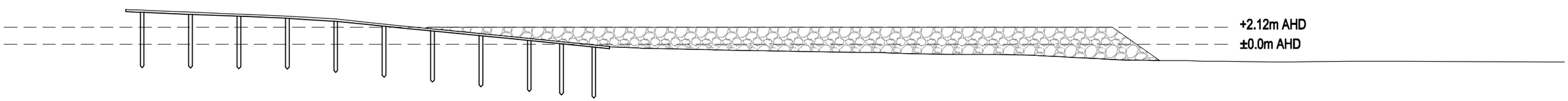


HAT +2.12
MHWS +1.14
MHWN +0.34
MSL +0.05
AHD ±0.00
MLWN -0.24
MLWS -1.04
LAT -1.84

TIDAL PLANES LUCINDA (OFFSHORE)
(QUEENSLAND TIDE TABLES 2010)

PLAN
SCALE 1:500



ELEVATION
SCALE 1:500

LEGEND

WAVE SHADOW

NOTES:
1. LEVELS ARE IN METRES TO AUSTRALIAN HEIGHT DATUM.
2. PROTECTION PROVIDED IN CONDITIONS UP TO 25 KNOTS FROM NE.
3. BOAT RAMP USEABILITY: 30%.

0 5 10 15 20 25m
SCALE 1:500 AT ORIGINAL SIZE

CLIENTS | PEOPLE | PERFORMANCE

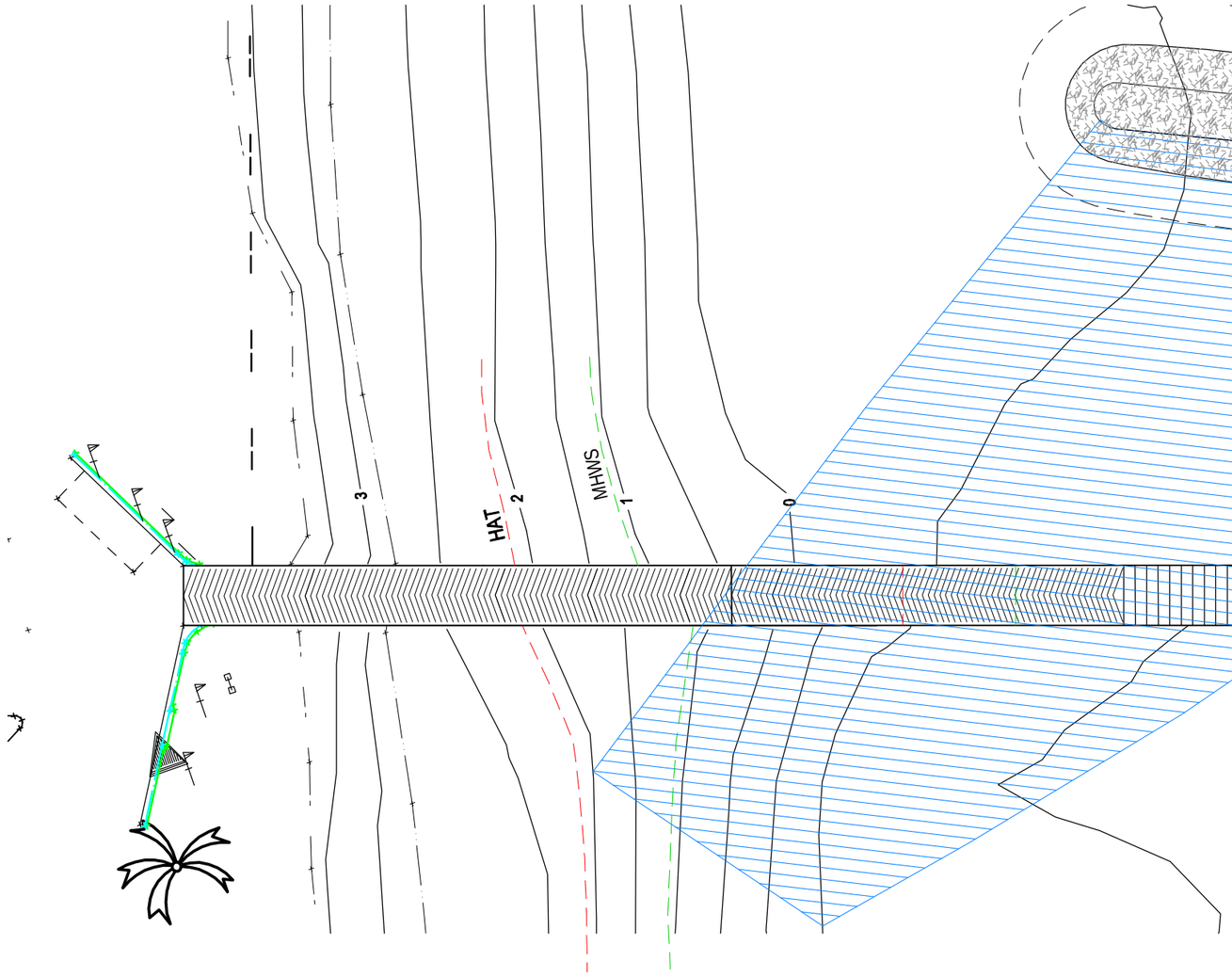
Hinchinbrook Shire Council
Forrest Beach Boat Ramp
RAMP PROTECTION CONCEPT
85m ROCK BREAKWATER
PLAN & ELEVATION

Job Number 41-21629
Revision B
Date July 10

Figure 05

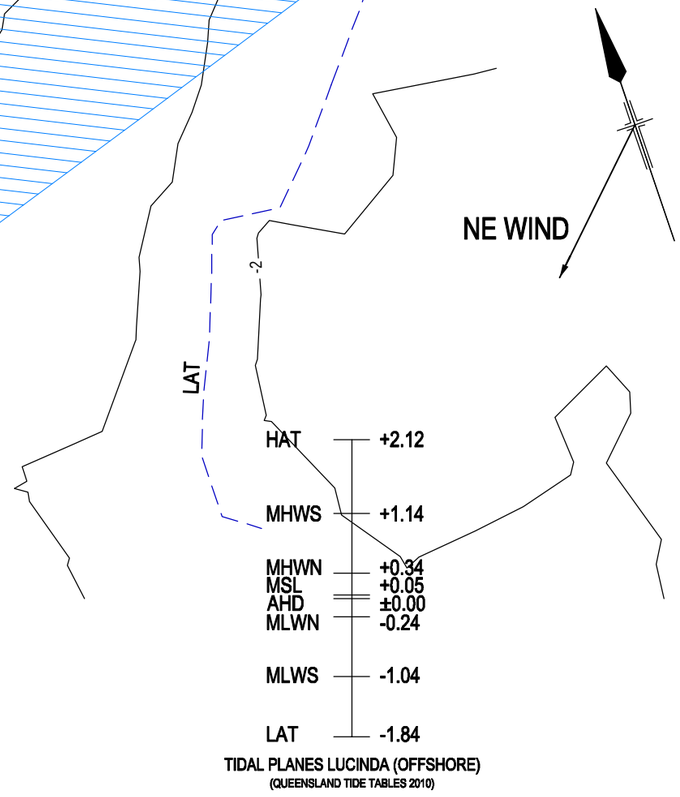
Level 4, 201 Charlotte St Brisbane QLD 4000 Australia T 61 7 3316 3000 F 61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Plot Date: 12 July 2010 - 2:22 PM Plotted by: Liam Houghton/Brisbane/GHD/AU Cad File No: G:\41\21629\CADD\Drawings\41-21629-FIG05-10.dwg

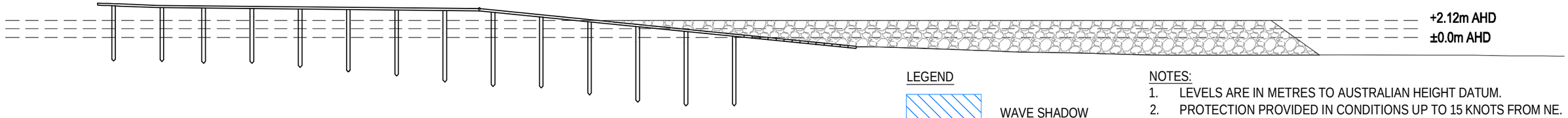


PLAN

SCALE 1:500



TIDAL PLANES LUCINDA (OFFSHORE)
(QUEENSLAND TIDE TABLES 2010)



LEGEND

WAVE SHADOW

NOTES:
1. LEVELS ARE IN METRES TO AUSTRALIAN HEIGHT DATUM.
2. PROTECTION PROVIDED IN CONDITIONS UP TO 15 KNOTS FROM NE.
3. BOAT RAMP USEABILITY: 29%.

0 5 10 15 20 25m

SCALE 1:500 AT ORIGINAL SIZE

GHD

CLIENTS | PEOPLE | PERFORMANCE

Hinchinbrook Shire Council
Forrest Beach Boat Ramp
RAMP PROTECTION CONCEPT
BOAT RAMP EXTENSION
PLAN & ELEVATION

Job Number 41-21629
Revision B
Date July 10

Figure 06

Level 4, 201 Charlotte St Brisbane QLD 4000 Australia T 61 7 3316 3000 F 61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

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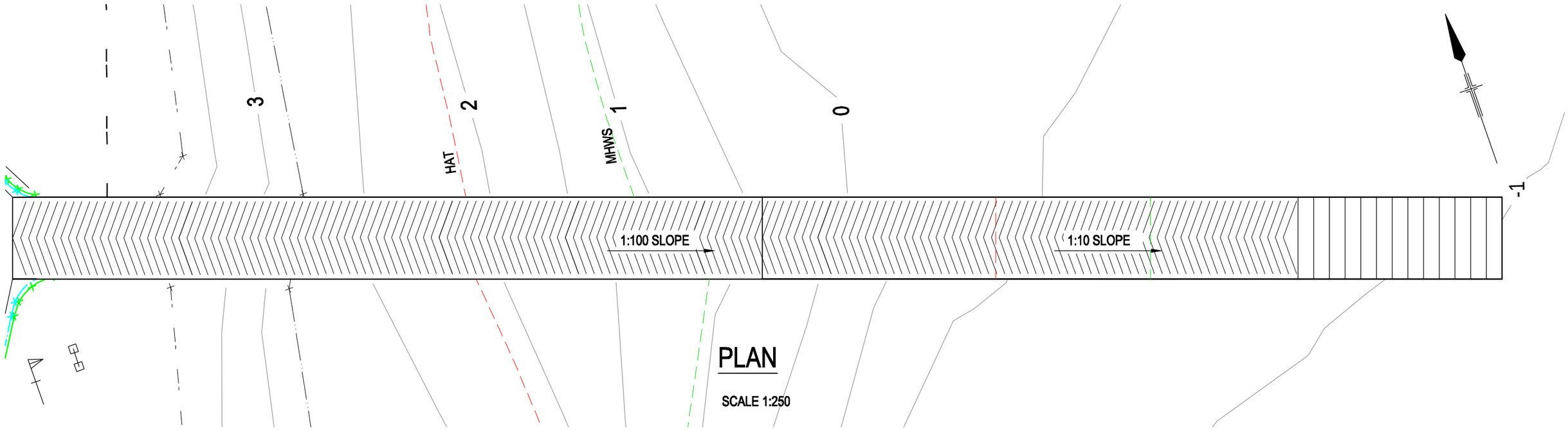
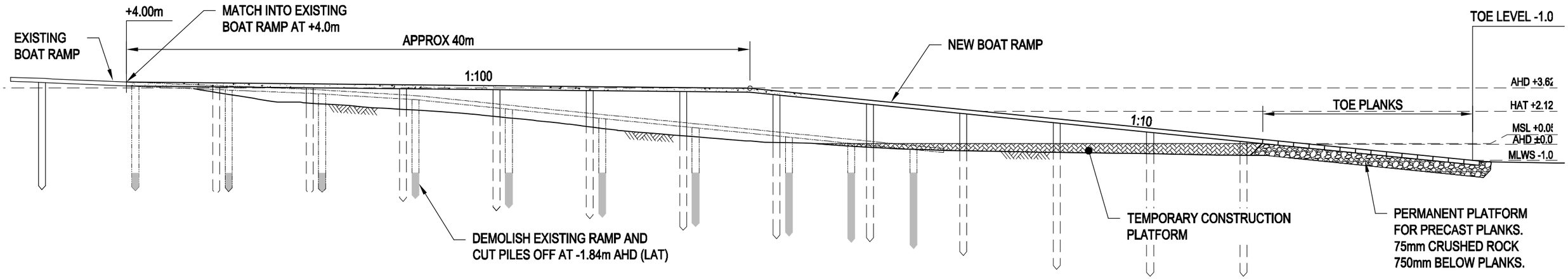


PLAN

SCALE 1:250



LONG SECTION

SCALE 1:250

NOTES:
1. LEVELS ARE IN METRES TO AUSTRALIAN HEIGHT DATUM.

0 2.5 5 7.5 10 12.5m

SCALE 1:250 AT ORIGINAL SIZE

CLIENTS | PEOPLE | PERFORMANCE

Hinchinbrook Shire Council
Forrest Beach Boat Ramp
RAMP PROTECTION CONCEPT

PROPOSED BOAT RAMP - EXTENSION

RAMP DETAILS

Job Number 41-21629
Revision B
Date July 10

Figure 07

Level 4, 201 Charlotte St Brisbane QLD 4000 Australia T 61 7 3316 3000 F 61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Plot Date: 12 July 2010 - 2:27 PM Plotted by: Liam Houghton/Brisbane/GHD/AU Cad File No: G:\41\21629\CADD\Drawings\41-21629-FIG11.dwg

GHD

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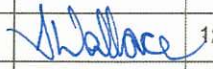
T: (07) 3316 3000 F: (07) 3316 3333 E: bnemail@ghd.com.au

Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
A	T Shield	D Miller				24.12.09
0	D Miller	P O'Keeffe		I Wallace		12.08.10