Twin Waters Lake Management Plan

2019 – 2029

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Contents

1 Introduction

This Lake Management Plan has been prepared by Sunshine Coast Council to promote effective long-term management of the Twin Waters Lake system. It is a 10 year plan that supersedes the original Lake Management Plan developed by Lend Lease in 2013.

1.1 Purpose

The purpose of the Lake Management Plan is to:

- outline the rights and responsibilities of the lake owners, residents and users;
- develop an appropriate inspection and maintenance schedule to meet objectives and performance standards;
- provide guidelines and management actions for ensuring compliance with secondary contact water quality guidelines;
- provide guidelines for acceptable use of the lake such as sport and recreation; and
- define permitted uses subject to approval such as commercial operations and private structures.

1.2 Objectives

The objectives of the Lake Management Plan are specified in Table 1 below.

Table 1: Management plan objectives

Objective	Performance standard	Refer
Public use complies with guidelines outlined in this management plan	• Public, residents and sporting bodies are informed of acceptable uses, their rights and responsibilities	Section 5
Water quality is maintained to a standard suitable for secondary contact recreation use[1]	• Compliance with water quality guidelines • Effective operation and maintenance of tidal exchange pipe, weir and stormwater infrastructure • Growth of undesirable marine organisms is absent or regulated	Section 6
Amenity and visual quality of the lake is of an acceptable standard	• The lake is free of litter and debris and/or removed in a timely manner • Growth of undesirable marine organisms is absent or regulated • Structures are designed and located suitably	Section 6 and 8
Lake assets are maintained in a structurally sound and safe condition	• Routine inspections and maintenance are undertaken in accordance with relevant schedules • Funding adequate to maintain assets	Section 8
The lake facilitates effective drainage of stormwater run-off	• Compliance with relevant design criteria • Maintain lake to acceptable tolerances from design profile • Effective operation and maintenance of tidal exchange pipe, weir, revetment walls and stormwater pipes	Section 8.2

[11] Secondary contact recreation is any activity where only the limbs are regularly wet, and swallowing water is unusual. Examples of secondary contact recreation are boating, fishing, rowing, kayaking, dragon boating, wading etc.

2 Background

2.1 Site overview

Twin Waters is a large residential development on the north shore of the Maroochy River which was developed by Lend Lease Development Pty Ltd in accordance with the relevant planning approvals granted by the Department of Natural Resources and Mines, Environmental Protection Agency and the former Maroochy Shire Council.

The development contributes 12% of the total 9.2km^2 catchment area, with surrounding land comprising a mixture of residential, industrial, agricultural, recreational, open space and bushland reserve.

The lake is an artificial waterway, approximately 40 ha in area and separated from the river by a constructed weir. The crest level of the trapezoidal weir is at 0.44m AHD and maintains tidal exchange through tidal overtopping and 2 x 1500mm open Reinforced Concrete Pipes (RCP's) underneath the weir. The lake was designed to be maintained in a brackish/semi-saline state with an average water level of RL 0.10m AHD, which is approximately 100mm above the adjacent river level.

The lake is defined as the area contained within the concrete revetment walls and beaches from the most upstream extent of property boundary 6SP147357 in the north to the weir structure in the south (lotplan 7RP807754). Figure 1 represents the Twin Waters Lake system and locality.

Stormwater drainage enters the lake from the adjoining land development through controlled outlet structures and pipes into the lake.

Public access is available at designated places along the lake banks, however vessels cannot navigate to Maroochy River from within the lake. Use of the lake system for recreational purposes is an additional benefit to the public and subject to guidelines outlined in this management plan.

Figure 1: Locality plan

2.2 Assets

The assets included in this management plan are specified in Table 2 below. Only assets managed and maintained by council are included.

Table 2: Lake assets

Assets	Description	Quantity
Weir and tidal exchange pipes	A constructed broad crested weir that controls the entry of tidal flows from Maroochy River. The weir was progressively constructed in association with stages of the adjacent residential development, with final completion of the lake in 2003. The weir was subsequently rebuilt in 2010. The weir crest is 10m long with a height of 0.44m AHD and maintains tidal exchange through tidal overtopping and 2 x 1500mm open Reinforced Concrete Pipes (RCP's) underneath the weir. It regulates inflows to achieve an average lake water level of RL 0.10m AHD. High tides up to RL 0.85m AHD (HAT) will over top the weir on approximately two hundred and seventy (270) occasions per year based on tidal predictions at the time of lake construction. Rock scour protection is provided on both upstream and downstream sides of the weir. The weir structure was designed to allow overtopping of the weir and scour protection, so as to maintain the health of adjacent mangroves in the Maroochy River and maintain a constant water level in the lake for general amenity.  	1

Assets	Description	Quantity
Weir walls	Protection of the flanks of the outlet channel were required to ensure its stability during major flood events. Infrastructure includes rock filled wire mattresses (i.e. rock gabion).  	170 m

Assets	Description	Quantity
Revetment walls	Lake edge abutting public land only - required to maintain the stability of the lake edge, whilst contributing to the aesthetics and usefulness of the lake. The top of the revetment wall is approximately RL 0.9m AHD (ranges from 0.8 – 1.1m AHD).  	Approx. 3,870 m

Assets	Description	Quantity
Rock scour	Rock scour provides protection to revetment walls and associated land assets. 	Approx. 185 m
Viewing platform	Platforms built partially over or adjacent to the water to faciliate lake viewing and enjoyment. 	1

Assets	Description	Quantity
Foot/cycle bridge	Bridges to facilitate access and connectivity  	3 (203 m)

Assets	Description	Quantity
Constructed beaches	Beach artificially created to facilitate enjoyment of the lake foreshore areas.  	3

Assets	Description	Quantity
Waterway access	Infrastructure facilitating access from public land to the water, e.g., stairs and ramps. There is 1 access to the lake for motor powered craft (council approval required), and 2 accesses for non-motor powered craft.  	3

Assets	Description	Quantity
Gross pollutant trap (GPT)	Gross pollutant traps (GPT's) are provided at most outlets from stormwater drainage systems to the lake. The GPT's provide primary treatment to all road runoff and secondary treatment to surface runoff.  	2

Assets	Description	Quantity
Stormwater drainage	Stormwater pipes draining directly into the lake includes 15 on the western side and 22 on the eastern side. There is also 1 large open drain on the western side extending from Gayome street, Pacific Paradise.  	38

Assets	Description	Quantity
Navigation aids	Aids to navigation are usually in the form of a channel marker, bouy or pile and may house a sign, light or beacon. One pile is located approximately 10m north of the weir to indicate a barrier to non-navigable areas:  A channel marker light is located either side of Lakeview Drive bridge: 	3

Assets	Description	Quantity
Signs	Public signage associated with lake use and safety.  	7

3 Land tenure and statutory requirements

3.1 History

The development of the Twin Waters residential estate adjacent to the Maroochy River was the subject of a Court ordered land rezoning in 1993 and subsequent rezoning deed between Maroochy Shire Council and the then Kabaskel Pty Ltd. The development was purchased by Lend Lease following the liquidation of Kabaskel and was developed in stages until completion in 2003.

The Twin Waters development consists of approximately 1,300 residential allotments on the north shore of the Maroochy River. The construction of Twin Waters involved the creation of a tidally restricted lake with a surface area of approximately 40 ha in accordance with an associated Environmental Management Plan 2003.

All adjoining reserves for park and environmental purposes have progressively been transferred to council since then.

3.2 Lake ownership details

Name: Sunshine Coast Regional Council

3.3 Lake owner's responsibilities

As owner, council is responsible for ensuring that the lake system and its infrastructure:

- is maintained to a safe and reasonable standard to the best of council's ability;
- provides adequate amenity for residents and general public; and
- facilitates effective drainage of stormwater run-off.

Facilitating water-based recreational use is not a responsibility of council, however guidelines are provided in this plan to allow for this additional community benefit of the lake (refer section 5).

3.4 Private landowners responsibilities

Private landowners abutting the lake are responsible for:

- their private property and infrastructure, including any constructed ramp, jetty, deck and/or pontoon;
- stormwater management within their property boundary;
- any pollution or run-off from their property that adversely affects lake water quality; and
- revetment walls fronting their property.

If any maintenance of privately owned revetment walls are required, owners are advised to first speak with council staff and also refer to the following:

- *Sunshine Coast Council Residents' Handbook: Artificial Waterways;*
- standards in section 8.3; and
- recommended typical revetment wall section in Appendix A

3.5 Legislation

The Lake Management Plan complies with the following statutory legislation and its associated regulations and policies:

- Local Government Act 2009
    - Sunshine Coast Council Local Laws
- Coastal Protection and Management Act 1995
- Planning Act 2016
- Environmental Protection Act 1994
- Waste Reduction and Recycling Act 2011
- Fisheries Act 1994
- Nature Conservation Act 1992
- Transport Operations (Marine Safety) Act 1994
- Transport Operations (Marine Pollution) Act 1995
- Aboriginal Cultural Heritage Act 2003

4 Lake purpose and function

4.1 Intent for use

The primary purpose of the lake is to provide amenity and visual quality for the surrounding Twin Waters residential development. Additional benefits include water-based recreation and a range of passive recreation opportunities associated with an extensive park and pathways network.

The design intent also considered that the lake facilitate effective drainage of stormwater from the upstream catchment and urban run-off.

The lake does not have a lock structure and is not intended to be navigable to the Maroochy River.

The cadastral boundary of the Twin Waters Lake is configured so that all revetment walls adjacent to private property are within adjacent private allotments and thus the responsibility of the individual land owner. This configuration alleviates many costs as council is not responsible for repair or replacement of these items.

A weir was constructed in the lake entrance channel to the development from the Maroochy River to permit tidal exchange between the river and the lake during daily tide events. The lake has been designed to achieve a semi-saline state to assist in maintaining water quality.

The land abutting the lake has been generally developed for urban purposes in accordance with an overall Masterplan Approval and subsequent development approvals. Access to the lake for the public is available at specific locations around its perimeter but does not support the launching of boats. All public access areas are created as public road reserve or parkland abutting the lake.

The lake is intended to be used by the community in a responsible way for their recreational enjoyment, with minimal adverse impact upon the amenity of those dwellings in proximity to the lake. The use of motor powered craft is limited, and contact with the water is proposed as secondary contact only (e.g. kayaks, canoes and stand-up paddle board). Fishing is also allowed within the lake, except as precluded in section 5.3.

5 Lake use

Permitted and prohibited uses are detailed in the following section and must be adhered to at all times.

5.1 Permitted uses

Lake use is open to the general public or 'sports-based' user groups providing the use is a 'permitted use' as described below.

With the exception of enforcement/safety/disaster response craft in emergency situations, the maximum speed must not exceed 6 knots.

Council, as the owner, may from time to time utilise the lake and/or surrounding open space for public events (e.g. markets and public displays).

The following uses and/or actions are permitted in or on the lake:

- human powered craft (e.g. canoe, kayak, row boat and stand-up paddle board);
- small wind powered sail craft;
- model boat;
- motor powered pleasure craft with an inboard or outboard motor not exceeding 10 horsepower;
- recreational fishing, except as precluded in section 5.3;
- mobile structures (e.g. dry docks, seapens and float bricks) that are secured to an approved privately owned pontoon or jetty;
- approved maintenance, disaster response and enforcement craft;
- approved construction craft (e.g. barges, dredges and support craft);
- use of lake water for fire control purposes (e.g. helicopter fire services); and
- any other activity prescribed by council from time to time.

Please note:

All lake users are encouraged to exercise a personal duty of care when accessing the lake system and/or participating in water-based recreation. Recreating in constructed tidal lakes has inherent risks, including but not limited to potentially hazardous marine creatures such as sharks and stingers.

The water quality in the lake is maintained to a secondary contact standard. At times post major rainfall events the water quality within the lake may be diminished below secondary contact standards (refer section 6 for an overview of council's water quality management of the lake).

Due to the above reasons, direct exposure through swimming is not advised.

5.2 Permitted uses subject to approval

5.2.1 Events, recreational clubs and commercial operations

Council may agree to allow certain low-use/low-impact events, group/club recreational activities and commercial operations to occur on the lake that do not negatively impact on surrounding residents and the overall amenity. The activity must be a permitted use as specified in section 5.1, including (but not limited to) water taxi, vessel hire and other water-based activities/events e.g. SUP lessons, dragon boat user groups, model boats etc. For such operations to be considered for approval, council requires a written submission detailing the type of activity and any potential impact the activity will have on surrounding residents, other users of the lake, water quality, council-owned assets and overall amenity.

Refer to council's Community Land and Complementary Commercial Activity Policy for more information.

5.2.2 Structures and permanent moorings within the lake

The location of private structures, namely a boat ramp, pontoon, deck or jetty for lot owners abutting the lake, must be approved by council. All works must comply with the standards outlined in the Planning Scheme Policy for Development Works within the Sunshine Coast Planning Scheme 2014.

A Quay Line Plan defines the allowable location of any structures available to an adjacent landowner. All works must be constructed in accordance with the Quay Line Plan in Appendix B.

5.2.2.1 Tenure

Prior to any adjoining lot owner lodging an application for approval to construct a boat ramp, pontoon, deck or jetty on part of the lake, they must enter into a lease over the area containing the proposed structure or works and its appurtenances, from council. Council will charge an application fee and an annual lease fee for the leased area as determined by council from time to time. The lease term would be to a maximum of 10 years. If a lease over 10 years is desired, a Development Application for reconfiguring a lot is required (maximum of 30 years permitted).

The registration on title of the lease into the name of the adjoining lot owner, must be completed before any applications to council for the proposed structure may be made.

5.2.2.2 Approval of works

Private boat ramps, pontoons, decks and jetties contained within the quay line designated area may be approved by council on application by that lot owner, subject to lodgement of engineering plans for the proposed structure and any/all conditions applied by council.

For lots that directly abut the lake, if part of a pontoon, deck or jetty is proposed to be located within 1.5 metres of the rear boundary of the lot, an application for relaxation under the Standard Building Law 1993, will also be required.

Construction of any permanent works must be approved by council and a private building certifier before any onsite work commences. Use of the works or structure must not commence until a final inspection and approval to use has been granted by the relevant authority. Failure to obtain the relevant approval or the carrying out of works to a lesser standard than required, may result in an order to remove the offending works.

The use of standard appropriate design structures is encouraged and provided in Appendix C.

5.2.2.3 Exclusivity and restrictions

By the action of granting a lease over the mooring structure or works, exclusivity of use is secured to the adjacent lot owner to whom the lease was granted, to the exclusion of any other user of the lake.

5.3 Prohibited uses and practices

The following uses or actions are prohibited in the lake:

- events/recreational clubs/commercial operations (SCC approved permits excepted, refer section 5.2.1;
- construction of ramps/pontoons/decks/jetties (SCC approved structures excepted, refer section 5.2.2);
- temporary moorings[2] (SCC approved event/recreational club/commerical permits excepted, refer section 5.2.1;
- diving or jumping off any structure over or in the lake;
- fishing from the following public infrastructure:
  - bridge;
  - deck/boardwalk;
  - jetty;
  - pontoon; or
  - weir structure.
- motor powered pleasure craft with an inboard or outboard engine capacity exceeding 10 horsepower;
- motor powered craft navigating at speeds exceeding 6 knots (with the exception of enforcement/safety/disaster response craft in emergency situations);
- waterskiing, freestyling or wave jumping whilst operating any watercraft;
- living on watercraft whether temporarily, intermittently or permanently;
- the construction, reconstruction, refitting or undertaking of structural repairs on or to watercraft;
- unmarked fishing equipment (e.g. crab pots and fish traps);
- refuelling of watercraft;
- dumping or depositing of any wastes (including garden wastes), contaminants or other pollutants into the lake, adjoining waterways or in a place (e.g. road-side gutter or stormwater drain) where it could reasonably be expected to blow or wash into the lake or adjoining waterways; and
- any other activity prescribed by council from time to time.

No public boat ramps are provided for waterway access to Twin Waters Lake. The boat ramp adjacent to Anchorage Circuit is only for council/contractor maintenance purposes or specialised use (e.g. low-use/low-impact commercial operations and group sport/recreational activities). Specialised use require council approval.

[2] Temporary moorings include the use of dry docks, seapens, float bricks etc. that are not secured to an approved pontoon or jetty.

5.4 Temporary restricted use

Council reserves the right to restrict lake use for a specific purpose at any time, if such action is required to either protect public health and safety or prevent pollution of the lake.

5.5 Abutting public land

Abutting public land is under the control of council. All normal activities that are permitted in parks and on roads are permitted on abutting public land fronting the lake except as may be restricted elsewhere in this Lake Management Plan, or by approved signs erected on such land.

5.6 Future development

No further development within the Lake or on adjacent public land is intended by council, unless determined necessary to support the primary purpose and function of the lake.

6 Water quality management

The lake system is best described as a lower catchment flow through system, i.e., an artificial waterway which acts as an estuary in some part, where the flow through rate is determined by a weir and tidal exchange pipe.

Influences on water quality in the lake system are therefore principally impacted by:

- sufficient tidal exchange;
- up-stream catchment practices;
- surrounding urban runoff (e.g. hydrocarbons, particulates, pesticides and herbicides);
- activities associated with vessel maintenance; and
- colonisation by marine organisms. Certain species may proliferate at times of elevated nutrient levels and cause other environment and human health risks (e.g. algal blooms)

Table 3 provides a framework to effectively manage these influences.

Table 3: Water quality management overview

Objective	Water quality is maintained to a standard suitable for secondary contact recreation
Performance standards	• Water quality is maintained in accordance with scheduled water quality objectives for secondary contact recreation in the Environmental Protection (Water and Wetland Biodiversity) Policy 2019 and Guidelines for Managing Risks in Recreational Water (NHMRC 2008) • Reactive water quality sampling is in accordance with the methods prescribed in the Queensland Monitoring and Sampling Manual (2018) • Growth of undesirable marine organisms is absent or regulated
Management controls	1. Maintain impervious and/or vegetated overland flow paths in accordance with routine inspection and maintenance schedules 2. Maintain stormwater drainage systems and GPTs in accordance with routine inspection and maintenance schedules 3. Maintain weir and tidal exchange pipes in accordance with routine inspection and maintenance schedules 4. Educate residents and public to reduce pollutant run-off and/or input (e.g. signage, residents' handbook and website)
Corrective action	• Respond to issues negatively affecting water quality in a timely manner • Erection of temporary signage if determined necessary • If a trend of declining water quality develops over an extended period, it will be considered to indicate the need for reassessment of the appropriateness and effectiveness of existing water quality management controls
Monitoring	• Visual monitoring to be undertaken concurrent with routine inspections and/or maintenance schedules • Water quality sampling will be undertaken on a reactive basis if requested and determined necessary • Maintain customer service request records and incident/non-compliance register
Reporting	The results of monitoring will be made available to the public at council's discretion and by request only
Responsibility	SCC

7 Incident, non-compliance and complaint management

Table 4: Incident, non-compliance and complaint management overview

Objective	To ensure prompt and efficient response to pollution, incidents, complaints and non-compliance
Performance standards	• Prompt removal of pollution spillages from waterways with minimum risk to the public and the environment • All incidents, complaints and non-compliance are dealt with promptly and efficiently, in accordance with council's Compliance and Enforcement Policy 2018 (or referred to the relevant agency if not already outlined in the policy) • Appropriate investigations are undertaken to determine the source of pollution and the cause of environmental incidents (e.g. oil spills, fish kills and algal blooms)
Management controls	1. Adherence to asset management plans 2. Asset inspections and routine maintenance schedules met 3. Adherence to water quality management procedures (refer section 6) 4. Sufficient signage to communicate safety matters and prohibitions outlined in this management plan (refer section 5.3)
Corrective action	• Pollution spill, fish kill or other environmental incident - report to the Department of Environment and Science to ensure that appropriate investigations and testing are undertaken • Address and/or rectify incident, complaint and/or non-compliance • Review customer service requests and incident/non-compliance register and implement improvement to processes and/or signage where deemed necessary
Monitoring	• Follow up monitoring to be undertaken in the event of an environmental incident • Maintain customer service request records and incident/non-compliance register
Reporting	Complete the appropriate incident report/debrief when required or requested
Responsibility	SCC

8 Maintenance

8.1 General

Maintenance of the lake and its assets are the responsibility of council and includes routine, planned and reactive maintenance work activities.

Maintenance work is managed through an asset management system and includes activities such as inspection, assessing condition, prioritising, scheduling, actioning the work and reporting what was done to develop a maintenance history and improve maintenance and service delivery performance.

Routine maintenance is performed on a regular cycle to upkeep visual amenity and/or replacement of components/sub-components of assets. This work generally falls below the capital threshold. Planned maintenance comprises larger scale repair work (below the capital threshold) or asset renewal (capital work). Reactive maintenance is unplanned repair work carried out in response to service requests and management/supervisory directions.

Types of maintenance may include:

- on-going maintenance of the weir and tidal exchange pipes;
- removal of siltation from bed and banks of the lake, as required, to ensure that it does not become a constraint on the function of the lake;
- removal of debris, rubbish and undesirable marine organisms/weeds from the lake and public foreshore areas;
- maintaining revetment walls where they front public lands;
- maintaining scour that supports all revetment walls; and
- maintaining navigation aids within the lake etc.

Table 5 outlines the entire maintenance framework and regimes.

8.2 Maintenance management

The following section provides an overview of the maintenance framework for lake features and public assets to meet specific management plan objectives outlined in Table 1.

Table 5: Maintenance framework overview

Feature / asset	Performance standard	Performance indicator	Comments / considerations	Inspection frequency	Routine maintenance frequency	Responsibility
Waterway feature						
Litter, debris etc.	Waterways are free of litter and debris that are impacting on amenity, health and/or safety	a) Inspection and maintenance schedules met b) Reactive works undertaken in a timely manner c) No complaints	• Officers undertaking litter removal should ensure that appropriate precautions are taken against hazardous objects such as discarded hypodermic syringes • Collected litter should be recorded in AMDI database and disposed of at council's refuse tip • A public education programme should be considered by council if litter is a persistent problem • If fishing equipment (e.g. crab pot or fish trap) is found either unmarked and/or in state of disrepair to a point of it being non-functional then it shall be removed as marine litter (report to DAFF for their agency to remove)	Monthly	Monthly	SCC Waterways team Engagement with Response Services where required for litter investigation
Undesirable marine organisms / weeds	Growth of undesirable marine organisms is absent or regulated	a) Inspection schedule met b) Reactive works undertaken in a timely manner c) No complaints	• Any vegetation or plant material, living or dead, located below the level of the highest astronomical tide (approximately RL 1.05m AHD) is classified as "marine vegetation" under the Fisheries Act. Refer to relevant fisheries *accepted development requirements* before undertaking any works involving marine vegetation • Although herbicides are a possible means of weed control, only herbicides registered for use in aquatic environments should be used • All removed vegetation should be disposed of at council's refuse tip • In the event of algal blooms, refer to Queensland Harmful Algal Bloom Response Plan 2014. Appropriate laboratory testing should be undertaken to determine the species present and likely cause of the outbreak. If testing indicates the presence of toxic species, specialist advice should be sought regarding any necessary health precautions.	6 monthly	No routine maintenance. Any required works are determined based on inspection condition assessment	SCC Lakes and Wetlands team
Lake profile	Lake is maintained to acceptable tolerances from design profile	a) Survey completed as scheduled b) Maintenance is undertaken in a timely manner before degradation of waterway profile affects vessel movement or the stability of revetment walls c) No complaints	• Appropriate geotechnical and chemical testing should be undertaken of material proposed to be dredged or excavated in maintenance operations • Approvals to undertake dredging, or other excavation, within a waterway are required under the Planning Act 2016, Coastal Protection and Management Act 1995 (Tidal Works) and the Environmental Protection Act 1994 (ERA 16) (dependant on volume of material to be managed)	7 yearly	No routine maintenance performed. Any required works are determined based on visual observation and 7 yearly lake survey	SCC Coast & Canals team
Constructed beaches	Accessible, safe and provides adequate amenity and visual quality	a) Open for use 90% of the time b) Clear of marine fouling and debris c) Safe d) Inspection schedule met e) Reactive works undertaken in a timely manner f) No complaints	• Weeding is performed by physical / mechanical means, no herbicides to be used • Sand profiles are maintained as designed	6 monthly	No routine maintenance. Any required works are determined based on inspection condition assessment	SCC Coast & Canals team
Infrastructure						
Weir and tidal exchange pipes	The weir and tidal exchange pipes are maintained in a suitable	a) Structures are not impeded by marine growth or sedimentation	Refer Appendix D for weir design.	6 monthly	Annually	SCC Coast & Canals team

Feature / asset	Performance standard	Performance indicator	Comments / considerations	Inspection frequency	Routine maintenance frequency	Responsibility
	condition to facilitate effective drainage of stormwater run-off	b) Inspection and maintenance schedules met c) Reactive works undertaken in a timely manner d) No complaints	Underwater inspections of the structures are likely to be required. A qualified commercial diver should be employed for this work and the required safety measures implemented			
Revetment wall (including weir gabion walls)	Revetments are maintained in a suitable condition to provide satisfactory protection to adjacent land and assets	a) Structure maintained to design b) Inspection schedules met c) Reactive works undertaken in a timely manner d) No complaints	• The stability of revetment walls and other concrete structures is heavily reliant on the condition of the associated scour (see scour maintenance below) • The maintenance of revetments is the responsibility of the abutting landowner (i.e. council for public land only). However, council are responsible for the associated scour and thus must ensure it is adequate to protect private landowners' revetment	Annually	No routine maintenance. Any required works are determined based on inspection condition assessment	SCC Coast & Canals team
Scour	Scour are maintained in a suitable condition to provide satisfactory protection to revetment walls	a) Structure maintained to design b) Inspection schedules met c) Reactive works undertaken in a timely manner d) No complaints	• The stability of revetment walls and other concrete structures can be rapidly compromised due to the loss of foundation support if the associated scour are not well maintained • Council are responsible for maintaining all scour including those abutting private land	Annually	No routine maintenance. Any required works are determined based on inspection condition assessment	SCC Coast & Canals team
Stormwater outlets	Provides effective drainage of stormwater run-off	a) Structure maintained to design standards b) Inspection and maintenance schedules met c) Reactive works undertaken in a timely manner d) No complaints	Piping failures, resulting in loss of support behind and beneath stormwater drainage outlet structures can result in rapid deterioration of these structures. This damage can quickly spread to adjacent revetment walls. It is important, for the longevity of these structures, to ensure that piping problems are promptly addressed	Annually	Annually	SCC Stormwater Services team
GPT's	Provides an effective pollutant trap to minimise litter, debris and sediment from entering the lake system	a) Structure maintained to design b) Inspection and maintenance schedules met c) Reactive works undertaken in a timely manner d) No complaints e) Minimal litter, debris and sediment entering the lake directly from stormwater outlets	Refer to manufacturer for design standard details	Monthly	Annually	SCC Stormwater Services team
Viewing platform	Accessible and safe, providing additional enjoyment of the lake amenity	a) Structure maintained to design b) Open for use 90% of the time c) Inspection schedule met d) Reactive works undertaken in a timely manner e) No complaints		6 monthly	No routine maintenance. Any required works are determined based on inspection condition assessment	SCC Transport Infrastructure team
Waterway accesses	Accessible, user-friendly and safe, providing additional access and enjoyment of the lake	a) Structure maintained to design b) Open for use 90% of the time c) Clear of marine fouling and debris d) Inspection schedule met e) Reactive works undertaken in a timely manner		Annually	No routine maintenance. Any required works are determined based on inspection condition assessment	SCC Coast & Canals team

Feature / asset	Performance standard	Performance indicator	Comments / considerations	Inspection frequency	Routine maintenance frequency	Responsibility
		f) No complaints				
Signs	Signs are reader-friendly, clearly visible, safe, and do not impact on the visual qualities of the lake	a) Structure maintained to design b) Inspection schedule met c) Reactive works undertaken in a timely manner d) Vessel operators are compliant with marine safety laws e) No complaints	If non-compliance and/or complaints register indicate a growing trend of users whom are not complying with regulations, assess suitability of all forms of public education, including signage. Implement any improvements where determined necessary (see more section 7)	Annually	No routine maintenance. Any required works are determined based on inspection condition assessment	SCC Coast & Canals team
Navigation aids	Effectively assist vessel operators to safely navigate the lake, without negatively impacting on vessel traffic or amenity	a) Structure maintained to design b) Inspection schedule met c) Reactive works undertaken in a timely manner d) No complaints or on-water incidents		Annually	No routine maintenance. Any required works are determined based on inspection condition assessment	SCC Coast & Canals team

8.3 Standards and specifications

Maintenance work is carried out in accordance with the following standards and specifications:

1. Building Code of Australia
   a) BCA Vol 2 Part 3.1.2.0 – Drainage (AS 3500.3.2)
   b) BCA Vol 2 Part 3.1.2.2 (d) – Excavation and Piling near Sewers and Drains
   c) BCA Vol 2 Part 3.1.1 – Earthworks
2. Australian Standards
   a) AS 1141.Methods for sampling and testing aggregates
   b) AS 1428: Design for Access and Mobility
   c) AS 1604: Treatment of piles
   d) AS 1664.1: Aluminium Structures Code
   e) AS 1665: Welding
   f) AS 1170.1 and 1170.2: Loading Codes
   g) AS 1650 Galvanising
   h) AS 1720: Timber Structures Code
   i) AS 2159: Piling Code
   j) AS 2239: Galvanic (Sacrificial) Anodes for Cathodic protection
   k) AS 2312 Two Pack Epoxy Paints
   l) AS 2832.3 Guide to the Cathodic protection of metals-fixed immersed structures.
   m) AS 3500: Part 3.2, Stormwater Drainage – Acceptable Solutions
   n) AS 3600: Concrete Structures Code
   o) AS 3700: Masonry Structures Code
   p) AS 3706: Geotextiles Methods of test
   q) AS/NZ 3004: Marinas and Recreational Boats
   r) ANZECC: Guidelines for Fresh and Marine Water Quality
   s) AS 3962: Guidelines for Design of Marinas Code
   t) AS 4110: Steel Structures Code
   u) AS 4133: Methods of testing rocks for engineering purposes
   v) AS 4997: Guidelines for the design of maritime structures
3. SEQ Restoration Framework, Guideline & Manual
4. Healthy Waterways – Water sensitive Urban Design – Technical Design Guidelines for SEQ
5. Healthy Waterways – Water by Design Construction and Establishment Guidelines
6. Any other relevant regulations, policies, codes and/or guidelines that fall under the Acts listed in section 3.5.

9 Contacts

Entity	Contact details	Enquiry type
Sunshine Coast Council - Customer Service	(07) 5475 7272 1300 007 272	All
Maritime Safety Queensland	(07) 5373 2310 A/H (07) 3305 1700	Marine safety and marine pollution, including oil spills
Mooloolaba Coast Guard	Radio: 88-90, 16-67-21-73-80 (07) 5444 3222	Marine safety
Sunshine Coast District Water Police	(07) 5457 6711 A/H 0438 200 705	Search and rescue, on-water criminal matters and marine safety complaints
Queensland Boating and Fisheries Patrol	(07) 5444 4599 (Mooloolaba)	Marine safety and fisheries complaints
Department of Environment & Science	1300 130 372	Involving pollution, environmental harm, fish kills and marine strandings
Department of Agriculture and Fisheries	(07) 3404 6999	Involving marine plants
RSPCA QLD	1300 ANIMAL (1300 264 625)	Involving injured wildlife. Will likely be attended by Queensland Parks and Wildlife Service (QPWS)

10 Review

This document may be reviewed and updated as determined necessary by council in response to new information, challenges in implementation or changing external factors such as technology, land use, the environment, legislation and community values.

Appendix A: Typical revetment wall section

By the signing of this statement I deem to certify this drawing as being in accordance with the project objectives.

PROJECT REVIEW — TITLE: PROJECT MANAGER

SIGNED: — DATE: 04 December 2013

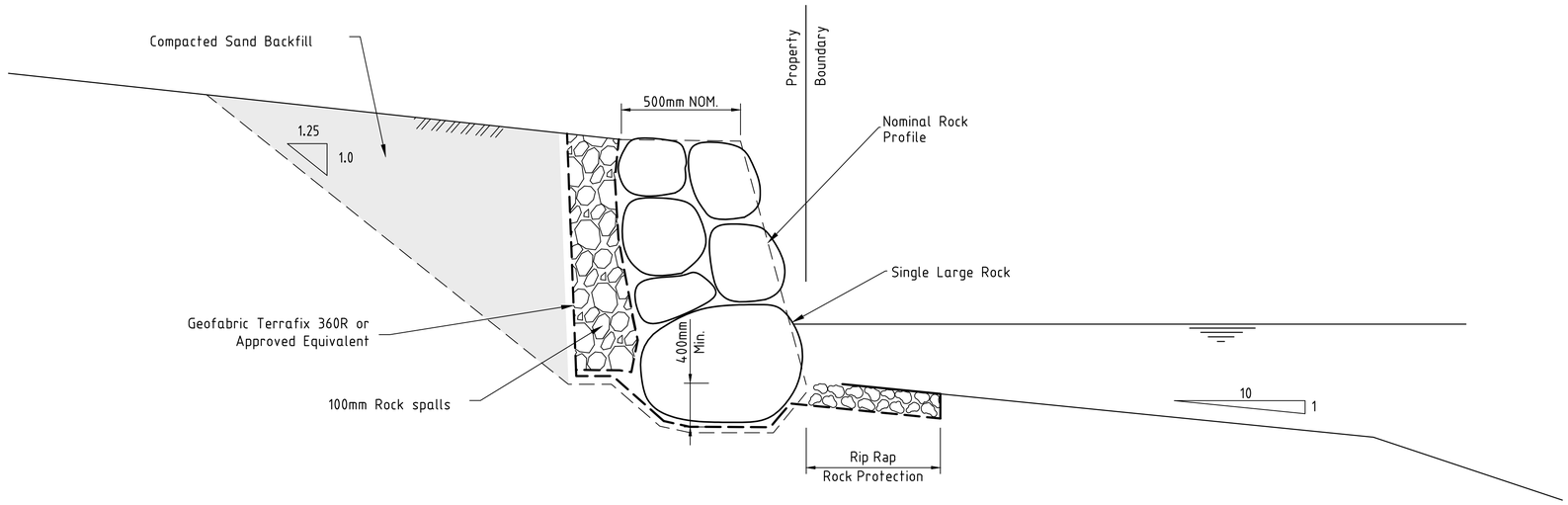
PROJECT SUBMITTED

We, Cardno Qld Pty. Ltd. being the Registered Professional Engineers, certify that we are responsible for the design of the building work described in this drawing.

We, Cardno Qld Pty. Ltd. certify that the design meets the requirements of all relevant Council Policies, References, Standards, Plans and Design Instructions, Codes of Practice, Guidelines, and Brief/Functional Specifications.

SIGNED: — TITLE: PROJECT DIRECTOR

RPEQ No.: 1723 — DATE: 04 December 2013



SECTION A-A
Scale 1:20

DATE PLOTTED: 17 October, 2013 - 3:59pm

Rv.	DATE	REVISIONS	REC.	APPR.

DESIGNED:
DRAWN:
CHECKED:
RECOMMENDED: PROJ. MAN.
APPROVED: PROJ. DIR.

A1 DATUM: A.H.D.

CAD FILE: 2760-40-SK100.dwg
XREF's:

Cardno (Qld) Pty Ltd
ABN: 57 051 074 992
SUNSHINE COAST OFFICE: Level 1, 9 Maud Street Maroochydore, Qld 4558
Email: sco@sun.cardno.com.au Ph. (07) 5443 2555 Fax. (07) 5443 5642

OFFICES	TELEPHONE	FAX
Sunshine Coast	(07) 5443 2555	(07) 5443 5642
Brisbane	(07) 3369 9822	(07) 3369 9722
Sydney	(02) 9416 8233	(02) 9416 6529
Gold Coast	(07) 5539 9333	(07) 5538 4647
Townsville	(07) 4772 1166	(07) 4721 2508
Hervey Bay	(07) 4124 5455	(07) 4124 5155
Cairns	(07) 4033 2995	(07) 4033 2992
Rockhampton	(07) 4924 7500	(07) 4926 4375
Darling Downs	(07) 4637 8122	(07) 4637 8155
Darwin	(08) 8981 3613	(08) 8941 1768

LEND LEASE DEVELOPMENT PTY LTD

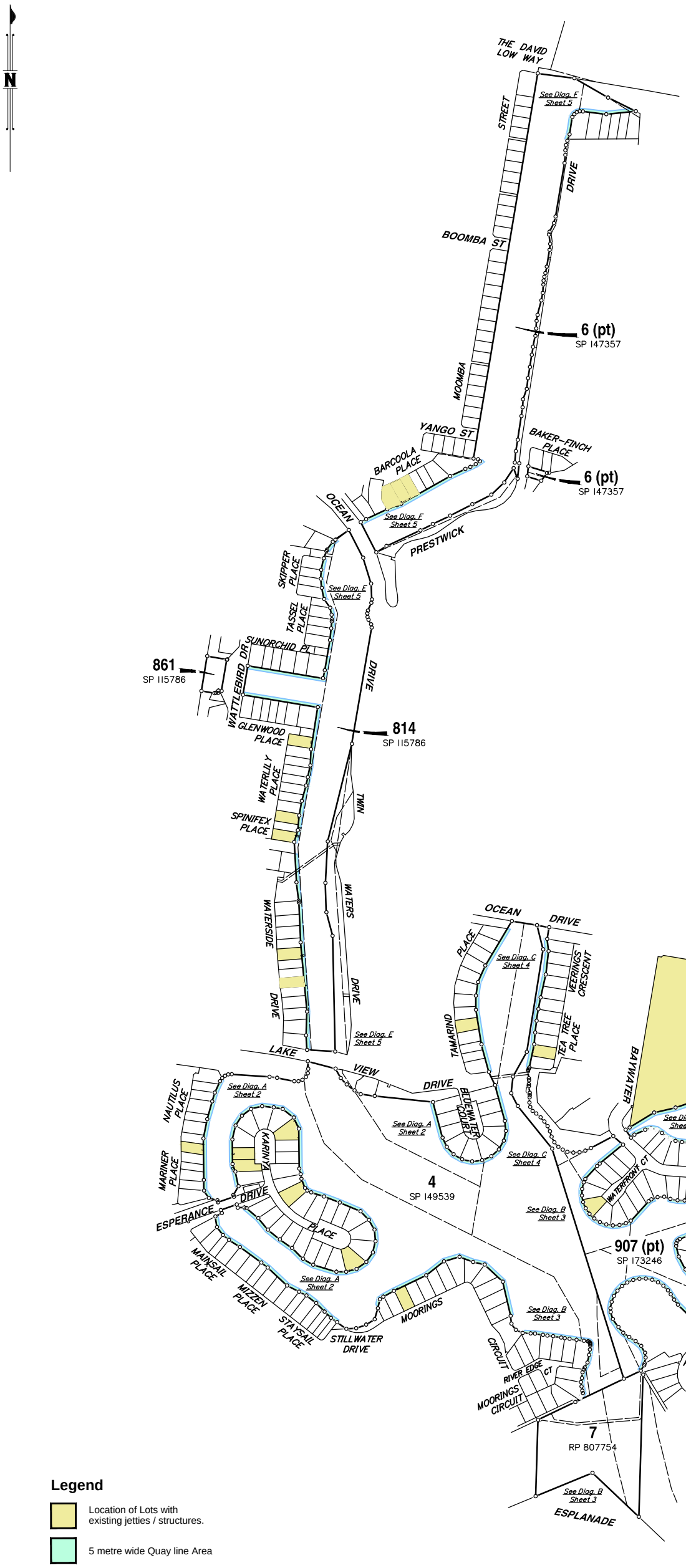
TWIN WATERS

REVETMENT WALL

DATE: 27/11/07 — Rv.

DRAWING No: 2760/40-SK100

Appendix B: Quay line plan



Encumbrance Easements to Lot 7 on RP 807754 (Title 18685053)

601100661	Emt B on RP 171267	In gross to Maroochy Shire Council (Drainage)
708270934	Emt E on SP 173245	In gross to Maroochy Shire Council (Right of Way / Services)

Encumbrance Easements to Lot 814 on SP 115786 (Title 50287345)

701957254	Emt B on RP 902714	In gross to Maroochy Shire Council (Drainage)
702915544	Emts J & K on SP 107424	In gross to Maroochy Shire Council (Drainage)
703684292	Emt L on SP 115786	In gross to Maroochy Shire Council (Drainage)
702144513	Emt E on RP 907882	Drainage / Effluent Line to Lot 5 on SP 149555 (Golf Course)

Encumbrance Easements to Lot 861 on SP 115786 (Title 50287346)

702915537	Emt I on SP 107424	In gross to Maroochy Shire Council (Drainage)

Encumbrance Easements to Lot 6 on SP 147357 (Title 50395502)

701892877	Emt E on RP 905435	Drainage to Lot 5 on SP 149555 (Golf Course)
701892880	Emt F on RP 905435	Drainage / Effluent Line to Lot 5 on SP 149555 (Golf Course)
701957254	Emt G on RP 836663	In gross to Maroochy Shire Council (Drainage)
701957254	Emt B on RP 893097	In gross to Maroochy Shire Council (Drainage)

Encumbrance Easements to Lot 4 on SP 149539 (Title 50412000)

701957254	Emts B, C & D on RP 902714	In gross to Maroochy Shire Council (Drainage)
701957254	Emt A on RP 171267	In gross to Maroochy Shire Council (Drainage)
706188804	Emt K on SP 155693	In gross to Maroochy Shire Council (Right of Way / Services)

Encumbrance Easements to Lot 907 on SP 173246 (Title 50616236)

701957254	Emt D on RP 902714	In gross to Maroochy Shire Council (Drainage)
706188804	Emt J on SP 155693	In gross to Maroochy Shire Council (Right of Way / Services)
706939807	Emts R & S on SP 155702	In gross to Maroochy Shire Council (Drainage)
707327735	Emt X on SP 155707	In gross to Maroochy Shire Council (Drainage)
708270916	Emt Z on SP 157563	In gross to Maroochy Shire Council (Drainage)

Legend

Location of Lots with existing jetties / structures.

5 metre wide Quay line Area

Drawn:	AW/SS/KN	Date:	25.06.12
Surveyed:	-	Date:	-
Checked:	DB	Date:	25.06.12

Associated Consultants

Local Authority:	Maroochy Shire Council
File Ref. No:	
RP Description:	Lot 7 on RP 807754, Lots 814 & 861 on SP 115786, Lot 6 on SP 147357, Lot 4 on SP 149539 and Lot 907 on SP 173246.
Original Portion:	66V, 68V, 79V, 333V & 460
Parish/County:	Maroochy / Canning
Date of Survey:	12/04/12
Level Datum:	AHD
Origin:	OPM 146862 (RL 2.068)
Level Bk / Fld Bk:	LB 754
Horizontal Datum:	SP115786
Contour Interval:	N/A

Scale

0 80 160 240m

1 : 4000 @ A1 (Before Reduction)

1 : 8000 @ A3

Notes

Structures located using Trimble R6 GPS.

The structures shown hereon have been located where possible by field survey. Whilst due care and attention have been exercised, T.H. Jensen and Bowers Pty. Ltd. does not warrant that the services have been located in their entirety.

The boundaries and offsets shown hereon are for plotting purposes only and are subject to final survey.

Approved: DGB

Issue	Description	Date	Appd.
A	Original Issue	25.06.12	DB

Client

Lend Lease Pty. Ltd.

Twin Waters Residential Community

Quay Line Plan - Sheet 1 of 5

Drawing No. S.4896-437-A

Original Size A1

JensenBowers ...people creating places

Town Planners - Urban Designers
Surveyors - Engineers - Project Managers

72 Costin Street, Fortitude Valley, Qld. 4006
PO Box 799, Spring Hill, Qld. 4004
Telephone : (07) 3852 1771
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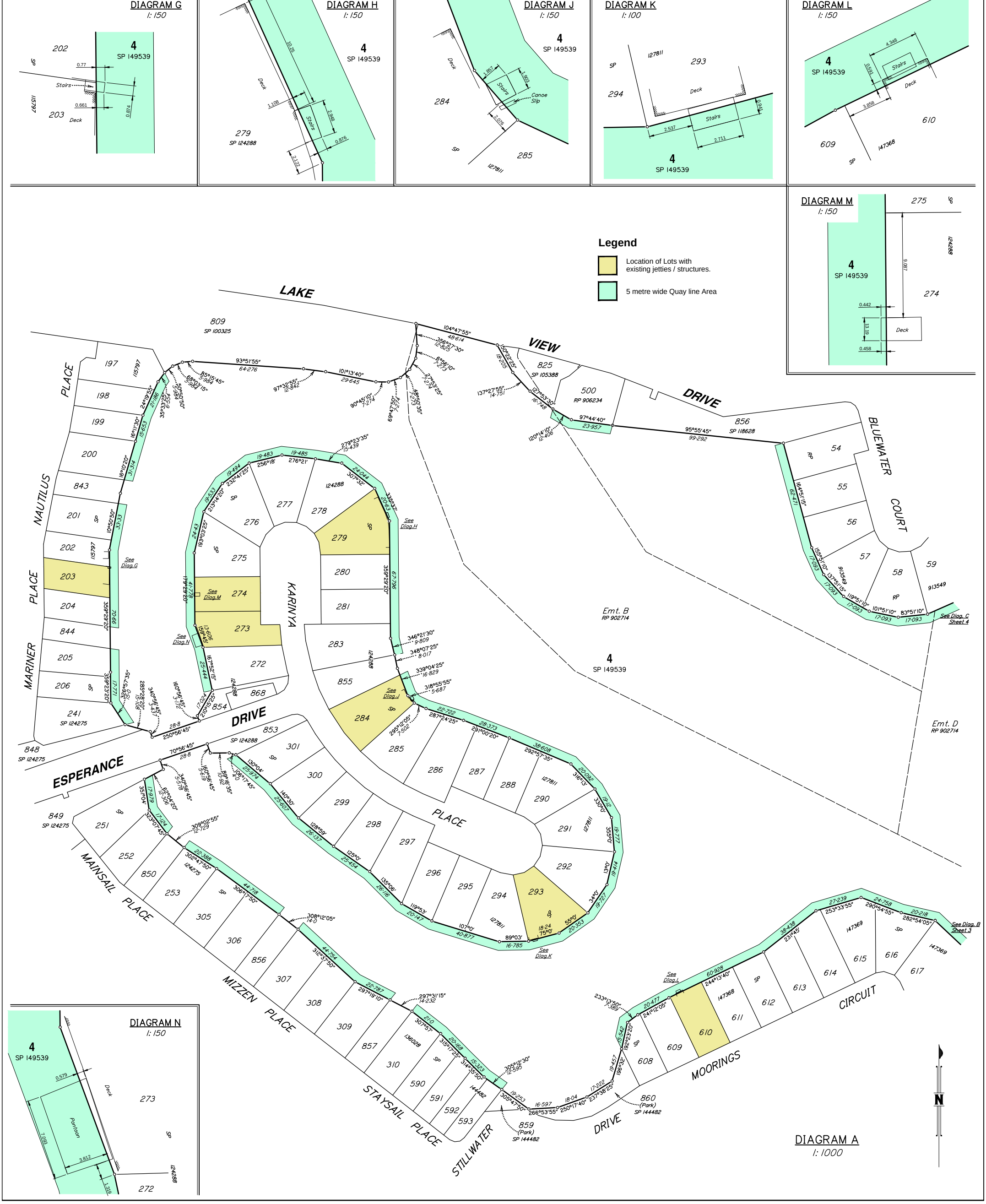
Email : admin@jensenbowers.com.au

T.H. Jensen & Bowers Pty. Ltd. (Consulting Surveyors)
ABN. 52 010 872 607



Drawn:	AW/SS	Date:	25.06-12
Surveyed:	-	Date:	-
Checked:	DB	Date:	25.06.12

Associated Consultants

Local Authority:	Maroochy Shire Council
File Ref. No:	
RP Description:	Lot 7 on RP 807754, Lots 814 & 861 on SP 115786, Lot 6 on SP 147357, Lot 4 on SP 149539 and Lot 907 on SP 173246.
Original Portion:	66V, 68V, 79V, 333V & 460
Parish/County:	Maroochy / Canning
Date of Survey:	12/04/12
Level Datum:	AHD
Origin:	OPM 146862 (RL 2.068)
Level Bk / Fld Bk:	LB 754
Horizontal Datum:	SP115786
Contour Interval:	N/A

Scale

0 20 40 60m

1 : 1000 @ A1 (Before Reduction)

1 : 2000 @ A3

Notes

Structures located using Trimble R6 GPS.

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Approved: DGB

Issue	Description	Date	Appd.
A	Original Issue	25.06.12	DB

Client

Lend Lease Pty. Ltd.

Twin Waters Residential Community

Quay Line Plan - Sheet 2 of 5

Drawing No. S.4896-437-A

Original Size A1

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Town Planners - Urban Designers
Surveyors - Engineers - Project Managers

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Email : admin@jensenbowers.com.au

T.H. Jensen & Bowers Pty. Ltd. (Consulting Surveyors)
ABN. 52 010 872 607

DIAGRAM B
1: 1000

DIAGRAM O
1: 100

DIAGRAM Q
1: 100

DIAGRAM P
1: 100

907 (pt)
SP 173246

Emt. D
RP 902714

Emt. S
SP 155702

Emt. Z
SP 157563

Emt. X
SP 155707

Emt. A
RP 171267

Emt. B
RP 171267

Emt. E
SP 173245

CP
SP 157566

4
SP 149539

7
RP 807754

WATERFRONT COURT
BAYWATER
OCEANIC COURT
DRIVE
CIRCUIT
MOORINGS
RIVER EDGE COURT
ANCHORAGE
ESPLANADE

Deck
Stairs
Boat Slip

Legend

Location of Lots with existing jetties / structures.

5 metre wide Quay line Area

Drawn:	AW/SS	Date:	25.06.12
Surveyed:	-	Date:	-
Checked:	DB	Date:	25.06.12

Associated Consultants

Local Authority:	Maroochy Shire Council
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Original Portion:	66V, 68V, 79V, 333V & 460
Parish/County:	Maroochy / Canning
Date of Survey:	12/04/12
Level Datum:	AHD
Origin:	OPM 146862 (RL 2.068)
Level Bk / Fld Bk:	LB 754
Horizontal Datum:	SP115786
Contour Interval:	N/A

Scale
0 20 40 60m
1 : 1000 @ A1 (Before Reduction)
1 : 2000 @ A3

Notes
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Approved: DGB

Issue	Description	Date	Appd.
A	Original Issue	25.06.12	DB

Client
Lend Lease Pty. Ltd.

Twin Waters Residential Community

Quay Line Plan - Sheet 3 of 5

Drawing No. S.4896-437-A
Original Size A1

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Town Planners - Urban Designers
Surveyors - Engineers - Project Managers
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Email : admin@jensenbowers.com.au
T.H. Jensen & Bowers Pty. Ltd. (Consulting Surveyors)
ABN. 52 010 872 607

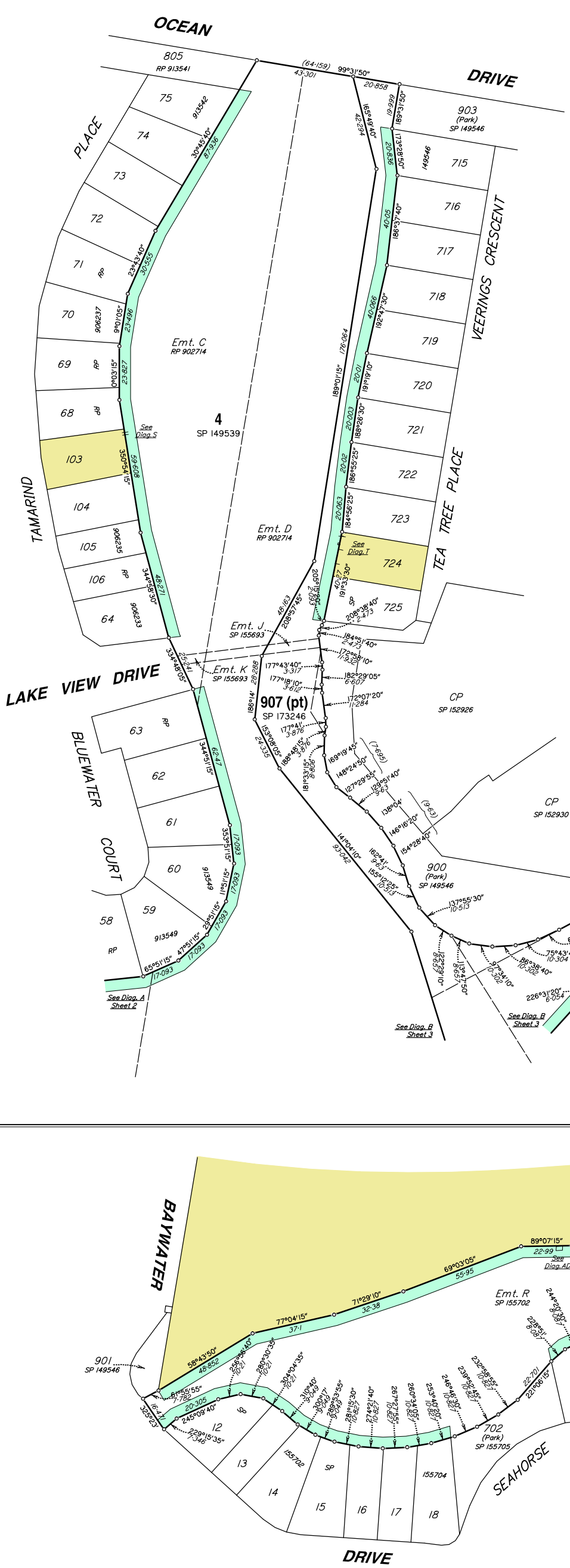

DIAGRAM AD
1: 100

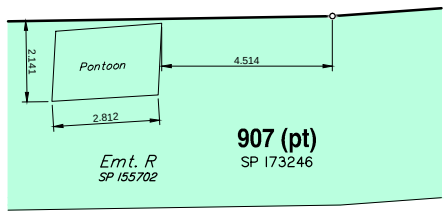

DIAGRAM S
1: 100

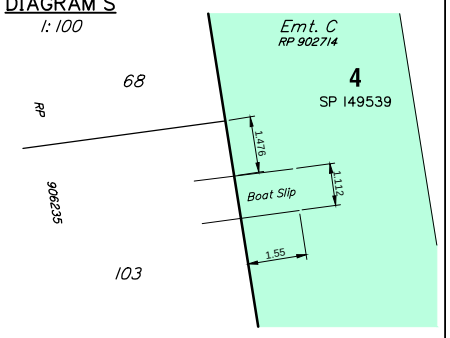

DIAGRAM T
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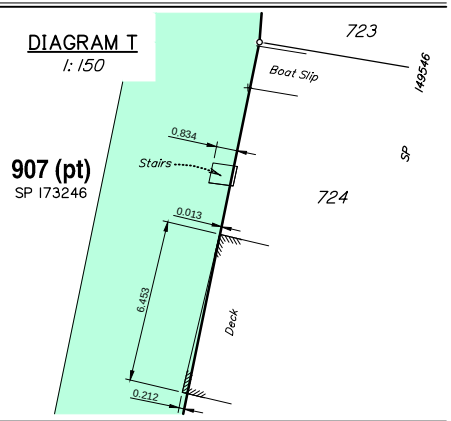
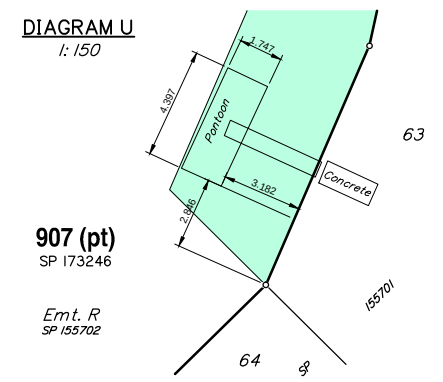


DIAGRAM U
1: 150



Legend

Location of Lots with existing jetties / structures.

5 metre wide Quay line Area

N

Drawn:	AW/SS	Date:	25.06.12
Surveyed:	-	Date:	-
Checked:	DB	Date:	25.06.12

Associated Consultants

Local Authority:	Maroochy Shire Council
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Parish/County:	Maroochy / Canning
Date of Survey:	12/04/12
Level Datum:	AHD
Origin:	OPM 146862 (RL 2.068)
Level Bk / Fld Bk:	LB 754
Horizontal Datum:	SP115786
Contour Interval:	N/A

Scale

0 20 40 60m

1 : 1000 @ A1 (Before Reduction)

1 : 2000 @ A3

Notes

Structures located using Trimble R6 GPS.

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Approved: DGB

Issue	Description	Date	Appd.
A	Original Issue	25.06.12	DB

Client

Lend Lease Pty. Ltd.

Twin Waters Residential Community

Quay Line Plan - Sheet 4 of 5

Drawing No.	Original Size
S.4896-437-A	A1

JensenBowers ...people creating places

Town Planners - Urban Designers
Surveyors - Engineers - Project Managers

72 Costin Street, Fortitude Valley, Qld. 4006
PO Box 799, Spring Hill, Qld. 4004
Telephone : (07) 3852 1771
Facsimile : (07) 3252 9818
Email : admin@jensenbowers.com.au

T.H. Jensen & Bowers Pty. Ltd. (Consulting Surveyors)
ABN. 52 010 872 607

DIAGRAM V
1: 150

DIAGRAM W
1: 150

DIAGRAM X
1: 150

DIAGRAM Y
1: 150

DIAGRAM Z
1: 150

DIAGRAM AA
1: 150

DIAGRAM E
1: 1500

DIAGRAM F
1: 1500

DIAGRAM AB
1: 150

DIAGRAM AC
1: 150

Legend

- Location of Lots with existing jetties / structures.
- 5 metre wide Quay line Area

Drawn:	AW/SS	Date:	25.06.12
Surveyed:	-	Date:	-
Checked:	DB	Date:	25.06.12

Associated Consultants

Local Authority:	Maroochy Shire Council
File Ref. No:	
RP Description:	Lot 7 on RP 807754, Lots 814 & 861 on SP 115786, Lot 6 on SP 147357, Lot 4 on SP 149539 and Lot 907 on SP 173246.
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Parish/County:	Maroochy / Canning
Date of Survey:	12/04/12
Level Datum:	AHD
Origin:	OPM 146862 (RL 2.068)
Level Bk / Fld Bk:	LB 754
Horizontal Datum:	SP115786
Contour Interval:	N/A

Scale
0 30 60 90m
1 : 1500 @ A1 (Before Reduction)
1 : 3000 @ A3

Notes
Structures located using Trimble R6 GPS.

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Approved: DGB

Issue	Description	Date	Appd.
A	Original Issue	25.06.12	DB

Client
Lend Lease Pty. Ltd.

Twin Waters Residential Community

Quay Line Plan - Sheet 5 of 5

Drawing No. S.4896-437-A
Original Size A1

JensenBowers ...people creating places
Town Planners - Urban Designers
Surveyors - Engineers - Project Managers
72 Costin Street, Fortitude Valley, Qld. 4006
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T.H. Jensen & Bowers Pty. Ltd. (Consulting Surveyors)
ABN. 52 010 872 607

Disclaimer
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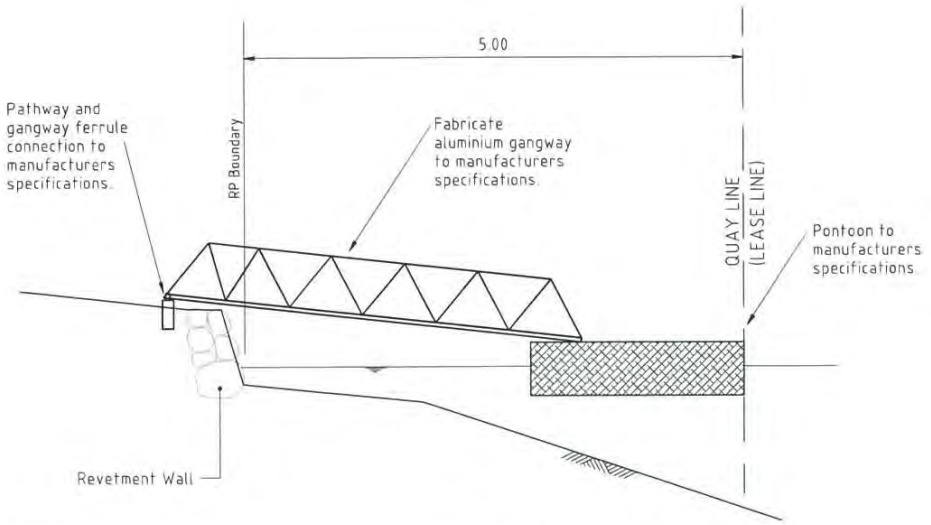
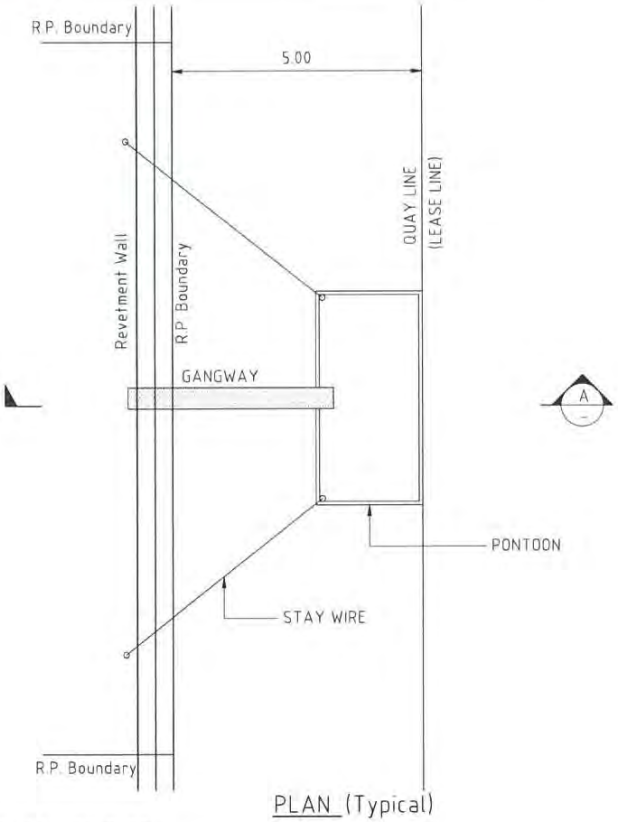
Appendix C: Approved design standards for pontoons, decks/stairs and boat ramps



This drawing shows general design parameters only and is not intended to be a detailed construction drawing. Detailed construction drawings prepared and certified by a qualified structural engineer are required for each individual installation.

SECTION A (TYPICAL)
N.T.S.



PLAN (Typical)
N.T.S.

MOORING ARRANGEMENTS:

Any vessel berthed at the the pontoon must not at any time :-

1. Extended into that area within 1.5m of the side boundaries of the designated Quay Line.
2. Exceed the design limitations of the pontoon.
3. Impede the safe navigation of vessels that utilise the waterway.
4. Compromise the safe ingress and egress of vessels to and from neighbouring structures.

GENERAL NOTES:

1. Design live loads for gangways and pontoons (Private use only):
   - single user residential site 2.0kPa
   - multi user residential site 3.0kPa
2. All structures shall be designed to withstand berthing impact and hydraulic loadings for a channel velocity of 0.75m/s.
3. Pontoons must be stable at all times. When the specified live load is distributed over half the width of the pontoon and over the walkway, there shall be not less than 75 mm of reserve bouyancy; the bottom corner shall not emerge from the water and the angle of tilt shall not exceed 15°.
4. Pontoons must be constructed of materials suitable for the purpose. Thin walled steel oil drums shall not be permitted for pontoon floats. Pontoons must be protected against corrosion, attack by marine organisms and deterioration of the materials by abrasion or immersion in sea water.
5. Pontoons are not to extend beyond quay line or closer than 1.5m to the projection of the side boundary of the quay line.
6. The pontoon must contain fixed lighting sufficient to indicate the presence of the pontoon. The lighting must be adequately shielded as to not cause a risk to the safe navigation of other vessels or a nuisance to surrounding properties.
7. All stay wires are to be fitted with retro-reflective tape or a similar material, sufficient to be clearly visible from approaching vessels.
8. The length of the pontoon must extend to the outer edge of the Quay Line.
9. Both pontoons and walkway shall be fully carpeted, fitted with mooring cleats and fender rubber to three sides.

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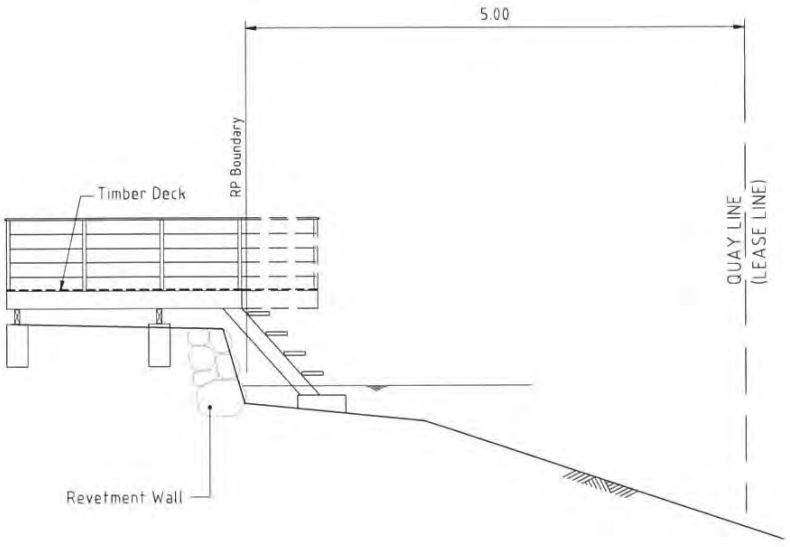
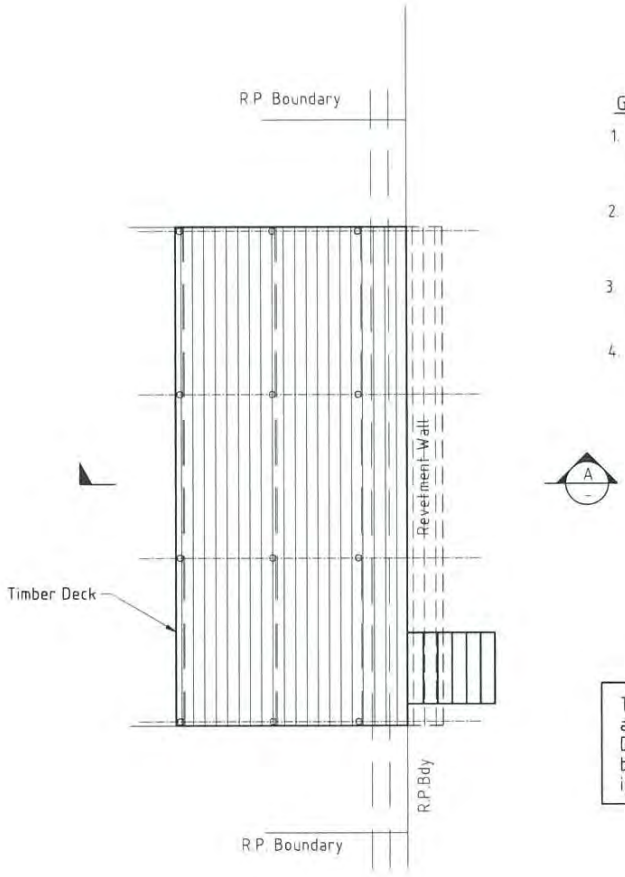
SUNSHINE COAST OFFICE: Level 1, 9 Maud Street Maroochydore, Qld 4558
Email: scc@cardno.com.au Ph. (07) 5443 2555 Fax. (07) 5443 5642

LEND LEASE DEVELOPMENT PTY LTD
TWIN WATERS PRECINCT
TYPICAL PONTOON
FIGURE 2.1



SECTION A
N.T.S.



PLAN
N.T.S.

GENERAL NOTES:

1. All structures shall be designed to withstand berthing impact and hydraulic loadings for a channel velocity of 0.75m/s. No loads are to be imposed on revetment wall by deck.
2. Design live loads for decks (Private use only):
   - single user residential site 2.0kPa
   - multi user residential site 3.0kPa
3. No fixing or deck support shall be made onto the existing revetment wall.
4. Maximum deck level of R.L.2.50

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ACN: 051 074 992
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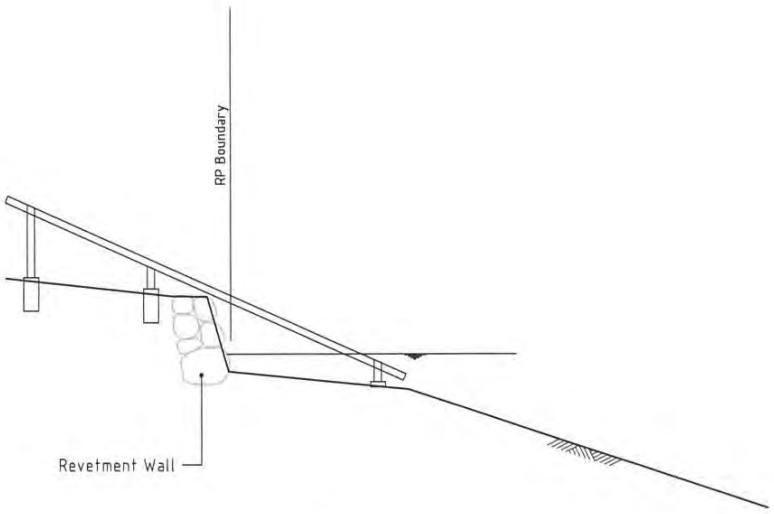
Email: scc@cardno.com.au Ph: (07) 5443 2555 Fax: (07) 5443 5642

LEND LEASE DEVELOPMENT PTY LTD
TWIN WATERS PRECINCT

TYPICAL DECK/STAIRS
FIGURE 2.2



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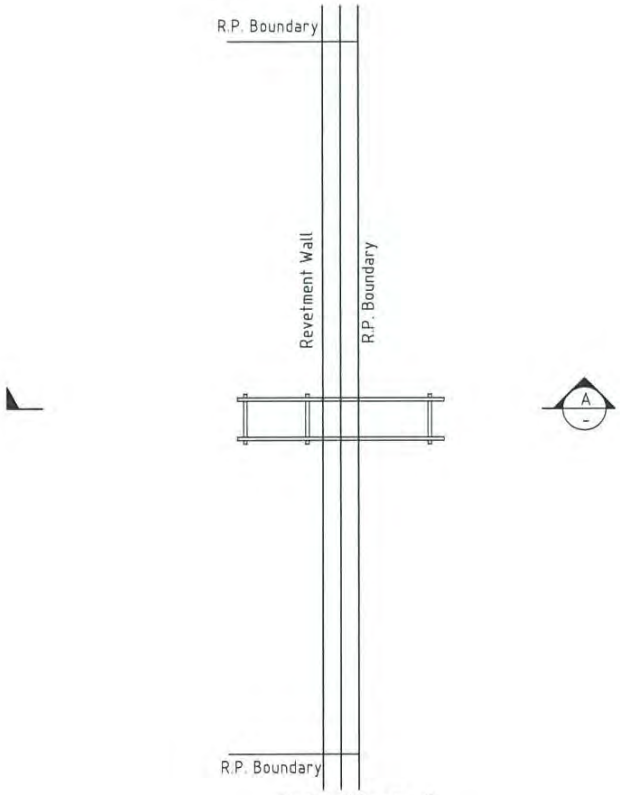
SECTION A (TYPICAL)
N.T.S.



PLAN (Typical)
N.T.S.

Cardno (Qld) Pty Ltd
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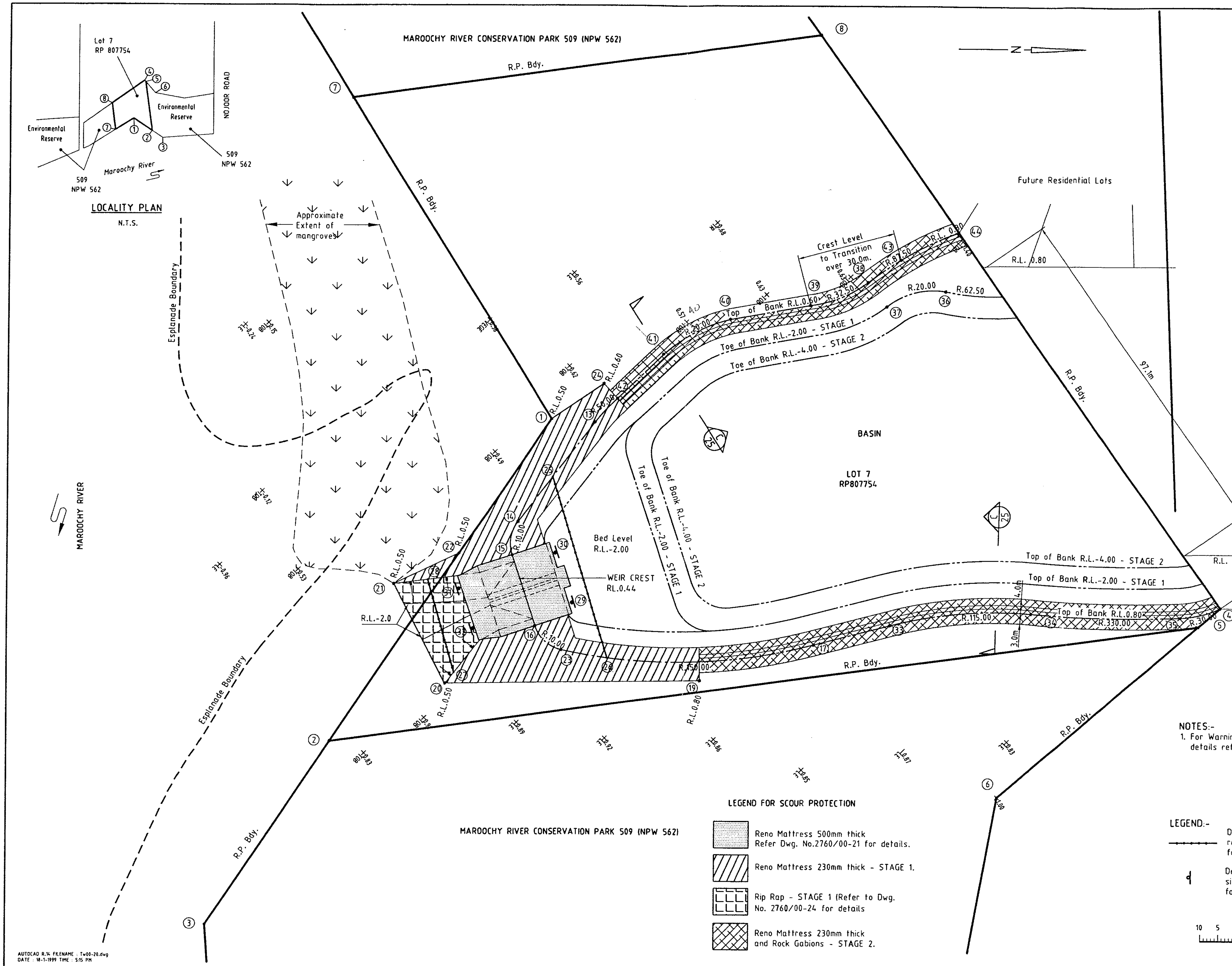
SUNSHINE COAST OFFICE: Level 1, 9 Maud Street Maroochydore, Qld 4558
Email: scc@cardno.com.au Ph. (07) 5443 2555 Fax. (07) 5443 5642

LEND LEASE DEVELOPMENT PTY LTD
TWIN WATERS PRECINCT

TYPICAL BOAT RAMP
FIGURE 2.3

Appendix D: Weir detailed design



COORDINATE TABLE *

Point No.	Easting	Northing	Description
1	8253.310	3487.377	R.P.
2	8331.933	3412.650	R.P.
3	8376.236	3370.544	R.P.
4	8335.101	3660.604	R.P.
5	8339.247	3653.761	R.P.
6	8377.000	3591.457	R.P.
7	8156.887	3447.536	R.P.
8	8160.840	3577.528	R.P.
~~9~~	~~8177.050~~	~~3667.160~~	~~Crest Level R.L.0.80~~
~~10~~	~~8178.346~~	~~3668.457~~	~~Crest Level R.L.0.60~~
~~11~~	~~8180.199~~	~~3669.014~~	~~Crest Level R.L.0.60~~
~~12~~	~~8180.940~~	~~3669.941~~	~~Crest Level R.L.0.60~~
13	8256.185	3499.367	Crest Level R.L.0.60
14	8280.109	3473.485	Crest Level R.L.0.60
15	8288.979	3470.390	Weir R.L.0.60
16	8309.575	3473.571	Weir R.L.0.80
17	8327.252	3548.760	Crest Level R.L.0.80
~~18~~	~~8285.437~~	~~3548.981~~	~~Crest Level R.L.0.80~~
19	8331.955	3515.852	Rock Protection
20	8321.243	3446.590	Rock Protection
21	8291.663	3437.331	Rock Protection
22	8286.084	3456.227	Rock Protection
23	8317.346	3479.772	Crest Level R.L.0.80
24	8245.999	3503.469	Rock Protection
25	8269.320	3485.157	Anchor block
26	8321.622	3492.114	Anchor block
27	8318.705	3449.422	Anchor block
28	8292.035	3446.567	Anchor block
29	8304.869	3484.880	Warning sign
30	8290.374	3482.497	Warning sign
31	8295.899	3454.503	Warning sign
32	8307.491	3456.438	Warning sign
33	8325.288	3570.088	Crest Level R.L.0.80
34	8328.345	3608.954	Crest Level R.L.0.80
35	8335.963	3649.318	Crest Level R.L.0.80
36	8235.931	3599.860	Crest Level R.L.-2.00
37	8237.449	3583.350	Crest Level R.L.-2.00
38	8230.062	3579.349	Crest Level R.L.0.70
39	8233.762	3562.992	Crest Level R.L.0.60
40	8233.923	3540.308	Crest Level R.L.0.60
41	8240.465	3520.626	Crest Level R.L.0.60
42	8250.656	3506.562	Crest Level R.L.0.60
43	8225.389	3589.140	Crest Level R.L.0.80
44	8220.498	3605.968	Crest Level R.L.0.80

* All Co-ordinates are on project Co-ordinate datum.

NOTES:-
1. For Warning sign, Safety cable and Marker pile details refer Dwg. No.2760/00-24

LEGEND FOR SCOUR PROTECTION

- Reno Mattress 500mm thick Refer Dwg. No.2760/00-21 for details.
- Reno Mattress 230mm thick - STAGE 1.
- Rip Rap - STAGE 1 (Refer to Dwg. No. 2760/00-24 for details
- Reno Mattress 230mm thick and Rock Gabions - STAGE 2.

LEGEND:-

- Denotes Safety Cable refer Dwg. No.2760/00-24 for details
- Denotes Marker Pile and warning sign refer Dwg. No.2760/00-24 for details

10 5 0 10 20 30 40 m 1 : 500
SCALE BEFORE REDUCTION

Rv.	DATE	REVISIONS	REC.	APPR.
D	17-2-1999	Co-Ordinate Data for points 33 and 34 amended.		
C	18-1-1999	Co-Ordinate Data amended.		
B	05-11-1998	Stage 2 Rock Gabions added.		
A	11-2-1997	Pipes amended		

DESIGNED:
DRAWN:
CHECKED:
RECOMMENDED: PROJ. MAN.
A1
DATUM: A.H.D.
APPROVED: PROJ. DIR.

Cardno & Davies Queensland Pty. Ltd.
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Sunshine Coast	(074)43 2555	(074)43 5642
Townsville	(077)71 5092	(077)71 2508
Wide Bay	(071) 21 2200	(071) 21 4901
Port Moresby	(0011675)25 2322	(675)25 0951

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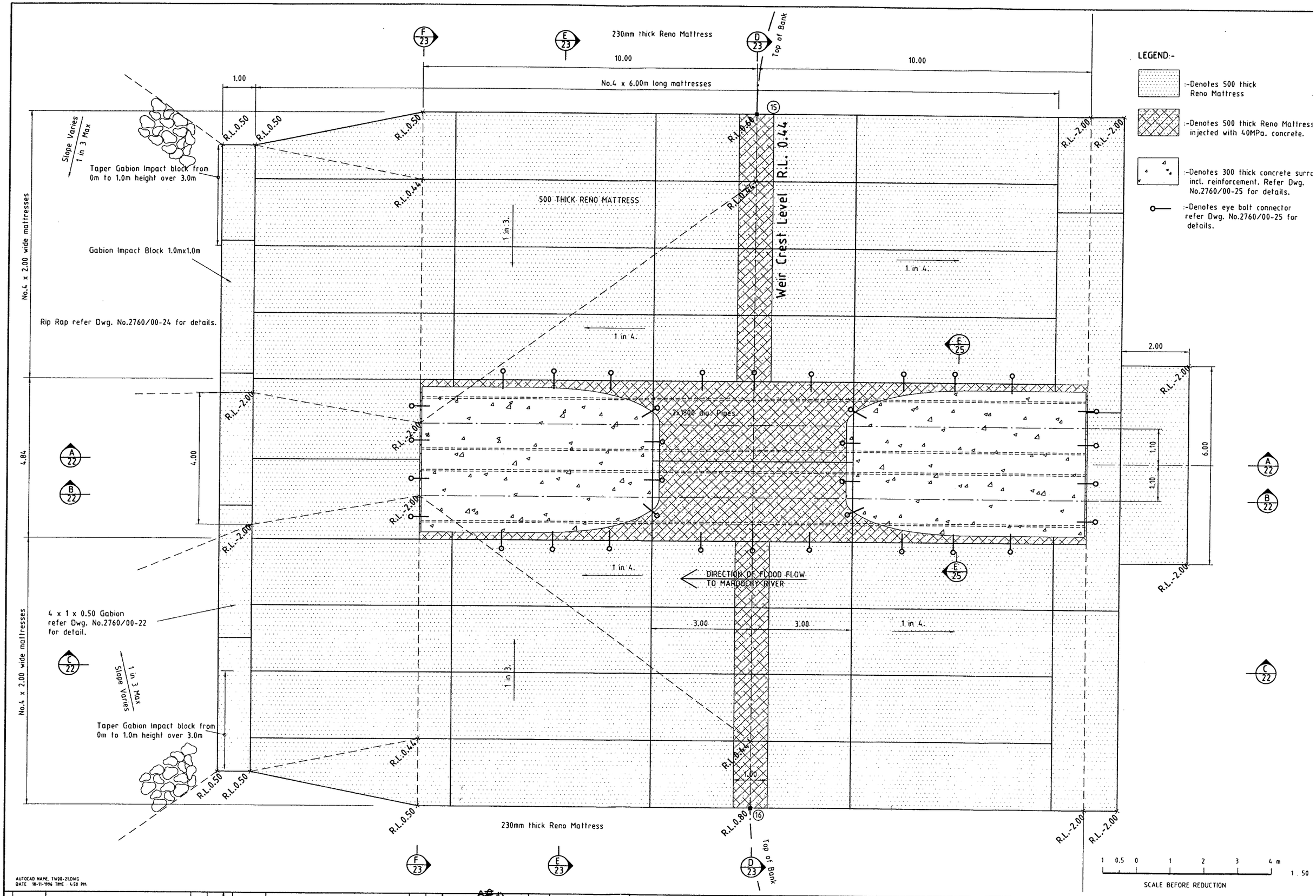
LEND LEASE DEVELOPMENT PTY. LTD.
TWIN WATERS RESIDENTIAL ESTATE
WEIR STRUCTURE
GENERAL ARRANGEMENT PLAN - STAGES 1 AND 2.
DATE: 11-10-1996
DRAWING No: 2760/00-20



AUTOCAD NAME. TW00-21.DWG
DATE 18-11-1996 TIME 4:50 PM

Rv.	DATE	REVISIONS	REC.	APPR.
A	8-2-1997	2 x 1500 dia. pipes amended, sections added.		

DESIGNED:
DRAWN:
CHECKED:
RECOMMENDED: PROJ. MAN.
A1
DATUM: A.H.D.
APPROVED PROJ. DIR.

Cardno & Davies Queensland Pty. Ltd.
ACN 051 074 992
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Sunshine Coast	(074)43 2555	(074)43 5642
Townsville	(077)71 5092	(077)71 2508
Wide Bay	(071) 21 2200	(071) 21 4981
Port Moresby	(00116)75125 2322	(675)25 0951

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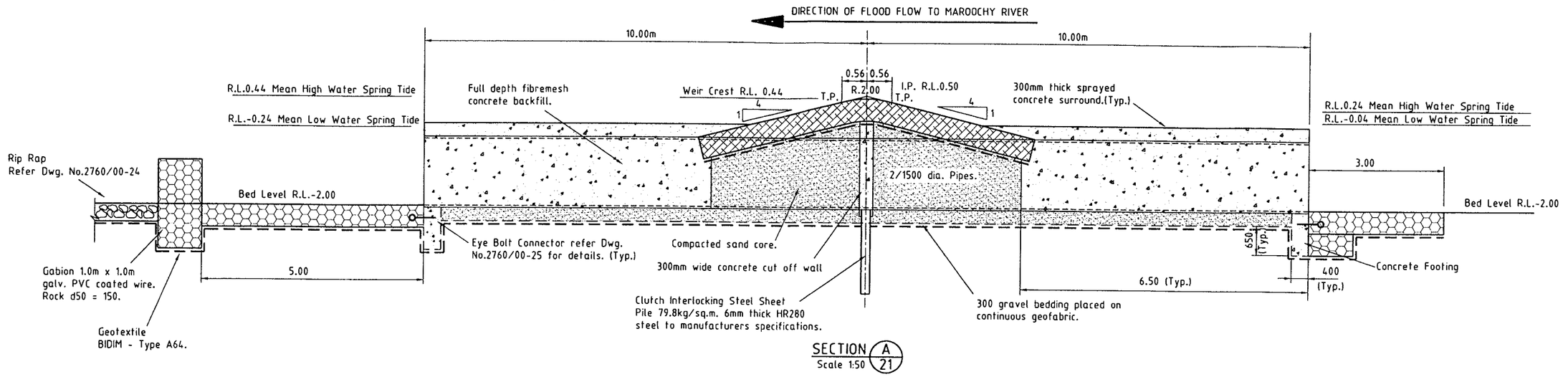
LEND LEASE DEVELOPMENT PTY. LTD.

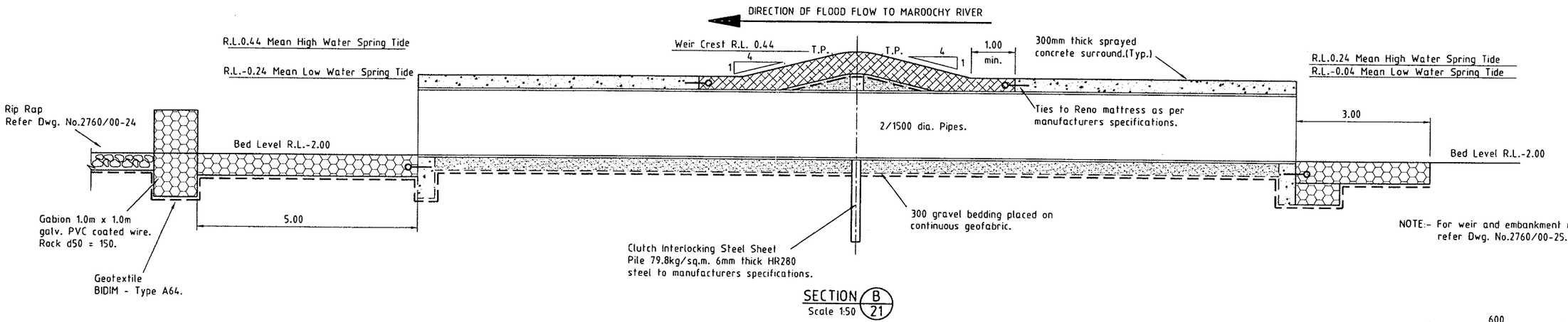
TWIN WATERS RESIDENTIAL ESTATE
WEIR STRUCTURE

GENERAL SETOUT AND LEVELS PLAN

DATE: 18-11-1996
DRAWING No: 2760/00-21

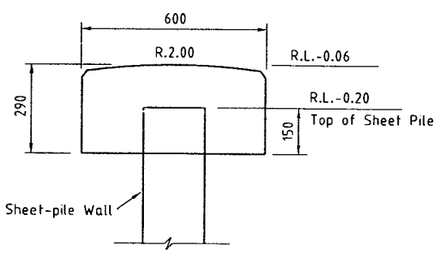


SECTION A
Scale 1:50 21

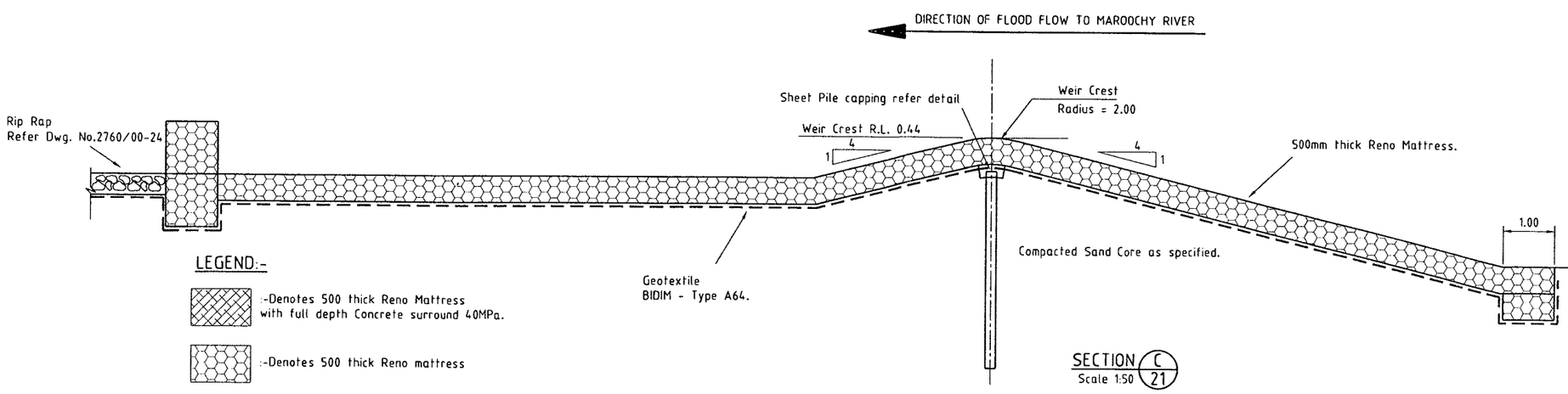


NOTE:- For weir and embankment notes refer Dwg. No.2760/00-25.

SECTION B
Scale 1:50 21



CAPPING DETAIL
Scale 1:10



SECTION C
Scale 1:50 21

1 0.5 0 1 2 3 4 m 1 : 5
SCALE BEFORE REDUCTION

2 1 0 2 4 6 8 m 1 : 100
SCALE BEFORE REDUCTION

AUTOCAD NAME: TW00-22.DWG
DATE 18-11-1996 TIME : 4:57 PM

Rv.	DATE	REVISIONS	REC.	APPR.
B	18-2-1997	Pipe surround material amended.		
A	8-2-1997	2 x 1500 pipes amended, concrete surround/section added.		

DESIGNED: A.F.H
DRAWN: M.W
CHECKED:
RECOMMENDED: PROJ. MAN.
A1
DATUM: A.H.D.
APPROVED: 11/9/97

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Wide Bay	(071) 21 2280	(071) 21 4901
Port Moresby	(00)1675125 2322	(675)25 0951

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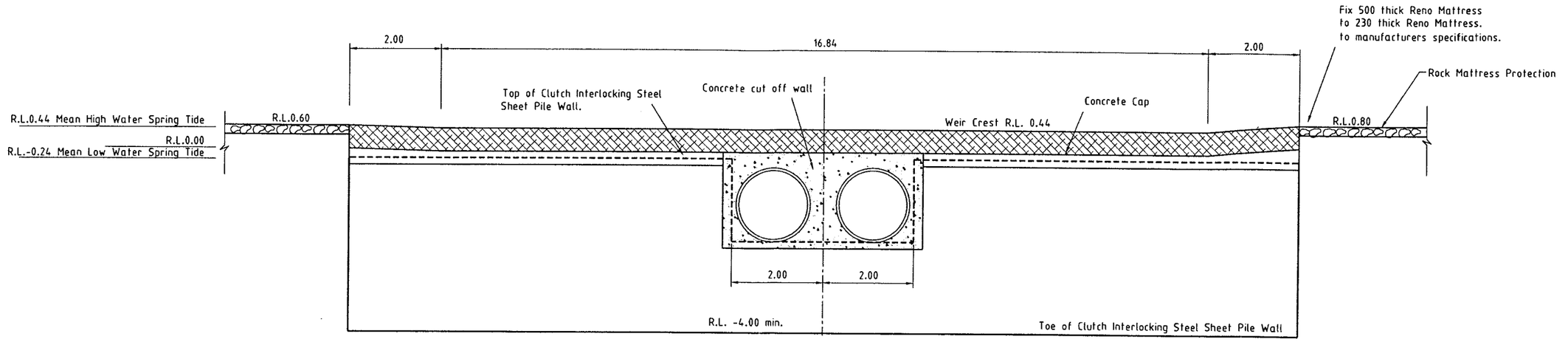
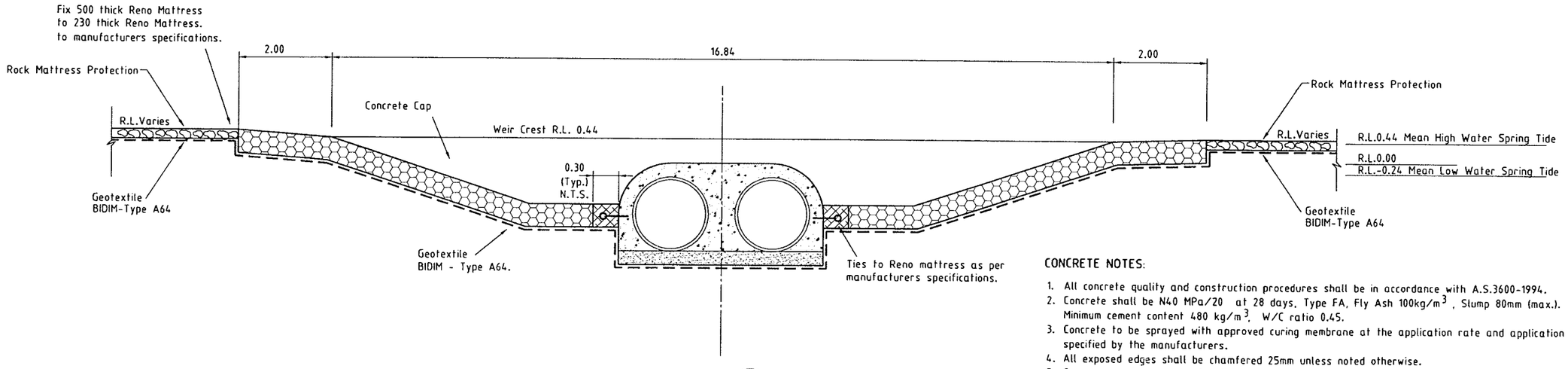
LEND LEASE DEVELOPMENT PTY. LTD.
TWIN WATERS RESIDENTIAL ESTATE
WEIR STRUCTURE
TYPICAL SECTION - SHEET 1

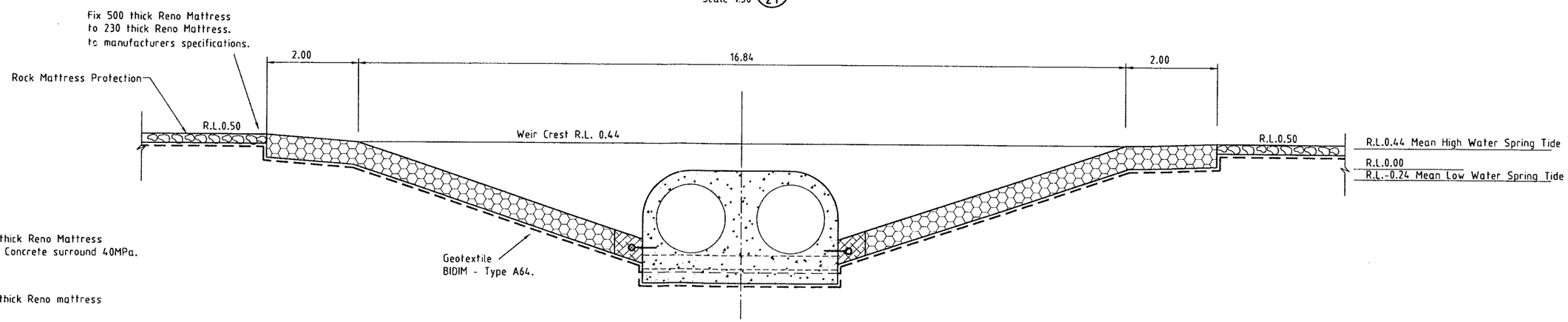
DATE: 18-11-1996 1996
DRAWING No: 2760/00-22



SECTION D/21
Scale 1:50



SECTION E/21
Scale 1:50



SECTION F/21
Scale 1:50

CONCRETE NOTES:

1. All concrete quality and construction procedures shall be in accordance with A.S.3600-1994.
2. Concrete shall be N40 MPa/20 at 28 days, Type FA, Fly Ash 100kg/m^3, Slump 80mm (max.). Minimum cement content 480 kg/m^3. W/C ratio 0.45.
3. Concrete to be sprayed with approved curing membrane at the application rate and application time specified by the manufacturers.
4. All exposed edges shall be chamfered 25mm unless noted otherwise.
5. Construction joints (as ordered).

LEGEND:-

-Denotes 500 thick Reno Mattress with full depth Concrete surround 40MPa.

-Denotes 500 thick Reno mattress

1 0.5 0 1 2 3 4 m
SCALE BEFORE REDUCTION
1 : 50

AUTOCAD NAME: TW00-23.DWG
DATE: 8-2-1997 TIME: 1:31 PM

Rv.	DATE	REVISIONS	REC.	APPR.
B	18-2-1997	Pipe bedding amended.		
A	8-2-1997	Concrete surround and section added.		

DESIGNED: A.S.H
DRAWN:
CHECKED:
RECOMMENDED: PROJ. MAN.
A1
DATUM: A.H.D.
APPROVED: PROJECT MGR.

Cardno & Davies
Queensland Pty. Ltd.
ACN: 051 074 992
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Sunshine Coast	(074)43 2555	(074)43 5642
Townsville	(077)71 5092	(077)71 2508
Wide Bay	(071) 21 2200	(071) 21 4901
Port Moresby	(001)675)25 2322	(675)25 0951

SUNSHINE COAST OFFICE:
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Postal Address: PO Box 152

LEND LEASE DEVELOPMENT PTY. LTD.
TWIN WATERS RESIDENTIAL ESTATE
WEIR STRUCTURE
TYPICAL SECTION SHEET 2

DATE: 18-11-1996
DRAWING No: 2760/00-23

MAROOCHY RIVER CONSERVATION PARK 509 (NPW 562)

R.P. Bdy.

RIVER EDGE CRESCENT

Residential

Lots

R.P Bdy

Approximate Extent of mangroves

Esplanade Boundary

Join smoothly to existing rip rap.

3.00

R.L 0.80

R.L 0.60

Top of Bank R.L 0.60

1 in 3

Toe of Bank R.L -4.00

R.L 0.50

R.L 0.60

Existing Pedestrian Bridge

R.P. Bdy.

BASIN

A 107

LOT 7 RP807754

Toe of Bank R.L -4.00

Provide Tubular Handrail with Warning Sign 1 and 2 mounted to handrail facing outwards. Refer detail Drawing 276040-703

Existing Marker Piles - Warning Sign 4 to be replaced where required. Refer detail Drawing 276040-703

Bed Level R.L.-2.00

Existing Marker Piles - Warning Sign 4 to be replaced where required. Refer detail DWG 276040-703

Toe of Bank R.L -4.00

4.0m

R.L. 0.80

MAROOCHY RIVER

WEIR CREST RL.0.44

R.L.-2.0

1 in 3

Top of Bank R.L 0.80

2.0m

Esplanade Boundary

R.P. Bdy.

R.L.0.50

R.L 0.80

Provide Tubular Handrail with Warning Sign 1 and 2 mounted to handrail facing outwards. Refer detail Drawing 276040-703

See note 5

R.P. Bdy.

Lots

Residential

ANCHORAGE CIRCUIT

Provide Warning Sign 3 to face river and basin. Refer detail Drawing 276040-703

R.P. Bdy

MAROOCHY RIVER CONSERVATION PARK 509 (NPW 562)

NOTES:-

1. Reno Mattress top mesh layer to be overlaid by an additional layer of Maccaferri Galmac mesh fastened to the existing top mesh in accordance with the manufacturer's instructions. Prior to installing the mesh overlay, the surface levels and profiles of the rock filled mattresses are to be reinstated by infilling any depressions and damaged areas with placed rock as specified.
2. Reno Mattress to be repaired as described in Note 1, but without sand overlay.
3. Rock used to fill wire mattresses shall be sized as follows:

	Size Range	d 50
Mattress - 230mm	80-200	150

4. Not more than 10% (by mass) of rock filing shall pass a 75mm aperture sieve.
5. A layer of clean beach sand is to be evenly spread through the exposed rocks in the area shown.

PHASING:-

CONSTRUCTION PHASE

- Rock replacement
- Gabion placement
- Mesh replacement
- Rock protection to west side
- Concrete and signage to weir.

MAINTENANCE & ESTABLISHMENT PHASE

- Sand placement
- Establishment of vegetation

LEGEND

- Existing Reno Mattress 230mm thick to be repaired. Refer to Note 1
- Existing Reno Mattress 500mm thick to be repaired. Refer to Note 2
- Existing sprayed concrete overlay to be repaired . Refer Drawing 276040-702
- Proposed additional rip rap. Refer Drawing 276040-702
- Denotes existing marker pile and warning sign. Refer Drawing 276040-703

5 0 5 10 15 20 25m

1:500 - A1 1:1000 - A3

DATE PLOTTED: 28 October, 2010 - 1:07pm

Rv.	DATE	REVISIONS	REC.	APPR.

DESIGNED:
DRAWN:
CHECKED:
RECOMMENDED: PROJ. MAN.
APPROVED: PROJ. DIR.

A1 DATUM: A.H.D.

RPEQ:

CAD FILE: 276040-701- 703.dwg
XREF's:

Cardno (Qld) Pty Ltd
ABN: 57 051 074 992
SUNSHINE COAST OFFICE: Level 1, 9 Maud Street Maroochydore, Qld 4558
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Sydney	(02) 9416 8233	(02) 9416 6529
Gold Coast	(07) 5539 9333	(07) 5538 4647
Townsville	(07) 4772 1166	(07) 4721 2508
Hervey Bay	(07) 4124 5455	(07) 4124 5155
Cairns	(07) 4033 2995	(07) 4033 2992
Rockhampton	(07) 4924 7500	(07) 4926 4375
Darling Downs	(07) 4637 8122	(07) 4637 8155
Darwin	(08) 8981 3613	(08) 8941 1768

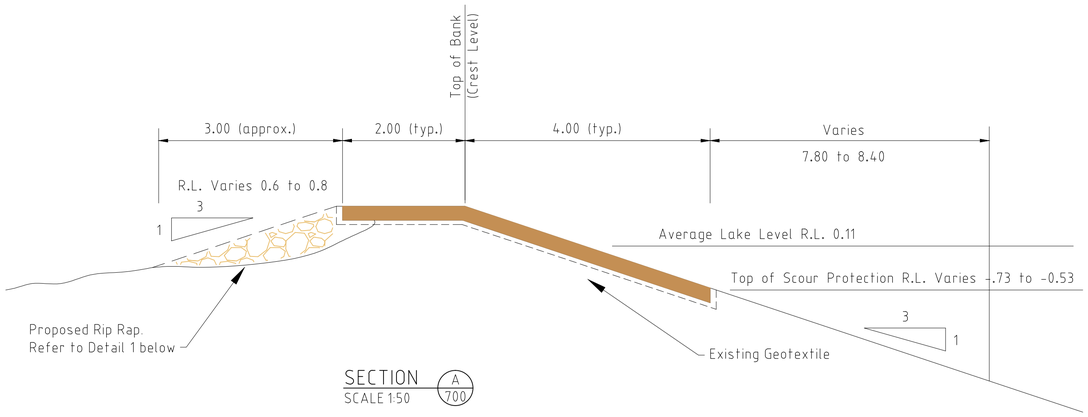
LEND LEASE DEVELOPMENT PTY LTD

TWIN WATERS RESIDENTIAL ESTATE
WEIR STRUCTURE
REMEDIATION WORKS
GENERAL ARRANGEMENT PLAN

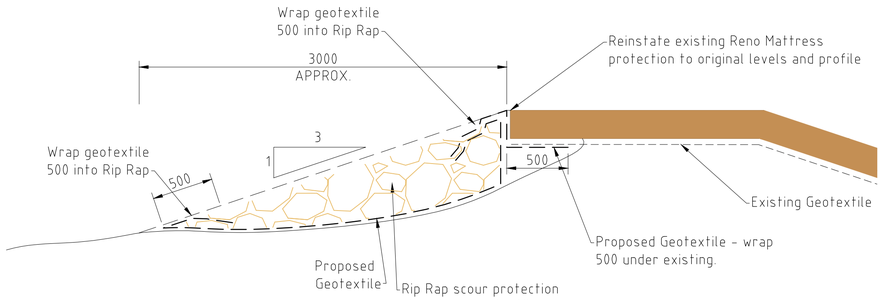
DATE: 7/05/2010 Rv.

DRAWING No:

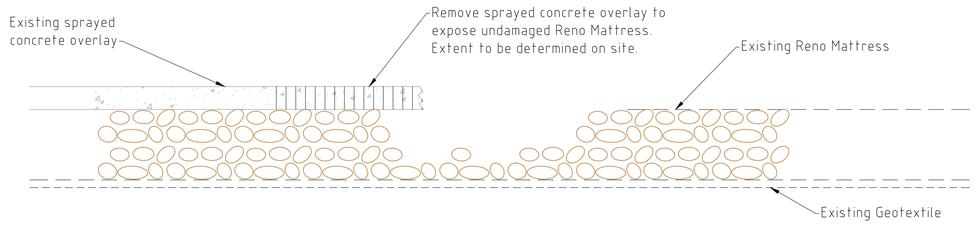
276040-701



SECTION A
SCALE 1:50 700

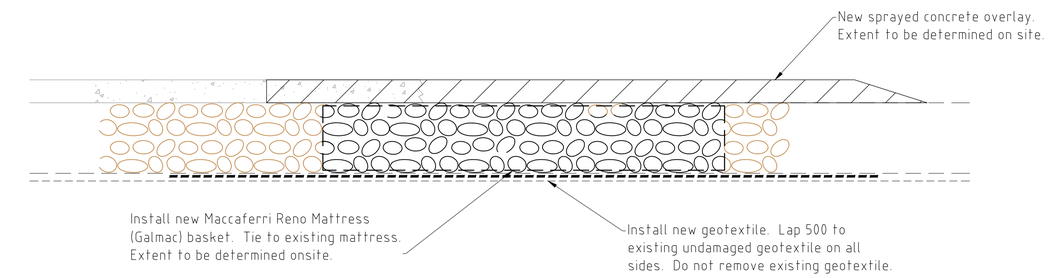


DETAIL 1
SCALE 1:25



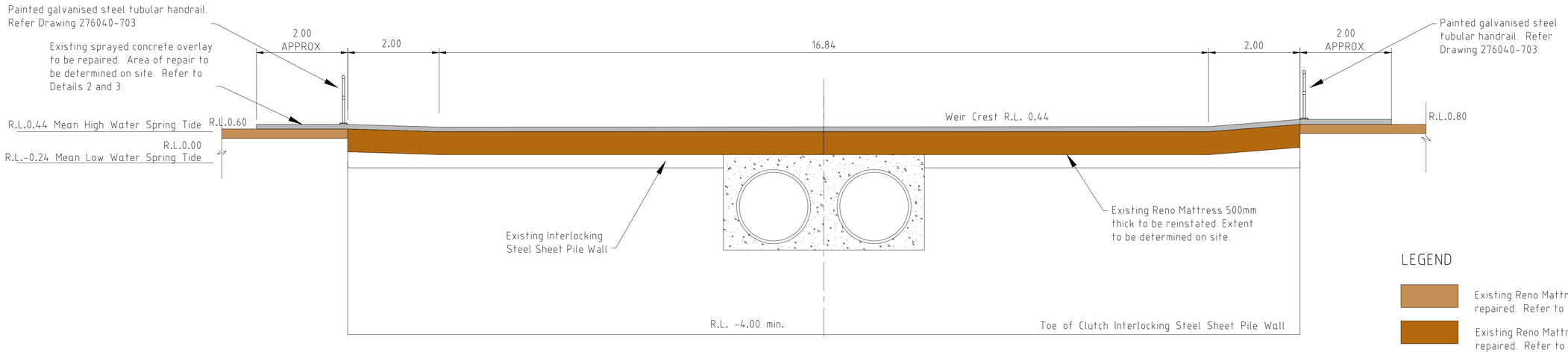
EXISTING

DETAIL 2
SCALE 1:10



PROPOSED

DETAIL 3
SCALE 1:10



SECTION B
SCALE 1:50 700

LEGEND

- Existing Reno Mattress 230mm thick to be repaired. Refer to Note 1 Drawing 276040-701
- Existing Reno Mattress 500mm thick to be repaired. Refer to Note 2 Drawing 276040-701
- Existing sprayed concrete overlay to be repaired .
- Proposed additional Rip Rap. Refer to detail.

5 0 5 10 15 20 25m
1:500 - A1 1:1000 - A3

DATE PLOTTED 27 October, 2010 - 2:37pm

Rv.	DATE	REVISIONS	REC.	APPR.

DESIGNED:
DRAWN:
CHECKED:
RECOMMENDED: PROJ. MAN.
APPROVED: PROJ. DIR.
RPEQ:
CAD FILE: 276040-701- 703.dwg
XREF's:

A1 DATUM: A.H.D.

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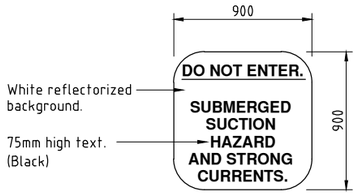
Townsville	(07) 4772 1166	(07) 4721 2508
Hervey Bay	(07) 4124 5455	(07) 4124 5155
Cairns	(07) 4033 2995	(07) 4033 2992
Rockhampton	(07) 4924 7500	(07) 4926 4375
Darling Downs	(07) 4637 8122	(07) 4637 8155
Darwin	(08) 8981 3613	(08) 8941 1768

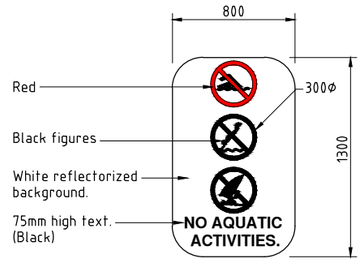
LEND LEASE DEVELOPMENT PTY LTD

TWIN WATERS RESIDENTIAL ESTATE
WEIR STRUCTURE
REMEDIATION WORKS
SECTIONS AND NOTES

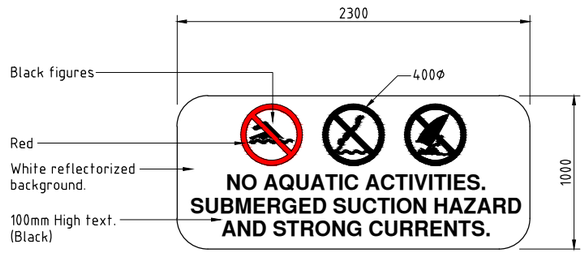
DATE: 7/05/2010 Rv.
DRAWING No:
276040-702



WARNING SIGN 1
Scale 1:20



WARNING SIGN 2
Scale 1:20

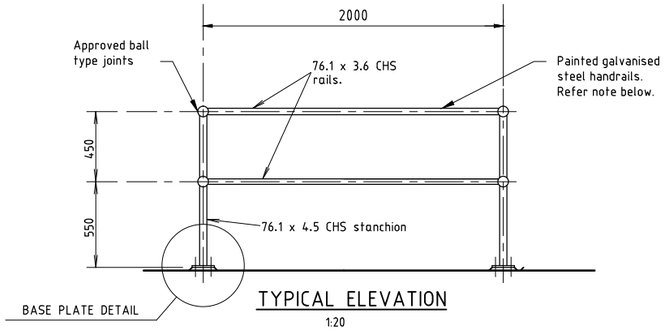


WARNING SIGN 3
Scale 1:20

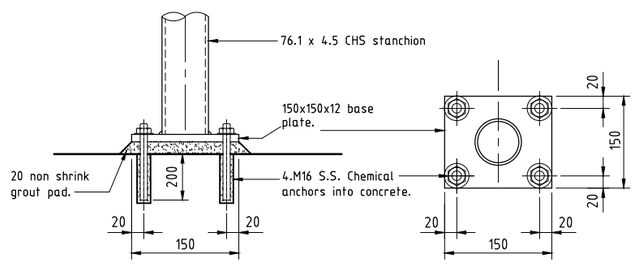
DANGER
SUBMERGED OBJECTS
NO NAVIGATION ACCESS

Sign to be 850 x 250 x 4 thick aluminium sheet in 50mm high white letters on a red background.

WARNING SIGN 4
N.T.S.



TYPICAL ELEVATION
1:20



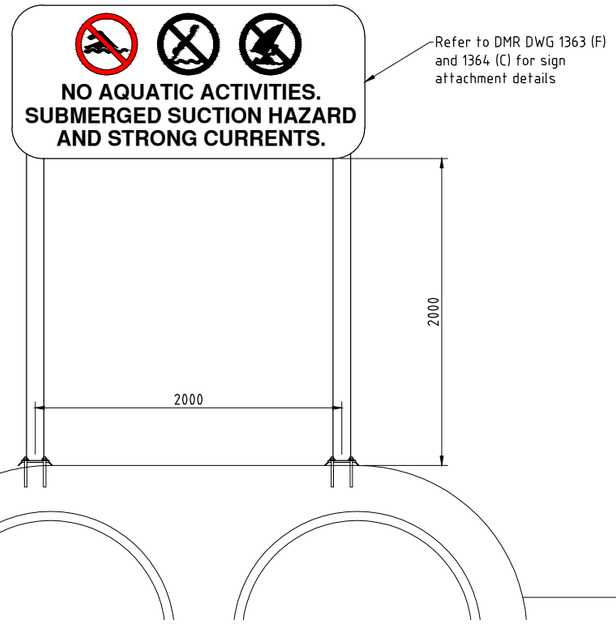
BASE PLATE DETAIL

TUBULAR HANDRAIL

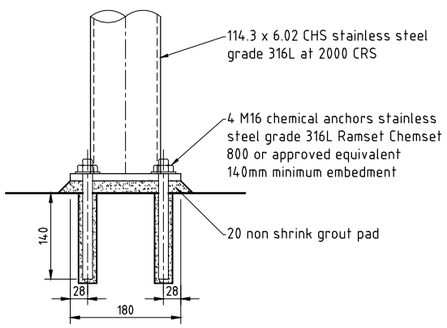
HANDRAIL COATING SYSTEM NOTE

Coating system designation: HDG600P7 (AS/NZS 2312:2002 - Table 5.3).

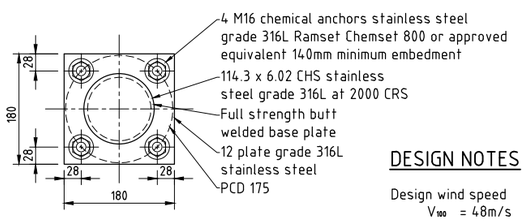
Hot dip galvanising:	600g/m^2
First coat:	Epoxy Primer (75 microns DFT)
Second coat:	Ployurethane Gloss (75 microns DFT)



TYPICAL ELEVATION
Scale 1:20



Elevation
Scale 1:5



Plan
Scale 1:5

DESIGN NOTES

Design wind speed
V_{100} = 48m/s
V_{DES} = 43.7m/s
$M_{t,cat}$ = 0.94
C_d = 2.4

BASE PLATE DETAIL

WARNING SIGN 3 MOUNTING DETAIL

5 0 5 10 15 20 25m
1:500 - A1 1:1000 - A3

PRELIMINARY
Date 28 May, 2010

Rv.	DATE	REVISIONS	REC.	APPR.

DESIGNED:
DRAWN:
CHECKED:
RECOMMENDED: PROJ. MAN.
A1
DATUM: A.H.D.
APPROVED: PROJ. DIR.
RPEQ:
CAD FILE: 276040-701- 703.dwg
XREF's:

Cardno (Qld) Pty Ltd
ABN: 57 051 074 992

OFFICES	TELEPHONE	FAX
Sunshine Coast	(07) 5443 2555	(07) 5443 5642
Brisbane	(07) 3369 9822	(07) 3369 9722
Sydney	(02) 9416 8233	(02) 9416 6529
Gold Coast	(07) 5539 9333	(07) 5538 4647
Townsville	(07) 4772 1166	(07) 4721 2508
Hervey Bay	(07) 4124 5455	(07) 4124 5155
Cairns	(07) 4033 2995	(07) 4033 2992
Rockhampton	(07) 4924 7500	(07) 4926 4375
Darling Downs	(07) 4637 8122	(07) 4637 8155
Darwin	(08) 8981 3613	(08) 8941 1768

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LEND LEASE DEVELOPMENT PTY LTD

TWIN WATERS RESIDENTIAL ESTATE
WEIR STRUCTURE
REMEDIATION WORKS
HANDRAIL DETAIL AND SIGNS

DATE: 7/05/2010
Rv.
DRAWING No:
276040-703

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