



PROJECT

Flinders Council -
Marine Access and Safe
Harbour

CLIENT

Flinders Council

DATE

September 2017

→ burburyconsulting.com.au



Contents

Executive Summary	1
1. Introduction	4
1.1 Inception Meeting	4
1.2 Project Objectives	4
2. Project Methodology	6
2.1 Project Scoping & Planning	6
2.1.1 Inception Meeting	6
2.1.2 Concept Design Workshop	6
2.1.3 Inception Report	6
2.2 Planning & Environmental Approvals Review	7
2.3 Stakeholder Engagement & Market Research	7
2.3.1 Engagement Strategy	7
2.3.2 Market Research	7
2.4 Desktop Technical Reviews	7
2.4.1 Desktop Reviews & Investigations	7
2.5 Preliminary Designs Concepts	8
2.5.1 Development of Concept Designs	8
2.6 Project Assessment	8
2.6.1 Demand Assessment & Site SWOT analysis	8
2.6.2 Rapid Assessment of Project Options	9
2.6.3 Pre – Screening (Triple Bottom Line) Analysis	9
2.7 Detailed Site Studies	9
2.8 Detailed Business Case	10
2.8.1 Finalised Concept Design Plans & Report	10
3. Project References	11
3.1 Technical References	11
3.2 Stakeholder Groups	11
4. Background Information	13
5. Stakeholder Engagement and Interviews	16
5.1 Introduction	16
5.2 Engagement Tools	16
5.3 Concept Design Workshop	16
5.4 Summary of Key Stakeholders Interview Responses	17
5.4.1 Marine Vessel Tourism	17
5.4.2 Key Maritime Sites	18
5.4.3 Marine Infrastructure Requirements	20
6. Preliminary Site Analysis	21
6.1 Site Assessments	21
6.2 Lady Barron	22
6.2.1 Description	22



6.3	Lady Barron – Slipway Site	24
6.3.1	Location	24
6.3.2	Existing Marine Facilities	24
6.4	Lady Barron – Port Wharf	27
6.4.1	Location	27
6.4.2	Existing Facilities	27
6.5	Trousers Point	30
6.5.1	Location	30
6.5.2	Existing Facilities	31
6.6	Whitemark	31
6.6.1	Location	31
6.6.2	Existing Whitemark Port Facilities	32
6.6.3	Whitemark Double Comer & Long Point	32
6.7	Port Davies	33
6.7.1	Location	33
6.7.2	Existing Facilities	33
6.8	Killiecrankie	36
6.8.1	Location	36
6.8.2	Existing Facilities	36
7.	Pre-Feasibility Screening Evaluations and Rapid Appraisal	40
7.1	Strategic Observations	40
7.1.1	A ‘SWOT’ Perspective	40
7.2	Rapid Assessment of Project Options	42
7.3	Pre – Screening (Triple Bottom Line) Analysis	42
7.4	Definition/Clarification of Criteria for Scoring Each Site	42
7.4.1	Economic/Financial	42
7.4.2	Social	42
7.4.3	Environmental	43
7.4.4	Governance	43
7.5	TBL Rating Scales	43
7.6	Overview of Pre-Screening Activities	44
7.6.1	Initial (First Order) Pre-Screening	44
7.6.2	Second Order Pre-Screening	44
7.6.3	Third Order Pre-Screening	45
7.7	Pre-Screening Summary	48
8.	Site Investigations	49
8.1	Marine Infrastructure Design	49
8.2	Site Investigations	49
8.3	Port Davies	50
8.3.1	Concept Design Development	50
8.3.2	Flora & Fauna (Marine and Terrestrial)	51
8.3.3	Coastal Processes	52
8.3.4	Geology	52
8.3.5	Bathymetry	52



8.3.6	Acid Sulfate Soils	52
8.3.7	Geoconservation	52
8.3.8	Landslide Risk	53
8.3.9	Sediment Contamination	53
8.3.10	Cultural Heritage (European and Aboriginal)	53
8.3.11	Environmental Conclusion	53
8.3.12	Planning Considerations	53
8.3.13	Planning Conclusion	55
8.4	Whitemark (Port)	56
8.4.1	Concept Design Development	56
8.4.2	Natural Values (Marine and Terrestrial)	57
8.4.3	Coastal Processes	57
8.4.4	Geology	58
8.4.5	Bathymetry	58
8.4.6	Acid Sulfate Soils	58
8.4.7	Geoconservation	58
8.4.8	Landslide Risk	58
8.4.9	Sediment Contamination	58
8.4.10	Cultural Heritage (European and Aboriginal)	58
8.4.11	Environmental Conclusion	58
8.4.12	Planning Considerations	59
8.4.13	Planning Conclusion	60
8.5	Trousers Point	61
8.5.1	Concept Design Development	61
8.5.2	Natural Values	62
8.5.3	Coastal Processes	62
8.5.4	Geology	62
8.5.5	Bathymetry	62
8.5.6	Acid Sulfate Soils	62
8.5.7	Geoconservation	62
8.5.8	Landslide Risk	63
8.5.9	Sediment Contamination	63
8.5.10	Cultural Heritage (European and Aboriginal)	63
8.5.11	Environmental Conclusion	63
8.5.12	Planning Considerations	63
8.5.13	Planning Conclusion	65
8.6	Lady Barron Wharf	66
8.6.1	Concept Design Development	66
8.6.2	Natural Values	67
8.6.3	Coastal Processes	67
8.6.4	Geology	67
8.6.5	Bathymetry	67
8.6.6	Acid Sulfate Soils	67
8.6.7	Geoconservation	68
8.6.8	Landslide Risk	68
8.6.9	Sediment Contamination	68
8.6.10	Cultural Heritage (European and Aboriginal)	68



8.6.11	Environmental Conclusion	68
8.6.12	Planning Considerations	68
8.6.13	Planning Conclusion	70
8.7	Lady Barron Slip	71
8.7.1	Concept Design Development	71
8.7.2	Natural Values	72
8.7.3	Coastal Processes	72
8.7.4	Geology	73
8.7.5	Bathymetry	73
8.7.6	Acid Sulfate Soils	73
8.7.7	Geoconservation	73
8.7.8	Landslide Risk	73
8.7.9	Sediment Contamination	73
8.7.10	Cultural Heritage (European and Aboriginal)	74
8.7.11	Environmental Conclusion	74
8.7.12	Planning Considerations	74
8.7.13	Planning Conclusion	75
8.8	Conclusions and Recommendations	76
9.	Preferred Concept	77
9.1.1	Breakwater Design	78
9.1.2	Floating Marina	80
9.1.3	Boat Ramp	81
9.2	Engineering Cost Estimates	82
10.	Economic Investment and Business Case	83
10.1	Economic Objectives	83
10.2	Project Appraisal Methodology	84
10.3	Project Analysis Questions	85
10.4	Relationship of Economic Development to Infrastructure Investment	86
10.5	F.I. Safe Harbour Project Investment	86
10.5.1	Results	88
11.	Cost Benefit Analysis	89
11.1	Initial Development Costs (Capital Investments)	89
11.2	Operating and Maintenance and Site Management Costs	89
11.3	Economic Results/Project Viability Estimation	89
11.4	Intangible or Non-Quantifiable Benefits	91
11.5	Marketing Directions	91
12.	Business Summary and Recommendations	93
12.1.1	Key socio-economic benefits	93
12.1.2	Key financial benefits	93
13.	References	94
	Appendix A – Preferred Development Drawings	95
	Appendix B – Economic Analysis Tables	96



Appendix C – Concept Site Option Drawings	97
Appendix D – Detailed Site Investigations Report (Marine Solutions)	98
Figures	
Figure 1 Locality Plan	13
Figure 2 Flinders Island Marine Facilities	15
Figure 3 Aerial of sites visited on Flinders Island	21
Figure 4 Lady Barron Location	23
Figure 5 Lady Barron Study Area	24
Figure 6 Lady Barron Slipway	25
Figure 7 Lady Barron Port	27
Figure 8 Trousers Point	30
Figure 9 Whitemark Region	31
Figure 10 Whitemark Port	32
Figure 11 Port Davies	34
Figure 12 Killiecrankie Location	36
Figure 13 Killiecrankie Study Area	37
Figure 14 Site Location Map showing proposed development proposal at Port Davies	51
Figure 15 Existing licenses within proposed development area at Port Davies	55
Figure 16 Plan showing proposed concept development option at Whitemark (Port)	57
Figure 17 Existing license within proposed development area at Whitemark (Port)	60
Figure 18 Plan showing proposed development at Trousers Point	61
Figure 19 Existing licenses within proposed development area at Trousers Point	64
Figure 20 Plan showing proposed development at Lady Barron Wharf	66
Figure 21 Existing licenses within proposed development area at Lady Barron Wharf	69
Figure 22 Plan showing proposed development at Lady Barron Slip	71
Figure 23 Outer Aerial of proposed development at Lady Barron	72
Figure 24 Existing licenses within proposed development area at Lady Barron Slip	75
Figure 25 Preferred Concept at Lady Barron Slip	77
Figure 26 Typical Section of Breakwater	79



Burbury Consulting Pty Ltd ACN 146 719 959

2/2 Gore Street, South Hobart, TAS 7004

P. 03 6223 8007

F. 03 6212 0642

admin@burburyconsulting.com.au

www.burburyconsulting.com.au

Document Status

Rev No.	Author	Status	Approved for Issue	
			Name	Date
0	B. Noakes, N.Palfreyman & J.Burbury	Draft – for client review	J.Burbury	27.04.2017
1	B. Noakes, N.Palfreyman & J.Burbury	Final	J.Burbury	14.09.2017



Executive Summary

Flinders Council is currently investigating the feasibility for options and location to develop a reliable and safe all-weather marine facility, to provide improved safety and visitor destination for the growing motor boat and yacht cruising tourism market. As part of the project Burbury Consulting undertook:

- Consultation with local stakeholders and interested residents to identify potential locations as well as infrastructure requirements for marine facilities;
- Site assessment of a range of sites around Flinders Island to assess suitability and requirements for marine infrastructure;
- Site specific studies for selected site including marine habitat mapping, bathymetry surveys and habitat impact assessments;
- Engineering design assessments for marine infrastructure;
- Project costings for each site option; and
- Development of a business case for specific options with recommended preferred site and project development.

Based on site suitability assessment and stakeholder the following sites were identified for development of options for marine infrastructure:

1. Lady Barron (slipway);
2. Lady Barron (existing port wharf);
3. Trousers Point;
4. Whitemark (existing wharf);
5. Killiecrankie; and
6. Port Davies.

This report identified potential issues that will require consideration in the process of planning construction for each of the sites assessed above. Considerations include the potential for interactions with threatened and protected species, foreshore and subtidal disturbance, and the potential loss of physical and cultural values. Of the many elements of the proposed development, the greatest known impact would be from the marine structures, which was seen to compromise the scenic quality of the sites (particularly Trousers Point and Port Davies) and the impact of which could not be successfully mitigated. Throughout site selection, consideration should primarily be given to minimise adverse impacts on:

- Degradation of social and/or visual values;
- Loss, disturbance or destruction of the fauna and flora values;
- Degradation and destabilisation of soils; and
- Detrimental impact on Aboriginal heritage values.

In consideration of social, physical and ecological factors, the **Lady Barron Slip site is considered the most suitable** of those surveyed for the development of a marina.

Such a development would also be feasible at Lady Barron Wharf and Port Davies, however, strong currents may present navigation hazards at Lady Barron Wharf, and access to shore-based amenities would need to be considered at Port Davies. Whitemark is considered a poor option on the basis of exposure to prevailing westerly weather conditions, combined with shallow water depths. The impact of a small marina development at Trousers Point would have a considerable impact on social value of the area, and strong community division to the proposal is considered likely for this site.



A project development plan for Lady Barron Slipway site was developed and costed incorporating the following scope:

- Rock breakwater structure to provide protection from wind waves and aligned to suit site bathymetry, currents and design arrangement;
- New trailer boat ramp for vessels up to 8 metres incorporating small boat berthing and mooring and small boat visitor berthing;
- Pontoon jetty incorporating access for boat ramp, visitor berthing and access to marina facilities;
- Development of up to 50 berth marina facility with floating marina and services; and
- Capacity to allow for parking and amenities alongside marina facilities including trailer parking, car parking and amenities building.

Preferred Development Plan – Lady Barron Slipway Site



The engineering estimate for the Lady Barron slipway site was estimated at \$4.8m incorporating all phases of the project.

Economical and Business Summary and Recommendations

The cost benefit analysis for the Lady Barron slipway site identified the following key economic outputs:

	EIRR (%)	NPV (\$ Million)	BCR (Ratio)
Option 2: Lady Barron – Slipway Development	13.86	3.57	1.72



The proposed development of new marine infrastructure at Lady Barron is likely to be a highly attractive public sector investment for Flinders Island.

It will ensure the increased appeal and sustainability of Flinders Island as an attractive ocean yachting destination. It will also be a major economic development incentive for the local economy, in particular, and for the Northern Tasmanian economy.

The proposed Project will provide a unique opportunity for the Flinders Island economy to strengthen and diversify its economic base, in terms of existing economic activities and additional tourism and outdoor recreation opportunities.

The proposed Project is expected to be an economically viable public sector investment, with a broad range of forecast benefits. It meets all COAG public sector investment pre-conditions and requirements. There are no perceived technical, economic or environmental risks associated with the project.

The Project represents an investment of State and Commonwealth Government significance, given the uniqueness of its natural environs and ocean yachting appeal. It meets all necessary preconditions for the development of a 'safe' harbour for ocean yachts, for commercial fishing vessels and for local yachting activities.



1. Introduction

This report was developed for the Flinders Council (Council) as part of the Flinders Island Marine Access and Safe Harbour (FIMASH) Feasibility Study Project.

The report provides a summary of the site inspections, stakeholder consultation, initial site analysis and outcomes of a feasibility screening evaluation on potential safe harbour sites investigated around the island.

This report provides recommendations to Council on the site(s) proposed for marine infrastructure development.

1.1 Inception Meeting

A working team consisting of an economist, principle engineer and project/environmental manager visited Flinders Island on Tuesday May 31, 2016 for the week to commence the FIMASH project.

A meeting was conducted with representatives from the Flinders Council (Jana Harper and Sophie Pitchford) and Burbury Consulting; James Burbury (principal maritime engineer), Nigel Palfreyman (project/environmental manager) and Bob Noakes (principal economist) to discuss project requirements, objectives and confirm the work program and outputs of the project. These discussions also facilitated input on the following items:

- Identification of key stakeholders;
- Nomination of island contacts that may provide relevant input to the project;
- Discussions for Flinders Island Planning requirements;
- Identify key current and likely future port and maritime facility users;
- Obtain background information and reports; and
- Plan for site inspection requirements for the site(s).

For the duration of our visit we utilised Council's office as our base to complete targeted consultation with key stakeholders and coordination of market research as well as undertaking the inspection of the recommended sites around the island.

1.2 Project Objectives

Prior to commencing with our consultation we prepared our specific definition around the project objective nominated in the Council brief:

"The FIMASH project is responding to the opportunity of providing enabling infrastructure to increase visitation to Tasmania by visiting boats and yachts and to ensure that the sea tourism transport environment supports growth in these visitors to the State yielding a broad return across the tourism supply chain."

The key objectives include:

- Identify the sea tourism transport users;
- Identification of infrastructure for attracting boating tourism and that can provide opportunity to increase interstate visitation to both Flinders Island and Tasmania; and
- Identify the areas of growth in marine visitation through improved infrastructure with marine access and safe harbour development.



The critical components to complete this project included:

- Consultation with existing businesses and users within the marine tourism sectors;
- Identification of marine tourism including existing and future growth;
- Identification of current and likely future demand of marine infrastructure;
- Understanding of existing and potential sites for marine access;
- Site desktop and physical site assessments;
- Masterplan and regional planning background review of potential sites;
- Site development SWOT (Strength, Weakness/constraints, Opportunities and Threats) assessment;
- Conceptual infrastructure planning and design of development for the preferred site(s);
- Identification of range of likely economic and social benefits;
- Development of project and construction cost estimates;
- Preparation of economic/financial justification for project investment costs (Benefit-Cost Analyses);
- Advice on planning and environmental assessment requirements; and
- Preparation of a clear master plan and business case and report.

This report brings together the overall study incorporating the stakeholder inputs, site assessments, and identification of site infrastructure opportunities, SWOT analysis of each site and recommendation of preferred sites on the basis of pre-feasibility screening assessment based on a triple bottom line (TBL) assessment.

The report makes recommendations on the preferred site and project proposal for further development.



2. Project Methodology

The methodology used was developed based on the project objectives and site appreciation as well as consideration of our approach to similar projects and success of the work undertaken to engage with community on consultation and project opportunity development.

The following section outlines the approach taken to complete the FIMASH project.

2.1 Project Scoping & Planning

2.1.1 Inception Meeting

At the commencement of the project we met with Council to facilitate input on the following items:

- Identification of key stakeholders;
- Nomination of island contacts that may provide relevant input to the project;
- Discussions for Flinders Island Planning requirements;
- Identify key current and likely future port and maritime facility users;
- Obtain background information and reports; and
- Plan for site inspection requirements for the site(s).

2.1.2 Concept Design Workshop

A design workshop was undertaken with targeted stakeholders to identify the key function and user requirements for marine access and the definition of a safe harbour for Flinders Island.

This workshop provided ideas and information to on key drivers that could increase vessel visitation including:

- Navigation improvements for safe access;
- Existing island access constraints;
- Facilities and access to marine supplies;
- Existing and future marine tourism needs and opportunities;
- Emerging trade and shipping trends affecting northern Tasmania; and
- Existing and current markets.

2.1.3 Inception Report

We have provided Council with a *DRAFT* Inception Report.

The report provided a summary of the preliminary site inspections, stakeholder consultation, initial site analysis and outcomes of a pre-feasibility screening evaluation on potential safe harbour sites investigated around the island, recommended as part of the study as well as identified during the stakeholder consultation.

The report provides recommendations to Council on the site(s) proposed for detailed investigation and concept development for the FIMASH project.



2.2 Planning & Environmental Approvals Review

We have assessed the likely planning and environmental issues associated with the concept plan which provided us with an initial understanding of the issues for any potential site.

The preferred location and design (i.e. encompassing port areas or leaseholds) dictated the approval requirements. The outcomes of this phase have been included in this report, and provides a summary of the likely approval requirements, including any additional detailed studies required to be prepared and submission of a Development Application (DA) for the preferred solution and site.

2.3 Stakeholder Engagement & Market Research

2.3.1 Engagement Strategy

Generally, the key objectives of the stakeholder/community engagement process was to:

- Inform stakeholders of the proposal;
- Gain input from stakeholders that can improve the project developments and outcomes;
- Gain an appropriate level of stakeholder engagement support in order to successfully develop and implement the project and deliverables; and
- Gain broad acceptance of the Projects from the relevant communities resulting in a “social licence” or agreed outcome for the project infrastructure proposal.

2.3.2 Market Research

We collated information on current and future needs for recreational and commercial boating facilities up and along the Tasmanian east coast as well as Project Team awareness of the mainland.

The market research has incorporated:

- Utilisation of the consultation surveys and stakeholder information;
- Market surveys for key economic and user needs;
- Tracking of users within the south east Australia region (i.e. through marina berthing registers);
- Interviews with potential users; and
- Development of opportunities and constraints to current and potential users.

2.4 Desktop Technical Reviews

The desktop technical assessments have been undertaken in conjunction with the preliminary design and siting workshops so that the technical reviews form part of the siting and concept design as well as preferred location from a financial and economic basis.

2.4.1 Desktop Reviews & Investigations

This phase included the following:

- Review existing infrastructure reports, plans and studies for the sites and surrounds (as nominated);
- Understanding of the site existing infrastructure including key access points, transport links to land and key nodes (parking, facilities, services infrastructure, etc.);



- Review of existing land mapping, zoning, available survey/bathymetric data and any other available information for each site;
- Identification of required site specific studies and investigations based on gap analysis of reviews from existing reports and results of the pre-feasibility screening of options (see Table 1 of the screening approach);
- Examination of existing data relating to demand, including increased boat/yacht utilisation; and
- Identify key interview targets for market assessments.

The existing reports and relevant policy and planning frameworks have been summarised for each site and captured in this report.

2.5 Preliminary Designs Concepts

2.5.1 Development of Concept Designs

Concept design plans have been developed and provide to Council for their review and comments.

The designs have incorporated general arrangement plans, typical sections and elevations, for public marine infrastructure and for private related marine infrastructure at the following sites:

- Whitemark
- Lady Barron;
- Port Davies; and
- Trousers Point.

The concept plans were used for preliminary engineering to help prepare project and construction estimates as well as define the basis of design.

The design criteria was guided by the following:

- Wave climate;
- Geotechnical conditions;
- Environmental constraints;
- Design loads (ultimate and serviceable); and
- Dimensional requirements (vessel, infrastructure and access).

2.6 Project Assessment

2.6.1 Demand Assessment & Site SWOT analysis

The most used approach to strategic planning at the initial phase of any investment activity is to complete a SWOT (Strengths, Weaknesses, Opportunities and Threats) framework, which classifies the various influences of proposed project investments into four (4) components:

- (i) Strengths;
- (ii) Weaknesses;
- (iii) Opportunities; and



(iv) Threats.

An initial SWOT analysis has been undertaken for Flinders Island to distinguish between internal and external influences (economic, technical, social, environmental) on any proposed project investments by public agencies, such as MAST, Transports; local residents, businesses and Maritime users/operators.

2.6.2 Rapid Assessment of Project Options

On completion of the SWOT analysis a Triple Bottom Line Assessment (TBL) was undertaken on each site assessed, to identify the preferred site(s) for more detailed investigations and assessment.

The results of the TBL appraisal are highlighted in the following sections.

2.6.3 Pre – Screening (Triple Bottom Line) Analysis

In the identification of the overarching strategic relevance and significance of the proposed marine infrastructure investment at Flinders Island, a ‘high level’ initial assessment was required to develop potential development opportunities. Sources of funding could be:

- (i) All public sector (Local/State/Commonwealth),
- (ii) All private sector, or
- (iii) A mix of staged public and private sector investment.

A Triple Bottom Line (TBL) checklist was developed, covering a range of key economic/ financial, social environmental and governance criteria/potential impacts. The question posed for each project site option was:

“What would be the likely impact (positive or negative) of the development of a range of maritime infrastructure (moorings/berths, boat ramps, marina facilities, dredging, reclamation and access to land development)?”

2.7 Detailed Site Studies

This phase helped in providing a site and specific project definition and objective and provide a summary of information required for Development Application (subject to final solution and planning scheme overlays for that specific site) as well as more detailed inputs for production of accurate engineering and construction costs.

The detailed studies included:

- Site specific investigations to minimise assumptions in design and improve engineering design and construction cost estimates;
- Analysis on potential environmental impacts of proposed development and impact on detailed business case;
- The site investigations involved the following works:
 - Site bathymetry surveys;
 - Dive surveys for habitat mapping and characterisation;
 - Sampling of sediments for potential contaminants of concern (i.e. such as around old slips or wharf), for toxic dinoflagellates and particle sizing (required for regulatory approvals and natural values assessment of the proposed design solution);
 - Geotechnical jet probing to assess marine sediment profiles (to quantify and estimate pile lengths and design for any piled structure);



- Deployment of survey vessels and equipment including dive cameras, dive equipment, sampling equipment, etc.; and
 - Documentation of a marine ecological investigation report for the proposed development which is a requirement of regulatory authorities (Crown Land Services, DPIPWE, EPA) on referral of marine/land developments.
- Refine engineering design based on site assessment, especially related to geotechnical and environmental inputs; and
 - Allowance to refine construction cost estimates from field studies results, allowing for more accurate input to detailed business case.

2.8 Detailed Business Case

2.8.1 Finalised Concept Design Plans & Report

The final, site specific, development proposal plans have been updated through the above phases and in conjunction with consultation with Council and any identified key stakeholders.

Final concept plans incorporate general arrangement plans detailing the extents of infrastructure, layouts, dimensions, associated land infrastructure and development opportunity links.

This report provides the details of the recommended infrastructure, business cases assessment and recommendations for a preferred site and development scope.



3. Project References

3.1 Technical References

The following documents and drawings were gathered as part the preliminary research. Flinders Council provided some of the references and added valuable input into our preliminary inquiries.

The below references were reviewed in conjunction with stakeholder and targeted consultation, as well as site investigations:

Table 1 Referenced Documents

Reference No.	Title	Author	Date
2.01	Flinders Island Ports Vision Study	Aurecon	February 2010
2.02	Flinders Island Shipping Needs	Auercon	March 2010
2.03	Flinders Island Sustainability Plan	Pitt & Sherry	April 2012
2.04	Flinders Island Tourism Region	REMPPLAN	June 2013
2.05	Ecotourism Accommodation Investment Potential – Flinders Island	EC3 Global and Clarke Hopkins Clarke	May 2012
2.06	Flinders Island Recreational and Community Facilities Assessment and Infrastructure Plan	Resonance Consulting	June 2014
2.07	Flinders Island Boat Ramp at Davies Bay – Breakwater Concept Design	Coastal Engineering Solutions	January 2012
2.08	Flinders Island Safe Harbour	Burbury Consulting	March 2011
2.09	Flinders Island Visitor Survey Report	Tourism Tasmania	2014
2.10	Flinders Island Fuel Supply Study	Resonance Consulting	January 2015

3.2 Stakeholder Groups

Prior to our site visit to the Island, Flinders Council provided a stakeholder list for us to communicate and engage with for the FIMASH project. Following our initial discussions on site, the following list of stakeholders was created and contact instigated:

- Flinders Council (staff and alderman);
- Tasports;
- Parks & Wildlife Services Furneaux Field;
- TasWater;
- Flinders Island Safe Harbour Group;
- Furneaux Tavern;
- Flinders Island Adventures;
- RockJaw Tours;
- Commercial fisherman;



- Tourism Tasmania;
- Flinders Island Tourism & Business Association;
- Cruise ship industry and shipping agents (existing Tasmanian visitors);
- Flinders Island Aboriginal Association (Mutton birding);
- Emergency Services;
- Tas Police;
- Lady Barron Store;
- Flinders Island Car Rentals/ FI Quad-Bike Tours;
- Furneaux Freight;
- Roberts Real estate;
- Flinders Fresh;
- Tamar Sea Rescue;
- Lady Barron Fuel Depot; and
- Marine & Safety Tasmania.

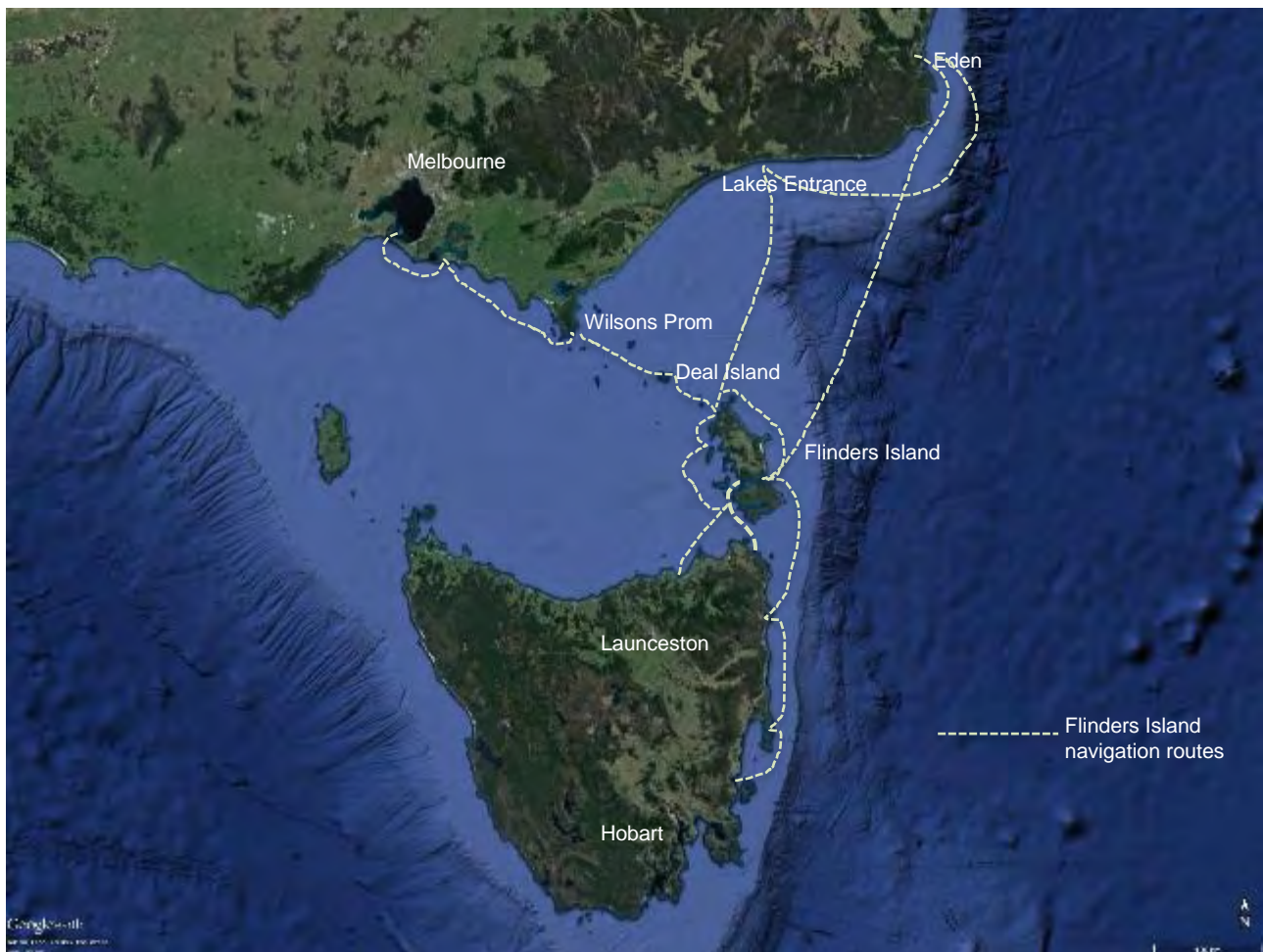


4. Background Information

Flinders Island resides in Base Strait, approximately 54 kilometres from the north-east tip of Tasmania. It is the largest and most populated of the Furneaux Group of Islands. Flinders is a long, narrow island, approximately 75km long and 40km wide.

The majority of the Flinders population is situated in the Islands capital, Whitemark and its other major settlement Lady Barron. The remaining population is dotted around the Island, in townships like, Emita (West Coast) and Killiecrankie (North West Coast).

Figure 1 Locality Plan



Whitemark is located on the south west coast and hosts the Islands main airstrip – Flinders Island Airport and key public infrastructure (hospital, council chambers, library, visitor information, fire, and emergency and ambulance services).

Lady Barron is located on the south coast of Flinders Island and is approximately 28km away from Whitemark. Lady Barron has its own operating airstrip – Murray Hollow Airfield and hosts an operating commercial Port Facility, owned and managed by Tasports.



Flinders Island is known for its remote and rugged natural beauty, and no other place emphasizes this like Strzelecki National Park and Trousers Point on the south west coast, where sparkling white beaches meet granite mountains.

The Islands west coast also boasts amazing scenery, with the beaches at Killiecrankie and Port Davies highlighting the great appeal of Flinders Island coastline.

The Island is readily accessed from both Tasmania and mainland Australia through a wide range of vessels, including commercial, recreational and tourist based water craft.

As a maritime destination, the island provides a stop-over or single point destination common for vessels navigating through or into the Furneaux Group of islands.

In addition, the island relies on commercial shipping and freight for imports and exports with infrastructure managed by Tasports and commercial shipping operators providing the freight services.

As noted in Figure 2 below the Island has a wide range of large and small marine infrastructure with emphasis around the key townships of Whitemark and Lady Barron for commercial facilities with regional boat ramps scattered around the island as well as several anchorages subject to weather conditions.

Like all Islands within Bass Strait, maritime navigation is heavily subject to the weather and in particular wind driven waves (and swell) and tidal currents.

Lady Barron is a naturally deep water, all tide access port with some protection from wind waves and swell waves through Franklin Sound and is the regular shipping port for the Island.

The only permanent berthing locations on the Island consist of grouped swing moorings at Lady Barron with additional moorings located at Port Davies and Killiecrankie and likely subject to weather (itinerant use of locals).

The layup jetty at Lady Barron's port is often used by visiting recreational and commercial vessels as well as the local vessels but has limited berthing capacity and is exposed to wind and waves (short durations).

A commercial 60 tonne vessel slipway owned and operated by Tasports is located in Lady Barron and is the only commercial slipway on the island.

There is no other maritime infrastructure suitable for visitors of marine tourism access.

A previous study into the port infrastructure and shipping needs was undertaken by Aurecon in 2010 (references 2.01 and 2.02 in Table 1 above) and provides a summary of the commercial shipping needs for the island as well as recommendations for a port vision including the following related to marine infrastructure for tourism based vessels:

- Expansion of tourist and recreational boating activity;
- Improved passenger vessel access;
- Consolidation of Lady Barron as the main freight port;
- Lady Barron recognised by stakeholders as preferred location for marina or tourism infrastructure;
- Opportunity to combine recreational boating facilities with the port at Lady Barron with additional infrastructure;
- Provide improved recreational boating infrastructure (boat ramp and marina facilities); and
- Recommendations of a port vision plan including proposed plan and infrastructure costs.

The report provided a comparative review between both Whitemark and Lady Barron on the basis of commercial shipping needs and has been used as a reference for this study.

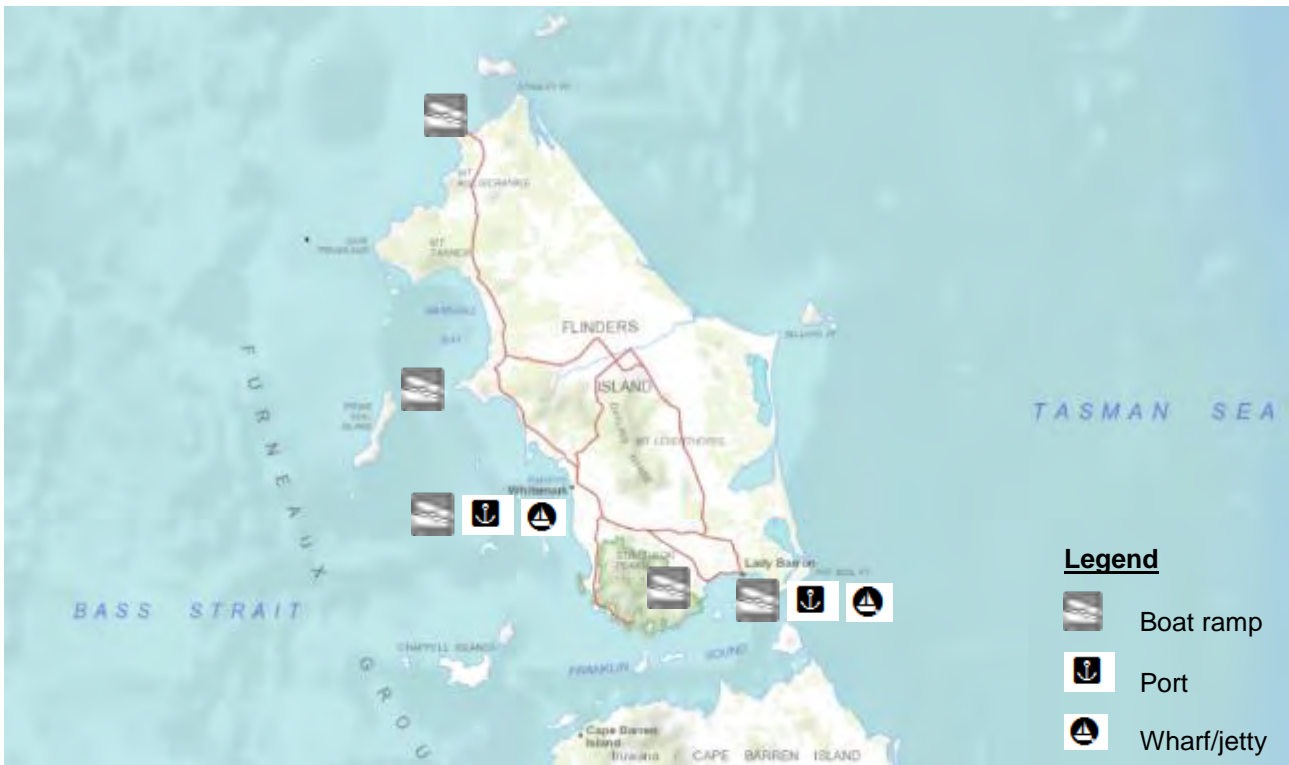
In 2011, Burbury Consulting were engaged by the Lady Barron Safe Harbour Group to review the sites at Lady Barron and provide recommendations for a safe harbour for recreation and commercial vessels. The



report included preliminary design for a safe harbor at the Lady Barron slipway site and has been used as another key reference for this study.

In consideration of the references above, the FIMASH study is not restricted to Whitemark and Lady Barron.

Figure 2 Flinders Island Marine Facilities





5. Stakeholder Engagement and Interviews

5.1 Introduction

The FIMASH feasibility study intends to identify marine access improvements as well as investigate the potential for a safe harbour incorporating all weather (tide, wave and current) infrastructure for mooring and berthing of vessels (permanent and itinerant). Associated facilities including boat ramp, amenities, fuel supply, jetties and marina berths may be considered subject to stakeholder input on demand and benefits of the infrastructure in terms of:

- Demand and suitability;
- Engineering requirements and costs;
- Economic benefits;
- Social benefits; and
- Environmental benefits.

The following items were discussed with the stakeholders:

- Current demand for marine facilities for permanent marine vessels and visitors;
- Future demand for facilities or improvements (public, private/commercial, etc.);
- Emerging demand trends for visitation or infrastructure requirements;
- Identification of critical marine access issues and improvement opportunities;
- Identification of a suitable site for a safe harbour (or recommended site);
- Limitations on existing facilities;
- Infrastructure requirements for a safe harbour (size, vessel capacity, services, vehicle access, location to amenities, etc.);
- Use or expansion of existing facilities;
- Impact on local businesses related to the infrastructure, etc.
- Incentives for regional/Australian investment;
- Opportunity for foreign investment;
- Business & job opportunities associated with new infrastructure – including existing businesses; and
- Known business or infrastructure proposals or improvements that may link with safe harbour or marine improvements.

5.2 Engagement Tools

The principle engagement tool that has been used for stakeholder analysis was face to face interactions with project team members experienced in stakeholder engagement with follow up correspondence and research to support the feedback.

5.3 Concept Design Workshop

A design workshop was undertaken with some key stakeholders to identify the key function and user requirements for marine access and the definition of a safe harbour for Flinders Island.



This workshop provided ideas and information to on key drivers that could increase vessel visitation including:

- Navigation improvements for safe access;
- Existing island access constraints;
- Facilities and access to marine supplies;
- Existing and future marine tourism needs and opportunities;
- Emerging trade and shipping trends affecting northern Tasmania; and
- Existing and current markets.

5.4 Summary of Key Stakeholders Interview Responses

For the purposes of openness in stakeholder discussion we have not provided specific stakeholder names or businesses that participated in the project discussions. The responses provided below are unfiltered and form the basis of the consideration with regard to the objectives of the FIMASH project:

5.4.1 Marine Vessel Tourism

As part of the stakeholder discussions we identified the existing and potential users of marine tourism for Flinders Island. These discussions identified common trends of traditional commercial vessel based visitors (both from mainland Tasmania and Australia) with emergence of larger recreational vessel visitation both from Tasmania and mainland Australia.

The recreational boating group offers the most consistent visitation, with vessels stopover travelling north and south as well as destination trips.

In recent times the largest growth has occurred in cruise ship visitations, which are brief stopovers to destinations such as Trousers Point for (limited) island time and tours.

Existing on island vessel charters provide access to the Flinders Island waterways with less restriction on weather impacts as well as charters to outer islands.

The following users groups were noted from the stakeholders and form the basis of marine tourism to Flinders Island:

Table 2 Marine Tourism Groups

Group / sector	Existing usage	Demands/needs	Marine Tourism Growth Potential	Additional Investment Opportunities
Commercial vessels	<ul style="list-style-type: none"> • Port requirements (import/export); • Base for commercial fishing: finfish, lobster, etc. • Vessels from both Tasmania, NSW and Victoria; 	<ul style="list-style-type: none"> • Port facilities; • Resourcing & supplies; • Access to fuel, water and food; • Shelter from seas; • Repairs and maintenance; 	<ul style="list-style-type: none"> • Based around existing commercial needs; • Not specifically tourism based market but similar demands for recreational vessels; 	<ul style="list-style-type: none"> • Make use of combined commercial and recreational infrastructure (reduced investment); • Market repairs and maintenance services for mainland vessels combined with island stays



Group / sector	Existing usage	Demands/needs	Marine Tourism Growth Potential	Additional Investment Opportunities
	<ul style="list-style-type: none"> Small island export; 			(safe harbour protection); <ul style="list-style-type: none"> Aquaculture farming;
Recreation vessels	<ul style="list-style-type: none"> Single vessel stop over (travelling north or south); Group vessel visitation or stopover; Both small and large vessel fleets visit; Generally short term stays; 	<ul style="list-style-type: none"> Shelter from seas; Access to longer term berthing for island visiting; Access to hire cars; Access to laundry and cleaning services; Access to fuel, water and food; Repairs and maintenance; 	<ul style="list-style-type: none"> Large vessel movements up and down east coast of Australia; Opportunity for longer term vessel stays; Increase duration of stays (better facilities and security of safe anchorages); Increased safety of navigation and access to island; 	<ul style="list-style-type: none"> Safe harbour vessel storage (including fly-in and fly-out usage); Improved vessel security; Vessel repairs and maintenance;
Cruise ships	<ul style="list-style-type: none"> Subject to weather stopover outside for Trousers Point for landings; 	<ul style="list-style-type: none"> Access to short term visitors (walks, food, gifts, etc.); Island experiences; 	<ul style="list-style-type: none"> High: Tourism based; Large cruise ship market visiting Tasmania regional ports and attractions (e.g. Port Arthur, Wineglass Bay, etc.); 	<ul style="list-style-type: none"> Flinders Island branding; Specific island experiences for cruise ship visitation (walks, charters, tours, food, gifts, etc.) covering wide markets;
On island charters	<ul style="list-style-type: none"> Existing businesses offering range of charter experiences; 	<ul style="list-style-type: none"> Utilise infrastructure at Lady Barron & Whitemark; 	<ul style="list-style-type: none"> Existing island market; 	<ul style="list-style-type: none"> Existing use

5.4.2 Key Maritime Sites

The following sites were regularly identified as key sites for marine infrastructure or opportunities for tourism infrastructure or marine access improvements:

- Pot Boil entrance and approaches into Lady Barron;
- Lady Barron port;
- Lady Barron slipway;
- Lady Barron White Beach (mooring area);
- Trousers Point;
- Whitemark wharf;



- Whitemark airport (Double Comer);
- Long Point;
- Port Davies;
- Killiecrankie; and
- Deal Island as a key island visited on route to Flinders Island.

The immediate opportunities and constraints of each site were also discussed:

LADY BARON

- Tasports maintains operation of the port, ro-ro and wharf with limitations to access jetties for commercial users and recreational vessel visitors;
- Port area was recently upgraded by Tasports;
- Site can be heavily exposed in south east to south westerly winds but is naturally well protected with deep water all tide access;
- Entrance into Lady Barron though the pot boil is difficult in certain conditions;
- Visiting vessels aren't prepared to stay alongside the port jetty due to limited space as well as wave exposure;
- Public moorings are limited and limit shore access;
- Access through the Pot Boil is difficult for inexperienced navigators;
- Sand bars shift within the approaches and hence permanent navigation marks are inadequate;
- Opportunity to look at semi-permanent navigation aids but they must be able to withstand wave and current conditions and be managed by either Tasports or Marine & Safety Tasmania;
- Lady Barron port ramp has limited boat and trailer access and is poor at low tide;
- Lady Barron slipway is commonly used as a boat ramp over the formed rock ramp;
- Lady Barron slipway is the only large vessel slipping facility before Triabunna or Bridport travelling south;
- Lady Barron is a common base for visiting trailer boats from north east Tasmania;
- Lady Baron is commonly used as a stop for visiting vessels travelling from the south;

TROUSERS POINT

- Popular for visiting vessels and cruise ships for natural beauty and iconic views;
- Cruise ship businesses identified it as an attraction point if adequate infrastructure was available for cruise ship tenders to access;
- Part of Strzelecki National Park;
- Limited road access or infrastructure;

WHITEMARK

- Commercial operations of Flinders Island;
- Has all resources at close proximity;
- Close to island main airport;
- Close to the majority of island accommodation and local land investment;
- Existing wharf is exposed to westerly prevailing winds and waves and tide limited;



- The approach channel that was previously formed through dredging has been retained without maintenance dredging;
- Any safe harbour at the existing wharf would be tide limited and require a breakwater for protection;

PORT DAVIES

- Good natural anchorage;
- Site of historical access wharf for import and export;
- Existing boat ramp upgraded by MAST with consideration of breakwater installed to improve access;
- Well positioned on the island with access to north and south;
- Limited infrastructure other than road access;
- Would require a breakwater for safe harbour infrastructure;

KILLIECRANKIE

- Popular for visitors travelling from the north;
- Limited all weather anchorage;
- Would require breakwater for safe harbour infrastructure;

Whilst our initial consideration for marine infrastructure and a safe harbour was limited to the existing facilities at Lady Barron and Whitemark the stakeholder input identified a wider range of opportunities to support the key objectives for attraction of tourism through marine infrastructure investment and therefore all nominated sites were inspected as part of the initial site assessment.

5.4.3 Marine Infrastructure Requirements

Stakeholders also identified the following infrastructure requirements;

- Safe all weather access and protection (wave protection);
- Permanent berthing facilities with land access (jetties or floating pontoons) to supplies and provisions;
- Greater itinerant berthing access;
- Shower and laundry facilities;
- Fuel supplies;
- Vessel security for short stay durations (including environmental);
- Readily accessible to hire cars (island transportation);
- Capacity to receive cruise ship tenders; and
- Improved boat ramp facilities (albeit more related to island use).



6. Preliminary Site Analysis

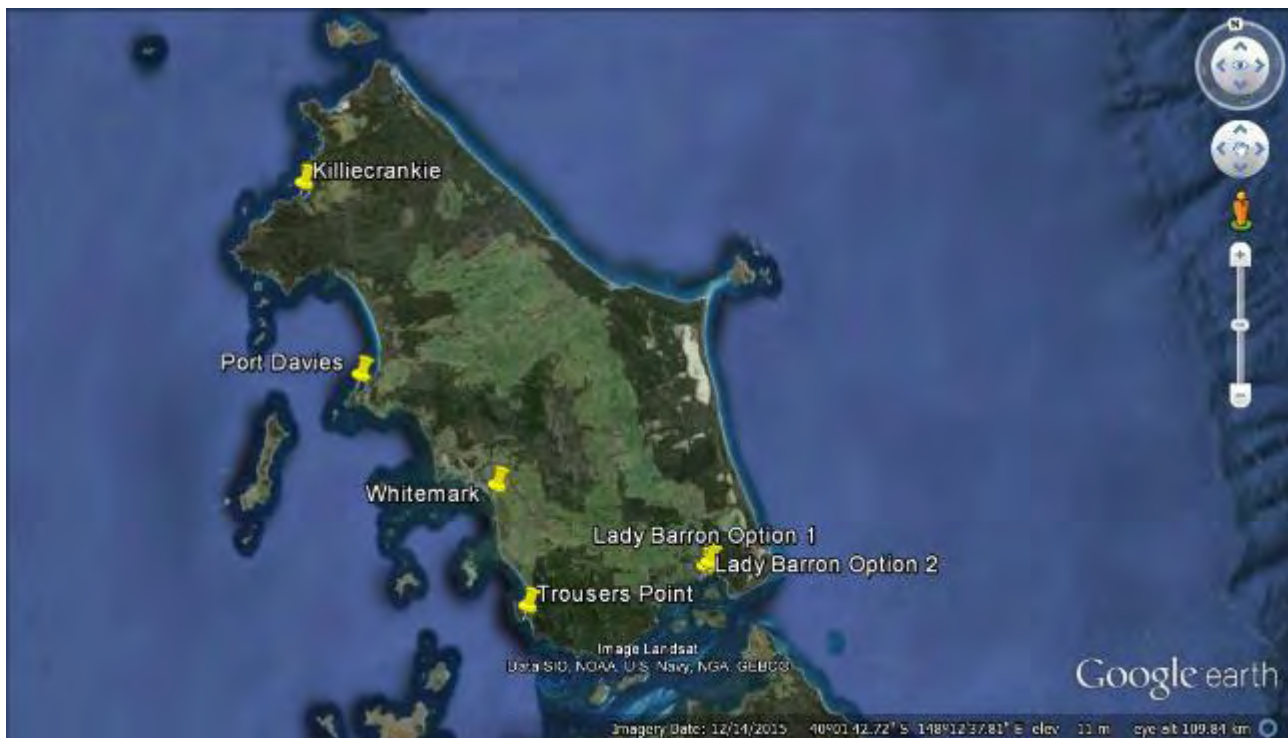
6.1 Site Assessments

Initial site investigations were conducted on the 31 May, 1 June and 2 June, 2016 by the project team (engineering, environmental and economist) to identify the site features and inputs into the Preliminary Site Assessment and Rapid Appraisal of Project Options.

A total of eight (8) sites were visited, these included:

7. Lady Barron (slipway);
8. Lady Barron (existing port wharf);
9. Trousers Point;
10. Whitemark (existing wharf);
11. Whitemark airport Double Comer;
12. Long Point;
13. Killiecrankie; and
14. Port Davies.

Figure 3 Aerial of sites visited on Flinders Island





6.2 Lady Barron

6.2.1 Description

Lady Barron is located on the south coast of Flinders Island within Adelaide Bay. Lady Barron is naturally well protected from swell waves and wind generated waves from the islands and shoals around the approaches into Lady Barron. These islands and shoals whilst providing good natural protection also require attention to navigation and limits vessel navigation and access to daylight periods only.

The bay is most exposed from the south east and south westerly wind waves that can provide difficult berthing and mooring conditions at the port wharf/jetty.

Within walking distance from the Lady Barron jetty are eating and re-supply facilities. There is also an airport within ~2 km of Lady Barron.

The main marine infrastructure at Lady Barron consists of the following

Port Wharves

- Ro-ro wharf for commercial shipping;
- Port hardstand and storage area;
- Layup jetties for commercial and recreational vessel berthing and mooring;
- Single lane boat ramp and jetty;
- Swing moorings;

Slipway

- Single cradle rail slipway for up to 60 tonne vessels;
- Formed boat ramp over rocks; and
- Swing moorings.



Figure 4 Lady Barron Location





Figure 5 Lady Barron Study Area



6.3 Lady Barron – Slipway Site

6.3.1 Location

The Lady Barron Slipway site is located around an existing slipway and boat ramp located off Franklin Parade. Accessing the site is via the first right hand turn past the fuel storage facility.

The site access is across an unsealed road down to an “informal” rocky shoreline that provides boat ramp access (tide restricted).

6.3.2 Existing Marine Facilities

- Over rock boat ramp;
- Slipway with cradles and winch hut; and
- Private swing moorings.



Figure 6 Lady Barron Slipway



Photo 1 Existing slipway & natural rock ramp





Photo 2 Access road to slipway and rock ramp



Photo 3 Existing Slipway





6.4 Lady Barron – Port Wharf

6.4.1 Location

The Lady Barron Port Wharves is a Tasports owned and managed asset that provides infrastructure for both commercial and public uses. It is accessed off Main Street, south of Franklin Parade in Lady Barron.

Figure 7 Lady Barron Port



6.4.2 Existing Facilities

The current marine facilities at the port site include:

- Main wharf ro-ro (commercial shipping);
- Outer wharf jetty with berthing on both sides (maximum 4 large vessels);
- Inner finger jetty with berthing on both sides for maximum of 4 small vessels; and
- Single lane boat ramp with access jetty with berthing on both sides (depth and tide limited).

The commercial port operates when required (to allow for tidal and weather conditions) and hence loading and unloading can occur during early morning hours – unsuitable for attracting visiting overnight vessels.

Public vehicle access into the port is area restricted with security fencing and gates other than the public jetty wharf and jetties. Vehicle and boat trailer manoeuvring at the boat ramp area restricts the size of vessel that can easily access the boat ramp to less than 6 metres.

The jetty is exposed to wind waves from the southern region and anecdotally susceptible to difficult berthing and mooring conditions during these conditions restricting permanent mooring for visiting vessels.



Photo 4 Port Jetties (public access)



Photo 5 Existing public boat ramp & jetty





Photo 6 Port layup jetties





6.5 Trousers Point

6.5.1 Location

Trousers Point is located on the South West of Flinders Island, near the settlement of Loccota. The site was recommended due to its attraction to cruise ship and tourist vessel visitation and anchorage within Trousers Bay.

The proposed study area lies within the boundaries of the Strzelecki National Park and is located at the end of Trousers Point Road as shown in Figure 8 below.

Figure 8 Trousers Point





6.5.2 Existing Facilities

- Recent installation of public mooring by Marine and Safety Tasmania.

6.6 Whitemark

6.6.1 Location

Whitemark is the island capital and has the largest population as well as being in close proximity to major infrastructure, services, supplies and the airport.

Three (3) locations were identified during the consultation phase at Whitemark including the main port jetty, Double Comer off Bluff Road south of the airport and Long Point.

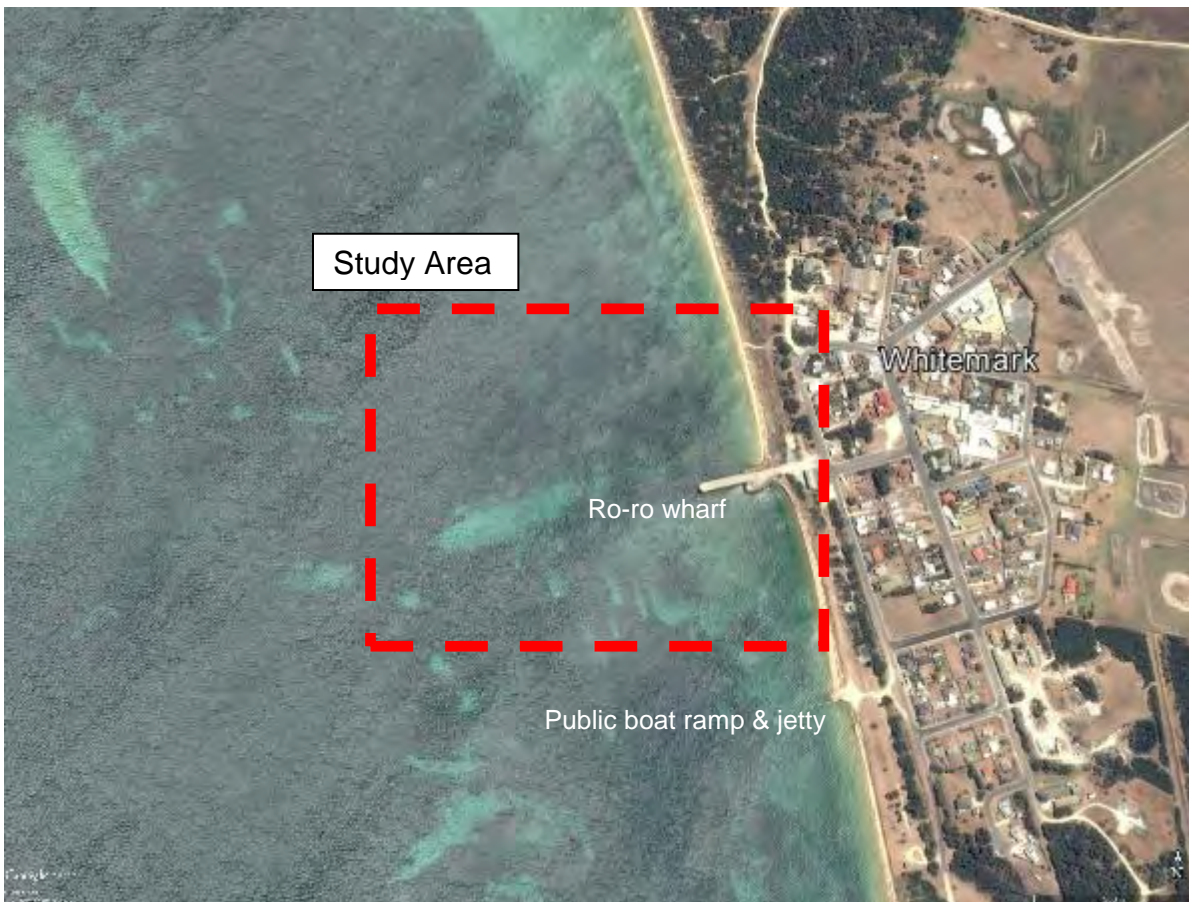
All sites are exposed to westerly weather and are exposed to tidal restrictions. The outer islands and reefs provide some reduction in the swell wave conditions however during large wind events the coast can be exposed to large waves, requiring any permanent infrastructure to be support with wave protection through breakwaters.

Figure 9 Whitemark Region





Figure 10 Whitemark Port



6.6.2 Existing Whitemark Port Facilities

- Public boat ramp and jetty; and
- Main wharf and ro-ro wharf.

6.6.3 Whitemark Double Comer & Long Point

Whitemark Double Comer was identified by a member of the stakeholder group for its natural protection to the north and existing swing mooring usage. The site is restricted for access in tidal conditions however it is in close proximity to Whitemark and the airport.

Long Point was also identified by the stakeholder group which is accessed along the end of Long Point Road. Both sites were inspected and compared to Whitemark port area with regards to infrastructure access, location to services and requirements for marine infrastructure. For this reason Whitemark Port was deemed more appropriate for further assessment.



6.7 Port Davies

6.7.1 Location

Port Davies is located on the West coast of Flinders Island within the township of Emita. Although situated on the exposed west coast, Prime Seal Island and Settlement Point to the south west of the proposed development and the four islands to the North West provide some protection from prevailing westerly weather and larger waves.

There is an existing public road to the site and public boat ramp, with the remains of the old main wharf abutment. We understand the old wharf was opened in 1939 and was approximately 115 metres long and 20 metres wide and previously used as a major import and export facility. We understand from the consultation group that the old wharf was damaged in heavy seas. The extensive abutment remains on site as seen in the photos below.

The public boat ramp was upgraded by MAST with improved ramp surface and mooring points installed on the rock faces to assist with vessel mooring and retrieving. We understood from consultation with MAST that previous studies were undertaken to provide a breakwater protection structure for the ramp which we accessed and reviewed for this project.

Whitemark is the closest town providing re-supply facilities which is ~17 km away. The main airport is a little closer ~12 km away.

6.7.2 Existing Facilities

- Public boat ramp; and
- Public and private moorings.



Figure 11 Port Davies





Photo 7 Existing boat ramp



Photo 8 Old wharf abutment





6.8 Killiecrankie

6.8.1 Location

Killiecrankie is a small coastal village situated on the northwest coast of Flinders Island. It was the remotest location visited, and is some 40km from the capital Whitemark.

The site areas recommended by the consultation group consisted of the swing moorings at the southern end of the bay which has natural protection from the rocky reef.

6.8.2 Existing Facilities

- Swing moorings.

Figure 12 Killiecrankie Location





Figure 13 Killiecrankie Study Area



Photo 9 Killiecrankie Beach view over to Old Man's Head





Table 3 Site Assessment Summary Review

Location	Existing Facilities	Consultation Inputs	Advantages	Disadvantages
Lady Barron Slipway	<ul style="list-style-type: none"> Slipway; Boat ramp; Moorings (public & private); Close proximity to services and supplies; Close proximity to port facilities and commercial wharf and jetty; 	<ul style="list-style-type: none"> Location would provide separation to the port and commercial vessels if catered for recreational vessels; Good natural protection from swell waves; Existing public and private moorings; Can be combined with a new boat ramp (or relocation of ramp from port area); Wide area for parking and vehicle access; Increases capacity and usage of the slipway with combined infrastructure; Reputation amongst "boaters" as difficult to access approaches in difficult wave and current conditions; 	<ul style="list-style-type: none"> Natural deep water all tidal access; Protected from swell waves; Existing maritime facilities, usage and marine businesses (port, slipway, ramps, etc.); Existing permitted usage with existing facilities; Access to services and resources; Concept plans already developed with local input; Improves tourism as well as island boating infrastructure; 	<ul style="list-style-type: none"> Predominantly recreational vessel focused; Difficult approaches; Southern end of island, away from popular tourist areas of north (Killiecrankie, Emita, etc.); Town requires upgrades of infrastructure to support additional development growth; Day access only;
Lady Barron Port	<ul style="list-style-type: none"> Port wharf; Layup jetty; Access to services & supplies; Public toilet and wash facilities; Boat ramp; Car parking; 	<ul style="list-style-type: none"> Existing port jetties are used for commercial and visiting recreational vessels; Access to services (power, water, lighting, public toilets and showers, garbage disposal, etc.); Secured area with port security; Port operations commence early hours making overnight stays alongside interrupted with noise; 	<ul style="list-style-type: none"> Existing port infrastructure; Permitted use and opportunity to allow upgrade in conjunction with Tasports; Infrastructure investment can be combined with wider use (port, commercial, recreation, tourism, etc.); Public amenities (toilets, wash, BBQ, etc.); Services and security of the existing port; 	<ul style="list-style-type: none"> Noise of working port; Working hours of port; Public access and separation of commercial port secure areas; Aging infrastructure; Town requires upgrades of infrastructure to support additional development growth; Day access only; Difficult approaches; Southern end of island, away from popular tourist areas up north (Killiecrankie, Emita, etc.);
Trousers Point	<ul style="list-style-type: none"> Limited unsealed road to site; 	<ul style="list-style-type: none"> Popular for cruise ships; Popular for short term mooring/anchorage in limited wind conditions (easterly); No direct road access; National park area; 	<ul style="list-style-type: none"> Scenic location popular for cruise ship visitation; Can attract additional ships with purpose access jetty; Allows for wider economic gain for businesses associated with tourism (passengers); 	<ul style="list-style-type: none"> Limited infrastructure; Limited road access; Sensitive environment; Visual impact of the infrastructure (potential for temporary structures for tourist season?);
Whitemark	<ul style="list-style-type: none"> Public wharf jetty; Public boat ramp; Car parking; Close proximity to services and supplies; 	<ul style="list-style-type: none"> Island and population Centre; Closer shipping than Lady Barron – previously used for airport upgrade (imported materials); Dredged channel has maintained over time (suggesting limited maintenance dredging required); Would require large breakwater for all weather protection particularly from westerly waves from Bass Strait; 	<ul style="list-style-type: none"> Provides central island location; Access to existing services; Road and infrastructure well developed; Close to major attractions (seaward and landside); Close to hire car and airport; 	<ul style="list-style-type: none"> Tasports focused on Lady Barron only; Unlikely to support multipurpose usage; Will require capital and maintenance dredging; Significant cost investment;



Location	Existing Facilities	Consultation Inputs	Advantages	Disadvantages
Whitemark Double Comer	<ul style="list-style-type: none"> Private swing moorings 	<ul style="list-style-type: none"> Close to airport and Whitemark township; Limited tidal access (dry at low tide) and would require dredging; North of the bay providing protection from north west; 	<ul style="list-style-type: none"> Good proximity to Whitemark and airport; Natural protection from the north west and east; 	<ul style="list-style-type: none"> Depth limited; Requires major dredging and breakwater; Will require maintenance dredging; Significant cost investment;
Port Davies	<ul style="list-style-type: none"> Boat ramp; Private moorings; Remains of old wharf 	<ul style="list-style-type: none"> Good natural safe harbor location; Site of historical port and wharf; Common mooring usage in summer periods; Close proximity to key tourist attractions; Central amongst island and towns to north and south; Land development amongst Erita and potential around Marshal Beach; 	<ul style="list-style-type: none"> Good proximity to Whitemark and airport; Natural protection from the south and east; Natural depth (all tidal access); Road access and existing public boat ramp; History of major wharf structure; Previous studies into breakwater protection for ramp and public moorings; Opportunity to link with land development potential as well as specific freight movement for north of island; 	<ul style="list-style-type: none"> Unsealed road through to site; Limited infrastructure – power, water and sewage; Sensitive local land fauna; Tasports focused on Lady Barron only; Unlikely to support multipurpose usage; Requires access to large rock for breakwater construction;
Killiecrankie	<ul style="list-style-type: none"> Private moorings Unsealed road access; Limited services and supplies 	<ul style="list-style-type: none"> Highly attractive destination to northern vessels; Commonly receives groups of vessels; Small township of holiday and permanent homes; 	<ul style="list-style-type: none"> Popular anchorage for visiting vessels (particular mainland); Existing community base; Road access; 	<ul style="list-style-type: none"> Unsealed road; Limited infrastructure – power, water and sewage; Visual impact of existing amenity;



7. Pre-Feasibility Screening Evaluations and Rapid Appraisal

7.1 Strategic Observations

7.1.1 A 'SWOT' Perspective

The most used approach to strategic planning at the initial phase of any investment activity is to complete a SWOT (Strengths, Weaknesses, Opportunities and Threats) framework, which classifies the various influences of proposed project investments into four (4) components:

- (i) Strengths;
- (ii) Weaknesses;
- (iii) Opportunities; and
- (iv) Threats.

An initial SWOT analysis has been undertaken for Flinders Island to distinguish between internal and external influences (economic, technical, social, environmental) on any proposed project investments by public agencies, such as, MAST, Tas Ports; local residents, businesses and Maritime users/operators.

Using a SWOT analysis is a useful as a starting point for the strategic evaluation and planning.

Table 4 provides a summary SWOT analysis of Flinders Island. The results provide insights into the likely levels of success (or otherwise) for any proposed Marine Infrastructure.

**Table 4 Initial Strategic Assessment or 'SWOT' Analysis of Flinders Island Marine Infrastructure**

Strengths	Threats
<ul style="list-style-type: none"> • Flinders Island has natural resource assets (white beaches, pristine/undeveloped coastal vistas, favourable rainfall/green landscapes). • Its tourism appeal is on par with the Binalong Bay and Coles Bay/Wineglass Bay locations. • Limited population development creating undesirable urban vistas. • Self-sufficiency/export capability for fine foods (beef, lamb, wallaby, fresh fruits, vegetables, wine). • Reliable electricity supply. • Reliable airline access. • A vibrant agriculture sector based on sustainable beef exports. • Low unemployment levels. 	<ul style="list-style-type: none"> • Discouraging thinking and mental inertia by small groups of local residents, in accepting new development proposals. • Negative images of Lady Barron, in relation to safe access and safe mooring, held by inter-state yacht owners/operators remains as a significant demand constraint. • Potential inter-state small business 'niche' potential and new business investment sources will be deterred by a lack of tourism image clarity and on-island promotional focus. • The lack of available/suitable on-island accommodation will limit new arrivals, interested in 'niche' tourism and fresh food exports. • Current development interest in Flinders Island development is a major constraint by State Government agencies. • State Government agencies need to be fully briefed as to their responsibilities for, and opportunities to further develop Flinders Island (specific references to TasWater, TasPorts, Tourism Tasmania and State Growth). • Without pro-active planning on Flinders Island, comparable developments could proceed at Binalong Bay as an alternative investment option, utilising similar 'white sand' tourist assets. Flinders Island could then fall away as a potential tourism development option.
Weaknesses	Opportunities
<ul style="list-style-type: none"> • No existing physical infrastructure to support visiting yachts. • No marina facilities to provide outdoor recreational boating/sailing for local, regional, inter-state boat owners. • No dry stacking or storage for kayaking/canoeing. • No new tourism-related infrastructure or assets to encourage new forms of tourism. • Acute shortage of accommodation for semi/permanent housing, individuals, tourist stays, or for tour groups. • Persistent sewage leakages and outfall to Lady Barron Harbour at Lady Barron (unresolved for the past decade). • Shortage of young skilled personnel to develop tourism-related 'niche' businesses. • Groups of negative residents in relation to new forms of tourism development. • An existing slipway with very limited supporting equipment for boat owners. • Inter-state negative perceptions held by potential yacht owners as to visiting Lady Barron. • Lack of clarity as to the marketing strategy required to promote Flinders Island. What is the image to be conveyed? 	<ul style="list-style-type: none"> • Development of new yachting infrastructure to provide safe/secure moorings. • Safe harbour facilities at various locations where visiting vessels currently visit: <ul style="list-style-type: none"> – Killiecrankie – Port Davies – Lady Barron • Marina facilities to enable easy access/egress from moored yachts and powerboats. • Navigation aids and solar lights to assist entry to any of the above three (3) mooring sites. • Availability of fresh water for yachts (at any of the 3 mooring sites). • Availability of a fuel supply. • Provision of alternative forms of water-based accommodation 'pods' and land-based low-cost accommodation units for tourists and short-term island employees. • Construction of marina-based café and bar/outdoor entertainment facilities (alternative form of food/beverage outlets to the Lady Barron tavern). • Marina-based facilities to develop a sailing school for Flinders Island children (currently, there are 65 children between 6 and 12 years). • Development of a service and storage area for scuba diving (an air supply is required, together with rental of scuba equipment). There are at least 69 known/mapped wrecks around the island. • Mooring facilities to allow for the development of a small business to hire dinghies/outboard engines. • Mooring/landing facilities to enable the development of additional adventure tours, such as 'wild water' tours, as provided on Maria Island (extensions of the existing adventure tour activities on island). • Integration of marina facilities with small craft able to transport tourists around the island for selected nature/bush walk tours, focussing on the white sands.



7.2 Rapid Assessment of Project Options

On completion of the SWOT analysis a Triple Bottom Line Assessment (TBL) was undertaken on each site assessed, to identify the preferred site(s) for more detailed investigations and assessment.

The results of the TBL appraisal are highlighted in the following sections.

7.3 Pre – Screening (Triple Bottom Line) Analysis

In the identification of the overarching strategic relevance and significance of the proposed marine infrastructure investment at Flinders Island, a ‘high level’ initial assessment was required to develop potential development opportunities. Sources of funding could be:

- (iv) All public sector (Local/State/Commonwealth),
- (v) All private sector, or
- (vi) A mix of staged public and private sector investment.

A Triple Bottom Line (TBL) checklist was developed, covering a range of key economic/ financial, social environmental and governance criteria/potential impacts. The question posed for each project site option was:

“What would be the likely impact (positive or negative) of the development of a range of maritime infrastructure (moorings/berths, boat ramps, marina facilities, dredging, reclamation and access to land development)?”

7.4 Definition/Clarification of Criteria for Scoring Each Site

7.4.1 Economic/Financial

- Total capital investment: the larger the proposed investment, the greater the on-island impact;
- Increased tourism revenues: potential for increased spending by visitors;
- Flow on benefits: multiplier effects from increased visitor expenditures;
- Local/regional employment gains: potential to create new jobs;
- Induced tourism investment: additional private sector investment stimulated by the initial investment in marine infrastructure;
- Increasing existing public sector asset use: potential for existing public infrastructure to be more fully utilised;

7.4.2 Social

- Overall amenity/scenic impacts: rating of the range of natural attractions on site;
- Visual appeal: the ‘wow’ factor on arrival;
- Heritage value: existing historic/cultural assets on-site;
- Land tenure: issues limiting future development of the surrounding land;
- Public safety improvement: potential to improve public landside safety standards with the Project;
- Maritime safety improvements: the extent to which the side will gain increased marine safety benefits;



- Additional outdoor recreation opportunities: the extent to which further recreational activities can be developed;
- Opportunities for new housing: the potential for the Project to develop additional forms of new housing on-site;

7.4.3 Environmental

- Sea access limitation: the extent to which the site is limited by adverse sea conditions;
- Inland waters and wetlands: the degree to which the site is affected by water resources (fresh and saline);
- Groundwater resources: the availability of groundwater for later site development use;
- Terrestrial biodiversity: the degree to which the site has a range of natural value features (flora and fauna);
- Road access: the accessibility of the site by existing sealed roads;
- Sewage disposal: the existence of raw sewage disposal/seepage near the site;
- Other resource use: existence or potential for other site uses (sand mining, quarrying, commercial fishing, seaweed harvesting, forestry, livestock);
- Fauna protection and management: degree to which access to the site and the site environmental values are affected by public intrusion (and road kills);
- Electricity and utilities availability: the extent to which the site is serviced by electricity/telephone/internet access/garbage collection;
- Access to quarry material: proximity of the site to available rock sources;
- Land degradation/erosion potential: the extent to which site development will result in adverse effects (drainage, land slippage/ slumping etc.);

7.4.4 Governance

- Local laws and policies: the extent to which Council regulations will provide site development direction and oversight; and
- State laws and policies: the degree to which specific agencies are involved near the site; the potential for the site to meet long-term sustainability targets.

7.5 TBL Rating Scales

An ordinal scaling system of -3 to +3 was developed to rank the scale and nature of the potential impacts (-3 being a major negative impact increasing to a major positive impact at +3).

A series of ratings were subsequently developed as follows, from the individual TBL scores:

- 0 to 5: unsuccessful impacts
- 6 to 10: marginal effects/marginal impacts
- 11 to 15: minor positive benefits
- 16 to 30: significant benefits
- > 30: major benefits



The results have been used to develop preferred site(s) for more detailed investigations (engineering, environmental, economic and financial).

7.6 Overview of Pre-Screening Activities

The first collective discussion and individual ranking of the five (5) potential development sites indicated that additional site selection criteria were necessary and highly relevant. The following were added to the list of criteria for the Pre-Screening analysis:

- Marine access to the site, from the open seas;
- Local community concern and support;
- Enabling laws and policies (rather than just local laws); and
- Opportunities for new specific private sector involvement.

7.6.1 Initial (First Order) Pre-Screening

Outcomes of the initial pre-screening indicated that all three (3) secluded beach sites; Killiecrankie, Port Davies; and Trousers Point had an intrinsic natural appeal ahead of Whitemark and Lady Barron.

Each of these three (3) secluded beach sites (Killiecrankie, Port Davies, and Trousers Point) could also be provided with breakwater structures to meet safe harbour requirements however require additional road and infrastructure upgrades to service the sites and are limited to existing service facilities and infrastructure found at Whitemark and Lady Barron.

Whitemark would require a major breakwater or a smaller breakwater and extensive and on-going dredging.

Lady Barron (slipway) would require a breakwater structure.

Lady Barron (port) has limitations on infrastructure usage (jetty/wharf and boat ramp), shared road access, fencing and general amenities with an existing operational port and restrictions to public access and usage.

Ranking

Initial rankings, in order of maximum overall scores, were as follows:

1. Port Davies
2. Lady Barron (both sites)
3. Trousers Point
4. Whitemark
5. Killiecrankie
6. Whitemark Double Comer

7.6.2 Second Order Pre-Screening

A second order pre-screening has been undertaken to compare breakwater development costs and required road upgrade and utility requirement costs at all assessed sites.

In order to provide a Base Case for consistent comparison purposes this pre-screening analysis used the criteria outlined in the Flinders Island Safe Harbour Working Group report. In addition, estimated costs to provide comparable access to each site was provided by Flinders Council. All access roads have been estimated to be sealed.



Ranking

Ranking in order of least capital infrastructure cost (simplified budget only) were as follows:

1. Whitemark
2. Lady Barron (slipway)
3. Lady Barron (port)
4. Port Davies
5. Trouser Point
6. Whitemark Double Comer
7. Killiecrankie

7.6.3 Third Order Pre-Screening

The emergence of potential visits to Trousers Point by Carnival Cruises indicated that potential visitor demand could be planned for a new loading jetty to allow for a tender vessel to meet and transfer cruise ship passengers to Trousers Beach.

Once on land the tourist could be met by a 'niche' food and wine catering business that's has been developed on Flinders Island by young innovative residents. Parties of up to sixty (60) guests have been catered for previously on Trousers Point Beach and Killiecrankie Beach. These concepts fit well within the concept of "A Taste of Flinders".

There is site-specific interest by Carnival Cruises in Trousers Point only. The company visited both King and Flinders Islands and has developed the view that of all possible cruise ship destinations, Trousers Point was the most desirable and the only tourist attraction for inclusion in small cruise ship itineraries (150 to 200 passenger range). Trips would likely run from October to January.

Subsequently a third order project pre-screening has been undertaken based on the potential for new forms of tourism and outdoor recreation to be developed. These range of activities, specifically focus on the natural attractiveness or "wow" factor of the Flinders Island 'white sand' beaches and Granite rock outcrops. All are of the same geological composition and character as the iconic Binalong Bay/Bay of Fires white sandy beaches, to the south on Tasmania's North East coast.

The ranking in order of potential tourism and recreation attractiveness, and subsequent potential to attract private sector investment, are:

1. Whitemark
2. Lady Barron (port)
3. Lady Barron (slipway)
4. Port Davies
5. Trouser Point
6. Whitemark Double Comer
7. Killiecrankie

The results of the pre-screening indicate that Killiecrankie and Whitemark Double Comer can be eliminated from further investigations.

Table 5 below contains a detailed description of the TBL scores for the sites assessed on Flinders Island.



Table 5 Pre-Feasibility Screening (Triple Bottom Line Assessment) for Project Site Ranking

Killiecrankie (KI)

Port Davies (PD)

Whitemark Double Comer (WK.D)

Whitemark (WK)

Trousers Beach (TB)

Lady Barron Port (LB.P)

Lady Barron Slipway (LB.S)

(Triple Bottom Line Assessment for Project Ranking)

Criteria/Potential Impact ^{1/}	Ranking/Rating of Each Site (-3 to +3)						
	KI	PD	WK.D	WK	TB	LB.P	LB.S
Economic/Financial							
▪ Total capital investment	3	3	3	3	2	2	3
▪ Increased interstate tourism revenues	1	2	1	1	3	1	1
▪ Flow-on benefits for tourism, other economic activities	1	2	1	1	3	2	2
▪ Local and regional employment generation/new skills	1	2	2	3	2	3	3
▪ Induced tourism investment	2	1	1	1	3	1	1
▪ Increased existing public sector asset utilisation	1	3	1	3	1	3	1
Social							
▪ Overall amenity/scenic impacts	-2	-1	0	1	-1	1	1
▪ Visual appeal of natural landscape	3	3	0	1	3	1	1
▪ Heritage value	1	3	0	0	3	0	0
▪ Land tenure	0	0	0	1	0	1	1
▪ Public safety improvement	2	3	2	3	2	3	3
▪ Maritime safety improvements	3	3	3	3	3	3	3
▪ Additional outdoor recreational opportunities	2	3	2	3	3	3	3
▪ Opportunities for new housing	0	1	1	2	1	-1	0
Environmental							
▪ Sea access limitations	0	0	-2	-1	0	1	1
▪ Terrestrial & marine biodiversity	-1	-1	-2	-2	-1	1	1
▪ Road access	-2	-1	1	3	-1	1	2
▪ Sewage management disposal	-2	-2	-1	1	-2	-1	-1



▪ Other resource usage	1	2	0	2	1	2	1
▪ Fauna (land and aquatic) protection and management	-1	-1	-1	-1	-1	0	0
▪ Electricity and utilities availability	-1	-1	1	3	-2	3	2
▪ Access to quarry material for construction (breakwater)	-1	1	1	1	-1	-1	-1
▪ Land and marine degradation/erosion potential	-1	0	-3	-2	0	0	0
Governance							
▪ Local laws and policies	-1	-1	-1	1	-1	1	1
▪ State laws and policies	-1	0	0	0	-1	0	0
- Range of agencies involved	0	-1	0	-1	0	-1	-1
- State-wide sustainability requirements	0	1	0	1	0	1	1
Sub-Total of Scores	8	24	10	31	19	30	29
	KI	PD	WK.D	WK	TB	LB.P	LB.S

Legend:

+ 3 : Major Benefit

+ 2 : Significant Benefit

+ 1 : Minor Benefit

0 : No Benefit

- 1 : Minor Negative Impact

- 2 : Significant Negative Impact

- 3 : Major Negative Impact



7.7 Pre-Screening Summary

Of strategic importance is the role of future public and private investment in tourism and outdoor recreation activities, to be dispersed across Flinders Island. Rather than a concentration of marine-based public and private investment in one location, investment should be allocated across the island, according to specific tourism and recreation demand and once a preferred safe harbour site is identified.

The detailed site specific studies for each site will result in greater identification of a preferred site and recommended design solution.

For preliminary design, infrastructure and concepts as referenced in the stakeholder meetings may include:

1. Whitemark:

- Provision of breakwater seaward of the existing port wharf providing all weather protection;
- Increased berthing facilities for wide range of vessels;
- Investigation into requirement for maintenance dredging and infrastructure costs is required;

2. Lady Barron (port):

- Provision for a wavescreen along the wharf face including upgrade to structure and extension of the wharf to increase harbour protection and berthing capacity;
- Extension to the inner jetty for new berthing facilities;
- Reconfiguration of boat ramp and jetty facilities to improve access and launching;

3. Lady Barron (slipway):

- New breakwater alongside slipway providing protection to new boat ramp, slipway and berthing facilities;
- New boat ramp and floating pontoons for jetty access and marina berths,
- Mooring facilities and fresh water/fuel point for visiting and local yachts, commercial fishing boats, recreational power boats and tourist vessels.

4. Port Davies:

- rehabilitation of the old jetty, to be extended as a breakwater, with the future opportunity for a private sector marina (initially 10 to 12 berths, modelled on the St. Helens marina development); allowing for local recreational sailing, a sailing club, kayaking and other water sports. Visiting yachts from the Northwest, via Deal Island, could be accommodated.

5. Trousers Point:

- provision of a new floating pontoon and gangway access for a cruise ship tender/tourist access vessel (similar to Port Arthur and Pennicott Cruises berthing facilities – low impact);
- Visiting vessels could be have temporary berthing.

6. Killiecrankie: no proposal

7. Whitemark (Double Comer): no proposal



8. Site Investigations

8.1 Marine Infrastructure Design

In conjunction with the site investigation phase a number of engineering solutions were considered for marine infrastructure within the investigated areas and sites.

In particular, the key design features considered in development of the marina layouts included:

- Site water depths;
- Surrounding infrastructure including navigation, separation distances and site lines;
- Impact on existing users (navigation and existing facilities);
- Proposed infrastructure requirements (marina berths, jetties, breakwaters, boat ramps, car parking, amenity buildings, etc.)
- Impact of new infrastructure on the environmental flows and existing natural environmental conditions;
- Land access and potential for managing land infrastructure requirements (car parking and services connections);
- Opportunity for staging on the basis of demand;
- Opportunity to enable connection with land and water;
- Appreciation of the site constraints through detailed investigations and planning requirements;
- Wave exposure, particularly with regard to breakwater alignment and marina berth protection;
- Breakwater design requirements for rock size, length and volume of rock;
- Provision of both permanent and itinerant berthing capacity;
- Concentration of marine facilities within close proximity to the existing and planned infrastructure; and
- Constraints and costs for dredging, reclamation and maintenance dredging (if required).

A key driver for the concept design and engineering costs included resolution of the above components within the site investigation phase as noted further below.

8.2 Site Investigations

To deliver Council with a detailed business case and project proposal, information required for a recommended project scope, as well as provide more detailed inputs for production of accurate engineering and construction costs, detailed site investigations were completed at five (5) targeted locations (Port Davies, Whitemark, Trousers Point, Lady Barron Slip and Lady Barron Wharf).

The detailed site investigations involved the following works:

- Site bathymetry surveys;
- Dive surveys for habitat mapping and characterisation;
- Sampling of sediments for potential contaminants of concern (i.e. such as around old slips or wharf), for toxic dinoflagellates and particle sizing (required for regulatory approvals and natural values assessment of the proposed design solution);



- Geotechnical jet probing assess marine sediment profiles (to quantify and estimate pile lengths and design for any piled structure);
- Deployment of survey vessels and equipment including dive cameras, dive equipment, sampling equipment, etc.;
- Documentation of a marine ecological investigation report for the proposed development which is a requirement of regulatory authorities (Crown Land Services, DPIPW, EPA) on referral of marine/land developments; and
- Engineering design development and drawings for developed concepts for marine infrastructure at nominated sites.

The aim of these investigations was to characterise ecological communities, map the bathymetry of proposed development footprints, and collect data to advise of any potential environmental impacts of developing marine infrastructure at each site and further advance the engineering design for the proposed marine infrastructure.

Marine Solutions, a specialist environmental consultancy company, completed the detailed investigations and have documented their findings in the following report (Refer to Appendix D for a copy);

Marine Solutions (February 2017) - Marine Ecological Investigations of Five Potential Sites for a Safe Harbour on Flinders Island.

8.3 Port Davies

Port Davies is located on the West coast of Flinders Island within the township of Emita (refer Figure 14).

In general, Port Davies has mostly a low level of development and modification, however, there is an existing public road to the site and public boat ramp, with the remains of the old main wharf abutment. We understand the old wharf was opened in 1939 and was approximately 115 metres long and 20 metres wide.

Whitemark is the closest town providing re-supply facilities which is ~17 km away. The main airport is a little closer ~12 km away.

There are a number of existing mooring points throughout the study area. These would need to be made redundant or relocated should any proposed development progress.

8.3.1 Concept Design Development

A concept design was developed for Port Davies developed through iteration of input from the stakeholders recommendations, site inspections, outputs from the site investigations and conceptual engineering design for a suitable marine infrastructure solution.

The concept design developed for Port Davies incorporates the following marine infrastructure:

- Rock breakwater structure to provide protection from waves and surge from the westerly quadrant of waves;
- Reclamation of land alongside boat ramp to allow for access to marina facilities;
- Development of up to 40 berth marina facility incorporating berthing access for boat ramp facility; and
- Capacity to allow for parking and amenities alongside marina facilities.

A concept sketch layout is provided in Figure 14 below.

The concept centres around expansion of the existing public boat ramp facility to provide combination of public and private investment opportunity for the development.

The breakwater component provides protection for both facilities and enables opportunity for private sector investment into the marina.



Figure 14 Site Location Map showing proposed development proposal at Port Davies



Image from LISTmap, 2016

A detailed assessment of the site and proposed development concept was undertaken as outlined below.

8.3.2 Flora & Fauna (Marine and Terrestrial)

A marine ecological investigation has been undertaken for the site. Marine Solutions were engaged to complete field surveys and have also completed desktop analysis for the marine environment.

Generally seagrass habitat dominated the subtidal zone, with a diverse community of microalgae present and patches of reef habitat. A high diversity of fish were also identified.

The desktop search, including both the EPBC Act Protected matters search and natural values atlas, identified seven (7) listed marine animal threatened species and one (1) verified record of a threatened species. For more detail refer to the Marine Solutions Report in Appendix D.

Whilst the threatened species weren't observed during the site dive survey they are listed as present and hence any proposed infrastructure would need to show that it would not impact on the existing habitat and biodiversity of the site.

Given the breakwater will provide a significant footprint over the reefs and seagrass this is a significant limiting issue with any breakwater proposal or harbour development for Port Davies.



8.3.3 Coastal Processes

Although Port Davies is situated on the exposed west coast of Flinders Island, Prime Seal Island and Settlement Point to the South West of the proposed development and the four (4) Islands to the North West provide some protection from prevailing westerly weather and larger waves. Despite this partial protection, it was noted during the site survey that a noticeable surge from long-period waves occurred at the proposed site.

The existing shoreline and outer island reef provides natural suitability for the proposed rock breakwater. The proposed rock breakwater will result in wave diffraction and refraction around the formed headland and still provide susceptibility to harbour surge from long period.

A concept design for wave climate, rock sizing and rock structure was developed to prepare construction estimates for the breakwater. All estimates have assumed rock is locally available on the island.

8.3.4 Geology

A search of the Land Information System Tasmania (The LIST) Map indicates that Devonian, Carboniferous granitoids and related rocks are present at the proposed site. This dominant granite basement bedrock is overlain by Undifferentiated Quaternary sediments.

The ground conditions provide good support for a breakwater structure however we recognise that the shallow granite will provide difficulties for piling for marina infrastructure which may be overcome with mooring systems in lieu of piles.

8.3.5 Bathymetry

The proposed development area was mapped using a vessel mounted Garmin GPS Map 551s running a dual frequency 50/200 kHz transducer. The water depth was logged every two seconds to Seabed Mapper running on a laptop computer.

The bathymetry was typical for a small coastal embayment, with water depth increasing with distance from the shore. The maximum water depth recorded was 7 m, this was to the north of the study area, adjacent to the proposed development. The shallow areas located in the north-west of the study area are according to Marine Solutions, reef environment.

The water depth throughout the site was considered sufficient for the proposed marina development.

Although the encountered depths for the rock groyne would require substantial quantities of rock.

8.3.6 Acid Sulfate Soils

A search of the Land Information System Tasmania (The LIST) Map indicated there was no occurrence of acid sulfate soils at the proposed site.

8.3.7 Geoconservation

A search of the Tasmanian Geoconservation Database (TGD, 2016) highlighted that two (2) listed geoconservation sites reside within Port Davies. Cave Beach Karren and Caves encompasses the proposed development footprint and beyond and Cave Beach Palaeosol and Hardpan, which is some 550m to the East of the proposed development site. As there are listed geoconservation sites within 1 km of the proposed development site, an assessment and subsequent report of potential impacts/threats to the listed sites and the geology, geomorphology and soils of the surrounding area is required (DPIPWE, 2015).



8.3.8 Landslide Risk

A search of the Land Information System Tasmania (The LIST) Map, produced by Department of Premier and Cabinet, indicates that the proposed development site has not had any known landslides.

8.3.9 Sediment Contamination

Marine Solutions did not establish if there is any current sediment contamination at the site.

8.3.10 Cultural Heritage (European and Aboriginal)

Due to Port Davies heritage significance, in particular the Wybalenna Historic Site (Aboriginal Heritage), which is located approximately 1 km south of the proposed development, a Cultural Heritage assessment will need to be undertaken to determine the sites cultural values should the proposed developed be further progressed.

8.3.11 Environmental Conclusion

The proposed development of infrastructure at Port Davies presents some potential environmental and heritage challenges, principally due to the presence and verified records of threatened species in the marine environment, the cultural sensitivity of the area and the unknown details around the terrestrial natural values.

Any proposed marine/ terrestrial infrastructure, would need supplementary assessments to be conducted and any potential impacts of the proposed structures on the existing environment would need to be detailed within a Development Application (DA).

To provide a more accurate and comprehensive understanding of the environmental conditions at the proposed site, particularly in regard to deficiencies in information on terrestrial natural values, sediment contamination and cultural heritage, it is recommended that supplementary environmental investigations and analysis could be required where deemed necessary, including:

- Terrestrial Natural Values Survey; including
 - Flora & Fauna (specifically for car parking & amenities zone);
 - Geoconservation;
 - Acid Sulfate Soils; and
- Cultural Heritage Assessment.

8.3.12 Planning Considerations

To provide Council with advice on matters relating to Statutory Planning and Land Tenure requirements on the preliminary designs for the new marina developments and associated land based infrastructure proposed for Port Davies, we have outlined the pertinent planning issues, which are summarised as follows:

Rock Groyne

The foreshore adjacent the proposed groyne sits with the following *Flinders Island Planning Scheme - Zone*

- *Environmental Management and Recreation*

The groyne will also trigger the following *Flinders Specials Areas*;

- *Heritage*;
- *Visually Sensitive*; and
- *Shoreline Waterbody*.



The proposed development could be dealt with as a standard Development Application. It would be defined as a Tourism Operation/Active Recreation and would be a Discretionary use in the Environmental Management and Recreation Zone.

The main planning consideration is likely to be visual and natural values impact.

Marina, Car parking & Amenities

The marina, car parking and amenities area sit with the following *Flinders Island Planning Scheme - Zone*

- *Environmental Management and Recreation*

The marina, car parking and amenities will also trigger the following *Flinders Specials Areas*;

- *Heritage*;
- *Visually Sensitive*; and
- *Shoreline Waterbody*.

The proposed development could be dealt with as a standard Development Application. It would be defined as a Pubic (car park)/Tourism Operation and would be a Discretionary use in the Environmental Management and Recreation Zone. However, due to the proposed site being within the Settlement Point Conservation Area, a Reserve Activity Assessment (RAA) would also be required in order to assess environmental, social and economic impacts/benefits before land owner consent would be provided by Parks & Wildlife Service.

The key issues to be addressed in any Development Application are likely to be:

- Environmental management (impact of proposed development on existing natural values);
- Landowner consent from PWS/Crown Land;
- Reserve Activity Assessment (RAA), a requirement of PWS,
- Visual Impact;
- Navigation and impact of reduction of navigable water within the Bay;
- Impact on mooring holders;
- Availability of sewage pump out facilities for vessels and on land management (no infrastructure);
- Lack of water supply infrastructure;
- Traffic impacts associated with the carpark; and
- Coastal Vulnerability, including;
 - Assessment on the potential impacts on inundation and erosion potential for the proposed site.

It is also recommended that any proposed Development Application be preceded by community and stakeholder consultation.

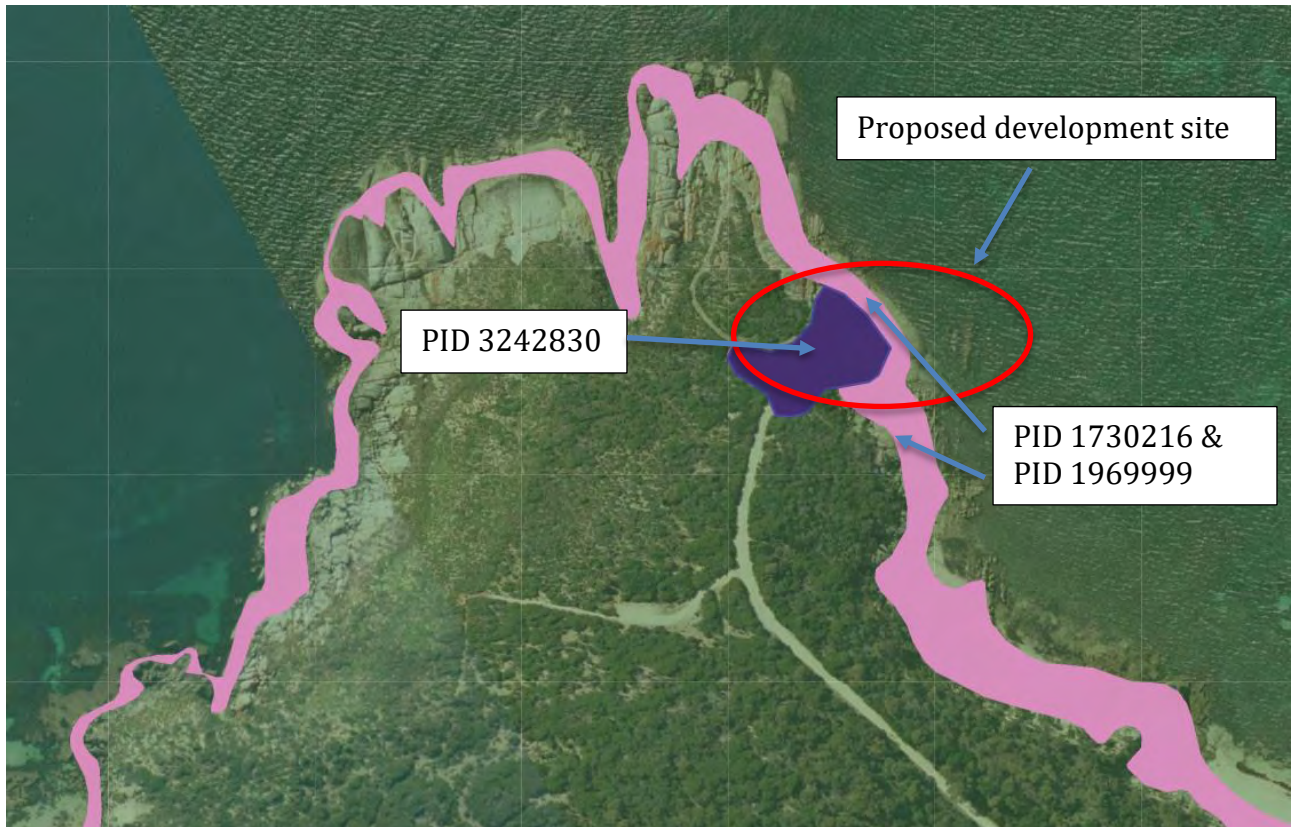
Existing Licenses

There are currently three (3) existing licenses within the proposed development area, these are;

- Encompassing proposed Car park area - PID 3242830; and
- Along Foreshore zone - PID 1730216 & PID 1969999.



Figure 15 Existing licenses within proposed development area at Port Davies



8.3.13 Planning Conclusion

Given that community opinions on the proposed development will vary and the assessment of the eventual visual impact will be subjective, it is recommended that the planning concept of the development would best be considered at a strategic level. This would initially be done as part of a comprehensive Island plan that holistically considers the benefit and impacts of the proposal.

Assuming all environmental and heritage matters can be satisfactorily mitigated it is considered more unlikely that the visual impact of the proposals would be acceptable given a previous DA proposal (mentioned above) was also refused at appeal largely on grounds of visual impact. It is likely that this proposed development concept may also face some opposition for similar reasons.



8.4 Whitemark (Port)

Whitemark is the Island capital and has the largest population as well as being in close proximity to major infrastructure, services and the airport.

The existing wharf port facilities at Whitemark are vulnerable to westerly weather and are exposed to tidal restrictions. The outer islands and reefs provide some reduction in the swell wave conditions however during large wind events the coast can be exposed to large waves, requiring any permanent infrastructure to be supported with wave protection through a rock breakwater.

8.4.1 Concept Design Development

A concept design was developed for Whitemark incorporating the following marine infrastructure:

- Rock breakwall structure to provide protection from waves;
- Dredging within formed harbour for private marina;
- Development of up to 50 berth marina;
- Extension to existing wharf for alongside port access (commercial shipping) and added protection from breakwater; and
- Capacity to allow for parking and amenities alongside existing port shed.

A concept sketch layout is provided in Figure 16 below.

Key design aspects related to the Whitemark concept design include breakwater construction approach, impact of breakwater on sedimentation, water depths, dredging and reclamation.



Figure 16 Plan showing proposed concept development option at Whitemark (Port)



Image from LISTmap, 2016

8.4.2 Natural Values (Marine and Terrestrial)

A preliminary marine ecological survey has been undertaken for the site.

The preliminary visual survey identified shallow water depths adjacent the existing wharf, indicating an extensive dredging program would be required for any proposed marina infrastructure.

For more detail refer to the Marine Solutions Report in Appendix D.

No terrestrial flora and fauna survey would be required as there is existing land based road access, parking and buildings that may be further developed as part of the proposal.

8.4.3 Coastal Processes

Whitemark is situated on the exposed west coast of Flinders Island, and is positioned where tidal influences are extreme. The coastline consists of shallow sediments from Long Point to Big Green Island.

Anecdotally the previous channel dredged for the port wharf, retained its form for long period of time however the area is depth limited and hence access restricted to high tide periods, particularly for deep keel boats.



Any formation of breakwater will result in diffraction of waves and tendency to drive sediments towards the groyne of the existing wharf.

A dredged harbour for all tide conditions would be required and likely require ongoing maintenance dredging to enable long term access to the port. Capital and maintenance dredging requiring specialised equipment to Flinders Island would be a costly exercise given mobilisation costs from either Tasmania or Victoria.

8.4.4 Geology

A search of the Land Information System Tasmania (The LIST) Map indicates that Quaternary sediments of sand, gravel and mud of alluvial, lacustrine and littoral origin, dominate at the proposed site.

8.4.5 Bathymetry

No bathymetry survey was conducted at the Whitemark (Port) site. However, Marine Solutions (2017) did undertake preliminary visual and aerial imagery of the site, and noted a shallow water depth (<2m Chart datum) within and adjacent to existing wharf facilities. (Refer to Appendix D).

8.4.6 Acid Sulfate Soils

A search of the Land Information System Tasmania (The LIST) Map indicated there was a low probability of occurrence of marine subaqueous and intertidal acid sulfate soils at the proposed site.

8.4.7 Geoconservation

A search of the Tasmanian Geoconservation Database (TGD, 2016) highlighted that no geoconservation sites residue at Whitemark Port.

8.4.8 Landslide Risk

A search of the Land Information System Tasmania (The LIST) Map, produced by Department of Premier and Cabinet, indicates that the proposed development site has not had any known landslides.

8.4.9 Sediment Contamination

Marine Solutions did not establish if there is any current sediment contamination at the site. However, with the site being historically a working wharf facility, there could be some residual contamination. Marine Solutions stated it would be unlikely contamination would be elevated due to the coarse nature of the marine sediments and that they are regularly reworked.

8.4.10 Cultural Heritage (European and Aboriginal)

No assessment required.

8.4.11 Environmental Conclusion

The proposed development of infrastructure at Whitemark Port presents some potential environmental challenges, principally due to the shallow depth of water, exposure to dominant westerly weather.

The development of the proposed marine infrastructure at Whitemark (Port), based on an extension of existing infrastructure, will generally have to ensure environmental issues are investigated and controlled in both construction and ongoing service. These may include water quality, sediment management and impact



of the new structure on the existing environments which would need to be further detailed within a Development Application.

8.4.12 Planning Considerations

To provide Council with advice on matters relating to Statutory Planning and Land Tenure requirements on the preliminary designs for the new marina developments and associated land based infrastructure proposed for Whitemark, we have outlined the pertinent planning issues, which are summarised as follows:

Marina, Breakwater and Wharf Extension

The foreshore adjacent the proposed groyne sits with the following *Flinders Island Planning Scheme - Zone*

- *Port*

The proposed infrastructure will also trigger the following *Flinders Specials Areas*;

- *Shoreline Waterbody.*

The proposed development could be dealt with as a standard Development Application. It would be defined as Commercial – Marine Sales, Hire and Maintenance and would be a Permitted use in the Port Zone.

The key issues to be addressed in any Development Application are likely to be:

- Environmental management (impact of proposed development on existing natural values);
- Landowner consent from TasPorts;
- Visual Impact;
- Coastal Vulnerability, including;
 - Assessment on the potential impacts erosion potential for the proposed site.

It is also recommended that any proposed Development Application be preceded by community and stakeholder consultation.

Existing Licenses

There is currently one (1) existing license within the proposed development area;

- Encompassing some of the marina and breakwater area - PID 2032380;



Figure 17 Existing license within proposed development area at Whitemark (Port)



8.4.13 Planning Conclusion

Given the proposed works are within an operating Wharf facility and would be a Permitted use in the Port Zone it is likely that approval would be granted. The limits on this would be the impact of the proposed development and any natural values identified from the recommended detailed investigations, could be satisfactorily mitigated. In particular the potential environmental impacts from the dredging requirements needed for the marina.



8.5 Trousers Point

Trousers Point is located on the South West of Flinders Island, near the settlement of Loccota. The site was recommended due to its attraction to cruise ship and tourist vessel visitation and anchorage within Trousers Bay.

The proposed study area lies within the boundaries of the Strzelecki National Park and is located at the end of Trousers Point Road as shown in Figure 20 below.

The proposed development site has existing road access but limited parking and services facilities. The nearest re-supply facilities are located at Whitemark, approximately 16 km north.

Trousers Point currently has a low level of development and modification. Any proposed marine infrastructure will have a high visual impact, making preservation of the natural attraction of the site challenging.

8.5.1 Concept Design Development

A concept design was developed incorporating the following infrastructure:

- Fixed wave panel jetty (to minimise visual impact);
- Access road for gaining access for construction and visitor vehicle access;
- Capacity to allow for parking and amenities (power/solar).

A concept sketch layout is provided in Figure 18 below. This facility is generally considered to be only suitable for visiting vessels to enable safe access to the national park and not support long term berthing.

Figure 18 Plan showing proposed development at Trousers Point





8.5.2 Natural Values

Generally seagrass habitat dominated the subtidal zone, with a diverse community of microalgae present and patches of coarse sand. In the intertidal/subtidal boundary was a large band of Neptune's necklace.

The desktop search, including both the EPBC Act Protected matters search and natural values atlas, identified seven (7) listed marine animal threatened species and one (1) verified record of a threatened species. For more detail refer to the Marine Solutions Report in Appendix D.

The majority of Strzelecki National Park is on the Register of the National Estate in recognition of its natural values. Accordingly, a terrestrial flora and fauna survey will need to be completed to analyse the potential for any threatened species/communities on the land, especially in regards to the proposed new access track.

8.5.3 Coastal Processes

The proposed development location is sited within the southern bay of Trousers Point. This location may provide some protection from southerly, south westerly wind conditions, due to the proximity and siting of the Chappell Islands and Cape Barren Island.

Marine Solutions also noted that there was a noticeable surge, despite conditions being relatively calm and offshore. A surf location was identified on the south-eastern point of Trousers Point, which breaks in swells over 2-3 m.

The site is exposed to wind waves and hence the concept nominates a partial depth widescreen panel jetty breakwater to improve vessel access to the shore. The partial depth screen will not impact current or sediment flow and hence not be of significant coastal impact to the site.

8.5.4 Geology

A search of the Land Information System Tasmania (The LIST) Map indicates that Devonian - Carboniferous granitoids (similar to granite) and related rocks dominate at the proposed site. Rocks are likely to be shallow below marine sediments and will make design of piled and construction of piled structures difficult.

8.5.5 Bathymetry

The proposed development area was mapped using a Suunto dive computer. The water depth data points were collected every 10 m, and calibrated using a weighted tape measure.

The bathymetry was generally typical for a coastal embayment, with water depth increasing with distance from the shore. The bathymetry dropped steeply for the first ten (10) meters from the shore, then increased more gradually, with the maximum water depth recorded being 5.2 m, this was recorded along the transect for the proposed jetty and wave screen.

It is important to note that these depth measurements only represent total water depth, they have not been tidally or barometrically corrected.

8.5.6 Acid Sulfate Soils

A search of the Land Information System Tasmania (The LIST) Map indicted there was a low probability of occurrence of marine subaqueous and intertidal acid sulfate soils at the proposed site.

8.5.7 Geoconservation

A search of the Tasmanian Geoconservation Database (TGD, 2016) highlighted that no geoconservation sites residue with the proposed development footprint.



North of the proposed development site there is one (1) site of significance, Fotheringate Bay Coastal Karst, which is located on the Northeast of Trousers Point.

8.5.8 Landslide Risk

A search of the Land Information System Tasmania (The LIST) Map, produced by Department of Premier and Cabinet, indicates that the proposed development site has not had any known landslides.

8.5.9 Sediment Contamination

Marine Solutions did not establish if there is any sediment contamination at the site. However, it would be unlikely if contamination present within the marine sediments, noting that particle size evaluations undertaken by Marine Solutions, highlighted that the marine sediments are predominantly sand, with some minor shell grit.

Adding weight to this idea, was the jet probing observations undertaken. Marine Solutions completed ten (10) jet probes into the marine deposits to ascertain sediment depths. The results highlighted that penetration into the marine sediments was easy, which demonstrates the sediments are mobile, and regularly reworked, thus restricting the deposition of any potential contaminants.

8.5.10 Cultural Heritage (European and Aboriginal)

Strzelecki National Park contains features of heritage significance. Accordingly a Cultural Heritage assessment will need to be undertaken to determine the sites cultural values.

8.5.11 Environmental Conclusion

The proposed development of infrastructure at Trousers Point presents significant environmental challenges, principally due to the majority of Strzelecki National Park being on the Register of the National Estate in recognition of its natural values, the cultural sensitivity of the area and the unknown details around the terrestrial natural values.

Any proposed marine/ terrestrial infrastructure, would need supplementary assessments to be conducted and any potential impacts of the proposed infrastructure on the existing environment would need to be detailed within a Development Application (DA).

8.5.12 Planning Considerations

To provide Council with advice on matters relating to Statutory Planning and Land Tenure requirements on the preliminary designs for the new marina developments and associated land based infrastructure proposed for Trousers, we have outlined the pertinent planning issues, which are summarised as follows:

Jetty, Wave Screen & New Access Track

The proposed works sit within the following *Flinders Island Planning Scheme - Zone*

- *Environmental Management and Recreation*

The proposed infrastructure and access track will also trigger the following *Flinders Specials Areas*;

- *Ecologically Sensitive;*
- *Shoreline Waterbody; and*
- *Visually Sensitive;*



The proposed development could be dealt with as a standard Development Application. It would be defined as a Tourism Operation/Active Recreation and would be a Discretionary use in the Environmental Management and Recreation Zone. However, due to the proposed site being within the Strzelecki National Park, a Reserve Activity Assessment (RAA) would also be required in order to assess environmental, social and economic impacts/benefits before land owner consent would be provided by Parks & Wildlife Service.

It is also noted that Trousers Point is known as “the most photographed and celebrated beach on the island” (Flinders Council, 2016). The natural appeal and high social value of this site would require significant mitigation controls and a robust and inclusive management strategy. These considerations would be an essential consideration in the planning of any development at this site.

The main planning consideration is likely to be visual and natural values impact.

The key issues to be addressed in any Development Application are likely to be:

- Environmental management (impact of proposed development on existing natural values);
- Landowner consent from PWS/Crown Land;
- Reserve Activity Assessment (RAA), a requirement of PWS,
- Visual Impact; and
- Traffic impacts associated with additional requirements on the carpark.

It is also recommended that any proposed Development Application be preceded by community and stakeholder consultation.

Existing Licenses

There is currently one (1) existing license within the proposed development area;

- Along Foreshore zone - PID 1730216.

Figure 19 Existing licenses within proposed development area at Trousers Point





8.5.13 Planning Conclusion

Given that community attitudes on the proposed development will vary and the assessment of the eventual visual impact will be subjective, it is recommended that the planning concept of the proposed development would best be deliberated at a strategic level. This would initially be done as part of a comprehensive Island plan that holistically considers the benefit and impacts of the proposal.

Assuming all environmental and natural values matters can be satisfactorily mitigated it is considered more unlikely that the visual impact of the proposals would be acceptable given the sites natural and public significance.

It is likely that this proposed development concept will encounter some public some opposition and hence not recommended.



8.6 Lady Barron Wharf

The Lady Barron Port and associated infrastructure is a Tasports managed asset that provides for both commercial and public uses. It is accessed off Main Street, south of Franklin Parade in Lady Barron.

The Lady Barron Wharf area is the most modified of any of the sites investigated.

8.6.1 Concept Design Development

A concept design was developed incorporating the following infrastructure:

- Reuse of existing wharves and jetties including upgrade of outer wharf to incorporate wave panels;
- Extension to outer wharf with jetty structure and wave panels to improve wave protection inside wharf and berthing jetties;
- Extension of existing jetty to increase berthing capacity; and
- Relocation of boat ramp to improve access and launching/retrieval.

A concept sketch layout is provided in Figure 20 below.

Figure 20 Plan showing proposed development at Lady Barron Wharf



Image from LISTmap, 2016



8.6.2 Natural Values

Generally, soft unconsolidated sediment, with a mosaic of algal and seagrass growth dominated the site. There was also substantial anthropogenic impacts identified, with large amounts of litter present at the site.

The desktop search, including both the EPBC Act protected matters search and natural values atlas, identified seven (7) listed marine animal threatened species and no record of a threatened species. For more detail refer to the Marine Solutions Report in Appendix D.

Due to the site being highly modified, with a current wharf facility being operational, the impacts to both the marine and terrestrial environment are considered to be minimal.

8.6.3 Coastal Processes

The Lady Barron area is relatively protected from oceanic derived waves, especially from southerly/south westerly swells, as the region is provided with some protection from Cape Barren Island and from a number of smaller Islands dispersed throughout Franklin Sound.

The large volumes of water moving through Franklin Sound do influence water velocities, which augments tidal currents affecting the Lady Barron Wharf and sediment movement within the bay area.

The wharf is located on the edge of a deep channel and hence partial depth wavescreen panels are unlikely to impact on current and sediment movement.

Given waves are only wind waves the wave screen will not affect sediment movement related to wave diffraction around the structure.

8.6.4 Geology

A search of the Land Information System Tasmania (The LIST) Map indicates that Devonian - Carboniferous granitoids (dominantly adamellite/ granite) and related rocks dominate at the proposed site.

8.6.5 Bathymetry

The proposed development area was mapped using a vessel mounted Garmin GPS Map 551s running a dual frequency 50/200 kHz transducer. The water depth was logged every two seconds to Seabed Mapper running on a laptop computer.

The bathymetric mapping of the area identified three (3) distinct zones;

- a near-shore shallow flat of ~ 0 – 2 m;
- a band of ~ 2 – 7 m water depth, where the proposed development will be located, and
- a deep channel of ~ 8 m + in the south of the study area.

The maximum depth recorded was over ten (10) m, this was located south of the proposed development site. The maximum depth in the immediate footprint of the proposed development was seven (7) m.

The depths highlighted the limitations of the port site for access and constraints around berthing and mooring of vessels in the extents of the port site.

8.6.6 Acid Sulfate Soils

A search of the Land Information System Tasmania (The LIST) Map indicted there was no occurrence of marine subaqueous and intertidal acid sulphate soils at the proposed site.



8.6.7 Geoconservation

A search of the Tasmanian Geoconservation Database (TGD, 2016) highlighted no geoconservation sites residue within the Lady Barron Wharf site

8.6.8 Landslide Risk

A search of the Land Information System Tasmania (The LIST) Map, produced by Department of Premier and Cabinet, indicates that the proposed development site has not had any known landslides.

8.6.9 Sediment Contamination

Marine Solutions did not establish if there is any current sediment contamination at the site.

8.6.10 Cultural Heritage (European and Aboriginal)

It is considered unlikely a Cultural Heritage assessment will need to be undertaken for the Lady Barron Wharf site, due to the current operational nature of the wharf facilities.

8.6.11 Environmental Conclusion

The development of the proposed marine infrastructure at Lady Barron Wharf based on an extension of existing infrastructure, will generally have negligible environmental issues to manage. However, unanticipated environmental issues may arise and in particular sediment contamination, water quality, and impact of the new structure on the existing a mine environment should be detailed within a DA.

8.6.12 Planning Considerations

To provide Council with advice on matters relating to Statutory Planning and Land Tenure requirements on the preliminary designs for the extension of current marine based infrastructure proposed for Lady Barron Wharf, we have outlined the pertinent planning issues, which are summarised as follows:

Wharf Extension & Wave Screen, Boat Ramp Relocation/Floating Pontoon

The existing marine wharf facilities and boat ramp sit within the following *Flinders Island Planning Scheme - Zone*

- *Environmental Management and Recreation*

The proposed infrastructure will also trigger the following *Flinders Specials Areas*;

- *Shoreline Waterbody.*

Presently the proposed development would be defined as a Tourism Operation/Active Recreation and would be a Discretionary use in the Environmental Management and Recreation Zone. The proposed development could be dealt with as a standard Development Application. Albeit as discretionary under the Planning Scheme.

Another option that could be considered is the following;

The proposed development could go through the process of applying for a re zoning of the marine foreshore area, where the proposal and current infrastructure resides.

It seems somewhat disconnected that an operational Wharf facility, which has the land side area zoned as Port, whereas the marine infrastructure is zoned as Environmental Management and Recreation.



If the re zoning application was successful, the proposal would then be a Permitted use in the Port zone, and approval would be granted.

Depending on what option is implemented, the key issues to be addressed in any Development Application are likely to be:

- Application to rezone the marine infrastructure area (re zoning option)
- Environmental management (sediment contamination issue of proposed development); and
- Landowner consent from TasPorts;

It is also recommended that any proposed Development Application be preceded by community and stakeholder consultation.

Existing Licenses

There is currently two (2) existing licenses within the proposed development area;

- Encompassing wharf extension area - PID 2032380;
- Encompassing Boat ramp relocation & floating Pontoon area - PID 1730216.

Figure 21 Existing licenses within proposed development area at Lady Barron Wharf





8.6.13 Planning Conclusion

Given the proposed works are within an operating port facility, the proposed concept works would be permitted use under the planning scheme. The proposed infrastructure are consistent with existing facilities and uses at the port including grouping of facilities with existing marine infrastructure.

It is expected that community support for an extension to the current facilities would be high at the Lady Barron Wharf site. In addition, the significant modification historically undertaken at the site, would make it unlikely that the proposed change to the visual amenity would be an issue for the proposed development.

This concept would only be suitable if developed in conjunction with Tasports and hence is unlikely to attract private investment without potential for public funding.

In terms of options presented for Lady Barron, this project should only proceed if deemed preferred of the two sites. In terms of long term future expansion, the wharf will always retain potential for expansion incorporating the proposed infrastructure identified within this report. Consultation with Tasports would be recommended in terms of opportunity to incorporate the public and private infrastructure should any future expansion or redevelopment be undertaken.



8.7 Lady Barron Slip

The Lady Barron Slipway site is an existing slipway and temporary boat ramp located off Franklin Parade. Accessing the site is via the first right hand turn past the fuel storage facility.

8.7.1 Concept Design Development

A concept design was developed incorporating the following infrastructure:

- Rock breakwater structure to provide protection from wind waves and aligned to suit site bathymetry, currents and design arrangement;
- New trailer boat ramp for vessels up to 8 metres incorporating small boat berthing and mooring and small boat visitor berthing;
- Pontoon jetty incorporating access for boat ramp, visitor berthing and access to marina facilities;
- Development of up to 50 berth marina facility with floating marina and services; and
- Capacity to allow for parking and amenities alongside marina facilities including trailer parking, car parking and amenities building.

The existing slipway remains and will be able to make use of the expanded facilities incorporating the use of the floating jetties and marina berths for temporary berthing during slipping as well as enable expansion of slipping services for wider range of vessels.

A concept sketch layout is provided in Figure 22 below.

Figure 22 Plan showing proposed development at Lady Barron Slip



Image from LISTmap, 2016



8.7.2 Natural Values

Generally, the seabed graded from bedrock into macro algae and finally sea grass beds. The sea grass beds where the dominant habitat type, with minor zones of unconsolidated sand.

The desktop search, including both the EPBC Act protected matters search and natural values atlas, identified seven (7) listed marine animal threatened species and no record of a threatened species. No listed threatened species were observed during the dive survey.

The sea grasses encountered are natural areas for subtidal communities and species and hence the breakwater will result in an immediate impact and losses of sea grass in this area. The rock structure that replaces the seagrass however will provide another source of natural habitat and protection for marine species and hence may be considered as minimal overall disturbance on the marine environment in that area.

For more detail refer to the Marine Solutions Report in Appendix D.

8.7.3 Coastal Processes

The Lady Barron area is relatively protected from oceanic derived waves, especially from southerly/south westerly swells, as the region is provided with some protection from Cape Barren Island and from a number of smaller Islands dispersed throughout Franklin Sound.

The large volumes of water moving through Franklin Sound do influence water velocities, which augments tidal currents affecting the Lady Barron Slip site but generally the tidal currents are further from the slip site and the proposed rock breakwater unlikely to impact water flow or quality in its proposed footprint.

The breakwater was limited to the proposed length and extents based on limiting both the effect on currents and sediment movements as well as protection for the marina and overall construction costs of the breakwater structure.

Figure 23 Outer Aerial of proposed development at Lady Barron





8.7.4 Geology

A search of the Land Information System Tasmania (The LIST) Map indicates that Devonian - Carboniferous granitoids (dominantly adamellite/ granite) and related rocks dominate at the proposed site.

The exposed granite is at the shoreline and area of the rock breakwater and boat ramp and extends below the marine sediments sloping at depth seaward.

Marine Solutions undertook probing on site to assess the likely depth of sediments which was in excess of 2 metres (maximum depth of recording instruments) which should make marina piling suitable with only minor rock socketing if required.

The soft sediments encountered will likely result in settlement of the rock material for the breakwater and we'd recommend a specification for design and placement of the rock incorporating large rock matrix at the seabed level to minimise the depth of settlement of the rock breakwater.

8.7.5 Bathymetry

The proposed development area was mapped using a vessel mounted Garmin GPS Map 551s running a dual frequency 50/200 kHz transducer. The water depth was logged every two seconds to Seabed Mapper running on a laptop computer.

The bathymetry of the area was typical for a coastline, with depth increasing the further from shore you went. The maximum depth recorded was over 7 m, in a channel south of the proposed development area. The maximum depth in the immediate footprint of the proposed development was ~2.5 m.

Extension of the breakwater further south is possible but the depths drop significantly which would substantially increase the rock quantity requirements as well as extend the breakwater into the tidal current zones as identified on site through drogue surveys.

8.7.6 Acid Sulfate Soils

A search of the Land Information System Tasmania (The LIST) Map indicated there was no occurrence of marine subaqueous and intertidal acid sulphate soils at the proposed site.

8.7.7 Geoconservation

A search of the Tasmanian Geoconservation Database (TGD, 2016) highlighted no geoconservation sites residue within the Lady Barron Wharf site

8.7.8 Landslide Risk

A search of the Land Information System Tasmania (The LIST) Map, produced by Department of Premier and Cabinet, indicates that the proposed development site has not had any known landslides.

8.7.9 Sediment Contamination

Marine Solutions completed sediment contamination sampling within the proposed development footprint of the Lady Barron Slip. The analysis from the laboratory has indicated that potential contaminants of concern for the area would consist of only Tributyltin (TBT), and these would most probably be of low significance and concentrated around the slipway areas. The largest footprint impact on the site is the marina breakwater which will incorporate rock backfilled and placed on the seabed and built up to above high tide and extreme wave levels.

For more detail refer to the Marine Solutions Report in Appendix D.



8.7.10 Cultural Heritage (European and Aboriginal)

A Cultural Heritage assessment will need to be undertaken to determine the sites cultural values.

8.7.11 Environmental Conclusion

The development of the proposed marine and land infrastructure at Lady Barron Slip, will generally have negligible environmental issues to manage within the existing natural environment.

Marine Solutions independent report on the sites identified Lady Barron as the preferred site based on the marine ecological assessment.

In development of the proposed design and approvals phase a construction environmental management plan outlining controls related to the following is recommended:

- Use of clean rock for the construction of the rock breakwater and free from sands or silts;
- Installation of silt screens during rock backfilling and boat ramp in the shallows to minimise the sediment disturbance;
- Limitation of construction activities that may result in sediment disturbance and loss of seagrasses; and
- Assessment of final landside footprint for construction and terrestrial survey of area to confirm suitable for the nominated areas.

Based on the findings of the marine assessment it was determined that there are no ecological contraventions to the development proposed within the overall Lady Barron area.

8.7.12 Planning Considerations

To provide Council with advice on matters relating to Statutory Planning and Land Tenure requirements on the preliminary designs for the extension of current marine based infrastructure proposed for Lady Barron Slip, we have outlined the pertinent planning issues, which are summarised as follows:

Marina, Breakwater, Boat Ramp Relocation/Floating Pontoon

The existing marine wharf facilities and boat ramp sit within the following *Flinders Island Planning Scheme - Zone*

- *Environmental Management and Recreation*

The proposed infrastructure will also trigger the following *Flinders Specials Areas*;

- *Shoreline Waterbody.*

Presently the proposed development would be defined as a Tourism Operation/Active Recreation and would be a Discretionary use in the Environmental Management and Recreation Zone. The proposed development could be dealt with as a standard Development Application. Albeit as discretionary under the Planning Scheme.

Another option that could be considered is that the proposed development could go through the process of applying for a re zoning of the marine foreshore area, where the proposal and current infrastructure resides.

Similar to the Lady Barron Wharf site, the Port zone is adjacent the proposed development area, and only extends to the neighbouring fuel facility. If this zone could be extended (through an application process) to this proposed development site the proposal would then be a Permitted use in the Port zone, and approval would be granted.

Depending on what option is implemented, the key issues to be addressed in any Development Application are likely to be:

- Application to rezone the marine infrastructure area (re zoning option);



- Environmental management (natural values – flora & fauna of proposed car parking zone);
- Landowner consent from TasPorts;
- Finalise the overall project scope, drawings and infrastructure proposed including staging;
- Availability of sewage pump out facilities and fuelling facilities; and
- Coastal Vulnerability, including;
 - Assessment on the potential impacts on inundation and erosion potential for the proposed site.

It is also recommended that any proposed Development Application be preceded by community and stakeholder consultation confirming the proposed development plans.

Existing Licenses

There is currently one (1) existing license within the proposed development area;

- Encompassing marine development area - PID 2032380;

Figure 24 Existing licenses within proposed development area at Lady Barron Slip



8.7.13 Planning Conclusion

Given the proposed works are adjacent an operating fuel facility within the Port zone, it is recommended that an application to re zone the proposed development area be undertaken.

If the re zoning application was successful, the proposal would then be Permitted use in the Port Zone, and would enable approval to be granted through a Development Application.

It is expected that community support for an extension to the current facilities with the proposed infrastructure would be high at the Lady Barron Slip site. In addition, the historic modification undertaken at



the site, would make it unlikely that the proposed change to the visual amenity would be an issue for the proposed development.

8.8 Conclusions and Recommendations

The aim of the detailed site investigations was to facilitate the identification of any potential environmental issues and planning constraints for each site investigated. All identified issues were then considered in the context of applying for a DA with Flinders Council.

Considerations for each site included the potential for impacts to any threatened and protected species, disturbance to coastal processes and any potential impacts to natural values.

The site selection process considered minimising and identifying any adverse impacts on the following:

- Matters relating to statutory planning and land tenure requirements;
- Degradation of social and/or visual amenity;
- Disturbance or destruction of natural values; and
- Adverse impact on heritage values.

In consideration of social, planning and environmental factors, the **Lady Barron Slip** site is considered the most suitable of those investigated for the development of marine/terrestrial infrastructure and creating a safe harbour for local and visiting vessels.

The total impact of the proposed marina development in combination with appropriate management controls, would not adversely impact the general physical amenity of the Lady Barron Slip, and no marine ecological contraventions to the development have been identified for this site.



9. Preferred Concept

The Lady Barron Slipway site was identified as the preferred site.

A concept development plan was prepared incorporating engineering design for the proposed infrastructure including:

- Rock breakwater;
- Boat ramp and floating pontoon jetty;
- Floating marina berths;
- Temporary berthing for visitor vessels;
- Amenities facilities including toilets, showers and washing;
- Marine services including sewage pump out, water supply, power and fuel; and
- Car and trailer parking for use of the facilities.

Figure 25 Preferred Concept at Lady Barron Slip





9.1.1 Breakwater Design

A concept alignment and design for a breakwater extension was developed based on the site analysis and detailed investigations. The design formation for the breakwater was based on the existing site conditions relating to water depths, wave actions and harbour protection limits.

An option for a wavescreeen panel type breakwater was also considered but the cost of rock supply was considered more viable than piled panel wall structure. In addition, a pile and panel type structure would require good foundation conditions for installation of piles and loads on the piles from wave action which would require significant construction equipment for socketing piles into the rock.

A floating wave attenuator may be an option for the site which would incorporate a 5m wide concrete floating pontoon structure with deep side panels that provide reflection and absorption of the wave energy from approaching wind waves. This type of structure would only be viable if rock was not readily available or the proposed rock structure deemed unsuitable to the natural environment.

The outer alignment and hook of the breakwater was designed to provide optimum protection to the boat ramp and marina berths whilst increasing the public jetty capacity and providing the opportunity for a return on the infrastructure through private leasing of the Crown Land for a new marina development.

The breakwater could be constructed in stages through back end tipping rock core and secondary rock with placement of armour rock on the seaward face required by a large excavator (20-30 tonne). The width of the breakwater would be designed for construction as well as providing pedestrian access.

Photo 1 Example of Rock Breakwater Construction (St Helens)





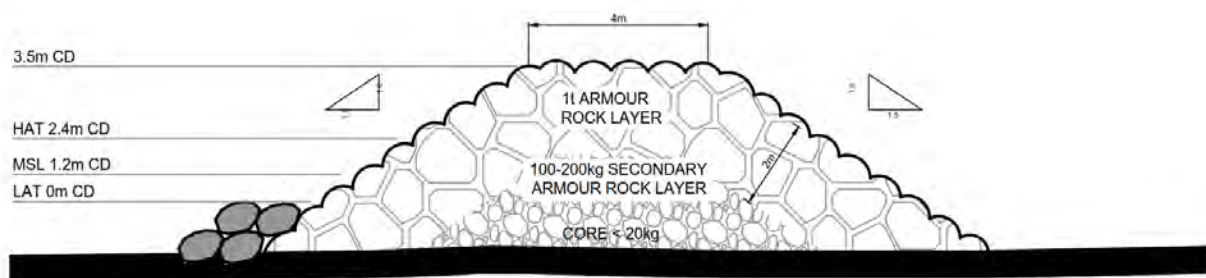
Photo 2 Example of Rock Breakwater Construction (St Helens)



The concept design for the rock breakwater was developed through hindcasting of the wave climate within the site fetch areas and development of the required rock size for the breakwater design. Rock for the site would need to be developed with the following specification:

- Specific density > 2.0 t/m³;
- Core rock for the base formation of the breakwater < 20kg with <20% of rocks greater than 200kg for base formation;
- Secondary rock overlaying the core rock = 100-200kg in weight;
- Armour rock nominal size (50% over the limit) = 1 tonne;

Figure 26 Typical Section of Breakwater



The proposed breakwater could be constructed in stages to account for budgeting and demand including the following:

- Stage 1 = boat ramp and inner breakwater; and
- Stage 2 = extension of breakwater and construction of inner marina (public or private).



9.1.2 Floating Marina

The proposed marina layout allows for a staged construction with a mix of recreational and commercial vessels.

Water depths are constrained in the marina to the existing bathymetry allowing for maximum 2 metre draft vessels. There is capacity to dredge the outer berths which would retain depth due to the breakwater protecting the berths.

A number of berth sizes would be provided within the marina including small berth capacity for trailer boats from local users as well as visitors from mainland that often arrive for short trip stays.

Generally, a marina mix is subject to demand assessment for the site and can incorporate a range of vessels sizes but for the purposes of the concept design we've adopted the following recommendation:

Table 6 Proposed Marina Berth Mix

Berth Size	Berth No.
<8m (trailerable)	8
12m	31
15m	15
20m	2
TOTAL	56

The marina berth mix provided above is a guide and represents our assessment of an appropriate mix for the usage within the proposed site, current demand, future demand and the design limits for the available protected area. The final size of berths can be adjusted to suit demand but at this stage we recommend a focus on recreational vessels between 6 and 20 metres in length however with the flexibility to cater for varying sizes subject to demand.

Fairways, walkways and fingers were all maintained with the Australian Standard, AS 3962, design guidelines for marinas.



Photo 3 Example of Marina with small boat berths



Photo 4 Example of trailerable boat berths



9.1.3 Boat Ramp

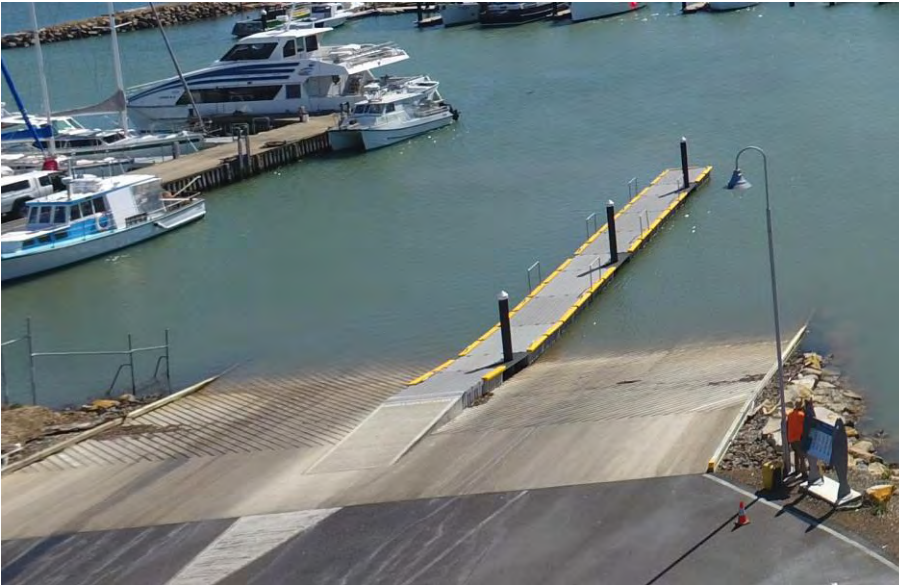
The proposed boat ramp for the development is a dual lane 4 metre wide ramp constructed from concrete. The formation would allow for 50-200mm rock to be backfilled from outside the current rock area to form a 1:8 grade boat ramp that can be concreted below and above water.

A concrete jetty abutment to gangway and floating pontoon will provide berthing for both the boat ramp, visiting berths and access to the outer marina.

An example photo for the proposed boat ramp is included below.



Photo 5 Example of typical boat ramp



9.2 Engineering Cost Estimates

Engineering cost estimates were provided for the marine infrastructure on the basis of:

- Engineering design development completed for this study;
- Quantities for new infrastructure (marina pontoons, piles, gangway, jetty and service);
- Quantities for rock groyne structure;
- Assumption that a suitable armour rock can be accessed within close proximity to the site (low transport costs);
- Required approvals and investigations to complete the detailed design and statutory approvals;
- Landside quantities and costs for car park, access paths, services, etc.; and
- Rates and construction costs for 2016/17 financial year.

Table 7 Construction Summary

TOTAL PROJECT - Cost Estimate Summary		
1	Establishment & Delivery of Materials to site	\$197,000.00
2	Rock Breakwater	\$2,227,200.00
3	New Marina Structures	\$1,808,750.00
4	New Boat Ramp & Jetty	\$204,000.00
5	Permits, engineering, project management, contingencies, etc	\$347,000.00
6		
	TOTAL OF WORK (EXCL GST)	\$4,783,950.00



10. Economic Investment and Business Case

This section of the report has been prepared to present the development logic and economic rationale underpinning the planning and engineering design work undertaken to develop a range of options for a safe harbour on Flinders Island. From the range of design options, an investment analysis has been completed to identify the most appropriate investment option for subsequent Flinders Island Council and Flinders Island community review and discussion.

10.1 Economic Objectives

The findings in this section specifically relate to the results of the preparation of an overall Business Case, which can be presented to the State Government and to the Commonwealth Government for funding support.

The Business Case has three (3) key components. These are as follows:

- (i) to indicate the strategic fit of the proposed Safe Harbour initiative. This is the extent to which the proposed development meets a range of strategic policy goals at the local, regional and state level. The Business Case needs to report that the Project is likely to resolve the problem posed, i.e. the need for a safe harbour for yachts and commercial vessels;
- (ii) to provide the necessary evidence, which can support and justify public sector investment in the development of a new safe harbour on Flinders Islands by completing an economic appraisal of the likely viability of the preferred Project; and
- (iii) to examine the deliverability of the Project in terms of its long-term financial viability and sustainability, based on proven maritime engineering construction principles.

The Business Case needs to report that the recommended project option is likely to resolve the problem posed, i.e. to provide for a safe harbour for yachts and commercial vessels.

It also needs to show that there have been a number of alternative technical options considered and that the recommended option is in line with the development needs and infrastructure priorities of Flinders Island.

Box 1 below provides an overview of the historic and current level of visitors to Flinders Island, including estimates of annual visitor expenditures. Flinders Island's current population is estimated at 850 persons. In 2005, it was estimated at 897 persons. Despite the relatively static growth in population, visitor demand has been consistently upwards (in the range of between 5% and 6.5% over the past two decades. In 2005, it was estimated at 4,000 visitors. By 2009, it had grown to 4,319 visitors, in 2014 to 5,692 visitors, and in 2016/17, it is estimated to have reached 6,600 visitors.



Box 1: Summary of Flinders Island Visitor Demand

A. Data on Arrivals				
Year (At Month of January)	Total Travellers	Total Visitors	Average Annual Growth Rate of Visitors	Total Visitor Expenditure (\$ Million)
2009 ^{1/}	8,638	4,319		4.05
:			6.35%	
2014 ^{1/}	10,239	5,692		5.12
:			5.0% ^{2/}	
2017 ^{2/}	11,850	6,600		9.92 ^{3/}

**B. Purpose of Visit:
2014**

Numbers of Visitors

- Holiday/Leisure: 36% 2,050
- Business/Employment: 31% 1,765
- Visiting Family/Friends: 27% 1,537
- Special Interest (History, Diving, Walks): 4% 227
- Other (Retirement Options, Real Estate Purchase): 2% 113
- Subtotal: 100%

^{1/} Source: Roy Morgan Research and Tourism Tasmania surveys.
^{2/} Source: Flinders Island airport surveys (private sector data).
^{3/} Consultants estimates based on Tourism Tasmania visitor expenditure surveys.

10.2 Project Appraisal Methodology

Infrastructure projects worldwide and across Australia, including those in Tasmania, may be regarded as the 'cutting edge' of local and regional development. The primary objective of preparing a Business Case is to develop an understanding of how a specific investment project may be developed and analysed to determine its overall viability. It requires the specification of the project's vision, focus and rationale in terms of direct and quantifiable economic costs and benefits. It needs to show the catalytic effects on the local/regional economy from the investment. Investment analysis, as conducted on a project-by-project basis, relies on cost-benefit analysis (CBA). CBA is the most used of the analytic techniques, which exist for the appraisal and evaluation of infrastructure programs and projects. Its widespread appeal as an investment tool lies in its technocratic aura, its financial orientation, apparent simplicity, neatness/methodological rigour, its emphasis on logic and rationality, and its underpinning of welfare economics principles, in terms of focusing on improving total community welfare.

Distinction needs to be drawn between the decision maker(s) [the environment within which decisions are made] and the analyst(s) who prepares the Business Case and prepares the analysis. 'Good' Business Case results are fundamentally dependent on 'good' inputs and processes from the broadest spectrum of government and the community. For this Business Case, full cooperation to provide estimates and support was experienced. Investment decision makers, such as for the proposed Flinders Island (Lady Barron) infrastructure investment, can choose not to consider the results of investment analyses, as contained in Business Cases. Project choice can be made without CBA. However, for Flinders Island in particular, and for Tasmania in general, it is fundamental that international and Australian best practices and procedures be



available and that fundamentally sound projects (in economic and financial terms) are prepared and presented.

The preparation of the individual investment analyses has followed the broad principles, which are found throughout Australia, at the Commonwealth and State level. These are as specified in the Council of Australian Governments (COAG) public sector investment guidelines. For Tasmania, the Department of Treasury and Finance (DTF) project analysis guidelines are outlined in the Project Initiation Process (PIP) document dated April 1997. This document, in referring to the PIP, “establishes a structured framework to be followed by agencies in presenting projects proposed for inclusion in the Capital Investment Program”.

Public sector project appraisals differ from private sector investments in that the former require time periods of up to 20 years. All operating and maintenance costs need to be sourced from various forms of user chargers. No taxes are paid on the benefits and there is no repayment of the capital investment in a typical public sector project.

10.3 Project Analysis Questions

The following fundamental issues or questions have been addressed in the preparation of the Business Case. They include:

- (i) what is the objective(s) of the project;
- (ii) what is the situation ‘with’ and ‘without’ the project;
- (iii) does the project represent the best alternative;
- (iv) who are the beneficiaries;
- (v) what is the structure/component mix for the project;
- (vi) is the project justifiable on broad economic, social and environmental grounds;
- (vii) is the project financially sustainable;
- (viii) what is the most appropriate timing for implementation and delivery;
- (ix) what investment performance measures will be generated and what discount rate should be used; and
- (x) is the project a risky investment.

In order to undertake the CBA spread sheet modelling, which underpins the Business Case, the following specific assumptions and procedures were followed:

- (i) a time period of 20 years was relied upon, with a residual or salvage value for relevant remaining assets included as a benefit in the 20th year;
- (ii) benefit streams only forecast to commence after the project investment has been completed, to allow benefits to be generated;
- (iii) all cost and benefit items were estimated in 2016/2017 constant prices, to avoid forecasting inflationary factors over 20 years;
- (iv) all capital development costs and O & M costs were net of GST, unless otherwise specified;
- (v) benefit streams were forecast to grow on the basis of ‘most likely’ demand and/or tourism demand. Hence, underlying benefits forecasts are conservative;



- (vi) additional charter boat investment, water tour services, and commercial fishing vessels servicing Flinders Island, are assumed to be operational by 2017/2018 (after development of the new facilities);
- (vii) additional ocean yacht traffic is assumed to increase from Victoria to the Flinders Island facilities at an annual rate of 2% per annum;
- (viii) a social discount rate of 6.5% has been used for all project viability estimation (the 6.5% has been assumed as the minimum accepted or hurdle rate for all projects). Net present values (NPVs) have been estimated using this discount rate. NPVs, economic internal rates of return (EIRRs) and benefit-cost ratios (BCRs) have been separately estimated. Project selection and project risk analysis have been based on all three (3) criteria. The NPV criteria has been used to rank projects in order of priority; and
- (ix) a series of sensitivity tests or 'what-ifs' have been completed to identify the relative levels of project robustness and viability, under alternative possible cost and benefit outcomes. The risk levels to be ascribed to each project scenario have been identified on the basis of the individual sensitivity tests.

10.4 Relationship of Economic Development to Infrastructure Investment

From the end of WWII, worldwide and in Australia, it has been demonstrated that high quality public infrastructure (public port/wharf facilities, roads/highways, railways, water supplies, sewerage systems, airports and power generation/transmission assets) were essential prerequisites for economic reconstruction and local/regional development. The case for such an assumption has been widely demonstrated throughout all Australian states. More specifically, the belief that public investment in maritime infrastructure, particularly coastal tourism facilities will generate economic growth, has also been proven. Examples of where State/local governments have invested in new coastal tourism facilities and have seen significant local/regional economic growth and investment from tourism and recreation and population in-migration and resultant employment growth can be found at:

- Triabunna (under final construction);
- Strahan;
- Launceston, on the Tamar;
- Lakes Entrance, Victoria;
- Eden and Ulladulla, Southern NSW;
- Broadwater, Gold Coast, Queensland; and
- Airlie Beach, North Queensland

10.5 F.I. Safe Harbour Project Investment

Across Australia, State and Commonwealth government agencies are striving to develop new forms of place-based investments. The specific goals, as relevant to the Flinders Island Project, include:

- (i) to plan for new public infrastructure at key locations, for tourism and recreation development;
- (ii) to stimulate local business investment and employment;
- (iii) encourage urban investors to more remote locations;
- (iv) improve information sharing and marketing as a destination; and



- (v) maximise State government interest and involvement with existing roles and service delivery.

Place-based investment seeks to generate positive impacts in under-serviced communities and achieve positive returns for investors (private and public).

Place is an increasingly important lens for regional policy innovation and investment. Place-based impact investment presents an opportunity to prevent and reverse cycles of relative decline in Australian communities, such as for the residents of Flinders Island. Flinders Island offers considerable potential to develop new tourism markets and areas of unique economic activity in national environments Australia-wide, and worldwide, where traditional investment markets are harder to access and are less predictable.

The proposed Business Case for Flinders Island involves two (2) forms of public and private investment.

These are:

1. **Growth Capital** - initially in the public sector infrastructure, leading to private sector investment in new and existing businesses; and
2. **Risk Capital** - to assist with potential high growth opportunities in new forms of resort and nature-based eco-tourism.

Prior to the development of the economic analyses underpinning the Flinders Island Safe Harbour Business Case, a strategic social assessment of the proposed investment option(s) was undertaken (refer Table 7). This is summarised as follows. The results of the assessment are shown in the right-hand column.

Table 8 Strategic Social Assessment

Social Wellbeing Indicator	Social Capital Element (Likely Impacts)	Rating (5 – Very High; 1 – Low)
(i) Sense of belonging	• Proposed public ownership by local government, with specific private sector investment in services	5
	• Full and friendly cooperation among visitors' experiences	5
	• Full social participation within the local community	5
	• High external visitor satisfaction levels with repeat visits	5
(ii) Community ownership	• Local community care and maintenance of assets and the natural environment	4
	• Local community promotion of use and management of public assets	3
(iii) Community focus	• Appropriate size of infrastructure investment – not overbuilt	4
	• Distribution of social benefits across the entire area of influence (island landscape)	4
(iv) Role in the ongoing life of the island community	• Strong interaction with private sector interests	5
	• Ability to openly welcome and assist visitors	5
	• Provide a broad range of incentives for new investor interest	4



10.5.1 Results

The results of this high-level social assessment of the proposed investment in Safe Harbour facilities indicated that the investment is highly likely to be well accepted, and will attract a high-level of community 'ownership' and support. Its sustainability is also likely to be assured.



11. Cost Benefit Analysis

11.1 Initial Development Costs (Capital Investments)

The following full development costs were estimated for the four (4) options:

	<u>\$ Million</u>
• Option 1: Lady Barron – Port	\$4.30
• Option 2: Lady Barron – Slipway Expanded Development with Marina Facilities	\$4.80
• Option 3: Port Davies – Redevelopment with Marina Facilities	\$6.80
• Option 4: Trousers Point – Expanded Development with Jetty Structure	\$2.00

NOTE: These costs do not include GST or other taxes. They have been estimated at the level of +/- 20% (conventional project appraisal level).

11.2 Operating and Maintenance and Site Management Costs

For all four (4) options, individual annual operating and management (O&M) and individual annual site management costs have been estimated and included in the economic analyses. These are assumed to be maximum annual disbursements and may not be fully required. However, the COAG Guidelines require that all O&M and periodic maintenance costs be included in the project analysis, to be reflected in the investment results.

11.3 Economic Results/Project Viability Estimation

Individual 20-year discounted cash flow (DCF) analyses were completed for each of the four (4) development options. Tables 2 – 5 provided details of the individual cost and benefit estimates used to establish the economic viability of each of the options. Each of the individual option tables contain supporting data, which explains the nature of the specific assumptions underpinning the individual cost and benefit columns and estimates.

For each of the four (4) investment options, the following range of benefits, in the 'with' investment cases, were identified and quantified. Not all were relevant for each individual option. These may be summarised as follows:

- Additional fuel sales benefits for visiting yachts (otherwise sourced elsewhere);
- Additional food/beverage/provisions profit margins per yacht visit (otherwise not spent);
- Additional profit margins from new 'wild water' island tours;
- Additional profit levels from additional around island tours (from visitors who were on island but not prepared to go to sea from existing launch facilities/sites);
- Additional net benefits from attracting new diving activities/support (from St. Helens): sales of permits and rental of diving equipment;
- Revenues/fees generated from the berthing of ocean yachts/commercial vessels at the new berth facilities (Option 1) or at marina facilities (Options 2 and 3);
- Net revenues generated from operations of wharf-based coffee/food canteen/chandlery operations;
- Additional full-time and part-time employment benefits;



- Net revenues associated with home-porting/regular calls of commercial fishing vessels (assumes 2 – 3 vessels); and
- Net revenues from the expanded operations of the existing slipway facilities, including savings to yacht/vessels owners from avoided relocation costs for slipping on the mainland or elsewhere in Tasmania;

Each of the above mentioned individual benefits are reported in the following economic analysis tabulated results (Tables 2 to 5).

Conservative assumptions have been adopted for all benefit category estimation. The projected benefits from the infrastructure development have been based on the most conservative growth assumptions in demand (based on Tasmanian GSP forecasts, reported in Table 1).

The economic analysis yielded the following estimates for each of the four (4) investment Options:

	EIRR (%)	NPV (\$ Million)	BCR (Ratio)
Option 1: Lady Barron –Port Development	11.91	2.28	1.51
Option 2: Lady Barron – Slipway Development	13.86	3.57	1.72
Option 3: Port Davies – Redevelopment with Marina	8.55	1.32	1.19
Option 4: Trousers Point – Redevelopment with Jetty	9.29	0.509	1.74

Based on the three (3) investment criteria, it would thus appear that each of the four (4) development options meets the minimum public sector investment criteria (> 6.5% discount rate, a positive NPV, a BCR > 1).

Each of the port development plans would appear have been appropriately scaled and designed in terms of overall demand and potential roles, as the total development costs can be justified by the public-sector criteria.

Of the four (4) options, the following economic order of importance/economic justification.

Priority can be established from the economic modelling:

Most Preferred Option:

- **Option 2: Lady Barron Development with Marina Infrastructure**

The remaining options can be prioritised as follows:

- Option 1: Lady Barron – Port
- Option 4: Trousers Point – Redevelopment with Jetty
- Option 3: Port Davies – Redevelopment with Marina

With Option 2 identified as the preferred option, a range of sensitivity tests were undertaken. This was to identify the relative robustness of the option's economic viability, under a range of adverse cost and revenue assumptions.

Table 6 reports the results of the various individual sensitivity tests, which were completed to identify the level of robustness of the preferred option, under a range of adverse assumptions relating to capital cost increases and individual benefit decreases. All tests indicated that the Project is likely to remain economically viable. An increase in capital development costs of 20% was likely to have the most significant impact on the economic results (the EIRR could reduce from 13.86% to 11.43% (a 17.5% reduction in the EIRR).



11.4 Intangible or Non-Quantifiable Benefits

As with all public sector investment projects, there are always additional impacts or local benefits, which can be identified. However, they cannot be reliably quantified, monetised and included in the economic analyses and reflected in the Business Case findings. For the proposed maritime development of **Lady Barron (Option 2, with Marina)**, a broad range of additional community benefits were identified from local discussions and interviews (personally and by telephone).

In many ways, the listing of the potential intangible benefits captures the innermost social gains for the Flinders Island community, now and for the next 20 years. Table 7 below, provides a listing of these intangible benefits.

Table 7 Lady Barron (Option 2) - Additional Intangible Benefits

- 1 Provision of a 'safe' harbour for ocean yachts and locally-based yachts and commercial vessels.
- 2 Provision of new additional commercial opportunities for Tasmania's fishing sector and for visiting fishing vessels.
- 3 Encouragement of new forms of water-based sports, including kayaking and canoeing.
- 4 Provision of incentives for investment in new commercial buildings/upgrading of existing buildings in the Lady Barron area.
- 5 Additional opportunities for day visitors and local residents to develop new forms of outdoor recreation, including bush and beach walking.
- 6 Provide additional commercial stimulus to the existing port and to generate additional cargo for the 'Matthew Flinders'.
- 7 Opportunity for young residents to learn to sail under safer conditions (previous mental perceptions of sailing being a 'hazardous and dangerous' sport can be corrected).
- 8 Significant improvements in the quality of life of Flinders Island residents with the provision of additional recreational and commercial boating activities.

11.5 Marketing Directions

Broad community support will be required of Flinders Islands' residents to achieve full realisation of the financial, economic and social benefits of the Lady Barron investment.

An outline Business Plan will need to be developed by Flinders Island Council management and community representatives to underpin the funding support from State/ Commonwealth governments. This Plan will show that the Island's community is fully committed to the sustainable development of the Lady Barron facilities, and that the investment, over time, will not be a 'stranded asset'.

Key issues to be covered in a Business Plan may include:

- Management Structure of the New Facilities;
- Flinders Island's Maritime Industry Profile;
- Market Analysis;
 - How existing businesses will expand;
 - Targeted new business activities;
 - Investor stimulus – from Tasmania and the mainland;



- Marketing Plan;
 - Flinders Island image profile;
 - Accessing Victoria's ocean yacht owners;
 - Accessing commercial fishing vessels for home porting;
 - Integrating the existing port operating with the new facilities;
- Financial Plan;
 - Development of Financial Assumptions;
 - Development of Financial Projections of revenues and costs;
 - Estimation of required maintenance and management costs;
 - Integration of the Lady Barron facilities into the Flinders Island Council asset base; and
 - Financial Milestones.

Of highest priority would appear to be:

1. Accessing Victoria's ocean yacht owners and supporting clubs; and
2. Accessing commercial fishing vessels for future home-porting/regular calls.



12. Business Summary and Recommendations

The proposed development of new marine infrastructure at **Lady Barron Slipway Site** is likely to be a highly attractive public sector investment for Flinders Island. It will ensure the increased appeal and sustainability of Flinders Island as an attractive ocean yachting destination. It will also be a major economic development incentive for the local economy, in particular, and for the Northern Tasmanian economy, in general.

The proposed Project will provide a unique opportunity for the Flinders Island economy to strengthen and diversify its economic base, in terms of existing economic activities and additional tourism and outdoor recreation opportunities.

The proposed Project is expected to be an economically viable public sector investment, with a broad range of forecast benefits. It meets all COAG public sector investment pre-conditions and requirements. There are no perceived technical, economic or environmental risks associated with the project.

The Project represents an investment of State and Commonwealth Government significance, given the uniqueness of its natural environs and ocean yachting appeal. It meets all necessary preconditions for the development of a 'safe' harbour for ocean yachts, for commercial fishing vessels and for local yachting activities.

12.1.1 Key socio-economic benefits

The main socio-economic benefits will include;

- additional day trip and visitor expenditures;
- induced local employment (during construction, maintenance and day-to-day operations), including increased job skills and work experiences;
- improved utilisation of existing public assets;
- induced commercial investment with land sales;
- increased land values and increased rate revenues;
- improved maritime safety; and
- increased yachting and marina activities/revenues.

12.1.2 Key financial benefits

The main financial benefits will include;

- Value of additional commercial investment in new properties and sea-based facilities;
- Opportunities for day charging for asset utilisation;
- Value of new construction and multiplier effects (local materials, local business services);
- Additional expenditures at new facilities/upgraded infrastructure and buildings (catering services, new café activity, day scenic cruises, fishing trips); and
- Additional GST revenue from private sector capital investment (to be returned to the State).



13. References

Backhouse, G, Jackson, J and O'Connor, J (2008) Background and implementation information for the Australian grayling *Prototroctes maraena* National Recovery Plan, *Department of Sustainability and Environment*, Melbourne.

Bryant and Jackson (1999)

Department of the Environment (2016). Subtropical and Temperate Coastal Saltmarsh in Community and Species Profile and Threats Database, Department of the Environment, Canberra. Available from: <http://www.environment.gov.au/sprat>. Accessed 2016-06-06T13:04:28AEST.

Department of Primary Industries, Parks, Water and Environment (2015) Guidelines for natural values surveys – estuarine and marine development proposals, *Policy and Conservation Advice Branch*, Australian Government.

Doran, N, and Horwitz, P (2010) *Engaeus martigener*. The IUCN Red List of Threatened Species 2010: e.T7737A12845688. Accessed 25/07/2016
<<http://dx.doi.org/10.2305/IUCN.UK.20103.RLTS.T7737A12845688.en>>

Flinders Council (2016) <http://www.flinders.tas.gov.au/trousers-point> Date of access: 12/12/2016

ListMap (2016) Land Information System Tasmania, Tasmanian Government. Accessed 15/07/2016 <<http://maps.thelist.tas.gov.au/listmap/app/list/map>>

Marine Solutions (February 2017) - Marine Ecological Investigations of Five Potential Sites for a Safe Harbour on Flinders Island

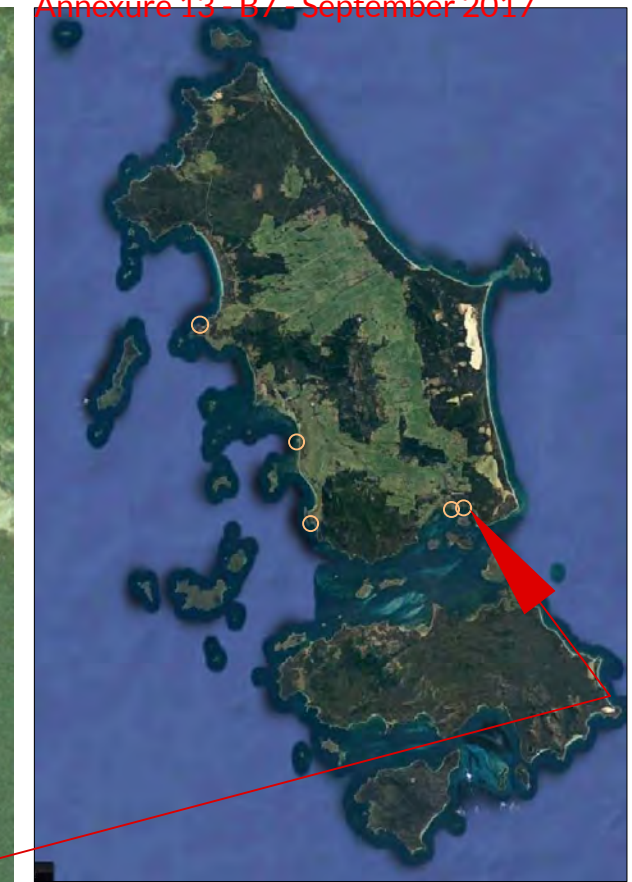
Navionics (2016) Navionics WebApp, Bathymetry Information. Accessed 29/07/2016

< <https://webapp.navionics.com/#boating@11&key=protFm%7Cvg%5B>>

Simpson *et al* (2005)



Appendix A – Preferred Development Drawings



FLINDERS ISLAND PLAN
NTS

FLINDERS ISLAND MARINE INFRASTRUCTURE PROPOSAL - LADY BARRON SLIP
BACKGROUND:

- EXISTING FACILITIES:
 - SINGLE LANE SLIPWAY OWNED BY TASPOTS;
 - FORMED ROCK RAMP FOR TRAILER BOATS;
 - FUEL STORAGE COMPOUND;
- SITE EXISTING OPPORTUNITIES & CONSTRAINTS:
 - EXPOSED TO WIND & WAVE (BUT COMMON MOORING & ANCHORAGE);
 - LIMITED VESSEL ACCESS (JETTY OTHER THAN WHARF);
 - GOOD VEHICLE ACCESS & PARKING AND SEPARATION FROM PORT ACCESS;
 - NO IMPACT ON EXISTING PORT OPERATIONS;

PROPOSAL:

- NEW ROCK BREAKWATER TO PROVIDE WAVE PROTECTION FOR MOORING AND BERTHING FOR VISITING & PERMANENT VESSELS, NEW BOAT RAMP & EXISTING SLIPWAY;
 - ROCK BREAKWATER FROM SHORELINE TO FORM PROTECTED HARBOUR;
 - NEW FLOATING PONTOON MARINA FOR UP TO 50 BERTHS (OPTIONS TO STAGE);
 - NEW BOAT RAMP AND JETTY WITH TURNING AREA & PARKING;

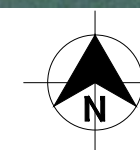
BENEFITS:

- SAFE HARBOUR FOR MARINA, LAUNCHING AND RETRIEVING TRAILER VESSELS & SLIPWAY;
- NATURAL DEPTHS FOR MARINA AND EXISTING PROTECTION;
- ITINERANT ACCESS FOR LARGER PERMANENT AND VISITING VESSELS;
- IMPROVED MARITIME SAFETY FOR VISITING VESSELS;

CONSTRUCTION COST ESTIMATE:

- \$4.8M EX GST

LADY BARRON - EAST BOAT RAMP PLAN
1:2000



PRELIMINARY
NOT FOR CONSTRUCTION

No.	Date	Revision Details	Des.	Che.	App.
B	24/01/17	ISSUED FOR REVIEW	JB	JB	JB
A	19/10/16	PRELIMINARY FOR REVIEW	JB	JB	JB



ABN 75 146 719 959
P.O. BOX 354,
SOUTH HOBART, TAS 7004
P: (03) 6223 8007
F: (03) 6223 1143
E: admin@burburyconsulting.com.au

COPYRIGHT ©
"This document is and shall remain the property of Burbury Consulting Pty Ltd. The document may only be used for the purpose for which it was commissioned and in accordance with the terms of engagement for the commission. Unauthorised use of this document in any way is prohibited"

Client:
FLINDERS COUNCIL

Project:
**FLINDERS ISLAND
SAFE HARBOUR OPTIONS**

Drawing Title:
**LADY BARRON
EAST BOAT RAMP OPTION**

Drawn	RP	Date	OCTOBER 2016
Designed	JB		
Checked	JB	Scale	AS SHOWN
Approved	JB		
Drawing No.	1386 - 05		Rev.
			B



Appendix B – Economic Analysis Tables

Table 1: KEY ASSUMPTIONS UNDERPINNING THE ECONOMIC AND FINANCIAL ANALYSES	
1.	Economic
1.1	Macro-Economic Growth Rates: Next 5 years <ul style="list-style-type: none"> • Australian economy (GDP): 3.2% • Tasmanian economy (GSP): 2.5% • Tasmanian population growth: 0.9% to 1.2%
1.2	Commonwealth/Tasmanian Public Sector Discount Rate: 6.5%
1.3	All cost and benefit estimates are in 2016/2017 constant prices (expressed as market prices). No GST or other public sector taxes are included in the fixed costs.
1.4	Residual value of the proposed small port facilities is estimated to be 40% after 20 years (based on experience of Australian marina operations/owners - depreciation is estimated on a sliding scale of 3% per annum).
2.	Flinders Island's Possible Development Scenarios (2017 - 2036)
2.1	Low Growth: <ul style="list-style-type: none"> • further gradual population decline <ul style="list-style-type: none"> - youths leaving for employment/study - elderly leaving for health care/family care • limited new major infrastructure and tourism investment <ul style="list-style-type: none"> - new MAST mooring buoys - limited road upgrading - no Killiecrankie resort development - delayed new port investment - small boutique food outlets only • tourism demand grows slowly <ul style="list-style-type: none"> - limited growth in visiting ocean yacht
2.2	Medium Growth: <ul style="list-style-type: none"> • population levels stabilise: out-migration is arrested • new port infrastructure development program (breakwater, ocean yacht berths, marina pens, cargo facilities, tender facilities for cruise ships to anchor) • new town developments - Port Davies and Whitemark • small cruise ship visits • expansion of regular airline services • introduction of charter flights from Melbourne and Hobart (Chinese tourists) • job creation from tourism (taxis, tours, catering, handicrafts, street markets, entertainment) • new residential and commercial building construction • further stimulus to agriculture for catering/sale of local produce <ul style="list-style-type: none"> - expanded slaughterhouse operations and exports of beef/goat/lamb meat; exports of vegetables - introduction of new tree crops (nuts, coffee) • expanded commercial fishing operations with new home-ported vessels at Lady Baron (if facilities are developed) • reduced levels of inventory costs for grocery/hardware items, leading to reduced costs of living
2.3	High Growth <ul style="list-style-type: none"> • all of conditions of 'Medium Growth', plus: <ul style="list-style-type: none"> • new commercial investment in a hotel, villas and beach-side restaurants • growth in retirement population • Mainland investment in tourism, agri-tourism, manufacturing/packaging • introduction of additional charter flights • additional trade stores/retail outlets (greater produce choice) • capital investment in land and cattle production by Chinese
For the four (4) economic appraisals for the fixed (capital) investment, the 'Medium Growth' scenario has been adopted as the 'Most Likely' set of development conditions. Forecast demand estimates for both investment appraisals reflect the 'Medium Growth'/'Most Likely' set of future economic development preconditions.	

Table 2: Economic Appraisal of Flinders Island - Marine Infrastructure Development

(\$ '000s): 2016/17 Constant Prices

Option 1: Lady Barron: Lower-Cost Development - No Marina Facilities

Year Ended June	Economic Costs (Project-Specific)				Net Economic Benefits (Additional Impacts from the Investment)														Net Benefit Stream
	1/ Initial Capital Development	2/ Operating and Maintenance	3/ Site Management (Periodic)	4/ Total Costs	4/ Ocean Yacht Visits		7/ Additional Visitor Adventure Tours (Wild Water)	8/ Additional Visitor Tours Around Island	9/ Additional Diving Activities for Wrecks Permits Rental ^{10/}		11/ Berth Rental Fees/ Expenditures		12/ Additional Facilities- Related Employment	Commercial Fishing (Home Porting/ Regular Calls ^{13/}	14/ Additional Slipway Benefits		15/ Total Benefits		
					5/ Fuel	6/ Food/ Beverage/ Provisions	9/ Permits	10/ Rental	Berths	Expenditures	Employment	Porting/ Regular Calls ^{13/}	Fees/ Labour	Avoided Relocation Cost					
1	2018	4,300.00			4,300.00													0.00	-4,300.00
2	2019		30.00	15.00	45.00	22.40	38.40	17.60	12.00	7.50	9.00	15.00	5.55	61.20	156.00	70.50	20.00	435.15	390.15
3	2020		30.00	15.00	45.00	22.85	39.17	17.95	12.24	10.00	10.00	15.30	6.66	61.20	177.60	71.91	20.40	465.28	420.28
4	2021		30.00	15.00	45.00	23.30	39.95	18.31	12.48	12.50	12.50	15.61	11.10	61.20	264.00	73.35	20.81	565.11	520.11
5	2022		30.00	15.00	45.00	23.77	40.75	18.68	12.73	12.75	12.75	15.92	11.32	61.20	271.92	74.82	21.22	577.83	532.83
6	2023		30.00	15.00	45.00	24.25	41.57	19.05	12.99	13.01	13.01	16.24	11.55	61.20	280.08	76.31	21.65	590.88	545.88
7	2024		30.00	15.00	45.00	24.73	42.40	19.43	13.25	13.27	13.27	16.56	11.78	61.20	288.48	77.84	22.08	604.28	559.28
8	2025		30.00	15.00	45.00	25.23	43.24	19.82	13.51	13.53	13.53	16.89	12.01	61.20	297.13	79.39	22.52	618.03	573.03
9	2026		30.00	15.00	45.00	25.73	44.11	20.22	13.78	13.80	13.80	17.23	12.26	61.20	306.05	80.98	22.97	632.13	587.13
10	2027		30.00	15.00	45.00	26.25	44.99	20.62	14.06	14.08	14.08	17.57	12.50	61.20	315.23	82.60	23.43	646.61	601.61
11	2028		30.00	15.00	45.00	26.77	45.89	21.03	14.34	14.36	14.36	17.93	12.75	61.20	324.69	84.25	23.90	661.47	616.47
12	2029		30.00	15.00	45.00	27.31	46.81	21.45	14.63	14.65	14.65	18.28	13.01	61.20	334.43	85.94	24.38	676.73	631.73
13	2030		30.00	15.00	45.00	27.85	47.75	21.88	14.92	14.94	14.94	18.65	13.27	61.20	344.46	87.66	24.87	692.38	647.38
14	2031		30.00	15.00	45.00	28.41	48.70	22.32	15.22	15.24	15.24	19.02	13.53	61.20	354.79	89.41	25.36	708.45	663.45
15	2032		30.00	15.00	45.00	28.98	49.67	22.77	15.52	15.54	15.54	19.40	13.80	61.20	365.44	91.20	25.87	724.94	679.94
16	2033		30.00	15.00	45.00	29.56	50.67	23.22	15.83	15.85	15.85	19.79	14.08	61.20	376.40	93.02	26.39	741.87	696.87
17	2034		30.00	15.00	45.00	30.15	51.68	23.69	16.15	16.17	16.17	20.19	14.36	61.20	387.69	94.88	26.92	759.25	714.25
18	2035		30.00	15.00	45.00	30.75	52.71	24.16	16.47	16.49	16.49	20.59	14.65	61.20	399.32	96.78	27.46	777.09	732.09
19	2036		30.00	15.00	45.00	31.37	53.77	24.64	16.80	16.82	16.82	21.00	14.94	61.20	411.30	98.72	28.00	795.40	750.40
20	2037		30.00	15.00	45.00	31.99	54.84	25.14	17.14	17.16	17.16	21.42	15.24	61.20	423.64	100.69	28.56	2,534.19	2,489.19
Economic Internal Rate of Return =																		11.91%	
Residual Value:		\$1,720.00 ^{16/}																Net Present Value (NPV) of Benefits @ 6.5% = \$6,770.40 ^{15/}	
																		Net Present Value (NPV) of Costs @ 6.5% = \$4,491.14	
Footnotes: See Table 2a.																		NPV @ 6.5% = \$2,279.26	
Benefit-Cost Ratio (BCR) =																		1.51	

Table 2a: Footnotes to Explain the Economic Analysis Assumptions of Table 2 and Table 3										
1/	Estimated total development cost of Option 1 \$4.3 million, which covers design supervision and construction. Completed within 12 months. No GST included. Option 2 covers increased marina berths and a total development cost of \$4.8 million.									
2/	Estimated allowance for monthly/annual maintenance (may not be required in full).									
3/	Covers routine safety inspections and security checks (may not be required in full).									
4/	Assumes an annual minimum level of ocean yacht visits of 200 yachts, from Melbourne and Sothern NSW, via Deal Island. Annual demand, with new infrastructure is forecast to grow at a minimum of 2 per cent per year.									
5/	Based on estimates of one-way fuel consumption for a 30 ft. sail yacht from Melbourne (assumes 350 kms.) at 8 litres/hour, at 7 knots speed. Assumes a 40¢ margin for diesel sales to be retained on island.									
6/	Assumes expenditures for crew of 2, on tavern accommodation (2 nights), meals, drinks, and provisions for onward sailing. Assumes 40 per cent margin on sales revenues.									
7/	Assumes that with appropriate berth infrastructure, new forms of adventure tours (wild water) can be attracted. Assumes 40% of additional net revenues from new trip experiences.									
8/	Based on assumptions of increased tour activity around the island, with appropriate passenger wharf/berth facilities for tourists. Assumes 40% of additional net revenues from tour sales.									
9/	Based on data/market intelligence from St. Helens. Assumes with new infrastructure, dive activity can be developed. Assumes \$25 per dive permit, with a total annual dive demand/visitation of 500 divers (10% of the estimated annual St. Helens demand with Ex-HMAS Tobruk in place).									

Continuation of Table 2a.

10/	Covers the net revenue from the lease of dive equipment held at the new wharf facilities.								
11/	Assumes a daily fee of \$50 for berthing of yachts/boats alongside the new facilities (an average of 2.5 days) per visit. (No marina facilities in this lower/minimum cost development). Assumes additional net revenues from the operations of an on-wharf kiosk/canteen (coffee, meals, small chandlery items). Also assumes permanent moorings for three vessels per year at \$900.00 per month each, increasing to four moorings after Y								
12/	Assumes additional employment of one (1) full-time employee and one (1) part-time employee. Salary benefits are net of PAYE/Superannuation.								
13/	A major commercial benefit of the new infrastructure is expected from the home-porting/regular calls of two (2) fishing vessels. Based on interviews and survey data from the commercial fishing sector of St. Helens. Assumes that two (2) fishing vessels would relocate from Victoria (Lakes Entrance) or NSW (Eden), with fish catch exported via Matthew Flinders to Bridport. Assumes a minimum benefit of \$2,700 per vessel call (over 6 hours).								
14/	Additional net revenues are assumed from the expansion of slipway activities, with new infrastructure to attract/service yachts and vessels. A major economic benefit will be the avoided costs of transferring the yachts/vessels to Tasmania (Devonport, Triabunna or Hobart), or to Victoria (Paynesville).								
15/	Conventional project investment criteria, as required by COAG (Council of Australian Government) Investment/Business Case Guidelines for public sector projects. Discount rate of 6.5% is assumed. (Project viability is assumed to be positive, with EIRR > 6.5%, NPV is positive, BCR is > 1).								
16/	Assumes a residual or salvage value of 40% for all infrastructure components (a conservative assumption) after 20 years (included as a benefit in the 20th year).								

Table 3: Economic Appraisal of Flinders Island - Marine Infrastructure Development
 (\$ '000s): 2016/17 Constant Prices

Option 2: Lady Barron: Expanded Development - With Marina Facilities

		Economic Costs (Project-Specific)				Net Economic Benefits (Additional Impacts from the Investment)																	
		1/ Initial Capital Development	Operating and Maintenance	Site Management (Periodic)	Total Costs	Ocean Yacht Visits		Additional Visitor Adventure Tours (Wild Water)	Additional Visitor Tours Around Island	Additional Diving Activities for Wrecks		Marina Rental Fees/ Expenditures			Additional Facilities- Related Employment	Commercial Fishing (Home Porting/ Regular Calls	Additional Slipway Benefits		Total Benefits	Net Benefit Stream			
Year Ended June						Fuel	Food/ Beverage/ Provisions		Permits	Rental Equipment	Berth Rentals	Permanent Moorings	Marina Expenditures		Porting/ Regular Calls	Fees/ Labour	Avoided Relocation Cost						
1	2018	4,800.00			4,800.00														0.00	-4,800.00			
2	2019		30.00	15.00	45.00	22.40	38.40	17.60	12.00	7.50	9.00	69.12	32.40	5.55	61.20	156.00	70.50	20.00	521.67	476.67			
3	2020		30.00	15.00	45.00	22.85	39.17	17.95	12.24	10.00	10.00	92.16	32.40	6.66	61.20	177.60	71.91	20.40	574.54	529.54			
4	2021		30.00	15.00	45.00	23.30	39.95	18.31	12.48	12.50	12.50	115.20	32.40	11.10	61.20	264.00	73.35	20.81	697.11	652.11			
5	2022		30.00	15.00	45.00	23.77	40.75	18.68	12.73	12.75	12.75	138.24	32.40	11.32	61.20	271.92	74.82	21.22	732.55	687.55			
6	2023		30.00	15.00	45.00	24.25	41.57	19.05	12.99	13.01	13.01	149.76	32.40	11.55	61.20	280.08	76.31	21.65	756.81	711.81			
7	2024		30.00	15.00	45.00	24.73	42.40	19.43	13.25	13.27	13.27	152.75	32.40	11.78	61.20	288.48	77.84	22.08	783.67	738.67			
8	2025		30.00	15.00	45.00	25.23	43.24	19.82	13.51	13.53	13.53	155.81	32.40	12.01	61.20	297.13	79.39	22.52	800.14	755.14			
9	2026		30.00	15.00	45.00	25.73	44.11	20.22	13.78	13.80	13.80	158.93	32.40	12.26	61.20	306.05	80.98	22.97	817.03	772.03			
10	2027		30.00	15.00	45.00	26.25	44.99	20.62	14.06	14.08	14.08	162.11	32.40	12.50	61.20	315.23	82.60	23.43	834.35	789.35			
11	2028		30.00	15.00	45.00	26.77	45.89	21.03	14.34	14.36	14.36	165.34	32.40	12.75	61.20	324.69	84.25	23.90	852.09	807.09			
12	2029		30.00	15.00	45.00	27.31	46.81	21.45	14.63	14.65	14.65	168.66	32.40	13.01	61.20	334.43	85.94	24.38	870.30	825.30			
13	2030		30.00	15.00	45.00	27.85	47.75	21.88	14.92	14.94	14.94	172.03	32.40	13.27	61.20	344.46	87.66	24.87	888.96	843.96			
14	2031		30.00	15.00	45.00	28.41	48.70	22.32	15.22	15.24	15.24	175.47	32.40	13.53	61.20	354.79	89.41	25.36	908.09	863.09			
15	2032		30.00	15.00	45.00	28.98	49.67	22.77	15.52	15.54	15.54	178.97	32.40	13.80	61.20	365.44	91.20	25.87	927.71	882.71			
16	2033		30.00	15.00	45.00	29.56	50.67	23.22	15.83	15.85	15.85	182.56	32.40	14.08	61.20	376.40	93.02	26.39	947.84	902.84			
17	2034		30.00	15.00	45.00	30.15	51.68	23.69	16.15	16.17	16.17	186.20	32.40	14.36	61.20	387.69	94.88	26.92	968.46	923.46			
18	2035		30.00	15.00	45.00	30.75	52.71	24.16	16.47	16.49	16.49	189.94	32.40	14.65	61.20	399.32	96.78	27.46	989.63	944.63			
19	2036		30.00	15.00	45.00	31.37	53.77	24.64	16.80	16.82	16.82	193.73	32.40	14.94	61.20	411.30	98.72	28.00	1,011.32	966.32			
20	2037		30.00	15.00	45.00	31.99	54.84	25.14	17.14	17.16	17.16	197.60	32.40	15.24	61.20	423.64	100.69	28.56	2,953.57	2,908.57			
Economic Internal Rate of Return =																				13.86%			
Residual Value:		\$1,920.00																		Net Present Value (NPV) of Benefits @ 6.5% =		\$8,530.86	
Footnotes:																				Net Present Value (NPV) of Costs @ 6.5% =		\$4,960.62	
1/		Estimated total development cost of \$4.8 million, with a marina designed for 30-50 berths. To be completed within 12 months. No GST.																		NPV @ 6.5% =		\$3,570.24	
2/		Assumes an average monthly berth rental fee of \$300, with average annual berth occupancy increasing from 30% in Year 1 to 65% in Year 5.																		Benefit-Cost Ratio (BCR) =		1.72	
3/		See Table2a for explanations of all other cost and benefit items, and for explanation of the investment criteria and the residual value.																					

Table 3a: Economic Cost to the Flinders Island/Tasmanian Economy of NOT Proceeding with the Lady Barron Marina Development (The 'Do Nothing' Option)			
			Economic Cost/ Penalty (\$ Million)
	Year		
	2019		8.53
	2020		9.71
	2021		9.89
	2022		10.03

Table 4: Economic Appraisal of Flinders Island - Marine Infrastructure Development

(\$ '000s): 2016/17 Constant Prices

Option 3: Port Davies: Redevelopment - With Marina Facilities

		Economic Costs (Project-Specific)				Net Economic Benefits (Additional Impacts from the Investment)															
		1/ Initial Capital Development	Operating and Maintenance	Site Management (Periodic)	Total Costs	2/ Ocean Yacht Visits		3/ Recre- ational Sailing	Additional Visitor Tours Around Island	4/ Food/ Beverage/ Provisions	5/ Additional Beach Tourism (Banquets /Walks)	6/ Additional Diving Activities for Wrecks		7/ Marina Rental Fees/ Expenditures		8/ Additional Facilities- Related Employment	Commercial Fishing (Home Porting/ Regular Calls	Total Benefits	Net Benefit Stream		
Year Ended June						Fuel	3/ Food/ Beverage/ Provisions					Permits	Rental Equipment	Berth Rentals	Marina Expenditures						
1	2018	6,800.00			6,800.00													0.00	-6,800.00		
2	2019		30.00	15.00	45.00	28.00	24.00	9.60	12.00	27.12	7.50	9.00	43.20	9.60	79.20	189.75	438.97	393.97			
3	2020		30.00	15.00	45.00	28.56	24.48	14.40	12.24	33.64	10.00	10.00	57.60	12.80	79.20	218.10	501.02	456.02			
4	2021		30.00	15.00	45.00	29.13	24.97	19.20	12.48	49.20	12.50	12.50	72.00	16.00	79.20	331.50	658.69	613.69			
5	2022		30.00	15.00	45.00	29.71	25.47	19.58	12.73	50.18	12.75	12.75	86.40	16.32	79.20	341.45	686.55	641.55			
6	2023		30.00	15.00	45.00	30.31	25.98	19.98	12.99	51.19	13.01	13.01	93.60	16.65	79.20	351.69	707.58	662.58			
7	2024		30.00	15.00	45.00	30.91	26.50	20.38	13.25	52.21	13.27	13.27	95.47	16.98	79.20	362.24	723.67	678.67			
8	2025		30.00	15.00	45.00	31.53	27.03	20.78	13.51	53.26	13.53	13.53	97.38	17.32	79.20	373.11	740.18	695.18			
9	2026		30.00	15.00	45.00	32.16	27.57	21.20	13.78	54.32	13.80	13.80	99.33	17.67	79.20	384.30	757.13	712.13			
10	2027		30.00	15.00	45.00	32.81	28.12	21.62	14.06	55.41	14.08	14.08	101.32	18.02	79.20	395.83	774.53	729.53			
11	2028		30.00	15.00	45.00	33.46	28.68	22.05	14.34	56.52	14.36	14.36	103.34	18.38	79.20	407.70	792.40	747.40			
12	2029		30.00	15.00	45.00	34.13	29.26	22.50	14.63	57.65	14.65	14.65	105.41	18.75	79.20	419.93	810.74	765.74			
13	2030		30.00	15.00	45.00	34.81	29.84	22.95	14.92	58.80	14.94	14.94	107.52	19.12	79.20	432.53	829.57	784.57			
14	2031		30.00	15.00	45.00	35.51	30.44	23.40	15.22	59.97	15.24	15.24	109.67	19.50	79.20	445.51	848.90	803.90			
15	2032		30.00	15.00	45.00	36.22	31.05	23.87	15.52	61.17	15.54	15.54	111.86	19.89	79.20	458.87	868.75	823.75			
16	2033		30.00	15.00	45.00	36.95	31.67	24.35	15.83	62.40	15.85	15.85	114.10	20.29	79.20	472.64	889.13	844.13			
17	2034		30.00	15.00	45.00	37.68	32.30	24.84	16.15	63.65	16.17	16.17	116.38	20.70	79.20	486.82	910.05	865.05			
18	2035		30.00	15.00	45.00	38.44	32.95	25.33	16.47	64.92	16.49	16.49	118.71	21.11	79.20	501.42	931.54	886.54			
19	2036		30.00	15.00	45.00	39.21	33.61	25.84	16.80	66.22	16.82	16.82	121.08	21.53	79.20	516.47	953.60	908.60			
20	2037		30.00	15.00	45.00	39.99	34.28	26.36	17.14	67.54	17.16	17.16	123.50	21.96	79.20	531.96	3,696.25	3,651.25			
Economic Internal Rate of Return = 8.55%																					
Residual Value:		\$2,720.00		Net Present Value (NPV) of Benefits @ 6.5% = \$8,160.92																	
		Net Present Value (NPV) of Costs @ 6.5% = \$6,838.56																			
Footnotes: See Table 4a.		NPV @ 6.5% = \$1,322.36																			
Benefit-Cost Ratio (BCR) = 1.19																					

Table 4a: Footnotes to Explain the Economic Analysis Assumptions of Table 4												
1/	Estimated total redevelopment cost of \$6.8 million to be completed in 12 months. No GST included.											
2/	Assumes a total average number of ocean yacht visits of 250 (more than to Lady Barron, due to directness via Deal Island and Victoria).											
3/	Assumes a total diesel cost of \$112 per trip from Melbourne (350 kms.).											
4/	Assumes total average expenditure on food/drinks and provisions (no accommodation costs) of \$240 per person (profit margin of 40%).											
5/	With new facilities, additional recreational yachting can be introduced. Benefits are estimated on the basis of the average willingness-to-pay/travel costs to/from Port Davies (assumes average distance of 30 kms. @ 0.80¢/km). Assumes 20 recreational sailing boats for 40 weekends/year.											
6/	With new infrastructure, local personnel plan to introduce boutique 'on beach' catering/banquets and conduct beach walks with catering (as marketed on the beaches at the Bay of Fires). Assumes a 42-week/weekend period at average sales of \$300 per year.											
7/	Based on the provision of a 30-40 berth marina, with berth occupation reaching an average of 70% after 5 years. Assumes \$300 per month berth rental fees.											
8/	Assumes new employment opportunities for one (1) full-time employee and two (2) part-time employees (benefits are net of taxes/superannuation).											

Table 5: Economic Appraisal of Flinders Island – Marine Infrastructure Development

(\$ '000s): 2016/17 Constant Prices

Option 4: Trousers Point: Expanded Development - With Jetty Structure

Year Ended June	Economic Costs (Project-Specific)				Net Economic Benefits (Additional Impacts from the Investment)						
	Initial Capital Development ^{1/}	Operating and Maintenance ^{2/}	Site Management (Periodic) ^{3/}	Total Costs	Ocean Yacht Visits ^{4/}		Cruise Ship Visits (Tours/ Shopping/ Wine/Meals) ^{7/}	Additional Facilities- Related Employment	Total Benefits	Net Benefit Stream	
					Fuel ^{5/}	Food/ Beverage/ Provisions ^{6/}					
1	2018	2,000.00			2,000.00					0.00	-2,000.00
2	2019		20.00	6.00	26.00	5.60	4.80	195.00	2.40	207.80	181.80
3	2020		20.00	6.00	26.00	5.71	4.90	198.90	2.40	211.91	185.91
4	2021		20.00	6.00	26.00	5.83	4.99	202.88	2.40	216.10	190.10
5	2022		20.00	6.00	26.00	5.94	5.09	206.94	2.40	220.37	194.37
6	2023		20.00	6.00	26.00	6.06	5.20	211.07	2.40	224.73	198.73
7	2024		20.00	6.00	26.00	6.18	5.30	215.30	2.40	229.18	203.18
8	2025		20.00	6.00	26.00	6.31	5.41	219.60	2.40	233.71	207.71
9	2026		20.00	6.00	26.00	6.43	5.51	223.99	2.40	238.34	212.34
10	2027		20.00	6.00	26.00	6.56	5.62	228.47	2.40	243.06	217.06
11	2028		20.00	6.00	26.00	6.69	5.74	233.04	2.40	247.87	221.87
12	2029		20.00	6.00	26.00	6.83	5.85	237.70	2.40	252.78	226.78
13	2030		20.00	6.00	26.00	6.96	5.97	242.46	2.40	257.79	231.79
14	2031		20.00	6.00	26.00	7.10	6.09	247.31	2.40	262.90	236.90
15	2032		20.00	6.00	26.00	7.24	6.21	252.25	2.40	268.11	242.11
16	2033		20.00	6.00	26.00	7.39	6.33	257.30	2.40	273.42	247.42
17	2034		20.00	6.00	26.00	7.54	6.46	262.44	2.40	278.84	252.84
18	2035		20.00	6.00	26.00	7.69	6.59	267.69	2.40	284.37	258.37
19	2036		20.00	6.00	26.00	7.84	6.72	273.05	2.40	290.01	264.01
20	2037		20.00	6.00	26.00	8.00	6.86	278.51	2.40	1,095.76	1,069.76

Economic Internal Rate of Return = 9.29%

Residual Value: \$800.00

Net Present Value (NPV) of Benefits @ 6.5% = \$2,649.97

Net Present Value (NPV) of Costs @ 6.5% = \$2,140.00

Footnotes: See Table 5a.

NPV @ 6.5% = \$509.97

Benefit-Cost Ratio (BCR) = 1.24

Table 5a: Footnotes to Explain the Economic Analysis Assumptions of Table 5											
1/	Estimated total development cost of \$2 million, to be completed within 12 months.										
2/	Estimated allowance for monthly/annual maintenance (may not be required in full).										
3/	Covers routine safety inspections and security checks (many not be required in full).										
4/	Limited number of ocean yacht visits of 50 per year, staying for 2-3 days.										
5/	Assumes fuel is purchased from Lady Barron (no fuel point to be included in the new facilities). Based on Lady Barron/Port Davies average demand for fuel of \$112 per yacht.										
6/	Assumes average minimum yacht visit expenditure of \$240 per visit (with a net profit of 40%).										
7/	Major development benefit is expected to be the expenditures from cruise ship passenger/crew arrivals. Based on interviews with Carnival Cruises, Sydney. Expression of interest was for mooring facilities to allow a cruise ship tender to land tourists for island walks, trips by taxis/buses around the island, lunch meals on the beach (to be provided by island caterers). Would cover the period October-November-December. Four (4) ship arrivals (maximum), with an average of between 300-400 passengers disembarking. Assumes an average on-island expenditure of \$300 (beach catering, tours, wine purchases).										

**Table 6: Sensitivity Testing of Recommended Option:
Option 2: Lady Barron - With Marina Facilities**

	EIRR (%)
Base Case (Preferred Investment Option)	13.86%
<u>What if:</u>	
(i) Initial Capital Development Costs are increased by 20%	11.43%
(ii) Ocean Yacht Visits are reduced by 30%	13.45%
(iii) Diving Activities do not proceed	13.34%
(iv) Commercial Fishing Benefits are reduced by 30%	12.16%
(v) Slipway Benefits are reduced by 50%	12.83%



Appendix C – Concept Site Option Drawings

FLINDERS ISLAND MARINE INFRASTRUCTURE PROPOSAL - TROUSERS POINT

BACKGROUND:

- EXISTING FACILITIES:
 - PUBLIC SWING MOORING - MAST;
- SITE EXISTING LIMITATIONS:
 - EXPOSED TO SOUTHERLY TO WESTERLY WEATHER WAVES;
 - LIMITED WATER DEPTH ACCESS;
 - LIMITED VEHICLE & SITE ACCESS;
 - LIMITED LANDSIDE INFRASTRUCTURE TO SUPPORT VISITING VESSELS;

PROPOSAL:

- CONSTRUCT A WAVESCREEN BREAKWATER TO PROVIDE WAVE PROTECTION FOR VISITING VESSELS & CRUISE SHIP TENDERS;
 - PILE & PANEL WAVE SCREEN FOR PROTECTION IN BERTHING
 - JETTY ACCESS FOR VISITORS ONLY

BENEFITS:

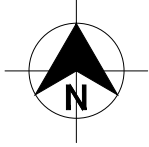
- OPPORTUNITY FOR ADDED INCOME GENERATION AND BENEFITS FROM DEDICATED CRUISE SHIP TENDER BERTH (SITE ATTRACTION);
- ACCESS FOR VISITING VESSELS;

CONSTRUCTION COST ESTIMATE:

- \$2.0M EX GST



FLINDERS ISLAND PLAN
NTS



TROUSERS POINT PLAN
1:2000

PRELIMINARY
NOT FOR CONSTRUCTION

No.	Date	Revision Details	Des.	Che.	App.
A	19/10/16	PRELIMINARY FOR REVIEW	JB	JB	JB



ABN 75 146 719 959
P.O. BOX 354,
SOUTH HOBART, TAS 7004
P: (03) 6223 8007
F: (03) 6223 1143
E: admin@burburyconsulting.com.au

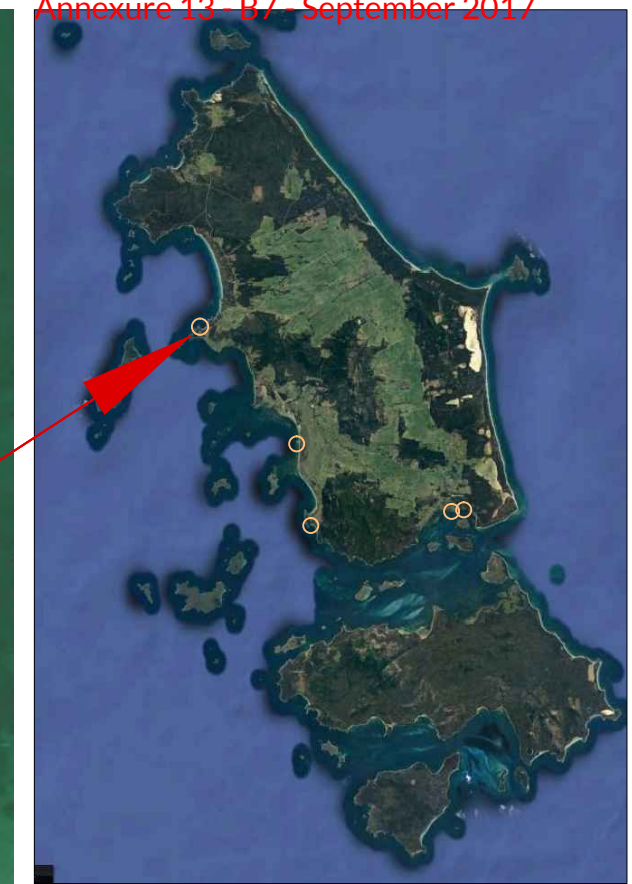
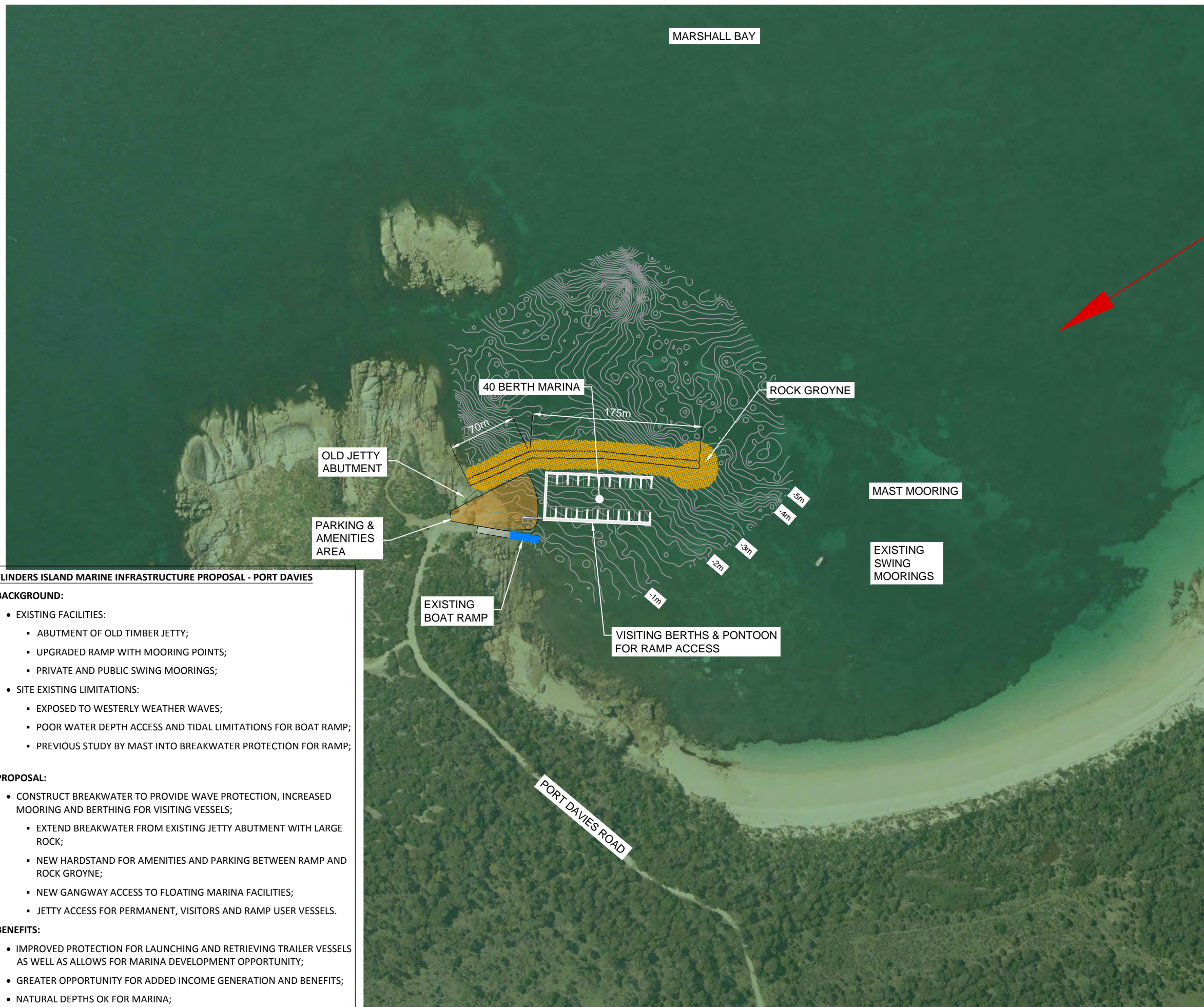
COPYRIGHT ©
"This document is and shall remain the property of Burbury Consulting Pty Ltd. The document may only be used for the purpose for which it was commissioned and in accordance with the terms of engagement for the commission. Unauthorised use of this document in any way is prohibited"

Client:
FLINDERS COUNCIL

Project:
**FLINDERS ISLAND
SAFE HARBOUR OPTIONS**

Drawing Title:
TROUSERS POINT OPTION

Drawn	RP	Date	OCTOBER 2016	
Designed	JB	Scale	AS SHOWN	
Checked	JB	Scale	AS SHOWN	
Approved	JB	Scale	AS SHOWN	
Drawing No.	1386 - 02			Rev.
				A



FLINDERS ISLAND PLAN
NTS

FLINDERS ISLAND MARINE INFRASTRUCTURE PROPOSAL - PORT DAVIES

BACKGROUND:

- EXISTING FACILITIES:
 - ABUTMENT OF OLD TIMBER JETTY;
 - UPGRADED RAMP WITH MOORING POINTS;
 - PRIVATE AND PUBLIC SWING MOORINGS;
- SITE EXISTING LIMITATIONS:
 - EXPOSED TO WESTERLY WEATHER WAVES;
 - POOR WATER DEPTH ACCESS AND TIDAL LIMITATIONS FOR BOAT RAMP;
 - PREVIOUS STUDY BY MAST INTO BREAKWATER PROTECTION FOR RAMP;

PROPOSAL:

- CONSTRUCT BREAKWATER TO PROVIDE WAVE PROTECTION, INCREASED MOORING AND BERTHING FOR VISITING VESSELS;
 - EXTEND BREAKWATER FROM EXISTING JETTY ABUTMENT WITH LARGE ROCK;
 - NEW HARDSTAND FOR AMENITIES AND PARKING BETWEEN RAMP AND ROCK GROUYNE;
 - NEW GANGWAY ACCESS TO FLOATING MARINA FACILITIES;
 - JETTY ACCESS FOR PERMANENT, VISITORS AND RAMP USER VESSELS.

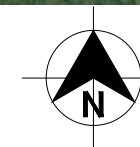
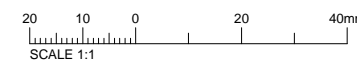
BENEFITS:

- IMPROVED PROTECTION FOR LAUNCHING AND RETRIEVING TRAILER VESSELS AS WELL AS ALLOWS FOR MARINA DEVELOPMENT OPPORTUNITY;
- GREATER OPPORTUNITY FOR ADDED INCOME GENERATION AND BENEFITS;
- NATURAL DEPTHS OK FOR MARINA;
- ITINERANT ACCESS FOR LARGER VESSELS;
- IMPROVED MARITIME SAFETY FOR VISITING VESSELS;

CONSTRUCTION COST ESTIMATE:

- \$6.8M EX GST

PORT DAVIES PLAN
1:2500



PRELIMINARY
NOT FOR CONSTRUCTION

B	24/01/17	ISSUED FOR REVIEW		B	B
A	19/10/16	PRELIMINARY FOR REVIEW		JB	JB
No.	Date	Revision Details	Des.	Che.	App.

ABN 75 146 719 959
P.O. BOX 354,
SOUTH HOBART, TAS 7004
P: (03) 6223 8007
F: (03) 6223 1143
E: admin@burburyconsulting.com.au

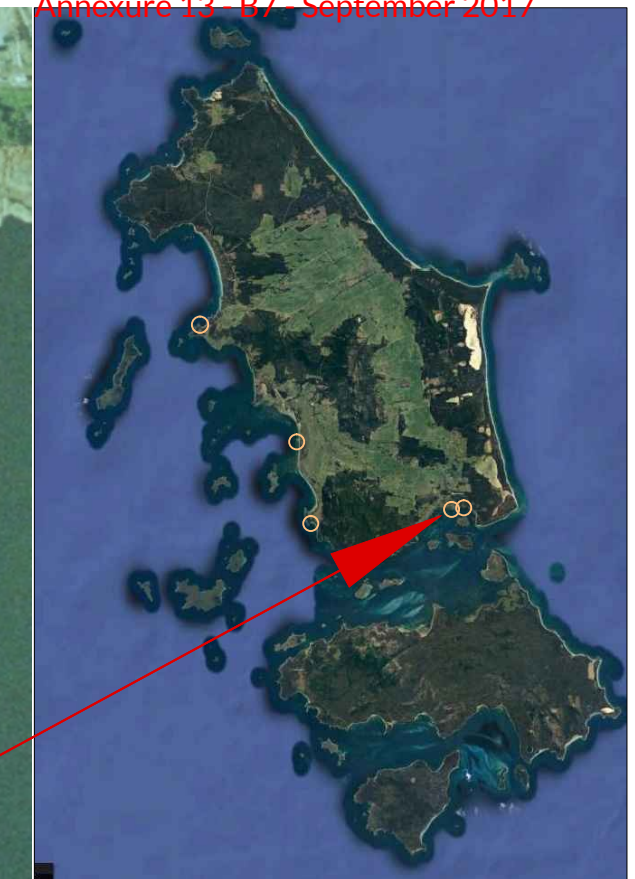
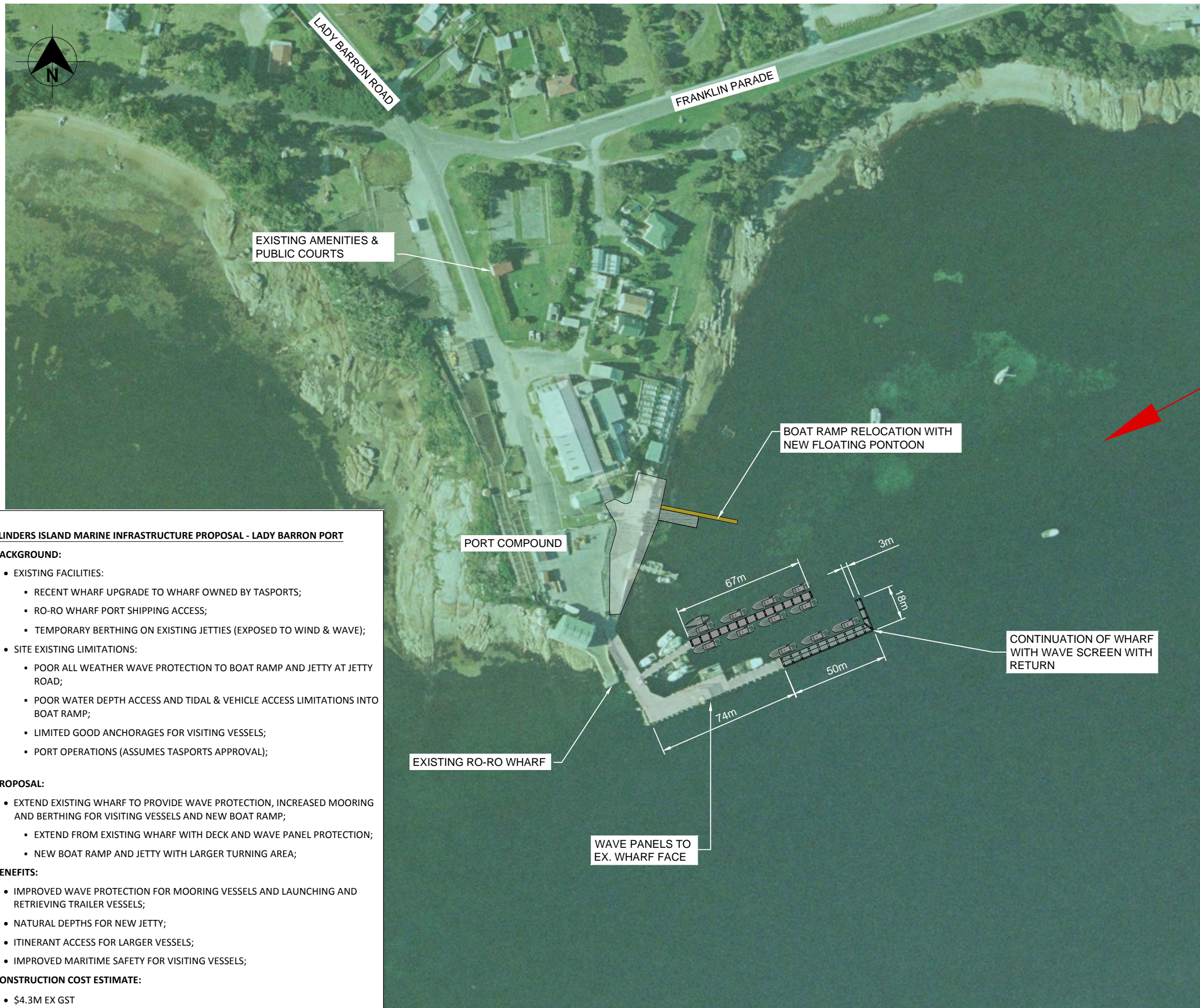
COPYRIGHT ©
This document is and shall remain the property of Burbury Consulting Pty Ltd. The document may only be used for the purpose for which it was commissioned and in accordance with the terms of engagement for the commission. Unauthorised use of this document in any way is prohibited.

Client:
FLINDERS COUNCIL

Project:
**FLINDERS ISLAND
SAFE HARBOUR OPTIONS**

Drawing Title:
PORT DAVIES OPTION

Drawn	RP	Date	
Designed	JB	OCTOBER 2016	
Checked	JB	Scale	A3
Approved	JB	AS SHOWN	
Drawing No.	1386 - 03		Rev.
			B



FLINDERS ISLAND PLAN
NTS

FLINDERS ISLAND MARINE INFRASTRUCTURE PROPOSAL - LADY BARRON PORT

BACKGROUND:

- EXISTING FACILITIES:
 - RECENT WHARF UPGRADE TO WHARF OWNED BY TASPOTS;
 - RO-RO WHARF PORT SHIPPING ACCESS;
 - TEMPORARY BERTHING ON EXISTING JETTIES (EXPOSED TO WIND & WAVE);
- SITE EXISTING LIMITATIONS:
 - POOR ALL WEATHER WAVE PROTECTION TO BOAT RAMP AND JETTY AT JETTY ROAD;
 - POOR WATER DEPTH ACCESS AND TIDAL & VEHICLE ACCESS LIMITATIONS INTO BOAT RAMP;
 - LIMITED GOOD ANCHORAGES FOR VISITING VESSELS;
 - PORT OPERATIONS (ASSUMES TASPOTS APPROVAL);

PROPOSAL:

- EXTEND EXISTING WHARF TO PROVIDE WAVE PROTECTION, INCREASED MOORING AND BERTHING FOR VISITING VESSELS AND NEW BOAT RAMP;
 - EXTEND FROM EXISTING WHARF WITH DECK AND WAVE PANEL PROTECTION;
 - NEW BOAT RAMP AND JETTY WITH LARGER TURNING AREA;

BENEFITS:

- IMPROVED WAVE PROTECTION FOR MOORING VESSELS AND LAUNCHING AND RETRIEVING TRAILER VESSELS;
- NATURAL DEPTHS FOR NEW JETTY;
- ITINERANT ACCESS FOR LARGER VESSELS;
- IMPROVED MARITIME SAFETY FOR VISITING VESSELS;

CONSTRUCTION COST ESTIMATE:

- \$4.3M EX GST

LADY BARRON PLAN
1:2000

B	24/01/17	AMENDED FOR REVIEW		JB	JB JB
A	19/10/16	PRELIMINARY FOR REVIEW		JB	JB JB
No.	Date	Revision Details	Des.	Che.	App.



ABN 75 146 719 959
P.O. BOX 354,
SOUTH HOBART, TAS 7004
P: (03) 6223 8007
F: (03) 6223 1143
E: admin@burburyconsulting.com.au

COPYRIGHT ©
"This document is and shall remain the property of Burbury Consulting Pty Ltd. The document may only be used for the purpose for which it was commissioned and in accordance with the terms of engagement for the commission. Unauthorised use of this document in any way is prohibited"

Client:
FLINDERS COUNCIL

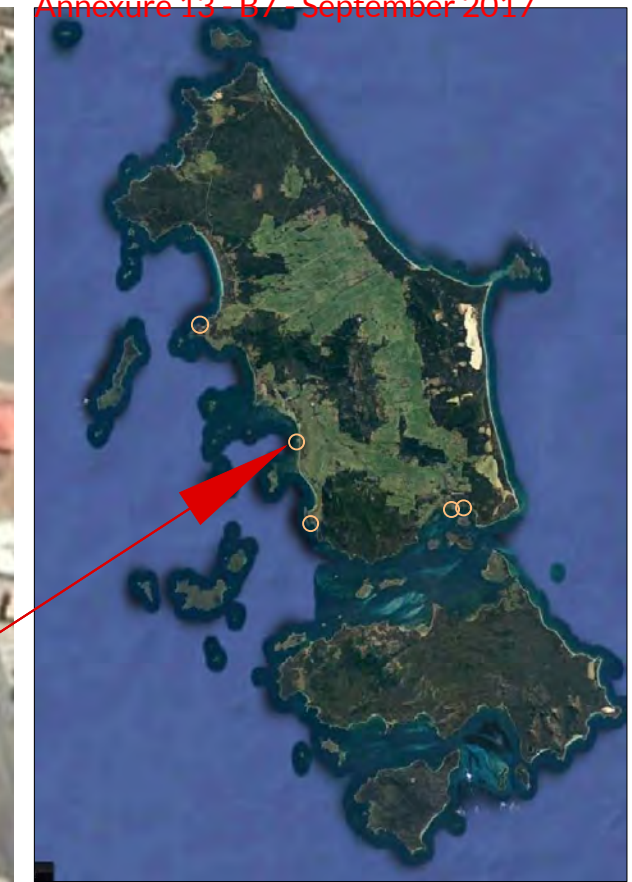
Project:
**FLINDERS ISLAND
SAFE HARBOUR OPTIONS**

Drawing Title:
LADY BARRON OPTION

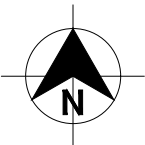
Drawn	RP	Date	
Designed	JB	OCTOBER 2016	
Checked	JB	Scale	A3
Approved	JB	AS SHOWN	

Drawing No.	Rev.
1386 - 04	B

PRELIMINARY
NOT FOR CONSTRUCTION



FLINDERS ISLAND PLAN
NTS



WHITEMARK PLAN
1:2000

PRELIMINARY
NOT FOR CONSTRUCTION

No.	Date	Revision Details	Des.	Che.	App.
A	19/10/16	PRELIMINARY FOR REVIEW	JB	JB	JB

ABN 75 146 719 959
P.O. BOX 354,
SOUTH HOBART, TAS 7004
P: (03) 6223 8007
F: (03) 6223 1143
E: admin@burburyconsulting.com.au

COPYRIGHT ©
This document is and shall remain the property of Burbury Consulting Pty Ltd. The document may only be used for the purpose for which it was commissioned and in accordance with the terms of engagement for the commission. Unauthorised use of this document in any way is prohibited.

Client:
FLINDERS COUNCIL

Project:
**FLINDERS ISLAND
SAFE HARBOUR OPTIONS**

Drawing Title:
WHITEMARK OPTION

Drawn	RP	Date	OCTOBER 2016	
Designed	JB	Scale	AS SHOWN	
Checked	JB	Scale	AS SHOWN	A3
Approved	JB	Drawing No.	1386 - 06	Rev. A
				120



Appendix D – Detailed Site Investigations Report (Marine Solutions)

MARINE ECOLOGICAL INVESTIGATIONS OF FIVE POTENTIAL SITES FOR A SAFE HARBOUR ON FLINDERS ISLAND

Port Davies, Whitemark, Trousers Point, Lady Barron Slip and Lady Barron Wharf



Report to

Burbury Consulting

February 2017



www.marinesolutions.net.au

© Marine Solutions 2017. This document should only be used for the specific project and purposes for which it was commissioned. ¹

Version	Author	Date reviewed	Reviewed by
1 of 4	Coco Cullen Knox and Annie Ford	-	-
2 of 4	Coco Cullen Knox and Annie Ford	29/07/2016	Carly Giosio
3 of 4	Laura Smith	-	-
4 of 4	Laura Smith		

Note: Location maps throughout this report are representative only; for precise GPS coordinates, see the appendices.

Analyte levels have been measured by NATA-accredited laboratories.

¹ Cover photo, aerial image of Lady Barron Slip (photo by Marine Solutions, December 2016).

TABLE OF CONTENTS

Table of Contents.....	3
Table of Figures.....	7
1 Executive Summary.....	10
2 Introduction	14
2.1 Proposal Brief.....	14
2.2 Purpose and Scope.....	15
3 Port Davies	17
3.1 Land Tenure	17
3.2 Geoconservation.....	21
3.3 Social Values	21
3.4 Hydrology.....	22
3.5 Habitat Characterisation.....	22
3.5.1 Intertidal Habitat.....	22
3.5.2 Subtidal Habitat	25
3.5.3 Bathymetry.....	27
3.7 Aquatic Flora and Fauna	29
3.7.1 Protected Matters.....	29
3.7.2 Natural Values Atlas.....	31
4 Whitemark	32
5 Trousers Point.....	37
5.1 Land Tenure	37
5.2 Geoconservation.....	41

5.3	Social Values	41
5.4	Hydrology.....	42
5.5	Habitat Characterisation	42
5.5.1	Intertidal Habitat.....	42
5.5.2	Subtidal Habitat	45
5.5.3	Bathymetry.....	46
5.6	Sediments	47
5.6.1	Particle Size	47
5.6.2	Depth (Jet Probing)	48
5.7	Aquatic Flora and Fauna	49
5.7.1	Protected Matters.....	49
5.7.2	Threatened and protected species	51
6	Lady Barron Wharf.....	52
6.1	Land Tenure	53
6.2	Geoconservation.....	57
6.3	Social Values	57
6.4	Hydrology.....	58
6.5	Habitat Characterisation	58
6.5.1	Intertidal Habitat.....	58
6.5.2	Subtidal Habitat	60
6.5.3	Bathymetry.....	62
6.6	Aquatic Flora and Fauna	65
6.6.1	Protected Matters.....	65
6.6.2	Threatened and protected species	67



7	Lady Barron Slip	68
7.1	Land Tenure	68
7.2	Geoconservation	68
7.3	Social Values	68
7.4	Hydrology.....	71
7.5	Habitat Characterisation.....	71
7.5.1	Intertidal Habitat.....	71
7.5.2	Subtidal Habitat	73
7.5.3	Bathymetry.....	76
7.6	Sediments	77
7.6.1	Particle Size	78
7.6.2	Contaminants.....	79
7.6.3	Depth (Jet Probing)	80
7.7	Aquatic Flora and Fauna	80
8	Additional Potential Impacts and Proposed Mitigation.....	82
8.1.1	Intertidal Community.....	82
8.1.2	Subtidal Community.....	82
8.1.3	Marine Pests	82
9	Conclusions	84
10	References	85
11	Appendices.....	86
	Appendix 1. Operational Summary	86
	Appendix 2. GPS Positions of Transects and Sampling Sites.....	88
	Appendix 3. Species List – Port Davies.....	88

Appendix 4. Species List – Trousers Point 90

Appendix 5. Species List – Lady Barron Wharf..... 91

Appendix 6. Species List – Lady Barron Slip 92

Appendix 7. Aquatic Flora and Fauna: Supplementary Information 93

 Australian Grayling..... 94

 Marine Mammals..... 94

 Great White Shark..... 95

 Marine turtles 95

 Subtropical and Temperate Coastal Saltmarsh..... 95

 Gunn's Screwshell 96

 Giant Kelp Marine Forests 96



TABLE OF FIGURES

Figure 1 Potential sites for marina development on Flinders Island (base image from LISTMap).....	15
Figure 2 Map showing proposed development at Port Davies (inset image from LISTmap, 2016. Engineering design drawings from Burbury Consulting, 2016).	18
Figure 3 Map indicating land tenure of the proposed development site at Port Davies (LISTmap, 2016)	19
Figure 4 Map showing land use and natural landmarks at Port Davies (LISTmap, 2016).....	20
Figure 5 Geoconservational significance in Port Davies (source: Tasmanian Geoconservation Database 2016)	21
Figure 6 Aerial view of the Port Davies study area, showing some modification of the shoreline.	23
Figure 7 Photos of the intertidal zone, showing the entry point of Transect 1 (left), and the east-facing aspect from the boat ramp (right).	24
Figure 8 Map showing positions of underwater video transects at Port Davies.....	25
Figure 9 Images of subtidal habitat types in Port Davies.....	27
Figure 10 Images of remnant piles in Port Davies. Some piles (e.g. left, mid) terminate near the sea surface and may pose navigational hazard to boaters at low tide. Others (e.g. right) have been sawn off near to the seabed.....	27
Figure 11 Bathymetric mapping of the proposed development area at Port Davies.....	28
Figure 12 Map showing proposed development at Whitemark (inset image from LISTmap, 2016. Engineering design drawings from Burbury Consulting, 2016).	33
Figure 13 Map indicating land tenure of the proposed development site at Whitemark, showing that the existing jetty is classed authority freehold land and is flanked by public reserve land (LISTmap, 2016)..	34
Figure 14 Aerial images of the proposed development site at Whitemark around the existing jetty, showing the shallow nature of the area and existing boat-track scouring.	35
Figure 15 Images of the proposed development site at Whitemark around the existing jetty.	36
Figure 16 Map showing proposed development at Trousers Point on Flinders Island (inset image from LISTmap, 2016. Engineering design drawings from Burbury Consulting, 2016).....	38
Figure 17 Map indicating land tenure of the proposed development site at Trousers Point (LISTmap, 2016)	39
Figure 18 Map showing land use and natural landmarks at Trousers Point (LISTmap,2016).....	40

Figure 19 Geoconservational significance at Trousers Point (source: Tasmanian Geoconservation Database 2016)	41
Figure 20 Aerial view of the Trousers Point study area	43
Figure 21 Photos of the intertidal zone at Trousers Point, showing a small sandy beach to the immediate north of the proposed study area (the point in the background right is the proposed location of the marina’s shore crossing) (left), and a south-facing aspect from near to the beginning of Transect 1 (right).	44
Figure 22 Map showing positions of underwater video transects and sediment sampling site at Trousers Point. Base image from LISTMap 2016.	45
Figure 23 Images of subtidal habitat types in Trousers Point.....	46
Figure 24 Particle size analysis from a sample at Trousers Point.	48
Figure 25 Bathymetry and sediment depth along Transect 1, Trousers Point.	49
Figure 26 Map showing proposed development at Lady Barron Wharf (inset image from LISTmap, 2016. Engineering design drawings from Burbury Consulting, 2016).	54
Figure 27 Map indicating land tenure of the proposed development site at Lady Barron Wharf (LISTmap, 2016)	55
Figure 28 Map showing land use and natural landmarks at Lady Barron Wharf (LISTmap, 2016)	56
Figure 29 Geoconservational significance at Lady Barron (source: Tasmanian Geoconservation Database 2016)	57
Figure 30 Aerial view of the Lady Barron Wharf study area.....	58
Figure 31 Photo of the shoreward facing aspect from the main jetty at Lady Barron Wharf.....	59
Figure 32 Map showing positions of underwater video transects at Lady Barron Wharf.....	60
Figure 33 Images of subtidal habitat types around Lady Barron Wharf.....	62
Figure 34 Bathymetric mapping of Lady Barron, encompassing the proposed development areas at both the wharf and slip area.	63
Figure 35 Bathymetric mapping of the proposed development area at Lady Barron Wharf.....	64
Figure 36 Map showing proposed development at Lady Barron Slip (inset image from LISTmap, 2016. Engineering design drawings from Burbury Consulting, 2016).	69
Figure 37 Map showing land use and natural landmarks at Lady Barron Slip (LISTmap, 2016).....	70

Figure 38 Aerial views of the Lady Barron Slip study area, showing some modification of the shoreline including a semi-natural rock boat ramp and an old slipway. 72

Figure 39 Photos of the intertidal zone, looking southwest (top) and northeast (bottom) from the boat ramp. 73

Figure 40 Map showing positions of underwater video transects, sediment sampling site and jet probing (JP) sites in the Lady Barron Slip study area. 74

Figure 41 Images of subtidal habitat types around the Lady Barron Slip study area. 75

Figure 42 Bathymetric map of the proposed development area at Lady Barron Slip. 77

Figure 43 A diver collects sediment cores at Lady Barron Slip for particle size analysis. Organic material on the seabed is evident at the sampling site. 79

Figure 44 Particle size analysis from a sample at Lady Barron Slip. Note that grain size fractionation may be compromised by high levels of organic matter. 79

1 EXECUTIVE SUMMARY

Flinders Council is currently investigating options for a reliable and safe all-weather marine facility, to provide better facilities and improved safety for the growing motor boat and yacht cruising tourism market. Marine Solutions were contracted by Burbury Consulting to conduct desktop and field-based marine environmental investigations at five potential sites, including Port Davies, Whitemark, Trousers Point, Lady Barron Slip and Lady Barron Wharf.

As a result of Flinders Island's remoteness, relatively few ecological studies have been conducted here; therefore, compared with other sites in Tasmania, Flinders Island has a paucity of data available on marine ecology and community composition. Desktop searches for species composition information may therefore not be comprehensive, and a lack of a species listing may reflect a lack of records rather than a species' actual absence from a site. Thorough field assessments partly offset the paucity of data available through desktop research. Field investigations were undertaken in December 2016, to characterise ecological communities, map the bathymetry of proposed development footprints, and collect information to inform potential environmental impacts of developing marine infrastructure at each site. Table 1 below provides a summary of the potential sites for the proposed development.

The development of a marina would cause a net loss of seagrass would be experienced at all the sites surveyed. Based on the findings of this investigation, it appears that the Lady Barron Slip site would be the most suitable site for a safe harbor.

Table 1 A comparison of potential sites for the development of a safe harbour on Flinders Island.

	Port Davies	Whitemark	Trousers Point	Lady Barron Wharf	Lady Barron Slip
Land Tenure	Settlement Point Conservation Area	Authority Freehold	Strzlecki National Park	Authority Freehold	Public Reserve
Geoconservation	Cave Beach Karren and Caves	None in immediate vicinity.	None in immediate vicinity; Fotheringate Bay Coastal Karst to the north.	None in immediate vicinity.	None in immediate vicinity.
Social Values	Wybalenna Historic Site (important Aboriginal heritage). Currently, relatively low level of modification. Potential moderate visual impacts.	Currently, high level of modification. Potential visual impacts considered minor.	Very high; potentially prohibitively so. Currently, virtually no anthropogenic modification. Potential visual impacts considered extremely high. Community likely to be divided over proposed development.	Currently, high level of modification. Potential visual impacts considered minor.	Currently, moderate level of modification. Potential visual impacts considered relatively minor. There appears to be high levels of community support for this option.
Hydrology	Swell-affected.	Very exposed to westerly weather.	Swell-affected	Current-affected.	Comparitively less affected by swell and currents.
Intertidal Habitat	Somewhat modified	Highly modified	Unmodified	Highly modified	Highly modified

	Port Davies	Whitemark	Trousers Point	Lady Barron Wharf	Lady Barron Slip
Subtidal Habitat	<p>Diverse macroalgal habitat.</p> <p>Distinct reef patches throughout area.</p> <p>Diversity and rugosity increases from the shore to the point.</p> <p>Extensive seagrass beds, predominantly <i>Posidonia</i> sp.</p>	<p>Shallow unconsolidated sediments, extensive seagrass beds.</p>	<p>Biodiverse macroalgae assemblages.</p> <p>Extensive <i>Posidonia</i> sp. beds.</p>	<p>Large amount of litter.</p> <p>Extensive seagrass (<i>Posidonia</i>, <i>Amphibolis</i> and <i>Heterozostera</i>).</p>	<p>Extensive seagrass (predominantly <i>Posidonia</i> sp.) beds.</p>
Bathymetry	<p>Typical coastal embayment. Max. depth of 5.4 m in immediate proposed development footprint.</p>	<p>Prohibitively shallow without considerable dredging (not surveyed).</p>	<p>Typical coastal embayment. Max. depth of 5.2 m recorded 100m offshore (not tidally corrected; limited survey).</p>	<p>Near-shore shallow flat of ~ 0 – 2 m, dropping steeply to a band of ~ 2 – 7 m, within which the proposed development will be located, grading to a deep channel of ~ 8 m + in the south.</p>	<p>Typical coastline, with max. depth of 2.4 m in immediate proposed development footprint. Deeper channel to the south.</p>
Aquatic Flora and Fauna	<p>6 threatened marine species (3 turtles, 1 shark, 2 mammals) and 2 threatened communities identified as occurring in the area.</p>	<p>Desktop natural values assessment did not proceed for this site, due to its non-suitability.</p>	<p>7 threatened marine species (3 turtles, 1 shark, 3 mammals) and 1 threatened community identified as occurring in the area.</p>	<p>7 threatened marine species (3 turtles, 1 shark, 3 mammals) and 1 threatened community identified as occurring in the area.</p>	<p>As for Lady Barron Wharf.</p>

	Port Davies	Whitemark	Trousers Point	Lady Barron Wharf	Lady Barron Slip
	No threatened species or communities were recorded in field surveys.	Extensive seagrass across shallow flats.	No threatened species or communities were recorded in field surveys.	No threatened species or communities were recorded in field surveys.	
Other		Propeller scouring evident alongside existing wharf.		Odour and noise issues associated with working port. Access issues at boat ramp (vehicle manoeuvrability).	TBT was detected in sediments at 9.2 ng Sn/g, exceeding the ISQG-low trigger value. It is likely that elevated TBT in these sediments is a result of proximity to the slip. No other exceedances of ANZECC triggers were detected for analytes tested in sediments (metals, TPH).

2 INTRODUCTION

2.1 PROPOSAL BRIEF

Flinders Council is currently investigating options for a reliable and safe all-weather marine facility, to provide better facilities and improved safety for the growing motor boat and yacht cruising tourism market. Site selection is critical from both a socio-economic and environmental perspective.

Marine Solutions was contracted by Burbury Consulting to undertake desktop and field investigations at a number of potential sites around Flinders Island, including:

- Port Davies, west coast,
- Whitemark, west coast,
- Trousers Point, south west coast,
- Lady Barron Wharf, south coast, and
- Lady Barron Slip, south coast.

The relative position of these potential sites is shown in Figure 1 below.



Figure 1 Potential sites for marina development on Flinders Island (base image from LISTMap).

2.2 PURPOSE AND SCOPE

The purpose of this report is to provide information on ecological considerations associated with the proposed development at each potential location. The scope of work undertaken for each potential site and reported in this document is indicated in Table 2.

Please note that the scope does not extend to terrestrial ecology or cultural heritage, however, it is noted that Flinders Island contains sites of cultural heritage significance and that a heritage survey and relevant consultation would be appropriate prior to proceeding with a development.

Table 2 Summary of works conducted for each potential development site.

	Activity	Port Davies	Whitemark	Trousers Point	Lady Barron Wharf	Lady Barron Slip
Desktop- based	Land tenure mapping	✓	✓	✓	✓	✓
	Geoconservation significance	✓	✓	✓	✓	✓
	Social values assessment	✓	✓	✓	✓	✓
	Natural values assessment	✓	✓	✓	✓	✓
Field-based	Underwater video	✓		✓	✓	✓
	Aerial photography	✓	✓	✓	✓	✓
	Jet probing for sediment depth			✓		✓
	Particle size analysis			✓		✓
	Sediment contaminant analysis			✓		✓
	Gridded bathymetric survey	✓			✓	✓
	Bathymetric transect survey			✓		
Ecological characterisation	✓		✓	✓	✓	

3 PORT DAVIES

Port Davies is located on the west coast of Flinders Island (Figure 2). The proposed development site is partially protected from predominant westerly weather by Prime Seal Island and Settlement Point to the west of the proposed development, and four islands to the northwest. There is an existing road and boat ramp at the western end of the bay. Port Davies is located relatively far from amenities; Whitemark is the closest town with re-supply facilities and is approximately 17 km southeast of the proposed development site. The closest airport is approximately 12 km away.

Historically, there has been significant marine infrastructure at this site, as evidenced by remnant jetty abutment and piles. This indicates that the site can be operate as a harbour.

3.1 LAND TENURE

The land tenure at Port Davies is characterized by a Nature Recreation Area on the northern end of the bay, a Conservation Area on the southern end of the bay (shore crossing of proposed development) and Private Freehold in the middle of the bay (Figure 3; Figure 4). The Conservation Area runs along the majority of the western coastline of Flinders Island.



Figure 2 Map showing proposed development at Port Davies (inset image from LISTmap, 2016. Engineering design drawings from Burbury Consulting, 2016).

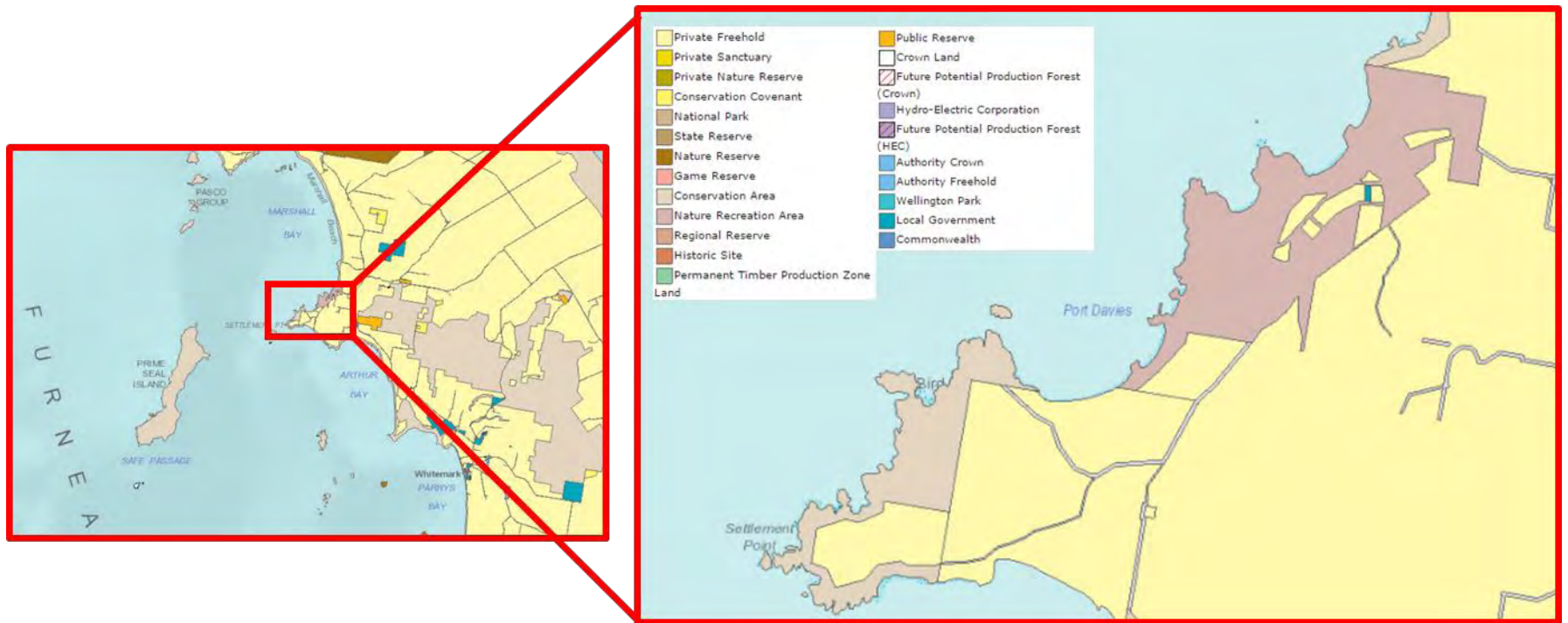


Figure 3 Map indicating land tenure of the proposed development site at Port Davies (LISTmap, 2016)

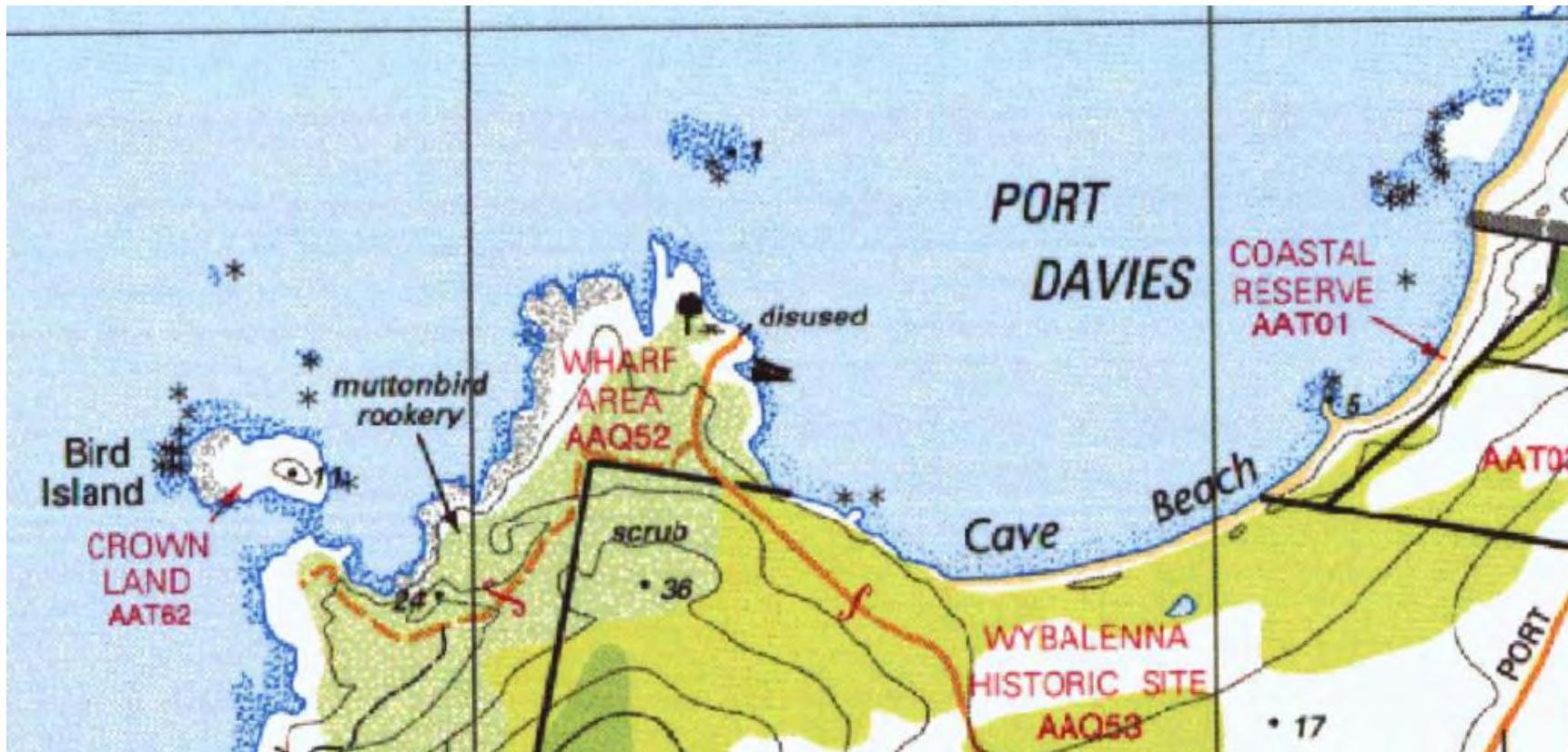


Figure 4 Map showing land use and natural landmarks at Port Davies (LISTmap, 2016).

3.2 GEOCONSERVATION

A search of the Tasmanian Geoconservation Database (TGD, 2016) determined that there were 2 sites of significance within Port Davies (Cave Beach Karren and Caves and Cave Beach Palaeosol and Hardpan; Figure 5). As there are geoconservation sites within 1 km of the proposed development site, an assessment and report of the geology, geomorphology and soils of the surrounding area is required (DPIPWE, 2015).

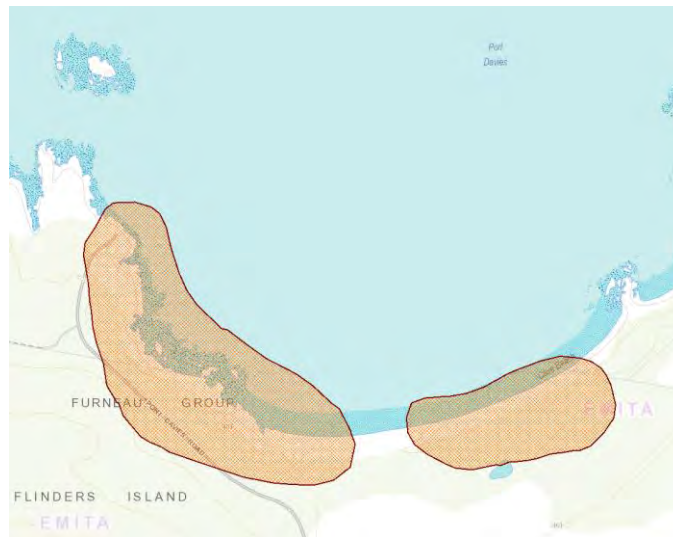


Figure 5 Geoconservational significance in Port Davies (source: Tasmanian Geoconservation Database 2016)

3.3 SOCIAL VALUES

Compared to Lady Barron or Whitemark, Port Davies has a relatively low level of development and modification. Developments have the potential to alter the social experience for users by altering their perception of the location being a natural and remote experience. Providing a more 'developed' setting may alter the recreational experience. Public use may change in the area (fishing, diving, and swimming). Potential impacts (especially noise) may arise from marina-users.

Construction of a break-wall and marina at any potential site will have lasting and high visual impact; retention of the apparent and biophysical naturalness of sites should be prioritised.

The visual impact of a marina and associated shore-based facilities at Port Davies would be considerable, and is an important consideration in any forward planning of a development, particularly in light of the high heritage values at this site.

There are a number of existing moorings throughout the study area, which would be removed or relocated should the proposed development proceed.

While a comprehensive heritage impacts review is beyond the scope of this report, it is noted that the Wybalenna Historic Site is located approximately 1 km south of the Port Davies proposed development site is one of the most important historic sites in Tasmania. If the proposal continues at Port Davies and risks impacting an Aboriginal site, a permit under the *Aboriginal Relics Act 1975* will be required. The State Coastal Policy would also need to be considered.

3.4 HYDROLOGY

At the time of on-site surveys, a pronounced surge from long-period waves was noted, suggesting that boats berthed at a marina may experience some level of movement/roll at this location. Despite partial protection, westerly ocean swell may affect marine structures on the western coast of Flinders Island.

3.5 HABITAT CHARACTERISATION

3.5.1 Intertidal Habitat

The intertidal habitat at Port Davies is somewhat modified already, with a boat ramp and remnant abutment of a historic jetty (Figure 6). The intertidal zone is characterized by granite outcrops and boulders (Figure 7).



Figure 6 Aerial view of the Port Davies study area, showing some modification of the shoreline.



Figure 7 Photos of the intertidal zone, showing the entry point of Transect 1 (left), and the east-facing aspect from the boat ramp (right).

3.5.2 Subtidal Habitat

To characterise the subtidal habitat, two transects were swum by divers and video footage recorded: a primary transect (T1 + T1b), running approximately along the alignment of the primary arm of the proposed marina, and a secondary transect (T2) that crossed through the development area and continued north (Figure 8). A general swim of the area to the south-east of T1 was also conducted, with video footage and still images recorded. Video footage is available from Marine Solutions as AVCHD video files.



Figure 8 Map showing positions of underwater video transects at Port Davies.

The first ~40 m of Transect 1 was a diverse macroalgal-dominated reef habitat. The most prolific algal species in this band was spaghetti weed (*Cladosiphon filum*), and to a lesser extent *Sargassum* sp. (Figure 9a). Approximately 40 m from the shore, the habitat graded from predominantly macroalgae to dense seagrass (*Posidonia* sp.), until approximately 65 m from shore, where the *Posidonia* density decreased and the habitat graded to a mosaic of *Caulerpa* sp. and seagrasses including *Posidonia*, *Halophila* sp., and *Heterozostera nigricaulis* (Figure 9b and Figure 9c). Approximately 90-100 m from

shore, at the end of T1/start of T1b (Figure 8), evidence of remnant piles from a historic jetty were found (Figure 9c). Anecdotal discussions with locals indicate that there are 27 remnant piles in the seabed; several of these have been sawn off near the seabed, but some terminate near to the sea surface and apparently pose a navigation hazard at low tides (Figure 10). Beyond 100 m (i.e. along T1b), habitat was predominantly dense *Posidonia* beds (Figure 9d), interspersed with patches of mosaic seagrass/macroalgae habitat. Discreet patches of reef were found throughout the study area. Moving towards the point to the north-west, the habitat rugosity increased, correlating with an increase in fish and macroalgae diversity.

There are no obvious sources of contamination at this site. With the exception of the remnant jetty abutment and piles, the subtidal habitat appeared to be relatively undisturbed. Scouring of the seabed around mooring bases was evident from aerial imagery (refer to Figure 6).



a) T1, ~ 5m from shore. Mixed macroalgal reef



b) T1, ~ 25m from shore. Mixed macroalgal reef, including *Cladosiphon* and *Sargassum*.



c) T1, ~ 90 m from shore. Mosaic of seagrasses and *Caulerpa* sp. Timber remnants of jetty piles.



d) T1b, ~160 m from shore. Dense *Posidonia* sp.

Figure 9 Images of subtidal habitat types in Port Davies.

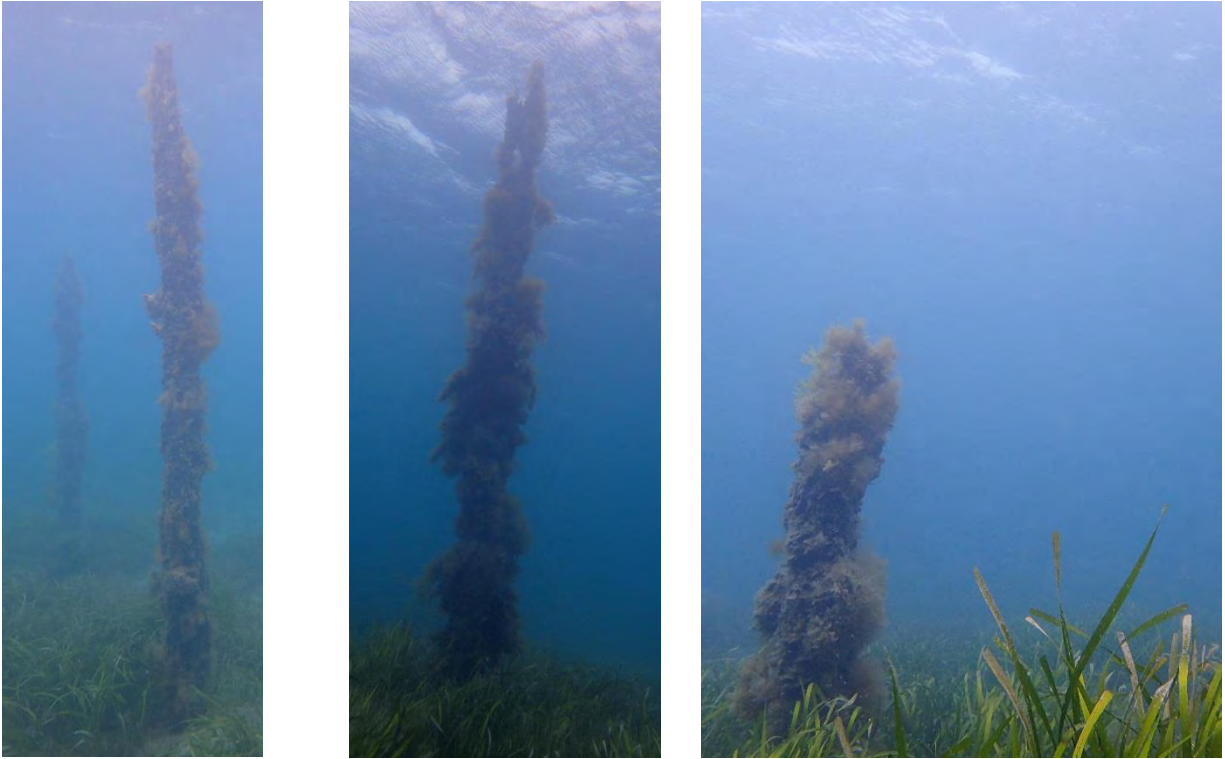


Figure 10 Images of remnant piles in Port Davies. Some piles (e.g. left, mid) terminate near the sea surface and may pose navigational hazard to boaters at low tide. Others (e.g. right) have been sawn off near to the seabed.

3.5.3 Bathymetry

The proposed development area was mapped using a vessel mounted Garmin GPS Map 551s running a dual frequency 50/200 kHz transducer. The water depth was logged every two seconds to *Seabed Mapper* running on a laptop computer. The depths were tidally and barometrically corrected for Chart Datum using the Bureau of Meteorology predictions of Big River Cove. Measurements are accurate to within +/- 0.2 m.

Bathymetric data was mapped with contour lines at intervals of 0.2 m (Figure 11). The bathymetry of the region was typical for a small coastal embayment, with depth increasing with distance from the shore. The maximum depth recorded in the bathymetry survey was 7 m which is in the northern reach of the study area and not in the immediate footprint of the proposed development. A relatively indistinct trough runs from the deep area in the north southwards through the study area. Two distinct shallow areas in the north-west of the study area represent reef habitat; it is also likely that the relatively shallow area in the east is also reef.

Depth was adequate throughout the site area for a marina, but it is noted that, with depths of >5 m throughout the proposed development footprint, the amount of rock required to build a rock wall would be greater and likely costlier than at a shallower site.

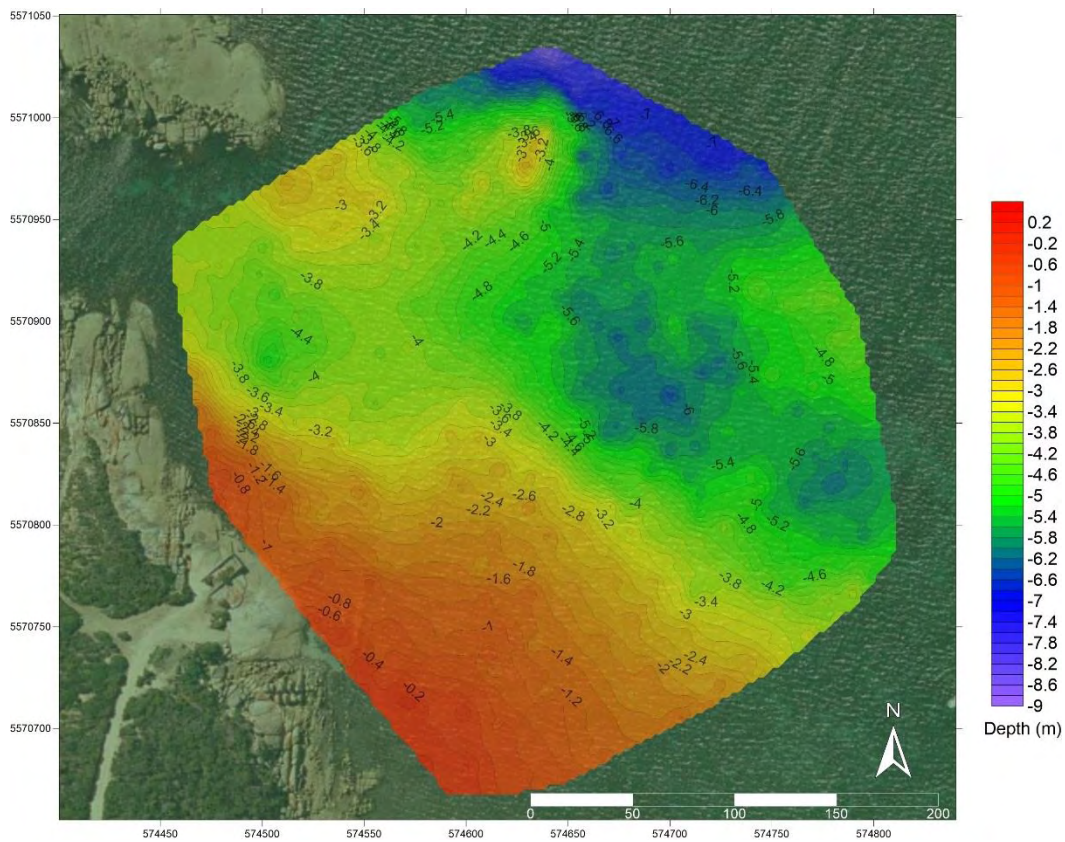


Figure 11 Bathymetric mapping of the proposed development area at Port Davies.

3.7 AQUATIC FLORA AND FAUNA

A diverse macroalgal community was present at this site. A high diversity in fish was also recorded, with diversity increasing with distance offshore as the habitat rugosity increased. For a full list of species observed during field surveys, refer to Appendix 3.

Desktop searches of the Environmental Protection and Biodiversity Conservation (EPBC) Act's Protected Matters Search Tool (PMST) and DPIPWE's Natural Values Atlas (NVA) were conducted. Results are discussed in the sections below. For additional information regarding species listing legislation and species identified in these searches, refer to Appendix 7.

3.7.1 Protected Matters

Within a 5000 m radius, the PMST identified 2 listed threatened community and 39 listed threatened species, including 25 birds, 1 fish, 1 frog, 3 marine mammals, 2 terrestrial mammals, 3 marine reptiles, 1 shark and 3 terrestrial plants. The search also identified protected species that 'may occur in the area' or are 'likely to occur in the area', including 29 syngnathid species (seahorses, sea dragons and pipehorses), 9 cetaceans and 2 seal species. The report is summarised in Table 3.

Table 3 Summary of findings of the EPBC Act Protected Matters Search Tool for Port Davies

	Item	# ID'd by PMST	Notes
Matters of National Environmental Significance	World Heritage Properties	None	-
	National Heritage Places	None	-
	Wetlands of International Importance	None	-
	Great Barrier Reef Marine Park	None	-
	Commonwealth Marine Area	None	-
	Listed Threatened Ecological Communities	2	- Subtropical and Temperate Coastal Saltmarsh -Giant Kelp Marine Forests of South East Australia
	Listed Threatened Species	39	6 are marine (Refer to section Table 4)
	Listed Migratory Species	39	(Refer to Appendix 7, marine mammals section)
Other Matters Protecte	Commonwealth Land	None	-
	Commonwealth Heritage Places	None	-
	Listed Marine Species	67	
	Whales and Other Cetaceans	12	

Extra Information	Critical Habitats	None	-
	Commonwealth Reserves Terrestrial	None	-
	Commonwealth Reserves Marine	None	-
	State and Territory Reserves	5	- Arthur Bay - Emita - Marshall Beach - Mulligans Hill - Settlement Point
	Regional Forest Agreements	1	Tasmanian RFA
	Invasive Species	22	None are aquatic
	Nationally Important Wetlands	None	-
Key Ecological Features (Marine)	None	-	

There are 7 listed marine animal threatened species, including the green turtle, *Chelonia mydas*; loggerhead turtle, *Caretta caretta*; leatherback turtle, *Dermochelys coriacea*; great white shark, *Carcharodon carcharias*; blue whale, *Balaenoptera musculus*, and humpback whale, *Megaptera novaeangliae*. Giant kelp marine forests and subtropical and temperate coastal saltmarshes were also listed as threatened ecological communities which may occur in Port Davies and are recorded as endangered and vulnerable, respectively. The threatened marine species and communities identified by the PMST are listed in Table 4 below.

Table 4 Summary of threatened marine species/communities identified in a search of EPBC Act Protected Matters Search Tool for Port Davies. Note that the scope does not extend to terrestrial or avian biota.

Community or Species	EPBC Act Status	Type of Presence
Green Turtle <i>Chelonia mydas</i>	Vulnerable	Breeding likely to occur within area
Loggerhead Turtle <i>Caretta caretta</i>	Endangered	Breeding likely to occur within area
Leatherback Turtle <i>Dermochelys coriacea</i>	Endangered	Breeding likely to occur within area
Great White Shark <i>Carcharodon carcharias</i>	Vulnerable	Species or species habitat known to occur within area
Blue whale <i>Balaenoptera musculus</i>	Endangered	Species or species habitat likely occur within area
Humpback whale <i>Megaptera novaeangliae</i>	Vulnerable	Species or species habitat likely to occur within area

Subtropical and Temperate Coastal Saltmarsh	Vulnerable	Community likely occur within area
Giant Kelp Marine Forests of South East Australia	Endangered	Community may occur within area

Additionally, there were 12 listed marine migratory species, including 7 marine mammal species, 3 marine reptile species and 2 shark species. The proposed development is not expected to notably impact the migration of any species, as it will not result in any barriers to migratory routes.

3.7.2 Natural Values Atlas

A search of the NVA (2015) identified 1 verified record of a threatened species (loggerhead turtle, *Caretta caretta*) within 500 m of the proposed site at Port Davies. The Australian grayling, *Prototroctes maraena* was also identified as a species with overlapping distribution within 500 m of the study site based on habitat mapping (Table 5).

Table 5 Summary of threatened marine flora and fauna species identified in a search of the Natural Values Atlas for Port Davies. Note that the scope does not extend to terrestrial or avian biota.

		Species	TSP Act listing	EPBC Act listing
Within 500 m radius	Verified Records	Loggerhead turtle <i>Caretta caretta</i>	Endangered	Endangered
	Based on habitat mapping	Australian grayling (<i>Prototroctes maraena</i>)	Vulnerable	Vulnerable
Within 5000 m radius	Verified Records	Loggerhead turtle <i>Caretta caretta</i>	Endangered	Endangered
	Based on habitat mapping	Australian grayling (<i>Prototroctes maraena</i>)	Vulnerable	Vulnerable

4 WHITEMARK

Whitemark is the largest township on Flinders Island, with access to amenity including a grocer, places to eat/drink, accommodation and an airstrip, all in close proximity to the existing jetty. The proposed development site at Whitemark is around the existing jetty structure (Figure 12), which is classed as authority freehold and is flanked by public reserve land (Figure 13).

A cursory survey of the proposed site at Whitemark was undertaken, whereby an above-water visual assessment was conducted by ground personnel, and aerial imagery was collected using a drone.

Sediments in the study area were predominantly very coarse, mobile granite sand. Patchy seagrass (*Amphibolis* sp.) beds are large and lush throughout the study area. Propeller wash was evident immediately alongside the jetty; furthermore, aerial imagery showed existing propeller scours from boat tracks through seagrass beds in the near vicinity (Figure 14). It is hypothesized that historically, contaminants originating from vessel hulls, including Cu and TBT, may have been elevated in sediments due to boat scour in the shallows; however, it is unlikely that any contaminants would remain elevated, as sediments are coarse and regularly reworked.

The site is very exposed to westerly weather conditions; furthermore, the shallow water depth (< 2 m Chart Datum in a large area around the existing jetty) around the site would preclude the development of a functioning marina without considerable dredging occurring first.

More detailed investigations were not undertaken at Whitemark, as it was apparent that this site is not suitable for a safe all-weather harbour, unless considerable capital works are undertaken. Should this site wish to be pursued as an option for an all-weather safe harbour development, a targeted dredging program would be required, including sediment analyses.



Figure 12 Map showing proposed development at Whitemark (inset image from LISTmap, 2016. Engineering design drawings from Burbury Consulting, 2016).



Figure 13 Map indicating land tenure of the proposed development site at Whitemark, showing that the existing jetty is classed authority freehold land and is flanked by public reserve land (LISTmap, 2016).



Figure 14 Aerial images of the proposed development site at Whitemark around the existing jetty, showing the shallow nature of the area and existing boat-track scouring.



Figure 15 Images of the proposed development site at Whitemark around the existing jetty.

5 TROUSERS POINT

Trousers Point is located on the south west of Flinders Island (Figure 16). The northern bay is characterised by shallow waters (approximately 2 m) and is a 'Geoconservation Site'. The southern bay is more environmentally suitable for the proposed development and has road access, a camp ground, and toilet facilities. The nearest re-supply facilities are located at Whitemark, approximately 16 km north.

Unlike the other sites, which are being investigated for a safe harbour development, the proposed development for Trousers Point is for a periodic-use jetty, for visiting vessels to make shore landings (Figure 16).

5.1 LAND TENURE

The land tenure at Trousers Point is characterized by a National Park (Strzlecki National Park) encompassing the point, and a Conservation Area along the coastal fringe on both the northern and southern beaches of Trousers Point (Figure 18). The Conservation Area runs along the majority of the western coastline of Flinders Island.



Figure 16 Map showing proposed development at Trousers Point on Flinders Island (inset image from LISTmap, 2016. Engineering design drawings from Burbury Consulting, 2016).

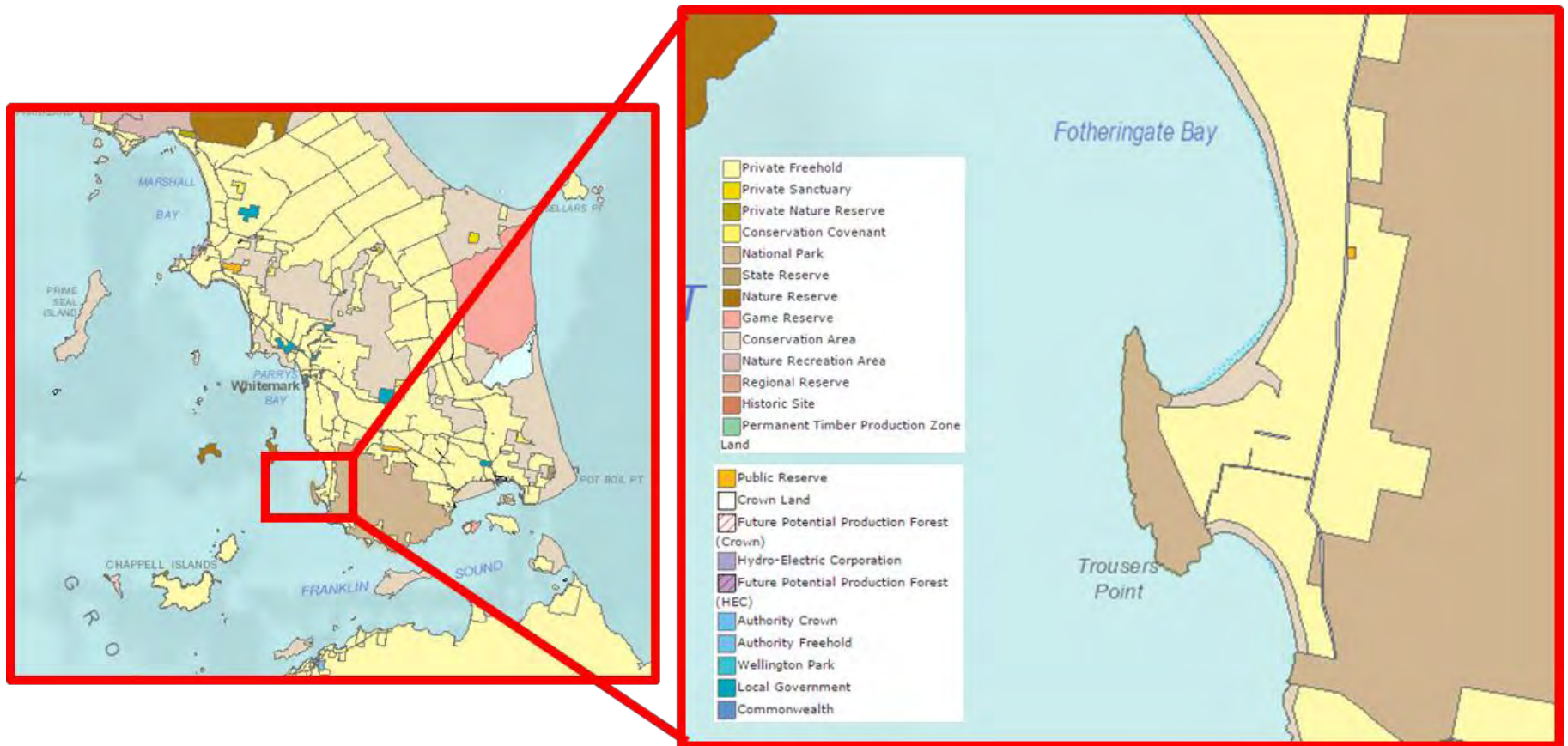


Figure 17 Map indicating land tenure of the proposed development site at Trousers Point (LISTmap, 2016)

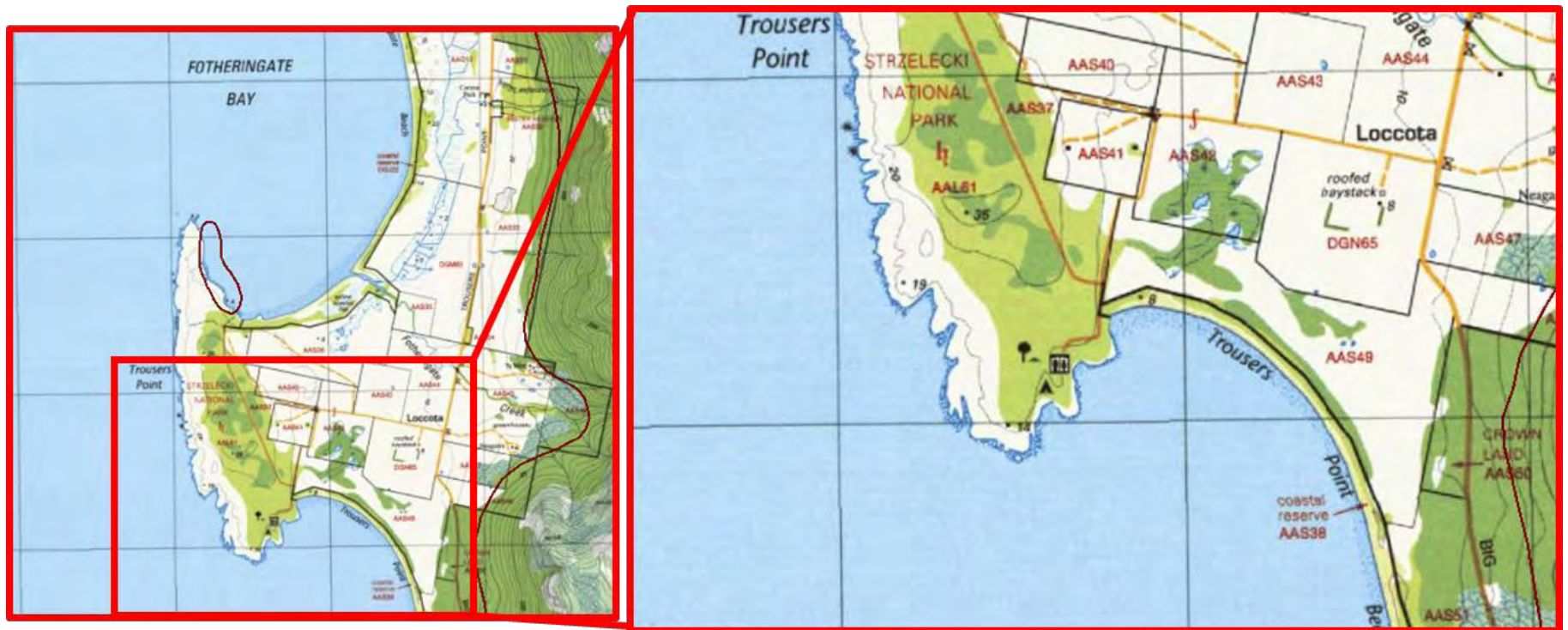


Figure 18 Map showing land use and natural landmarks at Trousers Point (LISTmap,2016)

5.2 GEOCONSERVATION

A search of the Tasmanian Geoconservation Database (TGD 2016) determined that there 1 site of significance on the northeastern side of Trousers Point (Fotheringate Bay Coastal Karst; Figure 19). Given the northern location of the Geoconservation Site at Trousers Point, as well as the shallow depth of the northern bay, the proposed development is deemed to be more likely suited to the southern side of Trousers Point than the northern side.



Figure 19 Geoconservational significance at Trousers Point (source: Tasmanian Geoconservation Database 2016)

5.3 SOCIAL VALUES

Trousers Point is known as “the most photographed and celebrated beach on the island” (Flinders Council, 2016). The high social value of this site is an essential consideration in the planning of any development here.

Trousers Point has a low level of development and modification. Developments have the potential to alter the visitor experience for users, by altering their perception of the location being a natural and remote experience. Public use may change in the area (fishing, diving, and swimming). Construction of a break-wall and marina at any potential site will have lasting and high visual impact, making retention of the apparent and biophysical naturalness of the site difficult.

The visual impact of a marina and associated shore-based facilities at Trousers Point would be considerable. Should a development here proceed, careful consideration needs to be given in regards to aesthetics.

5.4 HYDROLOGY

At the time of on-site surveys, there was a noticeable surge, despite conditions being relatively calm and offshore. Despite partial protection, westerly ocean swell may severely affect marine structures on the western coast of Flinders Island. A surf location was identified on the south-eastern point of Trousers Point, which breaks in swells over 2.5-3 m. This study was not able to obtain records of swell activity in the study areas.

Minor scouring from propeller wash and mooring or anchor chains dragging is expected to be relatively insignificant compared to that caused by storms at Trousers Point.

5.5 HABITAT CHARACTERISATION

5.5.1 Intertidal Habitat

The proposed development is located around a rocky outcrop that is flanked on either side by small sandy beaches. The intertidal zone at Trousers Point is characterized by lichen-covered granite outcrops and boulders (Figure 20 and Figure 21). Clear zonation was evident on intertidal boulders; boulders in the upper intertidal zone were bare or lichen-covered, with *G. caespitosa* and barnacles colonizing boulders in the middle-intertidal band. In the lower intertidal was a band of Neptune's necklace (*H. banksii*).



Figure 20 Aerial view of the Trousers Point study area.



Figure 21 Photos of the intertidal zone at Trousers Point, showing a small sandy beach to the immediate north of the proposed study area (the point in the background right is the proposed location of the marina's shore crossing) (left), and a south-facing aspect from near to the beginning of Transect 1 (right).

5.5.2 Subtidal Habitat

To characterise the subtidal habitat, two transects were swum by divers and video footage recorded: Transect 1, running perpendicular to the shore and approximately along the alignment of the proposed fixed jetty, and Transect 2, running along the edge of the shoreline from the beach to the point (Figure 22). A general swim of the proposed development area was also conducted, with video footage and still images recorded. Video footage is available from Marine Solutions as AVCHD video files.



Figure 22 Map showing positions of underwater video transects and sediment sampling site at Trousers Point. Base image from LISTMap 2016.

The majority of habitat throughout the study area was dense *Posidonia* seagrass beds, with a mosaic of diverse macroalgal assemblages and patches of coarse sand also found. Macroalgae recorded throughout the study area was predominantly brown (including *Ecklonia radiata*, *Acrocarpia* sp.,

Scaberia agardhii and *Cystophora* spp.), with greens (*Caulerpa* spp., *Codium fragilis*) also recorded but to a much lesser extent. A large band of Neptune's necklace (*Hormosira banksia*) was present in the intertidal/subtidal interface. The suspended particulates are visibly high in the shallows near the small beach to the north.



a) Neptune's necklace *Hormosira banksii*.



b) *Posidonia* seagrass beds and brown macroalgae.



c) Sand/seagrass interface. *Amphibolis antarctica* (foreground) and *Posidonia* sp. (background).



d) Diverse assemblage of macroalgae, predominantly browns but also greens.

Figure 23 Images of subtidal habitat types in Trousers Point.

5.5.3 Bathymetry

Bathymetry data points were collected every 10 m along Transect 1, using a Suunto dive computer. The computer's depth gauge was calibrated against a weighted tape measure and found to be accurate to within 0.1 m.

The bathymetry dropped relatively steeply in the first 10 m off the granite boulder intertidal to the seabed, after which depth increased gradually to 3.5 m 60 m from the shore (Figure 25). Bathymetry increased more steeply to 5.2 m between 60 m and 80 m from the shore. 5.2 m was the maximum depth recorded along the transect.

Note that these depth measurements have not been tidally or barometrically corrected, and represent absolute water depth measurements at the time of sampling. Based on the Bureau of Meteorology's tidal predictions at Big River Cove, it is estimated that these depths are to within 1.5 m of Chart Datum.

5.6 SEDIMENTS

5.6.1 Particle Size

Triplicate sediment cores were taken from a site located ~ 20 m from the shore along Transect 1 (see Figure 22), homogenized, and assessed volumetrically for particle size distribution. The sample was washed through a series of sieves (4 mm, 2 mm, 1 mm, 500 μm , 250 μm , 125 μm and 63 μm), and the content of each sieve was drained completely of water and transferred to a measuring cylinder, beginning with the coarsest sediment fraction (4 mm) and working down to the finest (63 μm). The volume of sediment measured in the measuring cylinder was recorded for each sieve size. The sediment fraction <63 μm was assumed to be the total volume of the sample minus the combined volume of all other size classes.

The sediment sample from Trousers Point was predominantly sand, with a very small amount of shell grit. Most the sample was between 0.125 and 0.5 mm particle (Figure 24).

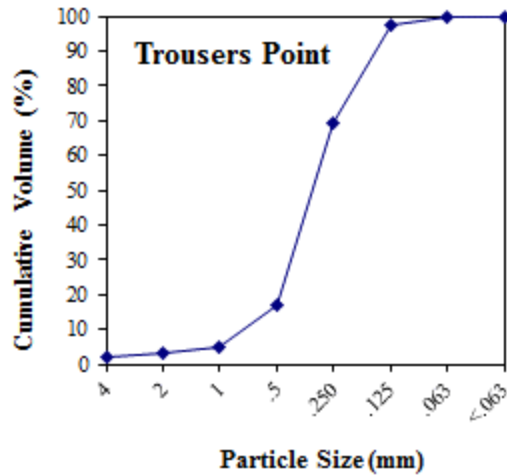


Figure 24 Particle size analysis from a sample at Trousers Point.

5.6.2 Depth (Jet Probing)

A 2.0 metre jet probe was used to assess sediment depth every 10 m along Transect 1. The ease in which the jet probe penetrated the sediment is indicative of mobile sediments. Results are shown in Figure 25 below.

The jet probe met refusal less than a metre below the surface in the first 30 m from the shore along Transect 1, indicating a relatively thin layer of sediments overlying hard substrate. Beyond 30 m, refusal depth was variable, with no refusal detected 60 – 80 m from the shore (Figure 25). These results indicate that any piles will be driven through a limited of sand, then likely into granite bedrock underneath.

Distance along transect (m)	Water depth (m)	Jet probe refusal (m)
0	0	0
10	1.9	0.4

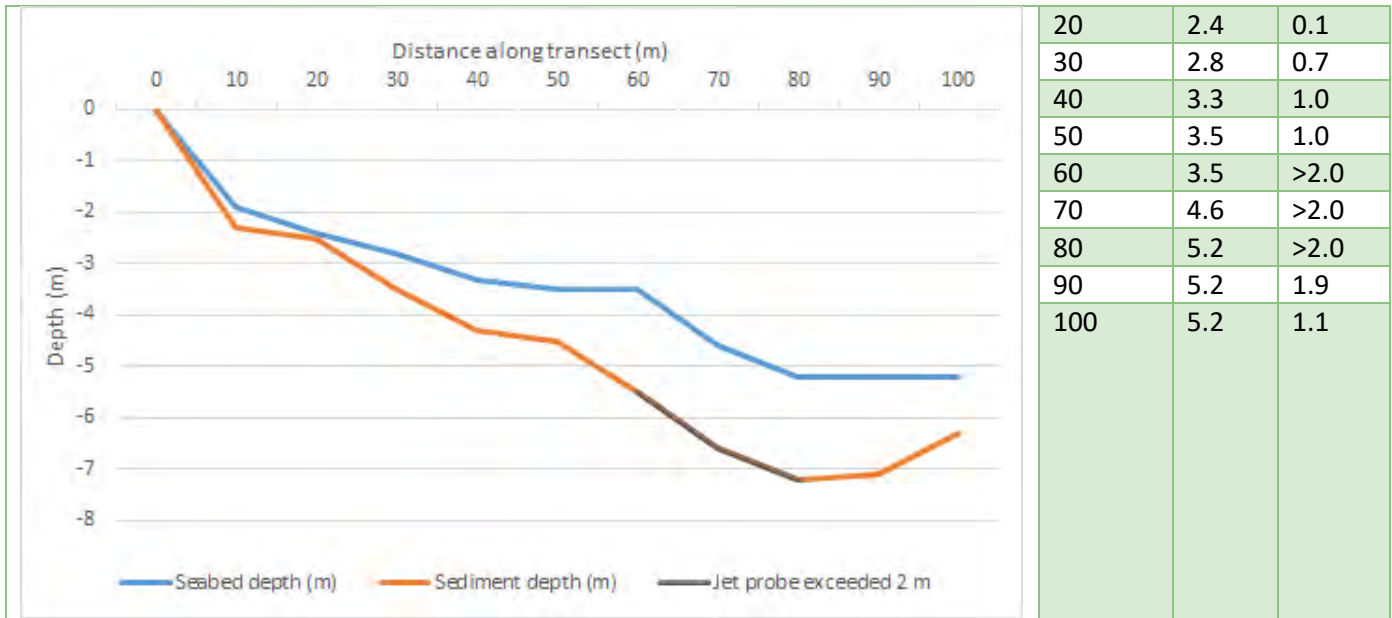


Figure 25 Bathymetry and sediment depth along Transect 1, Trousers Point.

5.7 AQUATIC FLORA AND FAUNA

Desktop searches of the Environmental Protection and Biodiversity Conservation (EPBC) Act's Protected Matters Search Tool (PMST) and DPIPWE's Natural Values Atlas (NVA) were conducted. Results are discussed in the sections below. For additional information regarding species listing legislation and species identified in these searches, refer to Appendix 7.

5.7.1 Protected Matters

Within a 5000 m radius, the PMST identified 1 listed threatened community and 42 listed threatened species, including 28 birds, 1 crustacean, 1 fish, 1 frog, 3 marine mammals, 2 terrestrial mammals, 3 marine reptiles, 1 shark and 2 terrestrial plants. The search also identified protected species that 'may occur in the area' or are 'likely to occur in the area', including 29 syngnathid species (seahorses, sea dragons and pipehorses), 8 cetaceans and 2 seal species. The report is summarised in Table 6.

Table 6 Summary of findings of the EPBC Act Protected Matters Search Tool for Trousers Point

	Item	# ID'd by PMST	Notes
Matters of National Environmental Significance	World Heritage Properties	None	-
	National Heritage Places	None	-
	Wetlands of International Importance	None	-
	Great Barrier Reef Marine Park	None	-
	Commonwealth Marine Area	None	-
	Listed Threatened Ecological Communities	1	- Giant Kelp Marine Forests of South East Australia
	Listed Threatened Species	42	(7 are marine; Refer to section Table 7)
	Listed Migratory Species	35	-
Other Matters Protected by EPBCA	Commonwealth Land	None	-
	Commonwealth Heritage Places	None	-
	Listed Marine Species	67	
	Whales and Other Cetaceans	11	-
	Critical Habitats	None	-
	Commonwealth Reserves Terrestrial	None	-
	Commonwealth Reserves Marine	None	-
Extra Information	State and Territory Reserves	4	- Fotheringgate Bay - Holts Point - Strzelcki - Trousers Point Beach
	Regional Forest Agreements	1	Tasmanian RFA
	Invasive Species	23	None are aquatic
	Nationally Important Wetlands	None	-
	Key Ecological Features (Marine)	None	-

There are 7 listed marine animal threatened species, including the green turtle, *Chelonia mydas*; loggerhead turtle, *Caretta caretta*; leatherback turtle, *Dermochelys coriacea*; great white shark, *Carcharodon carcharias*; blue whale, *Balaenoptera musculus*; southern right whale, *Eubalaena australis*; and humpback whale, *Megaptera novaeangliae*. Giant kelp marine forests were also listed as a threatened ecological community which may occur in the area and is recorded as endangered. Threatened marine species/communities identified by the PMST are listed in Table 7 below.

Table 7 Summary of threatened marine species/communities identified in a search of EPBC Act Protected Matters Search Tool for Trousers Point. Note that the scope does not extend to terrestrial or avian biota.

Community or Species	EPBC Act Status	Type of Presence
Green Turtle <i>Chelonia mydas</i>	Vulnerable	Breeding likely to occur within area
Loggerhead Turtle <i>Caretta caretta</i>	Endangered	Breeding likely to occur within area
Leatherback Turtle <i>Dermochelys coriacea</i>	Endangered	Breeding likely to occur within area
Great White Shark <i>Carcharodon carcharias</i>	Vulnerable	Species or species habitat known to occur within area
Blue whale <i>Balaenoptera musculus</i>	Endangered	Species or species habitat likely occur within area
Southern Right Whale <i>Eubalaena australis</i>	Endangered	Species or species habitat known occur within area
Humpback whale <i>Megaptera novaeangliae</i>	Vulnerable	Species or species habitat likely to occur within area
Giant Kelp Marine Forests of South East Australia	Endangered	Community may occur within area

Additionally, there were 12 listed marine migratory species, including 6 marine mammal species, 3 marine reptile species and 2 shark species. The proposed development is not expected to notably impact the migration of any species, as it will not result in any barriers to migratory routes.

5.7.2 Threatened and protected species

A search of the NVA (2015) identified 1 verified record of a threatened species (Gunn's screwshell) within 500 m, and 3 verified records of threatened marine species within 5000 m (loggerhead turtle, Gunn's screw shell and humpback whale) of the proposed development site. Based on the identification of the Gunn's screw shell within monitoring area, a targeted survey is advised by DPIPWE (2015). Range boundaries suggest that the Australian grayling may be found within 500 m and 5000 m of the study site. This species is identified in Table 8 and discussed in further detail below.

Table 8 Summary of threatened marine flora and fauna species identified in a search of the Natural Values Atlas for Trousers Point. Note that the scope does not extend to terrestrial or avian biota.

		Species	TSP Act listing	EPBC Act listing
Within 500 m radius	Verified Records	Gunn's screwshell <i>Gazameda gunnii</i>	Vulnerable	-
	Based on habitat mapping ²	Australian grayling <i>(Prototroctes maraena)</i>	Vulnerable	Vulnerable
Within 5000 m radius	Verified Records	Loggerhead turtle <i>Caretta caretta</i>	Endangered	Endangered
		Gunn's screwshell <i>Gazameda gunnii</i>	Vulnerable	-
		Humpback whale <i>Megaperta novaehangliae</i>	Endangered	Vulnerable
	Based on habitat mapping ²	Australian grayling <i>(Prototroctes maraena)</i>	Vulnerable	Vulnerable

No listed threatened marine species were observed during field surveys. For a full list of species observed during field surveys, refer to Appendix 4.

6 LADY BARRON WHARF

Lady Barron is a seaside township located on the south coast of Flinders Island. It is the second largest town on Flinders Island, after Whitemark. The island is afforded some shelter from southerly swells and winds by Cape Barren Island, as well as a series of smaller islands located dotted through Franklin Sound, including Little Green Island, Little Dog Island and Big Dog Island (Figure 26). Within walking distance from the proposed site are eating and re-supply facilities. Lady Barron has an existing jetty, located within approximately 2 km of an airport.

The existing wharf is managed and operated by Tasports. Current uses are commercial and include embarkation of livestock. There may be usage conflicts between a working port and a safe harbour, particularly relating to odour and noise.

6.1 LAND TENURE

The land tenure at Lady Barron is characterized as an Authority Freehold owned by TasPorts (Figure 27; Figure 28). The land immediately north is characterized as a Public Reserve. A 4.5 km long Conservation Area exists within 300 m to the east of Lady Barron and extends 1-1.5 km from the shore into Adelaide Bay.

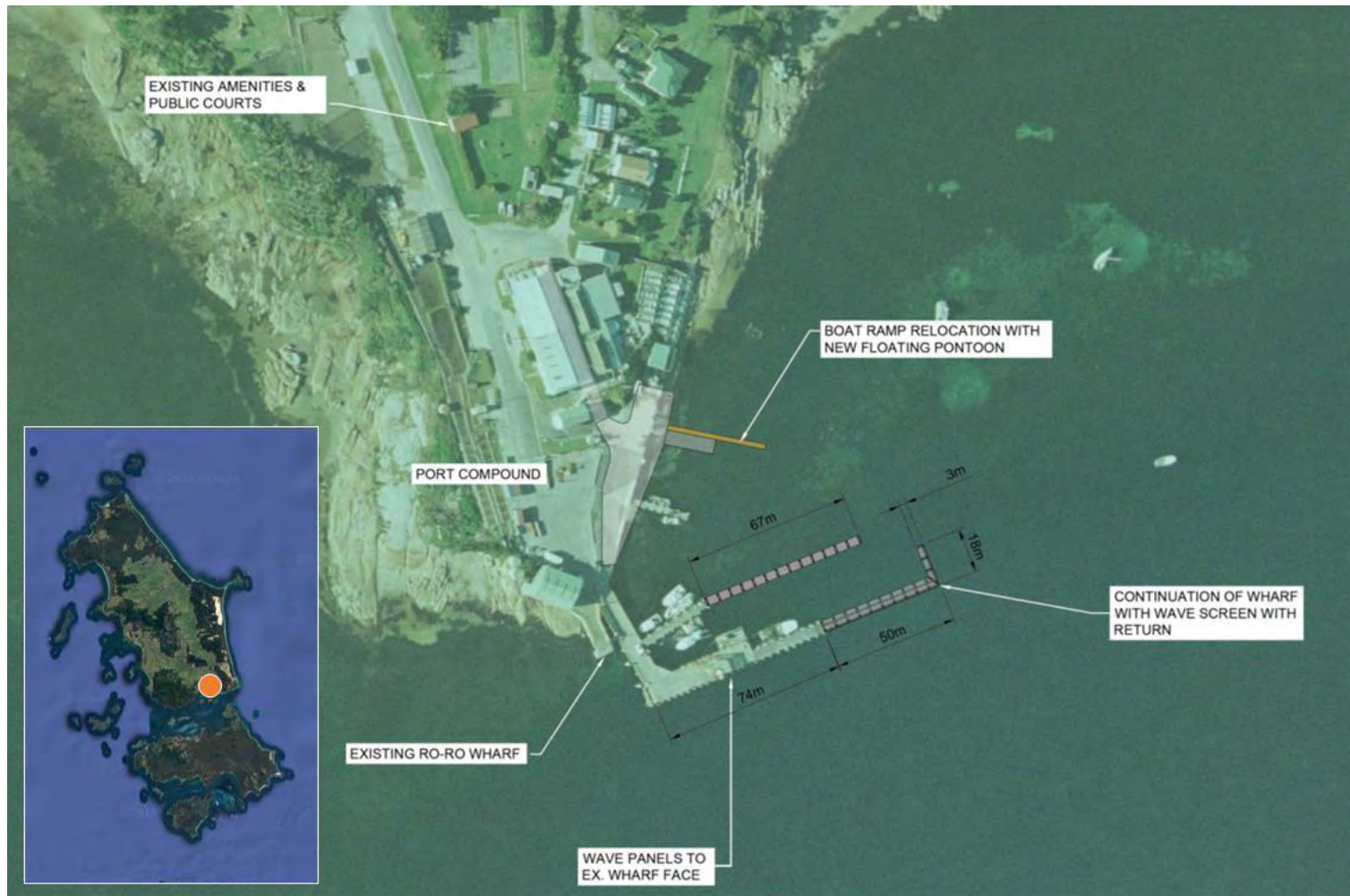


Figure 26 Map showing proposed development at Lady Barron Wharf (inset image from LISTmap, 2016. Engineering design drawings from Burbury Consulting, 2016).

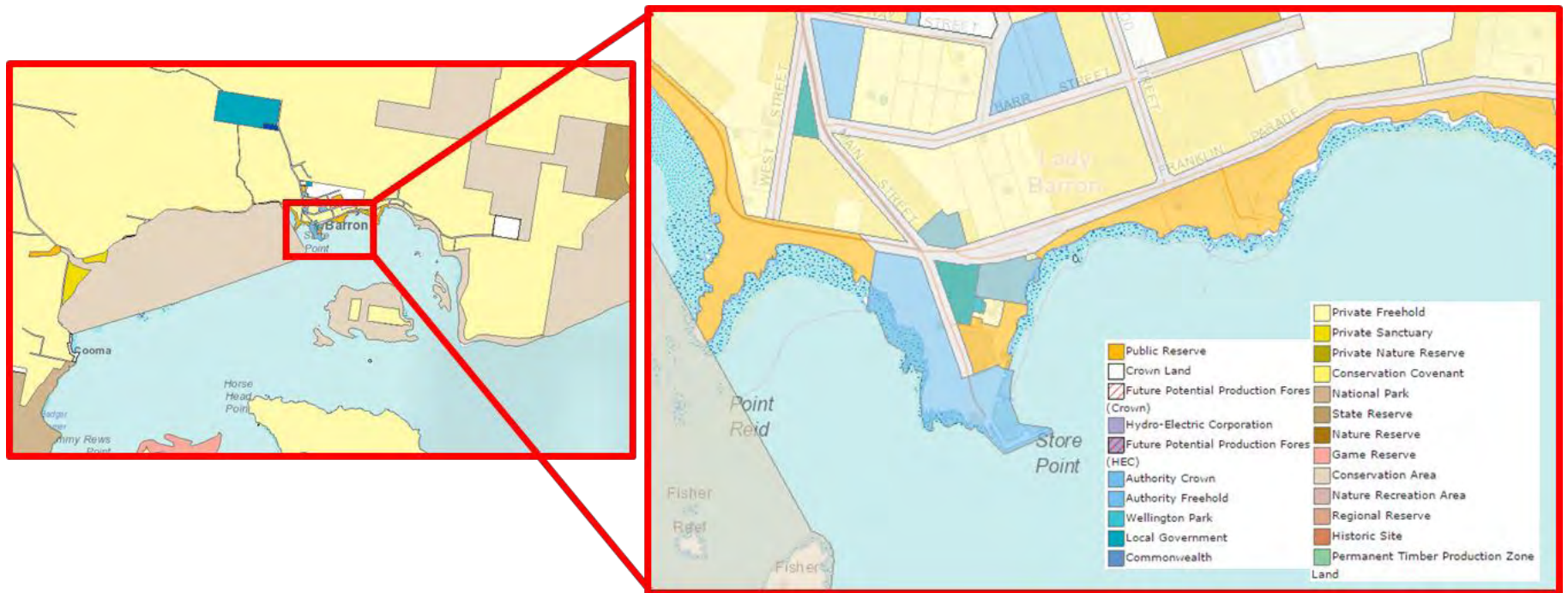


Figure 27 Map indicating land tenure of the proposed development site at Lady Barron Wharf (LISTmap, 2016)



Figure 28 Map showing land use and natural landmarks at Lady Barron Wharf (LISTmap, 2016)

6.2 GEOCONSERVATION

A search of the Tasmanian Geoconservation Database (TGD; 2016) determined that Lady Barron was not located in an area of geoconservation. Coastline to the east (approximately 2.5 km away) and west (approximately 3.5 km away) contained areas of geoconservation value (Figure 29).

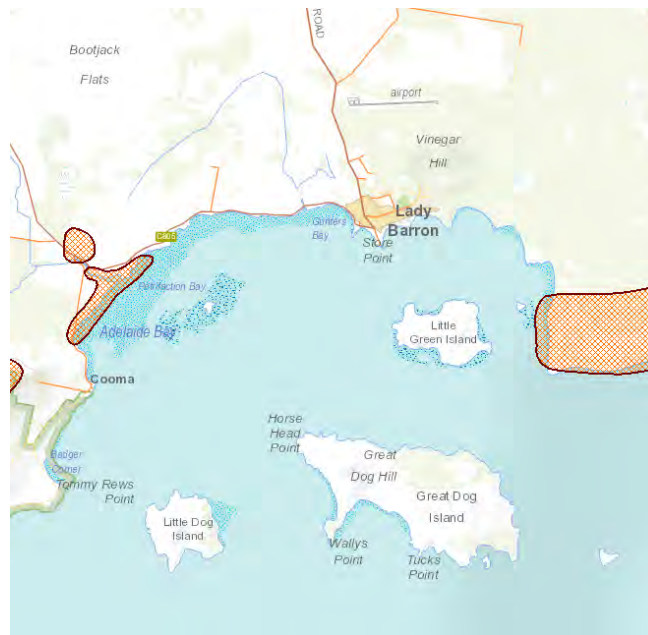


Figure 29 Geoconservational significance at Lady Barron (source: Tasmanian Geoconservation Database 2016)

6.3 SOCIAL VALUES

The Lady Barron Wharf area is the most modified of any of the sites surveyed. It hosts substantial development, including the jetty and working port. Considering the existing level of modification, visual amenity is unlikely to be a major issue for a development in the vicinity of the Lady Barron Wharf area. It is likely that local support for a marina development would be relatively high at Lady Barron Wharf, as an increase in boat visitation to the area would likely provide a boost to the local economy.

6.4 HYDROLOGY

Strong tidal currents are generated through Franklin Sound. In the deeper bathymetry around the Lady Barron Wharf, the strength of currents should be considered, particularly in regards to the proposed construction of a wave screen, which could cause an increase in current velocities passing under the screen and subsequently cause bottom scouring.

Swell is not considered to be an issue at this site, in comparison to sites located on the west coast which are significantly swell-affected.

6.5 HABITAT CHARACTERISATION

6.5.1 Intertidal Habitat

The intertidal zone around Lady Barron Wharf is highly modified already (Figure 30 and Figure 31).

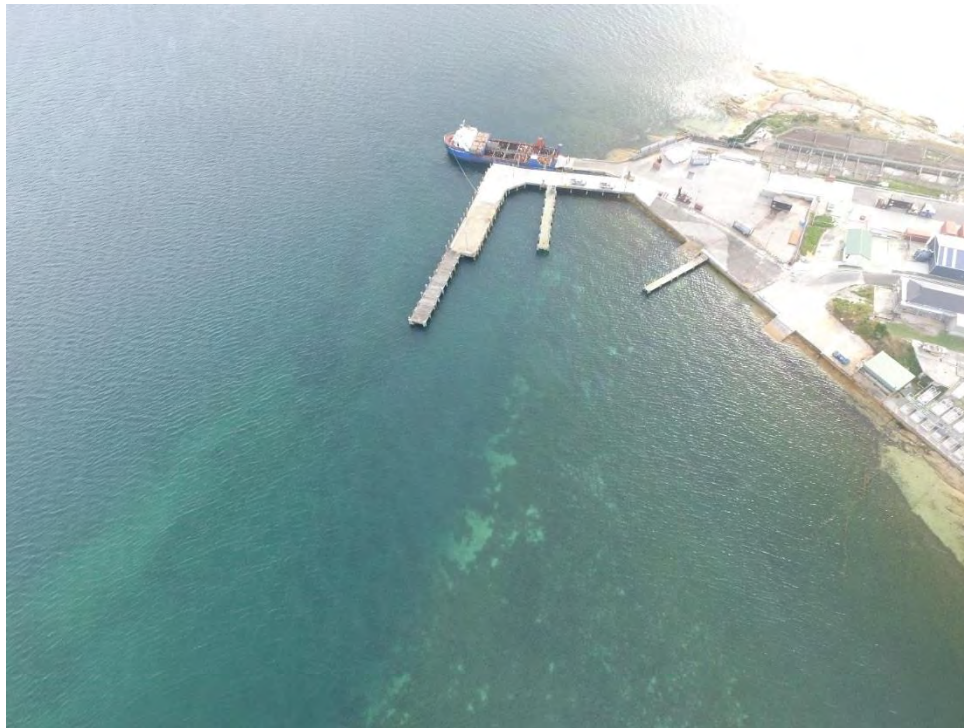


Figure 30 Aerial view of the Lady Barron Wharf study area.



Figure 31 Photo of the shoreward facing aspect from the main jetty at Lady Barron Wharf.

6.5.2 Subtidal Habitat

To characterise the subtidal habitat, two transects were swum by divers and video footage recorded: T1 ran approximately west to east along the alignment of larger existing finger jetty. T2 continued along the same alignment as T1 for approximately 65 m, before turning northwards on $\sim 90^\circ$ angle, continuing for ~ 30 m, then turning westwards and continuing approximately along the alignment of the smaller finger jetty for approximately 100m, terminating immediately north of the existing finger jetty (Figure 32). Video footage is available from Marine Solutions as AVCHD video files. A general swim was also conducted in the shallows immediately north of the smaller existing finger jetty.



Figure 32 Map showing positions of underwater video transects at Lady Barron Wharf.

A large amount of litter, including aluminium cans and glass bottles, was present in the study area under the wharf, particularly in the shallows (Figure 33a). Jetty pylons have been colonized by a range of plant and invertebrate life, including macroalgae, encrusting algae, ascidians, sponges and bryozoa (Figure 33c). The benthos can be characterized as soft unconsolidated sediment, with a mosaic of algal and seagrass growth. Predominant species included *Scaberia argardii*, *Caulerpa* cf. *geminata*, *Posidonia* sp. and *Heterozostera nigricaulis*.

The effects of a safe harbor development on the physical marine environment are anticipated to be lower at Lady Barron than at Trousers Point or Port Davies. Lady Barron has existing coastal developments, jetties, and comparatively higher boat traffic, and has therefore been more modified by anthropogenic impacts than the less developed sites (Port Davies and Trousers Point).



a) A range of debris, mostly aluminium cans, in the shallows near the shore.



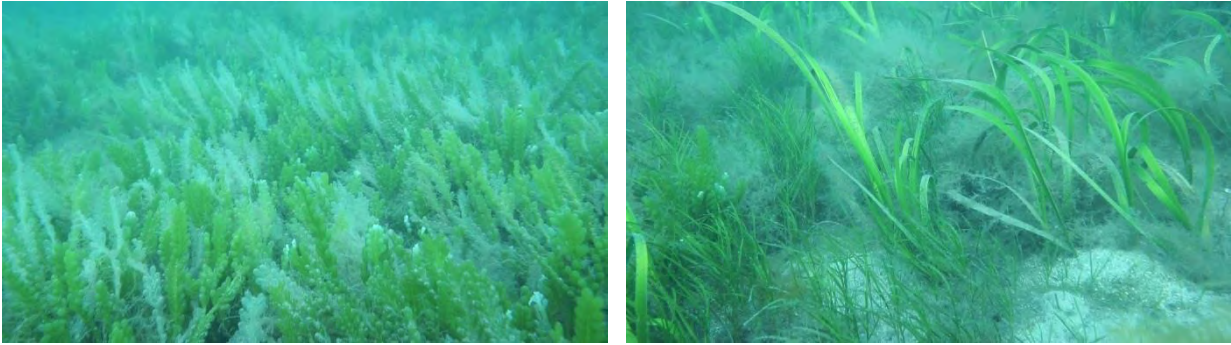
b) Sandy benthos with *Halophila* seagrass and *Scaberia* weed.



c) Piles have been colonized by a range of organisms including bryozoa, sponges, ascidians and macroalgae.



d) Organic matter is evident on the seabed surface.



e) *Caulerpa cf. geminata* was dense on the slope on T2b.

f) Seagrass including *Heterozostera nigricaulis* and *Posidonia* sp.

Figure 33 Images of subtidal habitat types around Lady Barron Wharf.

6.5.3 Bathymetry

The proposed development area was mapped using a vessel mounted Garmin GPS Map 551s running a dual frequency 50/200 kHz transducer. The water depth was logged every two seconds to *Seabed Mapper* running on a laptop computer. The depths were tidally and barometrically corrected for Chart Datum using the Bureau of Meteorology predictions from Lady Barron Harbour. Measurements are accurate to within +/- 0.2 m.

Bathymetric data was mapped with contour lines at maximum intervals of 0.2 m (Figure 34 and Figure 35). The bathymetric mapping of the area identified three distinct areas: a near-shore shallow flat of ~ 0 – 2 m, a band of ~ 2 – 7 m water depth, within which the proposed development will be located, and a deep channel of ~ 8 m + in the south of the study area. A distinct step running east/west, roughly on the same alignment as the smaller of the two existing finger jetties, divides the first and second of these zones; at this step, the depth increased by at least 4 m over a distance of ~ 20 m. The maximum depth recorded in the bathymetry survey was over 10 m, in a channel south of the proposed development area. The maximum depth in the immediate footprint of the proposed development was 7 m.

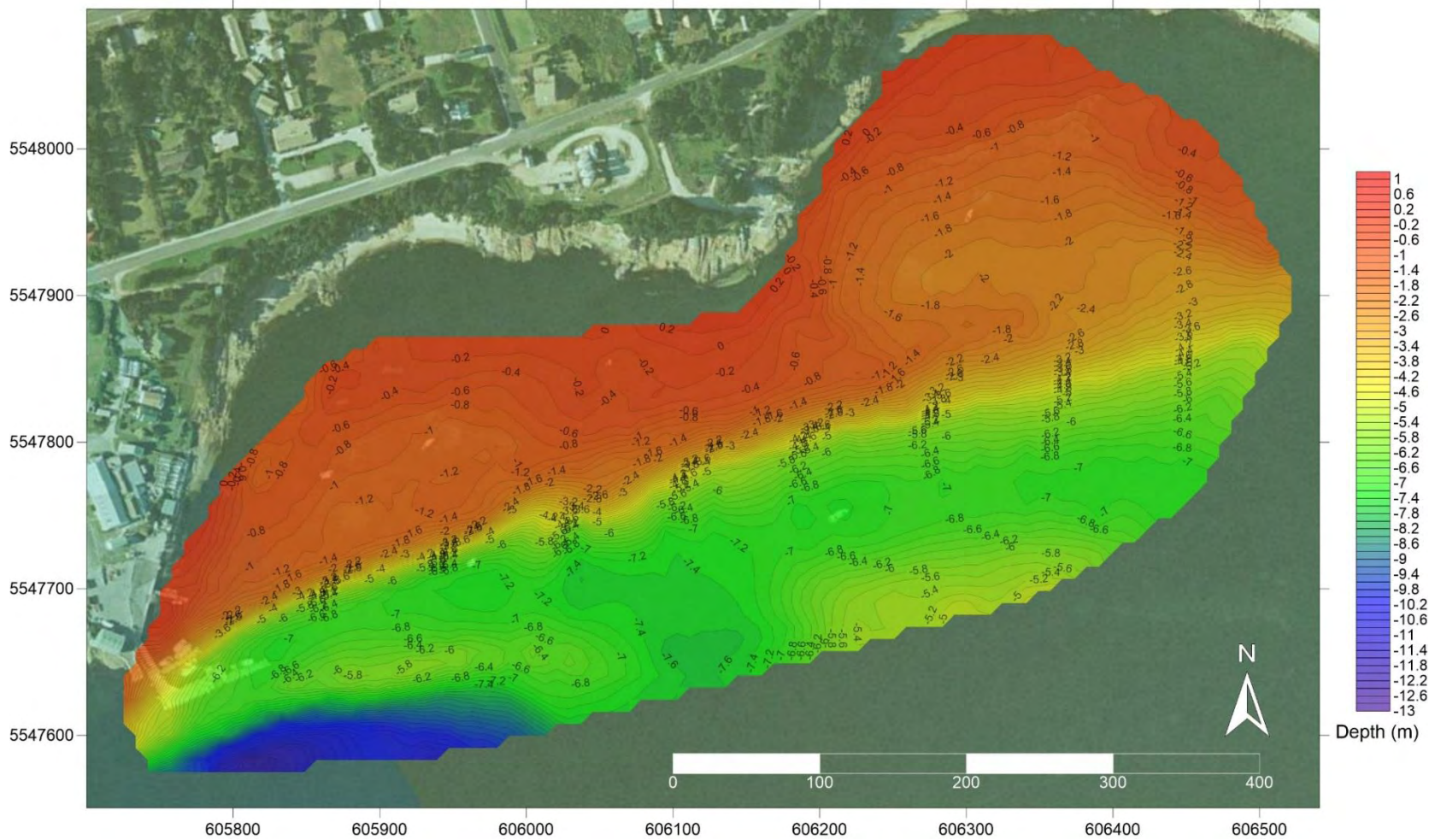


Figure 34 Bathymetric mapping of Lady Barron, encompassing the proposed development areas at both the wharf and slip area.

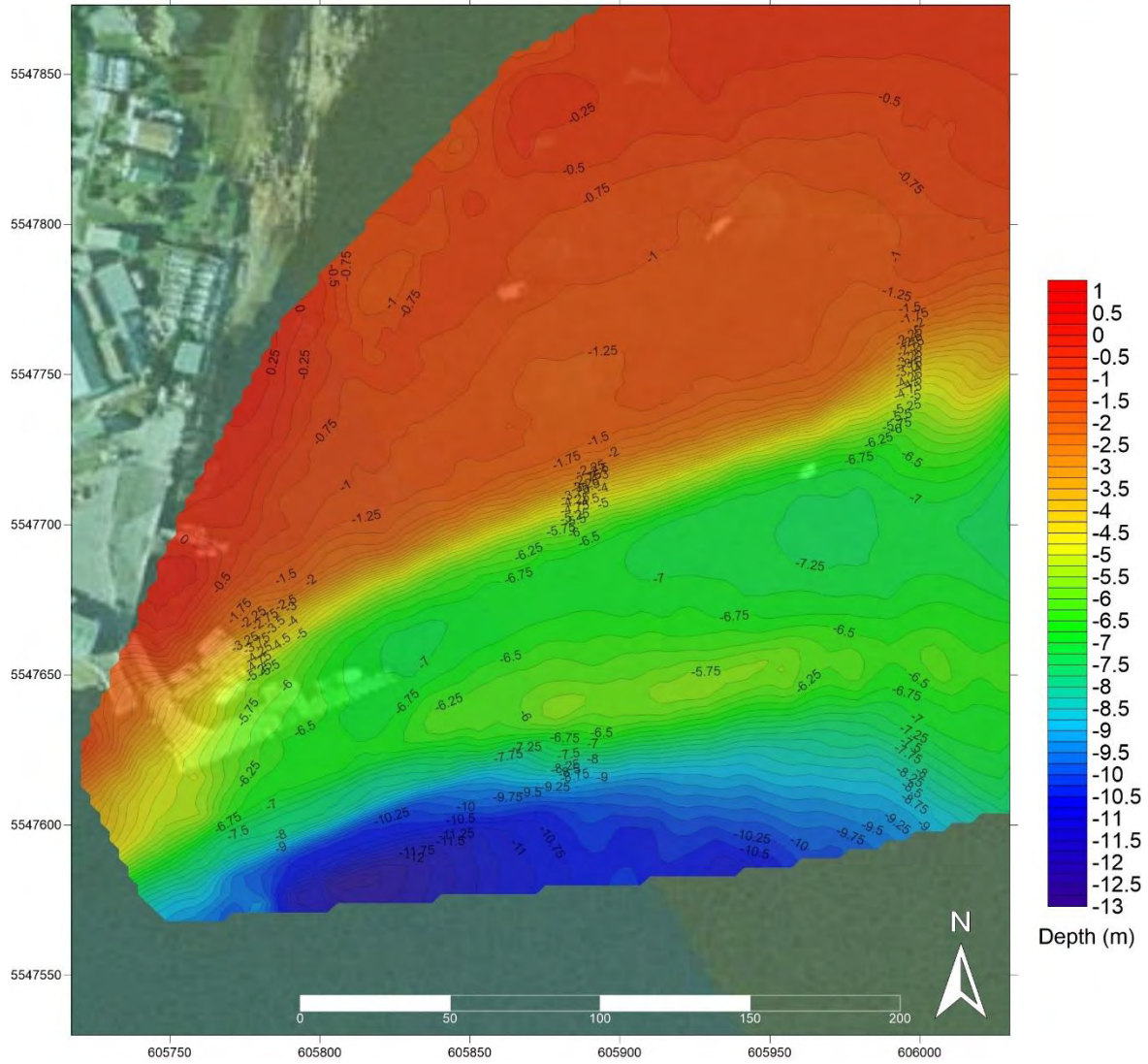


Figure 35 Bathymetric mapping of the proposed development area at Lady Barron Wharf.

6.6 AQUATIC FLORA AND FAUNA

Desktop searches of the Environmental Protection and Biodiversity Conservation (EPBC) Act's Protected Matters Search Tool (PMST) and DPIIWE's Natural Values Atlas (NVA) were conducted. Results are discussed in the sections below. For additional information regarding species listing legislation and species identified in these searches, refer to Appendix 7.

6.6.1 Protected Matters

The PMST identified 1 listed threatened community and 43 listed threatened species, including 29 birds, 1 fish, 1 frog, 3 marine mammals, 2 terrestrial mammals, 3 marine reptiles, 1 shark and 3 terrestrial plants. The search also identified protected species that 'may occur in the area' or are 'likely to occur in the area', including 29 syngnathid species (seahorses, sea dragons and pipehorses), 8 cetaceans and 2 seal species. The report is summarised in Table 9.

Table 9 Summary of findings of the EPBC Act Protected Matters Search Tool for Lady Barron.

	Item	# Identified by PMST	Notes
Matters of National Environmental Significance	World Heritage Properties	None	-
	National Heritage Places	None	-
	Wetlands of International Importance	2	- East coast cape barren island lagoons (within 10km of Ramsar site) - Logan lagoon (within Ramsar site)
	Great Barrier Reef Marine Park	None	-
	Commonwealth Marine Area	None	-
	Listed Threatened Ecological Communities	1	Subtropical and Temperate Coastal Saltmarsh
	Listed Threatened Species	43	(Refer to section 6.6.2)
	Listed Migratory Species	40	(Refer to Appendix 7)
Other Matters Protected by EPBCA	Commonwealth Land	None	-
	Commonwealth Heritage Places	None	-
	Listed Marine Species	75	(Refer to section 6.6.2)
	Whales and Other Cetaceans	11	(Refer to section 6.6.2)
	Critical Habitats	None	-
	Commonwealth Reserves Terrestrial	None	-
	Commonwealth Reserves Marine	None	-
Extra Information	State and Territory Reserves	9	-
	Regional Forest Agreements	1	Tasmanian RFA

Invasive Species	23	None are aquatic
Nationally Important Wetlands	None	-
Key Ecological Features (Marine)	None	-

There are 7 listed marine animal threatened species, including the green turtle, *Chelonia mydas*; loggerhead turtle, *Caretta caretta*; great white shark, *Carcharodon carcharias*; blue whale, *Balaenoptera musculus*, southern right whale, *Eubalaena australis*; and humpback whale, *Megaptera novaeangliae*. Subtropical and temperate coastal saltmarshes are also listed as a threatened ecological community which may occur in this area and is recorded as vulnerable. The threatened marine species/communities identified by the PMST are listed in Table 10 below.

Table 10 Threatened marine species/communities identified in a search of the Protected Matters Search Tool (EPBC Act) for Lady Barron. Note that the scope does not extend to terrestrial or avian biota.

Community or Species	EPBC Act Status	Type of Presence
Green Turtle <i>Chelonia mydas</i>	Vulnerable	Breeding likely to occur within area
Loggerhead Turtle <i>Caretta caretta</i>	Endangered	Breeding likely to occur within area
Leatherback Turtle <i>Dermochelys coriacea</i>	Endangered	Breeding likely to occur within area
Great White Shark <i>Carcharodon carcharias</i>	Vulnerable	Species or species habitat known to occur within area
Blue whale <i>Balaenoptera musculus</i>	Endangered	Species or species habitat likely occur within area
Southern right whale <i>Eubalaena australis</i>	Endangered	Species or species habitat known to occur within area
Humpback whale <i>Megaptera novaeangliae</i>	Vulnerable	Species or species habitat likely to occur within area
Subtropical and Temperate Coastal Saltmarsh	Vulnerable	Community likely occur within area

Additionally, there were 11 listed marine migratory species, including 6 marine mammal species, 3 marine reptile species, and 2 shark species. The proposed development is not expected to notably impact the migration of any species, as it will not result in any barriers to migratory routes.

6.6.2 Threatened and protected species

A Natural Values Atlas (2015) search determined that there are no verified records of threatened marine flora or fauna within a 500 m to 5000 m of the proposed development site. The Australian grayling (*Prototroctes maraena*) was identified as a species with overlapping distribution (within 500 m) based on habitat mapping (Table 11).

Table 11 Summary of threatened marine flora and fauna species identified in a search of the Natural Values Atlas for Lady Barron. Note that the scope does not extend to terrestrial or avian biota.

		Species	TSP Act listing	EPBC Act listing
Within 500 m radius	Based on habitat mapping ²	Australian grayling (<i>Prototroctes maraena</i>)	Vulnerable	Vulnerable
Within 5000 m radius	Based on habitat mapping ²	Australian grayling (<i>Prototroctes maraena</i>)	Vulnerable	Vulnerable

No listed threatened marine species were observed during field surveys. For a full list of species observed during field surveys, refer to Appendix 5.

² Not verified

7 LADY BARRON SLIP

The Lady Barron Slip site (Figure 36) is located approximately 500 m east of the Lady Barron Wharf site; therefore, it is also within walking proximity to the amenities of the Lady Barron township.

7.1 LAND TENURE

The land surrounding the Lady Barron Slip is Public Reserve (Figure 27, Figure 37).

7.2 GEOCONSERVATION

There are no areas of geoconservation significance in the immediate vicinity of the Lady Barron Slip. Refer to Section 6.2 for additional details.

7.3 SOCIAL VALUES

The Lady Barron Slip area is relatively modified, with an existing slip, rock boat ramp and road access. The area immediately behind the foreshore is residentially developed. Considering the existing level of modification, visual amenity is unlikely to be a major issue for a development in the vicinity of the Lady Barron Slip area. It is likely that local support for a marina development would be relatively high at Lady Barron Slip, as an increase in boat visitation to the area would likely provide a boost to the local economy.

There are a number of existing moorings throughout the study area, which would be removed or relocated should the proposed development proceed.



Figure 36 Map showing proposed development at Lady Barron Slip (inset image from LISTmap, 2016. Engineering design drawings from Burbury Consulting, 2016).



Figure 37 Map showing land use and natural landmarks at Lady Barron Slip (LISTmap, 2016).

7.4 HYDROLOGY

Strong tidal currents are generated through Franklin Sound. In the deeper bathymetry around the Lady Barron Slip, current velocities can be very high, however, the area of the proposed development is not subject to the brunt of these currents. Currents are significantly less at the slip site compared with the wharf site.

Swell is not considered to be an issue at this site, in comparison to sites located on the west coast which are significantly swell-affected.

7.5 HABITAT CHARACTERISATION

7.5.1 Intertidal Habitat

The intertidal habitat at Lady Barron Slip is somewhat modified already, with a semi-natural rock boat ramp and a disused slip (Figure 38). The intertidal zone is characterized by granite outcrops and boulders (Figure 7).

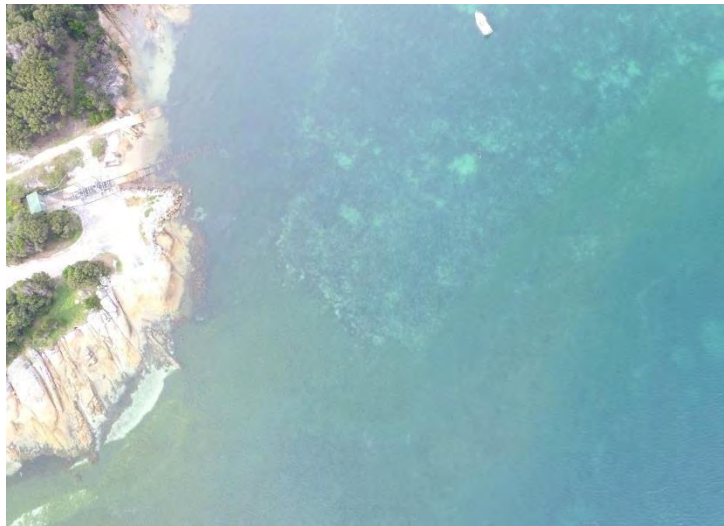


Figure 38 Aerial views of the Lady Barron Slip study area, showing some modification of the shoreline including a semi-natural rock boat ramp and an old slipway.



Figure 39 Photos of the intertidal zone, looking southwest (top) and northeast (bottom) from the boat ramp.

7.5.2 Subtidal Habitat

To characterise the subtidal habitat, two transects were swum by divers and video footage recorded (Figure 31). Video footage is available from Marine Solutions as AVCHD video files.

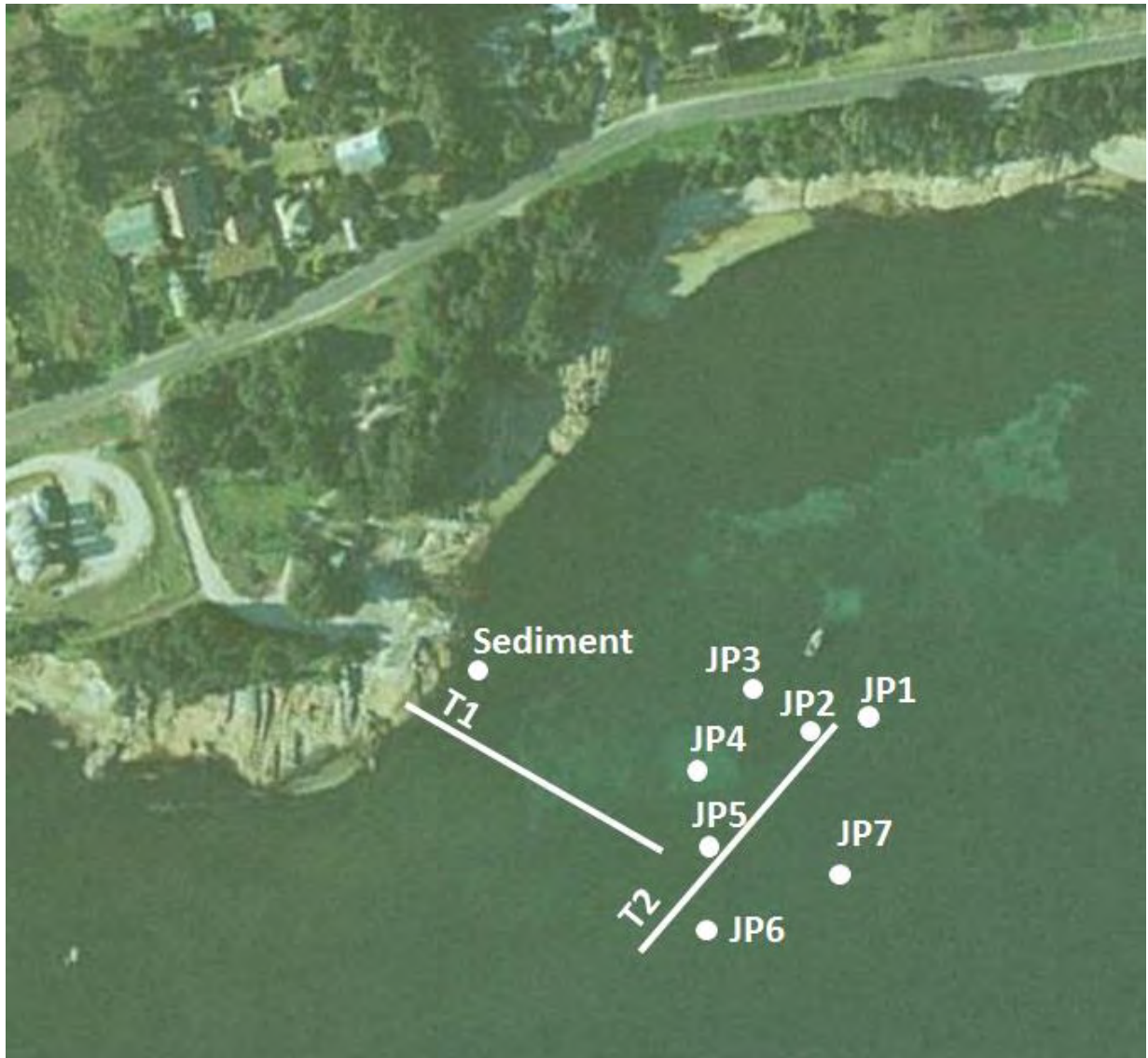


Figure 40 Map showing positions of underwater video transects, sediment sampling site and jet probing (JP) sites in the Lady Barron Slip study area.

From the shore along T1, the habitat graded quickly from granite to brown macroalgae to *Posidonia* seagrass beds. Continuing away from shore, *Posidonia* density decreased and dominant species changed to *Caulerpa cactoides*, *Scaberia agardhii* and *Heterozostera nigricaulis*. Approximately 90 m along the transect, the habitat returned to a dense bed of *Posidonia*. A general swim through the survey

area determined that large, dense patches of *Posidonia* seagrass were the dominant habitat type through the area.

There are areas of unconsolidated sand in the study area at Lady Barron Slip. Structures posing significant barriers to wave action or current flow are a risk of causing sand to bank up in their shelter, resulting in reduced water depths with could restrict navigability.



a) Brown macroalgae, predominantly *Sargassum*, in the shallows.



b) Macroalgae/seagrass interface in the shallows.



c) Brown algae *Scaberia agardhii*, and seagrasses *Heterozostera nigricaulis* and *Amphibolis antarctica* on sediment.



d) Dense, lush *Posidonia* seagrass bed

Figure 41 Images of subtidal habitat types around the Lady Barron Slip study area.

7.5.3 Bathymetry

The proposed development area was mapped using a vessel mounted Garmin GPS Map 551s running a dual frequency 50/200 kHz transducer. The water depth was logged every two seconds to *Seabed Mapper* running on a laptop computer. The depths were tidally and barometrically corrected for Chart Datum using the Bureau of Meteorology predictions from Lady Barron Harbour. Measurements are accurate to within +/- 0.2 m.

Bathymetric data was mapped with contour lines at maximum intervals of 0.2 m (Figure 34 and Figure 42). The bathymetry of the region was typical for a coastline, with depth increasing with distance from the shore. The maximum depth recorded in the bathymetry survey was over 7 m, in a channel south of the proposed development area. The maximum depth in the immediate footprint of the proposed development was ~2.4 m.

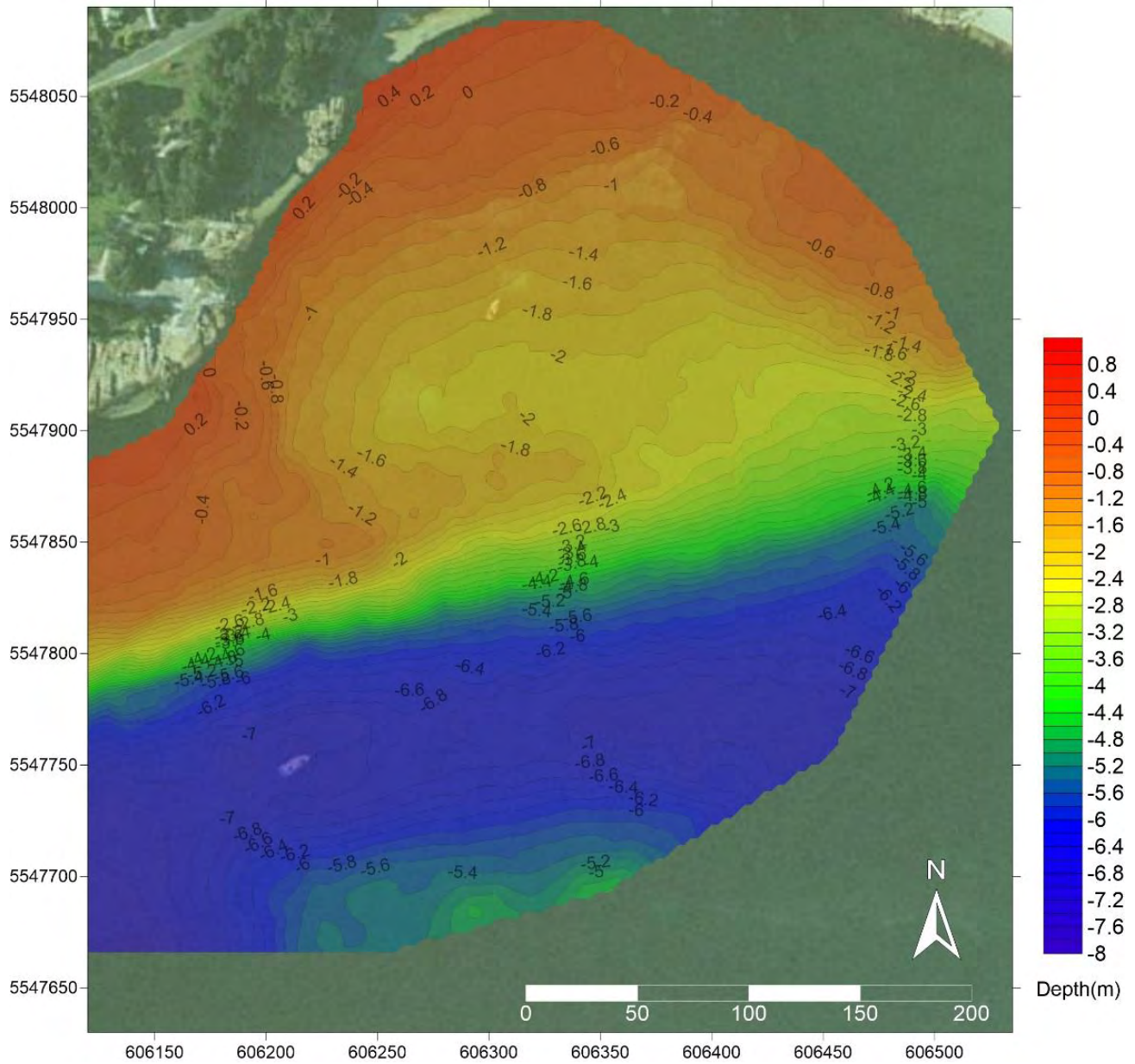


Figure 42 Bathymetric map of the proposed development area at Lady Barron Slip.

7.6 SEDIMENTS

Triplicate sediment cores were taken from within the study area, at a site selected for its close proximity to the slipway (Figure 40), and therefore considered to be likely a “worse-case” scenario for potential

contamination. Cores were combined, homogenized and split into two replicate samples, one of which was assessed volumetrically for particle size distribution, and one of which was analysed for sedimentary contaminants.

7.6.1 Particle Size

The sample was washed through a series of sieves (4 mm, 2 mm, 1 mm, 500 μm , 250 μm , 125 μm and 63 μm), and the content of each sieve was drained completely of water and transferred to a measuring cylinder, beginning with the coarsest sediment fraction (4 mm) and working down to the finest (63 μm). The volume of sediment measured in the measuring cylinder was recorded for each sieve size. The sediment fraction <63 μm was assumed to be the total volume of the sample minus the combined volume of all other size classes.

The sample was gravelly, comprised of relatively larger grain sizes and contained shell grit and pebbles. Organic matter was found in most grain sizes. A small amount of fine silt was present in the sample (Figure 44).



Figure 43 A diver collects sediment cores at Lady Barron Slip for particle size analysis. Organic material on the seabed is evident at the sampling site.

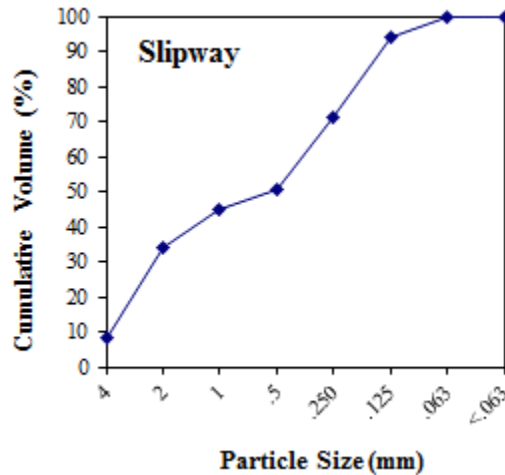


Figure 44 Particle size analysis from a sample at Lady Barron Slip. Note that grain size fractionation may be compromised by high levels of organic matter.

7.6.2 Contaminants

The sediment sample was placed into laboratory-supplied jars and stored on ice prior to transport to Analytical Services Tasmania (AST) for testing. Contaminant concentrations have been compared to the revised *ANZECC/ARMCANZ Guidelines for Fresh and Marine Water Quality* (ANZECC/ARMCANZ 2000) where available. These guidelines provide a set of interim sediment quality guideline (ISQG) trigger values by which to assess the risk those sediments may pose to the environment (Simpson *et al* 2005).

All results were below the ANZECC trigger values, apart from TBT which exceeded the ISQG-low trigger value. It is likely that elevated TBT in these sediments is a result of proximity to the slip. Results for contaminant analyses are summarised below in Table 12.

Table 12 Contaminant results for sediments from Lady Barron Slip. Note red indicates levels which have exceeded the ISQG-high limit and orange indicates levels which have exceeded the ISQG-Low trigger value.

	Analyte	Units	ISQG-Low*	ISQG-High*	Lady Barron Slip
Metals	Arsenic	mg/kg	20	70	2
	Cadmium	mg/kg	1.5	10	<0.5
	Cobalt	mg/kg	-	-	<1
	Chromium	mg/kg	80	370	3
	Copper	mg/kg	65	270	8
	Manganese	mg/kg	-	-	41
	Nickel	mg/kg	21	52	2
	Lead	mg/kg	50	220	4
	Zinc	mg/kg	200	410	12
	TBT	ng Sn/g	5	70	9.2
TPH	Total TPH	mg/kg	-	-	<100
	TPH C06-C09	mg/kg	-	-	<25
	TPH C10-C14	mg/kg	-	-	<25
	TPH C15-C28	mg/kg	-	-	<100
	TPH C29-C36	mg/kg	-	-	<100

* ANZECC sediment quality guidelines

7.6.3 Depth (Jet Probing)

A 2.0 metre jet probe was used to assess sediment depth at several locations in the study area. The ease in which the jet probe penetrated the sediment is indicative of mobile sediments.

No refusal of the jet probe was encountered at any of the 7 sites surveyed, indicating that penetrable sediments are found for at least the top 2 m of seabed.

7.7 AQUATIC FLORA AND FAUNA

Refer to Section 6.6 for results of desktop searches of the Environmental Protection and Biodiversity Conservation (EPBC) Act's Protected Matters Search Tool (PMST) and DPIPWE's Natural Values Atlas (NVA). For additional information regarding species listing legislation and species identified in these searches, refer to Appendix 7.

No listed threatened marine species were observed during field surveys. For a full list of species observed during field surveys, refer to Appendix 6.

8 ADDITIONAL POTENTIAL IMPACTS AND PROPOSED MITIGATION

8.1.1 Intertidal Community

Construction on the foreshore, increased human utilization of the area, and movement of equipment may affect the intertidal community. Such impacts may include trampling biota, erosion or habitat modification. To reduce potential disturbance, it is advised a construction corridor is created and human utilisation is restricted to the immediate vicinity. It is presumed less impact would occur at Lady Barron (both slip and wharf) due to the existing modification of the proposed site foreshore.

8.1.2 Subtidal Community

Physical disturbance of the seabed during the construction phase is likely to cause localised mortalities of benthic fauna through direct contact with construction materials. It would be prudent to avoid construction from late spring to early summer, as many species are most vulnerable to disturbance through these months, correlating with breeding/nursing seasons.

Acoustic disturbance during construction can adversely impact migratory fish and seabirds that rely on acoustic cues for social and reproductive behaviours. It is advised a 300 m diameter exclusion zone is applied around the construction site. If any species that may be threatened are sighted within the exclusion zone, construction works should be halted until such time that no marine mammal has been sighted for 30 min. A brief survey of the exclusion zone should be conducted prior to beginning construction on any day. A slow start-up of construction works is recommended to avoid causing unnecessary shock to fauna and to provide opportunity for mobile species to relocate. Development and implementation of a Construction Environmental Management Plan (CEMP) is recommended to ensure that environmental risk mitigation options are acknowledged and adhered to throughout construction.

8.1.3 Marine Pests

Translocation of introduced marine pests also presents a threat to the existing natural values of the proposed development area. Translocation and establishment of pest species can alter habitats and displace native, threatened and/or protected species. Translocation of pests may occur through numerous vectors, including ballast waters, biofouling, on people/equipment (e.g. footwear), etc.

Should marine construction equipment be sourced from outside Flinders Island, or be leaving this area to travel elsewhere at the completion of work, a management system for cleaning equipment should be introduced to mitigate the risk of spreading any introduced species. Existing regulations (prohibiting the translocation of pests or the collection of protected species under the *Living Marine Resources Management Act 1995*) provide appropriate controls by which to prevent translocation of pest species or removal of protected species.

9 CONCLUSIONS

This report identified potential issues that will require consideration in the process of planning construction. Considerations include the potential for interactions with threatened and protected species, foreshore and subtidal disturbance, and the potential loss of physical and cultural values. Of the many elements of the proposed development, the greatest known impact would be from the jetty structure, which was seen to compromise the scenic quality of the sites (particularly Trousers Point and Port Davies) and the impact of which could not be successfully mitigated. Throughout site selection, consideration should primarily be given to minimise adverse impacts on:

- Degradation of social and/or visual values;
- Loss, disturbance or destruction of the fauna and flora values;
- Degradation and destabilisation of soils; and
- Detrimental impact on Aboriginal heritage values.

In consideration of social, physical and ecological factors, the Lady Barron Slip site is considered the most suitable of those surveyed for the development of a marina. Such a development would also be feasible at Lady Barron Wharf and Port Davies, however, strong currents may present navigation hazards at Lady Barron Wharf, and access to shore-based amenities would need to be considered at Port Davies. Whitemark is considered a poor option on the basis of exposure to prevailing westerly weather conditions, combined with shallow water depths. The impact of a small marina development at Trousers Point would have a considerable impact on social value of the area, and strong community division to the proposal is considered likely for this site. The overall impact of a small marina development in combination with appropriate management will not adversely affect the overall landscape character of Lady Barron Slip, and no ecological contraventions to the development have been identified for this site.

10 REFERENCES

- Backhouse, G, Jackson, J and O'Connor, J (2008) Background and implementation information for the Australian grayling *Prototroctes maraena* National Recovery Plan, *Department of Sustainability and Environment*, Melbourne.
- Bryant S., Jackson J. (1999) Tasmania's Threatened Fauna Handbook: what, where and how to protect Tasmania's threatened animals. Threatened Species Unit, Parks and Wildlife Service, Hobart.
- Department of the Environment (2016). Subtropical and Temperate Coastal Saltmarsh in Community and Species Profile and Threats Database, Department of the Environment, Canberra. Available from: <http://www.environment.gov.au/sprat>. Accessed 2016-06-06T13:04:28AEST.
- Department of Primary Industries, Parks, Water and Environment (2015) Guidelines for natural values surveys – estuarine and marine development proposals, *Policy and Conservation Advice Branch*, Australian Government.
- Doran, N, and Horwitz, P (2010) *Engaeus martigener*. The IUCN Red List of Threatened Species 2010: e.T7737A12845688. Accessed 25/07/2016 <<http://dx.doi.org/10.2305/IUCN.UK.2010-3.RLTS.T7737A12845688.en>>
- Flinders Council (2016) <http://www.flinders.tas.gov.au/trousers-point> Date of access: 12/12/2016
- ListMap (2016) Land Information System Tasmania, Tasmanian Government. Accessed 15/07/2016 <<http://maps.thelist.tas.gov.au/listmap/app/list/map>>
- Navionics (2016) Navionics WebApp, Bathymetry Information. Accessed 29/07/2016 <<https://webapp.navionics.com/#boating@11&key=protFm%7Cvg%5B>>
- Simpson S.L. et al (2005) Handbook for Sediment Quality Assessment. CSIRO, New South Wales.

11 APPENDICES

Appendix 1. Operational Summary

Date	Personnel	Location	Start Time	Finish Time	Tide	Cloud Cover	Wind (knots)	Sea	Work Conducted
4/12/2016	S. Ibbott C. Cullen-Knox L. Smith	Whitemark	10:50	11:10	Low/ incoming	3/8	15 E	Calm	- Photo collection (including aerial)
		Trousers Point	11:30	13:30	Incoming	2/8	15 NE	Calm	- Underwater video transect - General swim - Jet probing - Sediment collection - Ecological characterization - Photo collection (including aerial) - Bathymetric surveying
		Lady Barron (Slip) and Lady Barron (Port)	17:30	18:00	Outgoing	5/8	<10 knot SW	Calm	- Aerial photo collection
5/12/2016	S. Ibbott C. Cullen-Knox L. Smith	Lady Barron (Slip)	09:30	13:30	Incoming	1/8	15 SW incr. 30+ SW	Small chop incr. to choppy	- Underwater video transects - General swim - Jet probing - Sediment collection

Date	Personnel	Location	Start Time	Finish Time	Tide	Cloud Cover	Wind (knots)	Sea	Work Conducted
									- Ecological characterization - Photo collection - Bathymetric mapping
6/12/2016	S. Ibbott L. Smith	Lady Barron (port)	07:15	08:15	Outgoing	7/8	10 SW	Very small chop	- Underwater video - General swim - Ecological characterization - Photo collection
	S. Ibbott C. Cullen-Knox L. Smith	Port Davies	10:30	13:30	Low/incoming	7/8 decr. to 1/8	10 knot W/SW incr. to 25 knot W	Calm incr. to choppy	- Underwater video transects - General swim - Ecological characterization - Photo collection - Bathymetric mapping
7/12/2016	S. Ibbott C. Cullen-Knox L. Smith	Port Davies	07:45	08:10	Incoming	4/8	10 knot W	Very small chop	- Aerial photos collected

Appendix 2. GPS Positions of Transects and Sampling Sites

	Site Name	Chart Zone	Easting	Northing
Port Davies	T1 start	55 G	574475.7	5570805
	T1 end	55 G	574559.4	5570852
	T1b end	55 G	574629.8	5570901
	T2 start	55 G	574492.1	5570785
	T2 end	55 G	574501.9	5570889
Trousers Point	T1 start	55 G	587811	5546256
	T1 end	55 G	587909	5546256
	T2 start	55 G	587793	5546325
	T2 end	55 G	587813	5546208
	Sediment sample	55 G	587831	5546256
Lady Barron Wharf	T1 start	55 G	605755	5547629
	T1 end	55 G	605802	5547644
	T2a start	55 G	605809	5547646
	T2b start	55 G	605871	5547672
	T2c start	55 G	605856	5547699
	T2c end	55 G	605763	5547661
Lady Barron Slip	JP1	55 G	606328.7	5547932
	JP2	55 G	606309.6	5547926
	JP3	55 G	606289.1	5547941
	JP4	55 G	606269.4	5547914
	JP5	55 G	606273.9	5547888
	JP6	55 G	606272.3	5547858
	JP7	55 G	606318	5547877
	Sediment sample	55 G	606196.4	5547949
	T1 end	55 G	606258.1	5547887
	T1 start	55 G	606172.6	5547939
	T2 end	55 G	606250.7	5547851
	T2 start	55 G	606315	5547926

Appendix 3. Species List – Port Davies

	Common Name	Scientific Name	Status Notes
Algae and Plants	Neptune's necklace	<i>Hormisira banksii</i>	
	Brown alga (ID unconfirmed)	<i>cf. Padina sp.</i>	
	Crayweed	<i>Ecklonia radiata</i>	
	Brown spaghetti weed	<i>Cladosiphon filum</i>	
	Long-filament Caulerpa	<i>Caulerpa longifolia</i>	
	Caulerpa bubbles	<i>Caulerpa sp.</i>	

	Fern Caulerpa	<i>Caulerpa flexilis</i>	
	Forked codium	<i>Codium cf. duthiae</i>	
	Dead mans' fingers	<i>Codium fragile</i>	
	Sea apples	<i>Codium pomoides</i>	
	Deciduous sargassum	<i>Sargassum dicipiens</i>	
	Smooth ballweed	<i>Colpomenia peregrina</i>	
	Unidentified Sargassum	<i>Sargassum sp.</i>	
	Rosy coralline	<i>Hailptilon roseum</i>	
	Strapweed	<i>Posidonia sp.</i>	
	Mueller's forkweed	<i>Dictyopterus muelleri</i>	
	Wireweed	<i>Amphibolis antarctica</i>	
	Black-stemmed eelgrass	<i>Heterozostera nigricaulis</i>	
Invertebrates	Tube worm	<i>Galeolaria caespitosa</i>	
	Ascidian	<i>Pyura sp.</i>	
	Sponge	(ID unconfirmed)	
	Gorgonian fan	<i>Gorgonia sp.</i>	
	Lace bryozoan	<i>Triphyllozoon sp.</i>	
	Vermilion biscuit star	<i>Pentagonaster dubeni</i>	
	Nectria seastar	<i>Nectria sp.</i>	
	Many-spotted seastar	<i>Fromia polypora</i>	
	Black-lipped abalone	<i>Haliotis rubra</i>	
	Green-lipped abalone	<i>Haliotis laevigata</i>	
	Purple urchin	<i>Heliocidaris erythrogramma</i>	
	Siphon shell	<i>Siphonaria</i>	
Fish	Blue-throat wrasse	<i>Notolabrus tetricus</i>	
	Brown-striped leatherjacket	<i>Meuschenia australis</i>	
	Leatherjacket	<i>Meuschenia flavolineata</i>	
	Horseshoe leatherjacket	<i>Meuschenia hippocrepi</i>	
	Blotch-tailed hulafish	<i>Trachinops caudimaculatus</i>	
	Magpie perch	<i>Cheilodactylus nigripes</i>	
	Silver sweep	<i>Scorpiis lineolata</i>	
	Southern Goatfish	<i>Upeneichthys vlamingii</i>	
	Old wife	<i>Enoplosus armatus</i>	
	Scalyfin	<i>Parma victoriae</i>	
	Dusky morwong	<i>Dactylophora nigricans</i>	
	Globefish	<i>Diodon nictemerus</i>	
	Wood's siphonfish	<i>Siphamia cephalotes</i>	
	Purple wrasse	<i>Notolabrus fucicola</i>	
	Common bullseye	<i>Pempheris multiradiata</i>	
Little rock whiting	<i>Neodax balteatus</i>		

Appendix 4. Species List – Trousers Point

	Common Name	Scientific Name	Status Notes
Algae and Plants	Neptune's necklace	<i>Hormisira banksii</i>	
	Rosy coralline	<i>Halmitilom roseum</i>	
	Crayweed	<i>Ecklonia radiata</i>	
	Fern Caulerpa	<i>Caulerpa flexilis</i>	
	Browns Caulerpa	<i>Caulerpa brownii</i>	
	Tangleweed	<i>Acrocarpia</i> sp.	
	Dead man's fingers	<i>Codium fragilis</i>	
	Zigzag Cystophora	<i>Cystophora monoliformis</i>	
	Three-branched Cystophora	<i>Cystophora monolifera</i>	
	Cube-leaved cystophora	<i>Cystophora torulosa</i>	
	Brown fingerweed	<i>Scaberia agardhii</i>	
	Broad-leaved Sargassum	<i>Sargassum fallax</i>	
	Branched daggerweed	<i>Xiphophora chondrophylla</i>	
	Filamentous hookweed	<i>Hypnea ramentacea</i>	
	Strapweed	<i>Posidonia</i> sp.	
	Wireweed	<i>Amphibolis antarctica</i>	
Black-stemmed eelgrass	<i>Heterozostera nigricaulis</i>		
Invertebrates	Tube worm	<i>Galeolaria caespitosa</i>	
	Feather star	<i>Comanthus tasmaniae</i>	
	Black-lipped abalone	<i>Haliotis rubra</i>	
	Flea mussel	<i>Limnoperna pulex</i>	
	Mosaic seastar	<i>Plectaster</i> sp.	
	Urchin	<i>Helicidaris</i>	
	Siphon shell	<i>Siphonaria</i>	
Fish	Castelnau's wrasse	<i>Dotalabrus aurantiacus</i>	
	Blue-throat wrasse	<i>Notolabrus tetricus</i>	
	Senator wrasse	<i>Pictilabrus laticlavus</i>	
	Brown-striped leatherjacket	<i>Meuschenia austrais</i>	
	Yellow-striped leatherjacket	<i>Meuschenia flavolineata</i>	
	Horseshoe leatherjacket	<i>Meuschenia hippocrepis</i>	
	Magpie perch	<i>Cheilodactylus nigripes</i>	
	White-ear	<i>Parma microlepis</i>	
	Globefish	<i>Diodon nichthemerus</i>	
	Rainbow fish	<i>Odax acroptilus</i>	
	Luderick	<i>Girella tricuspidata</i>	
	Sea sweep	<i>Scorpis aequipinnis</i>	
	Marblefish (stinky groper)	<i>Aplodactylus arctidens</i>	
	Goatfish	<i>Upeneichthys vlamingii</i>	
	Old wife	<i>Enoplosus armatus</i>	
Scalyfin	<i>Parma victoriae</i>		

	Dusky morwong	<i>Dactylophora nigricans</i>	
	Blue-arsed whiting	<i>Haletta semifasciata</i>	
	Silver trevally	<i>Pseudocaranx georgianus</i>	
	Spotted stingaree	<i>Urolophus gigas</i>	
	Zebrafish	<i>Girella zebra</i>	
	Smooth stingray	<i>Dasyatis brevicaudata</i>	
	Cardinalfish	ID not confirmed	
	Bullseye	<i>Pempheris sp.</i>	
	Little rock whiting	<i>Neodax balteatus</i>	

Appendix 5. Species List – Lady Barron Wharf

	Common Name	Scientific Name	Status Notes
	Crayweed	<i>Ecklonia radiata</i>	
	Caulerpa, possibly bubble or cactus caulepa	<i>Caulerpa cf. geminata</i>	
	Caulerpa	<i>Caulerpa sp.</i>	
	Amulet caulerpa	<i>Caulerpa hodgkinsoniae</i>	
	Cystophora	<i>Cystophora expansa</i>	
	Cystophora	<i>Cystophora retroflexa</i>	
	Three-branched cystophora	<i>Cystophora sp. cf monilifera</i>	
	Brown fingerweed	<i>Scaberia agardhii</i>	
	Broad-leafed Sargassum	<i>Sargassum fallax</i>	
	Strapweed	<i>Posidonia sp.</i>	
	Southern paddlegrass	<i>Halophila australis</i>	
	Wireweed	<i>Amphibolis antarctica</i>	
	Black-stemmed eelgrass	<i>Heterozostera nigricaulis</i>	
Invertebrates	Tube worm	<i>Galeolaria caespitosa</i>	
	Sponges	(species unconfirmed)	
	Doughboy scallop	<i>Mimachlamys asperrimus</i>	
	Lace bryozoan	<i>Triphyllozoon sp.</i>	
	Southern fanworm	<i>Sabella sp.</i>	
	Granular seastar	<i>Cf. Uniophora granifera</i>	
	Biscuit star	<i>Tosia magnifica</i>	
Fish	Blue-throat wrasse	<i>Notolabrus tetricus</i>	
	Magpie perch	<i>Cheilodactylus nigripes</i>	
	Southern Goatfish	<i>Upeneichthys vlamingii</i>	
	Long fin pike	<i>Dinolestes lewini</i>	
	Silver trevally	<i>Pseudocaranx georgianus</i>	
	Mado	<i>Atypichthys strigatus</i>	
	Zebrafish	<i>Girella zebra</i>	

	Stingaree	<i>Urolophus</i> sp.	
	Smooth stingray	<i>Dasyatis brevicaudata</i>	
	Blue-arsed whiting	<i>Halettasemifasciata</i>	
	Little rock whiting	<i>Neodax balteatus</i>	

Appendix 6. Species List – Lady Barron Slip

	Common Name	Scientific Name	Status Notes
Algae and Plants	Neptune's necklace	<i>Hormisira banksii</i>	
	Crayweed	<i>Ecklonia radiata</i>	
	Amulet Caulerpa	<i>Caulerpa hodgkinsoniae</i>	
	Cactus Caulerpa	<i>Caulerpa cactoides</i>	
	Browns Caulerpa	<i>Caulerpa brownii</i>	
	Brown fingerweed	<i>Scaberia agardhii</i>	
	Lace ballweed	<i>Hydroclathrus</i> cf. <i>clathratus</i>	
	Smooth ballweed	<i>Colpomenia peregrina</i>	
	Three-branched cystophora	<i>Cystophora</i> sp. cf. <i>monilifera</i>	
	Expansive cystophora	<i>Cystophora</i> sp. cf. <i>expansa</i>	
	Sea lettuce	<i>Ulva</i>	
	Broad-leafed Sargassum	<i>Sargassum fallax</i>	
	Strapweed	<i>Posidonia</i> sp.	
	Wireweed	<i>Amphibolis antarctica</i>	
	Black-stemmed eelgrass	<i>Heterozostera nigricaulis</i>	
Invertebrates	Tube worm	<i>Galeolaria caespitosa</i>	
	Red crab (subtidal)	(Species unconfirmed)	
	Black crab (intertidal)	(Species unconfirmed)	
	Sponge	(species unconfirmed)	
	Mussels	(species unconfirmed)	
	Scallop	<i>Cf. Equichlamys bifrons</i>	
	Siphon shell	<i>Siphonaria</i> sp.	
Fish	Banjo ray	<i>Trygonorrhina fasciata</i>	
	Blue-throat wrasse	<i>Notolabrus tetricus</i>	
	Globefish	<i>Diodon nichthemerus</i>	
	Blenny	<i>Parablennius tasmanianus</i>	
	Goby	(Species unconfirmed)	
	Goatfish	<i>Upeneichthys vlamingii</i>	
	Spotted stingaree	<i>Urolophus gigas</i>	

Appendix 7. Aquatic Flora and Fauna: Supplementary Information

Threatened species are protected under the *Threatened Species Protection Act 1995* (TSPA, Tasmanian state legislation) and/or the *Environment Protection and Biodiversity Conservation Act 2000* (EPBC Act, Australian government legislation). Under the TSPA, no listed species is allowed to be collected, disturbed, damaged or destroyed without a permit. Under the EPBC Act, any action with significant impact on a listed threatened species and/or community is prohibited without approval (EPBC Act Section 18 and 18A).

In addition to threatened species legislation, the *Fisheries (General and Fees) Regulations 2006* under the *Living Marine Resources Management Act 1995* (LMRMA) prohibits the taking/possession of a number of marine species, including syngnathids (seahorses, seadragons and pipehorses), handfish, threefin blennies, limpets/false limpets of three superfamilies, and five species of shark. Additional species are protected by the schedules of the *Wildlife (General) Regulations 2010* (Regulations under the *Nature Conservation Act 2002* [NCA]), under which a person must not take, buy, sell or have possession of any protected wildlife or any product of any protected wildlife without a permit.

The Natural Values Atlas (NVA) is a centralized database on Tasmanian flora and fauna, including threatened species and communities. The NVA is managed by the state's Department of Primary Industries, Parks, Water and Environment (DPIPWE). The EPBC Act Protected Matters Search Tool (PMST) is managed by the Department of the Environment. The PMST helps identify whether protected matters, or matters of national environmental significance (as stipulated in the *Environment Protection and Biodiversity Conservation Act 1999*), are likely to occur in a given area of interest. The PMST was used to identify protected matters relating the study areas, with a buffer of 5000 m.

Species that were identified by DPIPWE's Natural Values Atlas or by the EPBC Protected Matters Search Tool as occurring or likely to occur in any of the study areas investigated within this report are discussed in the following sections:

Australian Grayling

The Australian grayling (*Prototroctes maraena*) was identified in an NVA search as potentially occurring within 500 m of all potential study areas based on habitat mapping; however, there were no verified records of its presence.

The Australian grayling is native to Tasmania and southeast mainland Australia. Australian grayling have a diadromous lifecycle, inhabiting fresh water streams as adults, and migrating to coastal seas as larvae. Spawning takes place in late spring/early summer (Bryant and Jackson, 1999). Larvae are transported to sea in stream/river currents, and return as migrating juvenile's approximately 4-6 months later (Bryant and Jackson, 1999).

The most serious threat facing the Australian grayling population is barriers to migration, such as damming. Additionally, river regulation, loss of riparian vegetation, sedimentation, and sand and gravel extraction have previously been proposed as threatening processes (Backhouse *et al*, 2008).

Sedimentation during marina construction and loss of riparian vegetation may pose a threat to the local Australian grayling population.

Marine Mammals

All cetaceans are protected under the *EPBC Act 2000*. The NVA identified 1 verified record of a marine mammal (humpback whale) within 5000 m of Trousers Point.

The PMST for the Lady Barron study site identified 1 cetacean species that is 'known to occur in the area', 2 cetacean species 'likely to occur in the area', 8 cetacean species that 'may occur in the area', and 2 seals that 'may occur in the area'. The PMST for the Port Davies study area identified 2 cetacean species that are 'known to occur in the area', 1 cetacean species 'likely to occur in the area', 9 cetacean species that 'may occur in the area', and 2 seals that 'may occur in the area'. The PMST for Trousers Point identified 1 cetacean species that is 'known to occur in the area', 2 cetacean species 'likely to occur in the area', 8 cetacean species that 'may occur in the area', and 2 seals that 'may occur in the area'.

Acoustic disturbance during construction can affect some marine mammals that rely on acoustic cues for social and reproductive behaviours. A 300 m diameter exclusion zone should be applied around the construction site; should any marine mammals be sighted within the exclusion zone, construction works



should be halted until such time that no marine mammal has been sighted for 30 min. A brief survey of the exclusion zone should be conducted prior to beginning construction on any day. A slow start-up of construction works is recommended to avoid causing unnecessary shock to fauna and to provide opportunity for mobile species to relocate.

Great White Shark

Although great white sharks (*Carcharodon carcharias*) are known to occur within the area, they are unlikely to be adversely impacted as they are a primarily oceanic species. The primary threat to great white sharks is commercial fishing rather than shallow coastal development. Therefore, small-scale coastal development is not expected to impact on this species at local, regional or state-wide levels.

Marine turtles

The green turtle (*Chelonia mydas*), leatherback turtle (*Dermochelys coriacea*) and loggerhead turtle (*Caretta caretta*) were identified in the PMST as 'breeding likely to occur within area' for all study sites. All three turtle species are native to the coastal waters of Australia. The loggerhead turtle is more likely to occur in tropical and sub-tropical waters.

The main processes threatening these turtles are harvesting of their eggs, hunting of the adults, bycatch, wildlife trade and loss of nesting beaches. No turtle species are known to nest on Flinders Island beaches; therefore the development of a marina is not expected to impact any marine turtles.

Subtropical and Temperate Coastal Saltmarsh

Subtropical and temperate coastal saltmarsh communities were identified as 'likely to occur within area' of all study sites. This community typically occurs in coastal regions with some tidal connection including supratidal areas. These areas are characterized by sand, mud or coastal clay substrate. The vegetation consists of dense to patchy areas of coastal saltmarsh plant species including salt-tolerant herbs, shrubs or grasses and succulents.

Due to the marine nature of the proposed development it is unlikely that it will impact on coastal saltmarsh communities.

Gunn's Screwshell

The Gunn's screw shell is a small turritellid gastropod that is endemic to Australia. The species can attain lengths of up to 69 mm and have been recorded from shallow depths to at least 140 m in depth.

DPIPWE (2015) recommend a targeted survey is conducted to ascertain the potential impact of proposed developments on the Gunn's screw shell population in the vicinity of Trousers Point.

Giant Kelp Marine Forests

The giant kelp forests of South East Australia ecological community was identified as 'may occur within area' at the Port Davies and Trousers Point study sites. Giant kelp (*Macrocystis pyrifera*) typically grows at depths greater than 8 m below sea level and forms a closed or semi-closed surface or sub-surface canopy. The giant kelp marine forests were listed as endangered under the EPBC Act because the ecological community has undergone substantial decline in geographic distribution to the extent that regeneration is unlikely within the near future, even with positive human intervention (TSSC, 2012).

The key threats to giant kelp forests include increasing sea surface temperatures, changes in weather patterns, changes in large scale oceanographic conditions, changes in nutrient availability, and range extension of invasive species that can predate on the ecological community. These threats are primarily driven by climate change. Other threats include impacts on water quality from land-based activities and aquaculture (TSSC, 2012).

Given the historical verified presence of giant kelp at Port Davies or Trousers Point, potential impacts may arise from berthing vessels introducing marine pests to the area which could predate on the kelp community. Additionally, if there is a community within the direct vicinity of the proposed development site the construction of a marina and the associated vessel movement once the marina is established could interfere with giant kelp growth in the immediate vicinity. A site inspection will be required to determine the vulnerability to the proposed development.

No Giant Kelp (fitting the criteria for threatened status or otherwise) was seen during field surveys at any of the sites investigated.