

EIMR Conference, Stornoway, 30 April–1 May 2014 (<http://www.eimr.org/>)

Summary Paper

Title: Development and Consenting of Carnegie Wave Energy's *Perth Wave Energy Project*, Experiences from Down Under

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Introduction

Carnegie Wave Energy Limited is the inventor, developer and 100 % owner of the CETO wave energy technology. CETO is designed to extract energy from ocean waves to generate clean, renewable and emission-free electricity and desalinated water. Carnegie is based in North Fremantle, Western Australia and is publically listed on the Australian Stock Exchange.

The CETO technology has been under development for over 10 years from initial concept to demonstration of a single commercial scale CETO unit in the open ocean off Western Australia in 2011. Carnegie is now focussed on the construction and operation of a commercial CETO power generation plant, known as the *Perth Wave Energy Project* (PWEP or Project).

The AU\$35 m (\approx £21 m) *Perth Wave Energy Project* will be the world's first grid and water mains-connected wave energy project and will use Carnegie's CETO wave energy technology. The PWEP will be located at Garden Island, Western Australia, home to Fleet Base West, Australia's largest naval base, as well as a nationally-listed heritage site (Figure 1).

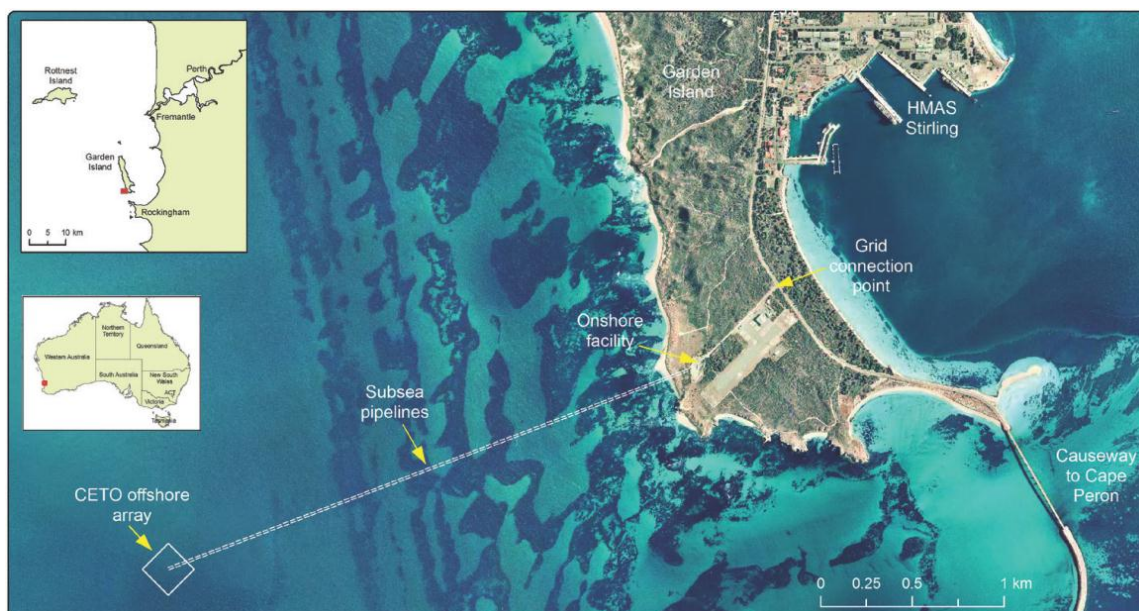


Figure 1. Perth Wave Energy Project Location

The PWEP is supported by AU\$22 m (\approx £13 m) of grant funding from the Australian Federal Government's Emerging Renewables Program and Clean Technology Innovation Program, and the Western Australian State Government's Low Emissions Energy Development fund. The PWEP will supply electricity and water to the Australian Department of Defence.

The onshore and offshore aspects cover multiple jurisdictions requiring a range of Federal, State and Local government permits and approvals. Given the novel nature of the project, there was little precedent available, hence a consenting strategy was developed in consultation with the regulator

and other key stakeholders using local and international experience. Carnegie has undertaken an extensive environmental impact assessment for all elements of the PWEP, using in-house and external environmental experts. This has been further supported by a comprehensive community consultation program that commenced during the CETO3 deployment in 2011 and continued throughout the PWEP. Carnegie also proactively carries out targeted environmental monitoring and assessment, including fauna interaction and device-made underwater sound, to identify and characterise potential environmental effects and further reduce adverse effects through sound environmental management and adaptable design.

The PWEP has been assessed as having relatively low potential risk and all permits and approvals granted. This reflects appropriate site selection, adaptable project design, thorough environmental impact assessment and extensive early and ongoing stakeholder consultation. This presentation will share Carnegie’s strategy for developing and consenting the *Perth Wave Energy Project*, the targeted environmental monitoring and assessment and community consultation undertaken, lessons learned and application to future CETO project development.

Legislative Framework

The PWEP requires a range of environmental approvals from the Australian Government, including Department of Defence (Defence), and the Government of Western Australia (Figure 2). Garden Island is Commonwealth-owned and is an active defence base. As such environmental management and approvals on Garden Island are managed by Defence, in accordance with the *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act 1999)* and Defence policy.

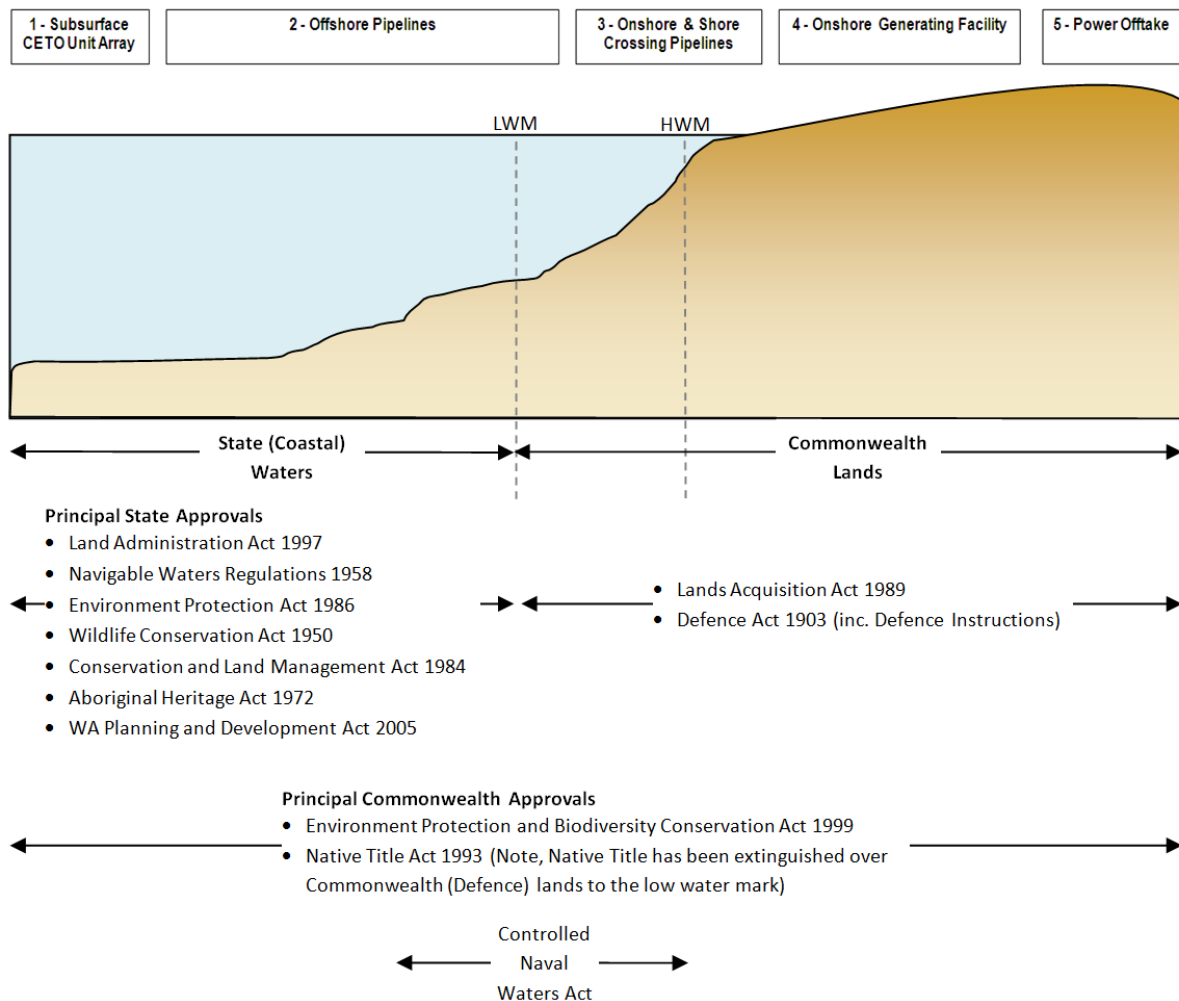


Figure 2. Jurisdictions for the Perth Wave Energy Project

Offshore of Garden Island, the primary environmental State legislation under which approvals are required are the *Environmental Protection Act 1986 (EP Act)*, the *Navigable Waters Regulations 1958*, the *Land Administration Act 1997*, the *WA Planning and Development Act 2005* and the *Wildlife Conservation Act 1950*.

Carnegie has undertaken an extensive environmental impact assessment (EIA) of all elements of the Project using in-house and external environmental experts. Separate marine and terrestrial environmental management plans (EMPs) have been completed, in consultation with key stakeholders, to support the Project and applications for regulatory approvals. The EMPs describe the PWEP, the receiving environment, identify and assess potential impacts and identify mitigation and management strategies to protect the environment.

Terrestrial Environment

Garden Island has significant natural landscapes and high natural heritage values (Figure 3). Its flora and fauna is important and scientifically diverse and includes some rare species. The island is a significant habitat for several species that have declined in the Perth metropolitan area, including the brush bronzewing pigeon, lined skink, tiger snake, carpet python and King's skink. It supports 30 waterbird species, in addition to 14 species of terrestrial reptiles and a population of Tamar wallabies that have been isolated from mainland populations for some 6000–7000 years.

Cultural values arise from the archaeology and history associated with the first settlement in Western Australia at Cliff Point by Captain James Stirling in 1829, World War II coastal defences, the development of HMAS Stirling Naval Base and recreational users. Indigenous mythological beliefs associated with sites on the island also make a contribution to the heritage values.

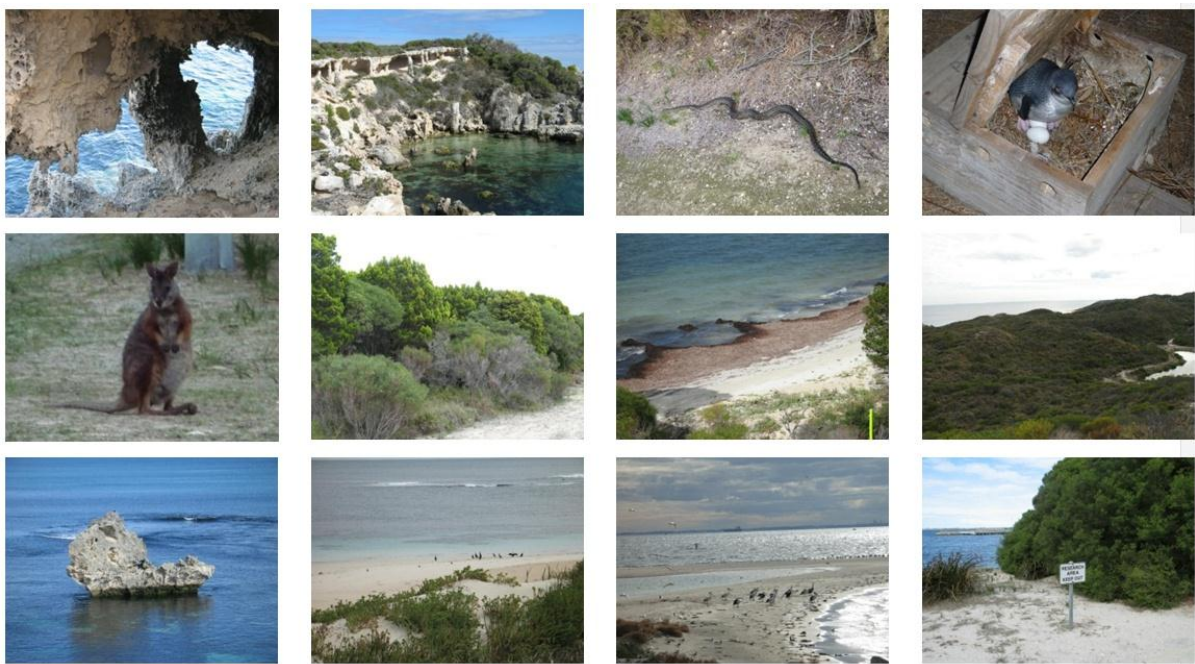


Figure 3. Heritage values of Garden Island, Western Australia (Department of Defence 2011)

Marine Environment

The marine flora and fauna of the region is typically comprised of a mixture of temperate and tropical species. Several marine mammal species are known to frequent the waters off Garden Island, including whales, dolphins and sea lions. Various birds, reptiles, sharks, rays, and other fish are also commonly found in the area. The seabed is primarily coarse sandy seabed with occasional macroalgal-dominated limestone reef. The beach is backed by a dune system consisting of a narrow, steep and generally well vegetated foredune. The waters surrounding Garden Island are used predominantly for recreational purposes such as cruising, fishing, kayaking, surfing and diving activities.

Environmental Assessment, Management and Monitoring

Environmental Assessment and Management

A Due Diligence Risk Assessment for PWEF was undertaken by respected professional consultancies with Carnegie input. The resulting management and mitigation measures were adopted in the Marine and Terrestrial EMPs and have been incorporated as appropriate in the Construction Management Plan (CMP) and Construction Environmental Management Plan (CEMP).

Overall, the Project has been assessed as having relatively low potential risk to the wider environment, with no high or unacceptable risks or potential impacts remaining after management. The Marine and Terrestrial EMPs identify, mitigate and manage all activities related to the Project and its potential impacts, including:

- impact on seabed habitat as a result of pipeline installation
- vessel safety during construction and operation of the Project
- disturbance and erosion of beach and onshore dunes
- increased bushfire risk during construction
- accidental discharge of freshwater-based fluids into the environment
- disturbance of native vegetation and native animals during construction
- disturbance of Defence and public recreational activity during construction.

A summary of EMPs for the PWEF includes the following:

- PWEF Due Diligence Report
- Marine EMP
- Terrestrial EMP
- Construction EMP
- Hydraulic Fluid Technical Report
- Desalination Pilot Plant EMP Addendum
- Bushfire Management Plan
- Emergency Response Plan
- Terrestrial Monitoring Plan
- Offshore Monitoring Plan
- Operations EMP
- Decommissioning EMP

Monitoring

The following monitoring and/or surveys were undertaken and are ongoing. Aerial time-lapse photography is also being used for monitoring purposes.

Offshore

- Baseline Benthic Habitat Survey
- MFO monitoring during Foundations Drilling
- Turbidity Plume Monitoring during Foundations installation
- Offshore Monitoring Baseline sediments and water quality survey
- Post-pipeline installation Benthic Habitat survey

Onshore

- Baseline Terrestrial site condition report
- Baseline Licence Area Field survey (flora and fauna)
- Baseline Flora Photoreference Points (seasonal)
- Baseline Pipeline Flora Condition Transects (seasonal)
- Baseline soil and groundwater sampling
- Onshore Flora and Fauna Monitoring
- Onshore Groundwater Monitoring

Community Consultation

Carnegie sees community consultation as an important and essential component of the PWEF, providing an opportunity for good working relationships to be established and continued with those parties whose attitudes and values towards the PWEF could define its success. Best practice community consultation is important in a project’s development and implementation phases. Managing stakeholders and the issues they identify through effective and targeted communication and engagement mechanisms can assist in:

- mitigating potential conflict that may arise
- managing risks involved with company activities
- increasing stakeholder understanding and awareness of a project, operational activities, and associated issues/impacts.

To ensure continued best practice community consultation, Carnegie engaged Sheridan Coakes Consulting Pty Ltd (Coakes Consulting), a well-respected social impact and community engagement consultancy. Coakes Consulting provided strategic advice and delivered a detailed Community Consultation Plan for the Project with clear objectives, activities and process evaluation. The Community Consultation Plan (the Plan) was finalised in July 2012 and builds on previous work Carnegie has undertaken for the single CETO commercial-scale unit testing and development of the PWEF to date. It identifies a fair and transparent engagement and feedback process for stakeholder consultation and integrates the social/community component in line with key planning phases and PWEF milestones. The key stakeholders are shown diagrammatically in Figure 4. It is important to recognise that the Plan is a live document that has been, and will continue to be, reviewed and updated on an ongoing basis in response to material changes as a form of adaptive management.



Figure 4. Key Stakeholders in Community Consultation

This Plan has been developed in accordance with relevant industry standards and best practice reflecting the type of project and community consultation to be undertaken, for example:

- AA1000 Stakeholder Engagement Standard (Accountability): a principles-based, open-source framework for the design, implementation, assessment and communication of quality stakeholder engagement

- ISO 26000 2010 Standard (Guidance on Corporate Social Responsibility): a guidance statement providing direction on identification of stakeholders and how best to engage
- Relevant International Finance Corporation Performance Standards.

Consultation with relevant key stakeholders has been an ongoing process since early 2008 regarding site selection, seabed and land tenure, environmental issues, and permit and approval requirements. Community consultation carried out as part of the single CETO unit deployment in 2011 was outlined in Carnegie’s Environment Plan for the Garden Island CETO Autonomous Unit (Carnegie Wave Energy Limited, 2009).

Carnegie has established a register/database of stakeholders which has been reviewed and extensively revised for the purpose of the PWEF and in the development of the Plan. The Company has also implemented a more formalised stakeholder and engagement database, using Darzin software, to provide an improved structure to tracking and logging of communication and engagement activities. The key stakeholder groups identified by Carnegie and Coakes Consulting for the PWEF are outlined in Table 1. These key stakeholders have been contacted by Carnegie either as part of a formal process, initially with an email or letter, or during the extensive stakeholder and community consultation processes, as follows.

Table 1. Summary of Key Stakeholders

Stakeholder Category	Stakeholder Type	Number of Organisations/Individuals
Primary	Federal Government	26
	State Government	36
	Local Government	23
	Special Interest Groups: Recreational	31
	Special Interest Groups: Environmental	9
	Special Interest Groups: Other	1
Functional	Service Providers: Rescue Groups	5
	Service Providers: Tourism-related	2
	Industry, Business and Research Associations: Fishing and Boating Associations	17
Intermediate	Wider Community	2 specific visiting surfers + Community residents residing within the broader City of Rockingham, City of Cockburn, Town of Kwinana and City of Fremantle. Includes: <ul style="list-style-type: none"> • General public who visit/access Garden Island for recreational purposes. • Recreational users living in the wider community who could potentially be impacted from a recreational and visual perspective
	Media	Includes newspaper (print and electronic), television, internet and radio media, at global, national, state and local levels

A four-page community information sheet was created and a copy attached to the initial email, or letter in some cases, and sent to nearly every group or individual on the list, coming to about 140 emails. Carnegie has a more formal ongoing process with the key state and federal government departments. All the stakeholder feedback and outcomes to date from these processes are recorded in the PWEF Community Consultation Database.

Community Consultation Summary

Throughout the consultation period, the majority of feedback received has been very positive. All the queries and concerns raised during all the presentations to groups and individuals can be collated under the following headings.

General Project Concerns

- Financial Viability and Funding
- Future Projects Locations
- How PWEF Works and its Infrastructure Life Span
- Location of Infrastructure Construction and Manufacturing
- Maritime Safety
- PWEF Site Location.
- Environmental Concerns
- Artificial Habitat
- Bushfire Management
- Climate Change Impacts
- Commercial Fishing Impacts
- Environmental Management in Regard to Garden Island
- Impacts from Accidental Spillage of Hydraulic Fluids
- Infrastructure Biofouling Management
- Marine Reserves
- Maritime Archaeology
- Pipeline Construction, Installation and Management
- Planning Approvals
- Recreational Fishing Impacts
- Traffic Impacts
- Underwater Noise
- Vegetation Clearing and Habitat Loss
- Water Quality (Turbidity).

Very few concerns were raised about environmental issues due to the information already given during the presentations. All queries were answered with appropriate information and potential management processes, if required. By far the majority of groups and individuals given a presentation were supportive of the PWEF and generally wished the best for its future.

Included in these consultation processes was a Community Information Day held on 11 August 2012 at Rockingham Shopping Centre, Boulevard Road, Rockingham. Carnegie put up a display, with banners showing the proposed Project, a video loop showing the Project areas, copies of the PWEF four-page information sheets and survey forms. Over 100 people stopped to get information and learn more about the PWEF and 41 people completed the survey. The full survey results can be seen summarised below.

Carnegie also carried out boat intercept surveys on 11 August 2012 at four local boat ramp sites: Palm Beach I, Palm Beach II, Mangles Bay and Point Peron, over a 2-hour period. These resulted in 27 surveys being completed and the full survey results are also summarised below.

Another community information display was held as a part of Fremantle Port Authority's Maritime Day on 31 August 2013, with animation displays, printed information sheets and newsletters, a miniature wave farm and children's fishing adventure tank where another public survey was undertaken with 82 respondents.

Community Information Day and Boat Ramps Surveys

The results of the Community Information Day survey show that over 80 % (33 people) had no concerns with PWEF. The 7 responses or 17 % that had concerns involved:

- Environmental Impacts: 1 (4%)
- Coastal Impacts: 1 (4%)
- Flora/Fauna Impacts: 1 (4%)
- Financial Viability: 3 (13%)
- Maritime Safety: 1 (4%)

All concerns raised were given the appropriate information for the concern, which generally resolved the concern. Only one respondent remained concerned and was opposed to the Project as it was "financially unviable" and "overly expensive". The resolution of most concerns was highlighted by the responses to the question whether or not they supported the PWEF, where 98 % (39) were

supportive and only 1 (2 %) was not supportive due to an opinion around financial viability and costs of renewable energy.

In regard to the boat intercept survey, it was a bright sunny day, with relatively calm waters, so the boat ramp sites were quite active. The general response from people was positive in regard to PWEF and a total of 27 survey responses were completed. In regards to having any concerns about the Project 78 % (21 responses) had no concerns and 22 % (6 responses) had concerns, which were noted as:

- Impacts on fishing activity: 1 (4%)
- Impacts of the closure area (250 m x 250 m): 3 (11%)
- Other: 2 (7%)
 - Other: Manufacturing quality and OH&S in China
 - Other: Environmental issues if pipe ruptured.

Again, all concerns raised were given the appropriate information for the concern, which generally resolved the concern. In response to the question whether or not they supported the PWEF 100 % (27) were supportive.

Notices to Mariners have been issued through the WA Department of Transport to ensure that all vessel operators are aware of the installation and the exclusion zone applied.

Carnegie will maintain communications with relevant agencies, commercial and recreational groups, Department of Defence and other key government departments to ensure that they are kept informed of Project activities and any changes which may affect other users of the area. The community consultation will remain ongoing throughout the PWEF.

Environmental and Planning Approvals

All the required environmental and planning approvals were achieved for the PWEF and are shown in Table 2.

Table 2. Perth Wave Energy Project Environmental and Planning Approvals

Name	Authorising Body	Approval
Offshore Lease Area & Offshore Easement Area	Western Australian (WA) Department of Lands	Final Lease & Easement Area: 22 August 2013
Offshore Environmental Approval	WA Environmental Protection Authority	Not Assessed, Public Advice Given: 10 December 2012 (The EPA therefore recommends that a condition requiring implementation of the Perth Wave Energy Marine Environmental Management Plan be included on the lease and easement to Carnegie Wave Energy")
Offshore Maritime Safety (CETO Units and Pipelines) Temporary Notice to Mariners (Installation) Notice to Mariners	WA Department of Transport, Marine Operations	August 2012 and 25 October 2012, with ongoing notices dated as appropriate
Offshore Planning Approval	Metro South-west Joint Development Assessment Panel (i.e., MSWJDAP for the WA Planning Commission)	DAP Application Approval: 8 February 2013 DAP Form 2 Amendment re foundations and pipelines: 27 June 2013 DAP Form 2 Amendment re Desalination outfall: 20 December 2013
Onshore Licence	Australian Department of Defence	17 July 2012
Onshore Environmental Approval, Environmental Clearance Certificate (ECC) for TEMP & MEMP)	Australian Department of Defence	28 November 2012
Onshore CEMP Approval, ECC for CEMP	Australian Department of Defence	16 September 2013

Onshore CMP	Australian Department of Defence	25 September 2013 (Rev 0) 22 January 2014 (Rev 1 for PWEF & DPP)
ECC Onshore Groundwater Monitoring Boreholes	Australian Department of Defence	24 July 2013
Onshore Desalination Pilot Plant ECC for Desal EMP Addendum	Australian Department of Defence	17 December 2013

Carnegie will be carrying out additional environmental monitoring and assessments during all stages of the PWEF to ensure effective management is maintained.

Short Abstract (<100 words)

Carnegie Wave Energy Limited has been developing CETO wave energy technology for over 10 years and at a cost of \$70 million. Carnegie is now in the construction phase of the Perth Wave Energy Project, a grid-connected CETO array off Garden Island, Western Australia. The Project will supply both power and desalinated potable water to the Australian Department of Defence. The Project is fully consented through a range of Federal, State and Local government permits and approvals, supported by a comprehensive community consultation program. This presentation will share Carnegie's experience of consenting this project and implications for future development.

Full Abstract (300–500 words)

Carnegie Wave Energy Limited is the inventor, developer and 100 % owner of the CETO wave energy technology. CETO is designed to extract energy from ocean waves to generate clean, renewable and emission-free electricity and desalinated water. Carnegie is based in North Fremantle, Western Australia and is publically listed on the Australian Stock Exchange.

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(413 words)

Biography

Mr Tim Sawyer, Project Development Officer, Carnegie Wave Energy Limited, Australia

Tim is an oceanographer with over eighteen years' experience in renewable energy project development, oceanography and marine environmental management. He has an in-depth

knowledge of wave, tidal and offshore wind energy and has specific experience relating to project development, conceptual design, resource assessment, environmental impact assessment, permitting and approvals and stakeholder consultation. At Carnegie, Tim is responsible for overseeing the identification, assessment, acquisition and development of commercial and pre-commercial wave energy projects worldwide. Carnegie Wave Energy Limited is an ASX-listed Australian company, focused on commercialising its CETO wave energy technology.

Ms Edwina HR Davies Ward, Environment and Planning Advisor, Carnegie Wave Energy Limited, Australia

Edwina's background is in environmental and sustainability management, science and communication, facilitation and innovative and effective community involvement, with over seventeen years' experience. Edwina holds a Bachelor of Environmental Science from Murdoch University, Western Australia, and a Bachelor of Science (Zoology) from London University. She has a great breadth of skills developed whilst working with government, business and non-government groups in environmental impact assessment, coordinating and facilitating a wide-range of stakeholder and community consultation and engagement activities across Australia within marine, coastal and wetland areas. Edwina was part of the team winning the *2003 Gold Banksia Award*, Australia's most prestigious environmental accolade, for *Leadership in Protecting Coastal & Marine Environments*. At Carnegie Wave Energy Ltd, Edwina is responsible for the Perth Wave Energy Project's environment and planning permitting and approvals and stakeholder consultation. Carnegie Wave Energy Ltd is an ASX-listed Australian company, focused on commercialising its CETO wave energy technology.