R.V. Oceanographer

8 Cowdroy Ave, Cammeray NSW 2062 Australia
Phone 02 9909 3437 Fax 02 9953 8203
ABN 29 001 704481 ACN 0017 04481
Email: fitzynet@bigpond.net.au Call Sign: VHN 9942

Designed and built in Survey for Hydrography, Oceanography, Marine Research and Oceaneering.

Excellence in Maritime Engineering

In 1997 Land & Marine Pty Ltd carried out the first mechanical transplanting of Zostera Seagrasses as part of the Lady Robinson's Beach remediation project. This project won the 1998 Case Earth Award for Excellence in Environmental Engineering

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Purpose Built in 2B CommerciaI Survey for – Oceanography - Hydrography - Environmental Monitoring - Diving - Marine Civil Works - Extremely stable level platform for cinematography & all visual activities.
R.V. Oceanographer has a fully approved Occupational Health and Safety Plan for Government contract work.

Details - 16 metres x 6 metres x 1. 2 meters Al. Catamaran - 20 tonnes - 13 knots cruise - 6 Tonnes fuel 3 Tonnes water - Twin 400 HP Cummins - 20 KW Onan gen. - Abundant 12, 24, 240, & 415v.power.

Very Cost Effective - RV Oceanographer can execute most marine research tasks that previously required a 50 m. Rig Tender Vessel - at a fraction of the cost - she is very fuel, cost & time efficient.

Spacious & Comfortable Work Platform - the operations room is set up with 15 square metres of dry, secure, stable, non slip bench space to provide scientists and operators spacious, fatigue free, safe working space - there are 3 large clear span working decks - operators are able to relax in comfort between tasks with plenty of hot & cold fresh water at all work stations along with high pressure salt water systems.

Bow and Stern Heavy Lift Gantries & Winches - ROVs and other marine research equipment can be safely deployed and recovered from either the bow or the stern. The bow gantry allows RV Oceanographer deploy a remarkable array of marine apparatus & vehicles whilst riding bow first to seas, winds & currents.

ROV and Dynamic Vehicle Management Systems - RV Oceanographer is able to position with great accuracy and hold that station with stability for protracted periods of time. She is able to position vehicles & equipment on the ocean floor with great accuracy using unique systems devised by the Fitzhenry Team.

Systems - 2 Survey Differential GPS - Digital Sidescan - High Resolution Dual Frequency Sounders - High Res. Radar - ROVs & Tether Management Systems - Towed ROVs - Tripcameras - Stratacam Vibrocorers - Gravity Corers - Deep Ocean Box Corers - CTD Systems - Bulk Sampling Equipment Bioaccumulation & Turbidity Monitoring - Underwater Video & Camera Systems - Oceaneering Systems

Key People - Capt. Daniel Fitzhenry – Registered Surveyor is an Accredited Specialist Hydrographer (NC, CZM, IOS), Dip. Environmental Studies (Macquarie). His work is acceptable to the Hydrographer RAN and the Australian Hydrographic Commission - Australian Commonwealth Commercial Diver.
Steven Fitzhenry BE Civil (Sydney) Coastal Studies Engineer and Assistant Hydrographer.
Adam Fitzhenry BE Civil Hons (Sydney) Maritime Civil Engineer and Assistant Hydrographer.

Engineering Excellence 1998

Land & Marine Pty Ltd

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Land & Marine conducts engineering surveys of Sydney's Deep Ocean Outfalls.

We have been doing this work for nine years. We inspect every 6 months.

The contract is awarded every three years via an international tendering process.

Our dynamic ROV's and flying ROV's are used to execute the tasks.

We position our vehicles and equipment arrays on the seafloor with great accuracy.

Land & Marine also contribute with Ocean Engineering remedial works.

Daniel Fitzhenry – Registered Surveyor – Dip. Environmental Studies (Macq.) – Accredited Specialist Hydrographer
Steven Fitzhenry – B.Eng. (Civil) Sydney – Maritime and Structural Engineer – Project Management
Adam Fitzhenry – B. Eng. Honours (Civil) Sydney – Civil and Structural Engineer – Project Management
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Underwater Works Wollongong Nearshore Outfall.

Land & Marine own and operate full containment environmental suits for shallow and deep oceaneering works in hostile environments.

We have state of the art underwater digital video equipment for engineering and environmental assessment tasks.

Land & Marine have the latest technology in underwater remedial engineering.

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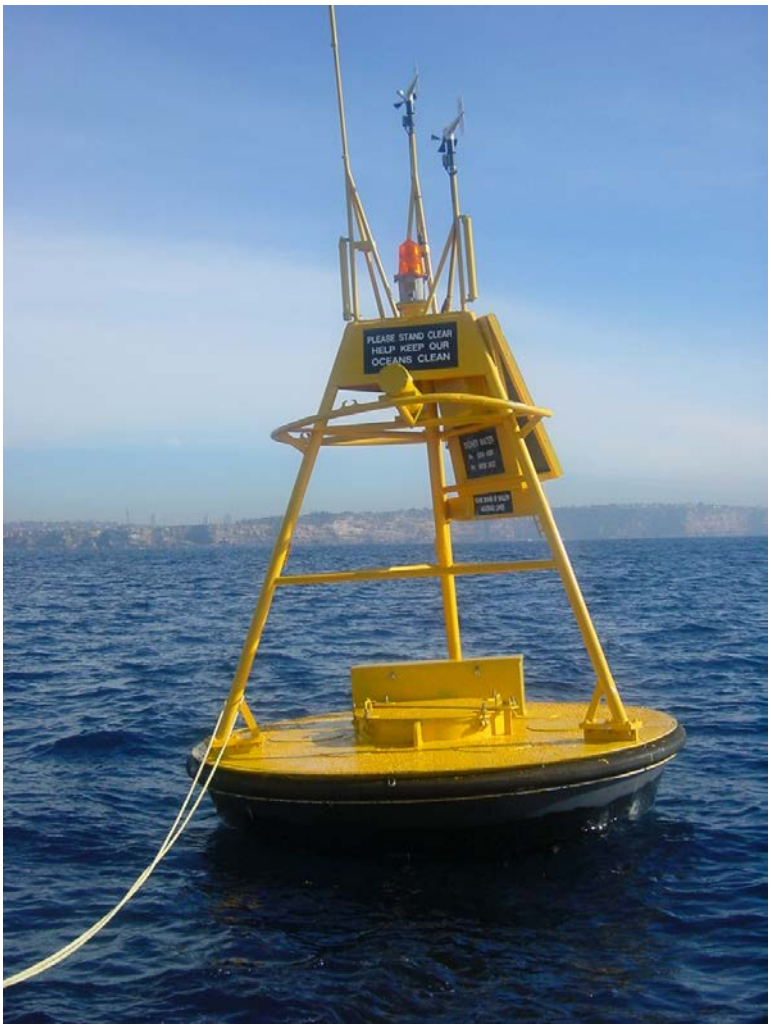

The Sydney "Ocean Reference Station" (ORS)
The ORS provides the following real-time data:

- **Wave height and period**
- **Wind velocity**
- **Full water temperature profile**
- **Current velocity at –20m and –55m**
- **Conductivity**

Land & Marine Pty Ltd operate and maintain the ORS on behalf of Sydney Water. We produce quality assured data, which is disseminated to the EPA, and to the scientific and marine community.

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Land & Marine Oceaneering

Wollongong Ocean Outfall – Remedial Works

End Plate Fabrication and Replacement

Removal of existing steel diffusers

Fabrication and installation of new stainless diffusers

'No results no pay engineering'

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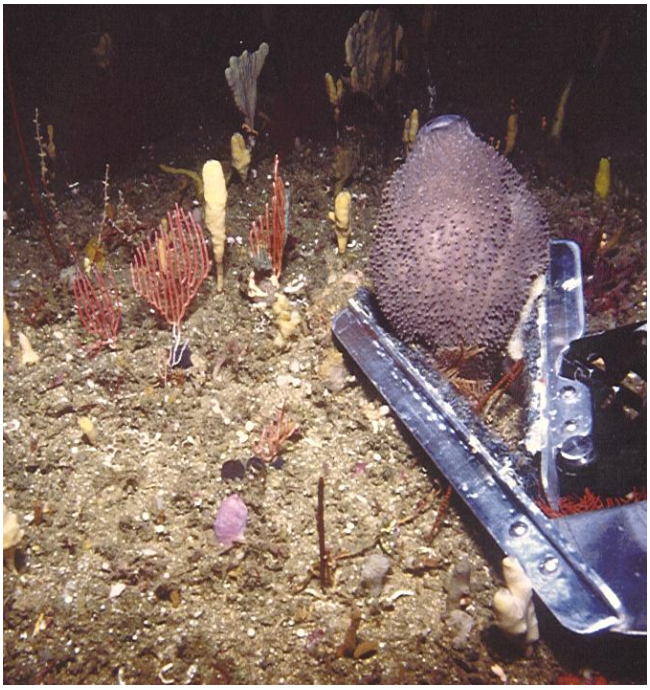

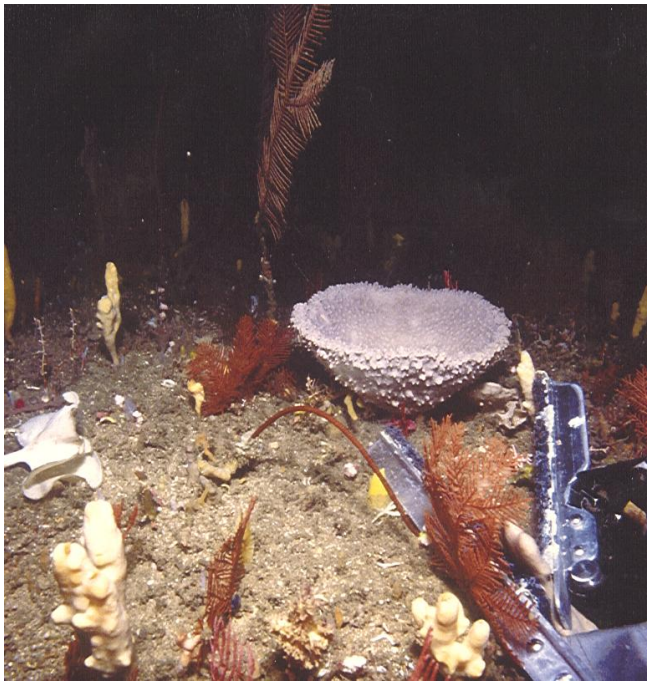

Collection of Deep Ocean Epi Benthos by ROV

Significant advances in pharmaceuticals have been made by delving into the complex chemistry of Deep Ocean Sponges.

Land & Marine can locate and harvest Deep Ocean Sponges.

We have carried out many thousands of ROV deployments for ocean monitoring, engineering and marine science purposes.

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This is our "Stratacam" vehicle that penetrates the seafloor.

"Stratacam" gives details of the near floor sediment in real time.

This vehicle can detect recent sedimentation or pollution very quickly.

"Stratacam" defines problem areas fast.

It can dramatically reduce the need for core sampling.

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Vibrocoring Operations – Shallow Estuarine Conditions.

Land & Marine Pty Ltd have deep and shallow water Vibrocoring capability.

We own and operate our own Vibrocorers.

R.V. Oceanographer was purpose built for Vibrocoring and ROV operations.

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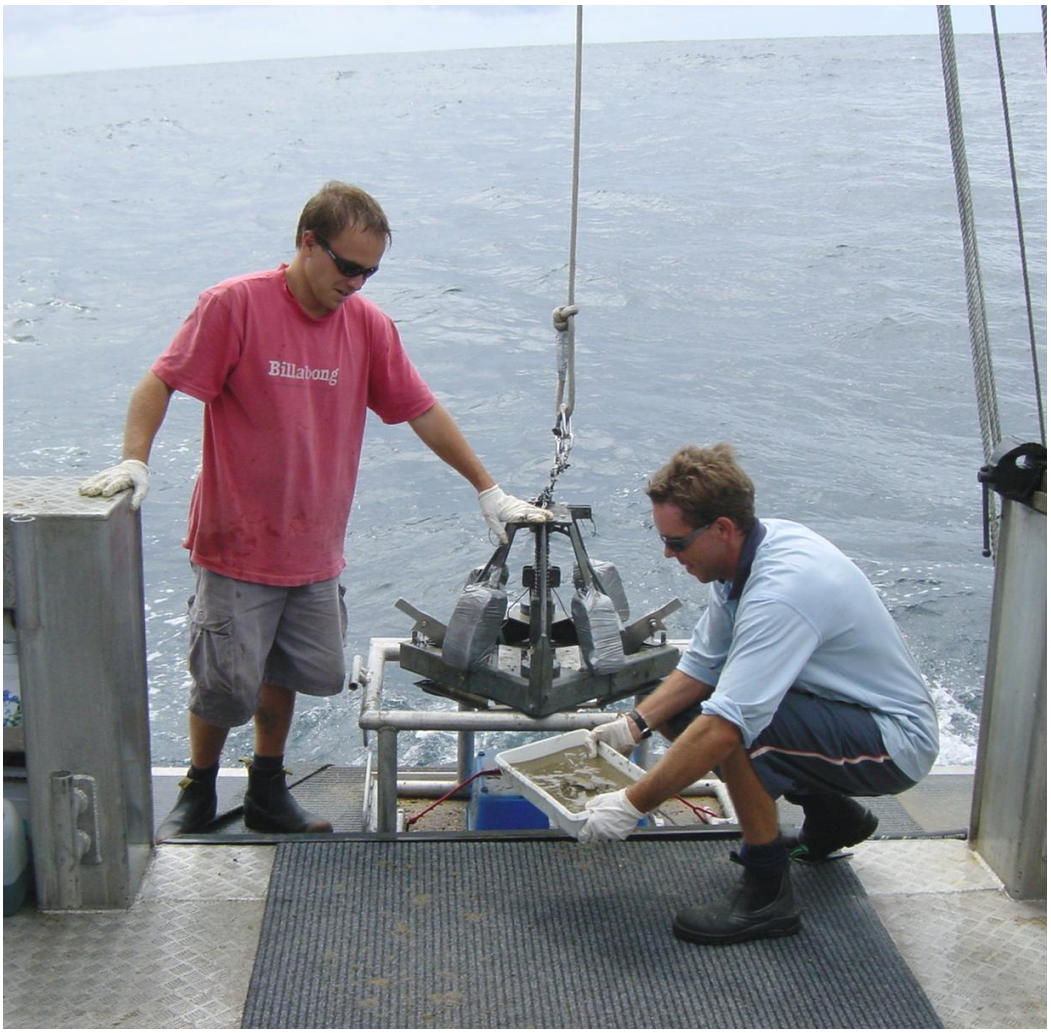

Ocean Sediment Sampling

We own and operate box corers, grab samplers, gravity corers and vibrocorers.

R.V. Oceanographer was built in survey especially to handle this equipment.

Our stratacam system can significantly reduce the requirements for floor samples.

Our twin differential GPS systems guarantee accurate positioning.

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Beach areas and foreshore zones along the western foreshore of Botany Bay, New South Wales, had been subjected to changed wave dynamics following the construction of the two airport Runways into Botany Bay and the construction of Port Botany on the north eastern foreshore, causing significant damage to beaches and loss of marine habitat.

By Mr Daniel Fitzhenry, Managing Director of Land & Marine Pty Ltd

Harvesting and Transplanting Seagrasses

The recently constructed runway is known as the Parallel Runway and it protrudes into the Bay on the eastern side of the main runway, being the North South Runway. The basin area between the North South Runway and the Parallel Runway was designated for regeneration of seagrasses. The harvest site at Lady Robinson's Beach, within the Bay area, required the removal of more than 80 per cent of the seagrasses, their rhizomes (root structures) and surrounding sand and silt. The brief required approximately 700 square metres of seagrass to be harvested and transplanted.

Seagrass Ecosystems

The predominant species of seagrass in the Botany Bay harvesting areas was Zostera capricorni, commonly known in Australia as Eel Grass or Silky Weed. Seagrass grow in shallow waters adjacent to relatively sheltered sandy estuarine beaches and on mud and sand bars in creeks and rivers in depths of less than five metres and are light dependant. A seagrass meadow contains a huge array of flora and fauna. As well as providing a habitat for many juvenile fish, they are a major source of food for estuarine animals and larger fauna including fish and birds.

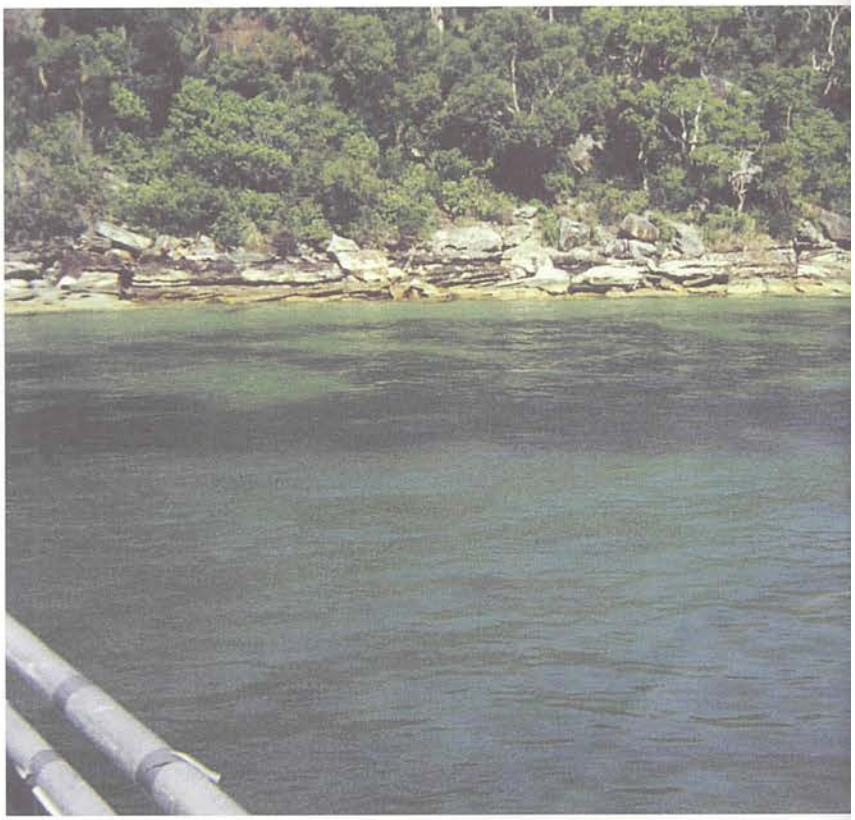
Seagrass Survey Prior to Harvesting

The limits of the seagrass beds were delineated by controlled aerial photogrammetry. As the beds occur in shallow water and the waters are relatively clear, the edges of the meadows were well defined and standard stereo survey methods were used to define the limits of the meadows from air photographs. The density and distribution within the meadows was defined by scuba floor surveys along surveyed transects. The mean 'Before' cover along the transects was 9.2 Zostera shoots per lineal metre. The bed limits were abrupt and well defined and the density of seagrass shoots would completely diminish within one or two metres of the perimeter.

The diver transects were controlled by land based surveyors using total stations. The density of the grasses in the harvesting area was sparse to medium.

Harvesting or Collecting Methods

A scoop harvester ('Dugong') was specially developed by Land & Marine

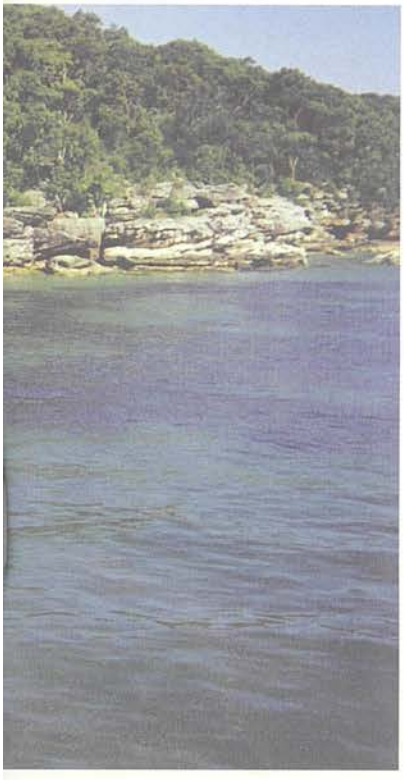


Typical Zostera seagrass beds

to complete the harvesting task. This harvesting or collection vehicle was a towed cutter/scoop capable of collecting 1.5 to 2 square metres of seagrass meadow per drop. It was estimated 30,000 box cores would have been required if traditional methodology was employed. This would have taken 12 months. With the 'Dugong' a start-to-completion date of one month was achieved.

The 'Dugong' was deployed from the bow of the catamaran Research Vessel Oceanographer. The vessel draws 0.5 metres at the bow and 1.2 metres at the stern. The typical configuration of the shafts gave a down thrust of 10 degrees. Accordingly, had we towed the Dugong in the 'ahead' mode, the propeller deploying from the bow and towing the vehicle with a ship astern, the propeller thrust was directed at the hull and dissipated forward between the hulls rather than disturbing the meadows below. Furthermore, as the vessel has a shallow draught forward, it allowed us to present the Dugong to the shallow, inshore perimeter locations, at most tides, without damage to the vessel or equipment.

The Dugong collection vehicle was subdivided into 30 centimetre wide longitudinal channels so that the Zostera was pre-sliced into a similar format to product from a turf farm. When the water clarity was good, the cutting edge of the vehicle was positioned by eye. In poor visibility conditions we positioned the vehicle by differential GPS.



RV Oceanographer with Dugong harvester on the bow

When the vehicle was full (generally a 2 metre travel) the vessel would be winched directly above the Dugong and the vehicle would be winched to deck level with the seagrass product then transferred from the longitudinal sections in PVC dive boxes. The seagrass product was placed with the grass down and the roots up. i.e. upside-down. The roots were covered with several centimetres of Bay water for the transit to the planning areas. The upside-down transit mode had no ill effects on the seagrass. From the commencement of the works the vehicle consistently recovered in excess of 2 square metres per drop and tow. Considerable engineering design went in to the cutting face so that the vehicle dug into the seagrass meadow to the required depth. The vehicle was equipped with well engineered limiting devices to ensure that the depth of cut remained constant whilst not damaging the meadow grasses adjacent to the vehicle.

Transporting Seagrasses from Pickup Point to Transplant Site

Once in the transfer boxes, the product was carefully stacked on deck. At each harvesting about 120 PVC boxes of seagrasses were collected and as soon as the last Dugong load was on deck, the vessel commenced transit to the planting sites, a distance of approximately seven kilometres. On most days three harvests of about 120 boxes each were achieved.

Planting the Seagrass

At the planting station of Research Barge was moored with the dive team and equipment set up on board. R.V. Oceanographer would come alongside and the 120 transit/planting boxes were rapidly transferred to the planting barge. The 120 empty transit boxes from the preceding planting would be transferred from the barge to the Oceanographer. As the contract required 10 to 15 centimetres of floor material around the seagrass roots, the loaded boxes sank with their own weight. Accordingly the barge team were able to swim the boxes directly to or near the planting site. The boxes always stayed upright in the short sink to the floor. The planting sites were in one to three metres of water and relatively close to the sea wall of the Parallel Runway.

After the planter boxes had been transferred to the seafloor with the seagrass still in the root up, leaves down format, the dive team would carefully place the boxes in a geometric grid pattern on the seafloor. Once arrayed on the bottom, the boxes were inverted. This allowed

Seagrass in transit to the planting site

the Zostera seagrass to slide on to the planing site the right way up. The planting sites on the western side of the Parallel Runway were subjected to difficult weather conditions. During southerly winds the imbayed area between the North South Runway and the Parallel runway became very disturbed with washing-machine-like conditions affecting the dive/planting team.

Four different planting techniques were used in the planting sites that were evenly distributed along the eastern and western side of the Parallel Runway. These were:

- Direct planting of the boxed grasses on to the undisturbed seafloor
- Shallow excavation followed by abutment planting
- Direct planting to the seafloor covered by artificial seagrass units
- Direct planting with stapling

Post Site Survey

Following the harvesting, four transects in the collection area were selected by the marine science team. A survey diver swam the transects and surveyed the number of Zostera shoots which touched the line or were within five centimetres of either side of the line, to establish the density. The four survey transects were established at randomly selected intervals along the north-south orientation of the seagrass bed.

The mean 'after' count for the combined transects was one shoot per lineal metre with a standard error of 0.15 shoots per lineal metre. This represented a reduction of 98 per cent in the mean seagrass cover from the original 'before' survey to the final 'after' survey.

Colonisation Results

Five months after the planting programme the Zostera seagrass planted on both sides of the Parallel Runway at Kingsford Smith Airport is colonising well with the direct planting and excavated sites appearing to be progressing at the same pace. The areas planted and covered with the steel mesh artificial seagrass units would appear to have suffered in the high storm conditions of the 20 Year Storm of 11th April, 1997. Sixteen metre high waves were recorded at the offshore reference station of Sydney during this storm. The eastern planted sears colonies suffered less damage from the extreme wave action but all the direct excavated sites are progressing and colonising well.

Biography

Mr Daniel Fitzhenry

Mr Daniel Fitzhenry is an Accredited Hydrographer with the Australian Hydrographic Commission. He has a post graduate diploma in Environmental Studies and is a Registered Surveyor and a Commonwealth of Australia Commercial Diver. He has been a practising hydrographic consultant since 1964 and his company, Land & Marine Pty Ltd, undertakes oceanographic, hydrographic, maritime engineering and marine research projects in the Australasian region. The company builds and operates task-specific underwater ROV and engineering vehicles. ■

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 # Sydney Deep Ocean Outfalls - Sydney Water - Predesign Study - Construction Subcontractors - Post Commissioning Engineering & Environmental Monitoring

 # Sydney Harbour Tunnel Hydro Study - Transfteld & Macdonald Wagner

 # Deep Water Macrobenthic Assemblages -7ump Camera Studies & ROV Collection for Bioaccumulation & Coverage Monitoring - Equipment Designers & Suppliers for the Musselwatch Programme - Environment Protection Authority

 # Port Study of The Skardon River & Approaches – Gulf of Carpentaria - Sea Grass Coverage & Type Study - Core & Floor Sampling Programme for Predredging & Design of Cyclone Moorings - Venture Exploration

 # Bioaccumulation, Species & Turbidity Studies of The Jacksons, Skardon, Namaleta & Wenlock Rivers - Gulf of Carpentaria - Drafting & Publication of the Oil Spill Contingency Plan - Ports Corporation of Queensland & Venture Exploration

 # The Location & Recovery of Crashed & Ditched Aircraft in Deep Ocean Locations by Digital Sidescan Sonar & Both Towed & Dynamic ROVs – Civil Aviation Authority - PNG Government - Sir Joh Belke Peterson

 # Vibrocore & Dropcore Sampling for Engineering, Oil Exploration, Inventory Of Offshore Resources, Predredging & Environmental Monitoring - BMP, PNG Government, Woodside Offshore, Esso BHP, Sydney Water, Transfield, HLA, EPA, *Sydney University, Port of Brisbane, Public Works & Many More.*

 # Salvage Operations - Provision of Nautical Charting, Offshore Positioning, ROV & Recovery Gear & Underwater TV Equipment - Including the Anro Asia, Co Op Marine, Manhattan Duke, Wagani Express, HMAS Wollongong, TNT Alltrans, Kyotan Maru & the Disposed WW11 Aircraft off Moreton Bay in 300 metres.

 # Hazardous Location Volumetric Surveys of Tailing Ponds & Floors including Caustic Red Mud Ponds at Gove - Nabalco - Sulphuric Acid Uranium Ponds CRA

 # Accredited Specialists in Nautical Charting, Industrial Offshore Survey & Coastal Zone Management - Surveys in or of most Australian Mining Ports & of Every Port in Papua New Guinea including Publication of their First Chart - Design Supply & Installation of Tanker, Ship & Cyclone Moorings - BP, Carpentaria Shipping, Venture Exploration

"Dedicated to Marine Research"

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