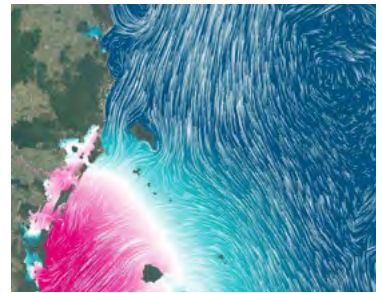




Water and Environment

Coastal Management



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We are a leading international multi-disciplinary engineering, science and technology consultancy offering a broad range of services, particularly in the energy, environment, shipping, ports and logistics and defence sectors

Background

BMT's team of coastal engineers and scientists specialise in developing solutions which can satisfy the competing demands placed on the coastal zone.

Customers are served by professionals located in a network of international subsidiary companies in over 30 offices and across 5 continents.

In Australia we have offices in Adelaide, Brisbane, Canberra, Melbourne, Newcastle, Perth and Sydney.

Wind, waves and tide constantly shape our coastline, while human activities and climate change are also having an impact. The challenge is to meet the increasing pressure to develop the coastal zone with environmentally sound practices, ensuring coastal processes, amenity, natural character and environmental values are protected and are sustainable.

Our approach includes investigations to develop a detailed understanding of the physical and ecological aspects of the coastal system and employing nature-based solutions to coastal management issues where possible.

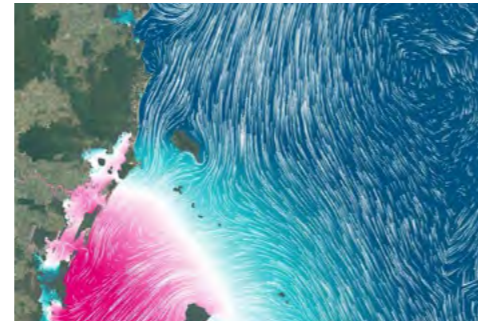
We use our experience to identify the real question, are transparent about the scale and cost of credibly answering it, and provide recommendations that are both defensible and actionable.



Our Capabilities

We are able to support our clients in every facet of coastal zone management. Our highly skilled and experienced staff use a combination of established and innovative approaches to addressing coastal challenges.

From conception to commissioning, we have a full range of services that combines valuable engineering experience with sustainable environmental management and economic practicality to deliver high value solutions.



Coastal Processes and Hazards

- Numerical modelling assessments of tides, currents, waves and coastal sediment transport
- Coastal process studies
- Definition of coastal hazards, erosion, shoreline realignment, sea level rise
- Coastal inundation hazard and risk assessments (storm tide and tsunami)
- Probabilistic hazard mapping
- Coastal erosion hazard and risk assessments



Coastal Management and Adaptation

- Coastal climate change adaptation plans
- Shoreline erosion management plans
- Design and implementation of coastal management solutions including engineering structures, beach nourishment and sand bypassing programs
- Coastal, estuary and wetland resource planning
- Strategic policy formulation, analysis and advice
- Coastal hazard and risk assessments
- Coastal management options assessment (MCAs and CBAs)
- Environmental auditing, evaluation and due diligence studies
- Stakeholder engagement to support the delivery of fit for purpose products



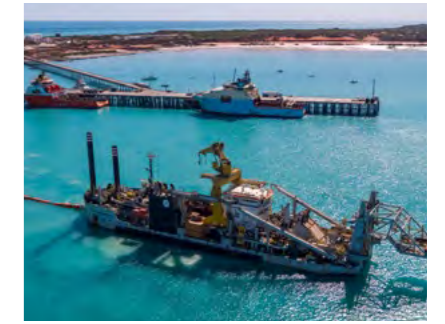
Foreshore Protection

- Definition of metocean design conditions (wind, waves, currents, water levels, sediment movement)
- Foreshore protection structures - design and specification for breakwaters, groynes, revetments, seawalls and hybrid/nature-based solutions
- Beach nourishment – design and specification
- Conceptual designs, layouts and cost estimates
- Design of geotextile filters/sand filled containers
- Design, specification and supervision of physical modelling studies
- Coastal Structure inspections, auditing and repair strategies
- Detail design drawings, specifications and tender documents
- Construction supervision of all on-site works



Boating Infrastructure

- Functional design for boating facilities including boat ramps, marinas, pontoons, jetties, wave protection and landside facilities
- Definition of metocean design conditions (wind, waves, currents, water levels, sediment movement)
- Concept development, design, cost estimates and approvals
- Detail designed drawings, specifications and tender documents
- Coastal engineering i.e. breakwaters, sea walls, erosion protection measures, beach nourishment
- Navigation channels/waterway planning
- Vessel movement simulations
- Maritime structural engineering
- Environmental audits



Dredging Services

- Dredging options assessment, cost estimates and strategy development
- Design of pre-, during- and post-dredging monitoring and management programs
- Dredge material characterisation
- Placement strategy development
- Dredging management plans, licences and approvals
- Dredging compliance monitoring and auditing
- Procurement and contract management
- Dredge Contractor supervision
- Stakeholder consultation and management.



Environmental Approvals

- Pre-feasibility and approval strategies
- Review of Environmental Factors (REF) and Environmental Impact Statements (EIS)
- Referrals under the Commonwealth EPBC Act 1999
- Development applications including lodgment management
- Assessment reports to support development applications
- Environmental Management Plans (EMP), offset plans and environmental monitoring strategies
- Reviewing conditions of approval
- Preparation and delivery of communication and engagement strategies for stakeholder and regulatory agency consultation
- Strategic advice, peer review, audits of conditions and expert witness reports

Monitoring and Data Collection

- Quality procedures
- Metocean (wind, waves, currents, water levels)
- Water quality assessment impact water quality measurement
- Benthic and marine habitat surveys and Ecological Impact mapping
- Oil spill monitoring and scientific response
- Biosecurity inspections and eDNA tracking
- Sediment/contamination data collection and analysis

Coastal Processes and Hazards

BMT are leaders in the field of coastal process analysis and coastal hazard mapping, including:

- Sediment transport
- Shoreline erosion
- Coastal inundation
- Response to climate change

Our expert engineers and scientists have pioneered the probabilistic analysis and mapping of coastal erosion and inundation hazards.

1. Noosa Spit Shoreline Erosion Management Plan

The Noosa Spit is identified as an erosion hotspot, with narrowing of the man-made peninsular presenting a risk of a future breakthrough.

The erosion is caused by natural migration of the channel, driven by sand infilling of the river mouth. Completed works were successful in stabilising the western extent of the spit; however, the rate of shoreline recession in the middle section has since increased.

BMT considered various shoreline erosion management options with the key objective to identify ways to reduce the risk of a breakthrough while maintaining or enhancing the recreational, social and environmental values attributed to the spit.

Key services:

- Data collection to support numerical model development and calibration
- Erosion management options tested using the modelling tools and Multi-Criteria Analysis
- Design of a novel approach to dredging and beach nourishment
- Preparation of approvals for the preferred erosion management strategy

2. Torres Shire Erosion Hazard Assessment

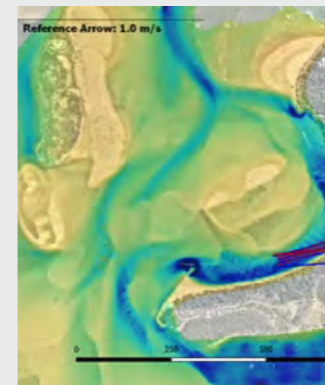
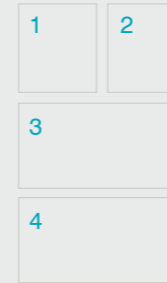
To inform adaptation to coastal hazards, BMT undertook an assessment of the potential for coastal erosion at settled areas on several islands within Torres Shire.

The assessment was prepared to address deficiencies in existing erosion assessments with a focus on site specific understanding and to represent multiple future climate scenarios and timeframes.

Key services:

- Detailed assessment of potential erosion of the shoreline over the specified planning periods
- Short term (storm-related) and longer term (gradual) trend assessment to include allowance for erosion from projected sea-level rise associated with climate change.
- Considerations of dune slumping after significant storm erosion

The assessment was endorsed by the QLD Government replacing the State's existing statutory declared erosion prone areas in development assessment and strategic planning.



3. Old Bar Probabilistic Coastal Erosion and Geotechnical Assessment

The Old Bar coastline is exposed to significant coastal erosion hazards, with sections of beach experiencing some of the highest recession rates in NSW. High value land and assets are exposed to erosion.

BMT assisted Mid Coast Council to better understand the physical condition and coastal hazard profile, through the preparation of a CMP Stage 2 Coastal Erosion Hazard Mapping Study.

Key services:

- Rigorous field based geotechnical assessment including walk over, geophysics, boreholes survey
- Coastal processes review and development of a sediment budget conceptual model
- Development of a probabilistic coastal erosion model
- Expert coastal processes modelling workshop, to facilitate model development and confirm input parameters
- Monte Carlo simulation of coastal erosion and shoreline recession hazards that accounts for storm erosion, geotechnical properties, sediment budget and climate change variables
- Mapping coastal hazard set back estimates for a range of probabilities and timeframes

4. Esperance Coastal Hazard and Vulnerability Assessment

This broad scale assessment of coastal erosion and inundation risks within Esperance Bay provided input to the Shires' 'Esperance Town Centre Revitalization Master Planning'. The study helped to refine development and landscape planning within and adjacent to the foreshore reserve by undertaking numerical modelling and application of the State Coastal Planning Policy guidance.

The physical context of the site was established through assessment of geomorphology and coastal processes and assessment of all coastal hazards.

Risk profiles were developed for hazard impacting the site under present day conditions and for the policy planning horizons of 2060 and 2110 accounting for anticipated future sea level rise. Adaptation planning recommendations were then developed for short term and longer term (2060 and 2110 planning horizons).

Key services:

- Project management and stakeholder liaison
- Data and information review
- Geomorphological review
- Coastal processes assessment and coastal hazard identification via numerical modelling
- Production of coastal risk profiles
- Provision of coastal management adaptation advice and planning guidance.

Coastal Management and Adaptation

We have completed coastal management studies and coastal climate change adaptation studies under several state policy frameworks (QLD, NSW, Vic and WA).

Coastal management is not just about coastal hazards, it is about people. Working in coastal management we always tailor our methodologies and maximise consultation with the client, stakeholders, regulators and the community to deliver outcomes that are technically sound, implementable and people focused.

1. QCoast2100 - Coastal Hazards Adaptation Program

BMT has lead or supported Coastal Hazard Adaptation Strategy (CHAS) projects on behalf of numerous Queensland coastal councils, since the program commenced in 2017. These projects are tailored to fit the specific and unique needs of each Council and typically include:

- Scoping of technical work and gaps studies needed to meet the State Government Minimum Standards.
- Supporting Council with funding applications.
- Storm tide inundation, coastal erosion and sea level rise hazard assessment.
- Identification of assets and values potentially exposed to coastal hazards.
- Coastal hazard risk assessment in accordance with ISO31000:2018 Risk Management.
- The development of risk mitigation options and adaptation pathways to the year 2100.
- Stakeholder and community consultation across all project phases.

2. Northern Moreton Bay Shoreline Erosion Management Plan

The Northern Moreton Bay Shoreline Erosion Management Plan (NMBSEMP) was developed to provide advice and direction for the future protection and management of the shoreline from coastal erosion. The study area covered approximately 21.5km of coastline and included shoreline communities at Deception Bay (2.5 km), Beachmere (7.0 km), Godwin Beach (2.5 km), Sandstone Point (4.0 km), Toorbul (3.5 km) and Donnybrook (2.0 km).

The study generally considered a planning timeframe of 50 years with a review recommended every 5-10 years, taking into account natural processes and community expectations for the coastal zone.

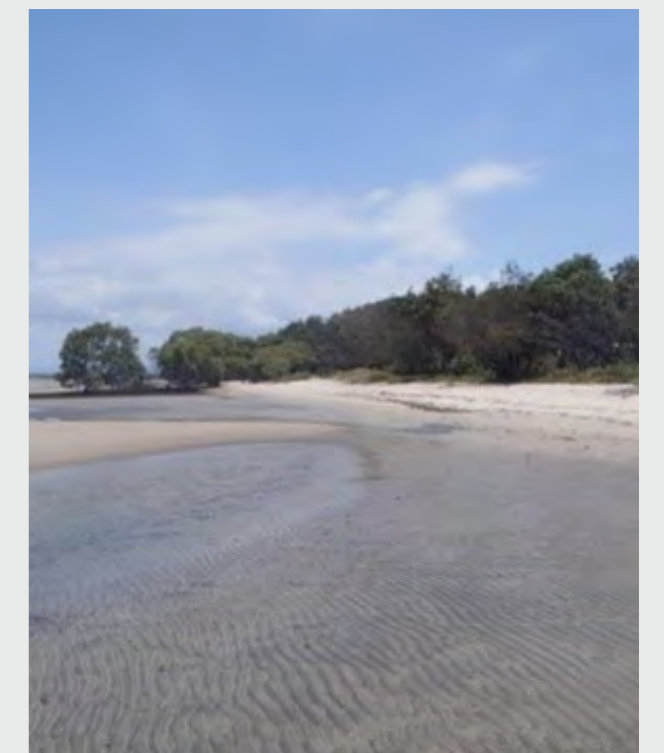
Key Services:

- Identification of short- and long-term erosion hazards (including climate change impacts)
- Identification of values where relevant (environmental, social and economic)
- Definition of areas of development to be protected and areas with sufficient buffer to be left unprotected
- Identify potential protection structures, or upgrades of existing structures, in vulnerable areas
- Recommended shoreline erosion management options for the study area
- Prioritisation of the implementation actions

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Coastal Management and Adaptation

3. NPWS Bonnie Vale and Bobbin Head Coastal Processes and Sea Level Rise Adaptation Study

The NSW National Parks and Wildlife Service (NPWS) manages several low-lying assets that are exposed to coastal hazards that frequently compromise their public amenity. As part of strategic planning for the long-term use and adaptation of these sites, BMT assisted NPWS in assessing site-specific impacts in a probabilistic way to better understand the range of future outcomes that are likely. The result was an outcomes-centric hazard study that assessed coastal risk specifically to key thresholds that triggered management options (such as inundation of a building) rather than assessing and mapping hazards to return intervals.

Key services:

- Coastal process and hazard analysis
- Probabilistic modelling of sea level rise
- Options development, assessment and costing
- Adaptation pathway development.

4. Lake Illawarra Coastal Management Program

BMT was jointly engaged by Wollongong City Council and Shellharbour City Council to undertake a Coastal Management Program for Lake Illawarra. Lake Illawarra is a highly modified estuary with a permanently open entrance. Construction of the entrance breakwaters has resulted in major geomorphic, hydrodynamic and ecological changes to the Lake, which was previously an ICOLL (Intermittently Closed and Open Lake or Lagoon).

The Lake is a significant natural asset for the region and is highly valued by the community. A CMP was necessary to outline strategic priority actions to protect valued aspects of the Lake and to tackle key threats. To identify the key threats to the Lake, BMT conducted a detailed review and interpretation of the scientific information, comprehensive community and stakeholder consultation, and a targeted stakeholder threat assessment. Nine management strategies were developed to target each of the threats to the Lake.

A combined multi-criteria and cost benefit analysis was conducted to select the preferred management actions, which were then detailed in the implementation schedules. The CMP business plan also includes detailed costings for each action over the full 10-year implementation period of the CMP, as well as identification of responsible parties and potential and committed sources of funding for the actions. The CMP was the first gazetted CMP in NSW under the revised coastal management framework.

Key Services:

- Stakeholder engagement
- Information and data review
- Coastal hazards and risk assessment
- Option development including multi-criteria and cost benefit analysis
- 10-year Business and actions plan (CMP)

5. Port Geographe Coastal and Environmental Management

Port Geographe harbour is a coastal marina and residential canal estate developed in 1996 near the town of Busselton, Western Australia. The development has experienced ongoing problems due to large accumulations of seagrass wrack in the harbour and on adjacent beaches during winter months. The Department of Transport's (DoT) preferred solution for the ongoing coastal management issue of wrack and sand build up included an extensive reconfiguration of the coastal structures and entrance channels.

BMT prepared the Port Geographe Coastal Structures Environmental Monitoring and Management Plan (EMMP) to enable the DoT to meet the requirements of Ministerial Statement 990. Since the EMMP was approved by the regulator in 2016, BMT has managed its implementation and completed annual compliance reporting and associated revisions of the EMMP. The preparation of the Plan was of a standard suitable for submission to the Environmental Protection Authority and considered the Environmental Factor Guideline—Coastal Processes. BMT has been implementing this monitoring program biannually since 2015 and assisting as Coastal Advisor.

Key Services:

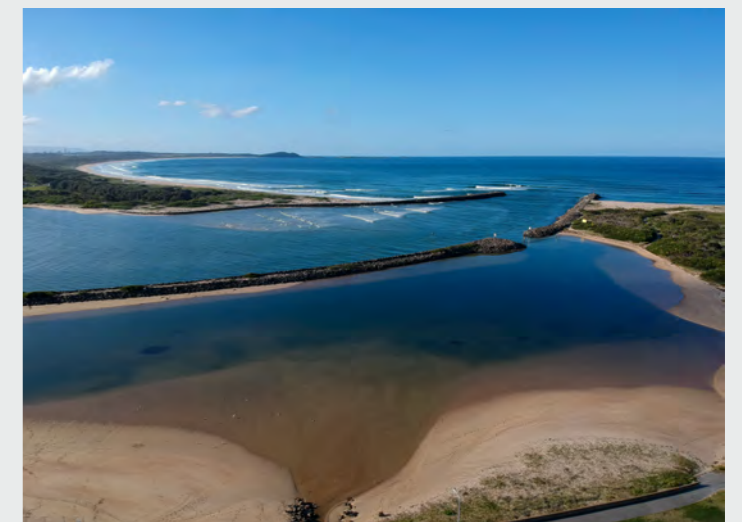
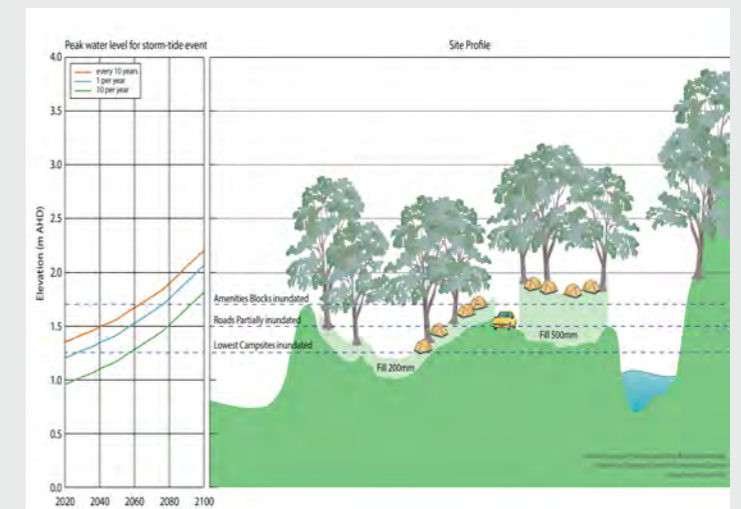
- Peer review for all coastal structure protection design
- Developed construction method, program and cost estimates for Groyne Construction and Dredging
- Planned and managed the construction works and managed the commercial contracts
- Provides ongoing coastal management advice
- Provides planning and supervision of wrack and sand by-passing
- Manages channel dredging and beach nourishment
- Condition assessment of 1700m of seawall
- Environmental management planning, approvals and compliance management and monitoring.

A number of key innovations have been brought to bear with ongoing engagement including remote data collection and drone surveys for coastal response and wrack management alongside our Consultancy Support Services for the DoT Dredging Program for Coastal Facilities and Other Sites covering the entire Western Australian Coast.

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Foreshore Protection

Wind, waves and currents constantly shape our coastline, while human activities can also have a major impact. As engineers, scientists and planners, we help identify issues and propose practical solutions.

We use our experience to identify the real question, are transparent about the scale and cost of credibly answering it and provide recommendations that are both defensible and actionable.

From building revetments to prototyping new nature-based solutions, our expertise in designing and managing the construction of coastal structures can overcome the complex technical challenges of such projects.

1. Maroochydore, Cotton Tree and Chambers Island Beach Nourishment Feasibility and Approvals

BMT worked closely with Sunshine Coast Council to investigate the feasibility of extracting sand from the lower Maroochy River for nourishment of beaches at Maroochydore, Cotton Tree and Chambers Island. Outcomes of the feasibility study were documented and presented to the community and stakeholders in a series of consultation meetings.

The feasibility study provided the supporting information for development applications to undertake the proposed sand extraction and placement works with the approvals process managed by BMT. Development permits were issued in late 2012 with works completed in three phases between 2013 and 2016 (an approximate total nourishment volume of 300,000 m³). BMT also assisted Council with the planning and approvals for an additional campaign in 2017.

The medium to long term feasibility of beach nourishment at Maroochydore was also the subject of an economic evaluation. As part of this study, we worked closely with specialist economists and applied an integrated coastal processes and economic model to explore the projected change in risk profile and the optimal time and scale of investment in coastal erosion risk mitigation options. This provided an economically sound approach for identifying trigger points for investment in management options, such as undertaking beach nourishment and delaying the need for seawall construction.

Key Services:

- Beach erosion modelling
- Beach nourishment concept design
- Preparation of the environmental approval's documentation and management of the application process
- Probabilistic modelling of shoreline position and subaerial beach width
- Stakeholder engagement to develop a relationship between beach with and social and recreational values
- Integration of coastal processes and economic modelling to optimise the timing of beach management action implementation

2. Port Stephens Coastal Structures Audit

Port Stephens is experiencing ongoing coastal hazards affecting amenity of this popular area and threatening natural and built assets. To manage these issues, Port Stephens Council (PSC) has commenced a Coastal Management Program (CMP) and engaged BMT to develop address and fill knowledge gaps and determine risks, hazards and opportunities through technical investigations of the area. As part of this engagement BMT completed a comprehensive audit of over 30 seawalls and revetments stretching over 20km.

Drawing upon our extensive condition assessment and coastal engineering experience, BMT developed an efficient but highly effective project methodology for the field-based condition assessments and associated residual life assessments.

Key Services:

- Visual condition assessment of both public and private seawalls
- Desktop review of the suitability of each foreshore structure to identify remediation priorities
- Development of a comprehensive GIS asset database of all public and private seawalls
- Preparation of costed long term maintenance schedules for all public seawalls

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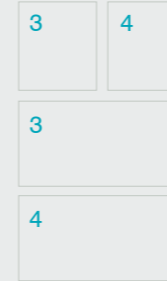
Foreshore Protection

3. Design of Long-Term Foreshore Protection for Apollo Bay

In recent years, the beach at Apollo Bay has experienced acceleration erosion which has impacted the foreshore reserve, heritage trees and beach access points as well as threatening the Great Ocean Road. In 2020 DELWP engaged BMT to develop concept and detailed design for \$7million of foreshore protection works including rock revetments, groynes and beach nourishment.

Key Services:

- Consultation with client and stakeholders including Eastern Marr traditional owner's group
- Numerical wave modelling
- Longshore sediment transport modelling
- Cross-shore (storm cut) sediment transport modelling
- Geotechnical investigations
- Development of a conceptual sediment budget
- Option development and evaluation
- Rock source investigations
- Sand source investigations
- Detailed design of rock groynes, revetment and beach nourishment
- Assistance with construction tender process
- Construction phase support
- Foreshore management plan to manage impacts on surrounding areas
- Advice on beach access structures, dune management and stormwater management



4. Esperance Seawall and Headland—Detailed Design

As part of the Esperance Foreshore Protection and Enhancement Project, the Shire of Esperance, Western Australia, commissioned BMT to review the Department of Transport (WA) design of a preferred seawall option to protect this section of coast from long term erosion based on our previous engagements in developing design conditions for the Town and the Port. Subsequently, BMT was commissioned to prepare a detailed design, technical specifications and tender documents for construction of a granite seawall and headland along approximately 1km of shoreline.

BMT developed technical specifications for the production of quarried rock to facilitate the estimation of the construction budget based on a concept level design.

The final built structure comprised 1km of partially buried, granite revetment to stabilise the shoreline position, whilst providing protection to valuable property and community assets located behind the foreshore reserve.

Key Services:

- Detailed design
- Technical specifications
- Tender documents for construction and evaluation of submitted tenders.
- Ongoing engineering advice during construction

Boating Infrastructure and Dredging Services

Our services offered include full project management from conception to completion on marine, harbour and coastal engineering projects.

We can act as an integral part of a team or lead a team managing all aspects from geotechnical investigation to design, construction and commissioning.

BMT's experience spans a wide range of dredging methods (cutter-suction, trailer suction hopper, excavation, agitation and sand bypassing), and dredging related issues, including dredged material management, environmental water quality monitoring and management and addressing secondary issues such as shading of marine habitats.

1. Bundeena Wharf Feasibility Study

BMT was engaged by Sutherland Shire Council to conduct an investigation of structural improvements to the wharf or wave mitigation measures to improve the wharf's ability to withstand damage from storms, general wave action and wear and tear from heavy use, with the objective of ensuring the wharf's continued safe operation and extending its lifespan.

Key services:

- Site Investigations and data collection:
 - Detailed Condition Assessment to WSCAM Standards
 - Maintenance recommendations and works prioritisations
 - Seagrass Survey
 - Bathymetric Survey
- Metrocean parameters (extreme water levels and waves) for infrastructure design
 - Analysed and prepared wave hindcast results through wave modelling and used to derive the ambient and extreme wave statistics at site
 - Prepared an overarching technical memo describing the environmental conditions at site noting key implications for wharf design, any major outstanding data gaps and recommendations for further work
- Concept Development and Selection
 - Developed basis of design, design approach, selection and refinement of options including concept level cost estimates for each concept design and selection of a preferred concept for future funding

2. Lake Bullen Merri Boat Ramp Concept and Detailed Design

Lake Bullen Merri is a significant regional asset for recreational fishing and boating located in southwest Victoria. The two-lane boat ramp and floating pontoons at South Beach are a hub for activity at the lake.

However, several significant issues have impacted the boat ramp facility including:

- Deteriorating structure reducing amenity and safety
- Sediment accumulation at the ramp leading to significant maintenance effort and cost
- Shoreline receding from the ramp due to the long-term trend in falling water level making boat launching more difficult
- Ad-hoc extension and repair of the ramp had very limited success.

The South Beach Committee of Management commissioned BMT to firstly provide concept design then reengaged for detailed design for the new boat ramp.

BMT was engaged with key stakeholders to understand the issues and values around the boat ramp, undertook a high-level assessment of the site conditions, and developed two concept designs and cost estimates suitable to progress approvals for funding of detailed design and construction of a new boat ramp. Survey of topography and bathymetry was included in the site investigation. BMT was then re-engaged to undertake detailed design and development of tender specifications and package for consultation.

Key services:

- Coordination of stakeholder and community engagement
- Coastal engineering and metrocean analysis
- Development of boat launching facility options and concept engineering designs
- Evaluation of costs and performance for competing concepts
- Planning of landside access to the boat ramp.
- Detailed design
- Ad-hoc extension and repair of the ramp had very limited success.

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Boating Infrastructure and Dredging Services

3. Kananook Creek Dredging Options Assessment, Dredging Design and Approvals

Maintenance dredging operations of Kananook Creek Entrance are required to provide access from Port Phillip Bay to a two-lane public boat ramp at this location which is a popular recreational boat launching facility year-round.

BMT has undertaken a series of investigations and studies to support the management of Kananook Creek entrance including:

- Sedimentation investigation
- Dredging Options Assessment
- Dredging Strategy Approvals

Key services:

- Coastal processes desktop studies, including review and estimations of sediment transport, conceptual modelling.
- Scoping of bathymetric and hydrographic surveys
- Visual inspection (Level 1) of existing entrance infrastructure (e.g., training walls).
- Sediment sampling and analysis plan preparation and implementation.
- Stakeholder and community engagement and consultation for input to and feedback on options.
- Concept engineering design, including cost estimates of options and Multi-Criteria Analysis (MCA) to support assessment of options.
- Environmental assessments and advice in support of CMA and MaCA Consent and Work Permit applications.
- Contract review and advice on procurement of maintenance dredging services from contractors.



4. Rottnest Island Maritime Facilities Concept Design

Rottnest Island Authority (RIA) identified the need to develop maritime facilities in South Thompson Bay, Rottnest Island. There is currently a lack of contingency for Ferry and Barge Operators on Rottnest Island during maintenance operations, and in conjunction, an increase in demand for commercial marine services on the island, which demands the need for additional marine facilities.

BMT was engaged to develop a base design, including a feasibility assessment of an alternative design. Our coastal engineers prepared a variety of concepts that achieved a varying level of functionality and operability at different cost levels, then evaluated them and selected two preferred design options for concept development.

Key services:

- Basis of Design including Metocean data QA/QC
- Stakeholder consultation
- Options assessment and selection
- Concept Development
- Concept design and documentation
- Cost estimation for quantitative assessment.
- Disposal and reclamation studies
- Feasibility assessment of marine and land-based facilities

5. Western Australia (WA) Maintenance Dredging Program Management

The WA Department of Transport (DoT) is responsible for the maintenance of its facilities which extend along the Western Australian coast from Wyndham in the North to Esperance in the South.

BMT has, since 2000, held the contract for project management of the maintenance dredging programs at these 20+ facilities. This work includes the ongoing monitoring of all facilities and periodic maintenance dredging to provide safe access for both public users and fishing fleets. Additionally, BMT manages the dredging of offshore channels, coastal inlets and river/estuarine channels, as well as coastal bypassing works undertaken with land-based plants.

Key services:

- Environmental approvals (including offshore dumping)
- Project Management of overall DoT maintenance dredging program including program status reporting
- Geotechnical investigations
- Survey monitoring
- Sand bypassing works
- Marine health and safety management.

Environmental Approvals, Monitoring and Data Collection

We work hand in hand as trusted advisors with our clients to gain environmental approvals that are timely and practical to implement. Our environmental management team is backed by strong technical experts, enabling BMT to offer innovative solutions to reducing project risk and optimising beneficial community and environmental outcomes.

BMT has a highly skilled field data capture team, supported by a full range of field sampling and monitoring equipment, together with two survey vessels and a scuba diving team certified for commercial activities.

1. Approvals for Dickies Beach Improvements

BMT supported Sunshine Coast Regional Council to progress the development of community infrastructure in the Dicky Beach area.

BMT worked closely with Council to understand the unique site constraints and manage the approvals process including responding to technical aspects of the statutory information requests, while minimising costs by leveraging from previous studies and assessments.

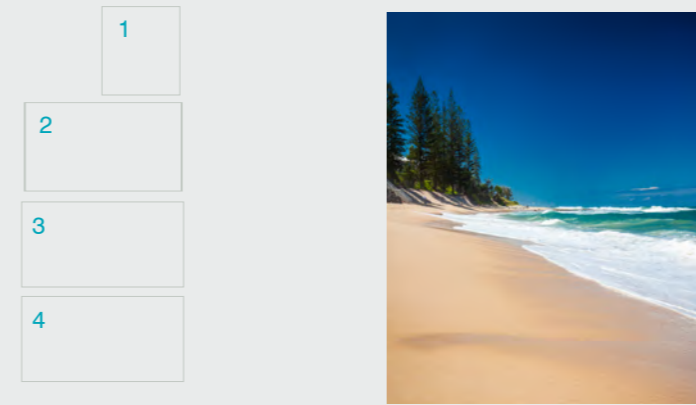
Key services:

- providing technical evidence on coastal processes and alternative management implications as part of securing statutory approvals for a seawall to protect community assets;
- undertaking a coastal hazard risk assessment for redevelopment of the skate park
- assessing coastal hazard risks and providing recommendations to complete the "missing link" of a proposed "all abilities" coastal pathway
- supporting Council with statutory approvals for the development of interpretive facilities associated with the adjacent historic shipwreck site.

2. Molongle Creek Boat Club Channel Assessments & Dredging Approvals

BMT was commissioned by the Queensland Department of Transport and Main Roads to undertake a coastal engineering assessment of hydrodynamic, wave and sediment transport processes that influence access and navigation for users of the Molongle Creek Boat Club facilities. An integrated suite of numerical models was used to assess the siltation potential of four alternative access channel scenarios for the Molongle Creek Boat Club. The models were developed and calibrated using information obtained during a site visit and targeted data collection campaign. The project identified the preferred channel option from a siltation and hydrodynamics perspective.

BMT was subsequently commissioned to implement a sediment sampling and analysis plan to characterise the material along the preferred channel alignment and inform the dredging and material management feasibility. Ultimately, a land-based dredge material management area was selected as the preferred option. BMT supported TMR with the planning and approvals to establish the new facility that provides capacity for both capital and maintenance dredge material.



3. Ground Penetrating Radar to inform Coastal Hazard investigations

Coastal erosion hazards are limited where bedrock is located beneath the beach and dunes, however most hazard studies assume the beaches to comprise only sand. BMT has been engaged to undertake a Ground Penetrating Radar (GPR) investigation in numerous locations (eg Gold coast, NSW Mid North Coast, Sydney region) to clarify the presence or otherwise of bedrock substrate that may constrain the extent of erosion hazards. GPR is a non-destructive method that images geotechnical conditions below the ground. It can identify natural features such as bedrock, dune erosion scarps, sedimentary layers and groundwater, and artificial structures such as seawalls, pipes and landfill. GPR works very well in sandy environments like beaches and dunes, and complements many types of coastal engineering investigations.

The GPR results were ultimately used to refine the mapping of erosion hazards, particularly by excluding areas of bedrock. This assist to confirm areas at risk from coastal erosion hazards that were previously identified in a standard coastal hazard assessment.

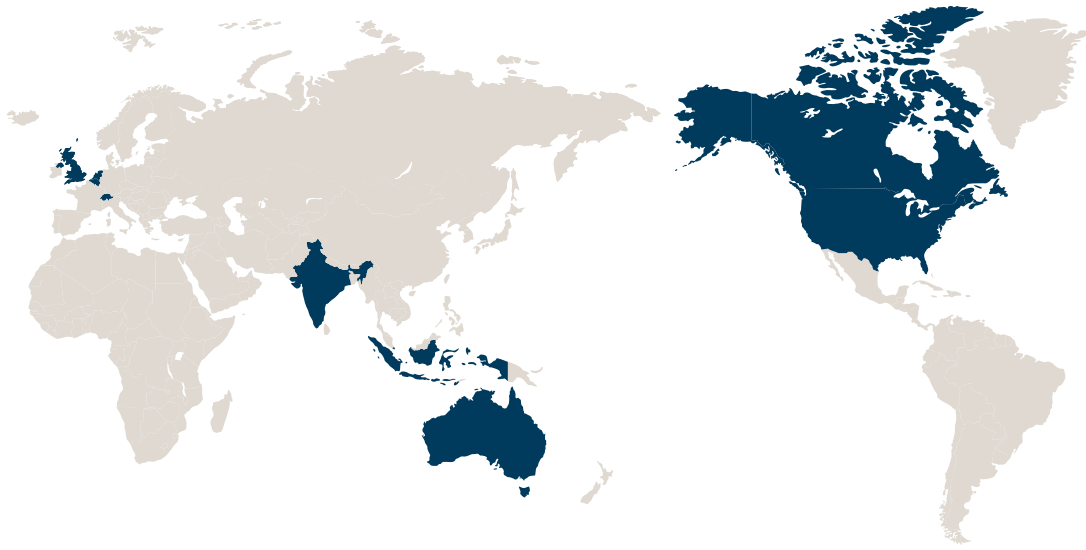
Key services:

- GPR survey of coastal geology;
- Identification of the bedrock-sediment interface beneath the beach and dunes;
- Geotechnical mapping of erodible substrate;
- Refinement of erosion hazard mapping to account for varying erodibility of coastal substrates.

4. Environmental Compliance Auditing for Marinas

MIA is the peak body for environmental management in the Australian and South East Asian marinas industry, and is responsible for managing the Clean Marina Program and Fish Friendly Marina certification systems. As an advisor to MIA, BMT conducts compliance audits against both of MIA's certification systems. In conjunction with this work, BMT also conducts compliance audits for marinas within the MIA network seeking to meet environmental approval conditions or to demonstrate local best practice.

BMT provides a combination of environmental management, marine ecology, water quality and environmental approvals expertise to evaluate the effectiveness of marina practices in meeting certification requirements. The application of this expertise has allowed for the MIA and individual marina operators to understand the state of their marinas and environmental activities. This in turn allows for targeted action to improve environmental management practice and to mitigate the risk of noncompliance with regulatory approvals.



BMT applies engineering, science and technology to help customers design, manage, maintain and improve their assets. Founded on a century's heritage in the marine environment and with a worldwide network of offices, BMT is an independent organisation held in trust for its employees.

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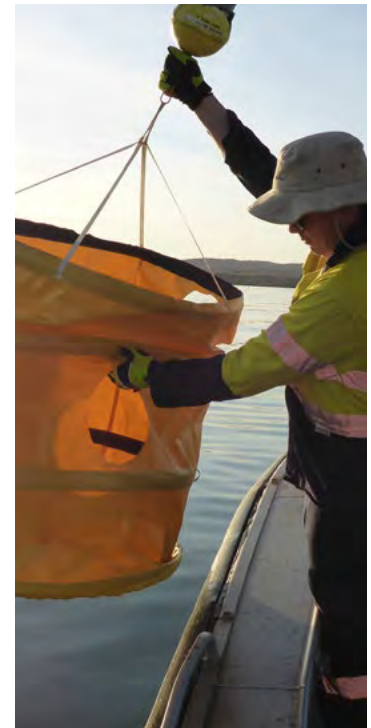
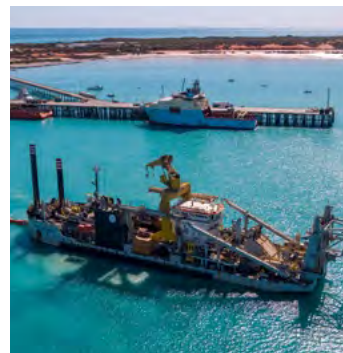
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