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Challenges and successes of Environmental Impact Management in the world's largest marine park.

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Synopsis

The Great Barrier Reef Marine Park Authority (GBRMPA) was established in 1975 and has striven to be a leader in marine environmental impact management. A review of the historical challenges and successes of Environmental Impact Management (EIM) by GBRMPA over the past 30 years indicates the increasing quantity and complexity of issues, projects, information and management.

GBRMPA has developed and now uses a range of tools including Legislation, Regulation, Policy, Memoranda of Understanding, Plans, Permits, Accreditation, Communication, Research, Vision Statements and Auditing to manage diverse activities including tourism, coastal and island developments, ports, aquaculture, research, defence, fishing and recreation.

The current economic value of major industries in the GBRMP is greater than twenty billion dollars. The ongoing challenge is the environmental management of multiple projects and activities whilst balancing resources between environmental protection, community and stakeholder expectations, project outcomes, systems improvements, staff development and increased communication.

Recent successes in relation to improved processes and systems include Guidelines for the Management of Artificial Reefs (2005), Environmental Impact Management Manual (2005), Strategic Environmental Assessment for Defence activities (2006) and Guidelines for Environmental Management Plans (2006). Specific high profile successfully managed projects include Nelly Bay Harbour and the largest dredging and disposal activity ever undertaken in Queensland at Hay Point (Mackay).

Keywords

History, Protection, EIA, policy, systems, risk, case study

The Great Barrier Reef

The Great Barrier Reef (GBR) is the largest most complex and diverse coral reef system on the planet. It is over 2,000 km long with 2,900 reefs and 900 islands and supports an incredibly diverse population of coral, sponges, molluscs, marine plants and species of fish. Large, iconic species on the GBR include six of the world's seven species of marine turtle, one of the world's most important dugong populations and over thirty species of whales and dolphins. In recognition of its unique values and universal significance, the GBR was listed as a World Heritage Area in 1981 (GBRMPA (1)).

The GBR is protected by a Marine Park, covering some 345,400 km² – the second largest Marine Protected Area in the world after the Northwest Hawaiian Islands Marine National Monument (US Department of State (2)).

The Great Barrier Reef Marine Park Authority (GBRMPA) was formed in 1975 with the primary function being the management of the GBR Marine Park. The GBRMPA's goal is: *to provide for the protection, wise use, understanding and enjoyment of the Great Barrier Reef in perpetuity through the care and development of the Great Barrier Reef Marine Park*. Management of the GBRMP also includes cooperative participation with the Queensland government.

History of Major Projects and Permits

The initial development of the GBRMP was largely a response to threats to the reef from coral mining and drilling for oil (Table 1). By 1980 the newly formed Authority had eight staff and did not manage any environmental impact assessment (EIA) projects or issue any permits. In the 1980s the main issue facing the health of the GBRMP was crown of thorns starfish (COTs) and its effects on coral, this

also put great economic pressure on the rapidly expanding tourism industry in locations such as Green Island (Table 1).

The first 'major project' EIA in the GBRMP was the Floating Hotel (Dutton, (3); Bastin and McGinnity (4)). During the latter part of the 1980's a small number of major offshore tourism developments and a harbour development on Magnetic Island required assessment and permits (Koloi et al (5)). In the 1990s tourism structures were still important EIA projects but additionally diverse proposals for mariculture of pearl oysters, a marina at Port Hinchinbrook and dredging at Heron Island were assessed. The tourism industry development continued and up to 850 permits were assessed and issued each year. By the late 1990's an Environmental Management Charge (EMC) was introduced, as an innovative way to generate some additional funding to support the ongoing management of the GBRMP. That EMC collection continues today and contributes approximately 20% of the operational budget of the GBRMPA.

In the current decade larger and more diverse projects have been subjected to the GBRMPA EIA processes, including large scale dredging and spoil disposal, marina developments, defence training exercises and several environmental clean-ups following ship groundings (Table 1). An increasing number of EIA processes are being completed each year and as a consequence both proactive and reactive EIA systems have been developed and implemented, for example risk assessment and strategic environmental assessment (SEA).

Today the GBR is under mounting pressure from a range of human activities. Similar pressures elsewhere in the world have contributed to the loss of up to 20 percent of the world's coral reefs, with a further 24 percent of the world's coral reefs under imminent risk of collapse (Sweetman *et al.* (6); AIMS (7)).

Key ongoing issues for the GBRMPA are coastal development, the downstream effects of land use, climate change, sustainable shipping and ports, tourism and commercial and recreational fishing. The cumulative impacts of all of these trends place critical pressure on the health of the reef and management approaches (GBRMPA (1)). The Authority structure includes specific critical issues groups to address those pressures for example including Fisheries; Water Quality and Coastal Development; Conversation, Heritage and Indigenous Partnerships; Tourism and Recreation; and Community Partnerships. Each of these critical issues groups contributes to the EIA process ensuring that a holistic approach is applied to the EIA process.

The current economic activity of major industries in the GBRMP is greater than twenty billion dollars. Ports and shipping activities are the most significant commercial activities in the Great Barrier Reef region, generating over \$15 billion per annum to the Australian economy (PCQ (8); TPA (9); CPA (10)) followed by tourism that generates over \$5.1 billion per annum (Access Economics (11)).

Table 1. A summary of key issues, EIA projects, permits and systems associated with the evolution of management of the GBRMPA over four decades.

Decades	Issue	EIA Projects	Number of permits per year	System
2000-2006	Tourism Fishing Water Quality Conservation Coral Bleaching	Ship grounding Nelly marina Hay Point dredging Defence training	713-911	Rezoning Strategic Environmental Assessment (SEA) Risk Database
1991-1999	Tourism	Palm Island mariculture Port Hinchinbrook marina Heron Is dredging	505-860	EMC
1981-1989	Crown of Thorns	Floating hotel Tourism pontoons	81-818	Regulations Joint permits
1975-1980	Mining Oil drilling	NA	0	Legislation

Assessment of Environmental Impacts on the Marine Park

The GBRMPA follows a multiple use philosophy, which attempts to balance the values of conservation with key users such as tourism, industry, fishers and traditional indigenous people. The basis of the EIA process is a framework including regulations, plans, policy, permits, deeds and bonds designed to work together to minimise potential impacts on the environment (Skeat et al. (12); Smith et al. (13)) (refer Figure 1). One tool in the management of environmental impact is the Zoning Plan (*Great Barrier Reef Marine Park Zoning Plan 2003*). This is based in principle on town planning design, and provides the framework for the protection of all critical natural habitats and the management of human use. To this end the Marine Park is divided into discrete zones of varying levels of protection, for example Marine National Park zone that accounts for approximately 33% of the entire Park. EIA processes utilise the zoning of an area in considering if a proposed activity is suitable for that site.

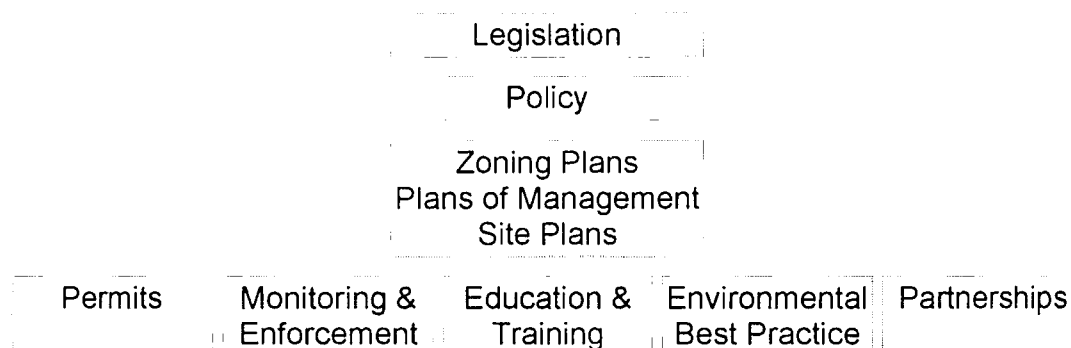


Figure 1. Management framework for EIA used by the Great Barrier Reef Marine Park Authority.

As part of its system of continuous improvement, the GBRMPA regularly reviews its EIA process in context with advances in research, international benchmarks, stakeholder feedback, case studies and environmental outcomes. GBRMPA's Environmental Impact Management (EIM) Vision statement is:

"The best environmental management is based on great leadership, innovative systems, effective decisions and developing strong partnerships".

Environmental Impact Management has evolved over the past 30 plus years (Wikipedia (14)). The EIA processes at GBRMPA have also changed as the field developed and also in response to the shift in key issues facing the GBRMP (Table 1). A summary of some of the changes in GBRMPA's EIA is presented in Table 2. The old approach (then) has evolved and the current approach (now) is to have a framework of policy and guidelines, risk based approach, longer-term simple permits, issue-based monitoring and a partnership approach (Table 2).

Table 2. GBRMPA EIA - then and now

THEN	NOW
Case by case	1. Policy and guidelines
EIS for small projects	2. Risk based approach
Short term complicated permits - 1 year	3. Longer Term simple permits - 5 to 15 years
Intensive, broad monitoring programs	4. Issue based monitoring
Regulatory approach	5. Partnership approach

The following sections, including some cases studies, will provide more information on the five current approaches that we use at GBRMPA.

1. Policy and guidelines

GBRMPA is a statutory Commonwealth Government authority. Policy and administrative procedures provide guidance for managers and the public on practical application of the legislation. GBRMPA's Board approves all policy. New policies and guidelines are developed based on priority and in consultation with advisory committees, stakeholders and the community.

Case study 1. Tourism, Pontoons and Coral transplantation guidelines

Tourism pontoons are one of the most intensive site-based uses of the GBRMP with some pontoon operations accommodating up to 400 persons per day. There are currently approximately 14 tourist pontoons permitted in the GBRMP (Smith et al. (15)). Some of these have been operating at the same sites for up to 20 years.

Coral cover at tourism sites is very important to both the experience of visitors and to the successful presentation of the Marine Park and its World Heritage values. Coral cover on healthy coral reefs fluctuates over time under a range of natural and human induced forces, including decreased water quality (Linton *et al.* (16)), fin damage from snorkellers and divers (Breen and Breen (17)), coral eating fish, algal blooms, coral bleaching (AIMS (7)), disease (Chin (18)), crown of thorns starfish (COTS) (Sweatman *et al.* (6)), ship groundings and storms. Consequently, levels of coral cover at a single tourism operation site on an otherwise healthy reef system can vary from year to year, and recovery may take five years or greater for even fast growing species.

The GBRMPA had received a number of enquiries from site-based tourism operators about the options available to them to manage their operations in the face of significant changes in coral cover at their sites over time. Under the GBRMPA – tourism industry partnership and stewardship approach, tourism operators are required to manage their operational impacts on the adjacent coral reefs. Satisfied by this management of impacts, the GBRMPA convened a working group that considered the recent experiences of the GBRMPA in transplanting corals, a review of scientific literature relating to coral transplantation and the objectives held by the tourism industry for site occupancy and use.

The working group concluded that the recovery of coral reefs should be, as far as practical, a natural process, however they also recognised that in limited circumstances small-scale managed coral transplantation was an effective process to sustainably manage individual fixed-site tourism operations. The working group's approach was to develop guidelines which clearly establish the minimum information requirements to be provided and to set agreed standards of operation to ensure that transplantation is as effective as possible, with the minimum ecological impact (GBRMPA (1)).

Application of the guidelines - Agincourt Reef 2D, Port Douglas

Using the Guidelines, in 2004 as a pilot study, 99 live coral colonies and fragments were transplanted to three discrete sites at a long-term tourism pontoon at Agincourt 2D Reef. The transplanted corals included: Staghorn *Acropora*; Bottle Brush *Acropora*; corymbose *Acropora*; *Pocillopora* spp.; *Stylophora* spp; and *Sinularia* spp. (soft coral). After approximately seven months there was 96% survival (Laycock (19)) of the transplanted corals. These results demonstrate a very high degree of success compared to all reviewed literature and confirm the appropriateness of the guidelines.

Overall the development and dissemination of the guidelines reinforces the benefit of conveying information from the scientific community to the general public in a practical and accessible form, with resultant improved environmental outcomes.

2. Risk based approach

The assessment of environment risk currently in use by the GBRMPA EIM unit is a hybrid risk assessment process based on Australian Standard ASNZS 4360: 2004, Risk Management and handbook HB 203: 2006 Environmental Risk Management: principals and process (GBRMPA (1)).

The assessment of risk is undertaken at various points in the assessment process dependent upon the information available. In most cases an initial risk assessment is undertaken to determine the "level of assessment" required (Table 3). The risk assessment process at this early stage is qualitative and generally benchmarks the application under consideration with other completed similar activities based on potential for environmental harm, including the extent and longevity of potential impacts and potential for impacts on other users of the Marine Park.

Table 3. Assessment Levels (from GBRMPA (20))

Level	Title	Impact Potential	Example
1	Minor Project	Minimal and/or transient	Small navigation marker
2	Small Project	Low and or short term	Jetty or pontoon, small boat ramp
3	Medium Scale Project	Medium scale project, Public Interest, Sensitive Environment, Moderate and medium term impact	Spoil disposal for maintenance dredging, submarine pipeline/cable
4	Complex Project	Large scale project, Public Interest, Sensitive Environment, Long term, irreversible and/or major impact	Large marina development, large capital dredging and spoil disposal

The levels of assessment are broad categories of assessment used to determine the scope with which a detailed risk assessment is undertaken.

A more detailed risk assessment is then undertaken for Level 2, 3 and 4 projects. The Project Manager and a group of experts undertake these risk assessments. For projects with increasing complexity and potential for environmental harm, the group of experts may be expanded with expertise from within the GBRMPA, relevant State and Commonwealth government agencies and universities, research institutions and industry.

Application of Risk Assessment - Nelly Bay Harbour

An example of a Risk Assessment undertaken by an 'Expert Panel' is the Risk Assessment process undertaken for the operational phase of the Nelly Bay Harbour Development (GBRMPA (21)). A Taskforce comprising core membership from within the GBRMPA was augmented with expertise from James Cook University, Queensland Transport and Townsville City Council.

This was the first major project assessment undertaken at GBRMPA within a risk assessment framework. The project, which involved dredging through a coral reef flat, was subsequently completed with a reactive monitoring and management program. Results indicated that impacts outside the footprint were managed to the agreed very low levels (Koloi et al. (5))

Based on that early successful application of risk assessment and in the period since June 2003, a number of improvements to that initial risk assessment process have been implemented, these include:

1. Refining likelihood and consequence tables;
2. The use of Risk Assessment as a tool for preliminary appraisal of assessment Level;
3. The review of the Risk Management processes within EIM and recommendations for improvement

The assessment of the potential impacts of proposals in the GBRMP using a Risk Assessment framework, is continually evolving. It is anticipated that overtime the EIM unit will develop a full risk register of the potential impacts of proposals within the Marine Park, from which assessing officers can draw guidance and in time provide permit application assessments by utilising the risk register as an "expert system".

3. Longer Term and Simpler Permits

Historically permits have been short-term (1 to 6 years) and complicated (up to 20 pages with over 80 individual condition and several maps). A joint permit process for Commonwealth and State waters significantly simplifies arrangements for permittees (Hassall *et al.* (22)). Permits may be issued for up to 15 years and longer-term permits have initially been issued to eco-certified tourism operators as well as for large infrastructure projects such as jetties, marinas and pontoons. The detail of some permits has now been covered in associated Environmental Management Plans (EMPs).

Case study 3 Approvals managed through Environmental Management Plans

- For large infrastructure projects permittees are required to submit an Environmental Management Plan (EMP) that demonstrates how the environmental impacts will be managed during construction and/or operation. The GBRMPA has developed simple EMP guidelines to assist operators in preparing and completing their EMP requirements (GBRMPA (1)). The EMP guidelines focus on issues and/or activities and provide flexible and responsive management.

4. Issue based monitoring

Large EIA projects have historically used intensive, broad monitoring programs and covered diverse variables such as water quality, sediment, plankton, marine vegetation, fish, invertebrates, mammals, reptiles, birds and physical processes such as tides, currents and seasons.

Case study 4. Dredging and spoil disposal at Hay Point, Mackay

The port of Hay Point is 40 kilometres south of Mackay and is Queensland's largest coal export port, exporting some 85 million tonnes in 2005 (PCQ (8)). Ports Corporation of Queensland (PCQ) are deepening the existing apron areas from 13.1 metres to 14.9 metres and creating a nine kilometre departure path to increase port efficiency. The nine million tonnes of dredging began on 8 May 2006 and is expected to take six months. This is the largest dredging and spoil disposal project to occur in Queensland and the GBRMP.

PCQ prepared an Environmental Impact Statement (EIS), which focussed on impacts associated with water quality and habitat change to seagrass and coral. There has been extensive community consultation through an EIS process that included newsletters, submissions and public meetings. There is an ongoing issue based monitoring program and a Management Response Group (MRG) comprised of Commonwealth, State, industry and consultants has been formed and meets at least monthly to review monitoring and management decisions as required throughout the dredging.

There have been long discussions between the MRG, PCQ and its environmental consultants about the accuracy of models, data and predictions made in the EIS and the link to management options. Issue based monitoring is focussed on water quality and coral at multiple impact and control locations. An agreed water quality trigger was in place to trigger management responses in the event of environmental change. There were three technical non-compliances as of the end on July and these were partially related to rough weather. Trigger exceedance is a technical non-compliance of the Environmental Management Plan and is referred to the MRG for consideration.

The EIS predicted impacts of up to 20% mortality of coral at some locations. Monitoring has shown increasing coral mortality, disease and sedimentation at impact sites especially to the south. However, the prediction of 20% coral mortality has not been reached at this stage of the project.

In comparison to other monitoring studies of dredging and spoil disposal in Queensland (Berkelmans *et al.* (23), 1998, Koloi *et al.* (5)), the Hay Point monitoring is more focused on issues and uses more sophisticated technology and data is available daily.

One of the challenges facing environmental managers is that there is no GBRMP, Australian or international standard protocols in monitoring program design, sampling procedures, sample or data analysis. That is each monitoring program must be individually designed and results may not be directly comparable to other programs. The intention is to use each programs result to collectively improve knowledge of impacting processes for ongoing EIA.

5. Partnership approach

The Partnership approach involves enhancing the work that the GBRMPA is already doing by developing better linkages with, and greater understanding, of the Great Barrier Reef and increasing industry and local involvement in decision-making, compliance and stewardship of the Great Barrier Reef.

Case study 5. Defence Strategic Environmental Assessment

The Great Barrier Reef region is used by the Australian Defence Force for a wide variety of Defence activities. A Strategic Environmental Assessment (SEA) based on risk assessment of Defence training activities was conducted in 2005 to address the cumulative environmental impacts of Defence activities in the GBRMP

The three components of the SEA were:

- I. description and quantification of the full range of Defence activities undertaken in the GBRWHA by Defence;
- II. consideration of the environmental implications of these activities, particularly with respect to World Heritage values, and the regulatory framework within which they are controlled; and
- III. review of the management framework within which these activities are planned, assessed and controlled to reduce environmental risk.

The SEA concluded that Defence activities in the GBRWHA are unlikely to have significant negative effects on the World Heritage values of the area or upon socio-economic values of the GBR region. GBRMPA accepted the SEA in March 2006 (GBRMPA, (24)). This strategic environmental assessment is the first of its kind in the world. This arrangement will provide both certainty and flexibility when planning Defence exercises, and also ensure best practice environmental management of the iconic values of the GBRMP. In light of the favourable outcome of the assessment, the Authority and Defence have agreed that routine military training exercises will not need to be individually referred for EIA if they meet agreed requirements. Defence will still be required to report any significant incidents to GBRMPA within 24 hours- such as unexploded ordinance, lost equipment, ship groundings, oil or sewage spills and impacts on sensitive habitats and species such as coral, threatened or endangered species. GBRMPA may seek to audit aspects of performance against the SEA plan

Successes

Successful environmental management can be measured through monitoring the health of the GBR (GBRMPA (1); AIMS (7)) but also through numerous other indicators including financial performance, awards, and stakeholder's feedback.

The Great Barrier Reef Marine Park Authority has been very successful with numerous regional, national and international awards in 2004 and 2005 including the World Wide Fund for Nature (WWF) Gift to the Earth, Sultan Qaboos Prize for Environmental Preservation for UNESCO's Man and the Biosphere Program, Planning Institute of Australia National Awards, US Coral Reef Task Force Award for Outstanding Management, Eureka Prize for Biodiversity Research and Banksia Environmental Award (for Government Leading by Example for a Sustainable Future).

The GBRMPA receives regular feedback from its stakeholders, most of which are generally positive, we have included an extract of four of these below and one negative piece of feedback is also included for balance:

"... your expertise and guidance has assisted our administrators and researchers significantly ..."
Prof Jim Mienczakowski, Central Queensland University

"Ports Corporation Queensland has long valued the GBRMPA's contribution to the management of port related activities...and considers the Authority's proactive, practical and expert advice on reef-specific environmental issues to be of the highest standard. The partnership approach taken by the EIM team has ensured consistently positive outcomes for both the natural environment and ports industry."

Bob Brunner, Environment and Safety Manager, Ports Corporation Queensland

"In our experience the GBRMPA approach to managing environmental impacts is second to none. The work of GBRMPA's EIM team to come to grips with the complexities of a strategic assessment approach for Defence activities was first class."

Colin Trinder, Defence, Director Environmental Stewardship

"I find this extended process and the complete lack of communication absolutely outrageous ..."
Name withheld

Challenges

Direct use of the marine park is increasing; there are new activities and technologies, stakeholders are more demanding, and resources for management are difficult to find (GBRMPA (1); Access Economics (11); Smith et al, (13)). Management agencies are focussed on cost recovery from users who are reluctant to pay (Kelleher and Craik (25)).

The quantification and management response to cumulative impacts in the Marine Park provides an ongoing challenge. Plans of Managements are developed and refined within frequently visited areas including Cairns, Whitsunday's and Hinchinbrook provide a foundation for managing cumulative impacts of well understood activities. For infrequent or unusual activities, the estimation of cumulative impacts is harder to predict.

The concept that development should be based on ecologically sustainable development is not new (Kelleher and Craik (25), GBRMPA, (20)). Marine areas may be particularly vulnerable to negative impacts of development and pollution due to these being traditionally considered the "commons".

The GBRMPA's EIA processes will continue to evolve based on continual improvement and benchmarking against other national and international organisations and developments and in response to emerging issues in the changing use of the GBRMP. One of the challenges is the interface between politics, economics, science, management and the community. Managers are expected to deliver equitable, legally defensible, science and risk-based, environmentally balanced advice and decisions; developed in partnership with stakeholders, in consultation with the community and politically palatable decisions within increasingly strict time limits. This is a complex and perhaps impossible task, particularly given additional resources are difficult to find despite increased workloads and increased community and stakeholder expectations.

In conclusion, this paper has been written to share knowledge and to seek continuous improvement of EIA. The GBRMPA strives to be a world leader in EIA and we regularly review our processes in

context with research, stakeholder feedback, case studies and environmental outcomes and have streamlined our management approach. These lessons over a thirty-year period of management should assist other organisations and countries with similar EIA issues and processes.

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