Australian Government
Great Barrier Reef
Marine Park Authority

Mid-Term Review

Great Barrier Reef Climate Change Action Plan 2007-2012 and delivery program

September 2010

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1. Introduction to the mid-term review

GHD was commissioned by the Great Barrier Reef Marine Park Authority (GBRMPA) to conduct a mid-term review of the Great Barrier Reef Climate Change Action Plan 2007-12 (the Action Plan) and its delivery program. The objectives of the review were to:

- Provide a mid-term evaluation (review) of:
  - progress made towards achieving the desired outcomes outlined in the Great Barrier Reef Climate Change Action Plan 2007-2012 (impact)
  - management of the delivery program and projects (implementation)
- Record and share the lessons learned so far
- Provide recommendations to guide adaptive management and continuous improvement of the implementation program
- Contribute to building evaluation awareness and capacity within the Climate Change Group (CCG) and other GBRMPA staff involved in delivering against the Action Plan.

This final report describes the review methodology and findings. It provides summary findings in relation to implementation, impact, alignment with action on climate change at other levels, and contribution to the GBRMPA Corporate Plan 2009-2014 in the main body of the report, and detailed results in the form of a series of results charts in an appendix.

2. Methodology

The review was undertaken through a combination of document review and interviews with participants within and external to the GBRMPA, and conducted over April - June 2010, with further interviews in August 2010.

A large amount of documentation was provided by the CCG, the majority of which was reviewed to provide evidence for the evaluation. Documents reviewed included project proposals, contracts, bulletins and reports, as well as external publications relevant to the work of the GBRMPA. Appendix C contains results charts for each of the four objectives of the Action Plan including an index of source documents for each objective.

A list of interviewees is provided in Appendix A. Overall, 15 informants internal to the GBRMPA and ten informants external to the GBRMPA were interviewed, giving a total of 25 interview participants. Some interviewees, particularly those external to the GBRMPA, spoke about their experience across the GBRMPA as a whole and did not limit their comments specifically to the CCG and the Action Plan. These comments have been included where they were relevant to the mid-term review, and have been distinguished by reference to the GBRMPA rather than the CCG and/or Action Plan.

The review focused on addressing five key evaluation questions as agreed with the Steering Group at an inception meeting in April 2010. The key evaluation questions set out the principal questions the review sought to address, providing information to assist the GBRMPA and other stakeholders to understand the level of delivery and impact of the Action Plan.

The first four questions relate to implementation of the Action Plan and were considered across all four areas of the Action Plan. The final question relates to impact and separately addressed each section of the Action Plan and its implementation program. The five evaluation questions were:

1. To what extent have planned projects and activities been delivered?
   - This question provides a baseline understanding of delivery, considering both the **effectiveness** and **efficiency** of implementation of the Action Plan to date.
2. To what extent are these projects and activities consistent with the Action Plan?
   - This question addresses the **appropriateness** of program activity, and the processes for determining appropriate program activity.
3. How have program planning, management and delivery processes supported delivery of these projects and activities?
   - This question addresses aspects of the **effectiveness** and **legacy** of the Action Plan, as these rely on effective planning, management and delivery processes. It covers the supporting functions outlined in the management effectiveness criteria in the Great Barrier Reef Outlook Report 2009.
4. What lessons have been learned in implementation for climate change and adaptation?
   - This question seeks to provide insight for future management of the Action Plan, addressing the **legacy** of the Action Plan through provision of knowledge and experience to guide ongoing implementation.
5. To what extent is delivery of planned projects and activities contributing to the achievement of Action Plan outcomes?
   - This question addresses **impact** and **effectiveness** by linking Action Plan activities with expected outcomes.
     - Objective 1 – Targeted science
     - Objective 2 – A resilient Great Barrier Reef ecosystem
     - Objective 3 – Adaptation of industries and communities
     - Objective 4 – Reduced climate footprints
     - Contribution to the GBRMPA Corporate Plan 2009-2014 and regional, national and international action on climate change.

3. Overview of the Climate Change Action Plan 2007-2012

The Great Barrier Reef Climate Change Action Plan 2007-2012 provides a five year strategy for the GBRMPA to focus attention on understanding and assessing the risks of climate change to the Great Barrier Reef. The Action Plan is a short document which outlines a body of work to be undertaken and outcomes to be achieved in order to support the ability of the GBRMPA to address these issues.

The Action Plan is intended to provide a coordinated response to the threat of climate change to the Great Barrier Reef, and specifically to identify and test strategies to maximise the resilience of the Reef and the communities and industries that depend on it.

The Action Plan recognises that the future health of the Reef will depend on both the rate and extent of climate change and the resilience of the system to that change, and that while climate change mitigation needs to be managed globally, resilience can be influenced locally. The Action Plan therefore outlines management actions to increase the resilience of the Reef. It establishes four objectives to be met by a five-year program of actions, delivered in partnership with Reef stakeholders and coordinated with other science and adaptation initiatives. The four objectives are:

- Targeted science (providing critical knowledge needs)
- A resilient Great Barrier Reef ecosystem (reducing stresses, facilitating adaptation and minimising impacts)
- Adaptation of industries and communities (identification, awareness raising and support strategies)
- Reduced climate footprints (supporting continuing action to protect the Reef from climate change).

A budget of almost $9 million has been allocated over 2007-2012 to implement the Action Plan. Funding was provided as part of the COAG National Climate Change Adaptation Framework, and is administered by the GBRMPA in conjunction with the Department of the Environment, Water, Heritage and the Arts and the Department of Climate Change.

The Action Plan is implemented by the staff of the GBRMPA Climate Change Group (CCG), as well as staff from other sections of the GBRMPA, and researchers, consultants and other organisations under contract.

4. Findings in relation to Action Plan implementation

Implementation of the Action Plan has been coordinated through the CCG, with project delivery undertaken by staff from CCG and other sections of the GBRMPA, and researchers, consultants and other organisations under contract. A wide range of projects have been delivered, many are underway and future projects are under development.

Four of the key evaluation questions relate to **implementation** of the Action Plan:

1. To what extent have planned projects and activities been delivered?
2. To what extent are these projects and activities consistent with the Action Plan?
3. How have program planning, management and delivery processes supported delivery of these projects and activities?
4. What lessons have been learned in implementation for climate change and adaptation?

This section outlines the findings in relation to each of these questions.

4.1 Key evaluation question 1: To what extent have planned projects and activities been delivered?

The Action Plan identifies a range of activities and strategies to be undertaken to meet the objectives. Some elements of the Action Plan clearly form the basis for projects, while other elements are broader strategies that have required further development of project concept and design prior to funding of project activities.

Formal project and activity planning has occurred each year, to develop an annual plan of work under the Action Plan.

Funding is provided both for external expenses, principally the contracting of project delivery (administered funds), and also through the use of departmental funds, which provides FTE to coordinate, manage and undertake projects.

CCG records provide documentation of the projects planned and funded through the Action Plan for administered funding (external expenses) but not for the value of departmental funds (FTE allocation).

The following tables show the distribution of administered funding across the four Action Plan objectives over the three years of the Action Plan to date. This analysis does not consider the linkages between projects and their contribution to multiple objectives. Within the CCG project management system, each funded project has been recorded against a single strategy under the Action Plan, although many projects are expected to contribute to multiple strategies and objectives. This analysis should be seen as indicative of the principal objectives to which individual projects are expected to contribute.

Table 1 Proportion of funding allocation* to objectives, 2007-08 to 2009-10

		*Percentage of annual administered funding**			
		3 years	2007-08	2008-09	2009-10
1	Targeted science	34%	37%	35%	33%
2	A resilient Great Barrier Reef ecosystem	17%	10%	16%	23%
3	Adaptation of industries and communities	28%	24%	18%	38%
4	Reduced climate footprints	20%	29%	31%	5%

** Note that this relates to administered funding allocated to projects delivered under contract, not departmental funding providing FTE for projects*

The emphasis on targeted science can be seen in

Table 1, with one third or more of funding each year directed to projects under this objective. The focus on adaptation (Objective 3) has grown over the implementation of the Action Plan such that it received the greatest level of funding in 2009-10. This may be due to the gradual development of industry programs in earlier years that are now actively working with the tourism and fishing industries. The CCG expected the pattern of allocation of funds to change over the years, as the results of Objective 1 (Targeted science) projects provide input for projects under other objectives.

Table 2 below shows the administered funding allocated to projects within each objective in the three years that have passed. Within each year, any objective receiving more than 25% of the funding is highlighted. There is no requirement for the funding to be allocated evenly across the four objectives of the Action Plan, but the identification of elements receiving greater than a quarter of the funding can demonstrate the areas of greatest emphasis for program delivery, particularly where contracted project delivery is required.

Table 2 Distribution of funding allocation* across objectives, 2007-08 to 2009-10

		*Total annual administered funding**			
		3 years	2007-08	2008-09	2009-10
1	Targeted science	895,762	256,570	298,120	341,073
2	A resilient Great Barrier Reef ecosystem	446,974	68,510	137,222	241,242
3	Adaptation of industries and communities	724,827	169,659	156,569	398,600
4	Reduced climate footprints	530,181	203,284	270,988	55,910
	Total	2,597,744	698,022	862,898	1,036,824

** Note that the amounts relate to administered funding allocated to projects delivered under contract. In addition these projects were supported by, and other projects were undertaken internally through, FTE funding allocations from Action Plan departmental funds*

Projects focusing on targeted science require significant engagement with researchers and specialist consultants; therefore this has formed the main area of funding allocation for the first two years. Information gained from these earlier projects, as well as internally implemented projects in the earlier years, has enabled the CCG to transition the focus of implementation from Objective 1 to Objectives 2 and 3 which are based on the scientific evidence derived from the projects funded under Objective 1.

This change of emphasis is consistent with the design of the Action Plan and it is expected that the emphasis will change further in the final years of implementation of the Action Plan.

4.2 Key evaluation question 2: To what extent are these projects and activities consistent with the Action Plan?

A wide range of projects and activities has been funded under the Action Plan, consistent with the Plan's broad objectives. The review found no activities funded under the Action Plan that did not contribute to one or more of the objectives.

Activities under the Action Plan are strongly interrelated and the implementation of many of the projects focused on addressing resilience and adaptation are based on knowledge and experience derived from earlier projects, particularly under Objective 1 (targeted science).

Projects promoting resilience planning and adaptation have been developed over time to gradually build, and then respond to, interest in industry, community and other stakeholders about the impacts of climate change. Through this time the CCG has worked to generate both the agenda for a climate change response, and the information and capabilities required to develop responses to climate change.

The use of a matrix program logic by the CCG, requiring each project to be allocated to a single category under the Action Plan, reduces the capacity for the GBRMPA to capture information on how projects contribute to multiple objectives under the Action Plan. This lack of recording of the multiple linkages between projects and objectives, and of the role of Objective 1 projects in providing the base for future projects under the other objectives, means the full contribution of many projects to the desired outcomes of the Action Plan is not effectively captured.

The emphasis of implementation will continue to change in the later years of Action Plan implementation and it will be important to capture these linkages between projects for greater clarity of understanding of the overall achievements at the end of the Action Plan period. The implementation of a Monitoring, Evaluation, Reporting and Implementation (MERI) Framework, currently being developed by the CCG, will assist in clarifying the expected contribution of projects to Action Plan objectives and should provide a body of evidence to demonstrate achievements of the Action Plan.

4.3 Key evaluation question 3: How have program planning, management and delivery processes supported delivery of these projects and activities?

The CCG has been responsible for establishing a series of program and project planning and management processes to support implementation of the Action Plan. These processes took some time to develop and streamline for effectiveness. By this mid-point in Action Plan delivery, the CCG has developed reliable and efficient processes for planning and managing projects under the Action Plan and the overall program delivery. Many of these systems are being adopted by other sections of the agency or will be incorporated through current efforts to improve corporate systems more broadly.

During this period, the GBRMPA has undergone a range of changes to internal processes, which has provided a dynamic context for the development of effective processes for Action Plan implementation.

Planning for projects under the Action Plan is integrated into the GRBMPA annual planning process. The project concept is identified in discussions between the CCG and other areas of the GBRMPA that propose to implement projects under the Action Plan. Following agreement on the intent and scale of the project, the project is added to the annual operating plan (AOP) of the relevant section, with a nominal funding amount. In addition, a range of project proposals are developed within the CCG each year for implementation by the CCG, and are included in the CCG AOP. Once AOPs are finalised and sections are clear on their scope of responsibilities for the year, a formal project proposal is required for each nominated project.

The project proposal is prepared on a standard template (developed by the CCG) setting out the project objective and justification and alignment with the Action Plan objectives. It also requires the proponent to establish the milestones, timeline and outcomes for the project, to support project management. The project proposals are refined in consultation with the CCG and approved by the CCG Director. Other sections within the GBRMPA are now adopting this project planning approach.

Many projects are delivered by researchers and consultants under contract, and CCG has advanced the GBRMPA procedure by developing guidance documents to support project managers in selecting contractors and administering contracts for project delivery. The increased level of contracted project delivery required to implement the Action Plan has necessitated further development of capabilities within the GBRMPA to develop and manage contracts, as this was previously a less common project delivery method. The procedures and documentation developed by the CCG for Action Plan implementation have now been circulated across the GBRMPA and are used to assist in management of most contracted activity. The focus of the CCG on documenting procedures and communicating these requirements to all staff involved in Action Plan projects has provided additional benefits to the GBRMPA and minimised the risks that may arise when undertaking a new program area through contracted project delivery.

As the coordination of Action Plan implementation is spreading more widely across the GBRMPA sections, CCG is providing ongoing support to project managers in other sections as they develop skills in project and contract management. While the formal responsibility for delivery of these projects may lie with the other sections, staff in the CCG continues to provide guidance on project and contract management, and internal GBRMPA procedures to support the successful delivery of these projects. It is envisaged that the need for support from CCG will reduce as staff become more familiar with formal processes for managing contracts.

Some external research informants compared the current management of research with the approach to research under the former Reef and Rainforest CRCs, and noted that the current relationship between the GBRMPA and research organisations is less collaborative than under the CRCs. One informant described the CRC model as “extremely successful”, stating that “such partnerships enabled the GBRMPA to have input and influence over research investments through a collaboratively brokered model”, and that “a lot of our current and good relationship with the GBRMPA and the level of collaboration really is derived from that experience”,

> *The CRC experience demonstrated the necessity of a collaborative approach to solving the problems of greatest interest to the Marine Park Authority because no one provider has all the skills, or the critical mass, or all the answers for a particular problem. Alliances or collaborations are absolutely the pathway for dealing with these problems. There are many mechanisms for encouraging collaboration among institutions, but as the managing agency with the overall responsibility for the Marine Park the GBRMPA is in the best of all possible places to provide the focus to build and nurture networks and*

get the right collaborations - they sit in a critical position. I regard them as having been very successful over the years in building networks and alliances of researchers.

The current approach to research was described by an external research informant as "the normal outsourcing model, writ large", with complex contracts, slow processes and high overheads. The informant described large outsourced research projects as having a range of "external decision-making and advisory committees", and stated that "while it may be necessary, …it has proven to be quite a cumbersome and a slow process… it has quite a high overhead." This was compared with the former approach to research: "in the CRC model there were regular management and steering group meetings where we could be much more responsive to emerging issues and had greater ownership of the problems."

External research informants also noted that the recent working relationship between researchers and the GBRMPA can be uncomfortable, for a number of reasons:

- The GBRMPA can be slow to establish contracts, pay researchers and assess reports, leading to delays in research or the need for research organisations to fund activities while waiting for payment. This slowness in administration has been apparent for the last 4-5 years.
- The delays in contracts and payments can cause problems for research organisations when audited, due to having commenced research without contract or payment.
- The process for obtaining research permits asserts the GBRMPA's role as regulator "where research is often put under the microscope, so it is not an essential partner, in fact it is almost an industry to be tolerated and permitted within the Marine Park. So there is a disconnect there, and it's an internal communication issue. It is not helped by the mobility of the mid-level career officers in the public service, there is a high turnover there".
- Research that is jointly funded is sometimes presented as being the product of GBRMPA and does not sufficiently recognise the financial and in-kind input of other organisations.
- Research is not always released or made available to other researchers, either because GBRMPA is sensitive to the reception of the information, or because the organisation is slow in assessing and communicating the findings. One external informant expressed concern that the GBRMPA at times keeps research findings for its own uses rather than contributing to collective understanding of issues, and that this has led to a loss of trust with some researchers and with industry where the research knowledge has been used in negotiations.

However the informant noted that despite the sometimes uncomfortable relationship, this does not usually impede the conduct of research, but it has inconvenienced researchers at times.

One external research informant stated that:

I would like the GBRMPA to truly recognise and appreciate research providers as partners with a common interest in terms of ensuring the wise use and healthy future of the Great Barrier Reef – we are just as invested in that.

The Great Barrier Reef Outlook Report 2009 established four management effectiveness criteria for program delivery, and this review indicates that the implementation of the Action Plan has performed well against these criteria:

- **Understanding of context** – the CCG has established the context for the Action Plan and provided a clear understanding of this context to staff across the GBRMPA. Knowledge of the risks of climate change and the scope of the Action Plan has been communicated, to support implementation of the Action Plan.

- **Planning** – project planning procedures are clear and consistently implemented, and assist in the formal approval of projects.
- **Financial, staffing and information inputs** – the CCG was not fully staffed until recently, but has been able to develop implementation practices through both leveraging the full range of skills of existing CCG staff and drawing on the broader organisational capacity of the GBRMPA, for example by the joint development of contracting guidelines.
- **Management systems and processes** – the CCG has implemented a range of management processes to plan and track the implementation of the projects. These enable visibility of project status to all team members and consistent tracking and reporting of project implementation. Because the management processes were developed specifically for routine project management and tracking, data was not collected or stored in a consistent way to support evaluation across projects. However the current development of a monitoring and evaluation framework is designed to provide a structure and processes to gather and organise project level data for program monitoring and evaluation.

  Some external research informants expressed frustration over the processes for research contracting and management across the GBRMPA (not specific to the CCG), in comparison to the approach under the former CRCs. The extent to which the projects run by the CCG experience these problems was not clear, but this feedback from research informants may indicate a need for changes to processes to reduce the administrative burden on external researchers and to increase timeliness of approvals and payment. There may also be a need to explain to researchers the administrative processes and rationale in more detail, to minimise future frustration.

4.4 Key evaluation question 4: What lessons have been learned in implementation for climate change and adaptation?

The CCG and the GBRMPA broadly have learned many lessons in implementation of the Action Plan, and will continue to do so. It will be important to capture these learnings for implementation of future climate change response activities.

- **Responsiveness** is critical to addressing the risks of climate change response and to adaptive management. This must be based on reliable knowledge both of impacts and of the appropriate actions in response, and the timing and method of the response as conditions change. For example, changes to permitting arrangements to respond to coral bleaching.
- This reinforces the need to have access to the underpinning science and the ability to understand the implications and translate it into **knowledge that enables informed management actions.**
- There is a critical role in **interpreting emerging knowledge** and filtering this to multiple audiences. Much of the emerging scientific knowledge is research focused and requires interpretation for use in adaptive management, or as input to communication of climate change issues. Investment of effort is required to interpret the results of scientific research for adaptive management and to present this in a form readily useable by Reef managers and other relevant users of the information.
- **Relationships and trust** are key to promoting climate change response, and in engaging with the community and industry to consider the implications of climate change and options to reduce their contribution to greenhouse gas emissions and other impacts on the Reef.
- **Networks and linkages** with researchers and policy makers are important to gather emerging knowledge as well as to influence the focus of research, and then to have an audience prepared to take this knowledge and use it for adaptive management.

- **Community understanding of the complex issues of climate change** and reef ecology is limited and community perceptions of support for climate change action can be eroded by other claims that undermine community trust in the sources of information on climate change. There is also a tendency for sectors of the community to adjust their opinions to align with that of public figures, and this can lead to unpredictable changes in community perception on climate change issues.
- **Communication through multiple means and messages** is needed to raise awareness of climate change risks and the range of responses required to support resilience and to reduce emissions.
- There is an **important role for procedures and documentation** to support development of organisational capacity to take on the new scope of work relating to climate change. The CCG investment in developing and documenting procedures has been a valuable support to implementation though enabling other areas of the GBRMPA to develop and document project proposals and manage projects, with support from the CCG. The willingness of corporate areas to support the implementation of the Action Plan through changes to procedures and communication of requirements has assisted in the implementation.
- **To continue to deliver emerging scientific knowledge for adaptive management**, the GBRMPA requires a body of people with specialist skills in the interpretation of scientific information and experience in assisting researchers to focus their research outputs towards information for adaptive management.
- The **Action Plan has served as a framework for adaptive program planning and delivery** – with annual adjustment to the portfolio of projects to respond to emerging knowledge and changing conditions. At each stage there is a changing frame of relevance to the overall Action Plan as the body of knowledge of risk and resilience is developed. Within the broad framework of the Action Plan, there is flexibility to adapt to the changing context to most effectively support the objectives.

5. Findings in relation to Action Plan impact

This section relates to key evaluation question 5: To what extent is delivery of planned projects and activities contributing to the achievement of Action Plan outcomes?

The Action Plan is broadly based on the key premise that the resilience of the Reef ecosystem to climate change is able to be influenced by local management strategies. Therefore, comprehensive and coordinated action needs to be taken locally to restore and maintain the resilience of the ecosystem, as well as contributing to the capacity for Reef-dependent communities and industries to understand and adapt to climate change. The key outcomes sought to achieve this include:

1. Targeted Science – provision of the **critical knowledge needs** for improving the resilience of the Great Barrier Reef to climate change and for helping Reef-based industries and regional communities adapt to impacts.
2. A resilient Great Barrier Reef Ecosystem – **reduce stresses** on the ecosystem, **facilitate natural adaptation** and **minimise ecological impacts**, based on the emerging knowledge of resilience and the risks posed by climate change and other stressors.
3. Adaptation of industries and communities – **understand and raise awareness of the vulnerability of communities and industries** to climate change, and **support adaptation** of communities and industry.
4. Reduced climate footprints – **motivate** individuals, communities, organisations and industries to **reduce their greenhouse gas emissions**, and **build support for continuing action** to protect the Great Barrier Reef from climate change.

This section provides an overview of the extent to which the delivery of planned projects and activities are contributing to the achievement of Action Plan outcomes, and is arranged by its four key objectives. A more detailed description of contribution is provided in Appendix C, and presented as a separate 'results chart' table for each of the four objectives.

5.1 Objective 1: Targeted Science

A results chart for this objective is provided in Table 3, Appendix C

As robust information provides the foundation for good decision-making, the key purpose of Objective 1 is to meet the critical knowledge needs to underpin and inform all other elements of the Action Plan. The Great Barrier Reef Vulnerability Assessment, which preceded and informed the Action Plan, provided a comprehensive synthesis of the state of scientific knowledge and highlighted significant gaps in the knowledge necessary to assess risk and develop effective adaptation strategies.

Based on this, Objective 1 includes three broad strategies to facilitate the provision and usefulness of knowledge.

5.1.1 Address critical knowledge gaps about climate change impacts on the Great Barrier Reef

Critical knowledge gaps identified in the Vulnerability Assessment were used to initially direct research investment and a mid-term priority research investment strategy has since further focused research investment. Research appears to have been undertaken across six of the eight critical knowledge areas identified.

Through the Action Plan, the CCG has and continues to partner with a range of research institutions and individuals to meet knowledge needs. External informants involved with research were generally positive on the research role, although some concerns were raised regarding the administration of contracted research. Some research informants noted that there had been changes in the relationship between the

GBRMPA and the research community in the years from the CRCs for Reef and Rainforest leading up to the preparation of the Vulnerability Assessment.

The experience of developing the Vulnerability Assessment was seen as a beneficial process to draw together the body of knowledge, and strengthen relationships with the research community. It was described as “the most extensive document” of its type for any region. As a result, the GBRMPA “now has a better process to gather scientific knowledge, to reflect on this and to form consensus to inform policy development." The Action Plan was seen by some external informants as building on this process.

As a result of the work in commissioning and synthesising research, an informant stated that the GBRMPA has a body of knowledge that supports “practical and defensible” decisions and better enables it to address its goals. However, another research informant advised that the research synthesis requires updating, as recent research subsequent to the Vulnerability Assessment has provided new findings that require attention – including new findings on acidification and understanding pre-existing adaptive capacity.

As organisational needs become clearer the focus is now shifting from the acquisition of knowledge to fill identified gaps to interpretation of knowledge for management – from data collection to data integration. To support this, the CCG has started to consider ways to get researchers to package research in a more useable form, that is, interpreted to extend research results into knowledge for management. This requires a more collaborative approach than the usual research provision relationship. While the relationships developed through the GBRMPA’s funding of research to complement the Marine and Tropical Sciences Research Facility (MTSRF) research are being leveraged for this purpose, this shift to a ‘knowledge integration’ approach probably needs a focused management effort to be effective. The CCG doesn’t currently have a dedicated function to facilitate this evolving relationship with researchers to support effective ‘knowledge integration’.

The Action Plan also seeks to map areas of high and low resilience in order to facilitate the prioritisation of investment in management effort. Resilience mapping, including for ecosystems and socio-economic resilience, has been implemented to some extent. Options for mapping coral resilience Reef-wide are being developed based on results of a case study test, and socio-economic resilience is being informed through the MTSRF Bayesian Belief Network (BBN) Model and Cyclone Hamish work.

An informant from the QPWS noted the beneficial nature of resilience research commissioned by the GBRMPA:

> *In terms of research there has definitely been work done that benefits us, e.g. a consolidation of literature and current thinking and knowledge on Raine Island as a functioning turtle rookery. The base knowledge of the health of reefs around the place is important, as is the knowledge we are getting about sites from tourist operators involved in observational monitoring. The satellite tracking of seabird feeding patterns that QPWS is supporting and the Climate Change Group is assisting with funding has real potential in the future to be a direct research benefit to our management.*

A tourism industry informant expressed support for the role of research in aiding the industry to understand climate change impacts, such as increasing knowledge on the recovery from coral bleaching. The informant explained that the industry has a preference for more applied research on issues affecting tourism values, but supports the need for general research on impacts such as water quality. The tourism industry provides in-kind support to research through providing transport on tour boats.

Other work identified as supporting knowledge needs is the assessment of synergies between climate and non-climate stressors on key physical, chemical and ecological processes. Assessment work to date has been used to inform the Climate Change Incident Response Framework (CCIRF) and several response plans, and is also included in the Great Barrier Reef Outlook Report 2009.

5.1.2 Identify thresholds, improve monitoring and predictions, and evaluate strategies

The thresholds beyond which climate change causes irreversible damage have been identified for vulnerable species and habitats, but less so for processes. This includes thresholds for nine groups of species (corals, seabirds, fish, marine reptiles, plankton, microbes, marine mammals, seagrasses, macroalgae) and five habitats (reef habitats, islands, coastal habitats, open water habitats, seabed habitats). There remains little known about trends in many key ecological processes such as microbial processes, primary production, symbiosis, competition and connectivity.

Improved tools have been developed for predicting, measuring and monitoring the effects of climate change on vulnerable species, particularly coral, and this has been supported by training of participants in monitoring and reporting. The Coral Bleaching Response Plan outlines a strategic response for monitoring risk and responding to coral bleaching events when they occur. The Early Warning System uses state-of the-art technology and a volunteer monitoring network to monitor the risk and onset of impacts each summer. ReefTemp enables a more accurate prediction of the severity of coral bleaching at regional or local scales - in particular, the detection of anomalous sea surface temperatures has revolutionised the way in which coral bleaching events are monitored and assessed in the Great Barrier Reef, and has enabled improved climate model projections and response readiness.

The Action Plan also seeks to evaluate existing resilience strategies to optimise their effectiveness in the context of climate change. In 2009, the CCG contributed to the review of the Reef Water Quality Protection Plan (Reef Plan) which now addresses climate change as a stressor and sets targets for remedial action to address water quality within the context of this threat.

5.1.3 Transform information into active management responses

The translation of information into active management responses somewhat duplicates strategies under Objective 2, which broadly seek to use emerging knowledge and understanding to influence management actions to maximise the resilience of the Reef. The biggest challenges for the Action Plan in this area include determining how to use the new information and knowledge generated to change policy – both within the GBRMPA and nationally, and how to best capture knowledge so that it is readily available when needed.

External informants were positive about the GBRMPA's work in compiling information from multiple sources and using it for communication and for informing management. This was particularly apparent in the way information was drawn together in the Outlook Report 2009. One external research informant referred to changes in the way the GBRMPA has used scientific knowledge since the Vulnerability Assessment. The informant noted that science is now more integrated into decision-making, and there is a developing understanding of the implementation pathways to apply new knowledge from research.

> *There is an inclusive approach to science – science is an integral part of the process and they work to develop science based policy.*

One external informant described the GBRMPA as a "power user of information" which makes use of research findings, such as the way that research has influenced the water quality guidelines. An external research informant described a dichotomy between the approach to research by scientists and that required by the operational management role of the GBRMPA, stating that:

> *The Authority as an operational agency has urgency attached to decision-making which can never be delayed pending the answering of the very last question. The managers are looking for information that is fit-for-purpose and that can be applied with effect as soon as possible.*

An informant from the QPWS noted the value of information from the GBRMPA and from activities conducted jointly with the GBRMPA, in supporting its management role.

> *Having a group there like that [CCG] to sharpen our focus and provide some direction for some of the things we do and some feedback and results on what is being done by others is a very good management thing for us. It is never just information one way and no one knows what's going on… We have an expectation that we would also be at the table involved in the decision making [when we have] a situation.*

The informant also described the role of QPWS in providing monitoring data that supports adaptive management by the GBRMPA, describing the QPWS staff as" the eyes and ears for some of those early indicators".

> *Our relationship has really strengthened over the last couple of years, both in terms of recognition of the role QPWS can play in climate change response and what it can offer in experience and knowledge. It has also strengthened in terms of on-the-ground collaborative projects around climate change, e.g. Raine Island and its susceptibility to climate change and what it needs to adapt. It has got to a point where we can have that open, unguarded discussion about what is going on at the moment and what each of QPWS and GBRMPA can do.*

The QPWS informant also referred to outputs from Action Plan projects as informing decisions within QPWS, particularly addressing the links between impacts on the Reef and associated impacts on the tourism and fishing industries. The Coral Bleaching Response Plan and sea surface temperate monitoring were seen as useful models to inform management responses with in QPWS. However, a need for more specific knowledge of management options was expressed.

> *Information that we do need is the management tools and actions that are going to work. A little bit of that is going on… How do you help recover an affected coral reef if you need to? How do you recover an inshore fringing reef that got hammered by a bleaching event that may be in a phase shift – can you get it back the other way, can you help it?*

The Action Plan's role to coordinate and synthesise emerging scientific knowledge to underpin effective management decisions is demonstrated through the draft management actions that have been outlined as a result of research into the critical knowledge gaps. This exists for at least 12 key species groups and five Great Barrier Reef habitats, with the most advanced examples being for turtles (testing of intervention strategies for feasibility), corals and seaweeds (testing potential for farming for excess nutrient absorption).

As part of developing management responses from information, the Action Plan also seeks to use cost-benefit analyses (CBA) to select management responses that maximise ecological resilience while minimising social and economic costs. The use of cost-benefit analyses to inform appropriate management responses has occurred via the Multi Criteria Analysis for Reef Rescue, the BBN Model, the Raine Island resilience assessment and development of adaptation plan, the Keppels Reef Protection Markers (RPMs) and Queensland Seafood Industry Association (QSIA) fisheries liaison project.

Partnering with stakeholder groups to understand climate change implications, reduce climate footprint and prepare adaptation plans is met more specifically through the work being completed under Objectives 3 and 4. The research undertaken as part of Objective 1 however informs the work of those objectives.

5.1.4 Status and trends of ecosystem resilience are measured

While not articulated in the Action Plan, this element has been identified in the CCG implementation program as complementary to Objective 1 and is generally an extension of other elements of this

objective, especially around resilience and stressor identification and incorporation into management plans.

Ecosystem resilience indicators have been identified for corals. The Keppel Bay resilience case study project tested and refined a protocol for assessing Reef resilience, providing the foundations for a resilience-based approach to future management of the region. The application of this research to the Reef as a whole is being furthered through a new project analysing 11 protocols for resilience assessment to meet identified management needs. The identification of social resilience indicators has also been initiated through the BBN Model and Cyclone Hamish research.

Predictive tools based on identification of acute stressors include the Coral Disease Model and Response Plan, the POAMA research, ReefTemp (and Coral Bleaching Response Plan), Integrated Eye on the Reef, and implementation of the BleachWatch program. The identification of chronic stressors and incorporation into management plans has occurred through the Great Barrier Reef Climate Change Incident Response Framework and other coral-specific plans.

The development of the integrated information system based on existing monitoring programs is expected to increase Reef stakeholder awareness of ecosystem resilience status and trends. Awareness is already improved through stakeholder involvement in Reef monitoring programs, particularly Eye on the Reef and BleachWatch.

5.2 Objective 2: A resilient Great Barrier Reef ecosystem

A results chart for this objective is provided in Table 5, Appendix C

Objective 2 is premised on the understanding that the resilience of the Reef to climate change is reduced by other stressors, particularly reduced water quality, fishing and the loss of biological diversity. This objective therefore focuses on understanding the interactions between climate and these other stressors in order to better identify actions that can restore and maintain resilience, and thereby minimise the impacts of climate change on the Great Barrier Reef ecosystem.

It seeks to achieve this through identifying the interactions between key stressors and climate change, adapting existing management to incorporate that understanding and implementing local management actions to put that understanding into effect.

5.2.1 Maximise resilience of the Great Barrier Reef ecosystem to climate change

A key contribution under this objective is the concept of moving from vulnerability assessment to understanding resilience, and then using that as a basis for identifying adaptive management actions. This objective is testing the idea that things can be done above and beyond what would normally be done to maximise resilience and is doing so in the context of the non-homogenous nature of vulnerability. Thus, while addressing whole-of-system stressors, for example water quality, it also provides for a focus on specific parts of the ecosystem, that is individual species and habitats, and the effect of stressors on those. The biodiversity strategy currently being developed by the GBRMPA is integral to supporting this focus on individual species and habitats.

The Action Plan is contributing to the current (broader GBRMPA) identification and mapping of the risk and exposure of the Great Barrier Reef ecosystem to water quality influences. This will contribute to the knowledge of ecosystem resilience of the Reef in relation to water quality and water quality threats.

Another stressor is fishing. Assessment of the sustainability of fishing practices to ensure protection of habitat and key functional groups of plants and animals as a strategy for building resilience is occurring through the Marine Aquarium Supply Industry Climate Change Vulnerability Assessment, the development of the Stewardship Action Plan, through partnership with the QSIA and Fisheries

Queensland, the trawl fisheries ecosystem resilience analysis and in part through the Cyclone Hamish research. A project to evaluate the ecological risks associated with bottom trawling is also underway, which is expected to significantly inform strategic plans to ensure the ecological sustainability of this sector.

Transition or alternative habitats that will provide for shifts in distribution and abundance of species and habitats affected by climate change are being identified through various resilience mapping projects (such as the mapping of coral, seabird and turtle resilience) and other targeted research (apex predators). The use of that information to inform or develop management and/or zoning plans has been limited, with the exception of the implementation of the Keppels Reef Protection Markers.

The protection of highly vulnerable species from non-climate pressures has been *facilitated* by the results of a range of projects, but there is a large gap between the tasks of identifying vulnerability and determining appropriate protection measures. There are risks associated with many potential intervention strategies, and in many instances there are significant cultural and policy barriers within agencies with relevant jurisdictions. An effort to understand these challenges and map policy barriers is underway for turtles and seabirds, and is expected to assist the future navigation of management response challenges.

External informants spoke highly of the GBRMPA's focus on resilience. An external research informant stated that:

> *In terms of building a resilient reef, we have seen a lot of action across multiple fronts across the GBRMPA to deal with the issues of water quality and fishing, in particular, side by side, thus the broad agenda of the Action Plan is definitely being implemented - and I believe with substantial effect….We see the GBRMPA very much in action on its strategy of building natural resilience.*

One external informant described the use of resilience thinking as a critical element of developing successful climate change adaptation for the Reef.

> *Resilience thinking is the most fruitful way to think about adaptation and to identify strategies to help the Reef cope with climate change impacts.*

This informant described the GBRMPA as "a leader in applying resilience thinking to environmental management" and commended its role in sharing knowledge and management strategies with other coral reef managers around the world. The informant believed that the leadership shown by the GBRMPA could benefit other organisations by sharing more of its processes of thinking about resilience, to help other organisations advance their own approach to resilience and adaptation.

> *The GBRMPA is more advanced than others in Australia, and maybe the world.*

5.2.2 Adapt existing management to incorporate climate change considerations

There are some examples of adaptive management under the Action Plan (for example, possible interventions for turtles have been identified but need to be assessed for their feasibility). However, this is limited by the large gap between identifying possible management interventions and the ability to take action. Risk management with respect to marine ecosystem intervention more generally needs to evolve, including policy on incorporating intervention into conventional management regimes. The CCG expects the biodiversity strategy currently being developed by the GBRMPA will provide the foundation for addressing marine ecosystem intervention.

An external research informant described a need to focus on adaptation actions – for "strong sit-down thinking" on appropriate management responses, as well as research on policies and mechanisms to deal with known impacts, such as mitigation of damage and disease. The informant stated that there is enough knowledge of some elements of the ecosystem to develop detailed policy on adaptation actions,

and that the GBRMPA must play a leadership role in developing and clarifying adaptation actions collaboratively with industry, researchers and the community.

Within the Reef industries the informant identified a strong motivation to respond to climate change risks, and an expectation for collaborative engagement from the GBRMPA in developing adaptation actions.

As mentioned under Objective 1, the biggest challenges in this area include determining how to use the new information and knowledge generated to change policy – both within the GBRMPA and nationally, and how to best capture knowledge so that it is readily available when needed.

A key outcome under this objective to date has been progress toward a system for measuring ecosystem resilience, and developing this framework to inform management decisions is a key focus of the remainder of the Action Plan's duration.

In terms of planned activities, expected climate change impacts have been considered in developing new water quality targets. This has been achieved through revisions to the Reef Plan, the water quality targets of Reef Rescue, and the Climate Change Incident Response Framework. Information on the vulnerability of species has been incorporated into registers of threatened and endangered species, through the IUCN listing of hard coral species. Work with fisheries management agencies to evaluate risks of climate change for sustainability of Great Barrier Reef fish populations is occurring through development of the Stewardship Action Plan and Queensland Seafood Industry Association (QSIA) Strategic Plan.

5.2.3 Minimise climate change impacts through local management actions

Under this element of Objective 2, the Action Plan seeks to undertake regional case studies of management responses to coral bleaching, test strategies to reduce the sensitivity of turtle and seabird nesting sites to climate change and adapt island management plans to address impacts that exacerbate climate change vulnerability.

Regional case studies of management responses to coral bleaching have been developed through a range of projects following regional bleaching in the Keppel Islands in 2006, including changes in access regimes following the bleaching, and the establishment of the Keppels Reef Protection Markers.

Adaptation options, including strategies to reduce the sensitivity of turtle and seabird nesting sites to climate change, are being tested and/or evaluated via a range of projects including the Raine Island projects and the development of a population model for the northern Great Barrier Reef green turtle stock. Other projects are identifying adaptation options, for example research into the role and importance of apex predators on the Great Barrier Reef ecosystem, the sea bird atlas work, the herbivory position statement and coral reef research.

There are plans to review and adapt island management arrangements with the aim of including principles and strategies for minimising climate change vulnerability. Focal sites include Raine Island, Low Isles, Lady Elliot Island and Michaelmas Cay.

5.2.4 Ecosystem goods and services are maintained (additional to the Action Plan)

While not articulated in the Action Plan, this element has been identified in the Action Plan implementation program under Objective 2. There is little information regarding the outcomes of the activities under this element. The conceptual framework of ecosystem goods and services, which captures interactions between ecosystem-focused objectives and adaptation (social-economic) oriented objectives, is used internally in the CCG for planning. In this sense it is somewhat synthetic, and progress in this area is likely to come through recognising synergies between other activities.

5.3 Objective 3: Adaptation of industries and communities

A results chart for this objective is provided in Table 7, Appendix C

Objective 3 is premised on the fact that some level of impact is unavoidable and that the communities and industries reliant on the Reef will need to adapt to these changes if they are to remain viable in the future. Objective 3 aims to work with those industries and communities to understand and improve their resilience. It intends to achieve this through identifying the factors that confer resilience to communities and industries and then supporting industry and community adaptation within that context via a range of strategies.

The Action Plan implementation program has worked with the tourism and fishing industries, and schools and councils, under this objective.

5.3.1 Identify factors that confer resilience to communities and industries in the context of climate change

The collection of social and economic information on Great Barrier Reef industries and communities to understand their risk and resilience to climate change is limited. Several projects have formed the foundation for further work in social and economic resilience, including the Bayesian Belief Network (BBN) Model and a project (currently underway) examining fishers' response to impacts from Cyclone Hamish and determining if/how management can help industry remain viable through future environmental events. Vulnerability assessment for coastal communities may occur through the GBRMPA coastal program, which is just starting, and may lead to a better understanding of resilience for those communities.

Action Plan activities have, however, assisted industries and communities to understand their risks and prepare for adaptation, irrespective of whether they have been based on the collection of social and economic information. Improvement in this has been made with the fishing industry, compared to the earlier industry adaptation work done with the tourism industry.

An industry informant described some tourism operators as highly committed to responding to climate change and able to change without encouragement from the GBRMPA, however the capacity of the industry to respond has been limited by reduced cash flow in the economic downturn.

The informant noted that tourism accreditation has been seen as beneficial by the industry as it provides advice to tourists in selection of operators and provides operators guidance on appropriate practices.

The planned atlas of social resilience to inform regional and local planning and coastal management (which would collate the social and economic information collected above) has not been developed, though the Great Barrier Reef Outlook Report 2009 did consolidate a lot of the existing research in this area. The Great Barrier Reef Outlook Report 2009 is considered by the CCG to be the main way of presenting information on climate change risks to the broader community.

The relevance and uptake of information about climate change implications for communities has been enhanced through the publication and distribution of printed materials, the Reef Guardian Schools program, the Reef HQ display, community participation in the annual BleachWatch and Eye on the Reef monitoring programs, TV advertising, and scoping studies to inform the development of community adaptation projects.

The relevance and uptake of information about climate change implications for industries has also been enhanced through the publication and distribution of printed materials, including fisheries and tourism case studies, the Stewardship Action Plan and the GBRMPA partnership with QSIA on climate change.

An external informant reported the usefulness of the material prepared for tourists under the Action Plan, enabling tourism operators to provide consistent information about climate change impacts on the Reef, stating that this material is “highly valued by the industry”.

5.3.2 Maximise resilience of industries and communities to climate change

Review of the GBRMPA policy to support adaptation by industries and communities has occurred through the Great Barrier Reef Outlook Report 2009 and Corporate Plan 2009-2014. The Great Barrier Reef Outlook Report 2009 notes that management emphasis is on adaptation and improving resilience to change. The Corporate Plan is now focused on resilience and provides for the development and implementation of responses (including adaptation strategies) to climate change, with government, industry, Reef users and the community.

An external informant observed that there is motivation among the fishing and tourism industries to respond to climate change:

In north Queensland, there is a hard edge to a changing climate that is hard to miss.

A tourism industry informant summarised the concern about climate change, stating:

Unless we look after the environment we will have nothing to show tourists.

The Action Plan is supporting and working with industries, particularly the seafood, fisheries, aquarium and tourism industries, to better understand the risks to their industries as a result of climate change and to prepare a variety of adaptation responses. These differ according to industry, and to date include assistance with the Stewardship Action Plan, the Great Barrier Reef Climate Change Action Strategy and the QSIA strategic plan. The GBRMPA has worked with the tourism industry and subsequently with QSIA to develop online Emissions Calculators for tourism operations, commercial fishers and related businesses to measure and manage their carbon emissions and conducted workshops on its use.

An external informant noted that the commitment of the GBRMPA to address climate change was clear through the Action Plan and the range of activities delivered through the Action Plan. The informant observed that the tourism industry recognises the commitment shown by the GBRMPA and the benefits to the industry from the work under the Action Plan. Another tourism industry informant stated that the activities under the Action Plan were driving change in the industry.

Engagement with industries has enabled an improved appreciation of industry economic and social dynamics and drivers. This includes a better understanding of the different perspectives of industry participants and leaders. The Action Plan is now placing greater emphasis on supporting industry bodies to take responsibility for engaging their members on climate change adaptation rather than focus on individuals within industries (such as fishers).

After struggling for a number of years, effective engagement with industry on climate change is perhaps the most tangible outcome of the Action Plan to date. A key CCG informant described the shift from the GBRMPA trying to engage with industries, to industries realising they need assistance on adapting to climate change and choosing to actively engage with the GBRMPA. This is supported by comments, for example, from external (fishing industry) informants that described the GBRMPA’s efforts as being “on the right track” and “a massive shift from a very antagonistic relationship to something more productive.”

A tourism industry informant described the engagement with the tourism industry being one of “goodwill and trust”, through formal and informal arrangements. The informant stated that the GBRMPA has been developing a better understanding of tourism operations and the issues for operators through the Action Plan activities. This has improved the perception of the GBRMPA among people in the industry and led to more constructive workshops and meetings.

A recent survey supports this review's findings of effective engagement – the survey found very high levels of awareness within the Reef marine tourism industry of the climate change initiatives offered by the GBRMPA and high usage of the initiatives to date.

An external informant noted that there is a "lingering mistrust" among some members of the fishing and tourism industries and communities, and that the GBRMPA could address this through changes to the way it engages with communities and shares information. The informant felt that the way the GBRMPA communicates with industry stakeholders is not sufficiently participatory to be to build trust across the industry and that there was a tendency to limit the sharing of information.

> *All stakeholders having access to the same information in the same timeframe increases trust around the table – openness is really important to counter public concerns.*

The informant expressed concern that the GBRMPA was not harnessing the motivations of industry as effectively as it could be, and that members of the tourism industry in particular had a strong sense of urgency to address the future of their industry. The informant encouraged a more collaborative approach with industry and others stakeholders concerned for the future of the Reef, and the need to communicate widely the issues for the Reef and the support that is needed.

The Action Plan also seeks to work with local governments and other organisations to provide local communities with the guidance, information and practical examples they need to adapt. The community is harder to define than industry so the focus has been on councils and schools as they are perceived as the institutions where thinking around adaptation is encouraged and key bodies of knowledge lie. Key avenues through which the Action Plan is successfully providing local communities with guidance and information include the Reef Guardian Councils, Reef Guardian Schools, the Local Marine Advisory Committees and Reef Advisory Committees.

A tourism industry informant noted that the GBRMPA has a "valiant attempt at a research agenda" for social, industrial and economic adaptation, but that this is "where research on adaptation falls down". The informant stated that some research knowledge has been made available, but that the information is not useful for implementation by industry. The informant believes that clear examples of industry implementation of research knowledge is needed, and suggested the need for a 'research extension' scheme to translate research findings into practical implementation within individual tourism operators, and to demonstrate these changes across the industry. These changes relate to both operational aspects of the industry, as well as improving the quality of interpretation of ecosystems to enhance the tourism experience.

Another tourism industry informant noted the role of the certification and accreditation schemes in facilitating change in the industry. However, it was noted that the process of participation is time-consuming for some operators and that the schemes would be more successful with face-to-face assistance to explain the requirements and determine how it applies to each operator's equipment and activities.

5.3.3 Climate change is integrated throughout the GBRMPA core business

The integration of climate change throughout the GBRMPA core business is additional to the original outcomes of the Action Plan, but represents a desire to see climate change resilience mainstreamed throughout the organisation as a legacy of the Action Plan.

The significance of climate change for the future of the Reef, and for the GBRMPA, has been confirmed in the Great Barrier Reef Outlook Report 2009, with a focus on improving resilience to change. The new Corporate Plan 2009-2014 is also focused on resilience and the responses to climate change by the GBRMPA, other levels of government, as well as industry, Reef users and the community. The

integration of climate change throughout the GBRMPA's core business is occurring generally through building capacity for other groups to understand the implications for climate change for the work their group is responsible for. While this is considered by internal informants to have been done moderately well at best, it has been facilitated through:

- Knowledge transfer of key climate change concepts and literature through project bulletins, presentations to conferences, email notifications and newsletters agency-wide
- CCG coordination of cross-agency climate change projects and contracts – but the responsibility for management of Action Plan-funded projects is starting to be shifted to the relevant groups.

The CCG maintains the role of monitoring up-to-date knowledge of adaptation and resilience research, and interpreting and disseminating that to the relevant groups.

This new focus of the Corporate Plan is expected to drive further integration of climate change throughout the operations of the GBRMPA.

5.4 Objective 4: Reduced climate footprints

A results chart for this objective is provided in Table 9, Appendix C

The Action Plan recognises the need to reduce greenhouse gas emissions to protect the long-term health of the Reef by reducing the risks of climate change impacts. This objective focuses on raising awareness of climate change, the risks to the Reef and implications for stakeholders, and to motivate reduction in greenhouse gas emissions.

In addition, the CCG includes another strategy of communicating the risk to the Great Barrier Reef from climate change to induce support for policy development and action on emission reductions at national and global scales.

5.4.1 Increase knowledge and involvement of stakeholders in climate change responses

Within this element, the Action Plan seeks to inform a wide range of audiences of the risks to the Reef from climate change, and the implications of these risks to stakeholder interests. In particular this was to be done through engagement in climate change impact monitoring and distribution of targeted information packages for use as educational tools within industry, education and the community.

The CCG and the GBRMPA more broadly have communicated widely on the risks to the Reef from climate change and the implications to communities and industries. The Vulnerability Assessment and Great Barrier Reef Outlook Report 2009 emphasised the risks and clearly described the causal linkages between climate change and damage to coral reef ecosystems.

An external research informant described the GBRMPA as having a strong role in communicating research outcomes to the broader community, as an interface between researchers and the broader community, through activities such as the LMACs, and Reef Guardian schools.

> *All in all, I think the GBRMPA does a great job in communicating research outcomes - it is hard to see how much more it could do without becoming an advocacy group. The one area where it is possibly least effective and most impotent, like all of us, is in the public press and the direct reach straight in to the climate change debate among the public. But I honestly don't think that's the role of the GBRMPA – it has to step gently there.*

Engagement of communities in climate change monitoring has been established through the BleachWatch and Eye on the Reef projects, building the understanding of local stakeholders of the potential impacts on the Reef and the causes. Engagement with Indigenous communities is planned to commence through the Traditional Use Marine Resource Agreements.

A range of material has been produced to explain the risks to the Reef, targeted at different audiences – in the tourism and fishing industries, as well as children and their families through the Reef Guardian Schools program.

This communication role has included influencing national and international communication on emissions reduction. The risks to the Reef were emphasised in the Garnaut Report on the design of Australia's emissions trading scheme, and mentioned in the Prime Minister's speech to the Copenhagen COP15 conference.

5.4.2 Work with organisations and individuals to reduce their climate footprint

This element seeks to motivate behavioural change to reduce emissions, supported by information on methods to reduce emissions.

The Reef Guardian Schools and Energy Wise Schools programs work with schools to provide curriculum materials on climate change and other issues for the Great Barrier Reef, and promote emissions reduction. The Energy Wise Schools program specifically focuses on energy and greenhouse gas emissions and includes a requirement for each school to put in place behavioural and/or technical changes to reduce emissions. The Reef Guardian Councils program requires participating councils to prepare an action plan for their contribution to Reef resilience, which is expected to include emissions reduction from council operations.

Showcasing the achievements of participants within the Reef Guardian programs and Energy Wise schools programs is an element of each of these programs and enables demonstration to other participants of options for emissions reduction.

Tourism and fishing industry operators are being assisted to identify options for emissions reduction through the emissions calculators and associated workshops and communication. These help operators to determine the areas of operations where emissions are greatest and propose energy-saving and emission reduction alternatives. A tourism industry informant noted that these projects were driving change in the industry, with high profile operators making visible changes to improve energy efficiency. This had been assisted by training workshops under the Action Plan which helped operators identify suitable changes and opportunities for government support for efficiency investments; these provided "pointers in the right direction" for operators.

In addition, the GBRMPA is working to reduce its own greenhouse gas emissions from operations and has undertaken a study of options for carbon neutrality, as well as implementing an Environmental Management System (EMS) and a Greenhouse Gas Reduction Strategy. In the short term, energy savings in buildings have been made from changes to lighting and air conditioning operations, with longer term changes being planned with landlords. As these changes are implemented, the GBRMPA intends to communicate its own changes as an example for other organisations.

An additional area of focus not articulated in the Action Plan is the role of the risk to the Reef in influencing national and global emissions reduction. As noted above, the fate of the Reef has been described in a range of national and international forums.

Changes in the public perceptions of climate change causes and risks, and the slower than expected pace of political action on emissions reduction, has meant that the impact of the GBRMPA's messages has waned. The CCG has decided that it is time to reframe the GBRMPA's communications on climate change, in the current context, to provide a more diverse and targeted range of climate change messages to address the more fragmented audience. The community typology project has assisted by providing a greater understanding of community perceptions of climate change. Learnings from this and

other projects will be used to develop more targeted climate change communications to contribute to Objective 4.

There is potential to harness the regional offices in a renewed focus on community awareness. Regional staff are keen to support the climate change message and have strong local links and networks to facilitate engagement. However regional staff are unsure of their role in climate change communication, and need support to effectively frame messages and target communications.

One research informant expressed concern that in the absence of international action to reduce emissions, there is a risk that the increase in atmospheric carbon dioxide will exceed a threshold and lead to greater warming on the Reef.

> *The conclusion of the Vulnerability Assessment is unpalatable but robust – the threshold of 450 ppm.*

The informant stressed the need for continued efforts to address mitigation, as well as recognising that current approaches to adaptation may be insufficient and that further research is needed on adaptation options for a higher global warming scenario and planning for interventionist policies.

> *More radical adaptation steps will be needed if there is no mitigation action – if it all gets really bad, what is our game plan?*

5.5 Conclusion – contribution to outcomes

The broad nature of the Action Plan has enabled it to effectively accommodate emerging needs and not risk limiting what could be implemented as part of the approach to maximising Reef resilience. At the same time, it has made determination of the contribution of planned activities to the desired outcomes of the Action Plan difficult, especially through the lack of a true articulation of the causal linkages between those activities and the outcomes sought. The GBRMPA is aware of this and the concurrent development of a MERI Framework for the Action Plan should be able to address this problem for future activities at least, and possibly retrospectively.

Regardless of this, the Action Plan has seen good progress on the delivery of activities, both planned and unplanned, and these are contributing to the outcomes sought by the Action Plan.

Significant progress has been made in addressing critical knowledge needs. Implementation of Objective 1 is currently undergoing a maturation to better meet emerging needs, including the need to integrate existing information into knowledge useful for informing management decisions. While the foundation for this has been laid, its ongoing effectiveness may depend on the formalisation of a ‘knowledge integrating’ function to drive the different approach required with researchers.

While less progress has been made with Objective 2 overall, significant progress has been made in embedding the understanding that adaptive management actions need to be based on vulnerability assessment and then an understanding of resilience. While there has been some progress with identifying adaptive management actions, conventionally, management of marine ecosystems has not involved intervention thus there remain barriers in terms of the policy environment and institutional culture around this, and intervention risk management. It is worth noting that while this objective is considered to be the least progressed under the Action Plan, it is progressed through the agency more broadly as it is agency core business. Additionally, the CCG has furthered the GBRMPA’s knowledge and capacity in responding to climate-related events on the Great Barrier Reef. The Coral Bleaching Response Plan is recognised globally as the leading approach to coral bleaching events, and is the basis for coral bleaching response programs in many other reef regions around the world. The development of a coral disease response plan is expected to replicate this contribution.

Significant progress has also been made in supporting industry and community adaptation (Objective 3), particularly industry adaptation. The Action Plan has worked well with assisting the tourism industry position itself for climate change adaptation and lessons learned from that have been leveraged to enable the Action Plan to work particularly well with the fishing industry to do the same. Effective industry engagement is probably the highlight of Action Plan outcomes to date. Community adaptation has also progressed, particularly through the Reef Guardian program (councils and schools) and through the effective use of Local Marine Advisory Committees and Reef Advisory Committees.

The objective of reducing climate footprints (Objective 4) relates to changes that are outside the control of the GBRMPA – changes at the individual, national and international levels. However, the GBRMPA has played a strong role in raising awareness and contributing to the motivation to reduce emissions due to the risk of damage to the Reef. Targeted projects for emissions reduction in the tourism and fishing industries have provided emissions calculators and advice on emissions reduction. Messages about the relationship between continued high greenhouse gas emissions and damage to the Reef have been heard locally, nationally and internationally. While these messages have not stimulated the level of change necessary to protect the Reef, the GBRMPA is well placed to re-frame communications on climate change risk and emissions reduction and to provide more targeted messages to stakeholders, policy-makers and the wider community.

An external informant expressed support for the broad scope of the Action Plan and the focus on understanding resilience to inform adaptive management, recognising that the outcomes from the Action Plan will provide the basis for more targeted work on adaptation in the future:

> *The Action Plan is certainly not a plan to solve climate change; climate change impacts are likely to be accelerating or starting to get to the stage where thresholds will have started to be approached and we will be seeing more evidence of it on the ground. The GBRMPA's challenges will be even bigger post-2012. The purpose of the Action Plan now is to crystallise the thinking, and align some of the structures, but it is almost the scoping phase for a more substantial strategy document for research and adaptation post 2012. The GBRMPA has an essential role in that.*

6. Alignment with action on climate change at other levels

The Action Plan seeks to support and be aligned with action on climate change at the local, regional, national and international levels. This section summarises the areas of contribution of the Action Plan implementation to these other levels of climate change response. More details are provided in Table 10 in Appendix C.

6.1 Contribution to regional action on climate change

The Action Plan (via Objective 4: Reduced climate footprints) contributes to the Queensland Government's response to climate change, as articulated in *Climate Q: Towards a Greener Queensland*, which is focused on delivering complementary measures that help achieve emissions reductions at least cost to the economy. The government response also recognises the need for reducing other stressors on ecosystems (Action Plan Objective 2 contributes to this) and for supporting adaptation (Action Plan Objective 3 contributes to this).

The Action Plan was instrumental in ensuring climate change considerations were incorporated into Reef Plan revisions. Future influence on regional action is anticipated to occur through the new GBRMPA coastal program and linkages with NRM groups, councils and other Queensland government agencies.

6.2 Contribution to national action on climate change

The Action Plan contributes to national action on climate change through its alignment with and/or contribution to:

- Adapting to Climate Change in Australia – An Australian Government Position (through its focus on maximising resilience, on adaptation, on vulnerable ecosystems and coastal communities, and through appropriate recognition of the roles of different stakeholders)
- National Climate Change Adaptation Framework (through its contribution to building understanding and adaptive capacity)
- National Climate Change Adaptation Research Facility (through CCG involvement in the Adaptation Research Plan for Marine Biodiversity and Resources and membership of the Marine Biodiversity and Resources Network)
- Great Barrier Reef Intergovernmental Agreement 2009 (through its contribution to action to maximise the resilience of the Great Barrier Reef to climate change and address climate change threats to the health and biodiversity of the Great Barrier Reef ecosystem)
- Climate Change Guide: Mitigation and Adaptation Measures for Australia Tourism Operators, 2009 (through Objective 3: Adaptation of Industries and Communities – including the tourism industry; and Objective 4: Reduced Climate Footprints – including working with the tourism industry to calculate and reduce their carbon footprint)

6.3 Contribution to international action on climate change

The Action Plan's contribution to international action on climate change has occurred through the use of the Reef as a 'poster child' for climate change risks, research and communication to inform other reef managers, and scientific and interest networks.

Examples of damage and risks to the Reef ecosystems provide a powerful symbol of the risks of climate change for use in communication and education. Risks to the Reef have been included as a motivating

factor in many international climate change campaigns, and were also mentioned in the Prime Minister's speech to the Copenhagen COP15 conference.

There is a range of media coverage on climate change that refers to damage to the Reef, and other communications beyond the control of the GBRMPA. This dispersion of messages means that the work of the GBRMPA in developing messages on the risks to the Reef and communicating these broadly has the potential to be dispersed internationally and to be communicated to a wide audience who may choose to act on the messages.

The Action Plan has also prompted more direct communication, with research papers published internationally and specific information products resulting from projects – such as the *Reef manager's guide to coral bleaching* which was distributed internationally, and the Great Barrier Reef Vulnerability Assessment, which itself was peer-reviewed and distributed internationally, and which also gave rise to additional research papers on climate vulnerability of reef components.

Members of the CCG and scientists undertaking research for the GBRMPA are members of international scientific networks through which emerging knowledge of reef ecosystems and climate change risk can be readily communicated. Through these mechanisms, the GBRMPA has the ability to influence international knowledge of climate change risks to reef ecosystems and to promote uptake of new adaptive management approaches.

7. Contribution to the GBRMPA Corporate Plan 2009-2014

This section summarises the contribution of the Action Plan to the GBRMPA Corporate Plan 2009-2014, with further details provided in Table 10, Appendix C.

The Action Plan has led to a greater understanding of the urgency and priority of climate change which has influenced both the Great Barrier Reef Outlook Report 2009 and the GBRMPA Corporate Plan 2009-2014. As such, the Great Barrier Reef Outlook Report 2009 acknowledges future predictions of climate change as dominating most aspects of the Great Barrier Reef's outlook over the next few decades and identifies climate change as key among a set of priority issues reducing the resilience of the Reef.

Through the Action Plan, the concepts of risk and resilience have been cemented and have strongly influenced the Corporate Plan. The Corporate Plan aims to strengthen the GBRMPA capacity to ensure long-term protection and sustainability of the multiple use Marine Park. Using the information from the Great Barrier Reef Outlook Report 2009 as a foundation for its activities over the coming years, the Corporate Plan focuses on improving the outlook and resilience of the Reef by developing and implementing strategies to address the key pressures highlighted in the Great Barrier Reef Outlook Report, including climate change.

While the Action Plan contributes to all three objectives of the Corporate Plan, it is highly aligned with **Objective 1** (Address key risks affecting the outlook for the Great Barrier Reef) including:

- Generate, capture and apply the best available science to improve understanding of ecosystem resilience, risks to that resilience and response options (through Objectives 1 and 2)
- Develop and implement responses (including adaptation strategies) to climate change, with Government, industry, Reef users and the community (through all objectives, but particularly through Objectives 2, 3 and 4)
- Support initiatives to improve water quality entering the Great Barrier Reef (through Objective 1 – including revisions to the Reef Plan; and Objective 2 – identify the main water quality threats to resilience)
- Contribute to the protection of coastal ecosystems that support the Great Barrier Reef (no progress to date, but through the recently established GBRMPA coastal program)
- Partner with the Queensland government, other governments, Traditional Owners and other relevant bodies to address the remaining impacts from fishing, and illegal fishing and poaching and other emerging risks using an ecosystem based management approach (through Objectives 2 and 3)
- Deliver communication and education about the key risks affecting the outlook for the Great Barrier Reef and ways to mitigate these risks (through all objectives, but particularly through Objectives 3 and 4)

Contributions to **Objective 2** (Ensure that management delivers ecologically sustainable use of the Great Barrier Reef) include:

- Provide effective legislation, policy, planning, assessment and permitting arrangements to achieve ecologically sustainable use of the Great Barrier Reef (through Objective 3, specifically Action Plan influence on the Great Barrier Reef Outlook Report 2009 and the GBRMPA Corporate Plan)
- Partner with Traditional Owners to ensure sustainable traditional use of marine resources and protection of Traditional Owner cultural and heritage values (to some extent through Objective 3 and Action Plan input into TUMRAs)

- Collaborate with industry, Reef users, other governments and the community to implement best practice approaches and certification programs to ensure protection and sustainable use of the Great Barrier Reef (through Objectives 2 and 3)

Contributions of the Action Plan to **Objective 3** (Maintain high performing, effective and efficient organisation) include through the development of documented procedures for project planning and contract management under the Action Plan which has been used widely across the GBRMPA, and in building capability to manage projects across the organisation.

Under this objective, the Action Plan specifically contributes to the strategy of ensuring the GBRMPA remains a world leader in marine protected area management through the example the Action Plan provides and the use that has been made internationally of some of its products, for example BleachWatch, and the Coral Bleaching Response Plan.

8. Implications and recommendations

The mid-term review has not focused on the development of recommendations as the review has not identified any major problems to be rectified. This section identifies some implications for the later stage of the Action Plan and recommendations that may assist the GBRMPA.

- Delivery of projects under the Action Plan has been comprehensive, addressing all objectives, and the focus of implementation has shifted over the delivery period to suit the emerging knowledge. There are no apparent gaps in delivery across the Action Plan that have affected implementation – all areas of lesser focus to date have been explained and are either now gaining focus as information from other projects and providers supports these new areas of focus, or have been determined to be less relevant. Therefore there is no recommendation on targeting further implementation. The CCG has an existing evidence-based process to target the application of the rest of the program funding.
- The GBRMPA must consider the future delivery of climate change adaptation activities beyond the life of the Action Plan – whether this be through a second Action Plan or mainstreaming of the climate change response throughout the GBRMPA. It is likely that an approach of integrating climate change risk and adaptation into the overall delivery of the GBRMPA activities would be the most sustainable, but this would still require some level of centralised coordination and responsibility for climate change activities. Additionally, continued effectiveness in agency response to climate change issues would require maintenance of a body of specialist expertise comparable to that gained through the life of the current Action Plan. Integration through disbanding of the CCG would risk losing the rich body of knowledge and capability of the CCG developed through implementation of the Action Plan. Ongoing management of this body of knowledge and experience will be important to assist the GBRMPA to integrate this knowledge across its operations.
- Much of the success of the Action Plan activities has been developed though relationships with researchers, industry and other stakeholders. Maintenance of these relationships and development of further relationships will be important to support ongoing responsiveness to climate change both within and beyond the GBRMPA.
- The CCG intends to renew its messages to the community and decision-makers in relation to Objective 4. This would include an increased awareness of climate change, the risks to the Reef and implications for stakeholders. In the changing context of community attitudes on climate change, this must be done in a more targeted way to address diverse audience perceptions. Work has been undertaken under the Action Plan to understand community perceptions and this should be used to inform targeting of future communication and development of messages.
- Many projects under the Action Plan are intended to address more than one objective, and there are substantial inter-linkages between projects. The current diagrammatic representation of the implementation program causes difficulty in communicating the inter-linkages between projects and the CCG should consider a different mechanism for communicating project linkages, rather than using the program logic to serve multiple roles. The recently revised program logic is expected to clarify linkages between projects and outcomes. Further clarification of linkages will be enabled through recent changes to the project proposal template, which should flow through to project reporting as well.
- Development of the MERI Framework is an important next step as it is intended to provide clearer articulation of the program logic that focuses on clarifying the causal links between activities and intended outcomes. This will provide the basis of future assessment of outcomes of the Action Plan and for communicating its achievements to stakeholders and the community.

Appendix A

List of interviewees

The Steering Group and Climate Change Group identified a range of internal and external stakeholders to provide input to the review where appropriate and available. The following is a list of those that were interviewed.

- GBRMPA staff
  - Paul Marshall — Director, Climate Change Group
  - Roger Beeden — Manager, Climate Change Group
  - Anna Lyons — Program Coordinator, Climate Change Group
  - Jen Dryden — Project Officer, Climate Change Group
  - Hugh Yorkston — Director, Coastal Ecosystems and Water Quality
  - Jason Vains — Project Manager, Coastal Ecosystems and Water Quality
  - Bruce Elliot — General Manager, Corporate Services
  - Barney Bebendorf — Office Services Manager, Corporate Services
  - Margie Atkinson — Project Manager, Ecosystem Conservation and Sustainable Use
  - Peter McGinnity — General Manager, Environment and Sustainability
  - Adam Smith — Director, Environmental Assessment and Management
  - Doon McColl — Regional Liaison Manager (Cairns), Regional Engagement
  - Di Walker — Senior Project Manager (Rockhampton), Regional Engagement
  - Kirsten Dobbs — Director, Strategic Outlook
  - Chris Briggs — Director, Tourism and Recreation

- External (project partners, researchers and other interested organisations)
  - Karen Collard — Queensland Seafood Industry Association
  - Eric Perez — Queensland Seafood Industry Association
  - Ryan Donelly — Provision reef fisheries
  - Col McKenzie — Chair, Association of Marine Park Tourism Operators
  - Daniel Gschwind — Chief Executive, Queensland Tourism Industry Corporation, and member of the Authority
  - Peter Doherty — Research director, Australian Institute of Marine Studies
  - Sheridan Morris — Managing Director, Marine and Tropical Sciences Research Facility (MTSRF)
  - Ove Hoegh Guldberg — Professor of Marine Studies, University of Queensland.
  - Richard Quincey — District Manager, Townsville Marine, Queensland Parks and Wildlife Service
  - John Higgins — Adaptation Innovation Branch, Department of Climate Change and Energy Efficiency

Appendix B

Climate Change Action Plan Implementation Program

STRATEGY CLIMATE CHANGE GROUP

CCG VISION	The Climate Change Group leads and coordinates GBRMPA's efforts to maximise the resilience of the Great Barrier Reef ecosystem, industries and communities to a changing climate under the GBR Climate Change Action Plan													
CCG MISSION	The GBRMPA Climate Change Group implements the Climate Change Action Plan through: *Effective internal collaboration Partnerships with governments, stakeholders and the community Effective communications that address stakeholder needs Targeted research programs that address critical knowledge gaps*													
CC ACTION PLAN OBJECTIVES	1. Targeted Science and Adaptive Management				2. A GBR ecosystem that is resilient to climate change				3. GBR industries and communities that depend on the reef are resilient to unavoidable climate change impacts			4. Global atmospheric greenhouse gas levels are stabilised <450 ppm CO2e		
LONG TERM OUTCOMES	1.1 Address critical knowledge gaps about climate change impacts on the GBR	1.2 Identify thresholds, improve monitoring and predictions, and evaluate strategies	1.3 Translate information into adaptive management responses	1.4 Status and trends of ecosystem resilience are measured	2.1 Refugia and vulnerable habitats are resilient	2.2 Vulnerable species/groups are resilient	2.3 Essential ecosystem functions are resilient	2.4 Ecosystem goods and services are sustained	3.1 GBR-dependent communities are resilient to climate change impacts	3.2 GBR-dependent industries are resilient to climate change impacts	3.3 Climate change is integrated throughout GBRMPA core business	4.1 Fate of the GBR influences national and global greenhouse gas emission reduction (natn'l/intn'l policy)	4.2 GBRMPA leads by example on GHG emission reduction measures	4.3 Target GBR-dependent industries / communities actively reduce GHG emissions
TARGETS (5 yrs)	By 2012 priority GBR vulnerability assessment knowledge gaps will be addressed by CCG research investment.	By 2012 critical ecosystem thresholds that can be affected by management actions are identified.	By 2012 targeted research results will inform a risk assessment of priority adaptive management options.	By 2012 key ecosystem resilience measures will be identified and validated	By 2012 key climate change refugia and vulnerable habitats will be identified and incorporated into ecosystem based management plans	By 2012 key vulnerable species and species groups will be identified and incorporated into adaptive management plans	By 2012 essential ecosystem functions will be identified and incorporated into ecosystem based adaptive management plans	By 2012 ecosystem goods and services are identified and incorporated into ecosystem based adaptive management plans	By 2012 climate change adaptation framework for communities supports ecosystem resilience	By 2012 climate change adaptation framework for industries supports ecosystem resilience	By 2012 all GBRMPA groups will incorporate climate change into policies and programs assisting in adaptive management	GBRMPA contributes to national and international efforts to stabilise CO2 concentrations below critical thresholds for GBR	By 2012 GBRMPA has zero climate footprint with annual review to mimimise offsets	Target industries / communities are identified and active participants in emission reduction pilot programs
		By 2012 key ecological, economic and social thresholds will be incorporated into prediction, monitoring and evaluation tools	By 2012 ecosystem thresholds will be incorporated into adaptive management plans.	By 2012 key ecosystem resilience indicators are incorporated into monitoring programs	By 2012 human pressures are identified and best practice guidelines aimed at reducing pressures on refugia and vulnerable habitats are developed	By 2012 human pressures are identified and best practice guidelines aimed at reducing pressures on vulnerable species/groups are developed	By 2012 human pressures are identified and best practice guidelines aimed at maintaining ecosystem functions are developed	By 2012 human pressures are identified and best practice guidelines aimed at maintaining ecosystem goods and services are adopted by 20% of reef users	By 2012 climate change adaptation framework contributes social resilience	By 2012 climate change adaptation framework contributes economic resilience				
Policy Outputs (5 yrs)		Key ecological, economic and social thresholds are identified		Temporal trends in ecosystem resilience are incorporated into relevant policies.	Policy update on refugia and vulnerable habitats	Policy update on vulnerable species / groups	Policy update on ecosystem functions.	Ecosystem intervention policy defined and Adaptive management policy developed	Adaptive management guidelines for GBR communities	Adaptive management provisions / guidelines for GBR industries		Development of GBRMPA position statement on critical GHG threshold of 450 ppm		
INTERMEDIATE OUTCOMES Duration of the Action Plan 2008 - 2012	1.1 A. Partner with research institutions and coordinate research projects that target species vulnerable to climate change (eg corals, fishes, crustaceans, plankton, marine turtles, seabirds and seagrass) to optimise effectiveness of resilience-based management	1.2 A. Identify thresholds beyond which climate change causes irreversible damage to vulnerable species (eg sharks, marine turtles, seabirds, corals, fishes and plankton), habitats (eg seagrass, mangroves and pelagic) and processes (eg productivity and connectivity)	1.3 A. Coordinate and synthesise emerging scientific knowledge to underpin effective management decisions.	1.4 A Ecosystem resilience indicators are identified and validated	2.1 A Potential climate change refugia are identified and protected in zoning plans or other management measures	2.2 A Management policies relating to vulnerable species are developed/revised to accommodate climate change risks	2.3 A Vulnerable ecosystem functions are identified and built into conservation strategies and policies	2.4 A Vulnerable ecosystem goods and services are identified	3.1 A GBR communities are aware of implications of climate change impacts for the GBR ecosystem and their reef-oriented activities	3.2 A GBR industries are aware of implications of climate change impacts for the GBR ecosystem and their business	3.3 A Knowledge transfer of key climate change concepts and literature to GBRMPA groups coordinated by CCG	4.1 A Strong international awareness of implications of climate change for GBR ecosystem	4.2 A The GBRMPA demonstrates leadership by adopting climate neutral footprint strategy	4.3 A GBR industries / communities are aware of importance of reducing climate footprint for sustainability of ecosystem goods and services
	1.1 B. Map areas of high and low resilience to prioritise investment of management effort (eg identify and protect refugia for thermally tolerant coral species that will provide genetic stock for recovery)	1.2 B. Work with partners to develop improved tools (eg operational remote sensing products, improved regional projections) for predicting, measuring and monitoring effects of climate change on vulnerable species (eg corals, marine turtles, seabirds, fishes and plankton)	1.3 B. Use cost-benefit analyses to select management responses that maximise ecological resilience while minimising social and economic costs.	1.4 B Social resilience indicators are identified and validated	2.1 B Stresses that interact with climate change to threaten refugia and vulnerable habitats are explicitly targeted in management plans and actions	2.2 B Species / group adaptation options are identified and risks are evaluated	2.3 B Zoning plan revisions maximise biodiversity conservation, refugia protection and connectivity	2.4 B Social and economic values of vulnerable ecosystem goods and services are estimated	3.1 B GBR communities are active partners in building resilience of GBR ecosystem	3.2 B GBR industries have identified adaptation strategies for coping with climate change impacts and business opportunities	3.3 B Through Green Office Committee initiatives GBRMPA staff are aware of their contribution to GBR resilience to climate change	4.1 B GBR stakeholders are aware of the implications of national and international climate change policies	4.2 B The GBRMPA commits to assessing the feasibility of innovative/ best practice in reducing its climate footprint	4.3 B Targeted GBR industries / communities adopt best practice initiatives to reduce climate footprints
	1.1 C. Assess synergies between climate and nonclimate stressors on critical processes (such as productivity, connectivity, calcification and recovery potential) and prepare reports that will be the basis for revising management policies and targets	1.2 C. Evaluate resilience strategies, such as the Reef Water Quality Protection Plan and Zoning Plan, to optimise their effectiveness in the context of climate change	1.3 C. Partner with stakeholder groups, such as the tourism industry, to understand climate change implications, reduce climate footprint, and prepare adaptation plans.	1.4 C Acute ecosystem stressors are identified and predictive tools are developed	2.1 C Management plans for island ecosystems are adapted to minimise climate change vulnerability	2.2 C Investment in key vulnerable species / group adaptation research	2.3 C Water quality targets are revised in light of climate change pressures on inshore habitats	2.4 C Ecosystem characteristics that are essential for sustenance of goods and services are identified and built into conservation strategies and policies	3.1 C GBR communities have identified adaptation strategies for coping with climate change impacts to GBR ecosystem	3.2 C GBR industries are active participants in developing strategies that improve the resilience of GBR ecosystem and business	3.3 C CCG successfully coordinates cross agency climate change projects and contracts for the purposes of adaptive management	4.1 C GBRMPA contributes to national and international mitigation and adaption policies relevant to GBR		4.3 C Identify, support and showcase initiatives of partners and stakeholders to reduce emissions
				1.4 D Chronic ecosystem stressors are identified and incorporated into management plans	2.1 D Reef users adopt practices that minimise pressures on refugia and vulnerable habitats	2.2 D Extractive activities such as fisheries adopt practices that minimise pressures on vulnerable species	2.3 D Ecosystem Disaster Response Plan developed and adequately resourced.	2.4 D Reef industries are aware of direct and indirect dependencies on ecosystem resilience			3.3 D CCG maintains up to date knowledge of adaptation/resilience research, through partnerships with researchers, consultative committes and government agencies.			4.3 D Reef Guardians (councils and schools) adopt emissions reduction strategies and targets and encourage emission reduction activities by local communities
				1.4 E Reef stakeholders are aware of GBR ecosystem resilience status and trends	2.1 E Extractive activities such as fisheries adopt practices that minimise pressures on refugia and vulnerable habitats	2.2 E Recreational users adopt practices that minimise pressures on vulnerable species	2.3 E Land holder awareness and support for water quality management as a measure to increase resilience of reef to climate change	2.4 E Reef industries are active partners in building resilience of GBR ecosystem						
Foundational Activities	**Strategic Planning, Risk Assessment, Consultation, Procurement, Approvals, Data Management, Adaptive Management, Communications, Education, Engagement, Training, Capacity Building, Monitoring, Evaluation, Reporting.**													

Appendix C

Results charts

Objective 1

Objective 2

Objective 3

Objective 4

Contribution to GBRMPA Corporate Plan 2009-2014 and action on climate change at other levels

Table 3 Results chart: Objective 1 (Targeted Science)

The left-hand column outlines the components of Objective 1 as articulated in the Action Plan, as well as additional outcomes for Objective 1, and associated targets and policy outputs, as articulated in the CCG implementation program. Where possible, the additional outcomes, targets and policy outputs have been mapped to the original components of the Action Plan. The right-hand column describes the strategies employed by the Action Plan and provides evidence of progress towards each. Bracketed numbers, e.g. (1.5) reference the data item from which the evidence was drawn; where evidence was provided through interviews this is referenced via: (Informant). Table 4 provides an index of data items for this results chart. The middle column provides a summary result of progress towards the strategies, based on the evidence provided in the right-hand column.

Action Plan component/outcomes	Result summary	Strategies & Evidence
1.1 Address critical knowledge gaps about climate change impacts on the Great Barrier Reef *Target (from Implementation Program): By 2012 priority Great Barrier Reef vulnerability assessment knowledge gaps will be addressed by CCG research investment*	Critical knowledge gaps identified in the vulnerability assessment were used to initially direct research investment. Research appears to have been undertaken across six of the eight critical knowledge areas identified. A mid term priority research investment strategy has further focused research investment. Focus is shifting from the acquisition of knowledge to fill identified gaps to interpretation of knowledge for management, i.e. from data collection to data integration. • Have and continue to partner with a range of research institutions and individuals to meet knowledge needs • Resilience mapping, including for ecosystems and socio-economic resilience, has been implemented to some extent. Options for mapping coral resilience Reef-wide are being developed based on results of a case study test. Socio-economic resilience is being informed through the BBN Model and Cyclone Hamish work • Synergies between climate and non-climate stressors on key physical, chemical and ecological processes have been assessed and used to inform the Climate Change Incident Response Framework and several response plans, and is also included in the Great Barrier Reef Outlook Report 2009.	**Evidence overview** • Initial critical knowledge gaps identified through vulnerability assessment (1.5) • Tiered approach to research investment to support medium and long term information needs and inform adaptive management actions possible between 2009/10-2011/12 described as including: 1. Discovery science through co-investment in ARC linkage, LIEF grants and Qld Smart State program; 2. Co-investment and in-kind partnerships with AIMS, CSIRO, BoM and academic institutions to support current MTSRF research; 3. Direct investment for research addressing critical knowledge gaps not covered by current science programs (1.4) • Of eight critical knowledge areas identified as gaps, six appear to have been met, or met to some extent. These include: o Comprehensive knowledge of highly vulnerable ecosystem components o Resilience factors and indicators are identified o Predictive models and monitoring tools are available for critical climate impacts o Cumulative impacts are identified and prediction and monitoring tools are available o Economic research supporting industry and community adaptation o Critical climate thresholds for the Great Barrier Reef ecosystem are known (1.1) • Two of the eight critical knowledge areas identified as gaps appear to remain to be addressed: o Quantify the adaptation and acclimation potential of key ecosystem components o Understanding of fundamental tropical marine processes (1.1) • Mid-term Research and Investment Report (2009) provides an assessment of what research is being done to date and identifies remaining gaps for 2009/10-2011/12 (4). This narrowed the wide range of potential research by collating goals to provide a priority research investment strategy based on industry vulnerability, the vulnerability risk assessment and opportunities for co-investment. Used internally to drive investment (Informant). • Knowledge gaps are no longer considered a limiting factor, but rather the implications of existing knowledge for reef management. Initial focus on acquisition of new knowledge to address identified gaps is shifting to a focus on interpretation of knowledge to inform management of climate change impacts on the Reef (Informant). • There has been a rationalisation of research funding, with other parts of the GBRMPA (ex-CCG) funding relevant climate change research as their awareness of research needs has been raised via the Action Plan. As research needs have become clearer, the CCG have also been able to access knowledge gathered (and funded) by others, and the National Adaptation Research Plans will also fill gaps (Informant)
		Strategy a. Partner with research institutions and coordinate research projects that target species vulnerable to climate change to optimise effectiveness of resilience-based management (e.g. corals, fishes, crustaceans, plankton, marine turtles, seabirds and seagrass) **Evidence** • Have partnered with the following research institutions to target species vulnerable to climate change: QPWS, RRRC, CSIRO, CBRP, AIMS, UQ and JCU plus range of individuals through Smart State Fellowships, Smart State Premiers Fellowship and ARC linkages (1.1) • JCU, AIMS and UQ researched the vulnerability of high trophic levels on the Reef to climate change, including seabirds, for example, which are sensitive upper-trophic-level indicators of potential climate change impacts at a range of spatial scales. The results are expected to allow determination of the likely range of oceanographic and climatic conditions within which seabird reproduction within the Reef will remain viable (1.25) • A research project determined the role and importance of apex predators in the Great Barrier Reef ecosystem, evaluated the threats and risks to apex predators in the Reef ecosystem, and provided recommendations regarding the conservation and sustainable use of apex predators in the Reef ecosystem (2.1). • Have started to look at ways to get researchers to package up research in a more useable form, i.e. interpreted to extend research results into knowledge for management. Requires researchers to collaborate with the GBRMPA, which is different to usual research provision. Don't have dedicated function in research area to manage this shift in focus (Informant) • While complementing MTSRF research has been opportunistic in parts, it has enabled the development of relationships that are now being utilised in the shift from addressing research needs identified through the Vulnerability Assessment to addressing information integration and usefulness (Informant) • In the last decade, there has been a major change in the way the GBRMPA has dealt with climate change and scientists, leading up to the Vulnerability Assessment. This drew together the body of knowledge, and is "the most extensive document" on climate change risks and response done for any region….. The Climate Change Action Plan has built on the earlier changes in the use of science by the GBRMPA and there are now strong relationships with the research community…… **"**The GBRMPA now has a better process to gather scientific knowledge, to reflect on this and to form consensus to inform policy development." (Informant) • Research has provided a body of scientific knowledge that is practical and defensible and provides a basis for the GBRMPA to address its goals.

Action Plan component/outcomes	Result summary	Strategies & Evidence
		(Informant) • The research synthesis needs to be updated, as more recent research subsequent to the Vulnerability Assessment had new findings that require attention – including new findings on acidification and understanding pre-existing adaptive capacity. (Informant) • "In terms of research there has definitely been work done that benefits us, e.g. a consolidation of literature and current thinking and knowledge on Raine Island as a functioning turtle rookery. The base knowledge of the health of reefs around the place is important, as is the knowledge we are getting about sites from tourist operators involved in observational monitoring. The satellite tracking of seabird feeding patterns that QPWS is supporting and the Climate Change Group is assisting with funding has real potential in the future to be a direct research benefit to our management." (Informant)
		Strategy b. Map areas of high and low resilience to prioritise investment of management effort (see also 1.4a and 1.4b) **Evidence** • The Keppel Bay resilience case study project tested and refined a protocol for assessing Reef resilience, providing the foundations for a resilience-based approach to future management of the region (1.17). The application of this research to the Reef as a whole is being furthered through a new project analysing 11 protocols for resilience assessment to meet identified management needs (1.18; Informant) • "Mapping natural variation and resilience is important for understanding the basis of resilience and understanding the system well enough to define some thresholds for concern that would trigger action: that is a very logical thing." (Informant)
		Strategy c. Assess synergies between climate and non-climate stressors on critical processes (e.g. productivity, connectivity, calcification and recovery potential) and prepare reports that will be the basis for revising management policies and targets **Evidence** • The Great Barrier Reef Outlook Report 2009 includes outlines of synergies between climate and non-climate stressors on key physical, chemical and ecological processes (1.7) • "Summer of extremes" report and Coral Bleaching Response Plan describe linkages between climate and non-climate stressors (Informant) • The Coral Bleaching Response Plan, predictive bleaching tools and disease tools, POAMA, ReefTemp and Reef Health Integrated Strategy further identify non-climate stressors such as damage and crown of thorns (Informant) • Synergies information used in informing the Climate Change Incident Response Framework and Coral Bleaching Response Plan, particularly in management responses being triggered against particular thresholds. Also used to inform management strategies such as the Coral Stress Response Plan for the Coral and Marine Aquarium Fish Fisheries (Informant)

1.2 Identify thresholds, improve monitoring and predictions, and evaluate strategies
 	
Targets (from Implementation Program):
By 2012 critical ecosystem thresholds that can be affected by management actions are identified
 	
By 2012 key ecological economic and social thresholds will be incorporated into prediction, monitoring and evaluation tools
 	
Policy outputs: key ecological, economic and social thresholds are identified
	• Thresholds beyond which climate change causes irreversible damage has been identified for vulnerable species and habitats but less so for processes
	• Improved tools have been developed for predicting, measuring and monitoring the effects of climate change on vulnerable species, particularly coral, including the Early Warning System for coral bleaching, ReefTemp, BleachWatch, the Coral Disease Outbreak Monitoring Program and the Integrated Monitoring Strategy. This has been supported by training of participants in monitoring and reporting
	• CCG contribution to the revision of the Reef Water Quality Protection Plan (Reef Plan) in 2009 saw climate change acknowledged as a stressor and included targets for remedial action to address this threat; in addition a water quality thresholds mapping project is in progress
		Strategy
		a. Identify thresholds beyond which climate change causes irreversible damage to vulnerable species, habitats and processes (e.g. productivity and connectivity)
		
		Evidence
		• Thresholds identified via projected vulnerability across a range of carbon dioxide concentrations for nine groups of species (corals, seabirds, fish, marine reptiles, plankton, microbes, marine mammals, seagrasses, macroalgae) and five habitats (reef habitats, islands, coastal habitats, open water habitats, seabed habitats) (1.7)
		• Changes that are occurring and are likely to occur over the next 100 years for a range of marine biodiversity (species and habitats) are outlined for tidal wetlands, seagrass, macroalgae, phytoplankton, zooplankton, coral reefs, tropical fish, temperate fish, pelagic fish and marine reptiles in Marine Climate Change Impacts and Adaptation Report Card Australia 2009 (1.6) The Director of the CCG was co-author of the coral reefs section, which includes an evaluation of vulnerability, knowledge gaps and adaptation options relating to climate change (Informant)
		• Great Barrier Reef Outlook Report 2009 notes there is little known about trends in many key ecological processes such as microbial processes, primary production, symbiosis, competition and connectivity (1.7)
		• Relevant projects include:
		  ○ Status of Seabirds & Shore Birds in the Great Barrier Reef World Heritage Area
		  ○ ARC Grant contribution from the GBRMPA as one of industry partners on NOAA-GBRMPA-UQ-ARC linkage grant on "Ecosystem tools"
		  ○ Smart State fellowship "Adaptation of corals to climate change
		  ○ Apex Predator Project
		  ○ Smart State Premiers Fellowship - Prof Ove Hoegh Guldberg
		  ○ ARC linkage – ocean acidification (UQ)
		  ○ Resilience analysis and risk assessment for turtles reef-wide
		  ○ Input into Raine Island risk assessment (1.1; 1.26)

Action Plan component/outcomes	Result summary	Strategies & Evidence
		Strategy b. Work with partners to develop improved tools for predicting, measuring and monitoring effects of climate change on vulnerable species **Evidence** • The Coral Bleaching Response Plan, which outlines a strategic response for monitoring risk and responding to coral bleaching events when they occur, is updated annually to incorporate new technologies and key learnings from the previous summer. The Early Warning System uses state-of the-art technology and a volunteer monitoring network to monitor the risk and onset of impacts each summer (1.8). • The Response Plan ensures that the Government is the authoritative source of information about coral bleaching, thereby minimising opportunities for misinformation and biased reporting of coral bleaching impacts on the Marine Park. The Response Plan is regarded internationally as best practice for dealing with coral bleaching events and has been adapted for use throughout the world (1.11) • An Integrated Monitoring Strategy was developed based on adaptation of the Coral Bleaching Response Plan's Early Warning System (1.3) • Use of ReefTemp to more to accurately predict the severity of coral bleaching at regional or local scales (1.12) [the detection of anomalous sea surface temperatures (SSTs) through models such as POAMA has revolutionised the way in which coral bleaching events are monitored and assessed in the Great Barrier Reef and Coral Sea (1.10). Information from POAMA enables improved climate model projections and response readiness (1.11.)] • BleachWatch engages community members as a partner in monitoring (Informant) • A project was implemented to develop an education and training package to facilitate and improve the training of participants in BleachWatch, Eye on the Reef and other monitoring and reporting of coral bleaching and reef ecosystem health (1.9) The package was used to train QPWS rangers to perform RHIS and point survey, and also to acknowledge non-climate impacts beyond bleaching (Informant) • As a result of the Coral Disease Outbreak Monitoring Program, a response-based action plan was recommended to appropriately monitor changes in coral communities on the Reef (1.24) • Input into database development for RHIS/BleachWatch/Eye on the Reef with Field Management group (1.1) • ARC linkage – benthic habitat remote sensing, UQ (1.1)
		Strategy c. Evaluate resilience strategies, such as the Reef Water Quality Protection Plan and Zoning Plan, to optimise their effectiveness in the context of climate change **Evidence** • Inclusion of climate change as a chronic stressor in the updated Reef Water Quality Protection Plan 2009. The Plan notes: "The impending threat of climate change to the Reef has been recognised as far more serious since the commencement of Reef Plan in 2003 and escalated the urgency of taking remedial action. Without taking this action the future livelihood of Queensland's industries and the lifestyle that Queenslander's enjoy could be under threat. Consequently, this plan has been reinvigorated to promote a more assertive approach to resolving the issue. Ambitious but achievable targets have been provided and both the Australian and Queensland Governments have committed significant resources to ensure they are met." (1.22) • The Zoning Plan (2003) does not appear to have been evaluated to include climate change considerations. • A water quality thresholds mapping project has been initiated. Thresholds have been calculated and developed and mapping is in progress (Informant)

Action Plan component/outcomes	Result summary	Strategies & Evidence
1.3 Transform information into active management responses *Targets (from Implementation Program): By 2012 targeted research results will inform a risk assessment of priority adaptive management options* *By 2012 ecosystem thresholds will be incorporated into adaptive management plans*	• The translation of information into active management responses is mostly picked up in Objective 2 which attempts to translate the information generated from the targeted science component into actions to maximise the resilience of the Reef. • The biggest challenges in this area include determining how to use the new information and knowledge generated to change policy – both within the GBRMPA and nationally, and how to best capture knowledge so that is readily available when needed (Informant). • Draft management actions have been outlined as a result of research into the critical knowledge gaps, and for at least 12 key species groups and five Great Barrier Reef habitats. Specific examples where active management responses have been implemented include for turtles, corals and seaweeds. • The use of cost-benefit analyses to inform appropriate management responses has occurred via the MCA for Reef Rescue, the BBN Model, the Raine Island resilience assessment and development of adaptation plan, the Keppels Reef Protection Markers (RPMs) and QSIA fisheries liaison project • Partnering with stakeholder groups to understand climate change implications, reduce climate footprint and prepare adaptation plans is better covered by Objectives 3 and 4, but includes at least the tourism and fishing industries and the Reef Guardian Schools and Councils.	**Strategy** a. Coordinate and synthesise emerging scientific knowledge to underpin effective management decisions **Evidence** • Preventive and responsive management actions outlined for five of eight critical knowledge gap areas (1.1) • Management responses outlined for 12 key species groups and five Great Barrier Reef habitats (1.7) • Adaptation options outlined for components of marine climate and marine biodiversity in Marine Climate Change Impacts and Adaptation Report Card Australia 2009 (1.6) , for which the CCG Director was co-author of the coral reef section (Informant) • The GBRMPA updates the Coral Bleaching Response Plan annually to incorporate new technologies and key learnings from the previous summer (1.8) • Areas where translation of information into active management responses has occurred include turtles (testing of intervention strategies for feasibility), corals and seaweeds (testing potential for farming for excess nutrient absorption) (Informant) • Relevant projects include: ARC Linkage - 5887 Risk Resilience and Response atlas and workshop; Andy Tobin FRDC - Hamish - Ecological Research - Survey of coral trout etc on the southern Great Barrier Reef; CCIRF - GE KML phase I – which gives a visual representation of the effects over summer which are not static, building into and illustrating levels of response that helps support management decisions; and community typology (1.1; 1.26; Informant) • The structure and skills of the GBRMPA have changed to better use science, which is now more integrated into decision-making, and there is an understanding of the implementation pathways to apply new knowledge from research…..”There is an inclusive approach to science – science is an integral part of the process and they work to develop science based policy.” (Informant) • The Authority is a power user of information and (name) is a research provider, in which we work to provide solutions. We are most comfortable and most suited to solving complex problems of environment impacting on society, and scientists like to have a good and clear understanding of the system before proposing the best way forward…..”The Authority as an operational agency has urgency attached to decision-making which can never be delayed pending the answering of the very last question. The managers are looking for information that is fit for purpose and that can be applied with effect as soon as possible. There is that natural dichotomy there.” (Informant) • “Having a group there like that (CCG) to sharpen our focus and provide some direction for some of the things we do and some feedback and results on what is being done by others is a very good management thing for us. It is never just information one way and no one knows what’s going on…… We have an expectation that we would also be at the table involved in the decision making (when we have) a situation.” (Informant) • “Our relationship has really strengthened over the last couple of years, both in terms of recognition of the role QPWS can play in terms of climate change response and what it can offer in experience and knowledge. It has also strengthened in terms of on-the-ground collaborative projects around climate change, e.g. Raine Island and its susceptibility to climate change and what it needs to adapt. It has got to a point where we can have that open, unguarded discussion about what is going on at the moment and what each of QPWS and GBRMPA can do.” (Informant) • “The CCG and Climate Change Action Plan clearly allows us to appropriately brief our hierarchy ministers and the Queensland government on climate change issues in the Great Barrier Reef World Heritage Area, and not just for corals but if there is a flow-on for tourism and fisheries. It also provides us direct access to some of the tools we would not have if there wasn’t the climate change response plan and the sea surface temperature model. (Informant) • ”Information that we do need is the management tools and actions that are going to work. A little bit of that is going on, but that is still a continuing thing in my mind….How do you recover an affected reef if you need to? How do you recover an inshore fringing reef that got hammered by a bleaching event that may be in a phase shift – can you get it back the other way, can you help it?” (Informant) **Strategy** b. Use cost-benefit analyses to select management responses that maximise ecological resilience while minimising social and economic costs **Evidence** • Some elements of work being done under the QSIA Climate Change and Fisheries Liaison Project incorporate cost-benefit analysis to inform the future sustainable positioning of industry (1.16) • A Bayesian Belief network (BBN) Model that provides catchment-to-reef integration of components of the Great Barrier Reef social-ecological system was developed to help decision-makers understand the socio-economic trade-offs associated with managing for resilient reef communities given the threat posed by climate change. The BBN Model formalises socio-ecological cost-benefit analysis within a risk assessment framework, aiding the difficult task of prioritising alternative management actions (1.19) • CSIRO has led an initiative to apply Multi-Criteria Analysis (MCA) to optimise management responses to water quality improvement challenges. The GBRMPA has been a key member of working groups with CSIRO under the Reef Rescue program and assisted the integration of climate change considerations into Reef Rescue program planning and analysis (Informant) • The Raine Island resilience assessment and development of adaption plan includes cost-benefit analysis for potential management options under a changing climate for seabirds and turtle (Informant) • The Keppels Reef Protection Markers (RPMs) involves a trade-off for the markers against the ability to anchor (Informant)

Action Plan component/outcomes	Result summary	Strategies & Evidence
		Strategy c. Partner with stakeholder groups, such as the tourism industry, to understand climate change implications, reduce climate footprint and prepare adaptation plans **Evidence** • Stewardship Action Plan - developed to ensure that licensed participants in the Queensland-based fisheries that supply the marine aquarium industry adhere to a uniform operational standard; and that operators have clear contingency plans in place to respond to catastrophic events linked to global climate (1.15) • Projects involving partnering include the Reef Guardian Council Program - Climate Change Module; Reef Guardian Schools; the QSIA fisheries liaison project and development of emissions calculator; the GBRMPA Tourism Climate Change Action Strategy; and Ecotourism Australia's climate change module and Climate Action Australia Certification Program; the Shifting Baselines research; Mitigation strategies for tourism sites - sprinkler project; Dive site evaluation; International dive site rating scheme; and the Bayesian Belief Network project (1.1) • Covered in more detail in Objectives 3 and 4 (overlap)
Outcomes complementary to Action Plan (as articulated in CCG implementation program)		
1.4 Status and trends of ecosystem resilience are measured *Targets (from Implementation Program): By 2012 key ecosystem resilience measures will be identified and validated* *By 2012 key ecosystem resilience indicators are incorporated into monitoring programs* *Policy outputs: temporal trends in ecosystem resilience are incorporated into relevant policies*	These outcomes are an extension of other elements of Objective 1, especially around resilience and stressor identification and incorporation of those into management plans. • Ecosystem resilience indicators have been identified for corals • Work on the Bayesian Belief Network (BBN) Model and a study of fisher response to Cyclone Hamish has set the foundation for the identification of social resilience indicators • Predictive tools based on the identification of acute ecosystem stressors include the Coral Disease Model and Response Plan, the POAMA research, ReefTemp (and Coral Bleaching Response Plan), Integrated Eye on the Reef and the implementation of BleachWatch • Incorporation of chronic ecosystem stressors into management plans has occurred through the CCIRF and other coral-specific plans • Development of an integrated information system based on existing monitoring programs is expected to increase reef stakeholder awareness of ecosystem resilience status and trends. This is also occurring through stakeholder involvement in those monitoring programs	**Strategy** a. Ecosystem resilience indicators are identified and validated **Evidence** • The Keppel Bay resilience case study project tested and refined a protocol for assessing Reef resilience, providing the foundations for a resilience-based approach to future management of the region (1.17). The application of this research to the Reef as a whole is being furthered through a new project analysing 11 protocols for resilience assessment to meet identified management needs (1.18; informant) • See also 1.1b
		Strategy b. Social resilience indicators are identified and validated **Evidence** • A Bayesian Belief Network (BBN) Model that provides catchment-to-reef integration of previously unlinked components of the Great Barrier Reef social-ecological system was developed to help decision-makers understand the socio-economic trade-offs associated with managing for resilient reef communities given the threat posed by climate change. Its application to inshore reef areas where there is a high risk of exposure to agricultural runoff produced maps which model bleaching risk, population growth and tourism use and highlight areas of concern over the coming decades. These will help guide management in assessing tradeoffs for improving water quality versus cost to the agricultural sector (1.19) • A project to examine fishers' response to any impacts from Cyclone Hamish, and to determine if/how management can help industry remain viable through future environmental events has been initiated (1.26)
		Strategy c. Acute ecosystem stressors are identified and predictive tools are developed **Evidence** • The Great Barrier Reef Climate Change Incident Response Framework (CCIRF) was developed to provide a common organisational structure to facilitate an effective and efficient response to climate change incidents. It sets out the organisational structure and communication arrangements for mobilising resources to deal with climate change incidents such as coral bleaching, severe rainfall events, coral disease outbreaks and cyclone impacts (1.21) It is based on the following predictive tools: POAMA, flood plumes data, ReefTemp, White Syndrome predictive tool, networks with AIMS and researchers (for information on temperature thresholds, upwelling etc.) ARC ecosystem tools grants and the NOAA hotspots work (Informant) • Predictive tools based on identification of acute stressors include the Coral Disease Model and Response Plan, the POAMA research, ReefTemp (and Coral Bleaching Response Plan), and implementation of the BleachWatch program (Informant) • See also 1.2b
		Strategy d. Chronic ecosystem stressors are identified and incorporated into management plans **Evidence** • Inclusion of climate change as a chronic stressor in the updated Reef Water Quality Protection Plan 2009. The Plan notes: "The impending threat of climate change to the Reef has been recognised as far more serious since the commencement of Reef Plan in 2003 and escalated the urgency of taking remedial action. Without taking this action the future livelihood of Queensland's industries and the lifestyle that Queenslander's enjoy could be under threat. Consequently, this plan has been reinvigorated to promote a more assertive approach to resolving the issue. Ambitious but achievable targets have been provided and both the Australian and Queensland Governments have committed significant resources to ensure they are met." (1.22) • Synergies between climate and non-climate stressors on key physical, chemical and ecological processes outlined in the Great Barrier Reef Outlook Report (1.7)

Action Plan component/outcomes	Result summary	Strategies & Evidence
		• Reef Rescue – climate change as a chronic ecosystem stress incorporated into this plan of management (Informant) • Chronic ecosystem stressors have been identified and incorporated into Australia's National Biodiversity Strategy (currently under development) (2.8) • See also 1.2c
		Strategy e. Reef stakeholders are aware of Great Barrier Reef ecosystem resilience status and trends **Evidence** • A project to develop an information system that integrates data and provides a more holistic and efficient approach to storing, reporting and managing data generated from the GBRMPA's monitoring programs (Reef Health and Impact Survey, BleachWatch and Integrated Eye on the Reef) has been initiated. A common protocol, common organisational framework for response, a common early warning system and database have been completed and the KML will interpret and illustrate. The expected outcome is a fully functional integrated GBRMPA information system that improves the management of the Reef through increased capacity to access and analyse reef health data. (1.23; Informant) • Projects include: BleachWatch/RAMP training package; CCIRF Bleach Watch/RAMP survey training; Reef Map consolidation project

Table 4 Data index: Objective 1 (Targeted Science)

Item #	Title	Type	Author	Year	Description
1.1	ActionPlanVA_ResPriorities MgtActions_RB Feb2010	Excel spreadsheet	CCG	2010	Spreadsheet of completed and current Action Plan research as of February 2010 against Action Plan research priorities for all objectives, including preventive and responsive management actions (1-4).
1.2	CCResQusGBRMPAInvest_ MgtActions Feb2010	Excel spreadsheet	CCG	2010	Appears to be same spreadsheet as above
1.3	IntegratedMonitoringStrategy fortheGBRv3	Powerpoint presentation	Roger Beeden	2010	Describes the development of an Integrated Monitoring Strategy for the Great Barrier Reef Marine Park, based on adaptation of the Coral Bleaching Response Plan's Early Warning System. Includes a three-tier integrated monitoring system linked to a Climate Change Incident Response Framework.
1.4	Climate Change and the Great Barrier Reef: Mid-term Research and Investment Report (DRAFT)	Report	The GBRMPA	2009	Outlines climate change strategic research directions in order secure the future of the Great Barrier Reef. Presents researchers and government with a clear strategic direction for research that will inform the GBRMPA's management priorities as they relate to climate change over 2009-2012.
1.5	The Great Barrier Reef: Vulnerability to Climate Change (DRAFT)	Report	The GBRMPA	2009	Summary of key findings from the vulnerability assessment, highlighting issues that could have far-reaching consequences for the Great Barrier Reef ecosystem and the industries and communities that rely on the Reef. Also identifies knowledge gaps and outlines management options that will assist the Great Barrier Reef and other tropical marine ecosystems to cope with future climate change
1.6	Marine Climate Change Impacts and Adaptation: Report Card Australia 2009	Webpage - www.oceanclimate change.org.au	CSIRO/ NCCARF	2009	Reports what is happening, what is likely to happen this century, key knowledge gaps and key adaptation options for each For Marine Climate (Temperature, Ocean Acidification, Sea Level, Coastal Climate, El Nino-Southern, Oscillation, East Australian Current, Leeuwin Current) and Marine Biodiversity (Tidal Wetlands, Seagrass, Macroalgae, Phytoplankton, Zooplankton, Coral Reefs, Tropical Fish, Temperate Fish, Pelagic Fish, Marine Reptiles).
1.7	Great Barrier Reef Outlook Report 2009	Report	The GBRMPA	2009	Describes what is known about the ecosystem, its use, its management and the pressures it is facing, and its future.
1.8	Coral Disease Response Plan 2009-2010	Report	The GBRMPA (R Beeden, JA Maynard, PA Marshall, and BL Willis)	2009	Outlines a strategic approach for monitoring risk and responding to coral bleaching events when they occur. Includes four components: 1. Early Warning System; 2. Incident Response; 3. Management Actions; 4. Communications Strategy.
1.9	Development of a training package for community monitoring of coral reef health	Project Brief	The GBRMPA	2009	Describes the project, the objective of which is to develop an education and training package to facilitate and improve the training of BleachWatch, Eye on the Reef and other participants in the monitoring and reporting of coral bleaching and reef ecosystem health.
1.10	Experimental Great Barrier Reef Coral Bleaching SST Forecasts from POAMA-1.5	Webpage	Bureau of Meteorology	2008	Shows experimental sea surface temperature (SST) forecasts from POAMA V1.5 at lead times of 0-7 months for the Great Barrier Reef region.
1.11	High coral bleaching risk for the Great Barrier Reef this summer (2008-2009) – updated forecast.	Ministerial briefing	DEWHA	2008	Provides information on the upgrade assessment of risk level from moderate to HIGH and provides an early warning of potential severe coral bleaching on the Great Barrier Reef for the summer of 2008-09.
1.12	ReefTempvsNOAA	Internal document	The GBRMPA	2008	Describes how ReefTemp overcomes NOAA problem of not being able to predict severity of coral bleaching locally
1.13	Approval of contract for climate change project to identify and map the risk and exposure of Great Barrier Reef ecosystems to water quality influences	Internal document	The GBRMPA	2010	Seeks approval of contract for JCU to undertake project to identify and map the risk and exposure of Great Barrier Reef ecosystems to water quality influences
1.14	Role and importance of apex predators in the Great Barrier Reef ecosystem	Project Brief	The GBRMPA	2009	Outlines the requirements of a research project to understand the role and importance of apex predators in the Great Barrier Reef ecosystem
1.15	Stewardship Action Plan - a statement of operational standards and climate change contingency planning	Plan	Pro-vision Reef Inc	2009	Outlines a plan of action for licensed participants in the Queensland-based fisheries that supply the marine aquarium industry, in terms of operational standards and climate change contingency. Developed to ensure that licensed participants in the Queensland-based fisheries that supply the marine aquarium industry adhere to a uniform operational standard; and that operators have clear contingency plans in place to respond to catastrophic events linked to global climate change.
1.16	Strategic Plan 2009-2010. Climate Change and Fisheries Liaison Officer, QSIA-GBRMPA Partnership - Milestone Report 1	Report	The GBRMPA/QSIA	2009	Outlines progress to date with the QSIA Climate Change and Fisheries Liaison Project
1.17	Keppel Bay Resilience Case Study - Building regional capacity for resilience-based management	Project Brief	The GBRMPA	2007	Describes the background to resilience-based management including the use of resilience assessment protocols to inform that, and outlines the objectives and expected outcomes of a project designed to test the protocol in Keppel Bay
1.18	Mapping coral reef resilience to climate change: GBRMPA workshop report	Report	C2O and Maynard Consulting	2009	Describes outcomes of a workshop to progress a project to develop an options paper and presentation outlining three to five feasible approaches for mapping resilience on a Reef-wide scale.

Item #	Title	Type	Author	Year	Description
1.19	The development of an integrated systems model for balancing coral reef health, land management and tourism risks on the Great Barrier Reef	Paper presented at 18th World IMACS / MODSIM Congress, Cairns, 13-17 July 2009	CSIRO/AIMS/GBRMPA	2009	Describes a prototype Bayesian Belief Network (BBN) Model that provides catchment-to-reef integration of previously unlinked components of the Great Barrier Reef social-ecological system.
1.20	Adapting to Change – Exploring the response of the Great Barrier Reef Coral Reef Fin Fish Fishery to a major environmental event (Cyclone Hamish)	Project brief	The GBRMPA	2009	Outlines the requirements of a research project to examine fishers' response to any impacts from Cyclone Hamish, and to determine if/how management can help industry remain viable through future environmental events.
1.21	Great Barrier Reef Climate Change Incident Response Framework (CCIRF)	Project Bulletin	The GBRMPA	2009	Describes the framework developed to provide a common organisational structure to respond to a climate change incident.
1.22	Reef Water Quality Protection Plan – For the Great Barrier Reef World Heritage Area and adjacent catchments	Plan	The State of Queensland (Department of the Premier and Cabinet)	2009	Outlines the plan for protecting reef water quality, including acknowledgement of threat of climate change.
1.23	Provision of consultancy services for Information System for Reef health	Request for Tender	The GBRMPA	2010	Outlines the tender requirements for a proposed project to develop a fully functional integrated GBRMPA information system that improves the management of the Reef through increased capacity to access and analyse reef health data.
1.24	Coral Disease Outbreak Monitoring Program – Implications for Management	Final Report	Allison S. Paley, David Abrego, Jessica Haapkyla and Bette L. Willis (JCU)	2009	Describes the results of ongoing monitoring of coral disease
1.25	Vulnerability of high trophic levels on the Great Barrier Reef (e.g. sea birds) to climate change	Progress Report	Brad Congdon	2009	Provides a progress update on the research project
1.26	07_08_09_CC_Traffic_Light_Report	Excel spreadsheet	CCG	2007-2010	Project spreadsheet, including project title, description, reference with respect to program logic and GBRMPA group, contract value and milestone allocation, project contact, a traffic light (red, amber, green) demoting progress – for each calendar year 2007/08 to 2010/11 (incomplete)

Table 5 Results chart: Objective 2 (A resilient Great Barrier Reef ecosystem)

The left-hand column outlines the components of Objective 2 as articulated in the Action Plan, as well as additional outcomes for Objective 2, and associated targets and policy outputs, as articulated in the CCG implementation program. Where possible, the additional outcomes, targets and policy outputs have been mapped to the original components of the Action Plan. The right-hand column describes the strategies employed by the Action Plan and provides evidence of progress towards each. Bracketed numbers, e.g. (2.5) reference the data item from which the evidence was drawn; where evidence was provided through interviews this is referenced via: (Informant). Table 6 provides an index of data items for this results chart. The middle column provides a summary result of progress towards the strategies, based on the evidence provided in the right-hand column.

Action Plan component/outcomes	Result summary	Strategies & Evidence
2.1 Maximise resilience of the Great Barrier Reef ecosystem to climate change	• This component is testing the idea that there are things that can be done above and beyond what would normally be done to maximise resilience. While addressing whole-system threats (e.g. water quality) it also allows a focus on specific parts of the ecosystem, given the non-homogenous nature of vulnerability. The biodiversity strategy currently being developed by the GBRMPA is the broad umbrella for this focus on specific parts (CCG Informant). • A key contribution under this outcome is the concept of moving from vulnerability assessment to understanding resilience and then to using that as a basis for identifying adaptive management actions • Action Plan contribution to the broader GBRMPA identification and mapping of the risk and exposure of Reef ecosystems to water quality influences is underway and aims to contribute to knowledge of ecosystem resilience of the Reef in relation to water quality and water quality threats. • Sustainability of fishing practices assessed via the Marine Aquarium Supply Industry Climate Change Vulnerability Assessment, Stewardship Action Plan and in part through Cyclone Hamish research • Transition or alternative habitats that will provide for shifts in distribution and abundance of species and habitats affected by climate change are being identified through various resilience mapping projects (coral, turtles), but have not been protected via management/zoning plans. • The protection of highly vulnerable species from non-climate pressures has been facilitated by the results of a range of projects, but there is a large gap between the tasks of identifying vulnerability and determining appropriate protection measures. There is risk associated with a move to intervention and policy and cultural barriers exist with respect to this.	**Strategy** a. Identify the main water quality threats (e.g. containment hotspots) to resilience as a basis for targeting management efforts **Evidence** • A project to identify and map the risk and exposure of Great Barrier Reef ecosystems to water quality influences is underway. The project will contribute to knowledge of ecosystem resilience of the Great Barrier Reef in relation to water quality and water quality threats (1.13) • "In terms of building a resilient reef, we have seen a lot of action across multiple fronts across the Marine Park Authority to deal with the issues of water quality and fishing, in particular, side by side, thus the broad agenda of the Action Plan is definitely being implemented - and I believe with substantial effect….We see the Authority very much in action on its strategy of building natural resilience…." (Informant) • Resilience thinking has been a critical element of developing successful climate change adaptation for the Reef. Much of the work done by the GBRMPA to address resilience, such as protected areas and water quality improvement is also key to building resilience to climate change. (Informant) • "Resilience thinking is the most fruitful way to think about adaptation and to identify strategies to help the Reef cope with climate change impacts." (Informant) • The GBRMPA is "a leader in applying resilience thinking to environmental management" and has been sharing knowledge and management strategies with other coral reef managers around the world. The GBRMPA could benefit other organisations by sharing more of its processes of thinking about resilience, to help other organisations advance their own approach to resilience and adaptation. "The GBRMPA is more advanced than others in Australia, and maybe the world." (Informant) **Strategy** b. Identify and protect transition or alternative habitats (e.g. turtle nesting, seabird breeding and productivity zones) that will provide for shifts in distribution and abundance of species and habitats affected by climate change Plus relevant outcomes from Implementation Program: 2.1a Potential climate change refugia are identified and protected in zoning plans or other management plans 2.3b Zoning plan revisions maximise biodiversity conservation, refugia protection and connectivity **Evidence** • An evaluation of the ecological role of apex predators on the Great Barrier Reef, their vulnerability to human activities and their contribution to ecosystem and economic values identified protection and management recommendations (2.1) • A project has been planned to develop a reef-wide resilience analysis for nesting and foraging populations of green, loggerhead, hawksbill and flatback turtles on the Great Barrier Reef, which is anticipated to culminate in a comprehensive Adaptation Plan for marine turtles on the Reef (2.2) • The Keppel's resilience project and resilience mapping project gives the idea of which locations are likely to be more resilient and survive over periods of time over differing circumstances (Informant) • The biodiversity strategy currently being developed by the GBRMPA will provide the broad umbrella for focusing on specific habitats and species, e.g. turtles, sea birds, apex predators, sea cucumbers (Informant) • The Raine Island resilience research suggested the identification and conservation of potentially suitable alternate nesting sites as a long term management action (2.6) • The Raine Island northern Great Barrier Reef turtles project found Raine Island to be very important to turtle nesting and led to further research by Mariana Fuentes as to what locations turtles might go to instead and what the threats are to those locations (Informant) • Zoning plans have not been revised (CCG informant) **Strategy** c. Assess sustainability of fishing practices to ensure protection of habitat and key functional groups of plants and animals (e.g. herbivores) as a strategy for building resilience Plus relevant outcomes from Implementation Program: 2.1e Extractive industries such as fisheries adopt practices that minimise pressures on refugia and vulnerable habitats 2.2d Extractive industries such as fisheries adopt practices that minimise pressures on vulnerable species **Evidence** • Sustainability of fishing practices assessed through work underpinning the Stewardship Action Plan (1.15) and in part through Cyclone Hamish research (1.20) • The Keppel's resilience project, which is the combination of the biophysical assessment, the resilience indicators and the Reef protection markers project) informed the Marine Aquarium Supply Industry Climate Change Vulnerability Assessment. The next step identified was the Coral Stress Response Plan for the Coral and Marine Aquarium Fish Fisheries (Informant)

Action Plan component/outcomes	Result summary	Strategies & Evidence

		Strategy
		d. Protect species and habitats (e.g. corals, marine turtles, seabirds, fish and mangroves) that are highly vulnerable to climate change from non-climate pressures (e.g. physical damage, human disturbance or coastal development)
		Plus relevant outcomes from Implementation Program:
		2.1 b Stresses that interact with climate change to threaten refugia and vulnerable habitats are explicitly targeted in management plans and actions
		2.2.a Management policies relating to vulnerable species are developed/revised to accommodate climate change risks
		Evidence
		• Project spreadsheet for 2.1b:
		  ○ Keppels Resilience Assessment and Resilience based Management (Jeff Maynard)
		  ○ Macroalgae resilience/adaptation project
		  ○ Support monitoring of Keppel's reef protection markers and resilience
		  ○ Review and map policy and permitting environment identifying useful tools for climate change and identifying any areas for improvement, e.g. SMAs, translocation policies, dredging
		• Stresses that interact with climate change to threatened refugia and vulnerable habitats explicitly targeted in the Reef Plan, which was revised in 2009 to acknowledge climate change as a stressor and included targets for remedial action to address this threat (1.22)
		• Potential adaptive management strategies outlined for Raine Island as part of climate change risk assessment work (2.6); the Raine Island Phase II project is adapting the Raine Island management plan using a risk assessment based process (joint with QPWS) (1.26)
		• A project is determining the potential for the Coastal Bird Atlas to address research and management needs for the understanding and protection of seabird populations on the Reef, especially in view of possible environmental impacts from climate change. Phase 1, which has been completed, defined the broad scale distributions of seabird breeding populations throughout the Reef and determined any temporal variations that may be related to local, or widespread changes in habitat conditions (2.9)
		• Facilitation of development of Wuthathi TUMRA Implementation Plan 2008-2013 (Informant)

2.2 Adapt existing management to incorporate climate change considerations (2.1-2.3) Refugia and vulnerable habitats, vulnerable species/groups and essential ecosystem functions are resilient *Targets (from Implementation Program): By 2012:* • *key climate change refugia and vulnerable habitats will be identified and incorporated into ecosystem based management plans* • *key vulnerable species and species groups will be identified and incorporated into adaptive management plans* • *essential ecosystem functions will be identified and incorporated into adaptive management plans* *Target (from Implementation Program): By 2012 human pressures are identified and best practice guidelines are developed aimed at:* • *reducing pressures on refugia and vulnerable habitats* • *reducing pressures on vulnerable species/groups* • *maintaining ecosystem functions* *Policy outputs: Policy update on:* • *refugia and vulnerable habitats*	• Some examples of adaptive management but limited by large gap between identifying and taking action. Have possible interventions for turtles, which need to be assessed for their feasibility. Risk management with respect to marine ecosystem intervention needs to evolve, including policy on incorporating intervention into traditional management regimes. The biodiversity strategy currently being developed by GBRMPA is providing the foundation for this. • The biggest challenges in this area include determining how to use the new information and knowledge generated to change policy – both within the GBRMPA and nationally, and how to best capture knowledge so that is readily available when needed (Informant). • A key outcome under this objective is the preparation of a system for measuring ecosystem resilience, and developing this framework to inform management decisions is a key focus of the remainder of the program (CCG informant) • QPWS have adopted a vulnerability risk assessment process in their planning. QPWS activities in the GBRMPA are detailed under the Field Management Program 2009-2012 Annual Business Plan and Climate Change 2009-2012 Annual Operating Plan, which are strongly aligned with the Action Plan and incorporate a vulnerability assessment –resilience analysis process for developing management responses to climate change risks (Informant) • Consideration of climate change impacts in	**Strategy** a. Consider expected climate change impacts whilst developing new water quality targets, ecosystem health guidelines and other management guidelines (e.g. Coastal Land Use Guidelines) Plus relevant outcomes from Implementation Program: 2.3c Water quality targets are revised in light of climate change pressures on inshore habitats 2.3d Ecosystem Disaster Response Plan developed and adequately resourced 2.3e Landholder awareness and support for water quality management as a measure to increase resilience of reef to climate change **Evidence** • Action Plan contribution to the revision of the Reef Water Quality Protection Plan (Reef Plan) in 2009 saw climate change acknowledged as a stressor and included targets for remedial action to address this threat (2.6) • Reef Rescue, which aims to reduce the decline in water quality entering the Reef, includes water quality targets. Targeting reef water quality is one element of improving the resilience of the Reef in the face of climate change (2.7) • The Climate Change Incident Response Framework (CCIRF) was developed to provide a common organisational structure to facilitate an effective and efficient response to climate change incidents. It sets out the organisational structure and communication arrangements for mobilising resources to deal with climate change incidents such as coral bleaching, severe rainfall events, coral disease outbreaks and cyclone impacts (1.21) • Ecosystem Disaster Response Plan – CCIRF plus Coral disease surveys (JCU); Swains aerial photography – DDM material; Coral disease response plan • Landholders aware of water quality management as a measure to increase resilience of the Reef to climate change through involvement in Reef Rescue. • There is a need for "strong sit-down thinking" on appropriate management responses to climate change and other impacts – both for ecosystem impacts and for communities and industries. This needs to be consultative and involve all interested parties – particularly industry which has a strong motivation to focus on responses to future risks. (Informant) • There is enough knowledge of some elements of the ecosystem to develop detailed policy on adaptation actions. The GBRMPA must play a leadership role in developing and clarifying adaptation actions collaboratively with industry, researchers and the community (Informant). • There is a strong motivation within the Reef industries to respond to climate change risks and an expectation for collaborative engagement for the GBRMPA in developing adaptation actions. (Informant)
		Strategy b. Ensure information on the vulnerability of species and habitats is incorporated into registers of threatened and endangered species **Evidence** • Input into IUCN red listing of hard coral species (1.26)

Action Plan component/outcomes	Result summary	Strategies & Evidence
• *vulnerable species/groups* • *ecosystem functions* 2.4 Ecosystem goods and services are maintained *Target (from Implementation Program): By 2012 ecosystem goods and services are identified and incorporated into ecosystem based adaptive management plans.* *Policy output: Ecosystem intervention policy defined and adaptive management policy developed*	developing new water quality targets achieved through Reef Plan revision, Reef Rescue and CCIRF. • Information on the vulnerability of species incorporated into registers of threatened and endangered species through IUCN listing of hard coral species • Work with fisheries management agencies to evaluate risks of climate change for sustainability is occurring through the development of the Stewardship Action Plan and QSIA Strategic Plan	**Strategy** c. Work with state fisheries management agencies to evaluate risks of climate change for sustainability of Great Barrier Reef fish populations and fisheries, which can be built into management plans **Evidence** • The Stewardship Action Plan - developed to ensure that licensed participants in the Queensland-based fisheries that supply the marine aquarium industry adhere to a uniform operational standard; and that operators have clear contingency plans in place to respond to catastrophic events linked to global climate (1.15) • Via the Queensland Seafood Industry Association Climate Change and Fisheries Liaison Project, the QSIA and the GBRMPA are working in partnership over a two-three year period to develop and implement a shared strategic framework to "futureproof" the Queensland commercial fishing industry operating in the marine park. The partnership aims to build a strong relationship between the commercial fishing industry and the GBRMPA to enable them to work together on projects hat will contribute to ensuring that the commercial fishing industry in Queensland remains both ecologically and economically sustainable in the face of global change (1.16) • Those responsible for permitting (permit assessors) seek advice from the CCG on an ad-hoc basis regarding climate change risk issues where relevant (Informant)
2.3 Minimise climate change impacts through local management actions 2.4 Ecosystem goods and services are maintained *Target (from Implementation Program): By 2012 human pressures are identified and best practice guidelines aimed at maintaining ecosystem goods and services are adopted by 20% of Reef users*	• Regional case studies of management responses to coral bleaching • Adaptation options, including strategies to reduce the sensitivity of turtle and seabird nesting sites to climate change, are being tested and/or evaluated via a range of projects including the Raine Island projects and the development of a population model for the northern Great Barrier Reef green turtle stock project. • Other projects are identifying adaptation options, e.g. the research into the role and importance of apex predators on the Great Barrier Reef ecosystem, the sea bird atlas work, the herbivory position statement and coral reef research • Plans to review and adapt island management arrangements with the aim of including principles and strategies for minimise climate change vulnerability include following sites: Raine Island, Low Isles, Lady Elliot Island and Michaelmas Cay.	**Strategy** a. Undertake regional case studies of management responses to coral bleaching (e.g. working with local communities to improve recovery potential of damaged reefs by protecting surviving corals, reducing fishing pressure and addressing point-sources of pollution) **Evidence** The Keppels Resilience report provides a regional case study of management responses to coral bleaching (Informant)
		Strategy b. Test strategies to reduce the sensitivity of important turtle and seabird nesting sites to climate change (e.g. limiting visitation during breeding season and providing shade at nesting sites) Plus relevant outcomes from Implementation Program: 2.2b Species/group adaptation options are identified and risks are evaluated 2.2 c Investment in key vulnerable species/group adaptation research **Evidence** Occurring through: • The Raine Island projects, particularly the Raine Island Phase II project - risk assessment and testing of priority interventions, e.g. turtle nest shading project practicalities, materials and protocols (joint with QPWS) (1.26) • The Seabird Atlas – the development of current state of knowledge of seabird resilience through database synthesis (resilience analysis for seabirds) (2.9), the research into the role and importance of apex predators on the Great Barrier Reef ecosystem (1.14), the development of a population model for the northern Great Barrier Reef green turtle stock project (2.2 and the Great Barrier Reef herbivory position statement, which describes the importance of herbivory to the resilience of coral reefs in the Great Barrier Reef Marine Park (2.10) • Coral reef resilience research, including the coral bleaching risk & water quality and coral disease risk projects
		Strategy c. Adapt island management plans to address impacts that exacerbate climate change vulnerability (e.g. weed infestations, fire disturbance and development) Plus relevant outcomes from Implementation Program: 2.1c Management plans for island ecosystems are adapted to minimise climate change vulnerability **Evidence** There are plans to review and adapt island management arrangements with the aim of including principles and strategies for minimise climate change vulnerability. Focal sites include Raine Island, Low Isles, Lady Elliot Island and Michaelmas Cay. (1.26; informant)
Strategies complementary to Action Plan (as articulated in CCG implementation program)		
	Most elements additional to the original outcomes of the Action Plan include those based around the maintenance of ecosystem goods and services. The conceptual framework of ecosystem goods and services, which captures interactions between ecosystem-focused objectives and adaptation (social-economic) oriented objectives, is used internally in the CCG for planning. In this sense it is somewhat synthetic, and progress in this area is likely to come through recognising synergies between other activities (Informant)	**Strategy** 2.1d Reef users adopt practices that minimise pressures on refugia and vulnerable habitats. Additional to fisheries as covered in 2.1e **Evidence** Occurring through the Keppels Reef Protection Marker System, the preparation and distribution of reef friendly household guidelines (to community - schools and councils), and the Keppel's resilience project (no anchoring zone) (1.26)
		Strategy 2.1e Recreational users adopt practices that minimise pressures on vulnerable species **Evidence** Facilitated through the Cyclone Hamish project and the Coral Stress Response Plan for the Coral and Marine Aquarium Fish Fisheries (1.26)
		Strategy 2.3a Vulnerable ecosystem functions are identified and built into conservation strategies and policies

Action Plan component/outcomes	Result summary	Strategies & Evidence
		Evidence • Occurring through policy input for resilience analyses/adaptation plan development; risk assessment for coastal ecosystems (adjacent to the GBRMPA) using expert panels to develop guidelines (mapping and spatial analysis of coastal catchment ecosystem extent and percent remaining) and a project utilising a leading scientist/expert to collate information on specific marine ecosystems and how they relate to water quality guideline values (map and analyse water quality impact on specific coastal marine ecosystems to assess actual WQ against guidelines) (1.26) • Ecosystem functions also being identified and built into strategies and policies through the research into the role and importance of apex predators on the Great Barrier Reef ecosystem (2.1), Australia's National Biodiversity Strategy (2.8), the EAM policy/assessor guidelines (1.26), the herbivory position statement (2.10) and the Great Barrier Reef Outlook Report (1.7)
		Strategy 2.4a Vulnerable ecosystem goods and services are identified **Evidence** Occurring through the coastal project (1.26) and the BBN Model (1.19)
		Strategy 2.4b Social and economic values of vulnerable ecosystem goods are estimated **Evidence** • Occurring through the BBN Model (1.19), scoping opinion research and Shifting baseline project (1.26) • Research was undertaken to explore current community motivations to adapt to and mitigate climate change impacts in the Great Barrier Reef World Heritage Area. Rationale was that given stakeholders have a key role to play in adaptation and mitigation programs managed by the GBRMPA, understanding the levels of awareness, levels of knowledge and motivations of the community in the Great Barrier Reef region is of critical importance (2.3)
		Strategy 2.4c Ecosystem characteristics that are essential for sustenance of goods and services are identified and built into conservation strategies and policies **Evidence** The GBRMPA's herbivory position statement describes the contribution of herbivorous fishes to the ecological resilience of coral reefs in the face of climate change and outlines options for further enhancing their protection (2.10)
		Strategy 2.4d Reef industries are aware of direct and indirect dependencies on ecosystem resilience **Evidence** Reef industry awareness of dependencies facilitated through CCIRF, and involvement in of the Stewardship Action Plan, the work being done by the QSIA in partnership with the fisheries liaison officer, and their involvement in the GBRMPA Tourism Climate Change Action Strategy 2009-2012
		Strategy 2.4 e Reef industries are active partners in building resilience of Great Barrier Reef ecosystem. Builds on 3.2c **Evidence** Reef industries as active partners in building resilience demonstrated through their involvement in BleachWatch, RHIS and Eye on the Reef, the development of the Stewardship Action Plan, the work being done by the QSIA in partnership with the fisheries liaison officer, and their involvement in the GBRMPA Tourism Climate Change Action Strategy 2009-2012

Table 6 Data Index: Objective 2 (A resilient Great Barrier Reef ecosystem)

Item #	Title	Type	Author	Year	Description
2.1	Role, importance and vulnerability of apex predators on the Great Barrier Reef – a review	Report	Ceccarelli, D. M. and Ayling, A. M.	2009	Describes the results of an evaluation of the ecological role of apex predators on the Great Barrier Reef, their vulnerability to human activities and their contribution to ecosystem and economic values
2.2	Resilience analysis and risk assessment for marine turtles reef wide	Project Proposal	The GBRMPA	2010	Describes the details of a proposed project to develop a reef-wide resilience analysis for nesting and foraging populations of green, loggerhead, hawksbill and flatback turtles on the GBR, which is anticipated to culminate in a comprehensive Adaptation Plan for marine turtles on the Reef.
2.3	A review of community perceptions of climate change: implications for the Great Barrier Reef.	Report	Ann-Maree Lynch, Stephen G. Sutton and Renae C. Tobin (JCU)	2008	Describes the findings of research exploring current community motivations to adapt to and mitigate climate change impacts in the Great Barrier Reef World Heritage Area
2.4	Not used				
2.5	Not used				
2.6	Seabird and turtle reproduction on Raine Island: a resilience analysis (Draft)	Report	Not stated	2009	Identifies the issues that will affect the reproductive success of the turtles and seabirds that use Raine Island for nesting, and potential adaptive management solutions for ensuring the long-term viability of the island as a site for turtle and seabird recruitment.
2.7	Caring for our Country Business Plan 2009-10	Business Plan	Commonwealth of Australia	2008	Outlines Caring for our Country priorities for investment, including outcomes and targets for those priority areas, operational information and information on the investment process
2.8	Australia's Biodiversity Conservation Strategy 2010-2020 (consultation draft)	Strategy document	National Biodiversity Strategy Review Task Group	2009	Describes Australia's new approach to addressing biodiversity conservation in a rapidly changing world and sets a national direction for biodiversity conservation over the next decade.
2. 9	Phase 1 Analysis of Coastal Bird Atlas data	Report	Peter V Driscoll	2010	Describes the potential of the Coastal Bird Atlas for addressing research and management needs for the understanding and protection of seabird populations on the Reef, especially in view of possible environmental impacts from climate change. It addresses Phase 1 of this investigation, which is to define the broad scale distributions of seabird breeding populations throughout the Reef and determine any temporal variations that may be related to local, or widespread changes in habitat conditions.
2.10	Position Statement: Protecting herbivory on coral reefs of the Great Barrier Reef - a key aspect of the resilience of reef ecosystems in the face of climate change	Draft discussion paper – not for distribution	The GBRMPA	nd	Describes the GBRMPA's position to ensure herbivory on coral reefs is comprehensively managed in order to maximise the ecological resilience of the Great Barrier Reef to climate change and other pressures. Provides background information on the importance of herbivory to the resilience of coral reefs in the Great Barrier Reef Marine Park

Table 7 Results Chart: Objective 3 (Adaptation of industries and communities)

The left-hand column outlines the components of Objective 3 as articulated in the Action Plan, as well as additional outcomes for Objective 3, and associated targets and policy outputs, as articulated in the CCG implementation program. Where possible, the additional outcomes, targets and policy outputs have been mapped to the original components of the Action Plan. The right-hand column describes the strategies employed by the Action Plan and provides evidence of progress towards each. Bracketed numbers, e.g. (3.5) reference the data item from which the evidence was drawn; where evidence was provided through interviews this is referenced via: (Informant). Table 8 provides an index of data items for this results chart. The middle column provides a summary result of progress towards the strategies, based on the evidence provided in the right-hand column.

Action Plan component/outcomes	Result summary	Evidence

3.1 Identify factors that confer resilience to communities and industries in the context of climate change	• Limited evidence of collection of social and economic information on Great Barrier Reef industries and communities to understand risk and resilience to climate change, though improvement has been made with the fishing industry compared to earlier work with the tourism industry. Lot of evidence of assisting industries and communities to understand their risks and prepare for adaptation
	• The planned atlas of social resilience to inform regional and local planning and coastal management (which would collate social and economic information collected above) has not been developed, though the Great Barrier Reef Outlook Report 2009 did consolidate a lot of the existing research in this area (Informant)
	• The Great Barrier Reef Outlook Report is the main way of presenting information to the broader community (Informant)
	• Relevance and uptake of information about climate change implications for communities enhanced through the publication and distribution of printed materials, Reef Guardian Schools program, Reef HQ display, annual BleachWatch and Eye on the Reef, TV advertising, and scoping studies to inform development of community adaptation projects
	• Relevance and uptake of information about climate change implications for industries enhanced through several products, fisheries and tourism case studies , the Stewardship Action Plan and partnership with QSIA
		Strategy
		a. Collect social and economic information on Great Barrier Reef industries (e.g. assess economic implications of climate change on Great Barrier Reef industries) and communities to understand risk and resilience to climate change
		
		Evidence
		• Several projects have formed the foundation for further work in social and economic resilience, including the Bayesian Belief Network project (1.19), and a project (currently underway) examining fishers' response to any impacts from Cyclone Hamish and determining if/how management can help industry remain viable through future environmental events (1.20)
		• Collection of this information was lacking in earlier work with the tourism industry but has improved with current work with fishing industry (Informant)
		• See also 1.4b "Social resilience indicators are identified and validated"
		
		Strategy
		b. Develop an atlas of social resilience for Great Barrier Reef communities that can be used to inform regional and local planning and coastal management aimed at minimising climate change impacts
		
		Evidence
		• Atlas of social resilience has not been developed though may be influenced by coastal work, which is just starting (Informant)
		• The Great Barrier Reef Outlook Report consolidated a lot of existing research in this (Informant)
		• Reef Guardian Councils greenhouse inventory and mitigation action plans (developed through the Reef Guardian Councils program by councils, through council working groups, with the support of the GBRMPA) have been developed, though these are aimed at minimising climate change footprint (3.4)
		
		Strategy
		c. Enhance the relevance and uptake of information about the implications of climate change for industries and communities (e.g. support MTSRF project assessing social and economic implications of coral bleaching on Great Barrier Reef industries and communities)
		Plus relevant outcomes from Implementation Program:
		3.1a Great Barrier Reef communities are aware of implications of climate change impacts for the Great Barrier Reef ecosystem and their reef-oriented activities
		3.2a Great Barrier Reef industries are aware of implications of climate change impacts for the Great Barrier Reef ecosystem and their business
		
		Evidence
		Communities:
		• The Great Barrier Reef Outlook Report is the main way of capturing and presenting information to the community (Informant)
		• Various glossy brochure style documents produced:
		  ○ Climate change and the Great Barrier Reef - aimed at the community to teach/inform them of climate change impacts on the Reef, current work to prevent long term degradation and how community can help (3.1)
		  ○ Coral Bleaching and the Great Barrier Reef - easy to understand scientific account of what coral bleaching is, how it is caused, what the GBRMPA are doing to prevent it and how the community can help. (3.2)
		  ○ Reef Beat posters - give a snapshot of climate change impacts on the Great Barrier Reef (ocean acidification, what is climate change, coral bleaching, what you can do, fish, native wildlife, sea turtles, corals, resilient reef). Easy to read, poster style information. Includes information on what community can do to help minimise impact (3.3) An evaluation in late 2009 found the recent Reef Beat edition on climate change was considered to be an excellent resource that was well targeted to the audience (3.11)
		• Reef Guardian Schools is a major program for the GBRMPA - an action-based program that aims to develop positive attitudes and behaviours in schools and their broader communities working towards sustainable environmental futures. It provides opportunities for students, teachers, parents, caregivers and friends to participate in a range of educationally beneficial initiatives. Through the Action Plan, the GBRMPA has augmented this program with information on climate change risk, adaptation and emissions reduction. Participating schools range from early childhood education, through to senior secondary, and all schools have committed to participating in and facilitating Reef Guardian activities and projects. Equates to approximately 55,000 students reached by the program (3.9)
		• Information about the activities that the GBRMPA are supporting through Reef Guardians Schools program provided in Reef Guardian Schools monthly newsletters, which describe the schools that have signed up to the program and those that have received awards for their work (3.8)
		• Community involvement in BleachWatch and Eye on the Reef monitoring programs
		• Reef Guardian program made possible in large catchment area by active partnerships with local government, natural resource management agencies, community groups and industry (Informant)
		• Provision of information to local community through LMACs and RACs, which understand local needs and communicate relevant new knowledge back to those

Action Plan component/outcomes	Result summary	Evidence
	• Vulnerability assessment for coastal communities may occur through the GBRMPA coastal program, which is just starting, and may lead to a better understanding of resilience for those communities (Informant)	communities (Informant) • Other projects contributing to the relevance and uptake of information about the implications of climate change for industries and communities include: o The Shifting baselines research o Attendance at the International Climate Change workshop (Sea Country Management discussions for further engagement of the Woopaburra group in the face of climate change) o Reef HQ Climate Change exhibit (provides a range of communication materials including display panels and interactive components that effectively communicate key Great Barrier Reef and climate change information to Reef HQ visitors) o Scoping Opinion Research Phase One: incorporating stakeholders and their values in the care and development of the Great Barrier Reef Marine Park (identifying and categorising community opinions and values relating to the Great Barrier Reef to inform the development of Great Barrier Reef industry and community adaptation projects. Will: serve to inform Great Barrier Reef climate change communications and measure changes in stakeholder and broader community beliefs resulting from climate change action plan projects; provide a basis upon which a future community survey, exploring the parameters that are precursors for adaptive behaviour in more detail, will be based; and provide essential information for future analysis of behaviour change) o MTSRF RRRC 5889: CT Phase Two: Community Typology extension project (maximise the return on investment of the GBRMPA climate change indigenous and community partnership, communication and education initiatives by directly targeting the defined needs of key stakeholders and community members) o Implementation of climate change strategic communications plan o Website o TV advertising – "the Reef is closer than you think" o Engagement with Aboriginal Shire Councils to workshop and tailor Reef Guardian Climate Change Module to meet needs o Partnering with Wuthathi TUMRA Steering Committee to develop the Wuthathi TUMRA Implementation Plan 2008-2013 (1.26) Industries • Fisheries – the Stewardship Action Plan; QSIA fisheries liaison project • Tourism industry: the GRBMPA Tourism Climate Change Action Strategy 2009-2012 • Other projects supporting and/or providing information uptake to industry regarding climate change implications include o Climate Change information CDs o Climate change and coral bleaching brochure o Reef Guardian Climate Change module o Development of processes to facilitate engagement with fishing industry on adapting to climate change (case studies on line and trawl fisheries addressing vulnerability and ability to adapt to impacts of climate change – 2 scoping studies and 2 workshops on resilience analysis) o Support of research into Cyclone Hamish impacts on susceptible fisheries o Tourism Reef Facts – printing and laminating o Tourism case studies (1.26) • Some tourism operators are highly committed to responding to climate change and are able to change without encouragement from the GBRMPA, however the capacity of the industry to respond has been limited by reduced cash flow in the economic downturn. (Informant) • Tourism accreditation has been seen as beneficial by the industry as it provides advice to tourists in selection of operators and provides operators guidance on appropriate practices (Informant) • The material prepared for tourists under the Action Plan is useful as it enables tourism operators to provide consistent information about climate change impacts on the Reef, the material is "highly valued by industry. (Informant)
3.2 Maximise resilience of industries and communities to climate change Relevant outcomes and targets from Program Logic: 3.1 Great Barrier Reef-dependent communities are resilient to climate change impacts *Targets (from Implementation Program):* *By 2012 climate change adaptation framework for communities supports ecosystem resilience.* *By 2012 climate change adaptation*	• Review of policy to support adaptation by industries and communities through Great Barrier Reef Outlook Report 2009 and Corporate Plan 2009-2014 • Assisting industries to understand business risks from climate change through assistance with Stewardship Action Plan Action Plan, the GBRMPA Tourism Climate Change Action Strategy 2009-2012 and QSIA strategic plan. There is greater emphasis on	**Strategy** a. Review the GBRMPA planning and permitting regulations, policies and guidelines to support adaptation by Great Barrier Reef industries and communities **Evidence** • The Great Barrier Reef Outlook Report 2009 was heavily influenced by the Action Plan, acknowledging predictions of climate change as dominating most aspects of the Great Barrier Reef's outlook over the next few decades. It notes that the broad threats to the Great Barrier Reef from climate change are understood and management emphasis is on adaptation and improving resilience to change (1.7) • The GBRMPA Corporate Plan 2009-2014, which uses information from the Great Barrier Reef Outlook Report as a foundation for its activities over the coming years, is focused on improving the outlook and resilience of the Great Barrier Reef by developing and implementing strategies to address the key pressures highlighted in the Great Barrier Reef Outlook Report, including climate change (5.1) • Haven't formally reviewed planning and permitting regulations, though those responsible for such regulations seek advice from the CCG where they see relevant (Informant) • Informally through flexibility in permitting arrangements for researchers, i.e. if believe there is a high risk of bleaching conditions then there is a fact track process for researchers working on bleaching to revise permits so they can access bleached areas for further research. Is done via a class native title application and is prioritised within the permits group (Informant)

Action Plan component/outcomes	Result summary	Evidence

framework contributes social resilience
Policy output: Adaptive management guidelines for Great Barrier Reef communities
 	
3.2 Great Barrier Reef-dependent industries are resilient to climate change impacts
 	
Targets (from Implementation Program):
By 2012 climate change adaptation framework for industries supports ecosystem resilience.
By 2012 climate change adaptation framework contributes economic resilience
Policy output: Adaptive management provisions/guidelines for Great Barrier Reef industries
	engaging with peak bodies rather than individuals and the Authority is successfully engaging with industry. A recent survey found very high levels of awareness within the Reef marine tourism industry of the climate change initiatives offered by the GBRMPA and high usage of the initiatives to date.
	• Provide local communities with the information they need through Reef Guardian Councils and Reef Guardian Schools programs, and LMACs and RACs
		Strategy
		b. Assist industries to understand the risk to their business from climate change and to prepare adaptation responses (e.g. support activities of the GBRMPA Tourism Climate Change Action Strategy 2009-2012)
		Plus relevant outcomes from Implementation Program:
		3.2.b Great Barrier Reef industries have identified adaptation strategies for coping with climate change impacts and business opportunities
		3.2.c Great Barrier Reef industries are active partners in developing strategies that improve resilience of Great Barrier Reef ecosystem and business
		
		Evidence
		• Lot of evidence of the GBRMPA supporting and working with industries e.g. seafood, fisheries, aquarium and tourism industries, to understand the risks to their industries better as a result of climate change and to prepare a variety of adaptation responses (different according to the industry)
		• This component is about showing that industry bodies are responsible for working with people (employees, industry members, community, children/future users and inheritors of the Reef) and providing them with the tools (practical, knowledge) to do something about the state of the Reef and climate change now and in the future. Industries have been clarified and there is a distinction between participants and leaders (Informant)
		• "This objective has been the most rewarding – I've seen the tensions between people lift as they begin to look past differences and address the common enemy of climate change" (Informant)
		• A recent (May 2010) survey evaluated the level of awareness, uptake and effectiveness of the current GBRMPA climate change initiatives within the tourism industry, including the Tourism Operators Emissions Calculator, 'Reef Facts for Tour Guides' on the GBRMPA website, Tourism Operators Climate Change Workshops, the GBRMPA Tourism Climate Change Action Strategy 2009-2012, the Climate Action Certification Program (run by Ecotourism Australia), the 'Taking Climate Change Action' webpage, general information on climate change on the GBRMPA website, email updates on coral bleaching conditions, BleachWatch, the High Standards Tourism Program and the Great Barrier Reef Outlook Report. It found awareness levels of the initiatives to be very high within the Reef marine tourism industry and that usage of one or more of the initiatives had also been high to date. The perceived effectiveness/usefulness was satisfactory for most initiatives, with scope to improve. The strongest performers within the suite of initiatives were 'Reef Facts for Tour Guides' on the GBRMPA website, Tourism Operators Climate Change Workshops, general information on climate change on the GBRMPA website, BleachWatch and the High Standards Tourism Program. Initiatives lagging in recognition and which may require better leverage included Tourism Operators Emissions Calculator, the GBRMPA Tourism Climate Change Action Strategy 2009-2012, the Climate Action Certification Program (run by Ecotourism Australia), the 'Taking Climate Change Action' webpage, and email updates on coral bleaching conditions (3.19)
		• The GBRMPA Tourism Climate Change Action Strategy 2009-2012 outlines the "shared vision" and partnerships between the Queensland Tourism Industry Council, the GBRMPA, Association of Marine Park Tourism Operators, in conjunction with Qld govt, Tourism Qld, Eco Tourism Australia and others, to assist the tourism industry in understanding the risks to tourism associated with climate change (3.18).
		• SeaRead highlights the seafood industry as an example of an industry that is taking a proactive approach to climate change and uses it as a practical example. The GBRMPA has worked with the tourism industry and subsequently with QSIA to develop online Emissions Calculators for tourism operations, commercial fishers and related businesses to measure and manage their carbon emissions and conducted workshops on its use (3.7; informant)
		• The Stewardship Action Plan provides a statement of operational standards and climate change contingency planning for the aquarium supply industry, for both domestic and commercial buyers and owners of aquariums. Demonstrates the GBRMPA is working with and supporting at-risk industries to better manage climate change in the future (1.15)
		• QSIA and the GBRMPA have developed a strategic plan (2009-10) for the seafood industry to better adapt to climate change in the future and demonstrates where the GBRMPA have successfully assisted industry to understand and identify adaptation to climate change (3.5 and 3.6).
		• Are placing greater emphasis on supporting industry bodies to take responsibility for engaging their members on climate change adaptation rather than focus on individuals within industries (e.g. fishermen) (CCG Informant)
		• After struggling for a number of years, the GBRMPA is now successfully engaging with industry on climate change. A key CCG informant described the shift from the GBRMPA trying to engage with industries, to industries realising they need assistance on adapting to climate change and choosing to actively engage with the GBRMPA. "It's about creating a space for people to come together and start talking about strategic issues and the need/how to start addressing them." (CCG Informant)
		• External (fishing industry) informants described the GBRMPA efforts as being "on the right track" and "a massive shift from a very antagonistic relationship to something more productive."
		• Other projects contributing to this outcomes include:
		  o Cities for climate protection
		  o Series of climate change workshops for tourism operators (1.26)
		• There is motivation among the fishing and tourism industries to respond to climate change: "in North Queensland, there is a hard edge to a changing climate that is hard to miss." (Informant)
		• "Unless we look after the environment we will have nothing to show tourists."(Informant)

Action Plan component/outcomes	Result summary	Evidence
		• The commitment of the GBRMPA to address climate change is clear through the Action Plan and the range of activities delivered through the Action Plan. The tourism industry recognises the commitment shown by the GBRMPA and the benefits to industry from the work under the Action Plan. (Informant) • The activities under the Action Plan are driving change in the tourism industry. (Informant) • Engagement with the tourism industry is one of "goodwill and trust", through formal and informal arrangements. The GBRMPA has been developing a better understanding of tourism operations and the issues for operators through the Action Plan activities. This has improved the perception of the GBRMPA among people in the industry and led to more constructive workshops and meetings. (Informant) • There is a "lingering mistrust" among some members of the fishing and tourism industries and communities. The GBRMPA could address this through changes to the way it engages with communities and shares information. The way the GBRMPA communicates with industry stakeholders is not sufficiently participatory to build trust across the industry. There is a tendency to limit the sharing of information. "All stakeholders having access to the same information in the same timeframe increases trust around the table – openness is really important to counter public concerns." (Informant) • The GBRMPA is not harnessing the motivations of industry as effectively as it could be. Members of the tourism industry in particular have a strong sense of urgency to address the future of the industry. A more collaborative approach with industry and other stakeholders concerned for the future of the Reef is encouraged. (Informant) • The GBRMPA has made "a valiant attempt at a research agenda" for social, industrial and economic adaptation, but this is "where research on adaptation falls down". Some research knowledge has been made available, but the information is not useful for implementation by industry. Clear examples of industry implementation of research knowledge are needed; there is a need for a 'research extension' scheme to translate research findings into practical implementation within individual tourism operators, and to demonstrate these changes across the industry. (Informant) • The certification and accreditation schemes have a role in facilitating change in the industry. However, the process of participation is time-consuming for some operators; the schemes would be more successful with face-to-face assistance to explain the requirements and determine how it applies to each operator's equipment and activities. (Informant)

		Strategy
		c. Work with local governments and other organisations to provide local communities with the guidance, information and practical examples they need to adapt to the impacts of climate change (e.g. case studies of adaptation strategies for tourism, fisheries, ports and harbours)
		Plus relevant outcomes from Implementation Program:
		3.1.b Great Barrier Reef communities are active partners in building resilience of Great Barrier Reef ecosystem
		3.1.c Great Barrier Reef communities have identified adaptation strategies for coping with climate change impacts to Great Barrier Reef ecosystem
		
		Evidence
		• Adaptation component is about showing that community bodies, i.e. schools and councils are responsible for working with people (employees, community, children/future users and inheritors of the Reef) and providing them with the tools (practical, knowledge) to do something about the state of the Reef and climate change now and in the future. Community is harder to define than industry so focus has been on councils and schools because they are perceived as the institutions where thinking around adaptation is encouraged and key bodies of knowledge lie (Informant)
		• Reef Guardian Councils - example of the GBRMPA working with local governments to address climate change adaptation. The action plans that have been developed under this provide councils with a range of practical options they can implement to adapt to climate change. Of the five Reef Guardian Councils Action Plans seen, all were in draft or final draft form. (3.4)
		• The Reef Guardian program is made possible in such a large catchment area by active partnerships with local government, natural resource management agencies, community groups and industry (Informant)
		• Provision of information to local community through LMACs and RACs, which understand local needs and communicate relevant new knowledge back to those communities (Informant)
		• Engaging community members in understanding reef health and risks through training for, and inclusion in, monitoring programs
		• Wuthathi TUMRA Implementation Plan 2008-2013 developed to provide traditional owners and government agencies with means to monitor and maintain the salt water turtles and dugong populations in the Shelburne/Temple bay regions for the five years 2008-2013. The GBRMPA assisted development through the Action Plan but has not yet been implemented (3.10)
		• Other projects contributing to this outcomes include:
		  ○ Sponsorship of Ecotourism Australia's climate change module and Climate Action Australia Certification Program
		  ○ Supporting the QSIA Climate Change Liaison Officer
		  ○ Implementation of the GBRMPA Tourism Climate Change Action Strategy 2009-2012 (1.26)

Action Plan component/outcomes	Result summary	Evidence
Strategies complementary to Action Plan (as articulated in CCG implementation program)		

3.3 Climate change is integrated throughout the GBRMPA core business
 	
Target (from Implementation Program): By 2012 all GBRMPA groups will incorporate climate change into police sand programs assisting in adaptive management
	Integration of climate change throughout the GBRMPA's core business in generally through building capacity for other groups to understand the implications for climate change for the work their group is responsible for. While this is considered by internal informants to have been done moderately well at best, it has been facilitated through:
	• Knowledge transfer of key climate change concepts and literature through project bulletins, presentations to conferences, email notifications, newsletters agency-wide – i.e. CCG maintenance of role of monitoring up-to-date knowledge of adaptation/resilience research, and interpreting and disseminating that to relevant groups
	• CCG coordination of cross-agency climate change projects and contracts – but the responsibility for management of Action Plan-funded projects is starting to be shifted to the relevant groups. Some groups are more advanced with this than others.
		Strategy
		a. Knowledge transfer of key climate change concepts and literature to the GBRMPA groups coordinated by CCG
		Evidence
		• Project bulletins distributed to the broader GBRMPA – examples includes: CCIRF; Climate Neutral Strategy and Environmental Management System; Community Engagement - Reaching out to communities through Regional Shows and events; Climate Change Action: Community Awareness and Empowerment Characteristics; An Early Warning System for coral bleaching on the Great Barrier Reef; Evaluation of climate change educational resources; Energy Wise Schools Program; Observed Impacts from Climate Extremes on the Great Barrier Reef - Summer 2008/09 (3.12)
		• Email notifications, newsletters, presentations
		Strategy
		b. Through Green Office Committee initiatives the GBRMPA staff are aware of their contribution to Great Barrier Reef resilience to climate change
		Evidence
		• The GOC's role is to provide strategic guidance and governance on behalf of the Executive Management Group, with its key projects being the development of a Climate Neutral Strategy; and the development and implementation of an Environmental Management System and associated policies (3.14)
		• GOC initiatives include energy meters; mobile phone recycling; and worm farm, among several others (3.15)
		Strategy
		c. CCG successfully coordinates cross agency climate change projects and contracts for the purposes of adaptive management
		Evidence
		• CCG coordination evident from AOP/SWPs
		• CCG is facilitating other GBRMPA groups to take responsibility for managing implementation of Action Plan-funded projects (CCG Informant)
		• Other projects demonstrating CCG is successfully coordinating cross-agency climate change projects for the purposes of adaptive management include
		  ○ Policy/systems development (audit of the GBRMPA/DEWHA Australian Government policies relevant to climate change adaptation)
		  ○ Action Plan MERI development and Mid-term review (underway) (1.26)
		Strategy
		d. CCG monitors up to date knowledge of adaptation/resilience research through partnerships with researchers, consultative committees and government agencies
		
		Evidence
		• This is more of an administrative function, than an outcome being sought through the Action Plan.
		• The CCG is linked in to the academic and policy community. A couple of examples are provided below, while others are evident throughout the results of other elements of the Action Plan (see results charts for all Action Plan objectives)
		• Conference presentations and attendance: at least ACMF (2006); ACRS (2007); AGO Climate Change and Coasts Workshop (2006); AIMS public forums; AUSIMM Climate Change Panel; EIANZ (2007); Florida Reef Resilience Conference (2008); LMAC Forums; Outlook Forum; Ports Conference (2008); TICCIA (2006); CSIRO Hot Water Conference (2007) (3.13)
		• Contribution to literature reviews: A Community Survey of Climate Change & the Great Barrier Reef (2009) - provides an understanding of the Australian community's awareness, concern and participation regarding climate change and the Great Barrier Reef (3.16); A review of community perceptions of climate change: implications for the Great Barrier Reef (2008) - explores current community motivations to adapt to and mitigate climate change impacts in the Great Barrier Reef World Heritage Area (3.17)

Table 8 Data index: Objective 3 (Adaptation of industries and communities)

Item #	Title	Type	Author	Year	Description
3.1	Climate change and the Great Barrier Reef	Information document	The GBRMPA		Brochure style information document that conveys information about the effect of climate change on the Reef, what is currently happening to protect the Reef and how the public can help.
3.2	Coral bleaching and the Great Barrier Reef	Information document	The GBRMP		Brochure style information document that conveys information about coral bleaching, how it is caused, what GPRMPA are doing to prevent it and how the community can help.
3.3	Reef Beat posters (x10)	Information document/poster	The GBRMP		One page climate change posters on climate change impacts on the Great Barrier Reef, ocean acidification, coral etc
3.4	'Inventory and Greenhouse Mitigation Action Plans' for: Cairns Regional Council; Cassowary Coast Regional Council; Cook Shire Council; Hinchinbrook Shire Council; and Tablelands Regional Council.	Reports (Draft)	Sustainable Focus Pty Ltd	2009	Outlines Greenhouse inventories and greenhouse mitigation action plans for councils.
3.5	Strategic Plan 2009-2010 Queensland Seafood Industry Association – GBRMPA Partnership	Report	The GBRMP		Provides a road map for the first year of the partnership between the Queensland Seafood Industry Association (QSIA) and the Great Barrier Reef Marine Park Authority (GBRMPA) to develop and implement a shared strategic framework to "futureproof" the Queensland commercial fishing industry operating in the marine park. It includes an overarching communications plan, timelines for projects initiated in the first year, a summary of the scope of each of the projects, along with project level communication plans.
3.6	QSIA/GBRMPA Climate Change and Fisheries Partnership – Project Bulletin	Information document/Project Bulletin	QSIA/GBRMPA		One page information document that gives some background information to the GBRMPA and QSIA partnership. Objectives, progress to date and future directions.
3.7	SeaRead	Newsletter	The GBRMP		Front page of SeaRead news showing seafood industry's approach to climate change
3.8	Reef Guardian Schools Newsletters	Newsletter			Monthly newsletters containing information about Reef Guardian Schools activities
3.9	Reef Guardian Schools Annual Report	Annual Report	The GBRMP	2006	Documents the journeys of Reef Guardian Schools for 2006. The report has collated different information on projects, activities and achievements, from the various participating Reef Guardian Schools and collated it. It includes testimonials and triple bottom line achievements.
3.10	Wuthathi Traditional Land and Sea Country Traditional Use of Marine Resources Agreement	Implementation Plan	Wuthathi Traditional Land and Sea Country		The purpose of the document is to provide an Implementation Plan which will enable Traditional Owners and Government agencies to monitor and maintain the local habitat in the region for the next 5 years
3.11	Evaluation of climate change educational resources	Report	CCG	nd	Provides results of a feedback survey sent to approximately 370 Reef Beat recipients in order to evaluate the success of the changes to the Reef Beat product and to determine if the product was still appropriate to meet the needs of teachers and schools.
3.12	Bulletins	File folder	CCG	various	Provides examples of project bulletins and briefs prepared to demonstrate projects undertaken under the Action Plan, for distribution within The GBRMP more broadly
3.13	Conferences	File folder	CCG	various	Provides information on various conferences attended
3.14	Terms of Reference for GOAG and GOC_APPROVED Feb 2010	Document	?	2010	Describes roles, responsibilities and key projects for GOC and GOAG
3.15	GOAG	File folder	CCG	various	Describes different GOC initiatives, among other GOC and GOAG related information
3.16	3.1A.401.3.07_CommunityTyMTSRF 4.8.5b	File folder	CCG	various	Houses all documents relating to a literature review titled: A Community Survey of Climate Change & the Great Barrier Reef (2009)
3.17	Project_Scoping opinion MTSRF 4.8.5a_AA	File folder	CCG	various	Houses all documents relating to a literature review titled: A review of community perceptions of climate change: implications for the Great Barrier Reef (2008)
3.18	The GBRMPA Tourism Climate Change Strategy 2009-2012 - Abridged	Report	TCCAG/GBRMPA	2009	Highlights the key actions the industry and individuals can take to make a difference to the future of the Reef and the tourism industry.
3.19	Great Barrier Reef Tourism Industry and Stakeholder Climate Change Survey	Powerpoint presentation	Roy Morgan Research	2010	Presentation of draft report of survey commissioned to investigate climate change awareness, perceptions and behaviours within the Reef marine tourism industry and relevant stakeholders

Table 9 Results chart: Objective 4 (Reduced climate footprints)

The left-hand column outlines the components of Objective 4 as articulated in the Action Plan, as well as additional outcomes for Objective 4, and associated targets and policy outputs, as articulated in the CCG implementation program. Where possible, the additional outcomes, targets and policy outputs have been mapped to the original components of the Action Plan. The right-hand column describes the strategies employed by the Action Plan and provides evidence of progress towards each. The middle column provides a summary result of progress towards the strategies, based on the evidence provided in the right-hand column.

Action Plan component/outcomes	Result summary	Strategies & Evidence
4.1 Increase knowledge and involvement of stakeholders in climate change responses	Objective 4 is the reduction of climate footprints, specifically the reduction of greenhouse gas emissions, however much of the focus has been on building broader community motivation to act on climate change (and reduce emissions) by building an awareness of both: i. risks to the Reef from continued high GHG emissions, and other causes of reduced Reef resilience ii. relationship between energy use and other lifestyle choices and the production of GHG emissions. Engaging with stakeholders to understand climate change and responses is an element of a range of activities under each Action Plan Objective, and therefore this strategy overlaps with other activities of the CCG and the GBRMPA broadly.	**Strategy** a. Involve community members, GBR industries and Indigenous people in climate change monitoring **Evidence** • BleachWatch and Eye on the Reef projects involve the community and tourism operators in Reef condition monitoring, including building the knowledge of participants of the risks to the Reef and the physical impacts of climate change. (Informants) • Traditional Use Marine Resource Agreements with indigenous communities are commencing, but have not yet included climate change or other condition monitoring activities. **Strategy** b. Develop information packages for stakeholders, industry, educators and community leaders to use to inform staff, peers and the community **Evidence** • Many Action Plan projects have produced materials for a range of audiences explaining the Reef ecology, climate change impacts and the related impacts on Reef-dependent communities and industries. • Materials for the Reef Guardian Schools and Reef Guardian Councils programs (delivered by GBRMPA) have been supplemented with information on climate change risks and responses, including emissions reduction. These have been targeted to children and their families, council staff and elected members, and households in general. • Projects with the tourism and fishing industry funded under Objective 3 have produces a range of information materials for industry members. **Strategy** c. Engage industry, stakeholder groups and the broader community to understand the implications of climate change for the GBR *Plus relevant outcomes from Implementation Program:* 4.1.a A strong international awareness of implications of climate change for GBR ecosystem **Evidence** • A number of products under the Action Plan Objective 3 have involved engagement with Reef-based industries, other stakeholder groups and the broader community, including building knowledge on the risks to the Reef from climate change and the implications for industries and other stakeholders. For example: o QSIA Climate Change and Fisheries Liaison Project o GBRMPA Tourism Climate Change Action Strategy 2009-2012 o Tourism Operators Climate Change Workshops • A recent survey of tourism operators found a high level of awareness of the risks of climate change, and some willingness to undertake personal action to reduce emissions. (4.5) • Engagement with the broader community on climate change has been developed through campaigns that raise awareness of the significance of climate change, that the GBRMPA is seeking to address climate change and that the community can support this through a range of actions. (Informant) • A survey of community perceptions has been used to develop a typology of community perceptions to assist with targeting of future messages. (4.6) • Regional office staff are keen to further the community communications on climate change through local networks and local events, but are unsure how this can be done within the framework of the Action Plan and project funding approach. (Informants) • International awareness of the implications of climate change has been promoted through: o distribution of knowledge from research funded through the Action Plan (Objective 1) in scientific papers published internationally (Informant) o widespread distribution of the Vulnerability Assessment report and Outlook Report o The GBRMPA CCG has been asked to provide input to speeches and other material to describe the risks to the reef from climate change, and the risk to the Reef was mentioned in the Prime Minister's speech to the Copenhagen COP15 conference. (Informant) • The GBRMPA has a strong role in communicating research outcomes to the broader community, as an interface between researchers and the broader community, through activities such as the LMACs, and Reef Guardian schools. "All in all, I think the GBRMPA does a great job in communicating research outcomes - it is hard to see how much more it could do without becoming an advocacy group. The one area where it is possibly least effective and most impotent, like all of us, is in the public press and the direct reach straight in to the climate change debate among the public. But I honestly don't think that's the role of the GBRMPA – it has to step gently there." (Informant)

Action Plan component/outcomes	Result summary	Strategies & Evidence
4.2 Work with organisations and individuals to reduce their climate footprint *Relevant outcomes and targets from Implementation Program:* 4.2 GBRMPA leads by example on GHG emissions reduction measures *Target: by 2012 GBRMPA has zero climate footprint with annual review to minimise offsets* 4.3 Target GBR dependent industries/ communities to actively reduce GHG emissions *Target: Target industries/communities are identified and active participants in emissions reduction pilot programs*	The Action Plan seeks to influence emissions reduction by motivating behavioural change – and by providing information to assist industry and the community to select and implement suitable methods for emission reduction. Much of this work under the Action Plan is conducted in conduction with other projects, or within projects run by the GBRMPA more broadly. • Climate change – both the impacts on the Reef and the importance of emissions reduction – has been incorporated into the Reef Guardian programs, providing a route for messages to the broader community. • Industry operators are being encouraged to reduce emissions through use of the emissions calculators and associated workshops. • The GBRMPA has assessed its climate footprint and implemented initiatives to reduce energy use and emissions from its operations. • As the political focus on climate change action has changed, there has been a reduced community momentum to address greenhouse gas emissions reductions. • The CCG intends to renew messages to the community on emissions reduction, in response to the changing public perceptions.	**Strategy** a. Expand Reef Guardians program and environment accreditation schemes to include energy and sustainability initiatives *Plus relevant outcomes from Implementation Program:* 4.3.c Reef Guardians (councils and schools) adopt emissions reduction strategies and targets and encourage emission reduction activities by local communities **Evidence** • Both the Reef Guardian Schools and Reef Guardian Councils programs have been modified to include educational materials on climate change and emissions reduction and designated activities to target emissions reduction. (Informants) o The Reef Guardian Schools Program has a sustainability focus, including climate change and greenhouse gas emissions o A series of handbook for local councils entitled *Land, Water, Waste, Community and Climate Change: Current best practice for Local Governments motivated towards Reef protection* was prepared through the Reef Guardian Council program, jointly funded with DEWHA (4.1) o The Reef Guardian Councils program requires participating councils to prepare an action plan for their contribution to Reef resilience, which is expected to include emissions reduction from council operations. (4.1) • The Action Plan has also supported the Queensland Government Energy Wise Schools program in schools near the Reef, and provided curriculum materials on climate change and other issues for the Great Barrier Reef. The Energy Wise Schools program specifically focuses on energy and greenhouse gas emissions and includes a requirement for each school to put in place behavioural and/or technical changes to reduce emissions.
		Strategy b. Showcase initiatives that reduce the climate footprint of GBR stakeholders *Plus relevant outcomes from Implementation Program:* 4.2.a GBRMPA demonstrates leadership by adopting climate change neutral footprint strategy 4.2.b GBRMPA commits to assessing the feasibility of innovative/best practice in reducing its climate footprint **Evidence** • ReefHQ has undertaken a range of modification to pumps and other equipment to reduce energy use, and has installed solar photovoltaic panels to generate electricity. This initiative and the associated emissions reduction has been promoted by ReefHQ and the GBRMPA more broadly. (Informant) • The GBRMPA has implemented energy savings initiatives in buildings, with changes to lighting and air conditioning operations. Longer term and more capital intensive changes are being negotiated with landlords. (Informant) • As these changes are implemented, the GBRMPA intends to communicate its own changes as an example for other organisations. (Informant) • The GBRMPA has undertaken a study of options for carbon neutrality (4.2) • The GBRMPA has recently implemented an Environmental Management System (EMS) and a Greenhouse Gas Reduction Strategy. (4.3, 4.4)
		Strategy c. Identify and support initiatives to reduce emissions and increase sustainability of reef-related activities *Plus relevant outcomes from Implementation Program:* 4.2.a GBR industries/communities are aware of importance of reducing climate footprint for sustainability of ecosystem goals and services 4.3.b Targeted GBR industries/communities adopt best practice initiatives to reduce climate footprints 4.3.c Identify, support and showcase initiatives of partners and stakeholders to reduce emissions **Evidence** • Development, promotion and use of emissions calculators for the tourism and fisheries industries. The emissions calculator for the tourism industry has been well received, according to a recent industry survey. (4.5) • These projects are driving change in the industry, with high profile operators making visible changes to improve energy efficiency. This had been assisted by training workshops under the Action Plan which has helped operators identify suitable changes and opportunities for government support for efficiency investments; these provide "pointers in the right direction" for operators. (Informant) • Communication material for fisheries and tourism industries that explains the links between greenhouse gas emissions and the climate change impacts on the Reef.

Action Plan component/outcomes	Result summary	Strategies & Evidence
Strategies complementary to Action Plan (as articulated in CCG implementation program)		
4.1 Fate of the GBR influences national and global GHG emissions reduction *Target (from Implementation Program): GBRMPA contributes to national and international efforts to stabilise CO2 concentration below critical thresholds levels for GBR* *Policy output: Development of GBRMPA position statement on critical GHG threshold of 450 ppm*	The intent of focussing attention on the risk to the Reef to influence national and global emissions reduction has been seen in activities under Objective 4 and other Objectives, and in the communications role of the CCG. Australia argued at the Copenhagen COP15 conference that the threshold of 450ppm was the appropriate target.	**Strategy** 4.1.b GBR stakeholders are aware of the implications of national and international climate change policies 4.1.c GBRMPA contributes to national and international mitigation and adaptation policies relevant to GBR **Evidence** • CCG staff have presented at many conferences (scientific and industry events) explaining the climate change impacts on the Reef and the need for national and international policy changes to drive emissions reduction. (Informants) • The risk of the loss of the Reef was discussed in the Garnaut Report on the design of the emissions trading scheme, and in public debates on the emissions trading scheme. (Observation) • The risk to the Great Barrier Reef was mentioned in the Prime Minister's speech to the Copenhagen COP15 conference. (Observation) • In the absence of international action to reduce emissions, there is a risk that the increase in atmospheric carbon dioxide will exceed a threshold and lead to greater warming on the Reef. "The conclusion of the Vulnerability Assessment is unpalatable but robust – the threshold of 450 ppm." (Informant) • There is a need for continued efforts to address mitigation, as well as recognising that current approaches to adaptation may be insufficient and that further research is needed on adaptation options for a higher global warming scenario and planning for interventionist policies. "More radical adaptation steps will be needed if there is no mitigation action – if it all gets really bad, what is our game plan?" (Informant)

Table 10 Data index: Objective 4

Item #	Title	Type	Author	Year	Description
4.1	Reef Guardian Councils participation CD	CD containing guidance documents for participating councils	GBRMPA	2009	Describes requirements for participating councils, and provides guidance on how to implement emissions reduction projects within council activities. Includes 5 handbooks in the series '*Land, Water, Waste, Community and Climate Change: Current best practice for Local Governments motivated towards Reef protection'.*
4.2	Great Barrier Reef Marine Park Authority Climate Neutral Options Report [REPORT 22-1038-R2 Revision 1]	Consultant report to the GBRMPA	Heggies Pty Ltd	2008	Consultants report on level of emissions from the GBRMPA activities and options for emissions reduction towards a goal of carbon neutrality in 2012.
4.3	GBRMPA Greenhouse Gas Reduction Strategy (GBRMPA GHG Strategy Rev5 - Final-revised.docx)	Report in preparation for presentation as internal GBRMPA strategy	SKM/GBRMPA	2009	Greenhouse gas reduction strategy 2009-2019, aiming towards carbon neutrality.
4.4	GBRMPA Greenhouse Gas Reduction Strategy and Environmental Management System: Initial Environmental Review	Report scoping the development of the EMS	SKM	2009	Initial Environmental Review setting out the scope for the EMS and how it might operate.
4.5	GBRMPA Climate Change Survey - Presentation of Draft Report - May 2010.pdf	PowerPoint presentation	Roy Morgan Research	2010	Presentation of summary report to the GBRMPA
4.6	Climate Change Action: Community Awareness and Empowerment Characteristics. Great Barrier Reef Survey Results	GBRMPA project bulletin	GBRMPA	2009	Summary of findings of a survey (conducted jointly with a MTSRF project) to develop a typology of community perspectives on climate change and appropriate responses.

Table 11 Results chart: Contribution of Action Plan to the GBRMPA Corporate Plan 2009-2014 and regional, national and international action on climate change

The left-hand column outlines the elements covered by this results chart and a summary result of progress towards those elements, based on the evidence provided in the right-hand column. The right-hand column provides evidence of progress towards the elements. Bracketed numbers, e.g. (5.4) reference the data item from which the evidence was drawn; where evidence was provided through interviews this is referenced via: (Informant). Table 11 provides an index of data items for this results chart.

Details/results summary	Evidence
Contribution to the GBRMP Corporate Plan 2009-2014	
The Climate Change Action Plan broadly contributes to the GBRMPA Corporate Plan 2009-2014, through informing the Great Barrier Reef Outlook Report 2009 upon which the Corporate Plan is based, and more specifically through its contribution to the objectives and strategies of the Corporate Plan. In particular, the Action Plan is highly aligned with Objective 1 generally (Address key risks affecting the outlook for the Great Barrier Reef) and the following strategies specifically: • generate, capture and apply the best available science to improve understanding of ecosystem resilience, risks to that resilience and response options (through all Action Plan Objectives) • develop and implement responses (including adaptation strategies) to climate change, with Government, industry, Reef users and the community (through Action Plan Objectives 2, 3 and 4) • deliver communication and education about the key risks affecting the outlook for the Great Barrier Reef and ways to mitigate these risks (through Action Plan objectives 3 and 4)	- The Action Plan has led to a greater understanding of the urgency and priority of climate change which has influenced both the Great Barrier Reef Outlook Report 2009 and the GBRMPA Corporate Plan 2009-2014. As such, the Great Barrier Reef Outlook Report 2009 acknowledges future predictions of climate change as dominating most aspects of the Great Barrier Reef's outlook over the next few decades and identifies climate change as key among a set of priority issues reducing the resilience of the Reef. - Through the Action Plan, the concepts of risk and resilience have been cemented and strongly influenced the Corporate Plan. The Corporate Plan aims to strengthen the GBRMP capacity to ensure long-term protection and sustainability of the multiple use Marine Park, and using the information from the Great Barrier Reef Outlook Report as a foundation for its activities over the coming years, focuses on improving the outlook and resilience of the Great Barrier Reef by developing and implementing strategies to address the key pressures highlighted in the Great Barrier Reef Outlook Report, including climate change. - Specific Action Plan alignment with the Corporate Plan (5.1) includes: Objective 1: Address key risks affecting the outlook for the Great Barrier Reef • Generate, capture and apply the best available science to improve understanding of ecosystem resilience, risks to that resilience and response options (through Objectives 1 and 2) • Develop and implement responses (including adaptation strategies) to climate change, with Government, industry, Reef users and the community (through all objectives, but particularly through outcomes of Objectives 2, 3 and 4) • Support initiatives to improve water quality entering the Great Barrier Reef (through Objective 1, including revisions to the Reef Plan; and Objective 2 – identify the main water quality threats to resilience) • Contribute to the protection of coastal ecosystems that support the Great Barrier Reef (this is a current identified gap – no progress to date, but anticipated to contribute to this through the recently established GBRMPA coastal program) • Partner with Queensland government, other governments, Traditional Owners and other relevant bodies to address the remaining impacts from fishing, and illegal fishing and poaching and other emerging risks using an ecosystem based management approach (through Objectives 2 and 3) • Deliver communication and education about the key risks affecting the outlook for the Great Barrier Reef and ways to mitigate these risks (through all objectives, but particularly through Objectives 3 and 4. Chiefly done through the Great Barrier Reef Outlook Report 2009) Objective 2: Ensure that management delivers ecologically sustainable use of the Great Barrier Reef • Provide effective legislative, policy, planning, assessment and permitting arrangements to achieve ecologically sustainable use of the Great Barrier Reef (through Objective 3, specifically Action Plan influence on the Great Barrier Reef Outlook Report 2009 and the GBRMPA Corporate Plan) • Partner with Traditional owners to ensure sustainable traditional use of marine resources and protection of Traditional Owner cultural and heritage values (to some extent through Objective 3 and Action Plan input into TUMRAs) • Collaborate with industry, Reef users, other governments and the community to implement best practice approaches and certification programs to ensure protection and sustainable use of the Great Barrier Reef (through Objectives 2 and 3) Objective 3: Maintain a high performing, effective and efficient organisation • Contributions to Objective 3 include through the development of documented procedures for contracted project management under the Action Plan which has been used widely across the GBRMP and have become the base for the organisation-wide project management system, and in building capability to manage projects across the organisation. Under this objective, the Action Plan specifically contributes to the strategy of ensuring the GBRMPA remains a world leader in marine protected area management through the example the Action Plan provides and the use that has been made internationally of some of its products, for example BleachWatch, and the Coral Bleaching Response Plan.

<table>
<tr><th>Details/results summary</th><th>Evidence</th></tr>
<tr><td colspan="2">Alignment with regional action on climate change</td></tr>
<tr><td>The Action Plan (via Objective 4: Reduced climate footprints) is aligned with the Queensland Government's response to climate change, as articulated in Climate Q: Towards a Greener Queensland, which is focused on delivering complementary measures that help achieve emissions reductions at least cost to the economy. The government response also recognises the need for reducing other stressors on ecosystems (alignment with Action Plan Objective 2) and for supporting adaptation (alignment with Action Plan Objective 3).
The Action Plan was instrumental in ensuring climate change considerations were incorporated into Reef Plan revisions. Future influence on regional action is anticipated to occur through the new GBRMPA coastal program and linkages with NRM groups, councils and other Queensland government agencies.</td><td>• Queensland's climate change response as articulated in Climate Q: Towards a Greener Queensland is underpinned by five key themes for action (5.4):
1. Reducing greenhouse gas emissions (Queensland playing its part in stabilising and reducing GHG emissions)
2. Lowering the cost to households and businesses (investing in energy efficiency to save money and avoid the costs of higher energy prices)
3. Investing in the productive future of key industries (targeting research, development and commercial application of new technology and science to reduce emissions and address climate-induced productivity challenges)
4. Protecting Queensland's natural wonders (conserving and replenishing significant ecosystems via GHS emissions reductions and reducing pollution and other disturbances)
5. Adapting to the impacts of climate change (providing information, building resilience and improving planning in Queensland)
• QPWS have adopted a vulnerability risk assessment process in their planning. QPWS activities in the GBRMPA are detailed under the Field Management Program 2009-2012 Annual Business Plan and Climate Change 2009-2012 Annual Operating Plan, which are strongly aligned with the Action Plan and incorporate a vulnerability assessment –resilience analysis process for developing management responses to climate change risks (Informant)
• The Action Plan is having more influence on DPI with respect to fisheries (Informant)
• Revision of the Reef Water Quality Protection Plan (Reef Plan) in 2009 acknowledged climate change as a stressor and included targets for remedial action to address this threat. The Action Plan was instrumental in ensuring climate change considerations were incorporated (Informant)
• The Reef Advisory Committees (RACs) have included climate change considerations in their Terms of Reference (TOR), either specifically (the Catchment and Coastal RAC TOR includes provision of advice to the GBRMPA on matters relating to the impact of climate change on the coast; the Ecosystem RAC TOR includes advice to the GBRMPA on practical and policy responses to the implications of climate change for the GBRMPA's responsibilities relating to ecosystem conservation and sustainable use within the scope of the Action Plan) or indirectly (e.g. through reference to their role to advise the GBRMPA on matters relating to the key findings of the Great Barrier Reef Outlook Report 2009 and interact with each other on matters of joint interest towards achieving the GBRMPA's corporate objectives) (Email from Ann Matthews to Chloe Schauble, 20/05/2010, titled "RACs and Climate Change")
• Future influence on regional action is anticipated to occur through the new GBRMPA coastal program and linkages with NRM groups, councils and other Queensland government agencies (Informant)</td></tr>
<tr><td colspan="2">Alignment with national action on climate change</td></tr>
<tr><td rowspan="2">The Action Plan contributes to national action on climate change through its alignment with and/or contribution to:
• Adapting to Climate Change in Australia – An Australian Government Position (through its focus on maximising resilience, focus on adaptation, focus on vulnerable ecosystems and coastal communities, and appropriate recognition of the roles of different stakeholders)
• National Climate Change Adaptation Framework (through its contribution to building understanding and adaptive capacity)
• National Climate Change Adaptation Research Facility (through CCG involvement in the Adaptation Research Plan for Marine Biodiversity and Resources and membership of the Marine Biodiversity and Resources Network)
• Great Barrier Reef Intergovernmental Agreement 2009 (through its contribution to action to maximise the resilience of the Great Barrier Reef to climate change and address climate change threats to the health and biodiversity of the Great Barrier Reef ecosystem)
• Climate Change Guide: Mitigation and Adaptation Measures for Australia Tourism Operators, 2009 (through Objective 3: Adaptation of Industries and Communities – including the tourism industry; and Objective 4: Reduced Climate Footprints – including working with the tourism industry to calculate and reduce their carbon footprint)</td><td>The Australian Government, aims to implement policy measures to improve resilience to climate change impacts and, as articulated in Adapting to Climate Change in Australia – An Australian Government Position paper (5.2):
• recognises the unavoidable nature of climate change
• has adaptation as one of the three pillars of its climate change strategy
• recognises that stabilising GHG at 450 ppm CO_2e is in Australia's national interest
• recognises the vulnerability of ecosystems and coastal communities primarily, and of agriculture and tourism secondarily
• recognises that Australia's biodiversity is approaching adaptive capacity limits and that climate change exacerbates the effects of existing stressors threatening Australia's biodiversity
• recognises that climate change adaptation will involve all levels of government, business and community, but with differentiated roles for each:
o individuals/business are better placed to manage their own risks (inefficient for government to make decisions on behalf of individuals)
o government has an important capacity building and reform role. Relevant to Action Plan is recognition of government role in promoting information for business and communities to adapt (public-private benefit)
o Commonwealth requirement to take a leadership role in positioning adaptation to climate change impacts that affect important natural assets, e.g. reform with respect to dealing with risks to natural systems of national significance
• recognises that it is necessary to trial new approaches to emerging climate change risks and draw lessons from both successes and failures
• recognition that an effective response requires prioritisation and Australian Government prioritisation includes (among others) natural systems of national significance (including the Great Barrier Reef)
• acknowledges existing frameworks are best positioned to manage risk (principle of embedding adaptation responses into policy and institutional frameworks) – demonstrated already through 2009 Intergovernmental Agreement between Commonwealth and Queensland, which recognises climate change pressures
• states that objective of development of national arrangements will be to generate strength of action through collaboration and elimination of duplication
• recognises importance of measuring performance – five-yearly Climate Futures Report will evaluate the effectiveness of government policy measures to improve resilience to climate change impacts</td></tr>
<tr><td>The National Climate Change Adaptation Framework (2007) identified climate change adaptation strategies and actions to guide action by jurisdictions over at least 2007-2012. This included (5.3):
1. Building Understanding and Adaptive Capacity - comprising actions to identify and fill knowledge gaps to enable effective adaptation action at the national and regional levels, including the proposed 'Australian centre for climate change adaptation'; improved regional climate change information and tools for decision makers; and integrated vulnerability assessments of climate change impacts.
2. Reducing Sectoral and Regional Vulnerability - in particular, water resources, biodiversity, coastal regions, agriculture, fisheries, forestry, health, tourism, and settlements, including addressing critical knowledge gaps; building sector relevant tools and information; and developing and implementing climate change action plans for vulnerable sectors.</td></tr>
</table>

Details/results summary	Evidence
	The National Climate Change Adaptation Research Facility (NCCARF) aims to lead the research community in a national interdisciplinary effort to generate the information needed by decision-makers in government and in vulnerable sectors and communities to manage the risks of climate change impacts. Established in 2007, it's role is to: • develop National Adaptation Research Plans to identify critical gaps in the information available to decision-makers • synthesise existing and emerging national and international research on climate change impacts and adaptation and developing targeted communication products • undertake a program of integrative research to address national priorities • establish and maintain adaptation research networks to link together key researchers and assist them in focusing on national research priorities. The Director of the CCG was a member of the drafting team for the National Climate Change Adaptation Research Facility (NCCARF) Adaptation Research Plan for Marine Biodiversity and Resources, and is currently co-lead of the Integration Theme of the Marine Biodiversity and Resources Network under the NCCARF (Informant)
	The Great Barrier Reef Intergovernmental Agreement 2009 provides a framework for the Australian and Queensland governments to work together to protect the Great Barrier Reef. The Agreement recognises that key pressures on the Reef, such as climate change impacts, catchment water quality and coastal development, cannot be effectively addressed by either government on their own. As part of the agreement, the Commonwealth and Queensland reaffirm their commitment to continue joint action to maximise the resilience of the Great Barrier Reef to climate change and address significant threats to the health and biodiversity of the Great Barrier Reef ecosystem, including the impacts of climate change (5.5)
	The Climate Change Guide: Mitigation and Adaptation Measures for Australia Tourism Operators (2009) is a supplement to a series of free workshops held across Australia in June and July 2009 and is designed to raise awareness amongst tourism operators of the part they can play in reducing their carbon footprint and understanding how climate change is likely to affect their tourism business. It covers 1. Getting started; 2. Evaluating your business; 3. Reducing your emissions; 4. Adapting your business; and 5. Education and monitoring (5.6)
Alignment with international action on climate change	
The Action Plan's contribution to international action on climate change has occurred through the use of the Reef as a 'poster child' for climate change risks, research and communication to inform other reef managers, and scientific and interest networks.	• The Vulnerability Assessment and Great Barrier Reef Outlook Report 2009 emphasised the risks to the Reef and clearly described the causal linkages between climate change and damage to coral reef ecosystems. These reports have been internationally disseminated and messages from these reports have appeared in other publications, campaigns and media coverage explaining the risks to the Reef. (Informants) • Information from Reef condition monitoring is available internationally through the GBRMPA website and material from other researchers. (Informant) • The GBRMPA CCG has been asked to provide input to speeches and other material to describe the risks to the reef from climate change. (Informant) • The risk to the Great Barrier Reef was mentioned in the Prime Minister's speech to the Copenhagen COP15 conference. (Observation) • Evidence from the Vulnerability Assessment and a specially commissioned report was used in the Garnaut Report on the design of Australia's emissions trading scheme, to emphasise the need for action to reduce emission (Observation) • The risks of climate change to the Reef are widely used in campaigns by NGOs to focus attention on climate change. (Observation) • Research funded through the Action Plan has resulted in scientific papers published internationally. (Informant) • Some Action Plan projects have released information products, such as the *Reef manager's guide to coral bleaching*, which have been distributed internationally, for use in management of other coral reefs. (Informant) • Members of the CCG and scientists undertaking research for the GBRMPA are members of international scientific networks and share information on research and climate change risks to reefs through these networks – through conferences, journal papers, and informal contact. (Informants) • CCG is involved with international research and policy groups, such as the US National Oceanic and Atmospheric Administration (NOAA); US Coral Reef Task Force; Coral Triangle Initiative on Coral Reefs, Fisheries and Food Security; and the International Working Group on Coral Bleaching. (Informant) • BleachWatch concept has been picked up in Florida. (Informant)

Table 12 Data index: Broader contribution of the Action Plan

Item #	Title	Type	Author	Year	Description
5.1	Corporate Plan 2009-2014 (DRAFT)	Planning document	The GBRMPA	2010	Establishes the GBRMPA direction and priorities for the five years 2009-2014.
5.2	Adapting to Climate Change in Australia – An Australian Government Position Paper	Paper	Australian Government	2010	Sets out the Australian Government's vision for adapting to the impacts of climate change and proposes practical steps to realise this vision
5.3	National Climate Change Adaptation Framework	Framework document	Council of Australian Governments	2007	Describes adaptation strategies and actions for 1. Building Understanding and Adaptive Capacity; and 2. Reducing Sectoral and Regional Vulnerability, to guide action by jurisdictions over the next five to seven years.
5.4	Climate Q: towards a greener Queensland	Report	Queensland Government	2009	Provides overarching context and strategies for action by the Queensland Government – presents the next phase in Queensland's response to the challenge of climate change. Presents investments and policies totalling $196 million including $87 million in new initiatives to ensure Queensland remains at the forefront of the national climate change response.
5.5	Great Barrier Reef Intergovernmental Agreement	Agreement document	Australian and Queensland Governments	2009	Agreement obliging the Australian and Queensland Governments to work together to protect the Great Barrier Reef from threats such as climate change
5.6	Climate Change Guide: Mitigation and Adaptation Measures for Australia Tourism Operators	Document	Department of Resources, Energy and Tourism	2009	Designed to raise awareness amongst tourism operators of the part they can play in reducing their carbon footprint and understanding how climate change is likely to affect their tourism business. Supplements a series of free workshops held across Australia in June and July 2009.