

Chapter 4

The impact of land-based activity on the health of the reef

Introduction

4.1 As noted in the previous chapter, the Great Barrier Reef Marine Park Authority (GBRMPA) *Outlook Report 2014* stated that two of the key threats to the health of the Great Barrier Reef ecosystem are land-based run-off and coastal development.¹ Therefore, this chapter discusses threats posed by run-off caused by broad-scale land use, including threats resulting from:

- nutrients from run-off mainly associated with the use of fertilisers;
- pesticides from run-off; and
- sediments from run-off mainly associated with broad-scale land clearing.

4.2 This chapter then looks at the management schemes and activities used to protect the health of the reef, including direct control of crown-of-thorns starfish outbreaks and indirect measures aimed at improving water quality.

4.3 The chapter also gives attention to impacts to the health of the Great Barrier Reef that may arise from large-scale development in the future, with specific reference to the proposed development of Northern Australia.

4.4 Finally, the context of existing plans and programs, in this chapter examines direct and indirect impacts of non-agricultural activities on the health of the reef, including impacts resulting from:

- the modification of coastal habitats as a result of mining and other forms of development;
- the creation of artificial barriers to hydrological flows; and
- the role of national parks and no-go zones in protecting the health of the reef.²

The related topic of disposal and resuspension of dredge material will be examined in the next chapter.

Water quality

4.5 As noted in Chapter 3, poor water quality has posed a major challenge to the health of the Great Barrier Reef. The *Reef Water Quality Protection Plan 2013* noted that:

1 GBRMPA, *Outlook Report 2014*, p. 255.

2 GBRMPA, *Outlook Report 2014*, pp 170–171, 255; Reef Water Quality Protection Plan Secretariat, *2013 Scientific Consensus Statement: Land use impacts on Great Barrier Reef water quality and ecosystem condition*, p. 1, <http://www.reefplan.qld.gov.au/about/assets/scientific-consensus-statement-2013.pdf> (accessed 5 August 2014).

Over the past 100 years, the land catchment areas adjacent to the Great Barrier Reef World Heritage Area have undergone extensive development for agricultural production, urban expansion, transport infrastructure, tourism and mining. This has led to elevated levels of pollutants leaving these catchments and entering the reef, with the largest contributor being agricultural land use activities.³

4.6 The *Outlook Report 2014* noted that the availability of light is central to the health and productivity of seagrasses and other plants and helps maintain symbiotic relationships between some animals (such as corals and clams) and algae. The amount of light at a particular depth in the water column is directly linked to water turbidity, which is affected by the amount of sediment and nutrients in land-based run-off.⁴ The *Outlook Report 2014* explained that increased nutrient loads in the water of the Great Barrier Reef may contribute to the increased frequency and severity of crown-of-thorns starfish and blooms of phytoplankton and cyanobacteria. The starfish prey on coral species, and cyanobacteria blooms have been directly linked to smothering corals and increasing the bioavailability of heavy metals, having a devastating effect on the health of the reef.⁵

Run-off caused by broad-scale land use

4.7 The committee notes GBRMPA has stated:

The best science available estimates that around 90 per cent of the loads of sediments, nutrients and toxic chemicals entering the Great Barrier Reef lagoon come from agricultural practices in the Great Barrier Reef catchment.⁶

4.8 More recently, the *2013 Scientific Consensus Statement* found that the greatest risks to the water quality of the Great Barrier Reef stem from nitrogen (often associated with the use of fertilisers), pesticides and fine sediment discharge (often

3 Australian and Queensland Governments, Reef Water Quality Protection Plan 2013: Securing the health and resilience of the Great Barrier Reef World Heritage Area and adjacent catchments, p. 6, <http://www.reefplan.qld.gov.au/resources/assets/reef-plan-2013.pdf> (accessed 25 August 2014); see also GBRMPA, *Outlook Report 2014*, p. 168; and Professor Hoegh-Guldberg, *Submission 6*, p. 3.

4 GBRMPA, *Outlook Report 2014*, p. 52; see also Professor Hoegh-Guldberg, *Submission 6*, p. 3.

5 GBRMPA, *Outlook Report 2014*, pp 63–64; see also Professor Hoegh-Guldberg, *Submission 6*, p. 3; Mr Brian Bycroft, *Submission 3*, p. 4; Mr David Arthur, *Submission 26*, p. 3.

6 GBRMPA, *Queensland Agriculture, Resources and Environment Committee 2012 Inquiry into Queensland Agriculture and Resource Industries*, *Submission 28*, p. 3, <http://www.parliament.qld.gov.au/documents/committees/AREC/2012/QldARIndustries/submissions/28-GBRMPA.pdf> (accessed 5 August 2014). See also, Queensland Resources Council, *Submission 28*, p. 16; see also World Heritage Committee, *Mission Report of the Reactive Monitoring Mission to Great Barrier Reef 6th to 14th March 2012*, June 2012, p. 41, <http://whc.unesco.org/document/117104> (accessed 7 August 2014).

associated with soil run-off), and the main source has been diffuse source pollution from agriculture.⁷ To this end, this section will examine these risks with regard to:

- the use of fertilisers;
- the use of pesticides; and
- broad-scale vegetation clearing and soil erosion.

Use of fertilisers

4.9 The committee received evidence that the environmental issue of greatest concern surrounding the use of fertilisers was eutrophication of fresh and marine waters. Eutrophication is the process where water becomes enriched with nutrients such as nitrogen and phosphorus, both of which can promote excessive plant growth, including algae, causing a diminution in water quality. Eutrophication can also directly harm aquatic plants and animals.⁸ It was acknowledged:

While there are numerous sources of eutrophication, it is clear that inefficient fertilizer use, particularly if combined with inappropriate farm management practices, has the potential to be a significant contributor. Poor storage, handling and transport can also result in fertilizers entering fresh and marine waters.⁹

4.10 Eutrophication has also been linked to outbreaks of crown-of-thorns starfish, one of the causes of coral loss.¹⁰ However, as Professor Terry Hughes, Director of the ARC Centre of Excellence for Coral Reef Studies, James Cook University, explained:

There are two plausible but unproven theories about the causes of outbreaks of crown-of-thorns starfish. One suggests that dredging and runoff of nutrient pollution from land promotes blooms of phytoplankton which speeds up the development of starfish larvae, contributing to outbreaks. The other surmises that the changes we have made to the structure of foodwebs have resulted in fewer juvenile starfish being eaten.¹¹

7 Reef Water Quality Protection Plan Secretariat, *2013 Scientific Consensus Statement: Land use impacts on Great Barrier Reef water quality and ecosystem condition*, p. 1, <http://www.reefplan.qld.gov.au/about/assets/scientific-consensus-statement-2013.pdf> (accessed 5 August 2014). See also GBRMPA, *Outlook Report 2014*, p. 170–171.

8 Fertilizer Australia, *Submission 22, Attachment*, p. 9: Fertilizer Industry Federation of Australia and the Australian Fertiliser Services Association, Fertcare, 2012 (Fertcare).

9 Fertilizer Australia, *Submission 22, Attachment*, p. 9: Fertcare.

10 Professor Hoegh-Guldberg, *Submission 6*, p. 3.

11 Mr David Arthur, *Submission 26*, p. 12: Appendix 2, Professor Terry Hughes, 'Crown of Thorns is a symptom of reef decline: let's address the cause', The Conversation, 3 October 2012, <http://theconversation.com/crown-of-thorns-is-a-symptom-of-reef-decline-lets-address-the-cause-9932>.

4.11 To that extent, the committee heard evidence that the 'scientific indications are that the outbreaks of the crown-of-thorns starfish are indeed related to water quality'.¹²

4.12 Professor Hoegh-Guldberg similarly told the committee that, in relation to crown-of-thorns, 'the best scientific evidence', produced by the Australian Institute of Marine Science (AIMS), is that there is a 'strong link' between water quality and crown-of-thorn outbreaks. Professor Hoegh-Guldberg stated:

...periodic flooding bringing nutrients and sediments out of catchments, disturbances to coastal processes, leads to algal blooms that happen more often that feed the baby starfish that then lead to outbreaks in plague proportions.¹³

Use of pesticides

4.13 The *Outlook Report 2014* noted that pesticides, including herbicides and fungicides, in land-based run-off can have a negative impact on marine plants and animals. The report went on to say:

Herbicide concentrations in flood plumes that extend into the marine environment can exceed concentrations shown to have negative effects on certain species of coral, seagrass and microalgae and present risks to marine mammals. Despite this, current levels of pesticides are considered to be a low to moderate threat to inshore coral reefs generally, but the consequences of long-term exposure are not understood. The threat is likely to be higher in some regions, especially when pesticides are present in combination with other pollutants and stressors.¹⁴

4.14 Submitters have called for better regulation of the use and transportation of pesticides.¹⁵ Dr Matthew Landos of the Frenchs Forest Veterinary Surgery said:

We have just recently watered down the regulation of pesticides at the federal level. This will have a further negative effect on the movement of those products, causing harm to the inshore areas and the offshore areas where we are measuring these pesticides travelling. Much further tightening of our pesticide regulation is required to allow the reef to remain, if we want to keep it.¹⁶

12 Professor John Pandolfi, Councillor and Past President, Australian Coral Reef Society, *Committee Hansard*, 21 July 2014, p. 5; see also Dr Jamie Oliver, Research Director, Australian Institute of Marine Science, *Committee Hansard*, 23 July 2014, p. 22.

13 Professor Ove Hoegh-Guldberg, *Committee Hansard*, 21 July 2014, p. 13.

14 GBRMPA, *Outlook Report 2014*, p. 174.

15 Dr Matthew Landos, Director, Frenchs Forest Veterinary Surgery; Honorary Lecturer and Associate Researcher, Sydney University Faculty of Veterinary Science, *Committee Hansard*, 22 July 2014, p. 57; Frog Safe Inc, *Submission 60*, pp 2–3.

16 Dr Matthew Landos, Director, Frenchs Forest Veterinary Surgery; Honorary Lecturer and Associate Researcher, Sydney University Faculty of Veterinary Science, *Committee Hansard*, 22 July 2014, p. 57.

4.15 Frog Safe argued for a bond to be introduced for chemical manufacturers who want to get approvals for their products to be sold in this country. Furthermore they recommended that:

There also needs to be a policy that chemicals which have been banned overseas need to be banned here automatically and concurrently...[and there] needs to be more research on the effects of chemicals on corals and fish species which come from coastal nursery areas to provide proof of the real impact that chemicals have (which will undoubtedly be far worse than what has been extrapolated so far).¹⁷

4.16 CropLife Australia submitted that pesticides, including herbicides, insecticides and fungicides, are critical to maintaining and improving Australia's agricultural productivity and meeting the global food security challenges of the coming decades. It noted that, without access to pesticides, farmers could lose as much as 50 per cent of their annual crop production to pests, weeds and diseases.¹⁸

4.17 CropLife Australia accepted that pesticides may find their way into river systems and ultimately end up in the Great Barrier Reef. However, CropLife Australia cited evidence from scientific research and monitoring which indicated that pesticides posed no threat to the overall health of the Great Barrier Reef and argued that the mere presence of pesticides in waterways did not necessarily mean that harm was being caused.¹⁹ CropLife went on to suggest that it would be beneficial to determine whether the concentration of pesticides in reef water actually presented a risk of environmental harm before calling for limits or a ban on the use of pesticides on agricultural land in catchments—an outcome that would have devastating impacts on rural economies and Australia's ability to produce food.²⁰ CropLife Australia stated:

...Governments need to balance the risk from pesticide use with the benefits accorded to the entire community from pesticide use...Furthermore, efforts to reduce pesticide concentrations to below detectable levels are unlikely to be successful in light of constantly improving detection technologies. These efforts may not be cost effective and may not result in better [Great Barrier Reef] health due to the negligible impacts that these chemicals currently have. Governments, farmers, land managers and pesticide suppliers need to work together to develop cost effective tools, products and procedures that will continue to reduce the risk to the [Great Barrier Reef] from pesticides.²¹

4.18 AgForce Queensland submitted that, on occasion, incorrect assumptions and toxicology impacts of pesticides have been used for pesticide modelling, resulting in

17 Frog Safe Inc, *Submission 60*, p. 3.

18 CropLife Australia Ltd, *Submission 21*, p. 1.

19 CropLife Australia Ltd, *Submission 21*, p. 1.

20 CropLife Australia Ltd, *Submission 21*, pp 2–4.

21 CropLife Australia Ltd, *Submission 21*, p. 4.

false claims about detected levels of pesticide run-off and the consequential impact on marine organisms in coastal waters. AgForce submitted that:

- (a) two herbicides (hexazinone and tebuthiuron) were modelled for runoff from cropping areas, which are not registered nor used in cropping;
- (b) the area used for calculating annual herbicide runoff loads was less than 0.16% of the grazing area and the herbicides were only applied every seven to twenty years;
- (c) end of catchment herbicide runoff values were added together across five herbicides for comparison to water quality trigger values, but all five herbicides were never detected together in run-off; and
- (d) herbicide exposure concentrations that could impact on corals and marine organisms were at least five times greater than any detected herbicide concentrations monitored in end of catchment watercourses.²²

4.19 As a result, AgForce recommended that the Australian Government conduct a scientific review of reef pesticide science using data derived from monitoring collected by independent expert pesticide scientists experienced in environmental toxicology. Such a review could help to ensure that future funding of environmental protection programs is targeted at actual threats to the health of the Great Barrier Reef, not perceived threats.²³

Broad-scale vegetation clearing and soil erosion

4.20 The *Outlook Report 2014* noted that past broad-scale land clearing, 'principally in the southern two-thirds of the Great Barrier Reef catchment, has significantly affected each of the supporting terrestrial habitats'. It went on to say:

Ongoing agricultural use of these habitats also affects their ability to support the Reef ecosystem...The resultant loss and modification of habitats has led to significant increases in pollutants, principally nutrients and sediments, entering the Great Barrier Reef lagoon which has reduced the ecosystem's ability to bounce back after impacts, especially in southern inshore areas. In addition, the loss of freshwater coastal habitats has affected some ecological functions and numerous marine species...²⁴

4.21 As submitted by Mr David Arthur, a major source of sediment load in river discharge stems from riverbank erosion consequent to excessive vegetation clearing.²⁵ Although the clearing of vegetation is regulated under the *Vegetation Management Act 1999* (Qld) and the *Water Act 2000* (Qld), the Capricorn Conservation Council

22 AgForce Queensland, *Submission 14*, p. 6.

23 AgForce Queensland, *Submission 14*, p. 6; see also Mr Charles Burke, Chief Executive Officer, AgForce Queensland, *Committee Hansard*, 21 July 2014, p. 39.

24 GBRMPA, *Outlook Report 2014*, p. 59. See also World Heritage Committee, *Mission Report of the Reactive Monitoring Mission to Great Barrier Reef 6th to 14th March 2012*, June 2012, p. 26, <http://whc.unesco.org/document/117104> (accessed 7 August 2014).

25 Mr David Arthur, *Submission 26*, p. 4.

submitted that illegal clearing of vegetation by both commercial entities and recreational visitors still occurs.²⁶

4.22 Submitters observed that recent amendments to the *Vegetation Management Act 1999* (Qld) have significantly reduced vegetation protection in Great Barrier Reef catchment areas. Submitters agreed that the legislation now allows for clearing of 'high value regrowth' and clearing of protected (native) vegetation for new purposes such as 'high value agriculture' or 'necessary environmental clearing'. As a consequence, many hundreds of thousands of hectares of vegetation are now vulnerable to clearing.²⁷

4.23 The *Water Act 2000* (Qld) has also been amended. Submitters noted that the requirement to obtain a river protection permit to destroy vegetation in a watercourse or spring has been removed. Furthermore, while the 50-metre riparian vegetation 'buffer zones' apply in certain catchments, there are reduced protections for watercourse clearing in other areas which may impact on the Great Barrier Reef. These changes make large quantities of riparian vegetation vulnerable to clearing.²⁸

4.24 Submitters explained that these recent amendments may have considerable negative consequences for land management, and may result in increased erosion and consequential sediment and nutrient run-off to the Great Barrier Reef. The resulting detriment to the water quality of the Great Barrier Reef will have negative impacts on the health of the Great Barrier Reef ecology.²⁹

26 Capricorn Conservation Council, *Submission 27*, p. 9.

27 WWF-Australia and the Australian Marine Conservation Society, *Submission 23*, p. 9; Alliance to Save Hinchinbrook, *Submission 37*, p. 2; Cairns and Far North Environment Centre, *Submission 19, Attachment 5*, pp 10, 43; WWF-Australia and Australian Marine Conservation Society, 'Report to UNESCO World Heritage Committee: Status of Implementation of recommendations in World Heritage Committee Decision 36 COM 7B.8 and 37 COM 7B.10, Great Barrier Reef (Australia) and the March 2012 Reactive Monitoring Mission', 30 January 2014 (WWF and AMCS report to WHC) and Environmental Defenders Office (Qld), 'Legislative Protection of the Great Barrier Reef World Heritage Area, Australia' (EDO analysis), Appendix 5 to WWF and AMCS report to WHC. See also *EDO Qld and EDO NQ Submission on the Draft Coastal Zone Strategic Assessment Report*, p. 7, <http://www.edoqld.org.au/wp-content/uploads/2014/01/2014-01-31-EDO-Qld-and-EDO-NQ-Joint-Submission-on-the-Draft-GBR-Coastal-Zone-SA-Program-Report.pdf> (accessed 7 August 2014); Capricorn Conservation Council, *Submission 27*, p. 2.

28 Cairns and Far North Environment Centre, *Submission 19, Attachment 5*, pp 10, 50; WWF and AMCS report to WHC and EDO analysis. See also, WWF-Australia and the Australian Marine Conservation Society, *Submission 23*, p. 9; *EDO Qld and EDO NQ Submission on the Draft Coastal Zone Strategic Assessment Report*, p. 14, <http://www.edoqld.org.au/wp-content/uploads/2014/01/2014-01-31-EDO-Qld-and-EDO-NQ-Joint-Submission-on-the-Draft-GBR-Coastal-Zone-SA-Program-Report.pdf> (accessed 7 August 2014).

29 Cairns and Far North Environment Centre, *Submission 19*, p. 6; WWF-Australia and the Australian Marine Conservation Society, *Submission 23*, p. 9; Alliance to Save Hinchinbrook, *Submission 37*, p. 2.

4.25 Offering a solution, Mr David Arthur proposed that Green Army participants should be deployed to restore vegetation on riverbanks and thereby minimise topsoil run-off via rivers into the Great Barrier Reef.³⁰

Management of the impacts of run-off caused by broad-scale land use

4.26 Activities, plans and programs have been designed to directly and indirectly abate the threats to the health of the Great Barrier Reef. Direct actions have targeted the symptoms of poor reef health by controlling outbreaks of crown-of-thorns starfish directly.³¹ Indirect actions have looked at combatting the root causes of poor reef health by trying to improve the quality of water that flows into the Great Barrier Reef from its catchments.

Direct control of outbreaks of crown-of-thorns starfish

4.27 Direct measures have been taken to control outbreaks of crown-of-thorns starfish. The Australian and Queensland Governments submitted that they are:

...addressing a key threat to the reef caused by destructive outbreaks of crown-of-thorns starfish. In late 2013, the Government allocated an extra \$1.1 million to support culling efforts. This adds to the more than \$7 million already committed to deal with the key threats.³²

4.28 The Australian Government recently implemented a culling program of crown-of-thorns starfish, with more than a quarter of a million starfish culled to April 2014. The process involved using a single injection causing an allergic reaction in the starfish which breaks it apart and causes it to die within 24 hours. Divers deployed by the local Association of Marine Park Tourism Operators in Cairns have found they can cull over 1000 crown-of-thorns starfish on a 40-minute dive. The culling has taken place in various parts of the Great Barrier Reef, including the area stretching from Cairns to Cooktown.³³

4.29 AIMS has conducted research into the effectiveness of direct control mechanisms on the total population levels of crown-of-thorns starfish. The research looked into interventions to control starfish numbers like culling programs, the introduction of specific diseases and the use of natural predators. Research has also been conducted into the life cycle of the crown-of-thorns starfish to better understand larvae ecology. Dr Oliver of AIMS told the committee that it was hoped that these

30 Mr David Arthur, *Submission 26*, p. 4.

31 Professor Terry Hughes, Director, ARC Centre of Excellence for Coral Reef Studies, James Cook University, *Committee Hansard*, 23 July 2014, p. 29; Mr David Arthur, *Submission 26*, p. 10; Appendix 2, Professor Terry Hughes, 'Crown of Thorns is a symptom of reef decline: let's address the cause', *The Conversation*, 3 October 2012, <http://theconversation.com/crown-of-thorns-is-a-symptom-of-reef-decline-lets-address-the-cause-9932>.

32 Australian and Queensland Governments, *Submission 34*, p. 8.

33 The Hon Greg Hunt and the Hon Warren Entsch, *Media Release*, '250,000 crown-of-thorns starfish culled', 22 April 2014, <http://www.environment.gov.au/minister/hunt/2014/pubs/mr20140422.pdf> (accessed 15 August 2014). See also Shipping Australia Limited, *Submission 3*, p. 4.

studies would lead to more accuracy in predicting future outbreaks and show ways that existing aggregations could be disrupted, such as through the use of pheromones.³⁴

4.30 Professor Hoegh-Guldberg cautioned that the task of 'trying to kill every last crown-of-thorns in outbreaks across the reef is enormous' and that solving the problem of crown-of-thorns should be 'all about dealing with the coastal water quality issue'.³⁵

Indirect measures designed to improve quality of water entering the reef

4.31 The *2013 Scientific Consensus Statement* acknowledged that there had been significant progress over the past four years towards better water quality through a greater scientific understanding and measurement of 'catchment to reef' processes and progress by the farming community towards improved land management practices. The improved land and agricultural management practices have been proven to reduce the run-off of suspended sediment, nutrients and pesticides. The reduction in sediment flows and consequential improvement in water quality help to improve ecosystem resilience to other pressures.³⁶

4.32 Submitters and witnesses also recognised the hard work of the agricultural sector in improving land management practices and the extent to which the sector has made financial contributions in cash and in-kind to mitigate the impacts on water quality.³⁷ Fertilizer Australia agreed that farm management practices can assist in the management of nutrients and ensure that run-off into waterways is minimised but argued that these measures must be established on a site-specific basis to be most effective, given the diverse range of soil types, use history and farming practices used in catchment areas.³⁸

34 Dr Jamie Oliver, Research Director, Australian Institute of Marine Science, *Committee Hansard*, 23 July 2014, p. 21–22.

35 Professor Ove Hoegh-Guldberg, *Committee Hansard*, 21 July 2014, p. 13. See also Mr David Arthur, *Submission 26*, p. 12; Appendix 2, Professor Terry Hughes, 'Crown of Thorns is a symptom of reef decline: let's address the cause', *The Conversation*, 3 October 2012, <http://theconversation.com/crown-of-thorns-is-a-symptom-of-reef-decline-lets-address-the-cause-9932>.

36 Reef Water Quality Protection Plan Secretariat, *2013 Scientific Consensus Statement: Land use impacts on Great Barrier Reef water quality and ecosystem condition*, p. 1, <http://www.reefplan.qld.gov.au/about/assets/scientific-consensus-statement-2013.pdf> (accessed 5 August 2014).

37 Cairns Local Marine Advisory Committee, *Submission 7*, p. 2; North Queensland Conservation Council, *Submission 30*, p. 2; Whitsunday Residents Against Dumping, *Submission 39*, p. 2. See also Capricorn Conservation Council, *Submission 27*, p. 18; Wildlife Preservation Society of Queensland, *Submission 33*, p. 3; Professor Peter Mumby, President, Australian Coral Reef Society, *Committee Hansard*, 21 July 2014, p. 4; Mr Tony Fontes, *Committee Hansard*, 21 July 2014, p. 4; Mrs Marie Vitelli, Policy Officer, AgForce Queensland, *Committee Hansard*, 21 July 2014, p. 40; Ms Ellen Roberts, Co-ordinator, Mackay Conservation Group, *Committee Hansard*, 22 July 2014, p. 20; Mr Michael McCabe, Coordinator, Capricorn Conservation Council, *Committee Hansard*, 22 July 2014, p. 35.

38 Fertilizer Australia Inc, *Submission 22*, p. 2.

4.33 Despite all the efforts made by the agricultural sector to improve land management practices, the committee notes that the improvements may not be enough to protect the overall health of the reef. The *Outlook Report 2014* explained that:

Significant investments in land management practices from 2009 to 2013 have resulted in a modelled 11 per cent reduction in the average annual suspended sediment load delivered to the Great Barrier Reef. However, there is likely to be a significant lag time before there are measurable and ecologically significant water quality improvements in the Region, with effects continuing for at least decades.³⁹

4.34 Further, the Environmental Defenders Office (Qld) stated that:

Even if all farmers adopted the [best management practices] it will not achieve sufficient reduction in the nitrogen load from cane farms to allow [Great Barrier Reef] recovery—the best available science says about 70 to 80% reduction is required. 100% adoption of the [best management practices] would reduce the nitrogen load by 14 – 30% which would be a substantial improvement.⁴⁰

4.35 The Wildlife Preservation Society of Queensland submitted that, although agricultural practices have had some impact on stemming the flow of nutrients, the potential cost of rehabilitation could be prohibitive. As noted, it would therefore be important to establish whether the current policies have not just had the effect of arresting the decline but managed to reverse the trend.⁴¹ The AIMS stated that research into this is currently underway.⁴²

4.36 Mr Josh Coates of the Cairns and Far North Environment Centre voiced concerns about the accuracy of some of the data coming from research. He stated:

The data that is used in our reef report card, for example, is very much based on modelling and there are some serious questions regarding the accuracy of that modelling. What I would like to see is more on-ground monitoring, actual recordings of things like erosion and pesticide loads,

39 GBRMPA, *Outlook Report 2014*, p. 50. See also WWF-Australia and the Australian Marine Conservation Society, *Submission 23*, p. 7; World Heritage Committee, *Mission Report of the Reactive Monitoring Mission to Great Barrier Reef 6th to 14th March 2012*, June 2012, p. 41, <http://whc.unesco.org/document/117104> (accessed 7 August 2014).

40 Cairns and Far North Environment Centre, *Submission 19, Attachment 5*, p. 45: EDO analysis. See also WWF-Australia and the Australian Marine Conservation Society, *Submission 23*, p. 8; Cairns and Far North Environment Centre, *Submission 19, Attachment 5*, pp 8, 44: WWF and AMCS report to WHC and EDO analysis; *EDO Qld and EDO NQ Submission on the Draft Coastal Zone Strategic Assessment Report*, p. 9, <http://www.edoqld.org.au/wp-content/uploads/2014/01/2014-01-31-EDO-Qld-and-EDO-NQ-Joint-Submission-on-the-Draft-GBR-Coastal-Zone-SA-Program-Report.pdf> (accessed 7 August 2014).

41 The Wildlife Preservation Society of Queensland, *Submission 33*, p. 3.

42 Australian Institute of Marine Science, *Submission 36*, p. 2.

rather than relying on modelling to determine the levels of impact and that those impacts are being addressed.⁴³

4.37 The Wildlife Preservation Society of Queensland also noted that without ongoing monitoring it would be impossible to determine the effectiveness of the management strategies and submitted that State and Commonwealth funding must be amended to allow for this ongoing monitoring.⁴⁴

Reef Water Quality Protection Plan

4.38 The *2013 Reef Water Quality Protection Plan* (Reef Water Quality Plan) set targets for improved water quality and land management practices, identified management actions that could be taken to improve the quality of water entering the reef and outlined specific actions and deliverables to be completed by 2018. By 2018, the program aims for:

- at least a 50 per cent reduction in anthropogenic end-of-catchment dissolved inorganic nitrogen loads in priority areas;
- at least a 20 per cent reduction in anthropogenic end-of-catchment loads of sediment and particulate nutrients in priority areas; and
- at least a 60 per cent reduction in end-of-catchment pesticide loads in priority areas.⁴⁵

4.39 The Reef Water Quality Plan also required that best management practice systems be put in place for 90 per cent of sugarcane, horticulture, cropping and grazing lands located in priority areas, for a minimum of 70 per cent of late dry season groundcover on grazing lands, for an increase in the extent of riparian vegetation and for no further net loss in the extent of natural wetlands.⁴⁶

4.40 The ongoing success of the plan has been documented, with Australian and Queensland Governments submitting that 'the management changes and water quality improvements being implemented are having a positive impact on water quality across the Great Barrier Reef catchments'.⁴⁷

43 Mr Josh Coates, Marine Program Coordinator, Cairns and Far North Environment Centre, *Committee Hansard*, 23 July 2014, p. 16. See also Mrs Marie Vitelli, Policy Officer, AgForce Queensland, *Committee Hansard*, 21 July 2014, p. 43.

44 The Wildlife Preservation Society of Queensland, *Submission 33*, p. 3. See also Australian Institute of Marine Science, *Submission 36*, p. 4.

45 Australian and Queensland Governments, Reef Water Quality Protection Plan 2013: Securing the health and resilience of the Great Barrier Reef World Heritage Area and adjacent catchments, p. 20, <http://www.reefplan.qld.gov.au/resources/assets/reef-plan-2013.pdf> (accessed 6 August 2014).

46 Australian and Queensland Governments, Reef Water Quality Protection Plan 2013: Securing the health and resilience of the Great Barrier Reef World Heritage Area and adjacent catchments, p. 20, <http://www.reefplan.qld.gov.au/resources/assets/reef-plan-2013.pdf> (accessed 6 August 2014).

47 Australian and Queensland Governments, *Submission 34*, p. 18.

4.41 Mr Brian Bycroft, a water quality expert and former Assistant Director for the Water Quality Policy at the former Commonwealth Department of Sustainability, Environment, Water, Population and Communities, questioned whether the targets set by the Reef Water Quality Plan were sufficiently specific to achieve its overall goal of ensuring that by 2020 the quality of water entering the reef would have no detrimental impact on the health and resilience of the Great Barrier Reef.⁴⁸ Further, as sustainable load targets were not specifically defined, Mr Bycroft submitted that it would not be possible to properly target management actions to best achieve goals and that explicit load reduction targets should be introduced to reflect estimated sustainable loads.⁴⁹

4.42 Mr Bycroft also noted that management actions should be undertaken by reference to robust scientific evidence, not just based on best management practice, so as to ensure that actions are properly targeted. Further, current management strategies may need to be revised as they would require significant land use changes to properly achieve their goals.⁵⁰

4.43 The report to World Heritage Committee commissioned by WWF-Australia and the Australian Marine Conservation Society also suggested that a different approach may be needed. It stated:

While present management measures that are primarily tackling land based agricultural activities are likely to improve conditions for water quality...benefits are unlikely to be realised in the short to medium term...The underlying problem for management is that, due to the lowered resilience of the Reef's ecosystems and the likelihood that management actions will not catalyse immediate recovery of declined systems, halting and reversing the overall declining condition of the Reef won't be possible using current approaches. There is growing consensus that recovery of the Reef will require significant additional investments and a different approach than business as usual.⁵¹

Funding of land management programs

4.44 Submitters have acknowledged the reduction in funding to land management programs. The Australian Government's initial commitment of \$200 million over five years has been reduced to \$160 million, with \$40 million being diverted into the Reef

48 Brian Bycroft, *Submission 3*, p. 1. See also Conference of the Parties to the Convention on Biological Diversity, Tenth meeting, Nagoya, Japan, 18–29 October, Item 4.2 of the provisional agenda, UNEP/CBD/COP/10/9 18 July 2010, Target 8, p. 5.

49 Brian Bycroft, *Submission 3*, pp 1–2; WWF-Australia and the Australian Marine Conservation Society, *Submission 23*, p. 7. See also Cairns and Far North Environment Centre, *Submission 19, Attachment 5*, p. 6; WWF and AMCS report to WHC; WWF-Australia and the Australian Marine Conservation Society, *Submission 23*, p. 7.

50 Brian Bycroft, *Submission 3*, pp 1–3.

51 Cairns and Far North Environment Centre, *Submission 19, Attachment 5*, p. 8; WWF and AMCS report to WHC.

Trust program.⁵² It was also noted that, when taking into account the effects of inflation and the fact that a wider diversity of activities have been placed under the same budget, the amount of funding that can be put into land management programs has effectively been reduced.⁵³

4.45 The Australian Coral Reef Society acknowledged that programs to reduce agricultural run-off through improving land management practices have progressed well, even if they have not reached their targets, and therefore it would be disastrous to reduce the funding allocated to them.⁵⁴ The 2012 Mission Report of the World Heritage Committee also stated:

Considering the overarching importance of water quality to the [Great Barrier Reef's] health, it is indispensable that the current level of investment in measures to tackle this threat is maintained and the recent positive trends are sustained.⁵⁵

4.46 WWF-Australia and the Australian Marine Conservation Society noted that there was insufficient detail on how the funding commitment was to be invested, concluding that if this investment were simply placed into supporting industry-developed voluntary best management practice programs without any further regulation or standards it would be unlikely that the Reef Water Quality Plan would be able to reach its environmental targets.⁵⁶

4.47 The submission by Professor Hoegh-Guldberg stated that:

A cost effective prioritisation of management actions that explicitly considers the economic costs, feasibility, and biodiversity benefits of a range of marine and terrestrial management actions to identify priorities has not been done in the [Great Barrier Reef], and is urgently required if we want to spend the limited budget effectively.⁵⁷

Reef Trust

4.48 As previously noted, \$40 million has been allocated to the Reef Trust program. The Australian and Queensland Governments explained that the Reef Trust

52 Professor Hoegh-Guldberg, *Submission 6*, p. 9; Australian Coral Reef Society, *Submission 8*, p. 1; WWF-Australia and the Australian Marine Conservation Society, *Submission 23*, p. 8; see also, Cairns and Far North Environment Centre, *Submission 19, Attachment 5*, p. 8; WWF and AMCS report to WHC; Australian and Queensland Governments, *Submission 34*, pp 8, 18.

53 Australian Coral Reef Society, *Submission 8*, p. 1; Cairns and Far North Environment Centre, *Submission 19, Attachment 5*, p. 10; WWF and AMCS report to WHC.

54 Australian Coral Reef Society, *Submission 8*, p. 1; Professor Peter Mumby, President, Australian Coral Reef Society, *Committee Hansard*, 21 July 2014, p. 5.

55 World Heritage Committee, *Mission Report of the Reactive Monitoring Mission to Great Barrier Reef 6th to 14th March 2012*, June 2012, p. 4, <http://whc.unesco.org/document/117104> (accessed 7 August 2014).

56 Cairns and Far North Environment Centre, *Submission 19, Attachment 5*, p. 9; WWF and AMCS report to WHC.

57 Professor Hoegh-Guldberg, *Submission 6*, p. 9.

will provide funding for activities through a range of mechanisms. Funding will initially go to farmers and land managers to assist them to implement land management practices to improve water quality, and then go towards actions designed to control crown-of-thorns starfish outbreaks and reduce the incidence of new outbreaks. It will also fund programs to provide greater protection for threatened species.⁵⁸ The Reef Trust will eventually also provide funds to target site-specific threats to water quality such as urban sewage discharge.⁵⁹

4.49 Submitters and witnesses noted that funds derived from environmental offsets may be incorporated into the Reef Fund.⁶⁰ The Mackay Conservation Group were concerned that incorporating money from offsets into the Reef Trust may create a conflict of interest for GBRMPA. They submitted that management activities:

...should not be tied to offsets funding. They should be part of GBRMPA's regular budget. Such a practice just encourages GBRMPA to allow destructive projects and spend money on projects elsewhere which should have been funded through its budget not through offset funding.⁶¹

4.50 WWF-Australia and the Australian Marine Conservation Society recognised that the Reef Trust 'has good potential if it results in building a multi-billion dollar fund to invest in the actions that will bring the greatest bang for buck for [Great Barrier] Reef health', but remarked that the '[Australian] Government contribution is only \$40 million and [this] is merely a rebadging of existing [Great Barrier] Reef funding.'⁶²

The Great Barrier Reef Region Strategic Assessment

4.51 In order to target the ongoing effects of catchment run-off, the Great Barrier Reef Region Strategic Assessment Report recommended:

- the further promotion of improved land management practices, the development and implementation of more regionally based water quality improvement plans for the catchments;
- the development of stronger links between water quality improvement initiatives and actions designed to protect and restore inshore biodiversity;

58 Australian and Queensland Governments, *Submission 34*, p. 33; see also Department of the Environment, *Answers to questions on notice from public hearing on 21 July 2014*, p. 6.

59 Dr Kimberley Dripps, Deputy Secretary, Department of the Environment, *Committee Hansard*, 21 July 2014, p. 55.

60 Shipping Australia Limited, *Submission 3*, p. 6; Australian and Queensland Governments, *Submission 34*, p. 32; Mackay Conservation Group, *Submission 42*, p. 53; Dr Kimberley Dripps, Deputy Secretary, Department of the Environment, *Committee Hansard*, 21 July 2014, p. 55; Ms Ellen Roberts, Co-ordinator, Mackay Conservation Group, *Committee Hansard*, 22 July 2014, pp 20–21.

61 Mackay Conservation Group, *Submission 42*, p. 53; see also Ms Ellen Roberts, Co-ordinator, Mackay Conservation Group, *Committee Hansard*, 22 July 2014, pp 20–21.

62 WWF-Australia and the Australian Marine Conservation Society, *Submission 23*, p. 8.

- the expansion of the Reef Water Quality Plan to include other sources of pollutants, such as from urban and industrial activities; and
- the better application of water quality guidelines across the Great Barrier Reef.⁶³

4.52 Some submitters supported the recommendations to better coordinate water quality testing, to promote improved land management practices and to expand the focus of the Reef Water Quality Plan to non-agricultural sources of pollution.⁶⁴ The Cairns Local Marine Advisory Committee suggested that providing local government authorities with the necessary funding to improve sewage treatment infrastructure through programs like the Reef Water Quality Plan would ensure that in the future sewage is not dumped at sea but properly treated on land.⁶⁵ Property Rights Australia recommended that:

...more research be done into other causes of "plausible" runoff such as inefficient sewage systems, fertiliser from parks and gardens, heavy metals from tyre residue, erosion caused by urban development and the fallout from mining.⁶⁶

4.53 These site-specific activities are examined in the next section.

Further improvements

4.54 Some submitters claimed that the agricultural sector can still do more to better protect the health of the Great Barrier Reef ecology.⁶⁷ For example, the Cairns Local Marine Advisory Committee called for improved regulation and monitoring of chemical application and run-off by requiring farmers to register chemicals and the authorities should adopt random tests of compliance.⁶⁸ The Environmental Defenders Office (Qld) recommended that regulatory mechanisms should be improved by establishing better enforcement of activities causing the harm, a re-examination of

63 GBRMPA, *Great Barrier Reef Region Strategic Assessment, Strategic Assessment Report*, August 2014, p. 12–10, http://elibrary.gbrmpa.gov.au/jspui/bitstream/11017/2861/1/GBR%20Region%20SA_Strategic%20Assessment%20Report_FINAL.pdf (accessed 13 August 2014).

64 Cairns Local Marine Advisory Committee, *Submission 7*, p. 2; Cairns and Far North Environment Centre, *Submission 19, Attachment 3*, pp 5, 7.

65 Cairns Local Marine Advisory Committee, *Submission 7*, pp 2–3.

66 Property Rights Australia, *Submission 9*, pp 2–3.

67 See, for example, Cairns Local Marine Advisory Committee, *Submission 7*, p. 2; North Queensland Conservation Council, *Submission 30*, pp 2–3; Cairns and Far North Environment Centre, *Submission 19, Attachment 5*, pp 45–46: EDO analysis.

68 Cairns Local Marine Advisory Committee, *Submission 7*, p. 2.

application allowances and an extension of the current regulatory regimes to all industries and catchments.⁶⁹

4.55 AgForce Queensland disagreed, opining that the best way to change land management practices would be through creating an 'economic imperative', that is, by showing farmers that if they put certain land management practices in place it would increase their financial bottom line and, at the same time, deliver environmental outcomes. The committee also heard that the improvement of land management practices is an ongoing and evolving process that cannot be measured by reference to static points in time and therefore the discussion should focus on where the process is going rather than on what has happened in the past.⁷⁰

4.56 AgForce observed that a major component of reef science is undertaken remotely, using computer generated models. AgForce argued that this research method undermines the potential to build connections between scientists and land managers. It was recommended that there should be increased community involvement in regional monitoring of run-off as this could foster more community ownership and also a better understanding by scientists of the need to co-manage issues such as productivity, and economic and environmental outcomes.⁷¹

4.57 AgForce Queensland opined that the risk of sediment run-off from grazing is determined more by the condition of grazing land rather than by grazing management practices. AgForce supported the new practice of monitoring fractional ground cover as an indicator of the condition of grazing land. This practice was used by agricultural industry groups five years ago in research and development. It recommended that in the future reef science should be built on existing industry science to avoid 'reinventing the wheel'.⁷²

4.58 The *2013 Scientific Consensus Statement* suggested that, in addition to continuous improvement in land management practices, transformational changes in some farming technologies may also be necessary to reach the ultimate goal of 'no detrimental impact on the health and resilience of the reef'.⁷³

69 Cairns and Far North Environment Centre, *Submission 19, Attachment 5*, pp 45–46: EDO analysis. See also *EDO Qld and EDO NQ Submission on the Draft Coastal Zone Strategic Assessment Report*, p. 9, <http://www.edoqld.org.au/wp-content/uploads/2014/01/2014-01-31-EDO-Qld-and-EDO-NQ-Joint-Submission-on-the-Draft-GBR-Coastal-Zone-SA-Program-Report.pdf> (accessed 7 August 2014).

70 Mr Charles Burke, Chief Executive Officer, AgForce Queensland, *Committee Hansard*, 21 July 2014, pp 40, 42.

71 AgForce Queensland, *Submission 14*, p. 5. See also Mr Charles Burke, Chief Executive Officer, AgForce Queensland, *Committee Hansard*, 21 July 2014, p. 38.

72 AgForce Queensland, *Submission 14*, p. 7. See also Mr Charles Burke, Chief Executive Officer, AgForce Queensland, *Committee Hansard*, 21 July 2014, p. 39.

73 Reef Water Quality Protection Plan Secretariat, *2013 Scientific Consensus Statement: Land use impacts on Great Barrier Reef water quality and ecosystem condition*, p. 1, <http://www.reefplan.qld.gov.au/about/assets/scientific-consensus-statement-2013.pdf> (accessed 5 August 2014).

4.59 Fertilizer Australia suggested that changes to the type of fertiliser used may make a difference:

There are a number of commercially available products including nitrification inhibitors and controlled release technologies that have shown good results in other parts of the world. However they have a significant cost and have not been widely adopted in the [Great Barrier Reef] catchments.

Field research in the [Great Barrier Reef] catchments to better quantify the efficacy of these products in local conditions would provide valuable information to growers and policy makers about the technical potential and economic viability of these products.⁷⁴

Future impacts from large-scale development

4.60 The extent and nature of future development has been and will be directly and indirectly influenced by the assessment and approvals processes, which are discussed in Chapter 8. More specifically, some submitters and witnesses expressed concerns about proposals to develop Northern Australia, especially development that would result in large-scale land clearing, animal husbandry and diversion of existing hydrological flows.

The proposed development of Northern Australia

4.61 The Cairns and Far North Environment Centre submitted that the push to develop Northern Australia, including catchment areas, could pose a significant threat to the health of the Great Barrier Reef. The submission noted:

Approvals that result in large scale land clearing, damming of seasonal flow rivers and runoff from large agricultural and intensive animal husbandry concerns would pose a significant threat, not only to the current natural values of the [Great Barrier Reef], but its existence as an ecosystem in its current stable state...⁷⁵

4.62 As a consequence, the Cairns and Far North Environment Centre recommended that the approval of large-scale development of the Cape York Peninsula, or other catchments adjacent to the reef, should not be allowed to be fast-tracked; rather:

The precautionary principle must be applied, particularly in areas of limited scientific understanding of biodiversity and interactions of ecosystems that depend on each other (for example, reef and rainforest).⁷⁶

4.63 Professor Mumby of the Australian Coral Reef Society expressed similar concerns about the Queensland Government's plans to develop the Cape York area. He noted that development and economic opportunity are not inherently problematic,

74 Fertilizer Australia, *Submission 22*, p. 2.

75 Cairns and Far North Environment Centre, *Submission 19*, p. 6.

76 Cairns and Far North Environment Centre, *Submission 19*, p. 11.

but it is important to have a discussion about what they may mean to the future state of the Great Barrier Reef.⁷⁷

4.64 WWF-Australia and the Australian Marine Conservation Society submitted:

Significant agricultural and mining development in Cape York's eastern catchments is likely to cause significant adverse impacts to [the] northern section of the [Great Barrier Reef] unless appropriately controlled, yet the draft Cape York Regional Plan does not contain any provisions to ensure that adverse impacts to the [Great Barrier Reef] are avoided. These impacts could include increased sediment loads caused by vegetation clearing, water quality degradation caused by contaminated agricultural runoff and alteration of catchment hydrology caused by mining activities...it is essential that all development activities in Cape York's eastern catchments are strictly controlled to protect the northern section of the [Great Barrier Reef] by ensuring degradation which has occurred to the reefs central and southern sections is avoided.⁷⁸

4.65 The 2012 Mission Report of the World Heritage Committee also recommended strict adherence to the precautionary principle when assessing the potential impact of development. The report further commented:

An extension of the footprint of development outside of currently industrialized areas would clearly present a significant threat to the [outstanding universal value] and integrity of the property.⁷⁹

Impacts from non-agricultural activities

4.66 Site-specific activities have had broad-ranging direct and indirect impacts on the health of the Great Barrier Reef. The health of parts of the reef has been affected by the poor quality of water flowing into the reef as a result of:

- current mining activities and practices;
- legacy mines; and
- urban developments, including residential and tourism developments.

4.67 There have also been direct site-specific impacts to the health of the Great Barrier Reef stemming from:

- the construction of artificial dams, weirs, estuarine barriers and fishways; and
- challenges to the protection offered by national parks and other protected areas.

4.68 This section examines each of these issues in turn.

77 Professor Peter John Mumby, President, Australian Coral Reef Society, *Committee Hansard*, 21 July 2014, p. 5.

78 WWF-Australia and the Australian Marine Conservation Society, *Submission 23*, p. 15.

79 World Heritage Committee, *Mission Report of the Reactive Monitoring Mission to Great Barrier Reef 6th to 14th March 2012*, June 2012, pp 4, 8, <http://whc.unesco.org/document/117104> (accessed 7 August 2014).

Current mining activities and practices

4.69 The Queensland Resources Council explained that the resources sector is a significant contributor to the economic wealth and stability of Queensland and the nation. This contribution has indirectly helped fund environmental protection programs. Resource companies have also contributed directly to a broad range of environmental programs that have had direct or indirect benefits for the management and protection of the Great Barrier Reef.⁸⁰ However, these benefits are partially tainted by the impacts that the resources sector has had on the health of the Great Barrier Reef. The committee received evidence that examined the impacts of current mining activities and practices on the quality of water flowing into the reef from catchments.

4.70 The Australian and Queensland Governments submitted that:

The Queensland Government manages water quality impacts from mining and industrial operations primarily through the use of regulatory approvals...and by working in partnership with the resources sector to support continual improvement in on-site water management and disposal strategies.

The Queensland Government also requires that regulated structures such as tailings dams are designed, constructed, operated and maintained to a high engineering standard that reflects the environmental risk associated with the contents of the structure and local climate conditions.⁸¹

4.71 Despite these precautions, mining and industrial activities may have impacts on the quality of water entering the Great Barrier Reef. The 2012 Mission Report of the World Heritage Committee acknowledged that mining activities in the region's catchments do pose a risk of pollution and sedimentation of waterways draining into the Great Barrier Reef. However, mine discharges are not as significant a threat to the water quality of the Great Barrier Reef as nutrients and pesticides from agricultural sources, as shown by the fact that the catchments having the worst effects on water quality were not the main catchments impacted by mining.⁸²

4.72 This was reiterated by the *Outlook Report 2014*:

While the contribution of pollutants from terrestrial point source discharges, such as mining and industrial releases, sewage, wastewater and stormwater, is relatively small compared to diffuse pollutant sources, discharges can be locally significant.⁸³

80 Queensland Resources Council, *Submission 28*, pp 5–6; see also GBRMPA, *Outlook Report 2014*, p. 152.

81 Australian and Queensland Governments, *Submission 34*, pp 25–26.

82 World Heritage Committee, *Mission Report of the Reactive Monitoring Mission to Great Barrier Reef 6th to 14th March 2012*, June 2012, p. 42, <http://whc.unesco.org/document/117104> (accessed 7 August 2014).

83 GBRMPA, *Outlook Report 2014*, p. 168.

4.73 Submitters argued that the relative impacts of mining activities must still be taken into account due to the projected increase in resource extraction in the catchments and the possible cumulative effects of these activities. The potentially adverse impacts to the Great Barrier Reef include the release of toxic waste and legacy floodwaters into the river systems draining into the Great Barrier Reef, and the modification of catchment hydrology caused by diverting and damming watercourses and disturbing groundwater discharge areas.⁸⁴

4.74 Although the Capricorn Conservation Council called for better regulation of the extraction of resources, it noted that improvements have been made to some mining practices, such as water management. These improvements have resulted in 'fewer pit total flooding events and uncontrolled discharges, increased water quality monitoring and reporting, improved compliance regimes and agreed water quality standards'.⁸⁵

Queensland Nickel Yabulu Refinery

4.75 Previous activities of the Queensland Nickel Yabulu Refinery were brought to the attention of the committee. WWF-Australia submitted a report to the inquiry specifically examining the impacts on the Great Barrier Reef of mining activities by the Queensland Nickel Yabulu Refinery. The report noted that the refinery, located at Yabulu, has been operating since 1974, producing nickel and cobalt from imported laterite ore through leaching the ore in ammonium carbonate and then washing it in an ammonia solution. The waste streams of the process are passed through stills to remove some of the ammonia and carbon dioxide before being sent to, and stored in, an on-site tailings storage facility (TSF).⁸⁶

4.76 It was submitted that, historically, the excess wastewater from the TSF would be discharged via a pipeline, 1.8 kilometres into Halifax Bay. However, since 2004, a permit to discharge has been required. The refinery held a permit to maintain and then decommission the pipeline until 2013, but this permit did not allow for discharge through the pipeline.⁸⁷

4.77 WWF-Australia reported that in 2004, 2009 and 2010 the refinery requested permission to discharge via the pipeline, but permission was not granted. GBRMPA cited the refinery in 2009 and 2011 for unauthorised discharges in 2009 and 2011 but did not prosecute the infringements.⁸⁸

84 WWF-Australia and the Australian Marine Conservation Society, *Submission 23*, p. 10; Capricorn Conservation Council, *Submission 27*, pp 19–20; see also Save the Reef, *Submission 50*, p. 10.

85 Capricorn Conservation Council, *Submission 27*, p. 20; see also WWF-Australia and the Australian Marine Conservation Society, *Submission 23*, p. 10.

86 WWF-Australia, *Submission 24*, pp 2–4.

87 WWF-Australia, *Submission 24*, p. 4.

88 WWF-Australia, *Submission 24*, p. 4.

4.78 The WWF-Australia report explained that:

While the precise concentrations of contaminants within the TSF are currently unavailable, the contaminants known to be in the system...suggest that these ponds do represent a significant threat (if released) to the ecology of Halifax Bay (within the [Great Barrier Reef]) and the coastal area adjacent the Yabulu refinery. Acute toxicity effects aside, the unauthorised release in March-April 2011 equated to approximately 20% of the total nitrogen load released from the Burdekin catchment annually, the single largest source if inorganic nitrogen input to the [Great Barrier Reef]. This single release was more than twice the size of the reported gains achieved under the Reef Rescue and [the] Reef [Water Quality] Plan programs...⁸⁹

4.79 The Australian and Queensland Governments stated that the refinery had not been in contravention of the conditions of its development approval under the EPBC Act, which remains in force until 2031. However, a variety of compliance actions have been taken against the refinery by the Queensland Government since it began its operations. In 2013, the Queensland Government, taking into account community concerns, amended the environmental authority conditions attached to the refinery's development approval to require better water management and improved dam safety.⁹⁰ It was submitted that:

In April 2014, shortly after Cyclone Ita crossed the coast in the Townsville area, the tailings dams at the Yabulu Refinery reached capacity and water from the dams began flowing over the spillway. In response, the Yabulu Refinery ceased deposition of tailings material and initiated mitigation measures. The matter is being investigated by the Queensland Government and the GBRMPA. The Yabulu Refinery is required by the Queensland Government to increase the capacity of its tailings dams before the next wet season begins in late 2014.⁹¹

Legacy mines

4.80 Abandoned mines continue to pose a risk to the quality of water entering the reef from catchments. Many abandoned mines have been left in the same state as they were when mining activities ceased. WWF-Australia and the Australian Marine Conservation Society claimed that the uncontrolled release of contaminated water from abandoned mine sites has had adverse impacts on freshwater ecosystems that support and maintain the health of the Great Barrier Reef ecology. It was recommended that:

Due to the projected increase of mining and CSG development in [Great Barrier Reef] catchments, it is essential that all relevant legislation is strengthened to ensure that adverse impacts to the [Great Barrier Reef]

89 WWF-Australia, *Submission 24*, p. 11.

90 Australian and Queensland Governments, *Submission 34*, p. 25; see also Queensland Government, *Answers to written questions on notice*, pp 35-36.

91 Australian and Queensland Governments, *Submission 34*, p. 25.

potentially caused by mining and CSG development are avoided and minimised to greatest extent possible.⁹²

4.81 With regard to rehabilitation of legacy mines, the Capricorn Conservation Council noted that:

...there is little evidence of any success in rehabilitating the often sodic soils of the region to any state useful for productive agriculture or natural habitats and corridors.⁹³

4.82 Save the Reef suggested that no meaningful rehabilitation of land is currently carried out in Queensland because the program for rehabilitation of old mines was put on hold by the current Queensland Government. It was claimed that, as a result of this failure to rehabilitate legacy mines, contaminated run-off from tailings storage facilities is inevitable during heavy rainfall events, even if waters are routinely pumped out of these facilities. Similarly to WWF-Australia and the Australian Marine Conservation Society, Save the Reef called for more regulation of the resources industry.⁹⁴

4.83 The evidence of the Australian and Queensland Governments contradicted the submission of Save the Reef in part, stating:

The management of abandoned mines in Queensland is overseen by the Queensland Government through the Abandoned Mines Land Program. Abandoned mines are sites of former mining activity for which no individual, company or organisation is responsible.

The Abandoned Mines Land Program manages the public safety and environmental risks associated with abandoned mines.⁹⁵

Urban developments including residential and tourism developments

4.84 The committee heard that run-off from urban developments has had a detrimental effect on the quality of water that enters the Great Barrier Reef. The main issues raised were related to stormwater, sediment and nutrient run-off and the release of sewage into the Great Barrier Reef.

Urban run-off and sewage

4.85 In relation to planning and development approvals, the Australian and Queensland Governments submitted that water quality impacts from diffuse urban sources have been managed under the *State Planning Policy: State interest—water quality*. Under this policy, developers have been required to incorporate drainage and erosion and sediment controls during the construction phase and water sensitive urban

92 WWF-Australia and the Australian Marine Conservation Society, *Submission 23*, p. 10.

93 Capricorn Conservation Council, *Submission 27*, p. 20.

94 Save the Reef, *Submission 50*, p. 10.

95 Australian and Queensland Governments, *Submission 34*, p. 26. See also Queensland Department of Natural Resources and Mines, *Abandoned Mines Land Program*, <http://mines.industry.qld.gov.au/safety-and-health/abandoned-mine-lands-program.htm>.

design features to address ongoing stormwater, sediment and nutrient run-off controls after completion. The policy also:

...encourages continual improvement in on-site water management and disposal strategies by requiring best practice environmental management adapted for local climatic condition...The State Planning Policy also protects Great Barrier Reef wetlands by ensuring development is regulated to prevent the loss or degradation of wetland environmental values, and ensuring wetlands continue to function to protect water quality of receiving waters.⁹⁶

4.86 In contrast, the North Queensland Conservation Council stated:

Run-off from non-agricultural, in particular urban, activities would appear to be the blind spot when it comes to protecting the [Great Barrier] Reef.⁹⁷

4.87 WWF-Australia and the Australian Marine Conservation Society noted that key issues affecting the Great Barrier Reef include increased contaminated urban stormwater run-off, the capacity of existing sewage treatment plants to manage current and future pollution loads and whether tourism development located in the coastal zone would be able to avoid and minimise impacts caused by wastewater discharges, marine moorings, loss of critical coastal habitat and increased sedimentation resulting from the clearing of vegetation.⁹⁸

4.88 The North Queensland Conservation Council observed that the removal of vegetation from urban blocks remains uncontrolled, stormwater from urban settlements is free to drain directly into the waters of the Great Barrier Reef and plastic shopping bags are still being widely used. Although these sources of pollution may be relatively small when compared to some of the perceived main threats to the health of the Great Barrier Reef ecology, given that the majority of the population living in the reef catchments create the sources of pollution, they must be taken seriously.⁹⁹

4.89 The Whitsunday Residents Against Dumping raised concerns about the marine disposal of urban sewage.¹⁰⁰ This concern was reiterated by Property Rights Australia, which observed that 'if nitrogen is a major part of the problem then untreated urban sewage has to be part of the problem also'.¹⁰¹

4.90 General Electric highlighted that, as the population in catchment areas is projected to grow by 44 per cent over the next 17 years, the discharge of secondary-

96 Australian and Queensland Governments, *Submission 34*, p. 26.

97 North Queensland Conservation Council, *Submission 30*, p. 3.

98 WWF-Australia and the Australian Marine Conservation Society, *Submission 23*, pp 10–11. See also Capricorn Conservation Council, *Submission 27*, p. 19.

99 North Queensland Conservation Council, *Submission 30*, p. 3.

100 Whitsunday Residents Against Dumping, *Submission 39*, p. 2.

101 Property Rights Australia, *Submission 9*, p. 4.

treated sewage is likely to be an increasing issue for the water quality of the Great Barrier Reef.¹⁰²

4.91 General Electric observed that:

All coastal sewage treatment plants that discharge into the marine environment had been required by Queensland Government policy to meet the most stringent treatment standards (i.e. tertiary treatment) by 2010.¹⁰³

4.92 However, due to a discontinuation of funding programs, most of the funds for upgrading the sewage treatment plants had to come from local government rates, making it less economically viable for smaller communities to upgrade their secondary treatment processes to tertiary treatment. The company recommended that sewage plant upgrades by local authorities be considered for funding under Reef Trust and the Australian Government's National Stronger Regions Fund, making the upgrade process less financially onerous on the local communities.¹⁰⁴

4.93 The Alliance to Save Hinchinbrook submitted that the directions calling for a high ecological (ecologically sustainable) standard of installation and management of sewage should be upheld as, without this direction, lower standards would prevail, potentially causing problems for water quality in the future as the human population in catchments expands.¹⁰⁵

Sewage originating from vessels

4.94 With regard to sewage originating from vessels, the Alliance to Save Hinchinbrook observed that most marinas do not have waste disposal facilities, and those that do have these facilities do not allow the emptying of sewage from porta-potties and the like into their toilets. Therefore, where no waste disposal facilities are available, all sewage generated on board a vessel enters the Great Barrier Reef. The alliance went on to state:

The marine sewage regulations contain elaborate directions as to particle size and where macerated sewage can be dumped inside the Great Barrier Reef World Heritage Area. Quite clearly these regulations have little to do with ecological considerations, and much to do with aesthetic and human health considerations. Apart from those rare sites where there may be land-based facilities, the total amount of sewage going onto the [Great Barrier Reef], its value as nutrient and particle pollution, is exactly the same as before the regulations came into effect.¹⁰⁶

4.95 The Cairns Local Marine Advisory Committee submitted that it had been lobbying for some time for sewage pump-out facilities to service the large tourism and recreational fleet based in Cairns. The submission stated that:

102 General Electric, *Submission 29*, p. 1.

103 General Electric, *Submission 29*, p. 2.

104 General Electric, *Submission 29*, p. 2.

105 Alliance to Save Hinchinbrook, *Submission 37, Supplement 3, Attachment 2*, p. 5.

106 Alliance to Save Hinchinbrook, *Submission 37, Supplement 3, Attachment 2*, p. 9.

It is time to review the inconsistencies in state and federal legislation and fund the facilities required to ensure sewage is not dumped at sea, but properly treated on land.¹⁰⁷

Dams, weirs, estuarine barriers and artificial fishways

4.96 Capricorn Conservation Council submitted that ecological barriers and the consequential loss of river corridors and changes to water flows and quality will have consequences for the Great Barrier Reef. Capricorn Conservation Council also observed that dams, weirs and estuarine barriers have reduced the connectivity of river systems. This has affected migratory species, including fish and turtles. Although attempts have been made to create artificial fishways using fish lock systems, little is known about their effectiveness.¹⁰⁸ Dams and weirs also drown remnant riparian vegetation.¹⁰⁹

4.97 The *Outlook Report 2014* also acknowledged that:

...artificial barriers to river and estuarine flow...affect the natural hydrology of the catchment and those Great Barrier Reef species that move between freshwater habitats and the sea. Many marine and estuarine fish species use the freshwater systems for part of their life cycle and can be affected by changes in water flow and the presence of artificial barriers. Artificial barriers have [also] disrupted sediment supply to some beaches.¹¹⁰

The role of national parks and protected areas

4.98 National parks and 'no-go' zones for development play vital roles in protecting the health of the Great Barrier Reef. These areas provide numerous benefits to the overall health of the Great Barrier Reef by supporting a high level of biodiversity, providing a refuge to different species, helping to control flood waters, allowing for the discharge of groundwater and acting as a filter for nutrient rich waters. The modification of these areas may impact on their capacity to perform these functions and may also have significant effects on the feeding and reproductive habits of many marine species.¹¹¹

4.99 A report by the Environmental Defenders Office (Qld) noted that:

In the past year, the State Government introduced amendments to the [*Nature Conservation Act 1992* (Qld)] which weakened protection of

107 Cairns Local Marine Advisory Committee, *Submission 7*, pp 2–3.

108 Capricorn Conservation Council, *Submission 27*, p. 18.

109 Capricorn Conservation Council, *Submission 27*, p. 2.

110 GBRMPA, *Outlook Report 2014*, p. 166.

111 See GBRMPA, *Outlook Report 2014*, p. 166; WWF-Australia and Australian Marine Conservation Society, *Submission 23*, pp 14–15; Capricorn Conservation Council, *Submission 27*, p. 19; see also Keppel and Fitzroy Delta Alliance, *Submission 40*, p. 1.

protected areas, including the national parks and other protected areas in the [Great Barrier Reef] in Queensland's jurisdiction.¹¹²

4.100 The Cairns and Far North Environment Centre's submission raised concerns about allowing proposed activities such as 'emergency grazing' in national parks and national reserve system properties, as such activities could increase sediment and nutrient loads reaching the Great Barrier Reef.¹¹³

4.101 The *Outlook Report 2014* noted that clearing or modifying coastal habitats has had a significant effect on the feeding and reproductive habits of many marine species and has also diminished the number of dry season refuges of marine species. These activities have the potential to increase the volume and speed of freshwater flows in the future, especially when taking climate change into account.¹¹⁴

4.102 WWF-Australia and the Australian Marine Conservation Society cited that an estimated 70 to 90 per cent of coastal wetlands in the Great Barrier Reef catchment have been lost. It was submitted that:

It is critical that these remaining areas are protected from future developments and become 'no-go areas'.

Not only do wetlands buffer the impact of pollutants entering rivers, streams and the Great Barrier Reef, they also support a high level of biodiversity, provide flood control, groundwater discharge and water purification...¹¹⁵

4.103 The Environmental Defenders Office (Qld) recommended that:

More areas in, adjacent to and in the catchments of, the [Great Barrier Reef] should be classified as national parks and afforded the highest level of protection. Queensland and GBRMPA should develop a plan for increasing the protected area estate, including mapping of 'no-go' zones for development in the [Great Barrier Reef], its coastline and catchments.¹¹⁶

112 Cairns and Far North Environment Centre, *Submission 19, Attachment 5*, p. 46: EDO analysis. See also *EDO Qld and EDO NQ Submission on the Draft Coastal Zone Strategic Assessment Report*, p. 10, <http://www.edoqld.org.au/wp-content/uploads/2014/01/2014-01-31-EDO-Qld-and-EDO-NQ-Joint-Submission-on-the-Draft-GBR-Coastal-Zone-SA-Program-Report.pdf> (accessed 7 August 2014).

113 Cairns and Far North Environment Centre, *Submission 19*, p. 5.

114 GBRMPA, *Outlook Report 2014*, p. 166.

115 WWF-Australia and Australian Marine Conservation Society, *Submission 23*, pp 14–15.

116 Cairns and Far North Environment Centre, *Submission 19, Attachment 5*, p. 47: EDO analysis. See also *EDO Qld and EDO NQ Submission on the Draft Coastal Zone Strategic Assessment Report*, p. 11, <http://www.edoqld.org.au/wp-content/uploads/2014/01/2014-01-31-EDO-Qld-and-EDO-NQ-Joint-Submission-on-the-Draft-GBR-Coastal-Zone-SA-Program-Report.pdf> (accessed 7 August 2014).