

# Priority Management Actions for the Grazing Industry in the Boyne and Calliope Catchments: 2016

Report prepared by Fitzroy Basin Association

Final Report: 01 March 2016



**This report should be cited as:**

Coughlin, T (2016). Priority Management Actions for the Grazing Industry in the Boyne And Calliope Catchments: 2016. Report produced for Gladstone Ports Corporation's Biodiversity Offset Strategy. 29 pp.

This report has been produced for Gladstone Ports Corporation's Biodiversity Offset Strategy. The study was undertaken through a Consultancy Agreement (CA1400136) between Gladstone Ports Corporation and Fitzroy Basin Association to identify priority areas and on-ground actions within the grazing industry in the Boyne and Calliope catchments in which works can be directed to achieve reductions in sediments and nutrients entering the waterways and impacting on the reef.

This publication has been compiled by Tom Coughlin.

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## 1. Introduction

The Fitzroy Basin natural resource management (NRM) region in central Queensland covers 156,000 square kilometres (catchment and marine areas) and extends from the Carnarvon Ranges in the west to the coast, and consists of six basins; the Fitzroy, Styx, Shoalwater, Waterpark, Calliope and Boyne (Figure 1). The region has significant agricultural and resource industries, with Queensland's largest multi-commodity port supporting these industries – the Port of Gladstone and the smaller Port of Rockhampton in the Fitzroy delta. The Fitzroy Basin itself comprises of six major rivers that are part of a network of 20,000 kilometres of waterways, and is the largest river basin discharging into the iconic Great Barrier Reef (GBR) lagoon, and the largest river system draining to the Australian east coast. The region includes 125 islands on the Capricorn Coast, the largest being Curtis Island off Gladstone and within port limits, as well as the Keppel Island and Capricorn Bunker groups that support nesting and migratory species, fisheries and marine tourism. Freshwater and marine ecosystems have been assessed as being at *high risk* from suspended sediment, nutrients and herbicides originating primarily from grazing and cropping lands (State of Queensland 2013, Brodie et al. 2013a).

Water Quality Improvement Plans (WQIP) aim to reduce pollution being released into aquatic ecosystems with high ecological, social and/or recreational values. The Fitzroy WQIP (WQIP:2015) covers six basins directly flowing to the GBR and has been developed by Fitzroy Basin Association (FBA) in partnership with industry, government, science and community to build on existing catchment-scale WQIPs. The WQIP:2015 integrates with the Central Queensland Strategy for Sustainability 2030 and incorporate aspirations from community-based catchment plans. A key element of developing the WQIP:2015 has been the integrated assessment of the benefits and costs of achieving water quality targets required to protect the values of the GBR. A conceptual diagram of the various components that were integrated into the WQIP:2015 is presented in Figure 2. The WQIP:2015 is a web based, interactive document and can be found at [www.fba.org.au/wqip](http://www.fba.org.au/wqip).

Gladstone Ports Corporation Limited (GPC) have commissioned FBA to identify priority areas and on-ground actions within the Boyne and Calliope catchments in which works can be directed to achieve reductions in sediments and nutrients entering the waterways and impacting on the reef. The report utilises the science and tools from the WQIP:2015 process to focus on these catchments of interest. A summary of the supporting evidence, along with a comprehensive list of the gaps and limitations in the science behind the WQIP:2015, is provided in Waterhouse et al (2015a) and should be read in conjunction with this report.

This report is presented in six Sections including the Introduction (Section 1). Section 2 presents a summary of the supporting studies that were developed as part of the WQIP:2015 and provides the evidence base for the prioritised neighbourhood catchments (NCs) and recommended management actions that are discussed in Section 3. A proposed implementation and monitoring plan is presented in Section 4 followed by the report's conclusions (Section 5). A closure statement is provided in Section 6.



**Figure 1: Map of Fitzroy Basin Region showing the Boyne and Calliope catchments**



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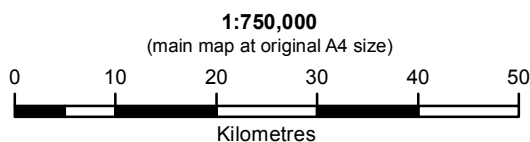
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**Main Map Legend**

- Places
- FBA Boundary
- Basin Sub-Areas
- Boyne Calliope Subregion
- Major Roads
- Major Drainage

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18 February 2016  
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FBA Ref No: WQIP BC Region

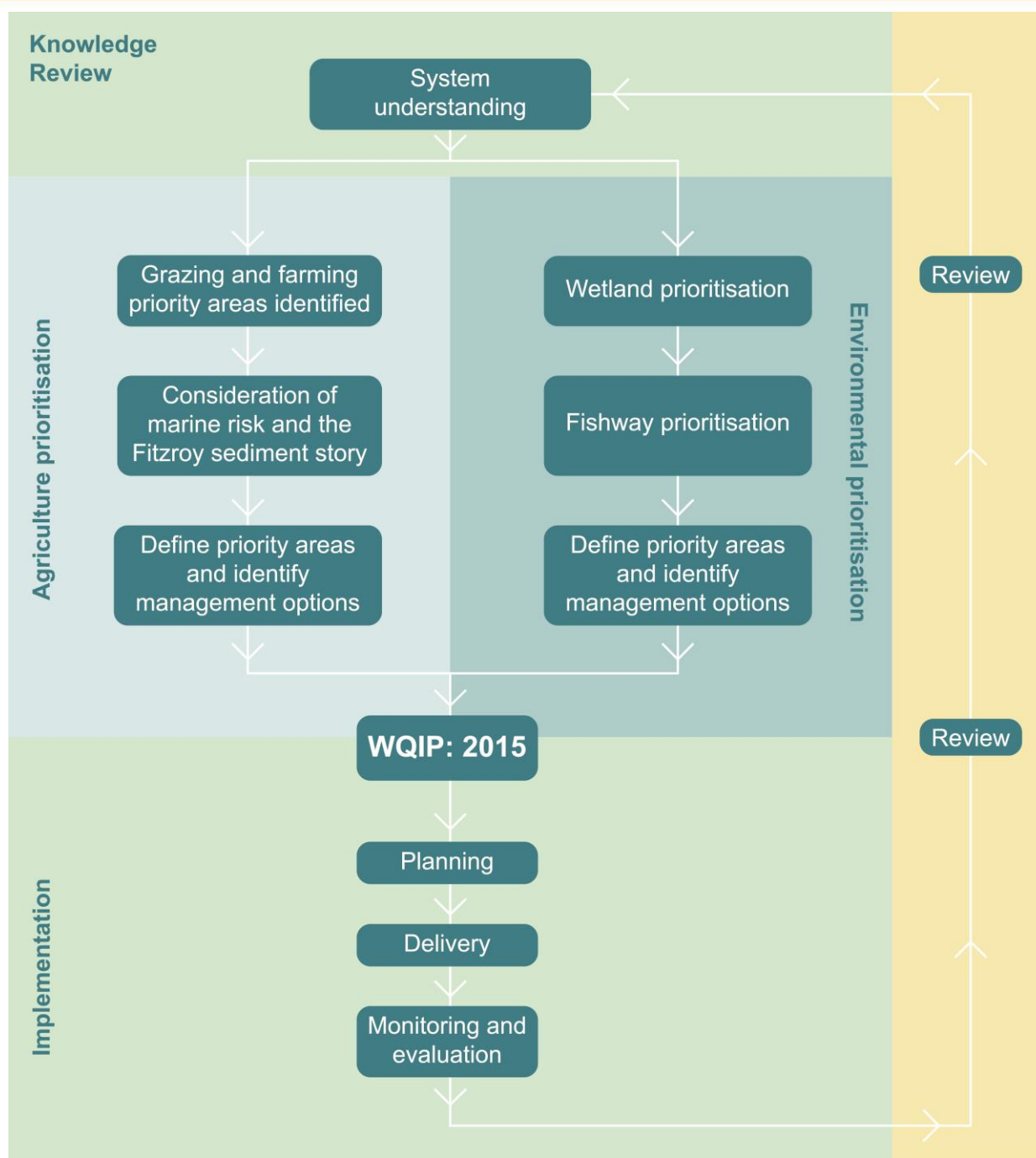


Figure 2. Conceptual Diagram of the Fitzroy WQIP:2015.



## 2. Supporting Evidence

FBA adopted the principle of utilising the best available knowledge for the development of the WQIP:2015, and commissioned a number of supporting science studies to assist in building the information base. The supporting studies have generated standalone reports which have been independently peer reviewed by either the Fitzroy Partnership for River Health Science Panel or independent experts (in the case of the Urban Scoping study). Each of the studies informs one or several steps in the development of the WQIP with the key findings having been incorporated into the plan where relevant. The studies are listed in Table 1.

A summary of the key findings of these studies can be found both on the WQIP:2015 website ([www.fba.org.au](http://www.fba.org.au)) and in the WQIP:2015 synthesis document (Waterhouse et al 2015a).

**Table 1. Summary of the supporting studies commissioned to assist FBA in the development of the Fitzroy WQIP:2015**

Supporting studies	Delivery Partner / Consultant	Project Leaders Report Reference
<b>Status of catchment, coastal and marine ecosystems</b>		
a) Review on water quality information in each of the major catchments of the Fitzroy and coastal catchments and collate existing information on environmental values and water quality objectives	TropWATER, JCU	Dominique O'Brien, Jane Waterhouse <i>Material incorporated to website</i>
b) State of the coastal and marine environment review	C2O Consulting CQUniversity	Johanna Johnson, Jon Brodie, Nicole Flint <i>Johnson et al. (2015)</i>
c) Estimate of the values for the benefits of improved inshore reef health from sediment and nutrient reductions aligned with the WQIP:2015	QDAF CQUniversity	Megan Star, John Rolfe <i>Star and Rolfe (2015)</i>
d) Environmental-economic values of marine and coastal natural assets: Fitzroy NRM region	TropWATER JCU	Colette Thomas, Jon Brodie <i>Thomas and Brodie (2015)</i>
<b>Scoping and risk assessment of water quality issues</b>		
a) Synthesis of water quality influences in ports of the Fitzroy region, Queensland	CQUniversity	Nicole Flint, Emma Jackson, Scott Wilson, Krista Verlis, John Rolfe <i>Flint et al. (2015)</i>
b) Rockhampton and Gladstone urban scoping studies	Earth Environmental	John Gunn <i>Gunn (2015)</i>
c) Assessment of the relative risk of degraded water quality to GBR ecosystems in the Fitzroy NRM region, including improvements to the Marine Risk Index	TropWATER JCU C2O Consulting Maynard Marine NOAA	Jane Waterhouse, Dieter Tracey, Jon Brodie, Steve Lewis, Eduardo da Silva, Michelle Devlin, Amelia Wenger, Dominique O'Brien, Johanna Johnson, Jeffrey Maynard, Scott Heron, Caroline Petus <i>Waterhouse et al. (2015b,c), Maynard et al. (2015), Petus et al. (2015)</i>
d) Fitzroy sediment story	TropWATER JCU DNRM DSITI CSIRO	Stephen Lewis, Bob Packett, Cameron Dougall, Jon Brodie, Rebecca Bartley, Mark Silburn <i>Lewis et al. (2015)</i>
<b>Regional prioritisation</b>		
a) Bioeconomic modelling and NCs prioritisation	QDAF DNRM CQUniversity	Megan Star, Terry Beutel, Kev McCosker, Adam Northey, Rob Ellis, John Rolfe <i>Star et al. (2015a, 2015b)</i>
b) Coastal ecosystems status and priorities including specific wetland prioritisation and Ecological Calculator	FBA Australasian Fish Passage Services Jaensch Ornithology & Conservation GBRMPA	Ronnie Baker, Roger Jaensch, Peter Smith, Tim Marsden, Shane Westley Paul Groves, Donna Audas <i>Baker (2015)</i> <i>Jaensch et al. (2015)</i> <i>Marsden (2015)</i>
c) Draft ecologically relevant targets for pollutant discharge from the drainage basins of the Fitzroy Region	TropWATER JCU GBRMPA	Jon Brodie, Steve Lewis, Scott Wooldridge, Jane Waterhouse, Carol Honchin <i>Brodie et al. (2015b)</i>

Source: Fitzroy WQIP:2015 ([www.fba.org.au/wqip](http://www.fba.org.au/wqip)).



## 2.1. Basin Profiles – Boyne and Calliope Catchments

The Boyne and Calliope catchments are coastal catchments located to the south east of what is known collectively as the Fitzroy Region (Figure 1). A description of their land use characteristics is described below.

**Calliope:** The majority of land within the basin is used for grazing (~81%) and production from forestry (~6%). The remaining land use within the basin includes ~5% of conservation and natural environments (nature conservation and minimal use); ~3% of intensive use (i.e. residential, industry, transport and utilities) and ~4% water (marsh/wetland, river and reservoir/dam). Less than 1% of land is used for cropping (Figure 3). As a consequence of the land use being dominated by grazing, the majority of sediment loads generated from this catchment comes from grazing lands (Table 2 and Figure 3). Table 2 also illustrates that, proportionally, the relative contribution of sediment loads from this catchment to reef is very low in comparison to that delivered from the Fitzroy River.

**Boyne:** The majority of land within the basin is used for grazing (~74%) and conservation and natural environments (~16%) (nature conservation and minimal use). The remaining land use within the basin includes ~5% production from forestry; ~2% of intensive use (i.e. residential, industry, transport and utilities) and ~3% water (marshland/wetland, river and reservoir /dam). Less than 1% of land is used for cropping (Figure 3). As a consequence of the land use being dominated by grazing, the majority of sediment loads generated from this catchment comes from grazing lands (Table 2 and Figure 3). Table 2 also illustrates that, proportionally, the relative contribution of sediment loads from this catchment to reef is very low in comparison to that delivered from the Fitzroy River.

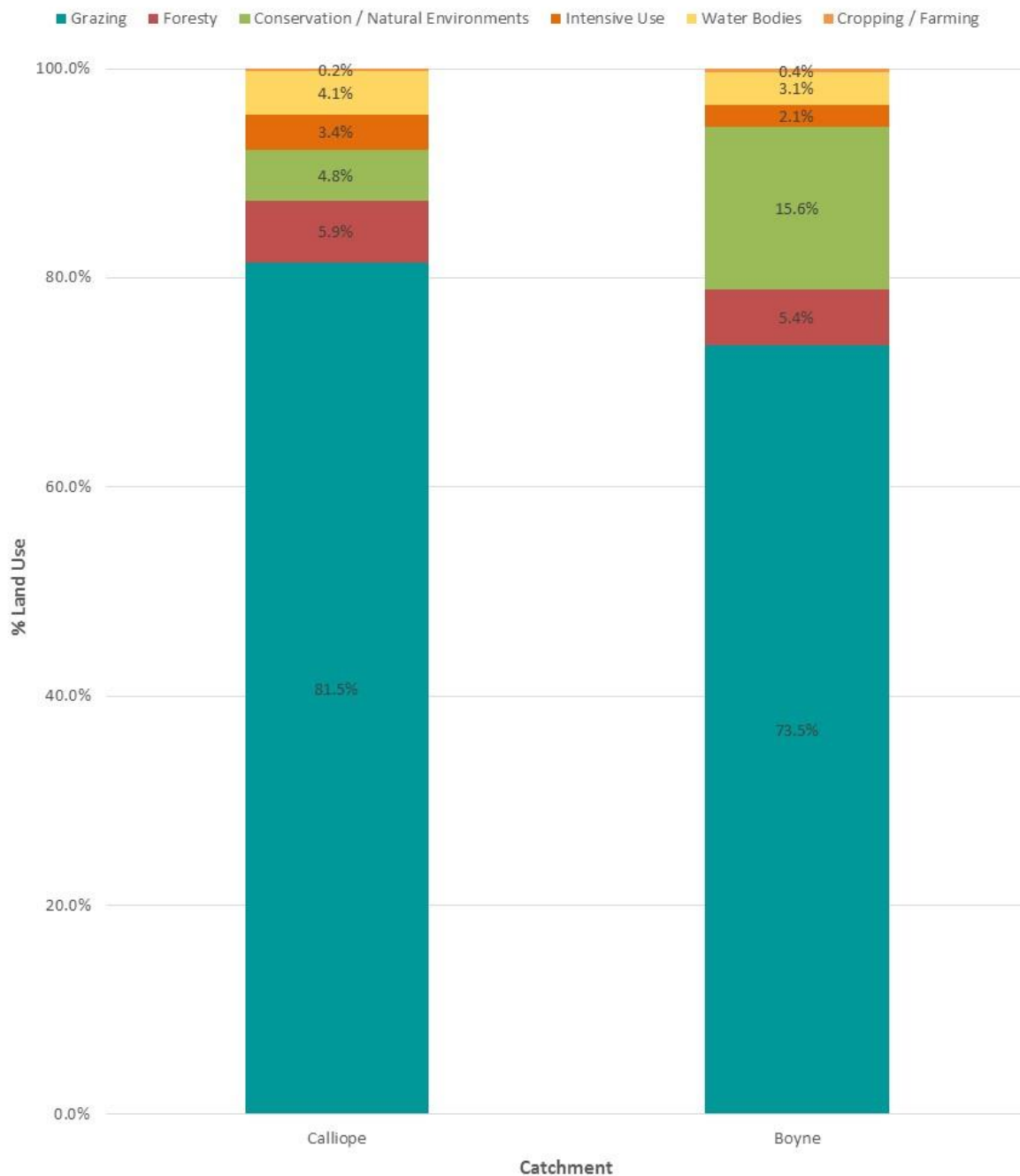


Figure 3: Proportion of land under various land uses for the Boyne and Calliope catchments.

Note: "Intensive use" = residential, industry, transport and utilities; "water" = marsh/wetland, river, reservoir/dam.

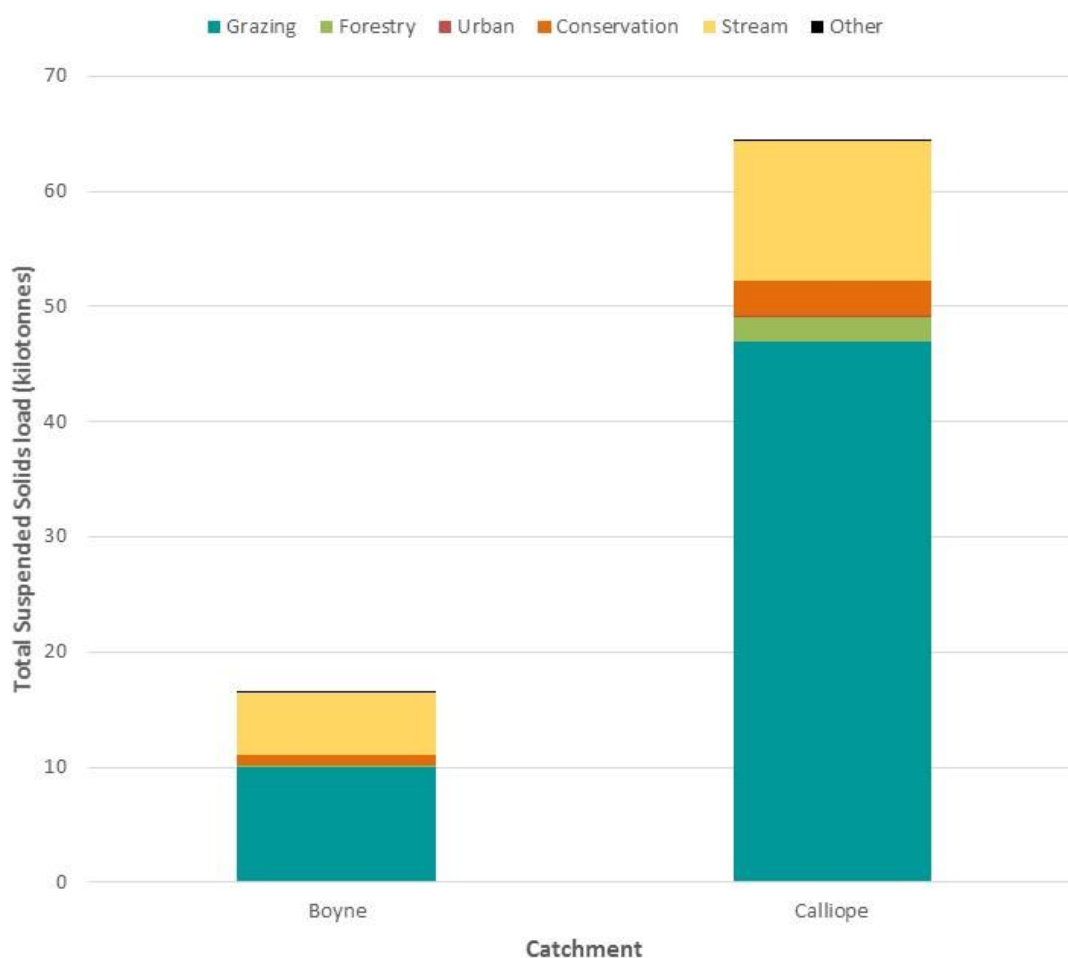
Source: Derived from land use mapping (Fitzroy Region) 2009 (DSITI 2009).

**Table 2: Land use contribution to total suspended solids loads (kilotonnes per year) for the Boyne, Calliope and Fitzroy basins.**

Basin	Grazing	Cropping	Forestry	Urban	Conservation	Stream	Other	Total
Fitzroy	638	27	42	2	34	552	4	<b>1299</b>
Calliope	10	0.0	0.1	0.0	1	5	0.1	<b>17</b>
Boyne	47	0.0	2	0.2	3	12	0.2	<b>65</b>
<b>Total</b>	<b>695</b>	<b>27</b>	<b>44</b>	<b>2</b>	<b>38</b>	<b>570</b>	<b>4</b>	<b>1380</b>

Note: Stream bank erosion is not segregated into a land use but is considered its own land use. As such, a significant proportion of streambank erosion will be occurring on grazing lands since they make up 81 and 74 percent of the Boyne and Calliope catchments respectively.

Source: Derived from latest Source Modelling outputs (201).



*Figure 4: Total suspended solids load for the Boyne and Calliope catchments based on land use.*

Note: Stream bank erosion is not segregated into a land use but is considered its own land use. As such, a significant proportion of streambank erosion will be occurring on grazing lands since they make up 81 and 74 percent of the Boyne and Calliope catchments respectively.

Source: Derived from latest Source Modelling outputs (2015).

Freshwater and marine ecosystems in the Fitzroy Region have been assessed as being at *high risk* from suspended sediment, nutrients and herbicides (Brodie et al. 2013a). A summary of the modelled contribution of the Calliope and Boyne catchments of these pollutants is provided in Table 3. This table provides a breakdown of the anthropogenic load against total load along with the loads delivered by the Fitzroy Catchment for comparison. The Boyne and Calliope catchments deliver only 1.1 and 4.2 percent respectively of the total anthropogenic sediment load to the Reef (Table 3). While this isn't much in comparison to regional delivery rates, sediments, nutrients and pesticides can have impacts on local water quality. In addition, the relative marine risk assessment conducted as part of the WQIP:2015 showed that the marine areas around Port Curtis and Curtis Island are in the high and moderate relative risk classes from poor water quality and that discharge from these rivers does impact on the health of the marine environment around Port Curtis, The Narrows, Rodds Bay Dugong Protection Area, Curtis Island and, in the case of the Calliope River, as far north as the Keppels (Waterhouse et al 2015b) (Figure 5). It should be noted though that the confidence in the data used to calculate the zones of influence associated with the discharge of these rivers is low (Waterhouse et al 2015b). While the Boyne and Calliope rivers only contribute 1.1 and 4.2 percent respectively of the anthropogenic suspended sediment loads of the Fitzroy Basin (Table 3), it is still important to ensure that the water quality from these Basins does not decline thereby exerting additional pressures on the local receiving environments.

**Table 3. Total and anthropogenic modelled loads for pollutants from the Fitzroy, Calliope and Boyne basins and as percentages of the total regional load and regional anthropogenic load.**

Basin Name	Pre-Development Load	Total Load (2012/13)	Anthropogenic load (2012/13)	Anthropogenic load % of Regional Total Load
<b>Total suspended solids loads (kt.y<sup>-1</sup>)</b>				
Fitzroy	205	1,505	1,299	85%
Boyne	5	21	17	1.1%
Calliope	14	78	64	4.2%
<b>Regional total<sup>(a)</sup></b>	<b>264</b>	<b>1,799</b>	<b>1,535</b>	<b>-</b>
<b>Dissolved inorganic nitrogen loads (t.y<sup>-1</sup>)</b>				
Fitzroy	1,205	1,283	78	99%
Boyne	71	71	0	0.2%
Calliope	114	114	0	0.0%
<b>Regional total<sup>(a)</sup></b>	<b>1,787</b>	<b>1,866</b>	<b>79</b>	<b>-</b>
<b>PSII herbicides toxic equivalent loads (kg.y<sup>-1</sup>)</b>				
Fitzroy	0	1,823	1,823	77%
Boyne	0	49	49	2.1%
Calliope	0	122	122	5.1%
<b>Regional total<sup>(a)</sup></b>	<b>0</b>	<b>2,369</b>	<b>2,369</b>	<b>-</b>
<b>Particulate nitrogen loads (t.y<sup>-1</sup>)</b>				
Fitzroy	458	2,666	2,208	66%
Boyne	12	45	33	1.0%
Calliope	51	266	215	6.4%
<b>Regional total<sup>(a)</sup></b>	<b>750</b>	<b>4,100</b>	<b>3,350</b>	<b>-</b>
<b>Particulate phosphorous loads (t.y<sup>-1</sup>)</b>				
Fitzroy	284	1,782	1,499	73%
Boyne	7	25	18	0.9%
Calliope	26	134	109	5.3%
<b>Regional total<sup>(a)</sup></b>	<b>423</b>	<b>2,465</b>	<b>2,042</b>	<b>-</b>

<sup>(a)</sup> Regional total includes total load estimates for all rivers discharging in the Fitzroy Region (i.e. also includes loads from Styx, Shoalwater and Water Park Creek catchments).

Source: Derived from latest Source Modelling outputs (2015)

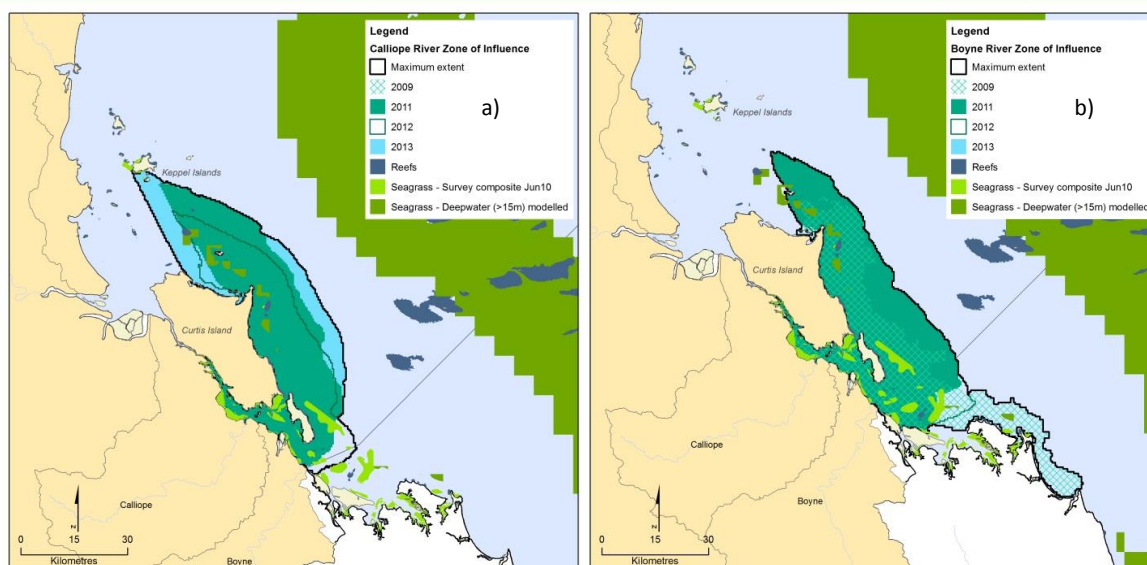


Figure 5: Modelled zone of influence for Calliope (a) and Boyne (b) rivers

Source: Waterhouse et al. (2015b).

### 3. Priority Neighbourhood Catchments and Recommended Management Actions

The primary management options for directly reducing agricultural pollutant loads in the Fitzroy region are associated with improvement or maintenance of sustainable management practices that maximise water quality benefits in agricultural lands (Waterhouse et al 2015a). The WQIP:2015 divides the Fitzroy NRM region into a number of management units for delivery of NRM programs. The region has 192 NCs which are based on smaller scale sub catchments and comprise of a varying number of landholders. Within the Boyne and Calliope catchments there are seven and 10 NCs respectively (Curtis Island has been included in the Calliope Catchment for convenience) (Figure 6). These NCs comprise the management units used in the prioritisation process.

The WQIP:2015 identified priority areas and recommended management actions for both the grazing and farming industries. Given that farming/cropping practices aren't producing reportable loads in the Boyne and Calliope catchments (based on modelled estimates) (Table 2), the focus on this prioritisation process has on the grazing industry. Furthermore, as particulate nutrients are highly correlated to sediment loads, the prioritisation process has taken the approach that if sediments are retained on property then the associated nutrient loads will also be reduced.

The selection of priority NCs and identification of recommended management actions to reduce sediment loads from grazing lands in the Boyne and Calliope catchments follows the same logic as the agricultural prioritisation illustrated in Figure 2. This has been described in more detail below.



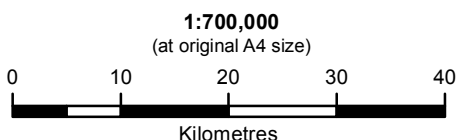


**Figure 6: Neighbourhood catchments within the Boyne and Calliope catchments**



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FBA Ref No: WQIP BC NC

**Step 1: System Understanding:** This component involved reviewing available regional water quality information in each of the major catchments of the Fitzroy Region and collating existing information on environmental values and water quality objectives. The current status of coastal and marine assets were reviewed, threats identified and a determination of their trend made. A review of the science underpinning core assumptions and recommended land management practices was also completed. The following supporting studies directly contributed to this step:

- Coastal and Marine Status Report (Johnson et al. 2015)
- Marine Risk Report (Waterhouse et al. 2015b)
- Environmental-economic values of marine and coastal natural assets report (Thomas and Brodie 2015)
- Ports Synthesis (Flint et al. 2015)
- Urban Water Quality Improvement Scoping Report (Gunn 2015)

Each of the above reports can be found on the WQIP:2015 ([www.fba.org.au/wqip](http://www.fba.org.au/wqip)).

**Step 2: Grazing Priority Areas Identified:** The Queensland Department of Agriculture and Forestry (QDAF) lead a team of scientists to undertake a multi criteria decision analysis to determine the priority areas in the catchment that sediment could be reduced in the most cost effective way. This was undertaken across the grazing and farming industries for all 192 NCs in the Fitzroy Region, including coastal catchments. The four key factors considered in this analysis were:

- i. Amount of sediment per hectare that is eroded and delivered to the Reef.
- ii. A ground cover factor that considered the impact of rainfall variability.
- iii. The effectiveness of current management practices and the likelihood of adoption of new practices.
- iv. The cost of delivering actions in each of the 192 neighbouring catchments on both grazing and farming enterprises.

The following support studies directly contributed to this step.

- Prioritisation of NCs reports (Star and Rolfe 2015, Star et al. 2015a, 2015b)
- Ecological Relevant Targets report (Brodie et al. 2015b)
- Fitzroy Sediment Story Report (Lewis et al. 2015)

**Step 3: Consideration of Marine Risk and the Fitzroy Sediment Story:** An assessment of the relative marine risk posed by each of the rivers in the Fitzroy Region, including coastal catchments was made. This included gaining a better understanding of the source and fate of sediment in our region, identifying the type of sediment that is having the greatest impact on Reef health and the time it takes this sediment to reach the Reef. In addition, this step considered the relative amount of sediment that makes it to the reef compared to the amount produced per NC (i.e. the sediment delivery ratio). The following support studies directly contributed to this step.

- Marine Risk Report (Waterhouse et al. 2015b)
- Fitzroy Sediment Story Report (Lewis et al. 2015)

- Ecological Relevant Targets report (Brodie et al. 2015b)

**Step 4: Define Priority Areas and Identify Management Options:** The above information was integrated to identify priority areas, gain an understanding of the drivers in these areas and to identify management options to improve Reef water quality.

The final ranking of the 17 NCs in the Boyne and Calliope catchments, their relative priority and identified management options is presented in Table 4. The overall relative priority ranking is also illustrated in Figure 7. Given the state of the current El Niño weather conditions, it is important that ground cover is either maintained or improved. A mix of mechanisms that includes both financial incentives with direct extension to support the infrastructure and management changes is required. Given that the production margin from cattle grazing in the Fitzroy Basin will decline further with the likely progression of an El Niño, private funds for infrastructure and improved soil management are limited (Star et al 2015a). Higher levels of co-investment on a sliding scale may be required; this would result in funding up to 75% of on-ground works in some instances (Star et al 2015a). The impending reduction in incentives funding associated with the closing of Reef Programme may be a serious impediment.

**Table 4: Relative priority and identified management options for each of the neighbourhood catchments of the Boyne and Calliope catchments.**

NC_ID	Catchment	Relative Priority	Catchment Description, Recommended Management Actions and Focus Areas
B13	Boyne River	High	<p>This NC has a high sediment delivery ratio to the Reef. It is mainly urban / industrial with some small landholders, horticulture and mango orchards.</p> <p>Grazing: There are very few grazing properties in this NC providing the opportunity to achieve whole of catchment outcomes. The focus of works should be on matching stocking rate to carrying capacity. It is important that ground cover is improved / maintained above gullies and scalds. Some streambank erosion also occurs and stock exclusion from riparian areas during the wet season should be encouraged. Where gullies are active in riparian areas complete stock exclusion is required until the gully is stabilised.</p>
B1	Calliope River	High	<p>This NC has a high sediment delivery ratio to the Reef. There is some grazing in this area and very little cropping. Most of this catchment is State Development Area land.</p> <p>Grazing: Projects should focus on achieving an improvement in groundcover as hillslope erosion is the dominant erosion process. Works should be targeted at encouraging sustainable stocking rates through extension activities. Gully projects should also be considered as part of an integrated, property wide solution. It is important that ground cover is improved / maintained above gullies and scalds.</p>

NC_ID	Catchment	Relative Priority	Catchment Description, Recommended Management Actions and Focus Areas
B8	Calliope River	High	<p>This NC has a high sediment delivery ratio to the Reef. The catchment experiences high rainfall with fast flowing streams. It is iron bark country running down to blue gum flats and is largely dominated by large scale landholders.</p> <p>Grazing: Projects should focus on achieving an improvement in groundcover as hillslope erosion is the dominant erosion process. Works should be targeted at encouraging sustainable stocking rates through extension activities. Gully projects should be considered as part of an integrated, property wide solution including targeted extension on prevention and property planning around infrastructure design. It is important that ground cover is improved / maintained above gullies and scalds. Significant streambank erosion also occurs and stock exclusion from riparian areas during the wet season should be encouraged. Where gullies are active in riparian areas complete stock exclusion is required until the gully is stabilised.</p>
B11	Calliope River	High	<p>This NC has a high sediment delivery ratio to the Reef. It is dominated by grazing of small, lifestyle blocks with some horticulture.</p> <p>Grazing: As there are a number of smaller lifestyle blocks in this NC, extension activities that occur after hours may provide opportunity to improve management practices. Incentives for on-ground works should not be provided for lifestyle blocks. The focus of on-ground activities for larger properties should be on managing hillslope and streambank erosion. This should include matching stocking rate to carrying capacity and stock exclusion from riparian areas during the wet season. Where gullies are active in riparian areas complete stock exclusion is required until the gully is stabilised.</p>
B9	Calliope River	High	<p>This NC has a high sediment delivery ratio to the Reef. The country is very hilly, experiences high rainfall with fast flowing streams. The catchment is dominated by grazing of small, lifestyle blocks. It is heavily timbered on lighter soils.</p> <p>Grazing: As there are a number of smaller lifestyle blocks in this NC, extension activities that occur after hours may provide opportunity to improve management practices. Incentives for on-ground works should not be provided for lifestyle blocks. The focus of on-ground activities for larger properties should be on managing hillslope and streambank erosion. This should include matching stocking rate to carrying capacity and stock exclusion from riparian areas during the wet season. Where gullies are active in riparian areas complete stock exclusion is required until the gully is stabilised.</p>

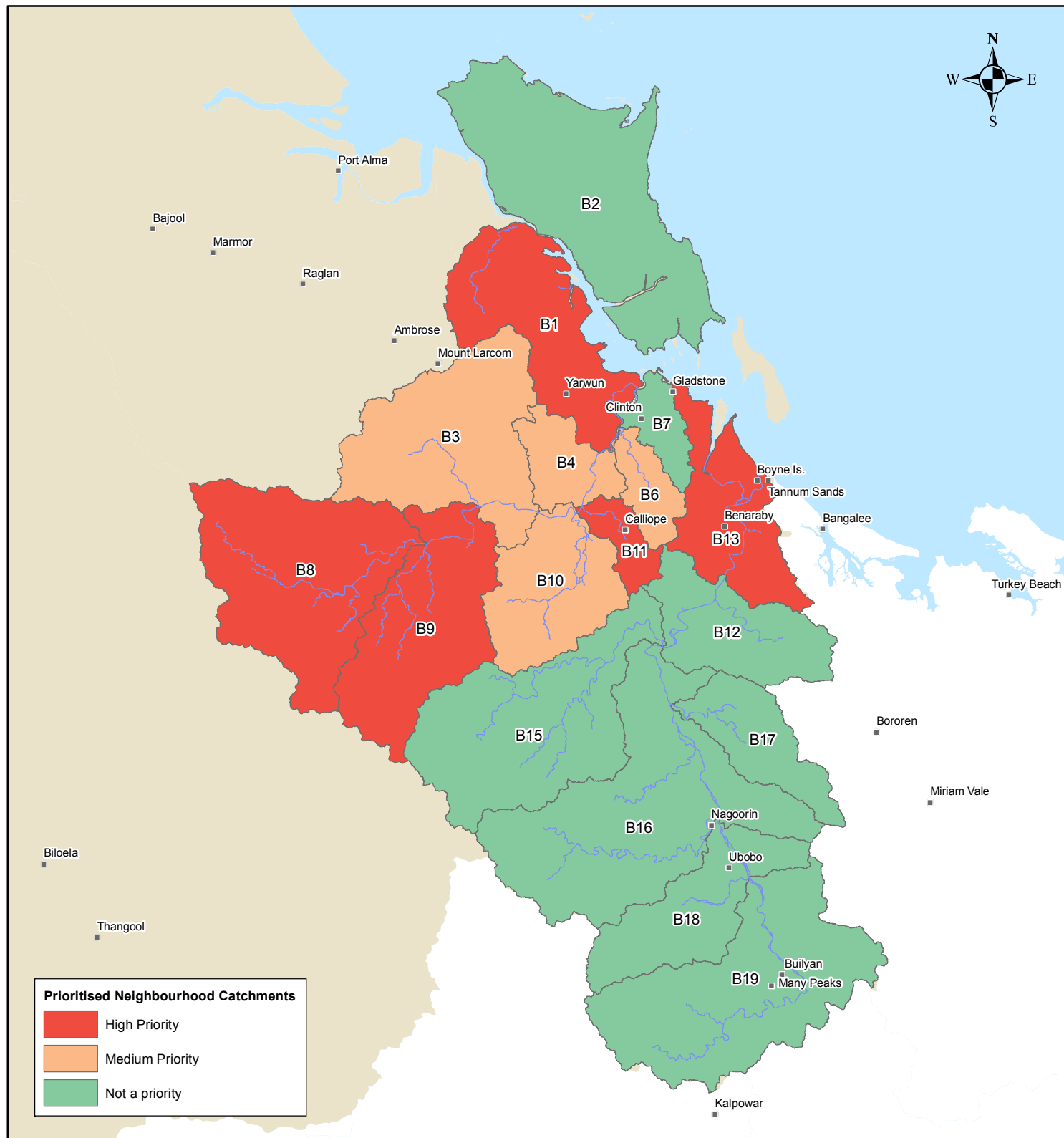
NC_ID	Catchment	Relative Priority	Catchment Description, Recommended Management Actions and Focus Areas
B6	Calliope River	Medium	<p>This NC has a high sediment delivery ratio to the Reef. It is dominated by peri-urban and lifestyle blocks</p> <p>As there are a number of smaller lifestyle blocks in this NC, extension activities that occur after hours may provide opportunity to improve management practices. Incentives for on-ground works should not be provided for lifestyle blocks. The focus of on-ground activities for larger properties should be on managing hillslope erosion through matching stocking rate to carrying capacity.</p>
B4	Calliope River	Medium	<p>This NC has a high sediment delivery ratio to the Reef. There is a mixture of large scale landholders and smaller, lifestyle blocks. It is mainly open forest country.</p> <p>Grazing: The focus of on-ground activities for larger properties should be on managing hillslope and streambank erosion. This should include targeted extension to achieve whole of property practice change and matching stocking rate to carrying capacity as well as stock exclusion from riparian areas during the wet season. Where gullies are active in riparian areas complete stock exclusion is required until the gully is stabilised. Any on-ground works will need to be determined at the property scale and will likely require an integrated approach to address multiple drivers. As there are a number of smaller lifestyle blocks in this NC, extension activities that occur after hours may provide opportunity to improve management practices. Incentives for on-ground works should not be provided for lifestyle blocks.</p>
B10	Calliope River	Medium	<p>This NC has a high sediment delivery ratio to the Reef. It is a high rainfall area that is dominated by grazing of small, lifestyle blocks. It is heavily timbered with some scrub country but mostly lighter soils.</p> <p>Grazing: As there are a number of smaller lifestyle blocks in this NC, extension activities that occur after hours may provide opportunity to improve management practices. Incentives for on-ground works should not be provided for lifestyle blocks. This NC delivers the most sediment from streambank erosion of all the Boyne and Calliope NCs and extension activities should target engaging with landholders on appropriate riparian management practices (e.g. off-stream watering points, stock exclusion during the wet season).</p>



NC_ID	Catchment	Relative Priority	Catchment Description, Recommended Management Actions and Focus Areas
B3	Calliope River	Medium	<p>This NC has a high sediment delivery ratio to the Reef. There is some grazing in this area, mostly of small, lifestyle blocks, though there are a small number of larger grazing enterprises. There is some State Development Area land and mining in the catchment. It experiences high rainfall and is characterised by alluvial box flats.</p> <p>Grazing: This NC has a mix of gully, hillslope and riparian erosion processes active. Management actions should focus on targeted extension to achieve whole of property practice change and to match stocking rate to carrying capacity. Any on-ground works will need to be determined at the property scale and will likely require an integrated approach to address multiple drivers. As there are a number of smaller lifestyle blocks in this NC, extension activities that occur after hours may provide opportunity to improve management practices. Incentives for on-ground works should not be provided for lifestyle blocks.</p>
B12	Boyne River	Low	<p>This NC has high rainfall on relatively steep land and ironbark ridges that run into Awonga Dam. Grazing blocks tend to be small.</p> <p>Grazing: Not a priority industry for this NC. Focus extension activities on matching stocking rate to carrying capacity and achieving whole of property practice change.</p>
B17	Boyne River	Low	<p>This NC is very undulating with high rainfall that results in fast flowing overland flows.</p> <p>Grazing: Not a priority industry for this NC. Focus extension activities on matching stocking rate to carrying capacity and achieving whole of property practice change.</p>
B15	Boyne River	Low	<p>This NC is in a high rainfall area that is dominated by grazing of small, lifestyle blocks. It is heavily timbered on lighter soils.</p> <p>Grazing: Not a priority industry for this NC. Focus extension activities on matching stocking rate to carrying capacity and achieving whole of property practice change.</p>



NC_ID	Catchment	Relative Priority	Catchment Description, Recommended Management Actions and Focus Areas
B16	Boyne River	Low	<p>This NC is dominated by grazing with some dairy and hay making enterprises. It is situated in the Boyne River valley with fertile river flats flanked by ranges and experiences high rainfall.</p> <p>Grazing: Not a priority industry for this NC. Focus extension activities on matching stocking rate to carrying capacity and achieving whole of property practice change.</p>
B19	Boyne River	Low	<p>This NC is very undulating with high rainfall that results in fast flowing overland flows. There are a number of large scale landholders in this catchment.</p> <p>Grazing: Not a priority industry for this NC. Focus extension activities on matching stocking rate to carrying capacity and achieving whole of property practice change.</p>
B18	Boyne River	Low	<p>This NC is very undulating with high rainfall that results in fast flowing overland flows. There are a number of large scale landholders in this catchment.</p> <p>Grazing: Not a priority industry for this NC. Focus extension activities on matching stocking rate to carrying capacity and achieving whole of property practice change.</p>
B2	Curtis Island	Low	<p>The majority of this catchment is national park. No commercial grazing is undertaken on Curtis Island anymore.</p> <p>Grazing: Not a priority industry for this NC.</p>
B7	Calliope River	Low	<p>Includes Gladstone urban centre and state development area. No significant level of commercial grazing is undertaken in this NC.</p> <p>Grazing: Not a priority industry for this NC. Focus extension activities on matching stocking rate to carrying capacity and achieving whole of property practice change.</p>



**Figure 7: Priority areas for management in the Boyne and Calliope catchments**



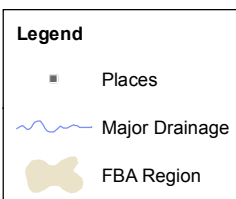
Australian Government



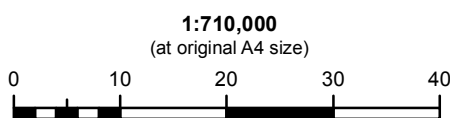
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FITZROY BASIN ASSOCIATION



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Coordinate System: Geocentric Datum of Australia 1994

Map Produced by: Pete Smith  
18 February 2016  
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FBA Ref No: WQIP BC GrazingPriority

## 4. Implementation and Monitoring

Implementation and monitoring of works in the Boyne and Calliope catchments is recommended to be undertaken in the same manner as that undertaken for the WQIP:2015. This will allow for efficiencies to be obtained through streamlining of workflow but also for regionally strategic outcomes to be achieved which align with the objectives of the Central Queensland Strategy for Sustainability (CQSS2030). The implementation and monitoring approach for the WQIP:2015 is conceptual presented in Figure 2 and contains four key components: Planning, Delivery, Monitoring and Evaluation and Review.

### 4.1. Planning

This report presents a summary of the priority areas to direct investment in along with recommended management actions to encourage practice change within the grazing industry to achieve sediment savings to local freshwater systems as well as near-shore marine environments. Key learnings from the development of these priority areas and management actions that should be considered in the planning process for the Boyne and Calliope regions include:

- WQIPs are tools to support users to document and quantify the issues impacting on water quality in the region and the Reef. They assemble and presents complex information in a way that can be understood by decision makers and communicated to the broader community so that the process is transparent. **WQIPs should not be considered as a final ranking for action.** Rather, they should be used to identify areas to be considered more closely for the potential to undertake specific projects within NCs and used in conjunction with other resources such as; on-ground knowledge, site specific data sets and common sense.
- This prioritisation processes involved a number of complex underlying process that have been combined to give final priority scores. It is important that users understand the strengths and limitations of each of these processes and the challenges that arise when combining these processes together and determining final priority areas and actions.
- Where possible, on-ground activities should be aimed at achieving landscape / multiple environmental outcomes (e.g. controlling cattle access to riverbanks and reducing stream bank erosion can help restore the ecological function and protect threatened freshwater turtle nesting sites, while also achieving sediment savings to the Reef). This can be achieved by considering the findings of both this agriculture prioritisation and the environmental prioritisation processes of the WQIP:2015 together.
- Investments should primarily be undertaken in priority areas identified in this document. Investment aimed at achieving water quality outcomes outside of these areas should only be undertaken where it compliments investment within priority catchments and where the investment will enhance water quality outcomes or there is the identification of a new threat / driver not identified through the WQIP development process. This may occur as a

result of new understanding of the science behind the sediment transport processes in the region.

- When determining final project locations within NCs and specific project types, the learnings of, and tools developed for, the WQIP should be used in conjunction with site specific tools such as GIS mapping, satellite imagery, property-scale mapping, previous project reports, case studies, and forage reports.
- Local knowledge including regional experts, project officers, field staff and landholders should all be consulted to 'ground-truth' the desk based analysis.
- On-going support during project implementation is required as well as post on-ground works. This support should be tailored for each project type but will generally be integrated and include extension support in unison with planning and financial incentives.
- Establish and implement a comprehensive monitoring and evaluation process which influences existing projects as well as future designs and investments.
- Stocking rate is considered one of the single greatest drivers of land condition that can be managed in the grazing industry (in contrast to soil type or rainfall for example) and should be a consideration of all projects related to this industry. Knowledge and management of a property's long term stocking rate are critical to achieve good water quality benefits as well as long term profitability.
- Extension support will need to be provided by staff with a high technical knowledge and be multi-faceted (e.g. focus on whole of grazing business management change to achieve environmental outcomes).
- Integrated training and extension alone is not enough to repair all types of degraded land. The amount and type of works required will be determined on a property by property approach dependent on landholder capacity and the highest risk drivers of erosion to achieve whole of property outcomes. Where there are remediation works required with limited private benefit, such as actively eroding gullies, deteriorated riparian areas and bad scalds, there is a need to provide public investment in on-ground works.
- Scalds, alluvial gullies and riparian areas are often interconnected and on-ground works would need to be designed such that all the drivers are addressed. For example, alluvial gullies are often started where cattle access streams to drink. On-ground works should address the cause as well as the symptom (e.g., gully works should include actions to repair scalds / reduced ground cover above the active gully head).
- Focus on areas of fine or highly erodible soils if possible as these are the soils travelling the furthest into, and doing the most damage to, the Reef.

Furthermore, it is important that GPC is clear on its objective that it would like to achieve in regards to environmental outcomes. If the purpose of works is to achieve an improvement in overall Reef health in the Fitzroy Region then funds would be much more effectively spent in the Fitzroy Catchment. Alternatively, if the purpose of works is to achieve a reduction in sediment entering waterways of the Boyne and Calliope rivers and impacting on local freshwater systems as well as near-shore marine environments then the findings of this report are a good starting point.

Below is a recommended planning approach to aid GPC in allocating funds for works aimed at achieving environmental outcomes.

- A clear understanding of the desired outcomes of the funding is perceived by GPC. This will be important in regards to identifying the type and location of works, determining delivery partners and ensuring the program has the most chance of achieving desired outcomes.
- Engage stakeholders to develop project proposals. This could be done through a competitive tender process or through a coordinated workshop in which the tools developed through the WQIP:2015 process are used in conjunction with site specific resources (e.g. forage reports, satellite imagery, local rainfall data) and local knowledge/expertise. It is through this process that the development of projects that achieve multiple environmental outcomes should be encouraged.
- Review and assess projects against a strict criteria that is aimed at achieving the desired outcomes established at the start of the process. It is important that projects that do not demonstrate that they are in priority locations or habitats are not selected if the most effective environmental outcomes are to be achieved. Likewise, projects that are not undertaking works that demonstrate best management (or better) practice should also not be selected.

## 4.2. Delivery

A mix of delivery mechanisms will be required to achieve water quality improvements, and these include both financial incentives and direct training and extension to support infrastructure and management change. The mix of delivery mechanisms needs to occur in a whole of business management environment with Grazing BMP providing an existing and effective program through which to engage graziers. It is recommended that all landholders that receive public funds for infrastructure works are required to undertake the appropriate BMP program for their industry and develop an *action plan* identifying the management and infrastructure changes required to shift to improved practices. Given that the production margin from cattle grazing in the Fitzroy Basin will decline further with the likely progression of an El Niño, private funds for infrastructure and improved soil management are limited. Higher levels of co-investment on a sliding scale may be required; this could be a case of funding up to 75% of on-ground works in some instances.

## 4.3. Monitoring and Evaluation

Monitoring and evaluation provides an insight into the success of the program/project by providing the proof that the initiative is tracking as planned and achieving the desired outcomes. Effectively designed and implemented monitoring and evaluation identifies risks, allows time for calculated adjustments if required and creates a culture of continual improvement for the participant, delivery organisation and investor. There are three principles in monitoring and evaluating of all investments:

- Has the project been effective and efficient in expenditure of funds and have on ground works been completed as prescribed?

- Has there been practice and management changes adopted by the land manager (both agriculture and environment)?
- Has there been a quantifiable outcome achieved (water quality and / or environmental)?

As a minimum, it is recommended that the following data is collected per on-ground project:

- Pre-works site photos (set up a photo monitoring point) and Stocktake land condition assessments.
- Pre-works management practice being undertaken.
- Shape file of project area with proposed infrastructure.
- Training completed through the project and extension support provided.
- Post-works site photos.
- Post-works management practice implemented.

Depending on the project type or duration, some mid-project monitoring may also be required. This data is then modelled and the estimated sediment saving calculated. This can then be compared against the costs of works to determine the overall value for money when compared against similar works.

## 4.4. Review

As part of any project delivery plan, regular review is required to assess the effectiveness of programs, guide decision-making, incorporate new knowledge and to improve future delivery. Interim reviews should be undertaken as new data becomes available (e.g., new modelled outputs of sediment delivery rates and sources, changes in our understanding of what constitutes 'best practice') and findings incorporated in to the program's implementation.

## 5. Conclusion

This report presents a summary of the priority areas towards which GPC can direct investment, along with recommended management actions to encourage practice change, within the grazing industry to achieve sediment savings to local freshwater systems as well as near-shore marine environments. The 17 NCs in the Boyne and Calliope regions have been described and prioritised based on a detailed scientific processes. The management priorities for each of these NCs to reduce sediment loads have also been identified (Table 4). When determining final project locations within NCs and specific project types, the key learnings identified in Section 4.1, along with the tools developed for the WQIP:2015, should be considered as a whole.

## 6. Closure

This report was prepared by FBA for GPC using the findings of the WQIP:2015 supporting studies.

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