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The social and economic cost of the North and Far North Queensland Monsoon Trough (2019)

Queensland Reconstruction Authority

June 2019

Deloitte Access Economics

Contents

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Acronyms

ABS	Australian Bureau of Statistics
ACCC	Australian Competition and Consumer Commission
DAF	Department of Agriculture and Fisheries
DES	Department of Environment and Science
DESBT	Department of Employment, Small Business and Training
DHPW	Department of Housing and Public Works
DRFA	Disaster Recovery Funding Arrangements
DSDMIP	Department of State Development, Manufacturing, Infrastructure and Planning
DTMR	Department of Transport and Main Roads
FRG	Functional Recovery Group
GRP	Gross Regional Product
GVA	Gross Value Added
ICA	Insurance Council of Australia
LGA	Local Government Area
NCD	Non-communicable diseases
NDRRA	Natural Disaster Relief and Recovery Arrangements
OBPR	The Office of Best Practice Regulation
PHAS	Personal Hardship Assistance (PHAS) Grants
QAS	Queensland Ambulance Service
QGIF	Queensland Government Insurance Fund
QRA	Queensland Reconstruction Authority

Executive summary

The *North and Far North Queensland Monsoon Trough – 25 January 2019 to 14 February 2019* ('the Monsoon Trough') has imposed billions of dollars in direct costs to individuals, businesses, councils and government. The region experienced heavy rainfall and major flooding across more than 100 million hectares – 56% of the state's land. The major economic hub of Townsville was inundated and large sections of grazing land and critical infrastructure were damaged or destroyed.

Beyond these impacts, there is also a broad set of flow-on impacts that will take months or years to recover from. This includes impacts from business disruption, as primary producers restock and rebuild and tourism and other trading take time to return to usual. It also includes environmental damage to productive land, waterways and coastal ecosystems that are yet to be fully realised, particularly in the context of a region that had previously been coping with prolonged drought.

There is also anticipation of a high and lasting social cost, with some consequences for people's health and wellbeing expected to persist for the rest of their lives. These include intangible impacts on physical and mental health, family and community cohesion. By the end of March 2019, more than 60,000 people had accessed psychological first aid and more than 100,000 people had applied for personal hardship assistance grants. The human and community impact of this event is already substantial.

This report defines and considers the economic and social cost of the Monsoon Trough, including direct and indirect costs. It draws on preliminary data available, as at 12 April 2019, from the Queensland Reconstruction Authority (QRA), the Insurance Council of Australia (ICA) and other government agencies in the eight weeks following the disaster event. The purpose of this report is to provide useful information for understanding the magnitude and type of social and economic impacts associated with the Monsoon Trough. This is important for aligning the identified impacts to the appropriate lines of functional recovery which will serve as a useful tool for evaluating existing disaster recovery planning and operations, as well as inform future disaster recovery and resilience policy planning.

At this time, impact assessments are still underway and the full cost of the disaster is yet to be determined. Consequently, the estimates developed in this report provide a conservative estimate by only considering those impacts where there is sufficient data to undertake quantification. It also acknowledges a broader set of impacts that are yet to be quantified, recognising that all identified outcomes are important and relevant to recovery planning and future mitigation decision-making. As such, costs included in this report should not be considered as a 'total cost' assessment, given that some costs estimated are transitory (for example, restoration or repair costs of infrastructure) and some costs capture a longer lasting impact to the community (for example, mental health and social impact costs).

This report estimates the social and economic cost of the Monsoon Trough to North, Far North and North West Queensland will exceed $5.68 billion. By value, this is approximately 14% of annual gross regional product (GRP) in the affected local government areas.[1] A summary of these costs is provided below.

[1] The comparison of social and economic cost against GRP is provided to contextualise the extent of the impact to this region. This is not intended to be an estimation of the shock to the economy as a result of the natural disaster.

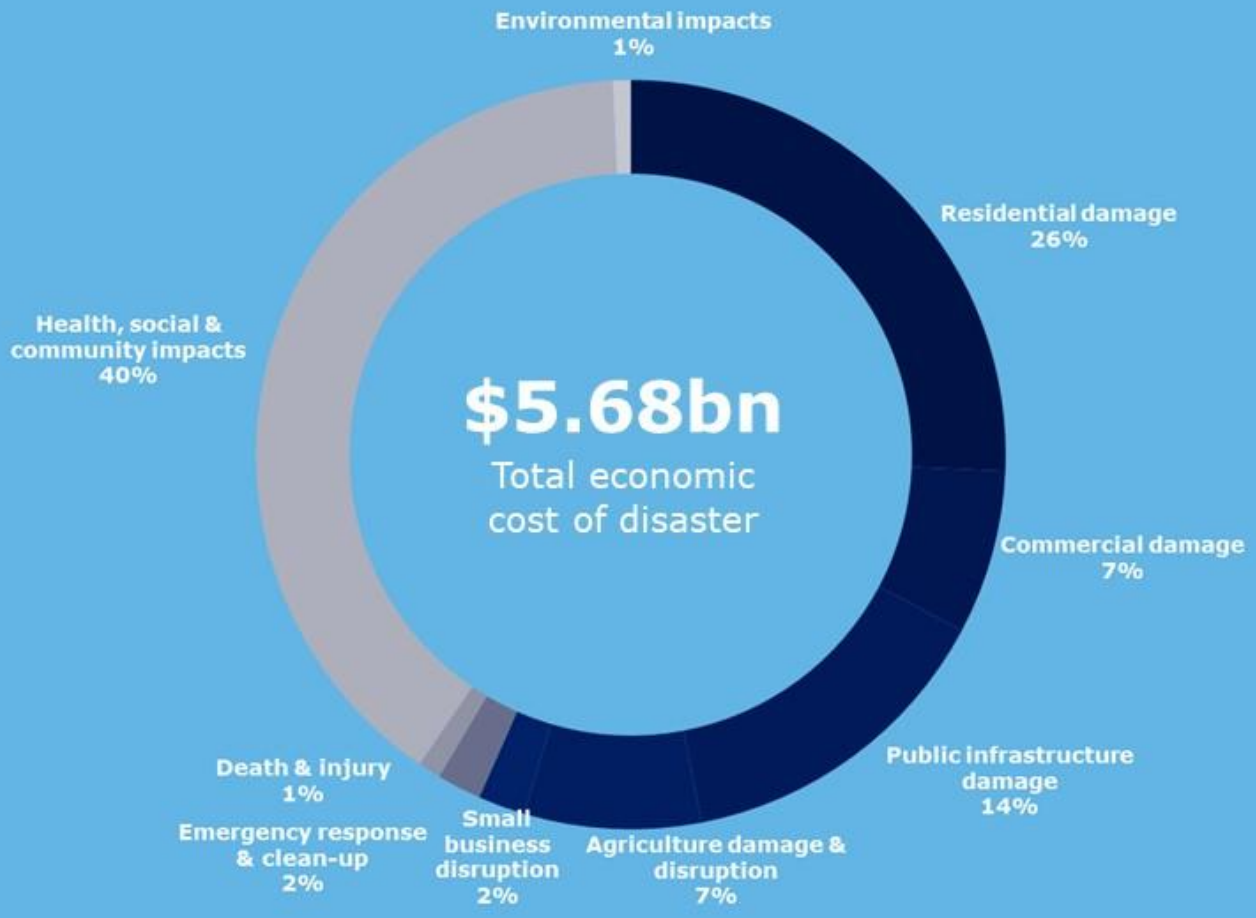
Table i: Key components of social and economic cost

Key components	$m
Residential damage	$1,460
Commercial damage	$402
Public infrastructure damage	$807
Agriculture damage and disruption	$432
Small business disruption	$116
Emergency response and clean-up	$109
Deaths and injury	$56
Health, wellbeing and community impacts	$2,255
Environmental impacts	$44
Combined social and economic cost	**$5,681**

Source: Deloitte Access Economics estimates.

Social and economic costs

North and Far North Queensland Monsoon Trough



39
Local Government Areas affected

$6.2bn
Average annual cost of disasters in Queensland

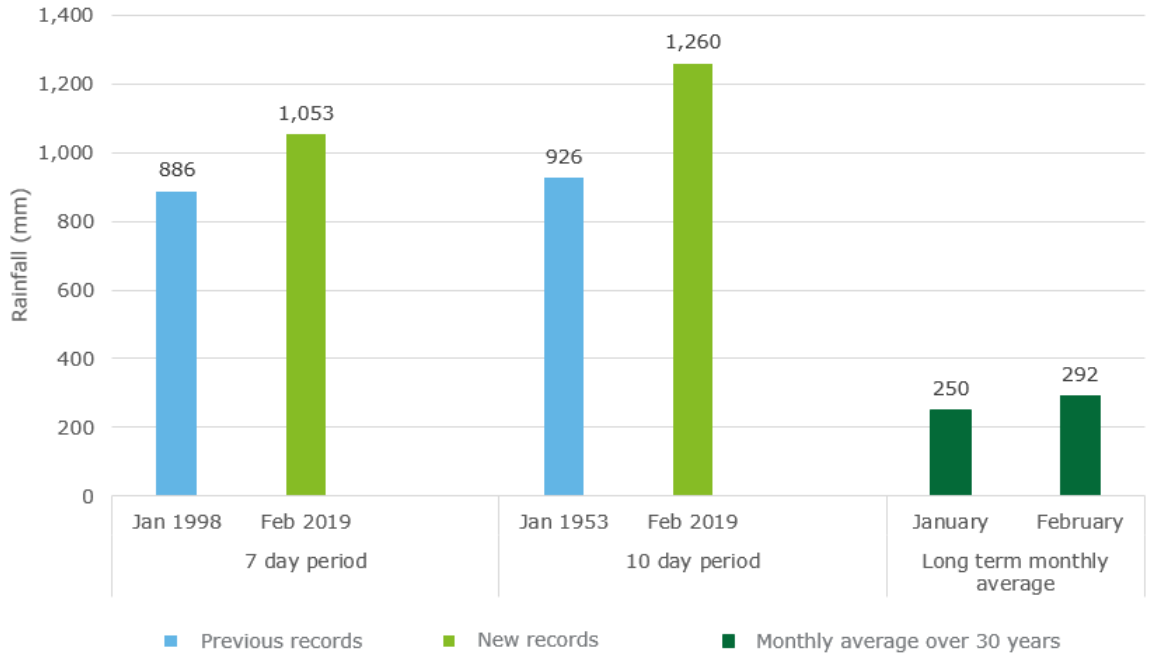
1 Introduction

1.1 Event details

From 25 January 2019 to 14 February 2019, North, Far North and North West Queensland experienced unprecedented heavy rainfalls and major flooding. Due to an active monsoon trough and a slow-moving low pressure system, the region hit new rainfall records with regard to geographic spread, duration and intensity of rainfall.[2]

More than 100 million hectares, covering an estimated 56% of the state's land, were affected and 39 local government areas (LGAs) were activated under the Disaster Recovery Funding Arrangements (DRFA).[3] The major economic hub of Townsville was inundated and large sections of grazing land and critical infrastructure were damaged or destroyed. Accumulated rainfall over consecutive days in Townsville exceeded previous records, over both a 7-day and 10-day period (Chart 1.1).

Chart 1.1: February 2019 accumulated rainfall (mm) in Townsville, against previous records



Source: Bureau of Meteorology (2019).

1.2 Economic and social context

The regions of North, Far North and North West Queensland are vulnerable to natural disasters, including storms, floods, cyclones and bushfires. More than any other state, around 60% of

[2] Bureau of Meteorology 'An extended period of heavy rainfall and flooding in tropical Queensland' (Special Climate Statement 69, 8 March 2019) <http://www.bom.gov.au/climate/current/statements/scs69.pdf>.
[3] The affected LGAs were: Aurukun, Barcoo, Boulia, Burdekin, Burke, Cairns, Carpentaria, Cassowary Coast, Charters Towers, Cloncurry, Cook, Croydon, Diamantina, Douglas, Etheridge, Flinders, Hinchinbrook, Hope Vale, Kowanyama, Lockhart River, Longreach, Mackay, Mapoon, Mareeba, McKinlay, Mornington, Mount Isa, Napranum, Northern Peninsula Area, Palm Island, Pormpuraaw, Richmond, Torres, Torres Strait Island, Townsville, Whitsunday, Winton, Wujal Wujal and Yarrabah.

disaster-related costs to the Australian economy are borne by Queensland.[4] Many of these relate to disasters affecting the region.

Every LGA of the 39 activated for the Monsoon Trough disaster has had at least one DRFA/NDRRA[5] activation in the past 12 months, and been impacted by at least five disaster events since 2011.[6, 7] The Insurance Council of Australia (ICA) has estimated damage of another catastrophic event in the region - the North Queensland floods (March 2018) - at more than $16 million in insured losses.[8] Further, disaster-related damage to public infrastructure alone has cost these councils an estimated $2.2 billion dollars since 2011, including $588 million since 2017.[9]

Table 1.1: Recent regional disaster events

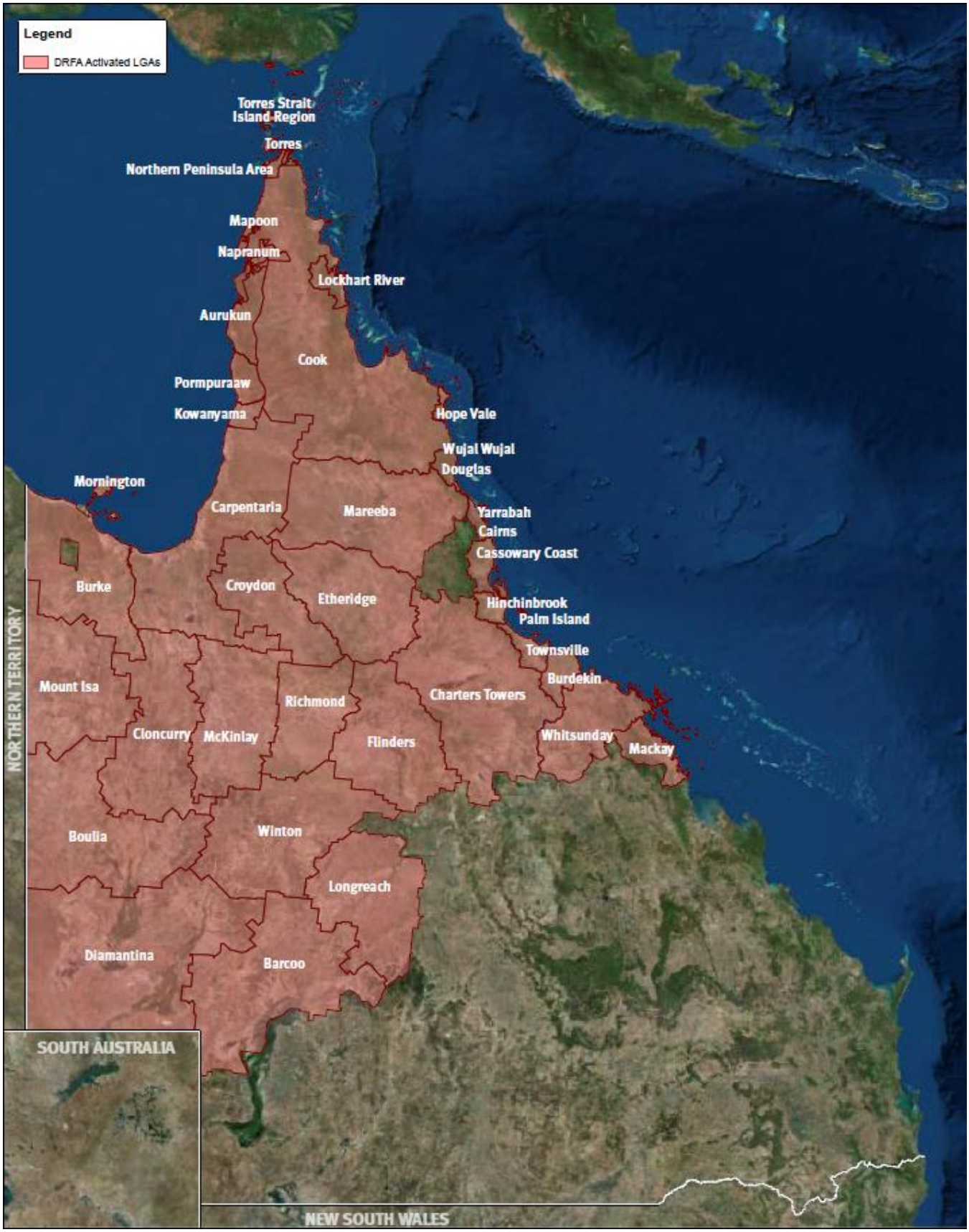
Event	Date
Severe Tropical Cyclone Trevor	19 - 27 March 2019
North and Far North Queensland Monsoon Trough	25 January - 14 February 2019
Tropical Cyclone Penny	24 December 2018 - 4 January 2019
Tropical Cyclone Owen	9 - 17 December 2018
Mareeba Tablelands Bushfires	17 September – 9 October 2018

Source: Queensland Reconstruction Authority (2019)[10].

These disasters have had direct and indirect economic and social impacts on individuals, communities and businesses. Both the up-front costs and the longer term community impacts will depend in part on the resilience of the community to withstand, respond to and recover from disaster events.

[4] Deloitte Access Economics, *Building resilience to natural disasters in our states and territories* (report commissioned by the Australian Business Roundtable for Disaster Resilience & Safer Communities, 2017).
[5] Natural Disaster Relief and Recovery Arrangements (NDRRA) was replaced by the DRFA in November 2018.
[6] According to Queensland Reconstruction Authority supplied information.
[7] Queensland Reconstruction Authority, *Activations* (2019) <https://www.qra.qld.gov.au/activations>.
[8] Insurance Council of Australia, *ICA Catastrophe Dataset* (28 February 2019) <http://www.icadataglobe.com/access-raw-hazard-datasets>.
[9] According to Queensland Reconstruction Authority supplied information.
[10] Queensland Reconstruction Authority, *Activations* (2019) <https://www.qra.qld.gov.au/activations>.

Figure 1.1: Map of affected LGAs in the 2019 North and Far North Queensland Monsoon Trough



Source: Queensland Reconstruction Authority (2019)

The regional economy – defined by the 39 affected LGAs – was valued at $40 billion in 2017-18, equivalent to 13% of the Queensland state economy.[11] Key economic drivers across the three regional clusters include agriculture, mining and tourism:

- The **North Queensland** economy (including Townsville) is relatively diversified. The region supports mining and agriculture processing and trade and employment is increasingly driven by services, defence and tourism.[12]
- **North West Queensland** is dominated by copper ore silver-lead-zinc ore mining, supported by beef cattle farming and expanding service-based sectors.[13]
- **Far North Queensland** is partly led by government services, education and health care, but tourism, specialised agriculture and bauxite mining are particular areas of regional competitiveness.[14]

Agriculture along the coastal corridor is centred around sugarcane, vegetables and fruit, while the inland areas are focused on livestock, particularly beef cattle.[15] The Monsoon Trough affected more than 600 primary producers. Prior to the flood event, many shires in the North West had already reduced stocking rates in response to prolonged drought. The Queensland government has estimated that stock numbers have been reduced from 1.4 million cattle to as low as 750,000 due to the drought.[16] Additional stock losses following the Monsoon Trough disaster has exacerbated this existing sector downturn.

Mining and minerals operations across the region employ over 15,000 people across a sparsely populated environment.[17] The region dominates Australian exports of copper, zinc and lead which are transported, largely by rail, to the Port of Townsville. The Monsoon Trough has caused major delays and disruptions to mining activity, largely as a consequence of the closure of the Mount Isa rail line. This has affected a number of mining operations as well as the flow-on supply chain.

Tourism accounts for around 25% of gross regional product (GRP) and 98,000 jobs[18]**.** The region includes popular destinations including the Great Barrier Reef, Daintree and Whitsunday Islands. Disaster events can deter visitors from the region and are anticipated to reduce short to medium term visitation numbers.

The Australian Bureau of Statistics (ABS) estimates the population for the affected area to include nearly 680,000 residents and 54,000 businesses in 2018.[19] The most populous areas affected were Townsville, Cairns, Mackay, Whitsunday and the Cassowary Coast. Around 193,000 people live in the City of Townsville, which suffered significant damage with almost 3,300 properties damaged and thousands of residents evacuated.[20]

The main industries of employment, according to the 2016 Census, are health care and social assistance (13%), retail trade (10%), and public administration and safety (9%).[21] However, the region also has relatively high unemployment of approximately 9% in Townsville and 8.31% across the broader region – higher than the overall Queensland unemployment rate of 6.2%[22]. The

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[11] .idcommunity, *National economic indicators for local government areas, 2017/18* (2018) <https://economic-indicators.id.com.au/?es=6&StateId=3>.
[12] Queensland Government Economic Research, Manufacturing and Industry Development, 'North Queensland – Regional Economic Growth Drivers' (October 2018).
[13] Queensland Government Economic Research, Manufacturing and Industry Development, 'North West Queensland – Regional Economic Growth Drivers' (October 2018
[14] Queensland Government Economic Research, Manufacturing and Industry Development, 'Far North Queensland – Regional Economic Growth Drivers' (October 2018).
[15] According to Queensland Reconstruction Authority supplied information.
[16] Four of the affect LGAs were drought declared on 1 January 2019
[17] Australian Bureau of Statistics, *2016 Census – Counting Persons, Place of Usual Residence (MB)* (2016).
[18] Deloitte Access Economics, Regional Tourism Satellite Accounts 2016-17
[19] Australian Bureau of Statistics, *2016 Census – Counting Persons, Place of Usual Residence (MB)* (2016).
[20] Gissing, A, O'Brien, J, Hussein, S, Evans, J, Mortlock, T 2019. Townsville 2019 floods: insights from the field, Bushfire and Natural Hazards CRC, Melbourne, 2019.
[21] Excluding the following industry of employment responses: 'Inadequately described', 'Not stated', and 'Not applicable'.
[22] Australian Bureau of Statistics, *2016 Census – Counting Persons, Place of Usual Residence (MB)* (2016).

overall population has been in decline for 19 of the LGAs, including 9 of the 11 LGAs[23] which the Queensland Reconstruction Authority (QRA) define to have experienced the hardest hit from the Monsoon Trough.

The affected region is relatively disadvantaged, with 19 of the 39 affected LGAs having a score of one against the ABS Index of Relative Socio-economic Disadvantage (IRSD)[24, 25]. Approximately half of the population have completed year 12 or equivalent schooling.[26]

During the event, communities were cut off from their places of work and schooling. The region's major rail line was severely damaged and more than 6,000 kilometres of roads were affected, with around 3,000 kilometres remaining closed for over a week.[27] 100 schools were closed as a result of the flood event,[28] for example at Oonoonba State School, where seven school buildings were damaged.[29]

The region's underlying socioeconomic vulnerability is likely exacerbated by the human and social impacts of the disaster event. By 27 March, more than 116,000 people had applied for personal hardship assistance,[30] 63,000 calls had been made to the Community Recovery Hotline and 62,248 people had been assisted with psychological first aid through the Salvation Army, UnitingCare Queensland – Lifeline, and Australian Red Cross.[31]

The region also suffered environmental damage with implications for how agriculture, tourism and the ecosystem is likely to recover. Large amounts of sediment have been disturbed and entered local waterways. Streambank retreat has been estimated to be up to 40 metres in some areas, including loss of riparian vegetation. Coastal areas, including those surrounding the reef, have lost large areas of sand and coastal habitat. Post-disaster, the region is at risk of pest and weed outbreaks that could cause further damage to the agricultural sector and environment.[32]

[23] The QRA has identified 11 local government communities as being the hardest hit by the Monsoon Trough, this includes; Burdekin, Burke, Carpentaria, Cloncurry, Douglas, Flinders, Hinchinbrook, McKinlay, Richmond, Townsville, and Winton. According to Queensland Reconstruction Authority supplied information.
[24] The Index of Relative Socio-economic Disadvantage (IRSD), which ranks geographic regions based on relative socioeconomic disadvantage using Census data. A low score (one being the lowest, and ten the highest) indicates relatively greater disadvantage, for example many households with low income, or many people in unskilled occupations.
[25] Australian Bureau of Statistics, *2033.0.55.001 - Census of Population and Housing: Socio-Economic Indexes for Areas (SEIFA), Australia, 2016* (27 March 2018) <https://www.abs.gov.au/ausstats/abs@.nsf/Lookup/by%20Subject/2033.0.55.001~2016~Main%20Features~IRSD~19>.
[26] Australian Bureau of Statistics, *2016 Census – Counting Persons, Place of Usual Residence (MB)* (2016).
[27] According to Queensland Reconstruction Authority supplied information.
[28] 38 schools remained closed as of April 2019.
[29] According to Queensland Reconstruction Authority supplied information.
[30] According to Queensland Reconstruction Authority supplied information.
[31] According to Queensland Reconstruction Authority supplied information.
[32] According to Queensland Reconstruction Authority supplied information.

2 Economic framework

2.1 Overview of economic framework

The Monsoon Trough event has had wide-ranging impacts on individuals, businesses and communities. The impacts of the flood disaster are ongoing and still being assessed. The purpose of this report is to estimate the economic and social impacts of the flood disaster using information collected to date by the QRA, in conjunction with other Queensland Government agencies. The purpose of the report is to provide useful information for understanding the magnitude and type of social and economic impacts associated with the Monsoon Trough. This is important for aligning the identified impacts to the appropriate lines of functional recovery which will serve as a useful tool for evaluating existing disaster recovery planning and operations, as well as inform future disaster recovery and resilience policy planning.[33]

The economic and social costs of the disaster should be distinguished from the financial costs. In an economic analysis, financial costs such as the direct damage to residential and commercial buildings are only a portion of the overall social and economic cost, and includes non-market impacts such as broader social impacts relating to death, injury, health and wellbeing.[34] Further, an economic analysis looks at **the net impact of the disaster**, meaning that the overall estimate of economic costs does not include monetary transfers between different entities (to avoid double counting), and costs that would have been incurred in the absence of the disaster event.[35]

To estimate the social and economic cost of the disaster, this report identifies and where possible quantifies, the value of the impacts of the flood disaster. As many of the social and economic impacts measured do not have a market value, a key and complex component of the analysis involves estimating a monetary value of those impacts. In these cases, valuation proxies from literature, such as the statistical value of life, have been used. Care has been taken in selecting appropriate proxies for monetisation to align with the context of this disaster event. Some of the intangible impacts cannot be reliably monetised in the absence of detailed non-market valuation studies. Where an appropriate non-market valuation approach for a given impact is not available or the impacts of the disaster are uncertain (due to for example, missing or incomplete data) impacts are discussed qualitatively.

The approach taken in this report draws on fundamental research conducted by the Bureau of Transport Economics (BTE) (now, the Bureau of Infrastructure, Transport and Regional Economics (BITRE)), and Deloitte Access Economics on the economic cost of natural disasters.

- A **BTE 2001** report developed a framework for estimating the economic cost of financial disasters, which included costs that should be included in the analysis and suggested approaches for estimation.[36]
- A **Deloitte Access Economics 2013** report adapted BTE's framework to develop a bottom-up approach to estimating the economic cost of disasters in Australia, using various available data relating to disaster impacts.[37]
- A **Deloitte Access Economics 2016** report revised the framework further to enable the estimation of broader, long-term social costs of natural disasters, including impacts on health and wellbeing.[38]

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[33] Economic modelling of the disaster impact has also been undertaken by Queensland Treasury and the Department of State Development, Manufacturing, Infrastructure and Planning (DSDMIP) for cabinet briefing purposes.
[34] Deloitte Access Economics, *Building our nation's resilience to natural disasters* (report commissioned by the Australian Business Roundtable for Disaster Resilience and Safer Communities, 2013).
[35] Bureau of Transport Economics 'Economic costs of natural disasters in Australia' (Report 103, 2001).
[36] Bureau of Transport Economics 'Economic costs of natural disasters in Australia' (Report 103, 2001).
[37] Deloitte Access Economics, *Building our nation's resilience to natural disasters* (report commissioned by the Australian Business Roundtable for Disaster Resilience and Safer Communities, 2013).
[38] Deloitte Access Economics, *The economic cost of the social impact of natural disasters* (report commissioned by the Australian Business Roundtable for Disaster Resilience and Safer Communities, 2016).

2.2 Approach in this report

This report applies the framework developed and refined through the above mentioned reports to enable the estimation of tangible direct, tangible indirect and intangible costs associated with the flood disaster, using a bottom-up approach.[39] These cost categories are defined as follows:[40]

- **Direct costs** are those that are incurred as a result of the disaster event. These costs have a market value such as the damage to residential or commercial buildings, or public infrastructure.
- **Indirect costs** are any flow-on effects that are not directly caused by the natural disaster but arise as a result of the consequences of the damage and destruction. Examples of such costs include business disruption and environmental degradation.
- **Intangible costs** are the direct and indirect damages that cannot be easily priced. Examples of intangible costs include social costs associated with death, injury, and health and wellbeing, as well as costs related to environmental impacts. While tangible costs tends to be one-off costs, intangible impacts, particularly those related to social impacts, can persist over a person's lifetime, and may be multiple or compounding (i.e. not necessarily linear).

Figure 2.1 provides a high-level snapshot of the economic framework underpinning the estimation of the direct and indirect costs of the disaster to the region of North, Far North and North West Queensland.

2.3 Assumptions and limitations

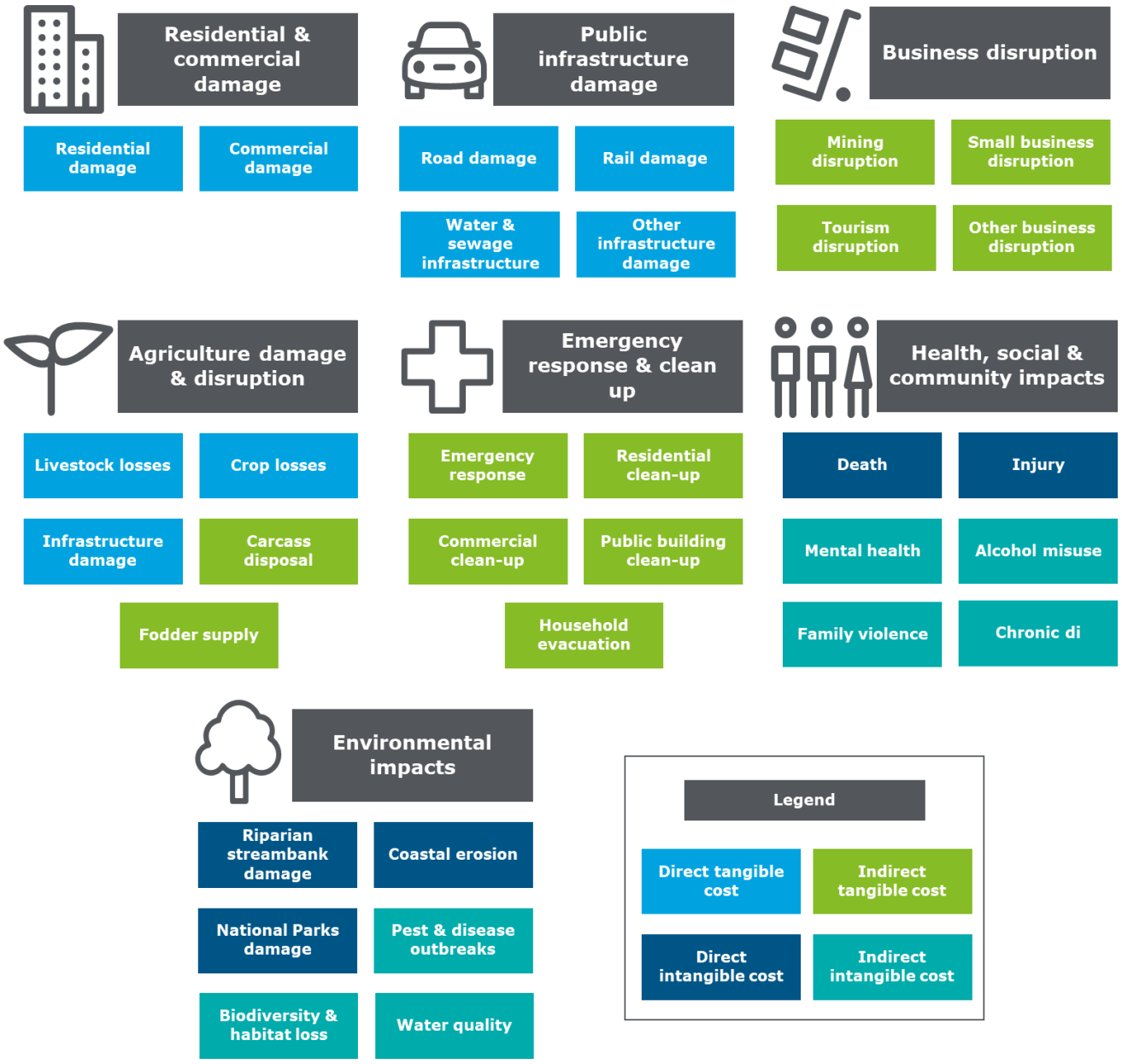
This report considers the social and economic impact of the disaster to the 39 LGAs impacted by the Monsoon Trough. As such, the results determine the social and economic cost of the disaster to the region of North, Far North and North West Queensland, rather than the state as a whole. This is because there are likely to be economic transfers from one region to another in response to the disruption. There may also be flow-on impacts to stakeholders in other regions which are not captured in the analysis.

This report draws on information supplied by the QRA regarding the impacts of the disaster in the eight weeks following the event. These data were provided to QRA by several government departments involved in response and recovery activities. Given this timeframe, several impacts to people, businesses, communities and the environment are still being assessed and data collection is ongoing (i.e. it takes up to three years for insurance claims data to be collected on a particular disaster event). As such, the social and economic cost estimate provided in this report is conservative and based on the information available as at 12 April 2019. It is expected that additional data would most likely revise the estimate upwards.

Costs included in this report should not be considered as a 'total cost' assessment given that some costs estimated are transitory (for example, restoration or repair costs of infrastructure) and some costs capture a longer lasting impact to the community (for example, mental health and social impact costs). A cost-benefit analysis has not been undertaken to take into account the timing and duration of identified impacts. As such, the estimates presented here should not be considered as the total cost of the natural disaster.

[39] A bottom-up approach looks at individual cost categories and uses data of the actual impacts of the disaster to build up a total picture of the disaster's costs.
[40] Deloitte Access Economics, *The economic cost of the social impact of natural disasters* (report commissioned by the Australian Business Roundtable for Disaster Resilience and Safer Communities, 2016).

Figure 2.1: Framework for estimating the social and economic cost of the flood disaster



Source: Deloitte Access Economics.

3 The social and economic cost of the Monsoon Trough

3.1 Introduction

Deloitte Access Economics has estimated the social and economic costs of the disaster based on data provided by QRA as at 12 April 2019. The estimate excludes a number of impacts which have been considered qualitatively due to data limitations or implicit difficulty associated with monetisation (e.g. some social and environmental impacts).

Unless otherwise specified, data have been provided by various Queensland Government functional recovery groups in place to support disaster recovery planning and activities. It has not been independently verified as part of this analysis.

All data is presented in 2019 dollars.

3.2 Social and economic cost summary

The preliminary estimated regional social and economic cost of the *North and Far North Queensland Monsoon Trough – 25 January to 14 February 2019* is $5.68 billion. By value, this impact is approximately 14% of GRP in 2017-18.[41] This includes $3.15 billion in direct costs and $2.53 billion in indirect costs (as a result of flow-on effects that are not directly caused by the disaster itself) (Table 3.1).

Table 3.1: Estimated direct and indirect costs

	$bn
Direct costs	$3.15
Indirect costs	$2.53
Combined social and economic cost	**$5.68**

Source: Deloitte Access Economics estimates

This section summarises each of the components of total social and economic cost estimated in this report. The following sections break down these costs in further detail. The larger cost is $3.15 billion in direct losses to homes, buildings, livestock and public assets (Table 3.2). This is closely followed by indirect social costs to health, wellbeing and communities at $2.53 billion. Compared to the direct costs, social costs are largely intangible and will be incurred over the long-term in the months and years to come.

These estimates are conservative and have been developed based on the data available in the eight weeks immediately following the disaster event. For example, impact assessments are ongoing to evaluate the extent of damage, including for infrastructure, agriculture, injuries and the environment. Experience from previous disaster events suggests that there are additional intangible impacts that could affect individuals and their communities over the long term.[42] These

[41] The comparison of social and economic costs against GRP is provided to contextualise the extent of the impact to this region. This is not intended to be an estimation of the shock to the economy as a result of the natural disaster.
[42] Deloitte Access Economics, *The economic cost of the social impact of natural disasters* (report commissioned by the Australian Business Roundtable for Disaster Resilience and Safer Communities, 2016).

social and environmental consequences are complex and difficult to measure but suggest the social and economic cost of the disaster could be even higher than those quantified in this report.

Table 3.2: Key components of total social and economic cost

Key components	$m
Residential damage	$1,460
Commercial damage	$402
Public infrastructure damage	$807
Agriculture damage and disruption	$432
Small business disruption	$116
Emergency response and clean-up	$109
Deaths and injury	$56
Health, wellbeing and community impacts	$2,255
Environmental impacts	$44
Combined social and economic cost	**$5,681**

Source: Deloitte Access Economics estimates

Environmental impacts are underestimated as this report primarily considers the direct environmental losses estimated according to their replacement value, based on available data.[43] The flow-on, intangible impacts cannot be reliably monetised without detailed non-market valuation studies. This includes impacts of sedimentation and asset damage on water quality, habitat and biodiversity.

While the above estimates include some disruption impacts to agriculture and small business, broader business disruption and supply chain impacts have not been included separately. These impacts cannot be reasonably determined given the difficulty in quantifying the commercial impacts for individual businesses that have been offset by an uptake in business activity elsewhere in the region (for example, increases in construction activity). In addition, these estimates are partially captured by commercial damage estimates, which includes insured business losses. For this reason, business disruption is excluded to avoid double counting.

These disaster costs are not outside the norm for Queensland. Deloitte Access Economics (2017) estimated that natural disasters have cost an average $6.2 billion per year to the State in the 10 years to 2016.[44] Some one-off events have exceeded this, including the 2010-11 Queensland Floods which cost an estimated $14.6 billion (see box below).

[43] It is recognised that some estimation approaches are more robust than others (i.e. a willingness to pay survey). The estimation approach used here is based on data available at the time of the report. Estimates based on better quality of data will be more robust than others.
[44] Deloitte Access Economics, *Building resilience to natural disasters in our states and territories* (report commissioned by the Australian Business Roundtable for Disaster Resilience and Safer Communities, 2017).

Queensland Floods 2010-11

The 2010-11 floods affected more than 78% of Queensland, 36 people died and over 2.5 million people were affected[45].

Deloitte Access Economics estimated the cost of the disaster in its report for the Australian Business Roundtable for Disaster Resilience and Safer Communities. The total economic cost of this disaster, including direct and indirect impacts, was estimated at $14.6 billion dollars (2015 dollars).

The economic cost of natural disasters in Queensland

In 2017, Deloitte Access Economics released a report that considered the economic cost of natural disasters in Australia's states and territories.[46] Key findings from that report are outlined below.

3.3 Residential and commercial damage

3.3.1 Residential damage

Direct damage to homes and residential property is one of the largest costs associated with disaster events.

The Monsoon Trough event damaged 3,369 homes, with 1,255 (37%) classified as uninhabitable and 2,114 (63%) assessed to have minor damage. As at 14 March, the ICA reported domestic claims valued at $817 million. Of these claims, 48% were lodged for insured buildings, 34% for contents and 17% for motor vehicles.

It is recognised that in the affected region, insurance premiums are costly and a high proportion of residences are uninsured or underinsured (see box below). Furthermore, analysis of historical

[45] Queensland Floods Commission of Inquiry, *Queensland Floods Commission of Inquiry Final Report* (2012) <http://www.floodcommission.qld.gov.au/__data/assets/pdf_file/0007/11698/QFCI-Final-Report-March-2012.pdf>.
[46] Deloitte Access Economics, *Building resilience to natural disasters in our states and territories* (report commissioned by the Australian Business Roundtable for Disaster Resilience and Safer Communities, 2017).

claims data suggests that disaster-related insurance claims tend to be made over a three year period following the event – with 48% of claims made in the year following the natural disaster, 32% the year after that and 20% in the third year following.[47] As such, the actual cost of residential damage could be higher than current estimates.

Insurance premiums in Northern Australia

Prior to 2011, flood cover was not widely offered in Northern Australia. In 2012, the Australian Government introduced legislation to increase the offering of flood cover to residential property. This led to an increase in premiums for consumers in high flood risk areas.

The Australian Competition and Consumer Commission's (ACCC) ongoing Northern Australia Insurance Inquiry indicates that insurance affordability is increasingly recognised as a challenge for liveability and subsequently, economic prosperity in the region.[48]

High premiums and a lack of transparent information about the potential cost impact of excluding flood cover mean that a high proportion of people are uninsured.

Underinsurance in Australia is also a concern. The Productivity Commission's inquiry in to national disaster funding suggested that consumers' lack of access to information, or lack of understanding about risk and insurance coverage can lead to underinsurance.[49] Given the high cost of insurance coverage in northern Australia, consumers may underestimate the value of their residences to avoid high premiums, unaware or sceptical about the impact this will have on their level of cover.

The Monsoon Trough may have a further impact on insurance premiums in this region. Premium adjustments may be made by insurance companies operating in this region if these companies experienced a loss as a result of the Monsoon Trough.

To estimate the total (insured and uninsured) cost to residential property, ICA data were adjusted by an estimated ratio of insured losses to uninsured losses developed by Deloitte Access Economics. Under this approach, **residential property damage is estimated at $1.46 billion**.

3.3.2 Commercial damage

There are a number commercial businesses operating in the impacted region that have suffered direct property damage. The area supports a large number of agricultural, mining, manufacturing and tourism activities. There are more than 46,000 businesses in the 11 most impacted councils, including 12,000 businesses in Townsville alone. There are around 450 primary producers in the worst affected areas. The impacted zone, activated in accordance with the DRFA, includes more than 17,000 small businesses.[50] A preliminary survey of small businesses, conducted by the Department of Employment, Small Business and Training (DESBT) has identified 214 respondents (out of 626 participants) with damage to premises.[51]

[47] Deloitte Access Economics, *Building our nation's resilience to natural disasters* (report commissioned by the Australian Business Roundtable for Disaster Resilience and Safer Communities, 2013).
[48] Australian Competition and Consumer Commission, 'Northern Australia Insurance Inquiry' (First interim report, November 2018) <https://www.accc.gov.au/system/files/Northern%20Australia%20Insurance%20Inquiry%20-%20First%20interim%20report%202018.PDF>
[49] Productivity Commission, 'Natural Disaster Funding Arrangements' (Inquiry Report Vol 1, No 74, 17 December 2014) <https://www.pc.gov.au/inquiries/completed/disaster-funding/report/disaster-funding-volume1.pdf>.
[50] There were 5 LGAs activated for Category C assistance for small businesses: Cloncurry, Flinders, McKinlay, Richmond and Townsville.
[51] Undertaken by the Department of Employment, Small Business and Training. Results as of 11 March 2019.

The ICA received 2,458 commercial property claims as at 14 March 2019, with a total value of $225 million[52, 53]. Using the same approach as for residential damage to account for insurance and underinsurance, the cost of **commercial property damage is estimated at $402 million**.

It is noted that a number of the recorded claims relate to business disruption (15%). As such, while the estimate mostly relates to direct business costs, it also includes some indirect costs.

3.4 Public infrastructure damage

Public infrastructure includes damage to roads, transport networks, communications systems, schools and other public assets. Much of the cost associated with restoring public infrastructure is covered by Category B assistance provided under the DRFA between Queensland and the Commonwealth. Other asset damage is insured or falls to councils, state governments and other asset owners to repair.

Damage to public infrastructure is estimated to be $807 million. Table 3.3 summarises these impacts which are detailed below, in the remainder of this section.

Table 3.3: Breakdown of public infrastructure costs

	$m
Road damage	$742.1
Rail damage	n.a.
Water and sewage infrastructure	$14.5
Other public asset damage	$50.0
Combined cost	**$806.6**

3.4.1 Road damage

The event caused extensive damage to Queensland's road network. More than 6,000 kilometres of state-controlled roads were affected by closures (4,422km) and restricted access (1,998km). Many areas have faced ongoing flood impacts as a result of further rainfall associated with Tropical Cyclone Trevor[54].

Road closures affected community access to homes, schools and places of work. In addition, temporary closure in the region's key transport corridors along the Bruce and Flinders Highways caused major supply chain disruption for regional trade. Inaccessible roads have also delayed assessments to determine the full extent of damages, including to primary producers.

The cost of the road damage includes the direct asset replacement cost as well as a number of additional costs arising from the need to conduct temporary works to ensure roads are safe and trafficable until full reconstruction can be scheduled. These counter-disaster operations include removal of hazards and pothole repairs and are included as part of emergency response cost estimates (section 3.7).

Council managed roads have an estimated a damage cost of just over **$442 million**. In addition, the Department of Transport and Main Roads (DTMR) has estimated a total cost of **$300 million** to recover the state-owned road network.

While not estimated, there are likely to be other indirect costs to the road network. Specifically, extensive rail damage (described in section 3.4.2) increased pressure on the road system, with a

[52] The claims relate to commercial property (67%), motor vehicles (16%) and business disruption (15%).
[53] Business disruption is classified as an indirect cost, but cannot be reliably separated from the total value of commercial claims, so is included in these figures and excluded from the calculations in section 3.6.
[54] Cyclone Trevor hit North Queensland in March 2019 and has exacerbated damage and prolonged recovery in some areas.

significant increase in the number of heavy vehicles using Flinders Highway to transport goods which would usually be transported by rail.

3.4.2 Rail damage

Flooding severely disrupted the Mount Isa rail line. More than 307km of the rail line was damaged, including severe damage to 200km of track between Richmond and Oorindi, which was closed until 29 April 2019.

As a result of the train derailment at Nelia, Queensland Rail removed 81 rolling stock, storing a mixture of minerals including zinc, lead and copper anodes.[55] A 1.2 km rail deviation has been constructed, to enable train services to resume while environmental remediation works are in progress around the derailment site.

The damaged rail line has now been repaired. At the time of this report, the cost of the repair was not available from Queensland Rail. Given a lack of information around the nature of the rail damage and thus the level of work that would be required to repair the damaged rail, a cost benchmarking exercise to approximate the cost of the rail damage has not been undertaken.

3.4.3 Water and sewage infrastructure damage

The disaster has caused extensive damage to water and sewerage networks including controls, mains, accesses and electrical assets. For example, Townsville City Council reported breakage to 21 bulk mains and 310 reticulation mains, as well as damage due to inundated pump stations. There are a number of dams affected including Burdekin Falls, Eungella, Julius and Teembra dams.

Some restoration costs are covered by public asset insurance (described in section 3.4.5). However, QRA has estimated additional **direct restoration costs of $14.5 million**. This excludes potential additional costs in North West Queensland where damage assessments remain underway.

3.4.4 Other public asset damage

An estimated 765 state-owned frontline public assets sustained damage, including 179 which sustained significant damage. These assets include social housing, schools and police stations. In addition, a number of community and recreational assets were damaged, such as public parks, reserves, playgrounds, and sporting facilities.

The Queensland Government Insurance Fund (QGIF) is the mandatory insurer for Queensland's state assets. While many claims are yet to be processed, they have estimated direct damages to state assets at $30 million. In addition, QRA and the Department of Housing and Public Works (DHPW) estimated restoration of community and recreation facilities to be at least $20 million.

These data suggest **public asset damage costs of at least $50 million.**

Costs to privately operated assets, such as energy and communications infrastructure, are accounted for under commercial damages (section 3.3.2). These costs included restoring supply to 8,900 electricity customers in Townsville and at 1,612 Telstra sites. It is to be noted that the full cost of restoring electricity and telecommunication lines at these sites may be higher than that quantified here, which has not factored in the indirect costs that may be incurred by users and service providers as a result of these utility outages.

3.5 Agriculture damage and disruption

The affected region is heavily dependent on agricultural production to support its economy. **Damage to agriculture is estimated at $432 million**, including $384 million in direct costs and $48 million in indirect costs. Table 3.4 summarises these impacts which are detailed in the sections below.

[55] Queensland Rail, *Mount Isa Line Recovery Plan* (22 May 2019) <https://www.queenslandrail.com.au/aboutus/mediacentre/mount-isa-line-recovery-plan>.

Table 3.4: Breakdown of costs to agriculture

	$m
Livestock losses	$376
Crop losses	$8
Direct cost	**$384**
Additional fodder	$2
Carcass disposal	$46
Indirect cost	**$48**
Combined cost	**$432**

3.5.2 Direct costs to agriculture

The Monsoon Trough event affected upwards of 600 primary producers, with 31 identifying damage as 'catastrophic'.[56] The worst impacts are among beef cattle and sheep farmers in the North West region. AgForce has estimated livestock losses at 500,000 head of cattle (1.7% of the national herd) and 30,000 sheep. Assuming an average replacement cost of $750 per head, the **replacement cost of these livestock is approximately $376 million.**

In the coastal region, there were a number of properties with major crop losses. This includes damage to a number of sugarcane, broadacre and horticulture farmers in Townsville, Burdekin and Hinchinbrook. As at 4 April, **$8 million in crop losses** (gross value of agricultural production) has been estimated by the Department of Agriculture and Farming (DAF) for these areas. Additional damage to crops was reported in Douglas, however damage has not been fully assessed at the time of this report.

In addition to crop and livestock losses, DAF has noted extensive damage to bores, watering points, yards and property buildings. On-farm infrastructure losses include up to 10,000km of fencing, 1,000km of water pipelines, and 15,000km of on-farm roads. **Damage to on-farm infrastructure has been estimated at $100 million.** These infrastructure costs are not included separately in aggregate economic cost estimates to avoid double counting with commercial losses.

3.5.3 Indirect costs to agriculture

Primary producers have also faced indirect flow-on costs from the need to purchase additional fodder and dispose of carcasses.

As well as the widespread livestock losses, many thousands of cattle and sheep that remained after the event were stranded and stressed. A major fodder drop was coordinated by government, industry and charitable organisations – including transport by helicopter to some inaccessible properties. **Extraordinary fodder costs have been estimated at $2 million**. This excludes the cost of hay that was donated (2,300 bales) and other fodder costs borne by producers that cannot be separated from commercial damages, as well as the cost of helicopter transport provided by the Australian Defence Force.

A Carcass Disposal Strategic Master Plan was adopted by the Commonwealth and State Governments and five local councils impacted in the North West LGAs to support the safe disposal of carcasses. As part of this plan, assistance grants of $5,000 have been offered to producers. To date, 458 producers have received $2.27 million.

In this report, the total cost of carcass disposal was estimated using average per head costs developed by BTE (2001).[57] Adjusted to 2019 dollars using CPI and applied to the stock losses

[56] There were 11 LGAs activated for Category C assistance for primary producers: Burdekin, Burke, Carpentaria, Cloncurry, Douglas, Townsville, Hinchinbrook, Richmond, McKinlay, Flinders and Winton.
[57] Bureau of Transport Economics, 'Economics costs of natural disasters in Australia'. Report 103, Canberra, (2001).

described above, the **total cost of carcass disposal is estimated at $45.5 million for cattle and $364,000 for sheep**.

3.6 Business disruption

Agriculture, mining and tourism are major industry sectors in the region. These major sectors, as well as other industry operators, have experienced trade disruptions because of this event. For example, stock and crop losses have major consequences for transport and freight operators, abattoirs and other input and service suppliers to the industry. These business disruptions are indirect losses as a consequence of the disaster.

Natural disasters disrupt businesses through a variety of mechanisms, specifically through disruption of infrastructure, transportation and telecommunications, which frequently forces businesses to close in the aftermath of a disaster.[58] Moreover, disasters can cause population dislocation, losses in discretionary income among employees in the impact area and competitive pressure from large outside businesses[59].

The closure of the Mount Isa rail line critically disrupted mining and minerals production – the major employer in North West Queensland. Glencore's Collinsville mine, Newlands Coal mine and Incitec Pivot's fertiliser facility were partially shutdown. These businesses incurred extraordinary costs associated with alternative storage and freight of product. Zinc and Copper refineries in Townsville as well as Port operations were also disrupted.

Other trade disruption has been incurred as a result of transport delays, electricity and communications network outages, temporary business closures and clean-up activities.

In general, business disruption is not included as an economic cost to the region. This is due to the difficulty in determining the shift in production from one location in the region to another, or from one affected business to an unaffected one. For example, where a grocer is closed for a week on account of flooding, customers would seek out the next best alternative grocer – transferring their expenditure within the economy. An estimated 98% of reconstruction activities are being undertaken by local contractors – a benefit to the regional economy. The net impact of these transfers within the region is complex to determine.

Nevertheless, some commercial damages claims include insurance for business disruption. To this extent, business disruption is partially accounted for in estimates of commercial damages.

In addition, this report quantifies indirect losses to small business, including those in the tourism sector. Data on small business impacts has been made available from a preliminary survey undertaken by the DESBT which provide an indication of the flow-on impacts to small business.

3.6.1 Small business disruption

Small businesses are disproportionately affected by disaster events. They are typically less resilient, lack capacity to design and implement hazard management programs and less likely to have insurance to cover interruption to trade. Small businesses also take longer to re-establish as they primarily depend on neighbourhood customers.[60]

There were five LGAs activated for Category C assistance for small businesses: Cloncurry, Flinders, McKinlay, Richmond and Townsville. Of the 12,383 small businesses in these regions, an estimated 52% (6,481) were affected[61]. This includes an estimated 1,067 tourism-dependent small businesses and 5,414 other small businesses.

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[58] Whitney, D.J., A. Dickerson and M.K. Lindell (2001) 'Non-structural seismic preparedness of Southern California hospitals'. 17(2) *Earthquake Spectra* pp. 153–171.
[59] Zhang, Y., Lindell, M.K., Prater, C.S. (2009), 'Vulnerability of community businesses to environmental disasters', 33(1) *Disasters*, pp. 38-57.
[60] Alesch, D.J., J.N. Holly, E. Mittler and R. Nagy (2001) 'When small businesses and not-for-profit organizations collide with environmental disasters'. *Paper presented at the First Annual IIASA– DPRI Meeting on Integrated Disaster Risk Management: Reducing Socio-Economic Vulnerability.* 1–4 August. Laxenburg, Austria.
[61] The share of the regional population affected was estimated using data on Category A claims for personal hardship assistance. That is, on average 52% of the resident population in these 5 LGAs had applied for

The DESBT survey found that 70% of small businesses had been directly affected by the disaster, with an average damage cost of $87,000[62]. However, 80% of businesses had been indirectly affected by temporary closures and trade interruptions. In addition, around 30% of businesses estimated that it would take more than three months for normal trading to resume.

Businesses had self-reported the indirect costs associated with disruption to trade. The average indirect cost was $34,479 to small business (excluding tourism) and $43,000 for tourism-dependent small businesses. For tourism small business, the high cost estimates accounted for the additional impacts associated with cancellation or deterrence of forward bookings.

Research has shown that tourism businesses can be slower to recover from disaster. In addition to direct property damage that needs replacement or repair, affected destinations can also be impacted by negative perceptions amongst potential tourists. [63, 64] This impact was more evident for business operation in coastal destinations, such as those affected in Far North Queensland.

To determine the economic cost of these business losses, it is assumed that 50% of the revenue loss is to gross value added (GVA).[65] As a result, it is estimated that **indirect costs to small business was $116 million**, including $23 million to tourism-dependent small businesses.

3.7 Emergency response and clean up

3.7.1 Emergency response

Emergency response costs have previously been estimated by Deloitte Access Economics in 2013[66] using data on Category A expenditure covering individual and household assistance. To date, a total of 65,823 grant applications have been paid to individuals and households, totalling $30.8 million in emergency response (Table 3.5).

Table 3.5: Category A – Individual assistance grants as at 3 April 2019

LGA	Applications Paid	Approved Payments	Grant Beneficiaries
Emergency Hardship Assistance (EHA)	54,801	$20,634,150	116,358
Essential Household Contents Grant (EHCG)	4,321	$8,186,549	9,835
Structural Assistance Grant (SAG)	2	$14,500	7
Essential Services Safety and Reconnection Scheme Grant (ESSRS)	-	-	-
Essential Services Hardship Assistance (ESHA)	6,699	$1,918,800	12,886
Total	**65,823**	**$30,753,999**	

Source: Queensland Reconstruction Authority.

In this analysis, data were also available on the cost of exceptional counter-disaster operations ($16 million) and the cost to the State government in administering PHAS grants and purchasing extraordinary recovery specific services such as psychological first aid, under Category A ($12.3 million).

Category A assistance. It was assumed that the share of affected small businesses was equivalent to the share of affected population across each LGA.

[62] These costs have not been separately considered from commercial damages, see section 3.3.

[63] Lehto, X., Douglas, A.C., Park, J, (2008) 'Mediating the effects of natural disasters on travel intention' 23(2-4) *Journal of Travel & Tourism Marketing*, pp.29-43

[64] Hall, M.H, (2010) 'Crisis events in tourism: subjects of crisis in tourism, *Current Issues in Tourism*, 13(5), pp. 401-417.

[65] Many loss assessments also make the error of counting lost turnover and lost sales as losses, instead of counting only lost profit. See: Emergency Management Australia, 'Disaster loss assessment guidelines' (2002).

[66] Deloitte Access Economics, *Building our nation's resilience to natural disasters* (report commissioned by the Australian Business Roundtable for Disaster Resilience and Safer Communities, 2013).

Accounting for these costs, **emergency response was estimated at $59 million.**

3.7.2 Clean up and evacuation costs

An estimated 3,369 residential properties, 1,655 commercial properties and 777 public buildings were damaged by the disaster. Average clean-up costs were drawn from a BTE 2001 report[67] and updated to 2019 dollars. The costs were estimated at:

- residential clean-up $6,734 per house
- commercial clean-up $4,337 per building.

Applying these estimates suggests **total clean-up costs to the region of $49.9 million.**

In addition, 1,700 people required emergency housing assistance (799 applications). Assuming that the average time evacuated was two nights, **evacuation costs were approximately $285,000**[68]**.**

Volunteers and disaster response

Emergency response to the disaster included substantial effort from councils, emergency services and management agencies, government employees (Ready Reserves), charity organisations and volunteers.

Hundreds of volunteers supported the clean-up and emergency response efforts. For example, Volunteering Queensland estimates that 226 volunteers per day were deployed for a total 2,834 work hours working with DESBT, Team Rubicon, GIVIT and Volunteering Queensland. Applying an estimated annual wage rate from Volunteering Queensland (in 2019 dollars) the cost of volunteer's time and effort in this program alone was estimated at $117,757.

In addition, 1,166 Community Recovery Ready Reserves were deployed for a total of 14,477 days to support recovery efforts. Team Rubicon also managed an additional 341 local volunteers in Townsville.

There are likely to have been many more undocumented volunteer hours supporting recovery efforts.

Table 3.6: Emergency response and clean-up costs

	$m
Emergency response	$59.0
Residential clean-up	$22.7
Commercial clean-up	$7.2
Public building clean-up[69]	$20.0
Household evacuation	$0.3
Combined cost	**$109.2**

Source: Deloitte Access Economics estimates.

3.8 Health, social and community impacts

Natural disasters can have direct and indirect social impacts. The direct impacts encompass death and injuries as a result of the disaster. Indirect impacts encompass the flow-on effects to people

[67] Bureau of Transport Economics 'Economic costs of natural disasters in Australia' (Report 103, 2001).
[68] BTE estimate evacuation costs at $84 for the first night and $42 for subsequent nights per person (updated to 2019 dollars). See: Bureau of Transport Economics 'Economic costs of natural disasters in Australia' (Report 103, 2001).
[69] According to QRA supplied information.

and community as they respond to, and recover from, the event. Social costs are incurred over many years, and in some cases a lifetime, making them difficult to reliably determine. Deloitte Access Economics in 2016 estimated that social costs of natural disasters can be up to 1.1 times the direct cost of these events.[70] This section makes conservative estimates of social costs using a bottom-up approach based on the data available. There are also other impacts to communities, such as social connectedness and cohesion that may be impacted in this disaster event. These impacts can be difficult to quantify and are considered qualitatively in this report.

Health, social and community impacts are estimated to be $2.3 billion. Table 3.7 summarises these impacts which are detailed in the following sections.

Table 3.7: Breakdown of health, social and community impacts

	$m
Death	$18
Injury	$38
Combined direct cost	**$56**
Mental health	$1,625
Alcohol misuse	$7
Family violence	$197
Chronic disease	$426
Combined indirect cost	**$2,255**
Combined direct and indirect cost	**$2,311**

3.8.1 Death and injury

At the time of the report, there were four fatalities and 97 injuries reported in relation to the disaster. Queensland Ambulance Service (QAS) recorded two of the fatalities from persons entering floodwaters. Two further fatalities have been communicated through the media and are attributed to melioidosis, contracted from a soil-borne bacteria present in floodwater.[71] Reports also indicate that up to 10 people were admitted to intensive care with symptoms of the bacterial infection, contracted through interaction with contaminated floodwaters.

The 97 injuries were reported at 7 February and there may be additional undocumented injuries.

The economic cost of these incidents has been estimated using the value of statistical life from the Office of Best Practice Regulation.[72] This estimates the lifetime cost of deaths and the effect of injuries on life quality.

Applying this life value to the four confirmed fatalities gives an estimated **cost of fatalities of $18 million** (in present value terms).

[70] Deloitte Access Economics, *The economic cost of the social impact of natural disasters* (report commissioned by the Australian Business Roundtable for Disaster Resilience and Safer Communities, 2016).
[71] Australian Associated Press, 'Deadly mud bacteria claims a life as Townsville Flood toll rises to three', The Guardian (online), 13 February 2019 <https://www.theguardian.com/australia-news/2019/feb/13/deadly-mud-bacteria-claims-a-life-as-townsville-flood-toll-rises-to-three>.
[72] Office of Best Practice Regulation *Best Practice Regulation Guidance Note Value of statistical life* (December 2014) <https://www.pmc.gov.au/sites/default/files/publications/Value_of_Statistical_Life_guidance_note.pdf>.

Assuming that two-thirds of the injuries were major and one-third were minor[73] and estimating the value of injury as a share of the value of statistical life[74] suggests that the lifetime **cost of injuries in present value terms is $38 million.**

3.8.2 Health, wellbeing and community impacts

The Monsoon Trough has already had large impacts on the affected population. By April 2019:

- 81,298 applications received for Personal Hardship Assistance (PHAS) Grants.
- 64,567 calls to the Community Recovery Hotline.
- 37,120 people contacted through outreach or recovery hubs.
- 62,651 people provided psychological first aid.
- 1,344 instances of acute mental health support services provided.
- 38 schools closed, disrupting education for 17,900 students.
- 9 early childhood centres remain closed and 2 of these intend to close permanently.
- 18 sporting and recreation facilities were identified as having been majorly impacted in Townsville alone.
- Widespread damage to public parks and playgrounds has also been reported.

Previous analysis[75] suggests flood events can have lasting community impacts on mental health, alcohol misuse and family violence, and can exacerbate chronic disease. Other impacts have been identified but remain difficult to measure, this includes community dislocation, crime, employee retention, school enrolment and completion. Further, analysis of Queensland Health data, following the 2010-11 Queensland Floods, found that people from disadvantaged socioeconomic backgrounds and in regional and remote areas were likely to be affected more.[76] This could include feelings of distress, helplessness, hopelessness or loss of income.

As a result of the social costs estimated in this chapter, there may be ongoing impacts for community cohesion and functioning, which are difficult to accurately measure. An increased rate of mental illness or of family violence may place additional pressure on community relationships and have flow-on effects on social cohesion. The social costs outlined below are key categories of social costs that are quantifiable at the time of the report. This cost assessment is not expected to be definitive.

Where quantification is possible, the outcomes of social impacts are measured in terms of human costs, general costs or economic efficiency losses. For example, Figure 3.1 summarises how an increase in family violence attributable to disaster can be valued monetarily in terms of health and justice system costs, productivity costs and costs of community support and housing.

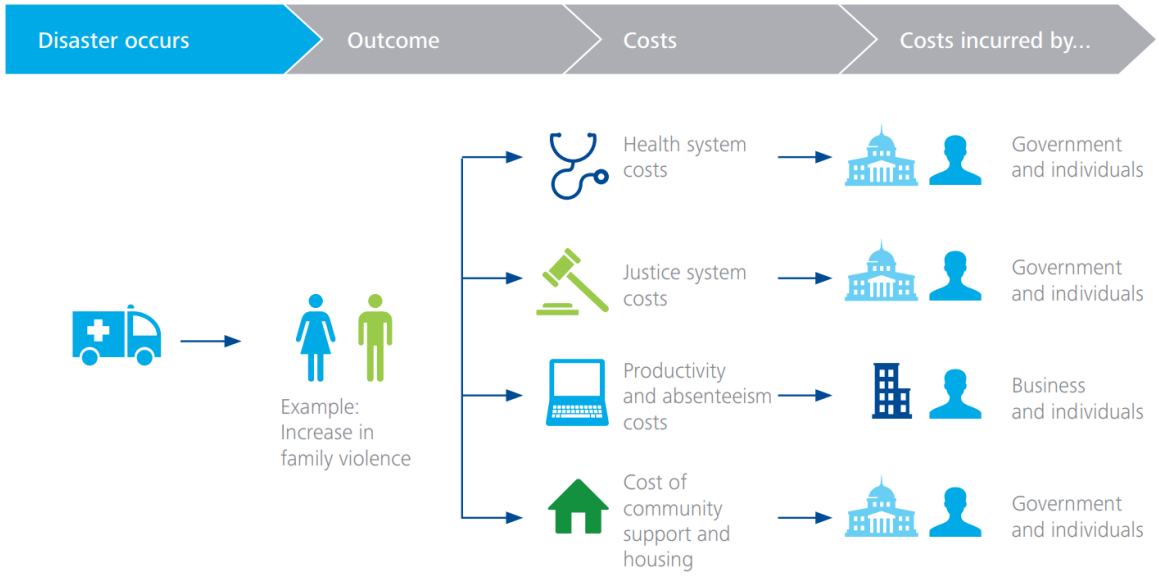
[73] Consistent with previous analysis. See Bureau of Transport Economics 'Economic costs of natural disasters in Australia' (Report 103, 2001), and Deloitte Access Economics, *The economic cost of the social impact of natural disasters* (report commissioned by the Australian Business Roundtable for Disaster Resilience and Safer Communities, 2016).

[74] Consistent with previous analysis by Deloitte Access Economics, *Building our nation's resilience to natural disasters* (report commissioned by the Australian Business Roundtable for Disaster Resilience and Safer Communities, 2013).

[75] See Deloitte Access Economics, *The economic cost of the social impact of natural disasters* (report commissioned by the Australian Business Roundtable for Disaster Resilience and Safer Communities, 2016) for a detailed review of the literature and methodological description.

[76] Clemens S.L., Berry H.L., McDermott B.M., Harper C.M., 'Summer of sorrow: Measuring exposure to and impacts of trauma after Queensland's natural disasters of 2010-2011'

Figure 3.1: Measuring economic cost of social impacts



Source: Deloitte Access Economics (2016)

Given that the social costs to the community are yet to be fully experienced, this report has estimated social costs using estimates of the affected population[77] and costing data from the Deloitte Access Economics analysis of the 2010-11 Queensland Floods.[78] In the 2016 analysis, relevant literature was used to estimate the incidence of various social impacts as a result of a flood-related disaster as well as the unit costs of these impacts over a person's lifetime. Where data could be differentiated by gender and by adults and children, these were accounted for in the analysis. For example, women had a higher incidence of mental health impacts (Table 3.9).

This report applies the unit cost of each impact by the incidence of social impacts as a result of the disaster. Costs were indexed to 2019 dollars and are presented in net present value terms.

Details are included in the following sections for each of the estimated impacts.

[77] As described above, affected population is estimated using Category A assistance data by LGA. ABS data on age and gender were used to estimate the number of male and female, adults and children affected.
[78] Deloitte Access Economics, *The economic cost of the social impact of natural disasters* (report commissioned by the Australian Business Roundtable for Disaster Resilience and Safer Communities, 2016).

Table 3.8: Affected population – North and Far North Queensland Monsoon Trough

	Adult (male)	Adult (female)	Child (male)	Child (female)	Total
Population	43,461	43,941	14,843	14,051	116,297
Average age at time of disaster	30	30	9	9	-
Average life expectancy	81	85	80	84	-

Source: Deloitte Access Economics estimates. Numbers may not add due to rounding.

Table 3.9: Incidence of social outcomes estimated for the 2011 Queensland floods [79]

Outcome	Incidence estimate
Mental health issues (male)	12.2%
Mental health issues (female)	14.7%
Alcohol misuse	1.1%
Family violence (female and children)	2.7%
Family violence (male)	1.1%

Source: Deloitte Access Economics (2016).

Table 3.10: Additional impact of the 2019 Monsoon Trough

Outcome	Persons affected	Average unit cost per year
Mental health issues (total)	15,600	$38,400
Family violence	2,000	$27,900
Risky alcohol consumption	920	$2,300

Source: Deloitte Access Economics estimates.

Mental health issues

Mental health issues are anticipated to be the largest impact from the Monsoon Trough event. This is a product of the large number of people affected by the disaster, the long term nature of this impact and the fact that many in the region are already dealing with the psychological impacts of other recent natural disasters.

Prior analysis of the 2010-11 Queensland floods suggests that a regional, remote and socioeconomically disadvantaged population is disproportionately more likely to report an emotional impact from the disaster.[80] Of a sample of more than 6,000 Queensland residents exposed to the 2010-11 floods, 14.3% reported feeling 'terrified, helpless or hopeless'. Up to five months after the disasters, 7.1% were 'still distressed' and 8.6% were 'worried about how they might manage'.[81]

Literature shows that people whose homes are directly affected in disasters are more likely to report poorer mental health. Alderman et al. found that residents whose homes were directly

[79] Incidence rates were assumed to occur in the first year of the disaster. The rate drops by one-third every year, to 5% of the rate by the fourth year post-disaster. This reflects an initial spike in social impacts after a disaster, following which most people recover to an extent over the medium-to-long term. However, a small proportion never recover and continue to experience lifelong trauma.
[80] Deloitte Access Economics, *The economic cost of the social impact of natural disasters* (report commissioned by the Australian Business Roundtable for Disaster Resilience and Safer Communities, 2016).
[81] *ibid.*

affected by the 2011 Brisbane Floods were more likely to report poorer physical and mental health.[82] The affected residents were:

- 5.3 times more likely to report poorer health than those not affected by the flood
- 2.3 times more likely to report respiratory issues
- 1.9 times more likely to report psychological distress
- 2.3 times more likely to report poor sleep quality
- 2.3 times more likely to have probable post-traumatic stress disorder (PTSD).

The effect of the Monsoon Trough disaster on the affected population's mental health is already evident. By the end of March 2019, more than 60,000 individuals have been provided with psychological first aid. Data collected by the Queensland government for past disaster events show that mental illness following a disaster can often take 6 to 12 months to manifest.[83] This suggests that there are likely to be many more individuals reporting a mental health impact in the coming months.

Literature suggests that the mental health impacts of natural disasters are long term. One study which assessed the long-term impact of the 2009 Black Saturday Bushfires found that three to five years after the disaster, a significant portion of the affected population were reporting symptoms which indicated mental health problems that were beyond levels likely to be manageable without professional support.[84] These mental health impacts were mainly attributed to major life stressors which arose following the disaster – such as income loss, changes in accommodation and changes in affected individuals' personal relationships. Similar results are evident in a study on the mental health impacts of the Lac-Mégantic Train Derailment Tragedy in Quebec, Canada. Analysis of the three-year impact on senior citizens exposed to the incident found that 41.7% believed that their mental health deteriorated in the years following the incident, while 68.7% showed symptoms of post-traumatic stress disorder.[85]

Another factor at play in this context is the cumulative impact of multiple disasters in the region. It is important to note that the financial and psychological impact of the Monsoon Trough will be felt by a community that is already managing the impacts of previous disasters. Every LGA in the affected region has had at least one DRFA/NDRRA activation in the past 12 months, and has been impacted by at least five disaster events since 2011. A study on the effect of natural disasters on mental health in rural Australia draws a link between individuals' prior experience in a disaster situation and their psychological resilience to future events.[86]

If the nature of the costs were similar to the 2010-11 Queensland floods, then the mental health impact would likely be significant. Based on available data at the time of the report, the net present value of the long-term **mental health costs of this event is estimated at $1.6 billion**.

Risky or high-risk alcohol consumption

Research undertaken in Brisbane following the 2010-11 Queensland floods found that those affected were 5.2 times more likely to increase alcohol use and 4.5 times more likely to increase tobacco use.[87] These figures are comparable with other international literature documenting risky substance use following a disaster impact.

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[82] Alderman K., Turner L.R., Tong S. (2013), 'Assessment of the health impacts of the 2011 summer floods in Brisbane', *Disaster Medicine and Public Health Preparedness*, 7(4), pp. 380-386.
[83] According to Queensland Reconstruction Authority supplied information.
[84] Gibbs L., Bryant R., Harms L., Forbes D., Block K., Gallagher H.C., Ireton G., Richardson J., Pattison P., MacDougall C., Lusher D., Baker E., Kellett C., Pirrone A., Molyneaux R., Kosta L., Brady K., Lok M., Van Kessell G., Waters E. (2016). *Beyond Bushfires: Community Resilience and Recovery Final Report.* University of Melbourne, Victoria, Australia. <https://mspgh.unimelb.edu.au/centres-institutes/centre-for-health-equity/research-group/beyond-bushfires>.
[85] Maltais, D., Tremblay, A.-J., Labra, O., Fortin, G., Généreux, M., Roy, M., & Lansard, A.-L. (2019). 'Seniors Who Experienced the Lac-Mégantic Train Derailment Tragedy: What Are the Consequences on Physical and Mental Health?' *Gerontology and Geriatric Medicine*, 5, p.1
[86] Morrissey S.A., Reser J.P. (2007), 'Natural disasters, climate change and mental health considerations for rural Australia', *The Australian Journal of Rural Health*, 15(2), p.120
[87] Turner LR, Alderman K, Huang C, Tong S (2013), 'Impact of the 2011 Queensland floods on the use of tobacco, alcohol and medication', *Australian and New Zealand Journal of Public Health*, 37(4), p. 396.

The net present value of the costs of **risky alcohol consumption is around $7 million**.

Family violence

Natural disasters can also increase the prevalence of family and gender-based violence. Stress is often noted as a key reason and the heightening of existing problems following a disaster event.

This incidence was estimated as the difference in reported family violence rates between those who reported having their house damaged or destroyed by a disaster with those that did not. Consequently, the lifetime **cost of family violence from the Monsoon Trough event is $197 million**.

Chronic and non-communicable diseases

A number of chronic and non-communicable diseases (NCDs) can be exacerbated by a natural disaster event. Most notable, there can be worsening of cardiovascular disease, diabetes and respiratory conditions such as Chronic Obstructive Pulmonary Disease (COPD). This can be due to illness (such as from increased susceptibility to injury or infection) or due to the disaster itself (such as separation from medication or treatment, or contamination of food and water).

A 2015 focus group in North Queensland found that disaster can interrupt management and care for people with NCDs living in rural and remote areas of Queensland, which has the potential to exacerbate their condition or even result in death.[88]

Those directly impacted by the 2010-11 Queensland floods were found to be 5.3 times more likely to experience worse overall health and 2.3 times more likely to experience worse respiratory health.[89]

Applying Deloitte Access Economics' past approach using prevalence data for diabetes, COPD and stroke in Queensland as a baseline, it is assumed that these conditions will be exacerbated in a proportion of people post-disaster. The estimated **cost of exacerbation of chronic diseases from the Monsoon Trough event is $426 million.**

3.9 Environmental impacts

Natural disasters cause extensive and lasting environmental damage, some of which cannot be restored. Part of the loss is direct, relating to the replacement cost of recoverable damages. However most of the costs are indirect and intangible, making them difficult to reliably quantify.

3.9.1 Direct environmental costs

There are three types of direct damages for which the Queensland government has estimated replacement costs: riparian streambank damage, coastal erosion and damage to national parks.

Riparian damage costs include the cost of removing debris from rivers, revegetation and stabilisation of river banks and rehabilitation of damaged gullies to improve water management. As at 8 April, seven regional natural resource management (NRM) groups across the affected region collectively estimated **$30.8 million in restoration costs.**

According to documentation from the Environment Functional Recovery Group, coastal erosion includes beach replenishment including any revegetation component, beach nourishment, repair of sea walls and repair of rock groynes. The **total cost of recovery activities across five councils was estimated at $8.4 million.**

Based on the information available at 8 April, the Department of Environment and Science (DES) Queensland Parks and Wildlife Service and Partnerships estimated damage to walking trails, broken fencing, roads and amenities inside **national parks will cost approximately $2 million**. This relates to damages not covered by QGIF or Category B claims. By early April 2019, five national parks remained closed and another 37 affected parks had been reopened. Damage to

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[88] Ryan, B., Franklin, R.C., Burkle, F.M., Aitken, P., Smith, E., Watt, K., Leggat, P. (2015), 'Identifying and describing the impact of cyclone, storm and flood related disasters on treatment management, care and exacerbations of non-communicable diseases and the implications for public health', *PLoS Currents*, 7, pii.
[89] Alderman K., Turner L.R., Tong S. (2013), 'Assessment of the health impacts of the 2011 summer floods in Brisbane', *Disaster Medicine and Public Health Preparedness*, 7(4), pp. 380-386.

nature refuges, privately managed conservation areas which help protect the state's biodiversity, has also been reported.

3.9.2 Indirect environmental costs

The indirect environmental costs have not yet been fully assessed and may take several months to eventuate. There is already concern about potential impacts of increased sediment loads and the potential effects of the event on water quality, biodiversity and habitat and pest and disease incursions. Many of the impacts that cannot be quantified are discussed qualitatively throughout the remainder of this section.

Water quality

Heavy rain and floods can affect water quality in rivers and surrounding oceans due to excess sediment and nutrients, pollutant runoff and debris. The Monsoon Trough caused major loss of sediment to some areas. Further, damage to riparian vegetation could contribute to increased nutrient and pesticide runoff. As well as affecting rivers and waterways, sedimentation can be detrimental to marine environments, including seagrass and coral on coastal areas.

The significant runoff generated from the Monsoon Trough caused increased pollutant loads to flow to the environmentally sensitive Great Barrier Reef lagoon, from catchments spanning Mackay-Whitsundays to Cape York. The most severe flooding occurred in the Burdekin region, which encompasses the coastal catchments of the Black, Ross, Burdekin, Haughton Rivers and Barratta Creek. For the Burdekin region catchments, pollutant loads generated during the event exceeded the average annual monitored load by between 50-60%, depending on the indicator. This equates to 6.6 megatonnes of total suspended solids, 9,400 tonnes of particulate nitrogen, 1600 tonnes of dissolved inorganic nitrogen, and 4700 tonnes of particulate phosphorus that flowed to the Great Barrier Reef from the Burdekin River system alone, as a result of the Monsoon Trough.[90]

Biodiversity and habitat loss

Biodiversity and habitat have likely been affected by this event. Riparian zone habitats are distinctive due to their high nutrient and water availability and play a significant role in maintaining regional biodiversity. Coastal areas are also biodiversity hotspots for a number of seagrass and coral communities. Natural disasters can also create new risks for certain endangered species, due to food and habitat shortages[91].

Repeated periods of flooding in Queensland following the 2010- 11 Queensland Floods has stressed seagrass beds along the Queensland coastline, particularly between Townsville and Gladstone. As a result, green turtle and dugong are facing food supply shortages and there are increased rates of turtle and dugong stranding.[92] The Department of Environment and Science are monitoring the impact of the Monsoon Trough event on turtle and dugong populations. Based on previous events, recovery of seagrass beds could take more than a year.

Floods can also have benefits for some plant and animal population. In many natural systems, flooding helps spread organic material, nutrients, and sediments which enrich floodplain soils. Floodplains are important habitats for aquatic fauna and flora when inundated, as nutrients are released, plankton blooms develop and aquatic invertebrates grow. Flood conditions also enhance successful fish recruitments. They also replenish water resources and trigger life processes such as bird breeding events, migration and seed dispersal in flora and fauna adapted to these cycles. Good soil moisture can also allow crops and pastures to be established[93].

Pest and disease outbreaks

Flood affected areas are also susceptible to pest and disease incursions. According to the Queensland Government Environment Functional Recovery Group, a large number of carcasses can

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[90] According to Department of Environment and Science supplied information.
[91] Oceanwatch Australia, 'What are the negative and positive impacts of flooding on the environment?', (2019), < http://www.oceanwatch.org.au/latest-news/coastal-marine/what-are-the-negative-and-positive-impacts-of-flooding-on-the-environment/>.
[92] Department of Environment and Science (Queensland), *Marine wildlife strandings data* (24 October 2016) < https://environment.des.qld.gov.au/wildlife/caring-for-wildlife/marine-strandings-data.html>.
[93] Queensland Government, Office of the Queensland Chief Scientist, 'What are the consequences of floods', April (2019), <https://www.chiefscientist.qld.gov.au/publications/understanding-floods/flood-consequences>.

create a favourable environment for invasive pests, such as feral cats and wild pigs. In addition, fodder programs could spread weed species not common to the region. The cost to avoid flood-related **pest, weed and disease outbreaks is estimated by QRA at $3.0 million.**

Table 3.11 Environmental costs

	$m
Riparian streambank damage	$30.8
Coastal erosion and beach damage	$8.4
Direct damage to national parks	$2.0
Pest and disease outbreaks	$3.0
Biodiversity and habitat loss	NA
Water quality	NA
Combined cost	**$44.2**

Appendix A: Summary of costs estimated

Table A.1A: Costs estimated in this report

Cost category/item	Direct/indirect	$m
Residential damage	Direct	**$1,460**
Commercial damage	Direct	**$402**
Public infrastructure damage		**$807**
Roads	Direct	$742
Water and Sewage	Direct	$15
Other public assets	Direct	$50
Agriculture damage and disruption		**$432**
Livestock	Direct	$376
Crops	Direct	$8
Extraordinary fodder	Indirect	$2
Carcass disposal	Indirect	$46
Small business disruption		**$116**
Emergency response and clean-up		**$109**
Emergency response	Indirect	$59
Residential clean-up	Indirect	$23
Commercial clean-up	Indirect	$7
Public asset clean-up	Indirect	$20
Household evacuation	Indirect	$0*
Deaths and injury		**$56**
Death	Direct	$18
Injury	Direct	$38
Health, social and community impacts		**$2,255**
Mental health	Indirect	$1,625
Alcohol misuse	Indirect	$7
Family violence	Indirect	$197
Chronic disease	Indirect	$426
Environmental impacts		**$44**
Riverine streambank damage	Direct	$31
Coastal erosion	Direct	$8
Direct damage to national parks	Direct	$2
Pest and disease outbreaks	Indirect	$3

* This estimate has been rounded to the nearest million. The cost of household evacuation is approximately $0.279 million.

Source: Deloitte Access Economics

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