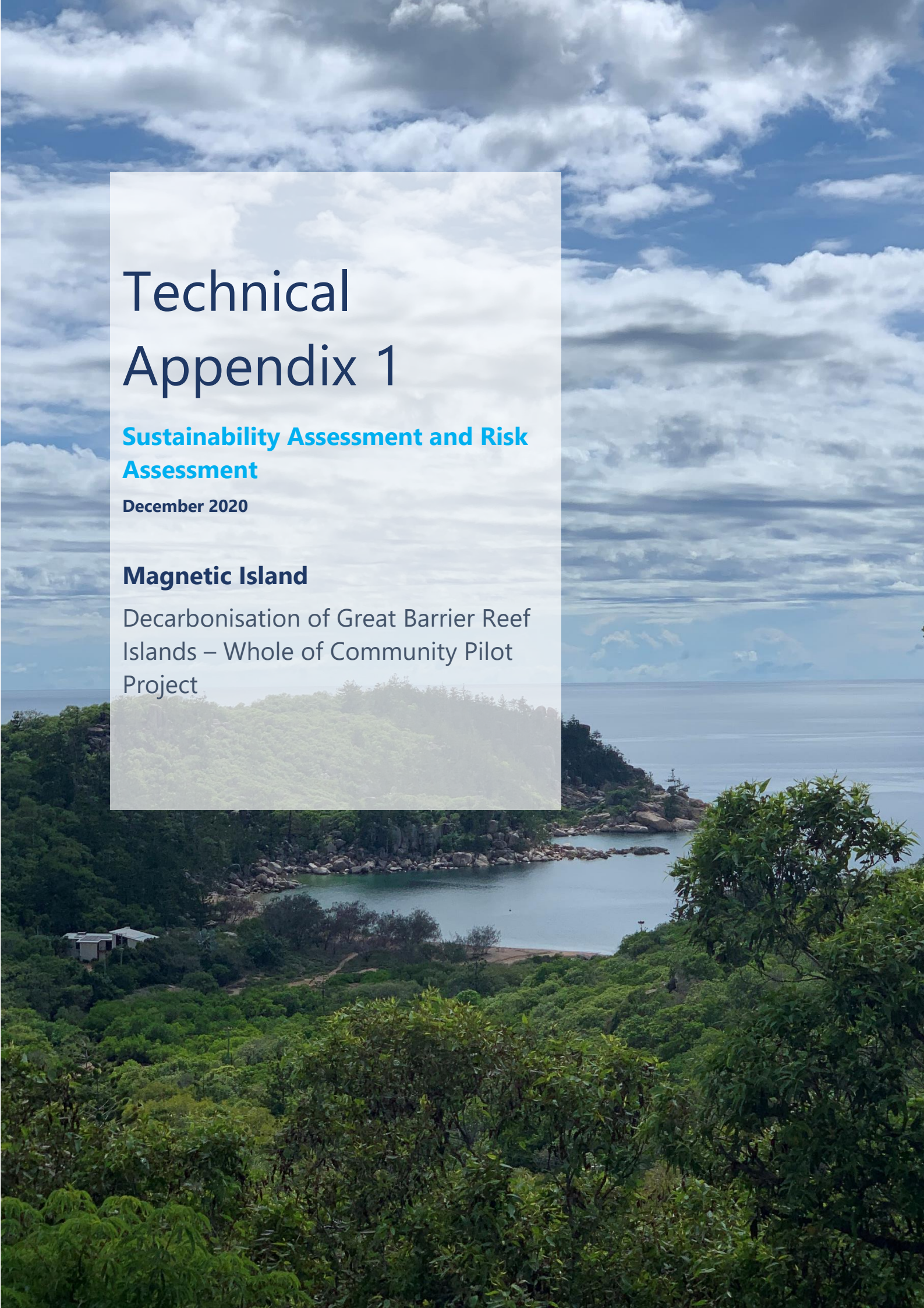

Technical Appendix 1

Sustainability Assessment and Risk Assessment

December 2020

Magnetic Island

Decarbonisation of Great Barrier Reef Islands – Whole of Community Pilot Project

EARTHCHECK

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GLOSSARY

Table 1: Acronyms

Acronym	Definition
ABS	Australian Bureau of Statistics
AEP	Annual Exceedance Probability
AC	Air conditioning
ATM	Automatic teller machine
DES	Department of Environment and Science
CHAS	Coastal Hazard Adaptation Strategy
EV	Electric vehicle
FTE	Full-time equivalent
FY	Financial year
GBR	Great Barrier Reef
GBRMPA	Great Barrier Reef Marine Park Authority
GHG	Greenhouse gas
HAT	Highest astronomical tide
LED	Light-emitting diode
LOA	Length overall
LPG	Liquefied petroleum gas
MICC	Magnetic Island Community Care
MICDA	Magnetic Island Community Development Association
MINCA	Magnetic Island Nature Care Association
MIRRA	Magnetic Island Renters and Ratepayers Association
MRF	Materials Recovery Facility
NA	Not applicable
QFES	Queensland Fire and Emergency Service
QPWS	Queensland Parks and Wildlife Service
QTIC	Queensland Tourism Industry Council
RCD	Residual current devices
RES	Regional Economic Solutions
RSL	Returned Services League
SCADA	Supervisory control and data acquisition
SES	State Emergency Service
Solar PV	Solar photovoltaic
STP	Sewage treatment plant
TCC	Townsville City Council
TMI	Tourism Magnetic Island
TMR	Transport and Main Roads
WTP	Water treatment plant

Table 2: Units

Measurement	Symbol	Meaning
Area	m^2 km^2 ha	Square metre Square kilometre Hectare
Temperature	°C	Degrees Celsius
Carbon Emissions	tCO_2-e $kgCO_2$-e	Tonne of Carbon dioxide equivalent Kilogram of Carbon dioxide equivalent
Energy	MJ GJ TJ kWh MWh	Megajoule Gigajoule Terajoule Kilowatt hour Megawatt hour
Mass	Kg T	Kilogram Tonne
Solar panel power rating	Wp kWp kW	Watt peak Kilowatt peak Kilowatt
Speed	m/s	Metre per second
Volume	L kL ML M^3	Litre Kilolitre Megalitre Cubic metre

Table 3: Terms

Term	Definition
Blackouts	The loss of electrical power to users
Brownouts	Extended drop in energy voltage
Compost	Convert organic material waste into nutrient-rich substance
Decarbonise	Reduce the amount CO2 (or CO2 equivalents) emitted by an activity or a process
Ecosystem	A biological community of interacting organisms and their environment
Energy efficiency	Using less energy to provide products and services
Isolated power supply	A power grid which is not connected to other power systems
Opal fuel	Opal is a variety of low-aromatic 91 RON petrol developed in 2005 by BP Australia to combat the rising use of petrol as an inhalant in remote Indigenous Australian communities
Passive building design	Buildings designed to naturally circulate air and cool during the summer and retain sunlight heat during winter
Per capita	Per capita is equivalent to 365 full person days. This activity measure incorporates both resident and visitor populations. It includes the number of residents obtained from the 2016 ABS census, and it includes visitor numbers as provided by the TRA for 2018.
Potable water	Water that is safe to drink and use for food preparation
Qualitative data	Can be observed and recorded. It is usually not numerical, and collected through methods of observations, one-to-on interviews, conducting focus groups, and similar methods.
Quantitative data	Information and numbers which describe something in a detailed manner
Recycle	Convert waste into a reusable material
Resilience	The capacity to recover and rebuild after a traumatic event
Severe weather event	Dangerous weather with the potential to cause damage or social disruption
Solar photovoltaic (PV)	Technology which converts sunlight into electric current
Sustainability	Resources are consumed in a responsible manner and maintained for future generations while ensuring environmental, social and economic balance
Sustainability theme	The five sustainability themes for this project are energy, waste, water, transport and resilience
Waste stream	Flows of specific kinds of waste from the source to recycling or disposal (burial/incineration)
White goods	Large electrical domestic goods (refrigerator, washing machine, etc.)

MAGNETIC ISLAND SUSTAINABILITY AND RISK ASSESSMENT

EXECUTIVE SUMMARY

The sustainability assessment represents the first phase of the Decarbonisation of the Great Barrier Reef Islands – Whole of Community Pilot Project as presented in Figure 1. The aim of this project, run by EarthCheck in partnership with Arup, Regional Economic Solutions (RES) and Queensland Tourism Industry Council (QTIC), is to provide Magnetic Island with community-led contextually and culturally appropriate project options for decarbonisation and resilience-building.

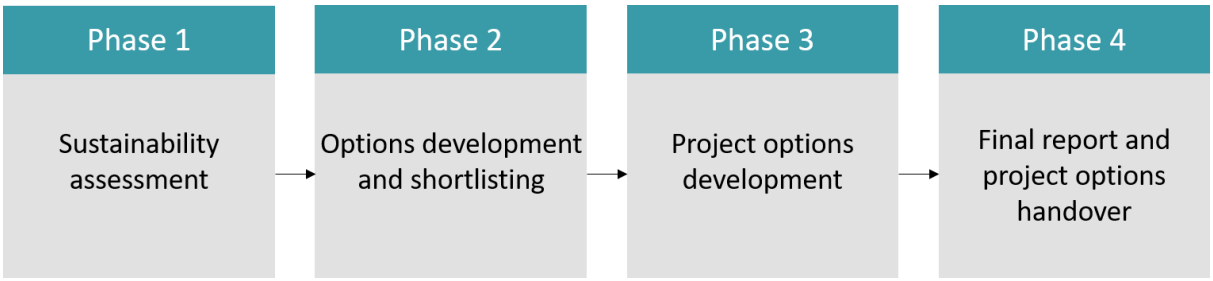

Figure 1: Decarbonisation of the Great Barrier Reef Islands - Whole of Community Pilot Project phases

The sustainability assessment phase commenced on the 24th of June 2019 and was carried out in the following order:

- Project preparation and planning;
- Desktop research on Magnetic Island;
- Engagement with key contacts (on and off-island);
- Island visit (29th, 30th and the 31st of August 2019);
- Data assessment; and
- Sustainability reporting (this report).

The sustainability assessment focused on developing a whole-of-community sustainability profile across the five key areas of energy production and efficiency, water and wastewater use, waste management, transport and resilience. Based on these findings, the whole-of community carbon emissions profile was developed as a benchmark for Magnetic Island.

The findings from this sustainability assessment helped to identify opportunities for decarbonisation and resilience-building. The results from this first project phase were used to inform the development of a preliminary long list of emission reduction options. Further community consultation, options analysis and the gateways process tested these options to identify projects with the highest feasibility and likelihood, developing these into final project options.

Sustainability Assessment Key Findings

The Magnetic Island community are passionate about sustaining the natural beauty and attraction of Magnetic Island. The Townsville City Council's (TCC) sustainability department is supportive and innovative with many projects and programs running to encourage efficiency and sustainability within the Townsville region, including Magnetic Island. The project evoked high levels of interest from the community and many on and off-island stakeholders.

The island is prone to natural climate related disasters, and as such has experienced physical and economic impacts. The island community's main concerns are how to be more resilient in the future and how to reduce reliance or dependence on the mainland for goods and essential services.

Information that was gathered from community input and consultation, the greenhouse gas emissions profile as well as the contextual information were used to inform the identification and development of decarbonisation and resilience building options and projects. Annual carbon emissions for the island were **19,643t CO_2-e** on average[1]. This equates to per capita emissions of **5.54t CO_2-e** per year.

Energy Production and Efficiency Key Findings

- ***Community sentiment:*** The Magnetic Island community would prefer to be more self-reliant regarding energy supply, for example, increasing installation of solar and battery arrays at a household level, or having community micro-grids.
- ***Energy generation:*** Energy is supplied from the mainland via two submarine cables (one which is approaching end of life) managed by Ergon Energy. Ergon are interested in investigating alternative solutions to the upgrade or the delay of the submarine cable. Most energy generated and consumed is electricity generated by the mainland grid (50%), followed by marine transport (33%), on-island road transport (12.12%), solar generation (5.29%) and diesel generators (0.02%).
- ***Energy use***: Non-residential consumption makes up a higher proportion of the energy consumed on-island.
- ***Solar profile:*** Approximately 33% of residences already have solar PV panels installed and feeding into the grid. The Solar Cities program from 2007 to 2012 found this to be the maximum available roof space at the time of the project, due to shade cover, structural integrity due to older roof ages, asbestos roofs and rental properties where the owner could not be met; a more recent study has not been conducted so there may be more roof for solar uptake. Ground mounted solar is constrained due to hilly terrain and the majority of the island is designated as National Park.
- ***Energy efficient practices:*** Energy reduction is well understood by residents and the wider Magnetic Island community due to the long history of energy efficiency projects. The community is still motivated to achieve further energy reductions. The Solar Cities program, spanning from 2007 to 2012, led to high awareness of energy usage and encouraged energy efficiency. High energy use and emissions primarily come from transporting goods and people to the island and removing waste from the island (33% of energy consumed attributed to the seagoing transport of passengers and freight). The survey conducted as part of this project in Phase 1 showed that 96% of respondents considered efficiency ratings when making an appliance purchase.
- ***Building types and design:*** Many new buildings were observed to follow efficiency design principles, such as elevation, orientation, light roof colour and large awnings. Renting and affordability were seen as the largest barriers for improving energy efficiency in rentals on

[1] *An average year for carbon emissions is based on a combination of components (i.e. electricity, transport and waste) calculated using different timeframes dependent on the data that was available at the time of writing this report. For more details on electricity, refer to section 3. For more details on waste, refer to section 5. For more details on transport, refer to section 6.*

Magnetic Island as efficiency improvements need to be approved by the lessor (approximately 36% of residences rented)[2].

The total annual energy consumption for Magnetic Island based on data obtained from a variety of time periods and assumptions was estimated at **125,237GJ** or **35.32GJ** per capita[3].

Water Key Findings

- ***Community sentiment:*** The Magnetic Island community expressed an interest in becoming more self-sufficient in access to potable water and less reliant on the mainland supply, however were unsure how to progress this at a household level (e.g. would a rainwater tank be enough to supply them with water to be "off the grid"?).
- ***Wastewater infrastructure and treatment:*** There are wastewater treatment plants located in Picnic Bay and Horseshoe Bay, treating most of the island's effluent. Houses in the suburb of Arcadia are not connected to the wastewater treatment network and have individual septic systems instead (46% according to survey results). TCC is also looking for additional areas to discharge treated water for irrigation. The wastewater treatment plant at Picnic Bay is at capacity and TCC is looking to upgrade the plant.
- ***Water consumption:*** Potable water is supplied via an undersea pipeline from Townsville and distributed around the island through feeders. Project survey results found that some residents have rainwater tanks (18%).
- ***Water quality:*** There is no groundwater management in place and minimal use of rainwater tanks and bores as per the survey results due to historical lack of consistent rains and limited water tables.
- ***Water usage reduction:*** As Magnetic Island uses three times more water on a per capita basis than Queensland averages, water saving measures are important for residents and tourists to understand and implement. This could potentially be linked to the tourism sector on the island. TCC has supplied water consumption monitoring equipment to homes to detect leaks in the Townsville Region on the mainland.

Total annual water consumption for Magnetic Island including residential and non-residential usage based on the 2017/18 FY and 2018/19 FY is **833,360kL** or **235.04kL** per capita[4].

Waste Key Findings

- ***Community sentiment***: The community is concerned that the general waste and comingled recycling is disposed of in the same bins once waste reaches the on-island transfer station. It was observed that the same waste removal truck is used for collecting the waste and recycling (it is washed out between uses), which caused the confusion. There is also a high level of waste contamination with general waste being disposed of in comingled recycling bins and vice versa at the household disposal level as reported by TCC, which may have also led to the confusion regarding the combining of waste streams at the transfer station. The community group Zero Waste Magnetic Island (ZWMI) are responsible for the management of any funded Zero Waste projects and escalating any risks to the Magnetic Island Community Development Association, whilst also communicating the work and outcomes to island residents and other stakeholders.

[2] (Australian Bureau of Statistics, 2016)

[3] *Energy consumption components will be detailed further in the Energy section.*

[4] *Water consumption data provided by Townsville City Council, current as of 2019. Per capita includes residents and visitors.*

This includes Townsville City Council approving a trial of a small bio-regen unit for restaurants in Horseshoe Bay to use to reduce food waste. ZWMI have been identified as a key stakeholder group within the community for waste projects. The Townsville Region is also engaged in the Plastic Free Places initiative which is intended to be expanded to Magnetic Island.

- ***Waste disposal:*** General waste pickups are conducted weekly and co-mingled recycling pickups are conducted fortnightly by the council. Waste and comingled recycling is transferred to the waste transfer station for separation and sorting and then transported off the island to be landfilled or recycled in Townsville. There are no waste disposal facilities for tourists in motorhomes which acts to limit stay duration and can lead to illegal disposal of sewage and waste. Beaches on Magnetic Island are often contaminated with plastic waste washed up as debris. Annual beach clean-up days are organised by the community.
- ***Waste facilities:*** Waste facilities: Waste is separated and sorted at the waste transfer station and then transported off the island to be landfilled or recycled in Townsville. Disposal facilities for tourists in motorhomes are not available, limiting stay duration and encouraging illegal disposal of sewage and waste.
- ***Community initiatives:*** Waste facilities: Waste is separated and sorted at the waste transfer station and then transported off the island to be landfilled or recycled in Townsville. Disposal facilities for tourists in motorhomes are not available, limiting stay duration and encouraging illegal disposal of sewage and waste.
- ***Reduction, recycling and re-use:*** The council conducts best practice green waste management, providing free mulch to residents. Enzymes are added to green waste disposed (free of charge) by the residents to produce the mulch. High contamination rates of non-recyclable materials in comingle recycling bins, suggest lack of education, understanding or misconception of the recycling process. TCC is doing work on-island to introduce circular systems with waste management and water reduction.

Total waste generated in 2018/19 was **6,243m^3** which was comprised of waste sent to landfill and recycled, reused and composted waste[5]. Waste sent to landfill amounted to approximately 2,948m^3 which includes non-residential and residential waste (2,515m^3 residential and 432m^3 non-residential). A larger amount of waste was recycled, reused or composted equating to approximately 3,296m^3.

Transport Key Findings

- ***Community sentiment:*** Transport was the most talked about issue on the island during consultation sessions, with concerns raised about the size and operation of public buses, the condition of walking and bike paths and number of vehicles on the island.
- ***Walking tracks and paths:*** Walking paths are available throughout the island. Hire bikes, including some electric bikes, are also available. The community are concerned with pedestrian safety on Magnetic Island due to lack of footpaths in some built-up areas.
- ***Vehicles:*** There are approximately 1,300 motor vehicles on the island – 49% of respondents to the ABS 2016 Census had one vehicle, 25% had two and 8% had 3 or more. Approximately 12% of households reported no motor vehicles, which is twice the state average[6]. Visitors can bring

[5] *Waste data provided by Townsville Water and Waste, current as of 2019.*

[6] (Australian Bureau of Statistics, 2016)

their own car or hire car onto the island via the vehicle ferry. There were nine hire car companies identified on the island in 2019.

- ***Public transport:*** A bus service runs frequently and accommodates the ferry arrivals and departures from Magnetic Island, available for both residents and visitors to the island. There is a small taxi service and one Uber available. The bus route services Picnic Bay, Nelly Bay, Arcadia and Horseshoe Bay. The bus service is widely used and considered to provide a good service to the Magnetic Island community, however, there were concerns raised by residents about the size of buses and potential impacts to road safety. Residents and visitors also reported a lack of service over midday, as the bus service generally aligns with the ferry arrivals and there were no ferry services during this time.
- ***Marine transport:*** A passenger and a vehicle ferry run multiple and regular services to the island throughout the week and until late at night, with over 100 trips per week. SeaLink have made significant investments in increasing fuel efficiency of their fleet. Residents did raise concerns that prices for both ferry services were quite high, even though some discounts are available specifically for the vehicle barge.

The Magnetic Island transport profile consists of both road and marine transport including public transport buses, tour company buses, privately owned motor vehicles as well as barges and ferries used for freight and passenger transport. The total amount of fuel estimated to be used by the Magnetic Island community for all transport modes based on an average year is **1,474kL** including petrol and diesel[7]. The barge and ferry use the most fuel per year (1,052kL) followed by privately owned motor vehicles (224.31kL of petrol and 147.79kL of diesel). Public transport and tour company buses used the least amount of fuel (50.08kL).

Resilience Key Findings

- ***Island mode:*** Perceived island mode is estimated at 6 days for businesses and 7 days for residents, based on the responses provided in the project survey. Island mode is defined as the ability to operate without ongoing support or resources, such as power generation, water supply, food supply and waste removal from the mainland.
- ***Community sentiment:*** Water supply, natural disasters, power generation and the island's reliance on the mainland for food, water, energy and medical services are seen as areas of significant concern in terms of resilience and self-sufficiency.
- ***Current climate and climate change:*** The Townsville region is prone to heavy precipitation events and cyclones which cause overland flow, flash flooding and damaging winds. Coastal inundation is the largest climate related threat to Magnetic Island, including rising sea levels, increasing intensity in storm surges/cyclones, coastal erosion and increased flooding during storm events. The majority of the island's infrastructure is located along the coastlines, or bays which are more likely to be cut off during severe weather events.
- ***Projected climate change impacts:*** Climate change is likely to increase the severity of these extreme weather events. Recognising this, the council is committed to the QCoast2100 program to improve the resilience of the island's assets and areas. Climatic events already have an impact on the tourism industry with domestic and international travellers not wanting to visit the island during the summer cyclone/storm season[8].

[7] *Transport data collated from different sources over different time periods. Refer to the Transport section for further details.*

[8] (Bitten by the Travel Bug, n.d.)

- ***Experienced events:*** Magnetic Island has experienced damage over the last decade and predictions indicate that this will continue to worsen over time, mainly due to impacts from floods and storm surges (including cyclones) according to the Queensland Reconstruction Authority's North and Far North Queensland Monsoon Trough State Recovery Plan 2019-2021. Severe weather events such as the North and Far North Queensland Monsoon Trough in January 2019 caused an estimated $5.68 billion in physical damage to communities, property and infrastructure and an estimated $116 million in small business disruption for Magnetic Island[9].
- ***Community preparedness and perceived resilience:*** The perceived resilience to climate related impacts by Magnetic Island residents is high, due to strong support within the community. Residents show strength within community groups and are willing to work together for repairs/reconstruction after a climate related event. However, as the island is dependent on the mainland for supplies and essential services, actual resilience is low if the island is forced to operate independently for more than a week. There is no designated cyclone shelter on the island and many residents stated they would not want to evacuate the island during consultation. Magnetic Island operates under TCC's Disaster Management plan, however there is no specific evacuation or disaster management plan for the island.
- ***Current emergency plans***: There is no designated cyclone shelter on the island and many residents stated they would not evacuate the island. There is a disaster management plan for the Townsville Region which includes actions for Magnetic Island and delegated authority TCC, however there is no stand-alone evacuation or disaster management plan for the island, which was raised as a concern by community.

The results from the sustainability assessment were used to inform the development of a preliminary long list of options to help reduce emissions and increase resilience of the island communities. Community consultation was undertaken to test the options and generate feedback on their potential feasibility.

[9] (Queensland Reconstruction Authority, 2019)

1. SUSTAINABILITY ASSESSMENT METHODOLOGY

Figure 2 below illustrates the main steps taken to complete the sustainability assessment. The five themes of energy generation and efficiency, water, waste, transport and resilience were assessed.

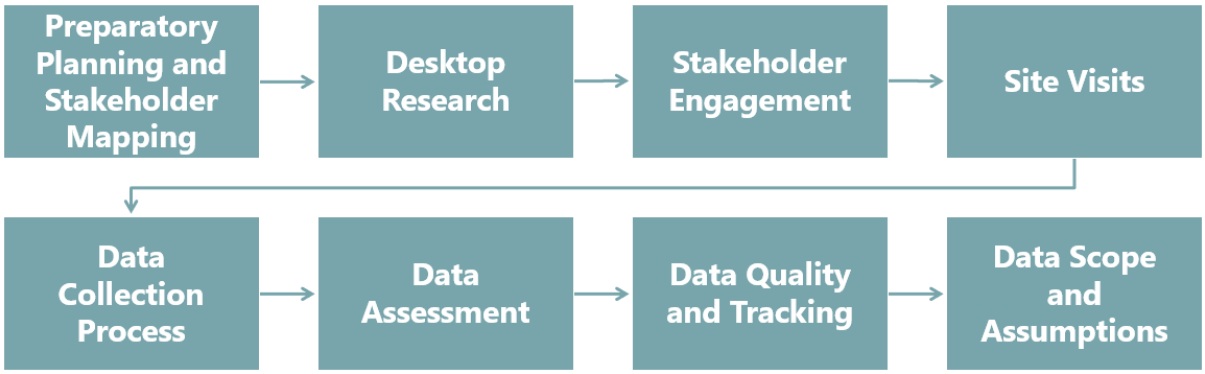

Figure 2: Sustainability assessment methodology

1.1. Preparatory Planning and Stakeholder Mapping

The project team defined the scope and method to assess the five key themes of energy generation and energy efficiency, waste, water, transport and resilience. During the preparatory planning and stakeholder mapping steps, the project team identified stakeholders and groups to engage with. These were captured in a central stakeholder register (containing names, organisations, positions, email addresses, phone numbers as well as a communication log) which was continuously updated throughout the project to account for evolving relationships and changes (see Appendix 1: Magnetic Island Communication and Engagement Plan).

A wide-ranging and flexible data collection strategy was essential to collect the required primary and secondary data. This approach effectively captured input from the high number and variety of stakeholders involved throughout the sustainability assessment and relevant to the project. For this reason, a combination of data collection methods was applied that were deemed most appropriate for this project phase, which are defined in Table 4.

Table 4: Data collection methods for sustainability assessments

Data collection method	Approach and sustainability assessment outcome
Desktop research	Operational data, statistics, reports, etc. were obtained from a range of stakeholders including council, Ergon and other key contacts. This also included research papers and publicly available documents. This information was gained through information requests sent to the concerned parties alongside desktop research.
Online survey	A survey targeting the project's five key themes were distributed to the Magnetic Island community before the second visit (November 2019). Key contacts included businesses, residents and government bodies based on the island. Approximately 214 respondents participated in the survey for Magnetic Island (9.16% of the population) and the results have been included in this assessment. The survey allowed the different stakeholders

	to provide focused answers and quantitative data about life on the island. Refer to Appendix 2: Project Survey Results for survey responses.
Interviews	Interviews consisted of one-on-one or small group discussions and focused on the five sustainability themes. Information was captured by note-taking. All field notes were collated in a central Sustainability Assessment OneNote document.
Drop-in sessions	Drop-in sessions allowed the project team to meet community members and other stakeholders, build relationships and promote the project. The project's key themes were the focus of the conversations with the community. Three drop-in sessions were held on the island between Friday the 30th of August and Saturday the 31st of August. The team met with representatives from the island's community associations to discuss the project and the island on Thursday the 29th of August.
On-island visits	On-island visits allowed the project team to collect detailed qualitative and quantitative information on the project's five key themes. Buildings, infrastructure, equipment, etc. were visited during an island-wide tour conducted by EarthCheck, accompanied by a representative from TCC. All field notes were collated in a central Sustainability Assessment OneNote document.
Photographs	Photographs were taken during island visits to provide context to the collected data. Photographs of private property and people were only taken where permission was granted.

1.2. Desktop Research

Desktop research and a literature review were undertaken to develop understanding around the history, culture, demographics, infrastructure, facilities and future development of Magnetic Island including previous climatic events and impacts, future climate projections and existing preparation and recovery documentation.

The review encompassed secondary information including reports, existing data and previous studies conducted on the island and the region as well as other publicly available information to inform the following steps of the assessment.

The desktop research informed the background and provided the foundation for each of the key sections of the sustainability assessment.

Among others, key documents included in the literature review were:

- Coastal Hazard Adaptation Strategy (CHAS) for Townsville City Council Pilot Project, GHD (2012)
- Magnetic Island (Yunbenun) Management Statement, Department of National Parks, Recreation, Sport and Racing (2013)

- Magnetic Island, Queensland EPBC Act Policy Statement 5.1, Department of Environment and Science (2010)
- Townsville Local Disaster Management Plan, Townsville City Council (April 2019)
- Townsville Queensland Solar City Final Report, Ergon Energy (2006-2013)

1.3. Stakeholder Engagement

The project team was introduced to local government contacts from the Townsville City Council (TCC) and other key on and off-island contacts such as SeaLink, Ergon and community association leaders. EarthCheck led the project team's engagement activities with key stakeholders and the community, together with advice from council and Magnetic Island Community Development Association (MICDA). RES led engagement with First Nation families on Magnetic Island.

The EarthCheck project team worked closely with the council to obtain relevant information for the sustainability assessment. The council assisted with the distribution of communication, booking facilities, introductions to key on-island stakeholders and arrangements for on-island access where required.

An island operational team that met fortnightly throughout the duration of the project, was formed to ensure project engagement, local ownership and strategic alignment with other programs. The project team liaised with the operational team throughout the project to gain their feedback on proposed approaches, findings and draft recommendations. Magnetic Island's operational team consisted of Greg Bruce (TCC), Adam King (TCC), Dylan Furnell (TCC), Julie Heath (Ergon Energy), Les Sampson (MICDA) and Margaret Gooch (ZWMI).

Magnetic Island Community Development Association (MICDA) was identified as a key stakeholder in the project. MICDA is one of the main on-island project proponents, having advocated for Magnetic Island to be included in this pilot project. MICDA's president is a member of the project's operational team. MICDA were key in organising meetings with the presidents of other community organisations on-island, such as Tourism Magnetic Island (TMI), the Magnetic Island Residents and Rate Payers Association (MIRRA) and Magnetic Island Nature Care Association (MINCA), at key stages of the project.

As the energy supplier for Magnetic Island, Ergon was a pivotal stakeholder at all project stages due to the previous work done as part of the Solar City project and with one of the undersea cables nearing end of life. Ergon provided critical input throughout the project and was involved in the shape and form of energy-related options and projects. Ergon provided information and data for the sustainability assessment and provided technical and logistical knowledge and experience to the project and its outcomes.

All contacts identified were added to the stakeholder register (see Appendix 1: Magnetic Island Communication and Engagement Plan) and communication strategies were developed and implemented.

Pre-interviews with key contacts from the Operational Team from Ergon, TCC, MICDA and ZWMI were conducted before the first on-island visit. These communications were critical in establishing a relationship with the key stakeholders, gaining island context as well as developing the island visits and individual site visits.

Key aspects discussed in the pre-interview stage included:

- Perspectives on the objectives of the project and climate change issues;

- Perspectives on how to get the best outcome for the project;
- Similar and relevant studies conducted on the island and lessons learnt; and
- Feedback on the assessment methodology and community engagement strategy for the sustainability audit phase.

During this stage, a data request was issued to the council to gather information and data about Magnetic Island's:

- Utilities and infrastructure;
- Extreme weather events and disaster management planning;
- Economic development plans;
- Local planning;
- Census and demographic data; and
- Other documents, practices and protocols that may assist in the assessment.

1.4. Site Visits

The project team visited Magnetic Island to collect quantitative and qualitative data on the 29th to 31st of August 2019. To complete the sustainability assessment and address any remaining information gaps, further data collection was conducted during the second island visit between the 31st October to the 2nd November 2019. A third visit was conducted on the 5th to 7th of March 2020 in order to gain further information around the proposed project options and understand prioritisation of the projects.

Community engagement activities were held during all three island visits. Table 5 below lists the type of engagement activity, dates, location as well as an approximation of persons engaged during each activity.

Table 5: Community engagement activities and persons engaged

Date	Location	Activity	Persons engaged
29.08.2019	Amaroo on Mandalay	Meeting with presidents of community association groups	10
30.08.2019	RSL Arcadia	Community meeting and information session	6
30.08.2019	Amaroo on Mandalay	Community meeting and information session	2
31.08.2019	RSL Arcadia	Community meeting and information session	12
31.10.2019	Amaroo on Mandalay	Meeting with presidents	7
01.11.2019	RSL Arcadia	Community drop-in session (Options longlist)	16

01.11.2019	Arcadia Village Hotel	Community drop-in session (Options longlist)	1
01.11.2019	Amaroo on Mandalay	Community drop-in session (Options longlist)	2
02.11.2019	Amaroo on Mandalay	Community drop-in session (Options longlist)	13
05.03.2020	Amaroo on Mandalay	Meeting with presidents	9
06.03.2020	RSL Arcadia	Community drop-in session (Options shortlist)	4
06.03.2020	Amaroo on Mandalay	Community drop-in session (Options shortlist)	2
07.03.2020	RSL Arcadia	Community drop-in session (Options shortlist)	8

In preparation for each of the island visits, posters advertising the project purpose and drop-in session schedule were circulated throughout the community via council and the different community organisations (Magnetic Island Community Development Association (MICDA), Magnetic Island Nature Care Association (MINCA), Magnetic Island Renters and Ratepayers Association (MIRRA), North Queensland Conservation Council, Tourism Magnetic Island (TMI), Returned Services League (RSL) and Zero Waste Magnetic Island). These were also posted on the ferry. As a presentation tool to guide discussions, the methodology (different project phases and scope) was presented as project flyers. These were printed out and distributed during drop-in sessions.

Once on-island, EarthCheck led community engagement and held multiple meetings and informal conversations with the Magnetic Island community. This process involved RES leading meetings with key traditional owner stakeholders, which was critical to constructive community engagement and overall project success.

During the island visits, TCC took EarthCheck personnel around key facilities and infrastructure on-island to provide contextualisation of the island's services and operations. Council provided the project team with relevant information regarding infrastructure under the various themes. The sites visited included:

- Nelly Bay, Arcadia, Picnic Bay and Horseshoe Bay;
- Both wastewater treatment plants;
- Solar skate park;
- Waste transfer station;
- Golf course;
- Council and state government facilities, including workshops, garages and buildings;
- Marina;
- Capped landfill site; and
- Emergency service areas and SES base.

The consultation process on Magnetic Island also involved arranging multiple meetings and discussions with stakeholders around the island.

1.4.1 Island Infrastructure

Important energy, water, waste and transport infrastructure on Magnetic Island has been mapped in Figure 3. Energy infrastructure includes the submarine cables and overhead feeders that provide electricity to the community. The waste transfer station and capped landfill site are located around Picnic Bay. Transport including the ferry terminal, public bus route and the old jetty have been mapped. The locations of the community consultation meetings have also been illustrated including the RSL Arcadia, Amaroo on Mandalay and Arcadia Village Motel.

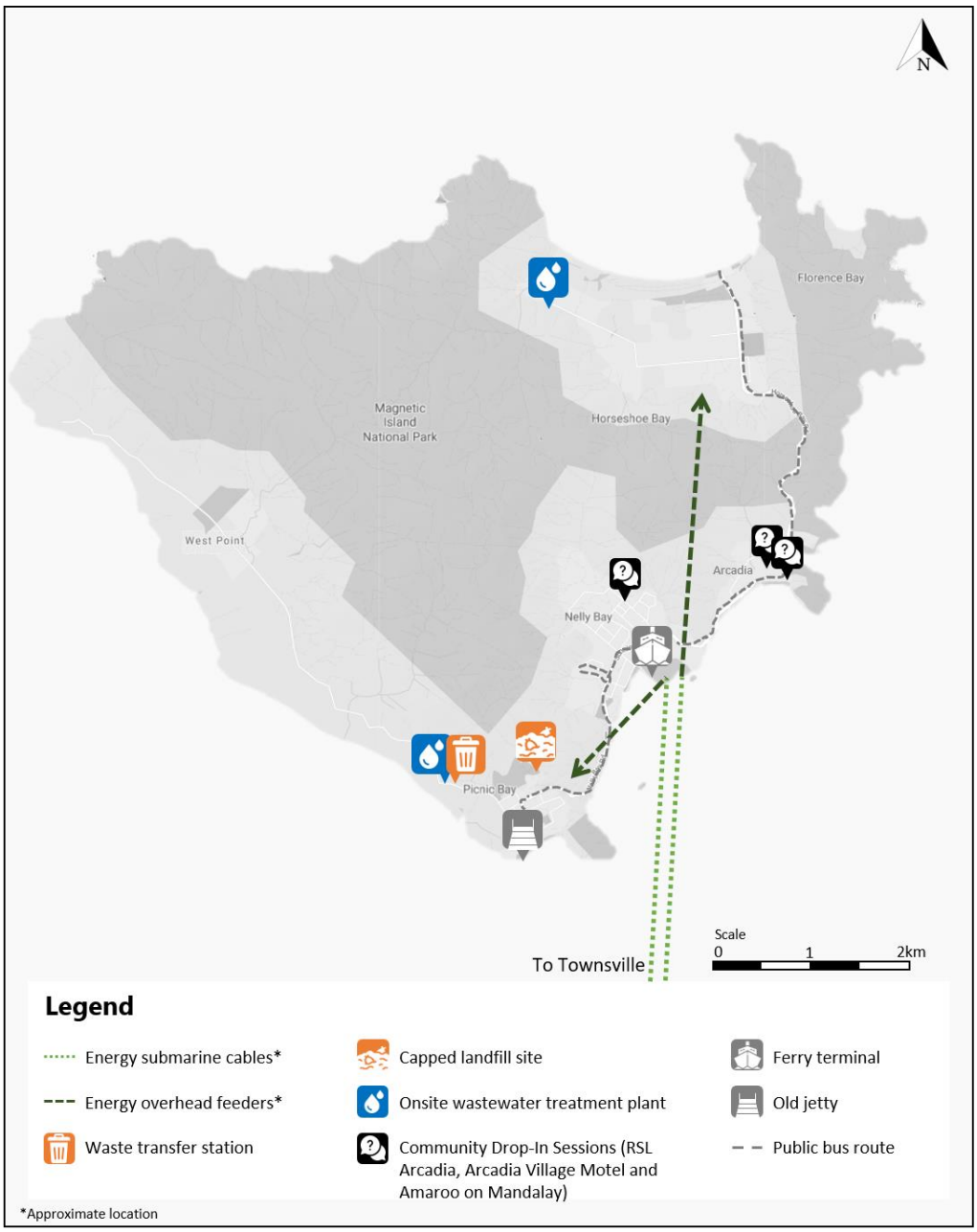

Figure 3: Magnetic Island Infrastructure

1.5. Data Collection Process

The sustainability assessment data collection process was led by EarthCheck (supported by RES and QTIC) and targeted the five key areas of energy (generation and efficiency), water (supply and treatment), waste, transport (inter and intra-island), and resilience to the effects of climate change. All data and information were collected through one or many of the data collection methods outlined in Table 6.

Table 6: Sustainability Themes

Sustainability Theme	Description
Energy	**Consumption and Generation** The energy data scope relates to on-island energy production (non-renewable and renewable) as well as energy usage. The main energy consuming elements/ practices on-island were identified and catalogued. Energy production figures for the grid as well as the residential/ non-residential split in energy consumption numbers were obtained through Ergon Energy. This data was used to develop energy demand graphs to illustrate monthly energy demand as well as over a 24-hour period. Energy data was measured and collected in a range of units and figures therefore it was converted into gigajoules (GJs) for presenting all results, performance measures and comparisons (except for demand which is presented in kW). **Energy Efficiency** Energy efficiency data relates to energy reduction systems and initiatives as well as energy consumption behaviours. Information around this theme comprised of project team observations during the site visits, conversations and meetings with stakeholders, and community input provided during the drop-in sessions. This data was measured and collected in a range of units and figures that were converted into GJs for presenting all results, performance measures and comparisons.
Water	This key area addressed potable water treatment, sewerage treatment/ management, water consumption as well as water usage reduction/ efficiency measures and practices. Data for potable water production and wastewater management was obtained through TCC, who manage the infrastructure. Information around water usage reduction/efficiency measures and practices was obtained through third party reports and data, interviews, surveys, drop-in sessions as well as the project team observations during site visits. Water consumption was measured in kilolitres (kL) of water.
Waste	The waste management data relates to on-island waste generation, waste management as well as recycling and materials re-use initiatives. Waste data relating to waste streams and quantities were obtained through Townsville Water and Waste. Waste production was measured and reported in cubic meters (m^3).
Transport	The transport sustainability assessment targeted two main transport types: on-island transport (including vehicles, walking, public transport and a tour

	company) and marine transport (including barges and ferries). There are no flights to and from Magnetic Island. Transport data was obtained through Australian Bureau of Statistics (ABS) data, community consultation and relevant company websites. Transport data was measured and collected in a range of units and was converted into litres of fuel for presenting all results, performance measures and comparisons. Energy data for transport was converted to GJ from litres of fuel.
Resilience	For the purpose of this project, the community's resilience was evaluated through a climate resilience and self-sufficiency lens. Essentially, the climate and weather-related risks were assessed and compared to the community's preparedness, in terms of infrastructure, emergency planning and mitigation measures. This information, mostly qualitative in nature, was collected by the project team during the site visits through discussions with community stakeholders. All the data collection methods described in Table 4 were employed. The sustainability assessment findings allowed the project team to assess the community's preparedness to severe weather events and climate change, estimate the capacity to operate in island-mode through the information provided to us via the survey, as well as provide the context for the developed project options.

1.6. Data Assessment

The quantitative sustainability assessment data collected was assessed using EarthCheck's proprietary benchmarking software, to catalogue, organise and contextualise the information. Detailed profiles were developed for each of the key themes. The use of the benchmarking tool allowed for the modelling of the island's approximate greenhouse gas emissions on a whole-of-island/whole-of-community level as well as for each of the five project themes.

The qualitative data collected as part of the sustainability assessment informed and contextualised the current situation on Palm Island around energy, water, waste, transport and resilience. This assessment set the foundation for the options identified by the project team, community and other key stakeholders, and supported the risk assessment.

1.7. Data Quality and Tracking

Throughout the project, ensuring data quality, traceability, and shareability were key. A data repository and assumptions log (spreadsheet) were used for the collection of all sustainability assessment data. This consisted of a table including the obtained data divided by key area, the data source, as well as accompanying assumptions relating to the information.

All third-party sources (reports, studies, emails, etc.) were collated in a document register to ensure data tracking, identification of knowledge gaps and assumptions as well as facilitation of information sharing through the project team.

Stakeholders and stakeholder communications were tracked through a stakeholder register (see Appendix 1: Magnetic Island Communication and Engagement Plan). This document was updated and maintained throughout the project to account for changes and evolving relationships over the duration of the project.

1.8. Data and Scope Assumptions

Several informed assumptions defined the scope of the sustainability assessment throughout the report as outlined in Table 7 below. Other assumptions specific to each theme are included in the relevant sections below.

Table 7: Scope and data assumptions

ACTIVITY MEASURE	ASSUMPTION	SOURCE
Destination residents	It is assumed there are 2,335 residents on Magnetic Island as per the 2016 census.	Australian Bureau of Statistics
Guest nights	It is assumed there were approximately 441,890 guests that stayed at least one night on Magnetic Island in 2018.	Tourism Research Australia
Residential properties	It is assumed there are 1,821 residential dwellings on Magnetic Island as per the 2016 census.	Australian Bureau of Statistics
Commercial buildings	It is assumed there are 211 commercial buildings on Magnetic Island as per the 2015 region data summary.	Australian Bureau of Statistics
Average household size	It is assumed Magnetic Island has 1.3 persons per household and Queensland has 2.6 persons as per the 2016 census.	Australian Bureau of Statistics

2. CARBON EMISSIONS

Total carbon emissions were calculated as **19,643t CO_2-e** for an average year[10].

The Magnetic Island emissions profile includes several emissions sources including electricity generation, diesel generators, waste sent to landfill, onsite wastewater treatment and transportation (land and sea) as shown in Figure 4. The following section provides a summary of the composition of the carbon emissions, with more detailed information and context provided in the following individual theme sections.

Magnetic Island sources electricity from the grid located on the mainland of Australia. Electricity generated by the grid is the single largest producer of emissions, representing 76% of Magnetic Island's total carbon emissions. Just over half of the electricity consumed is attributed to non-residential use (53%)[11].

Transportation (land and sea) makes up the next largest portion of carbon emissions for the island. Marine transport constitutes 14% of the total emissions profile, whereas motor vehicles (petrol and diesel) form 3% and 2% respectively. Emissions produced by buses (public transport and tour companies) are relatively small (0.7%).

Waste sent to landfill, onsite wastewater treatment and generator usage has a relatively small contribution to the total carbon emissions profile.

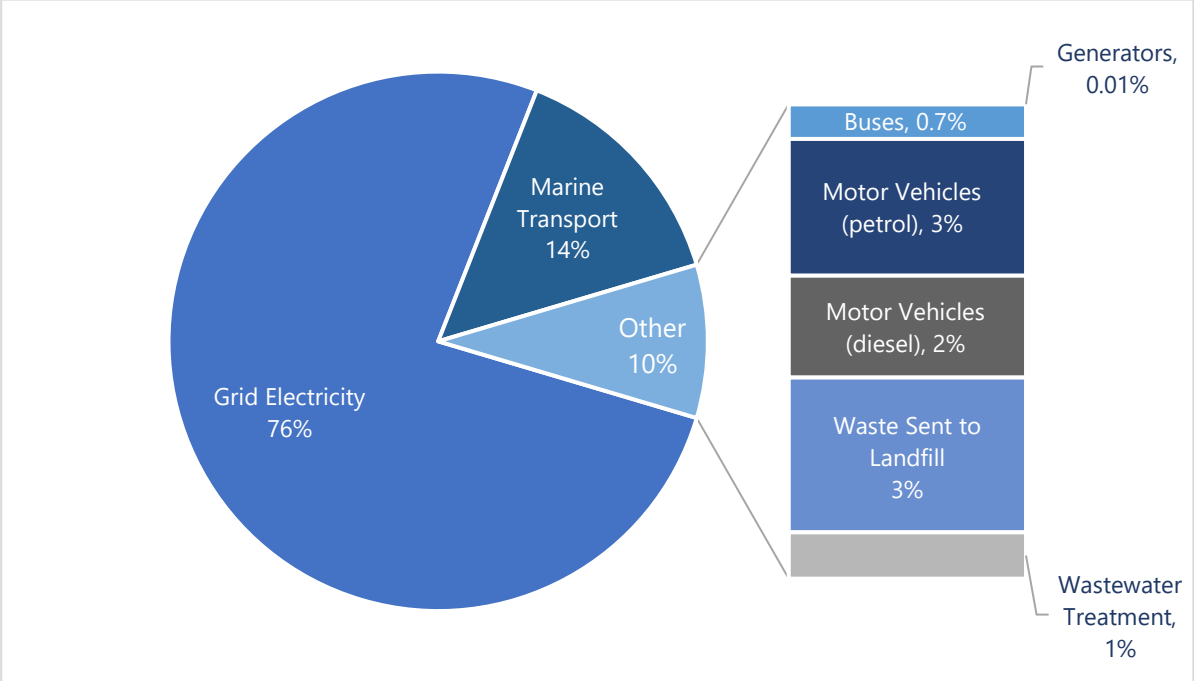

Figure 4: Magnetic Island's carbon emissions profile

[10] *An average year for carbon emissions is based on a combination of components (I.e. Electricity, transport and waste) calculated using different timeframes dependent on the data that was available at the time of writing this report. For emissions relating to electricity, see section 3. For emissions relating to waste, see section 5. For emissions relating to transport, see section 6.*

[11] Electricity data provided by an Ergon Energy representative, current as of 2019.

3. ENERGY

3.1. Energy Generation and Consumption

This section provides an overview of Magnetic Island's energy profile and infrastructure, including energy generation and consumption.

3.1.1. Overview of Energy Generation and Consumption

Magnetic Island is supplied with electricity by Ergon Energy via two submarine cables. One of the cables is nearing its end of life and is marked for an upgrade. Upgrades will need to consider potential population growth and peak season loads for tourism.

The annual energy consumption for Magnetic Island is estimated at **125,237GJ**, which is illustrated below in Figure 5. Electricity from the grid forms the largest part of the energy profile (50%). Marine transport, including the ferry and barge service, accounts for 33% of the total energy usage. Road transport which includes motor vehicles, public transport and bus tour companies forms 12% of energy. Solar power (5%) and diesel generators (0.02%) contribute the lowest portion of energy usage to the total island profile.

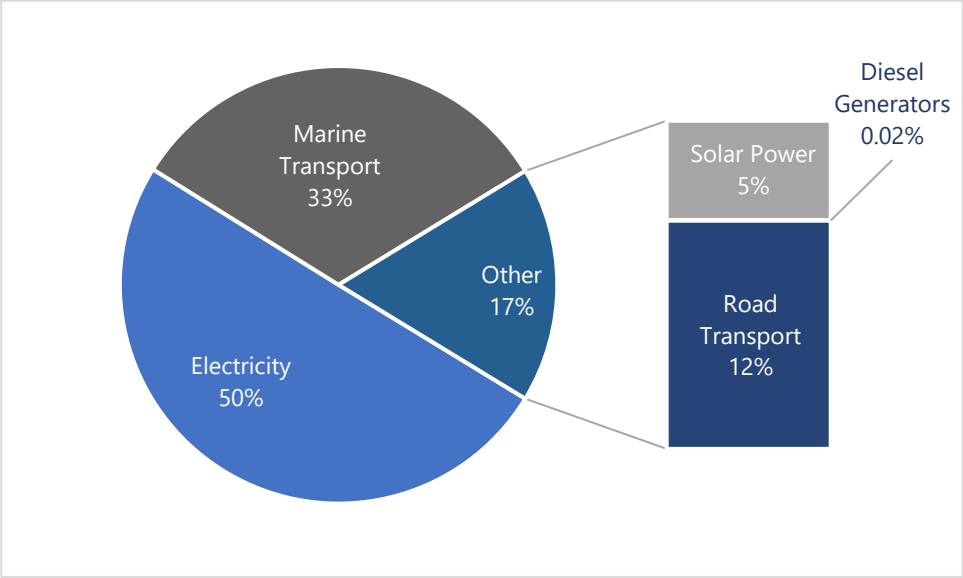

Figure 5: Energy consumption profile based on an average year[12]

3.1.2. Energy Generation

The island is supplied with electricity by Ergon Energy via two submarine cables each approximately 12km in length, extending from the mainland to Nelly Bay[13]. Once on the island, the 11kV

[12] *An average year for the energy profile is based on a combination of aspects (i.e. electricity, solar and transport) that were calculated on the basis of different timeframes as this was the data that was available at the time of writing this report. Electricity consumption is based on the average of previous financial years. Solar energy is based on the average number of sunlight hours a year and the current kW of solar systems on the island. For more details on transport related energy, see section 6.*

[13] (Ergon Energy, 2010)

distribution network radiates from Nelly Bay as two separate and predominantly overhead feeders, one to Horseshoe Bay and the other towards Picnic Bay[14].

One of the submarine cables is nearing its end of life and is earmarked for a costly upgrade and Ergon Energy are currently assessing an expected upgrade date. Any upgrades in the future will need to consider potential population growth and handle peak season for tourism. Through the previous Solar City project, the additional solar installations on-island were successful in deferring the upgrade of the cable. Any efforts to reduce total energy consumption in the near future on the island, would further extend the need to upgrade the cable, including the potential to completely remove a cable if the island is able to be self-sufficient in energy generation.

Annual electricity consumption for Magnetic Island is **62,798GJ**[15]. Peak load is an issue which needs to be closely managed for Magnetic Island so the island does not run the risk of exceeding its import capacity. The peak demand occurs between 6pm and 9pm daily (Figure 6) which was shifted later into the day as part of the Solar City project to reduce competing demand on the grid with Townsville areas on the mainland.

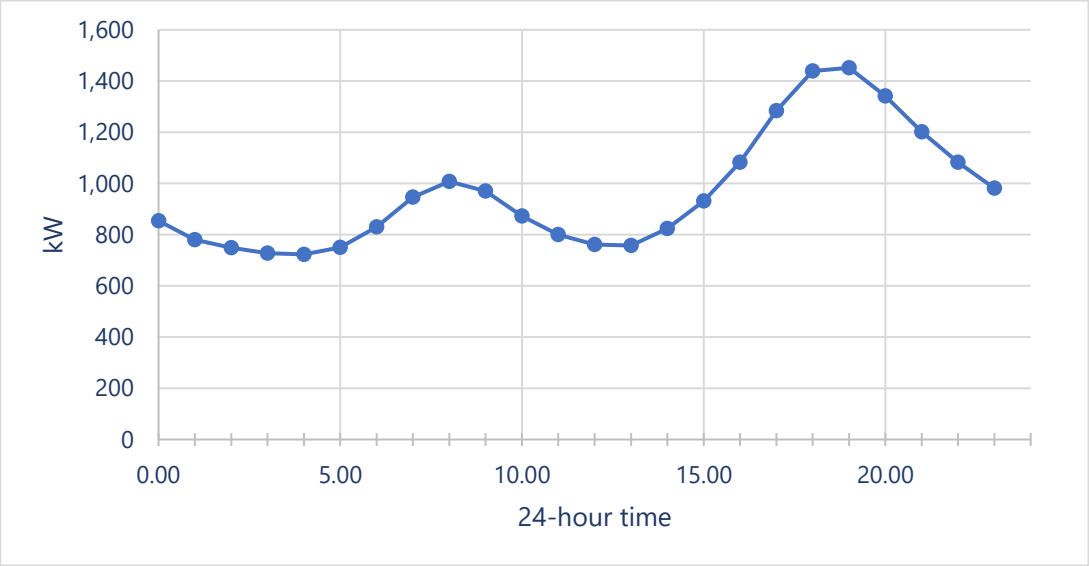

Figure 6: Daily energy demand over a 24-hour period[16]

Non-residential properties including industry and businesses use 13% more electricity overall than residential properties based on data provided by Ergon Energy (Figure 7). Non-residential energy consumption includes council offices, buildings and infrastructure (water treatment plants, transfer station, etc.), restaurants, hotels, seasonal holiday home accommodation, schools and multiple community organisations who hire facilities and venues to meet (including Zero Waste Magnetic Island, Magnetic Island Community Development Association (MICDA), Magnetic Island Lions Club, Magnetic Island Nature Care Association (MINCA), Magnetic Island Residents and Ratepayers Association (MIRRA), North Queensland Conservation Council, Returned Services League (RSL) and Tourism Magnetic Island).

[14] (Ergon Energy, 2013)

[15] *Based on the average of previous financial years produced by both feeders. Provided by Ergon Energy, current as of 2019.*

[16] *Energy demand data provided by Ergon Energy, current as of 2019.*

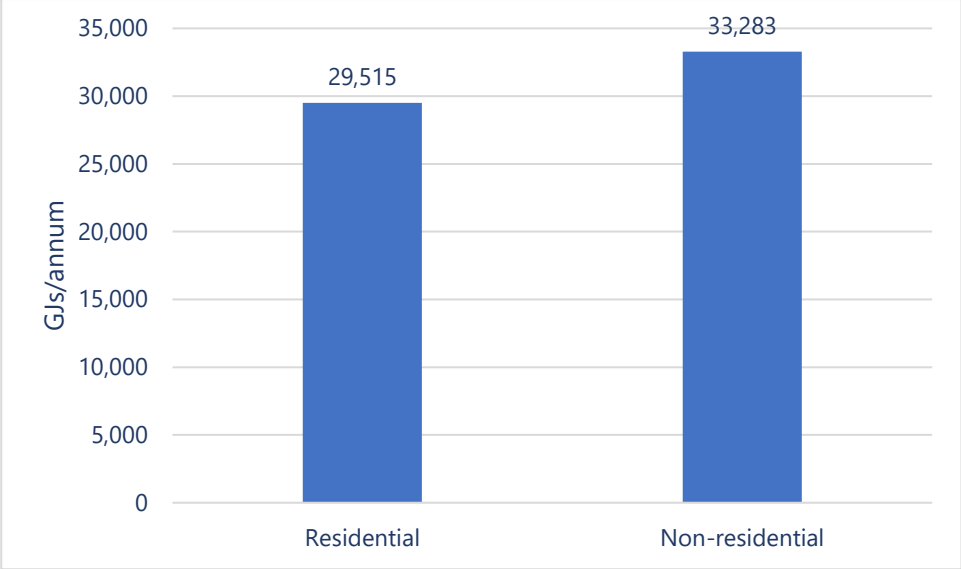

Figure 7: Comparison of electricity consumption between residents and businesses per annum[17]

Energy demand is at its highest during the summer months. Hotter temperatures typically require increased usage of air conditioners. The summer months also align with many holidays, where tourism influx to the island greatly increases. Energy demand peaks in December-January, April and September and aligns with holidays such as Christmas, Easter and school holidays (Figure 8).

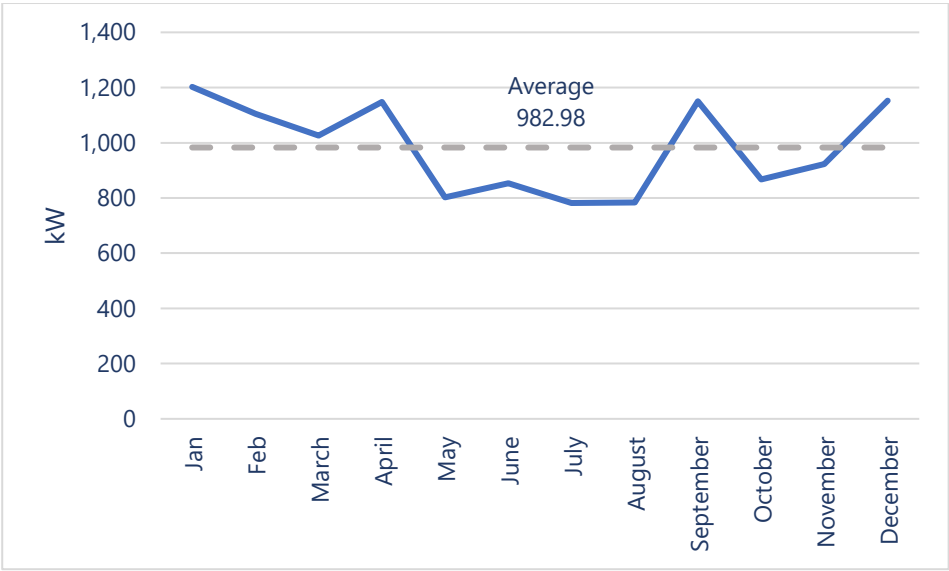

Figure 8: Average daily energy demand per month[18]

As shown in Figure 9, Magnetic Island has a lower per household electricity consumption compared with the Queensland average, although a higher per person consumption. This is due to the average household on Magnetic Island being smaller, the average age of islanders and the majority of

[17] *The percentage of usage for residents compared with non-residents was provided by Ergon Energy, current as of 2019.*

[18] *Energy demand data provided by Ergon Energy, current as of 2019.*

residents being retired or semi-retired[19]. Households on the island typically count 1.3 persons, while the state-wide average sits at 2.6 persons per household[20].

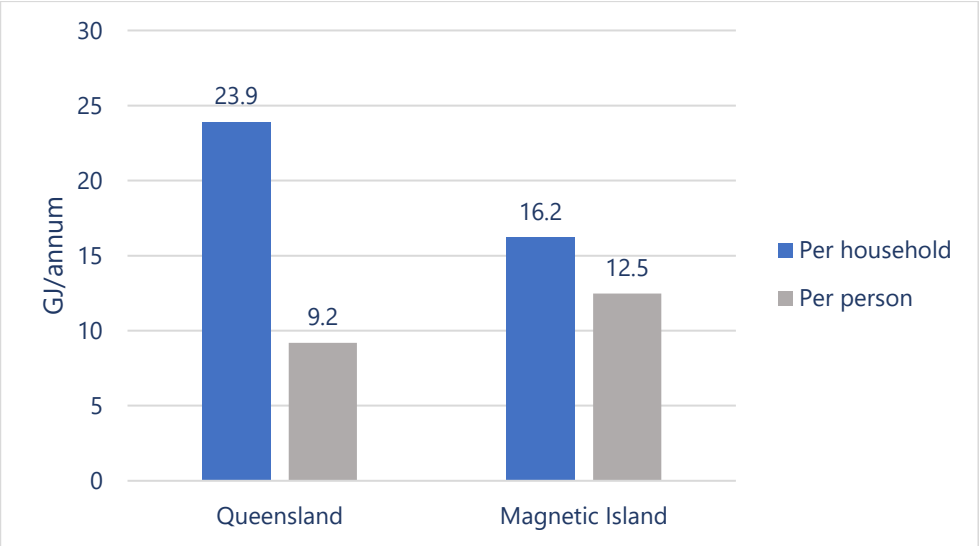

Figure 9: Electricity consumption on Magnetic Island compared with the Queensland average[21]

3.1.3. Solar Profile

As part of the TCC local government area, Magnetic Island participated in the Australian Government's Solar Cities program from 2007 to 2012 which deferred the requirement for an investment of $17M in an additional cable for 8 years.

Key facts about the Solar Cities program:

- The project focused on delivering a range of energy efficiency measures in council and community owned buildings, facilities and sites and delivering the Magnetic Island Solar Suburb project.
- Approximately 30% of the residences on Magnetic Island had solar panels installed as part of the program, generating electricity which is fed into the grid. This was the maximum available roof space at the time of the project, due to shade cover, structural integrity due to older roof ages, asbestos roofs and rental properties where the owner could not be met. However, since the project, more development on-island or changes in house or business ownership, means there may be new viable roof space or roofs may have been upgraded to increase structural integrity.
- Over 200 solar PV and smart meters were installed which introduced approximately 100kW of energy into the grid as part of the Solar Cities project[22]. 95% of these panels were purchased by the homeowners after the conclusion of the project, the remaining 5% were removed by Ergon.
- During the project, there was a commissioning of a new Magnetic Island Solar Park (100kW system) that also provided shade to the community's skatepark. As well as the skatepark,

[19] (Australian Bureau of Statistics, 2016)
[20] (Australian Bureau of Statistics, 2017)
[21] (Australian Bureau of Statistics, 2013)
[22] (Ergon Energy, 2006)

the council facility currently rented by the Men's Shed has a 17kW solar system and the Magnetic Island council depot has a 25kW rooftop system, both installed as part of the program.

- In 2011, Magnetic Island received a national accolade for community participation in reducing electricity usage (Townsville Queensland Solar City, 2013)[23]. Once the Solar Cities program ended residents could purchase their solar panels at a reduced rate and obtain a feed-in tariff to incentivise its continued use.
- Through the efforts of increased solar penetration on-island, incentivisation to shift peak loads and behaviour change education within the Magnetic Community, the targets for the Solar City program were exceeded.
- The Solar City project reduced electricity demand from the grid by 10.5% from the 2008-09 levels of demand. Compared to the Solar City business case, annual maximum demand in 2011-12 was 40% below business as usual without the Solar City project. This meant the project reduced energy demand by 19% beyond the target.
- Energy consumption reduction exceeded the target by 29% and exceeding by 29% the target set for the project. This translates to savings for customers of $1.784 million.
- Energy savings resulted in CO_2-e savings of about 54,000 tonnes to date which has exceeded the project target of 50,000 tonnes.

Through the Solar Cities program, TCC engaged the community in various ways to identify barriers to behaviour change and is now working with the community to address these barriers through further education and communication programs. There is strong evidence that behaviour change brought about by comprehensive energy assessments and extensive community engagement is resulting in a noticeable reduction in electricity consumption. It is also evident from the program, that the community is responsive to energy efficiency and energy reduction programs and are familiar with and receptive to these programs.

A stakeholder reported a mixed response to the Solar Cities trial, as some residents would have reaped larger benefits than others as they received reduced electricity costs from utilising the solar panels with high feed-in tariffs. The stakeholder was an early adopter of the trials and thus benefited significantly from the scheme.

In 2007 batteries were trialled on the island, however the trial proved largely unsuccessful due to a failure in technology. TCC went on to clarify that technology had improved substantially since then and future trials were not ruled out.

3.2. Energy Efficiency

The following section provides an overview and background to energy efficiency on Magnetic Island, including energy efficient practices, and building types and design.

3.2.1. Overview of Energy Efficiency

Energy issues around reduction and efficiency are well understood by Magnetic Island residents due to the long history of energy efficiency projects on-island. There is a strong solar energy culture on the island as well as a high concentration of solar infrastructure throughout the community due to the successful Solar City project.

[23] (Australian Government, n.d.)

During the Solar Cities program, Magnetic Island residents were introduced to energy efficiency measures to delay the upgrade of the undersea cables. Ergon are aiming to continue to delay the upgrade of the undersea cable by further reducing energy consumption and increasing energy efficiency.

3.2.2. Energy Efficient Practices

The project survey conducted asked island residents what appliances were used in their homes to establish a baseline for household energy demand and identify any potential opportunities for improvements to energy efficiency. The results (see **Error! Reference source not found.**) showed t hat most houses on the island had standard appliance set up (for example, air conditioners, TV's, dishwashers, dryers etc.), which are commonly high energy consuming appliances. Whereas previous results on a similar pilot performed on Great Keppel Island showed that many residents forewent these optional appliances, due to running on their own off-grid systems, and these appliances were seen as an unnecessary energy drain.

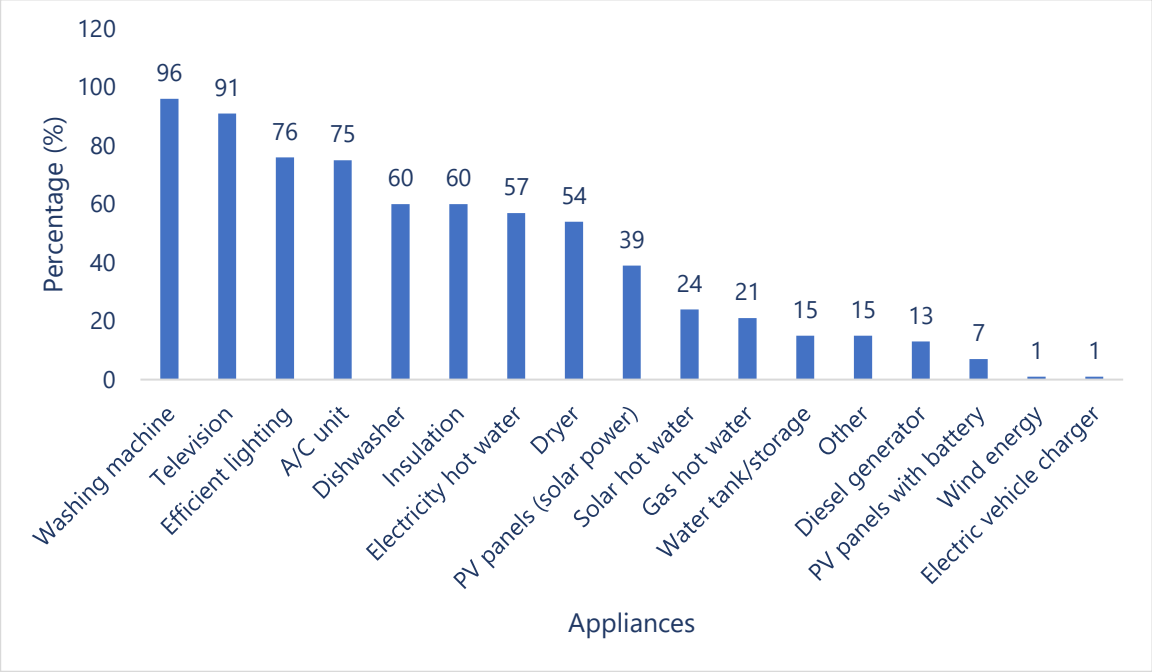

Figure 10: Energy efficiency measures within Magnetic Island Residences (2019)

Over 70% of residents surveyed had energy efficient lighting and energy efficient appliances. Almost all residents who responded to the survey (96.4%) consider energy efficiency ratings when purchasing new equipment or appliances.

According to a survey of Magnetic Island businesses, businesses identified electricity usage as their main operating cost, equalling approximately $21,310 per year on average. Equipment used by businesses high in energy use include fridges and freezers followed by air conditioning systems. Current energy efficient or renewable opportunities used by businesses identified in the survey include smart technologies such as sensor devices for air conditioning and timers for lighting, as well as solar energy. Businesses identified cheaper smart technologies and the availability of government subsidies or incentives as the best options to reduce energy consumption.

It was not possible to obtain individual business consumption profiles as part of the sustainability assessment. However, commercial electricity consumption was provided by Ergon Energy which

included council offices, buildings and infrastructure (water treatment plants, transfer station, etc.), schools, and multiple community organisations, as well as businesses.

All electricity meters installed from November 2018 onwards (residential and non-residential) provide customers with the ability to download and request electricity data from their own meters. In addition, Energy Queensland's rebranded Energy Services division, Eureka, is providing opportunities for communities to participate in their virtual power plant, to create awareness of energy use and thus reducing usage.**Error! Reference source not found.**

Streetlights on Magnetic Island are older designs, such as on Sooning Street. TCC reported that most of the streetlights use mercury vapor lights which produce highly inefficient or non-functional lighting[24].

The physical positions of these poles are set for 100 years, locking-in the position of this infrastructure in the community. It was reported that there is currently no lighting code for Magnetic Island, hence the lighting can sometimes be poor, or the bulbs used are quite old[24]. There are approximately 1,000 streetlights on Magnetic Island which are all Ergon owned and council leased. Council have put forward a proposal to upgrade all bulbs on the island to LEDs.

3.2.3. Building Types and Design

Several residents and businesses have painted their roofs white to further reduce electricity consumption, thereby reducing their costs and greenhouse gas emissions. Painting a roof white with heat reflective paint saves 20-30% of energy usage[6].

TCC provides information on sustainable housing in an information kit, which includes guides on energy savings achieved by having a white roof, drought resilient landscaping etc[25]. The guides in this information kit were last updated in 2009. A range of new technologies and general practice change have emerged since their release. The lack of a formal sustainable housing code means that there is no requirement for new investment to consider energy efficiency building and design practices.

[24] *Interview with TCC representatives, October 2019.*
[25] (Townsville City Council, 2009)

4. PROFILE OF WATER USE AND WASTEWATER TREATMENT

This section provides an overview and background on water use and wastewater treatment on Magnetic Island, including water infrastructure, water consumption, water quality, water usage reduction and wastewater treatment.

4.1. Overview of Water Treatment

Total water consumption on Magnetic Island (including resident and visitor usage) is **833,360kL** based on the average of 2017/18 FY and 2018/19 FY data provided by TCC.

Based on an average water usage of 283kL per year per household provided by TCC for 2017/18FY and 2018/19FY, residential water usage is approximately 516,046kL per year. This equates to 62% of the average total usage for the island.

The remaining 317,314kl is used for non-residential purposes. Non-residential usage can be broken down into commercial use and other use based on council tariffs. Based on an average water usage of 378kL per year per commercial property as provided by TCC for 2017/18FY and 2018/19FY, commercial use represents approximately 79,765kL per year. Considering the touristic nature of the island, this usage appears low. However, this can be attributed to the fact that some properties such as rental accommodation units that are being run as commercial entities are being billed under the residential tariff rate, hence the large proportion of residential usage. The remaining 237,582kL per year is attributed to other properties or uses that are supplied based on the council tariff including irrigation of public open spaces and council facilities and buildings.

4.2. Water Infrastructure

Magnetic Island is dependent on Townsville for its water supply. Potable water is supplied through a high-density polyethylene submarine pipeline that extends for 5.6km from Pallarenda on the mainland to Bolger Bay reservoir. From the reservoir, water is distributed to other reservoirs on the island and finally delivered to the island's properties[26].

Townsville is the main supplier of potable water to Magnetic Island, however some stakeholders voiced that they would like to be more self-sufficient in access to water. While there is not a water shortage on Magnetic Island, TCC has previously introduced water restrictions for the region, including Magnetic Island when there has been drought restrictions put in place[27].

Most residents surveyed by the project team did not harvest rainwater at their property (82%). Rainwater tanks are used by some community members. The uptake is not widespread as many reported they did not see the need for tanks as they are not cost-effective on the island; and the island has a predominantly dry tropical climate, rather than wet, hence many residents do not see the need.

4.3. Water Consumption

The water consumption for Magnetic Island for 2017/18 and 2018/19 financial years is shown in Figure 11.

TCC has supplied water consumption monitoring equipment to homes to detect leaks in the Townsville Region on the mainland. The council has also encouraged the uptake of growing Zoysia

[26] (CitiWater Townsville, 2002)
[27] (Townsville City Council, n.d.)

grass in the region as it is a less water intensive grass and is better suited for the dry tropic conditions of Townsville, which would also extend to Magnetic Island. The grass species however is quite expensive, and education is required surrounding how often to water and mow a lawn.

Some rainwater collection tanks are used on the island, mostly for irrigation or emergencies, while a few residents use rainwater to flush toilets. During a meeting with TCC, it was agreed that residents could utilise rainwater tanks during a disaster, but would need education and support on how to access the water and how to keep it free from contaminants until it is needed to be used.

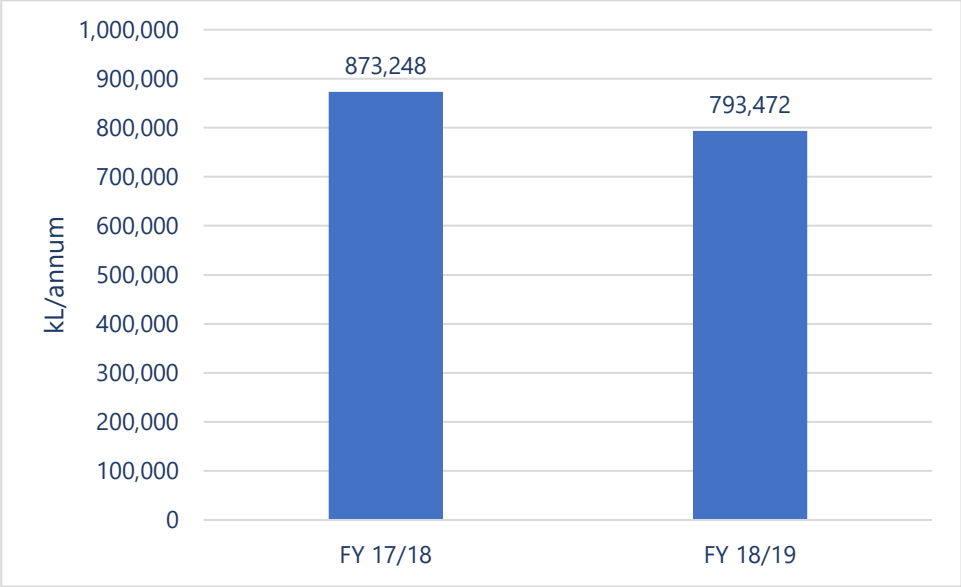

Figure 11: Annual water consumption for two financial years for all water sources on the island, sourced from a Townsville City Council representative

As shown in Figure 12 annual residential water consumption is higher per household and per person on Magnetic Island compared with the Queensland average[28].

[28] (Australian Bureau of Statistics, 2019)

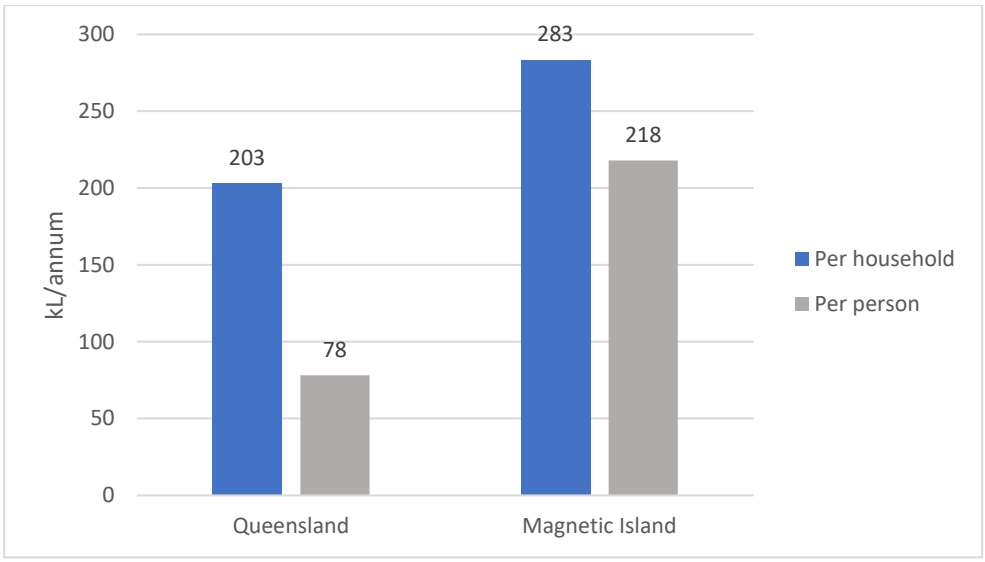

Figure 12: Residential water consumption on Magnetic Island compared with the Queensland average (2016/17 FY)

4.4. Water Usage Reduction

In July 2019, TCC launched the Water Smart Package in collaboration with the Queensland Government, providing rebates of up to $500 to homeowners and renters, and up to $1,000 for body corporates for the purchase of water smart products[29]. The project survey indicated that 66% of respondents are not aware of any incentive scheme that encourage water usage reduction. From the 34% of respondents (37 people) who are aware of incentive schemes, only 35% of residents specified the Water Smart Package or Water Wise Project.

Products and services provided through the program include low-flow sprinklers, tap timers, native plants, compost bins, and irrigation systems. The council engaged with the Townsville community, including the Magnetic Island community, to build awareness and inform them of their water saving and greenhouse gas reduction opportunities from 2019 to 2020.

Townsville City Council has installed 1616 smart water meters in 2020, to help reduce water consumption and cut ongoing costs on Magnetic Island[30]. The installation of the smart water meters was part of the $10 million Water Smart Package to better understand water use across the Townsville area. The meters allow people to track their consumption online so they can react quickly if they see any changes and they are alerted to potential leaks automatically. The Water Smart Package is part of the $225 million 3-point water security solution funded by the State Government.

The council currently offers residents the opportunity to trade-in their less efficient fixtures for more water-efficient fixtures, such as the 'Wabble-Tee' irrigation sprinkler[31].

[29] (Townsville City Council, 2018)
[30] (Townsville City Council, 2020)
[31] (Townsville City Council, 2018)

If Zoysia grass is unaffordable for members of the community, the council also offer grass watering training schedules, which trains the residents' lawn to expect less water over time[32]. This alternative and lower cost method allows for water reductions across the council.

Some parcels of land around the island are irrigated with recycled water, such as the park next to the Skatepark, or irrigated with treated water from the wastewater treatment plants.

4.5. Water Quality

Water is treated by City Water (TCC) on the mainland and pumped to the island from TCC's water supply. The water quality is consistent and treated to a potable level. Access to potable water from the mainland has only been affected in the past during climate related events, such as cyclones or heavy rain events. One resident informed the project team the longest the island had gone without running water was 5 days after Cyclone Yasi (2011). Whereas, two residents indicated in the project survey that this was up to 10 days during the cyclone.

There is currently no groundwater management in place for the management of rainwater runoff. Rainwater tanks and bores are minimally used due to a historical lack of consistent rains (dry tropical climate) and limited water tables.

4.6. Wastewater Treatment

All wastewater generated on Magnetic Island is treated on the island. There are two wastewater treatment facilities on Magnetic Island. One is located in Picnic Bay, the other one is located in Horseshoe Bay. The Picnic Bay facility treats 340kL of water per day with a maximum capacity of 540kL per day, which supplies approximately 1260 people[33].

The Magnetic Island Water Recycling Facility was commissioned in 2002 with one membrane cell containing 1,000 flat sheet membranes. In 2006, the second Magnetic Island Water Recycling Facility was commissioned with the same membrane cell containing 1000 flat sheet membranes. The facilities discharge wastewater in three locations: the golf course irrigation system, as site irrigation and service water reuse, and at the local wetland[33].

The treatment plants are operated by TCC who monitor the site remotely with weekly on-island visits to undertake operational and maintenance checks. There are backup generators at the plant which run for 3 hours per annum for testing only, unless activated in back up mode.

Some residents from Arcadia reported that their properties are not connected to the wastewater treatment plants as the pipes were too difficult to run to their property. These properties that are not connected have their own septic systems (46% of project survey respondents). It is estimated that there are 20-30 residential bio-cycle wastewater treatment systems located in Arcadia and West Point, to purify wastewater and recycle the clean, disinfected water through garden sprinklers or sub-surface irrigation systems.

[32] (Townsville City Council, 2020)
[33] (Townsville City Council, n.d.)

5. WASTE AND RECYCLING

This section provides an overview on waste and recycling on Magnetic Island, including waste disposal, and reduction, recycling and re-use.

5.1. Overview Waste Management

There was a total of **6,243m³** of waste generated on Magnetic Island in the 2018/19 financial year[34]. This equates to approximately 1.76m³ of waste per capita per year. Approximately 52% of the waste generated is recycled, reused or composted equalling a total of 3,296m³ diverted from landfill for 2018/19. Waste sent to landfill generates a total of **587.9 tCO_2-e** per annum which forms approximately 3% of the total island emissions profile[35].

Recycled, reused or composted waste includes green waste, residential comingle and other recovered waste. Approximately 8% of total waste is recycled and 45% of total waste is green waste (Figure 13).

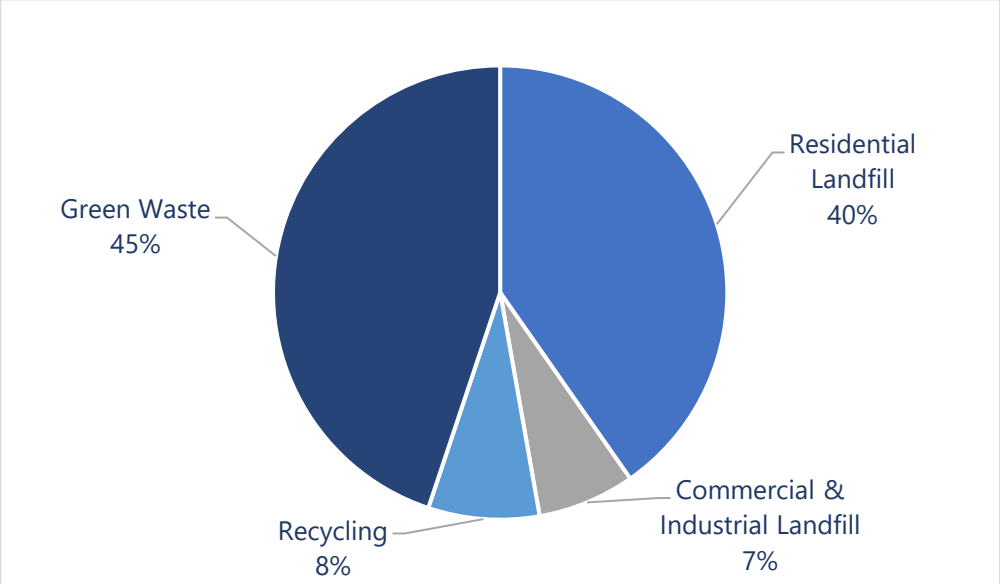

Figure 13: Waste disposal profile (2018/19 FY)

Most residential waste was diverted from landfill (Figure 14). At the time of writing this report, there was no data presented for non-residential recycling, reuse or composting. However, businesses produced less landfill waste than households. Council provides general waste collection services to 17 businesses on-island and recycling collection services to 12 businesses.

[34] *All waste data provided by Townsville Water and Waste, current as of 2019.*
[35] *Emissions calculated by EarthCheck proprietary software.*

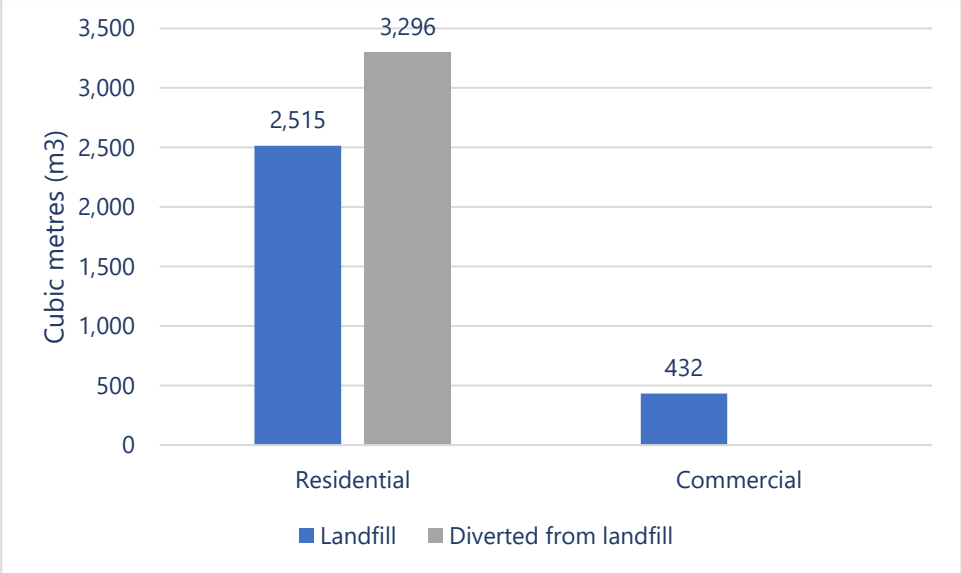

Figure 14: Comparison of waste production between residents and businesses per annum (2018/19 FY)

As shown in Figure 15, waste disposed on Magnetic Island is less per household and per person compared with the Queensland average[36].

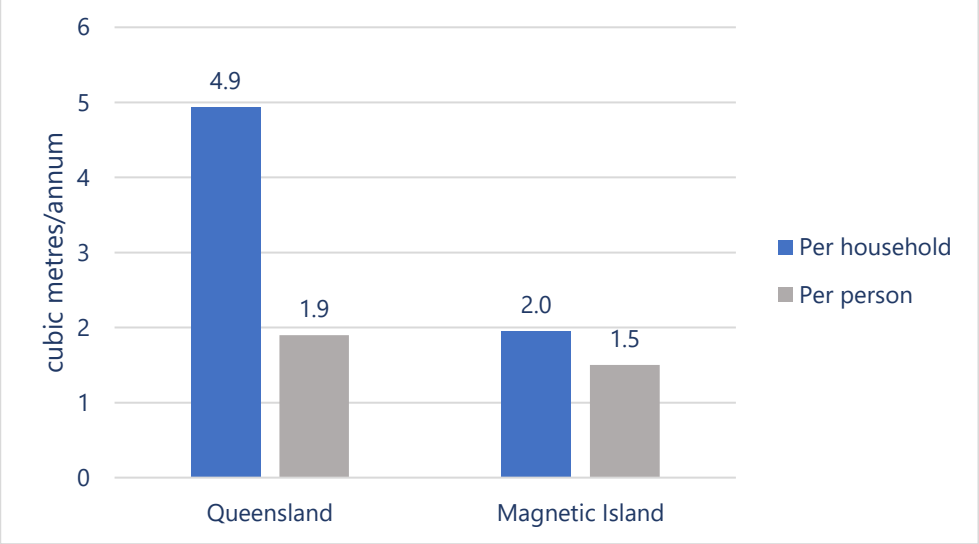

Figure 15: Household waste disposed on Magnetic Island compared with the Queensland average (2016/17 FY)

5.2. Waste Disposal

General waste is collected weekly and household recyclables are collected fortnightly via garbage trucks and transported to the waste transfer facility on-island. Each waste type is segregated into bins and sent to Townsville for processing.

The previous landfill site at Picnic Bay has been capped and all waste is now barged to the mainland three times per fortnight departing from Nelly Bay. Townsville City Council advised that it costs approximately $5,000 each trip and is based on a flat rate/volume change, in addition to a waste

[36] (Queensland Government, 2020)

levy cost. There are approximately three barges per fortnight (waste and recycling) however more are available upon request due to seasonality requirements.

A waste transfer facility was established at Picnic Bay for the transfer of domestic, non-residential and comingled recycling to a council operated waste station on the mainland. Garden waste is kept on-island to be mulched. The transfer facility has been designed to withstand major climate events such as cyclones and flooding and has additional capacity should the island be cut-off from the mainland for a period of time[37].

There are currently no waste disposal facilities for tourists travelling in motorhomes, which may either limit their stay or lead to illegal disposal of sewerage and waste.

Some claims were made of construction operators illegally disposing waste concrete on the beach front. Construction, demolition and industrial waste is required to be removed by the contractor at their own expense and disposed of on the mainland at an acceptable industrial waste disposal facility. These claims were not within the scope of the project to investigate further. It is not clear that there is monitoring of construction activities on the island in relation to the disposal of waste materials.

The beaches on Magnetic Island are often contaminated with plastic waste which is washed up as debris. A recent waste pollution event occurred in July 2019 where bean bag balls washed up on beaches of Geoffrey, Alma and Nelly Bay[38]. The island hosts an annual beach clean-up, but the community has identified the need for ongoing or more frequent management of waste in coastal areas.

5.3. Reduction, Recycling and Re-use

The transfer station offers residents and businesses the opportunity to divert waste from the landfill including green waste, white goods, car batteries, paints and chemicals, and to recycle waste such as glass and tins. The majority of non-landfilled waste is green waste (Figure 16). Co-mingled recycling is taken to the Materials Recovery Facility (MRF) in Townsville, where it is sorted and cleaned before being recycled.

[37] (Townsville City Council, 2017)

[38] (Wainwright, Magnetic Island beach polluted with millions of bean bag balls, 2019)

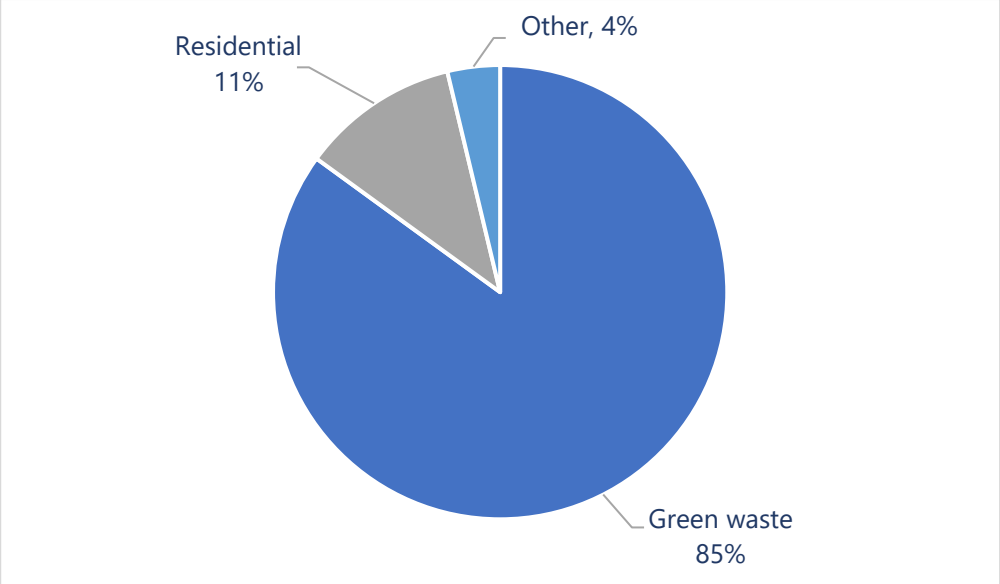

Figure 16: Waste diverted from landfill (2018/19 FY)

TCC also offer free curb-side collections annually for bigger, bulkier household items. Residents can also pay to dispose of other household waste or larger items such as white goods, car batteries, paints and chemicals at the waste transfer station (see Figure 17). Construction and demolition waste are also accepted at the waste transfer station at a cost per cubic metre for residents or per tonne for non-residential disposal[39]. Waste is then barged off the island once enough capacity is reached.

Figure 17: Waste separation area transfer station. White goods, air conditioners, tyres, electronics and gas canisters are separated.

Residents can dispose green waste free of charge at the transfer facility (see Figure 18). Green waste is made into mulch at the transfer station using an enzyme and is freely available for residents on the island for re-use. The majority of recycled or recovered waste is green waste (85%, 2,801.5m^3) as per Figure 16. TCC is discussing the opportunity to turn this green waste into soil using microbes. This process would produce high quality soil that could be sold, demonstrating an economic value (see Figure 19). A local Townsville company has significant expertise in bio-fertilisers, composting and mulch and exports its products to agricultural producers and landowners. Using microbes means that the decomposition happens aerobically which reduces greenhouse gas emissions. The company

[39] (Townsville City Council, n.d.)

have previously supplied their microbial enzyme to TCC to assist with the breakdown of green waste on the island.

Figure 18: Green waste collection / disposal area. Soil collection area visible in back left of photo.

Figure 19: Soil collection area at transfer station.

There is also recognition that green waste, fibres, wood and cardboard can be composted, potentially going someway (combined with compost already produced) to meet the shortage of soil on the island. The council has previously run a soil clinic to engage the community in a discussion about how waste and wastewater can be utilised in a circular system.

There is still substantial food waste in the general waste stream, increasing emissions from landfill on the mainland. Council were offering Bokashi bins (composting bins) through the Water Smart program. It is unknown how many Magnetic Island residents received one of these bins. As that program has ended, residents can now purchase a Bokashi bin, a worm farm or an aerobic composting system with a 40% discount[40].

TCC reported a high rate (above 20%) of contamination of the recycling waste for Magnetic Island and the Townsville region generally. Many residents reported suspicion and confusion around the

[40] (Compost Revolution, n.d.)

recycling effort on the island, with many believing that the recycling is mixed in with waste bound for landfill, hampering recycling efforts. The situation has highlighted the need for more effective communication and engagement around this subject.

The community group Zero Waste Magnetic Island (ZWMI) are responsible for the management of any funded Zero Waste projects and escalating any risks with waste management issues to the Magnetic Island Community Development Association (MICDA), whilst also communicating the work and outcomes to island residents and other stakeholders. This includes Townsville City Council approving a trial of a small bio-regen unit for restaurants in Horseshoe Bay to use to reduce food waste. ZWMI have been identified as a key stakeholder group within the community for waste projects. The Townsville Region is also engaged in the Plastic Free Places initiative which is intended to be expanded to Magnetic Island.

There was a report of a local, resident led initiative to reduce waste to landfill. A resident reported they are starting a small business (initially as a pop-up shop at the markets) to sell detergents, shampoos, body products, and eventually food products in BYO bottles. The intent is to promote reuse of bottles and containers to avoid landfill[41].

[41] (Mills, S & Capps, L 2019 pers. comm., 2 November)

6. TRANSPORTATION

This section provides an overview on transportation on Magnetic Island, including walking tracks and cycle paths, vehicles, public transport, bus tours and marine transport.

6.1. Overview of Transportation

Magnetic Island is located 8 km off the coast of Townsville, Queensland. It is well serviced in terms of public transport options, which include a regular barge and ferry service, public transport buses and multiple car hire companies, which thrive off the strong tourism market in the region. On-island, there are a range of transport options including personal vehicles, car hire, bicycle hire, bus tours, a public bus and walking trails.

Magnetic Island is characterised by steep topography separating the different bays, in which the different community hubs are located. Narrow and winding roads can make access for bikes and pedestrians difficult.

On-island transportation fuel usage is comprised of petrol cars (53%), followed by diesel cars (35%), then diesel buses (comprised of public transport and the bus tour company – 12%) based on an average year (Figure 20)[42].

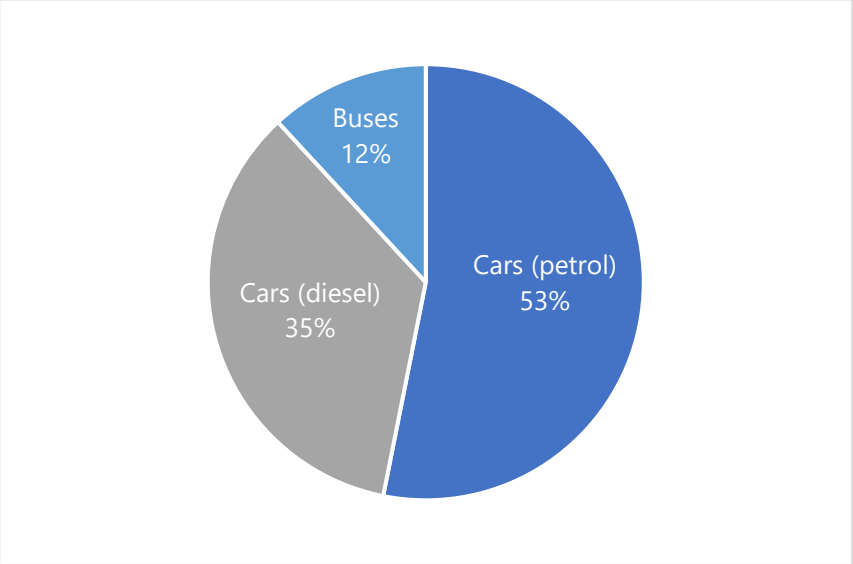

Figure 20: On-island transportation fuel usage (L)[42]

[42] *An average year is calculated based on a combination of transport modes using assumptions dependent on the data and sources that were available at the time of writing this report. Details provided in this section for each mode of transport.*

*The total emissions from on-island vehicles and water vessels transporting passengers and goods to and from the island is **3,876t CO_2-e** based on an average year*

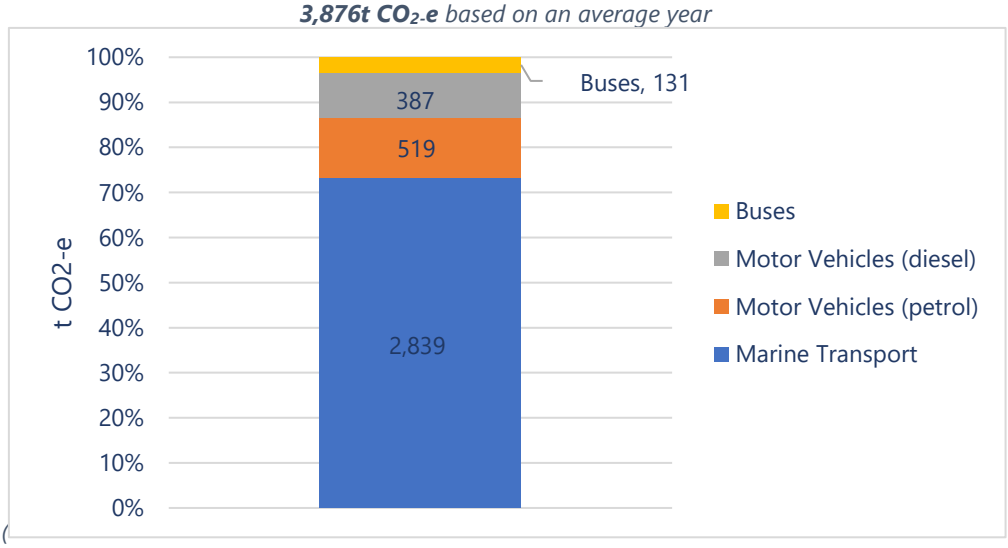

Figure 21)[42]. This includes 2,839t CO_2-e for marine transport, 906t CO_2-e for personal vehicles, and 131t CO_2-e for buses (public transport and bus tours).

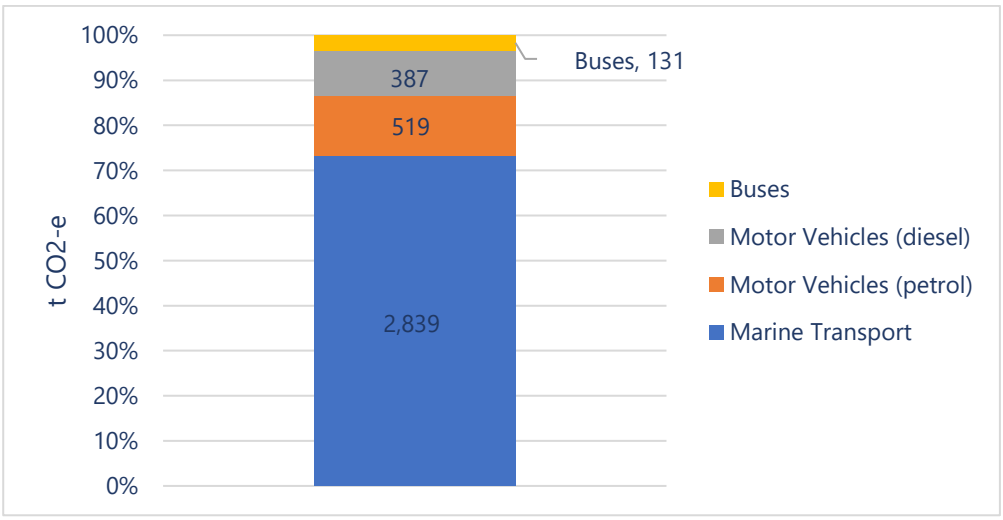

Figure 21: Breakdown of transport emissions

The breakdown of fuel usage for both on-island and marine transportation methods are provided in Figure 22.

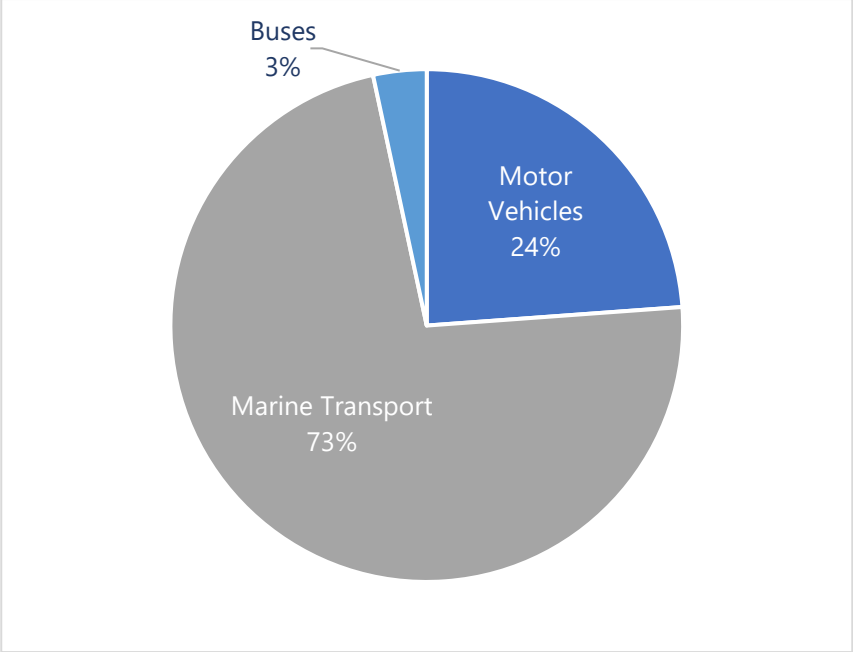

Figure 22: Transport fuel consumption profile (GJ)

Marine transport uses the most fuel for transport departing Townsville and travelling to Magnetic Island including barges and ferries (diesel - 73%)[43]. Personal motor vehicles (diesel and petrol) used by residents and businesses on Magnetic Island accounts for 24% of annual fuel usage[44]. Public transport[45] and a tour company[46] use much less fuel per year to service residents and visitors on the island (3%). The average volume of fuel used for all transportation methods in a year is **1,474,223L** (Figure 23).

[43] *Marine transport includes the passenger ferry operated by SeaLink and the barge operated by Magnetic Island Barge Company. Fuel consumption for the ferry is calculated based on the SeaLink timetable and consultation with a representative. Fuel consumption for the barge is calculated based on the Magnetic Island Barge Company timetable and consultation with a representative.*

[44] *Based on the number of registered vehicles, average fuel efficiency and percentage of diesel vs petrol cars on Magnetic Island, current as of 2019.*

[45] *Public transport average annual fuel consumption is estimated based on Translink timetables and the average fuel efficiency, current as of 2019.*

[46] *Tour company average annual fuel consumption based on estimations from details obtained on the website.* (Magnetic Island Tours, 2019)

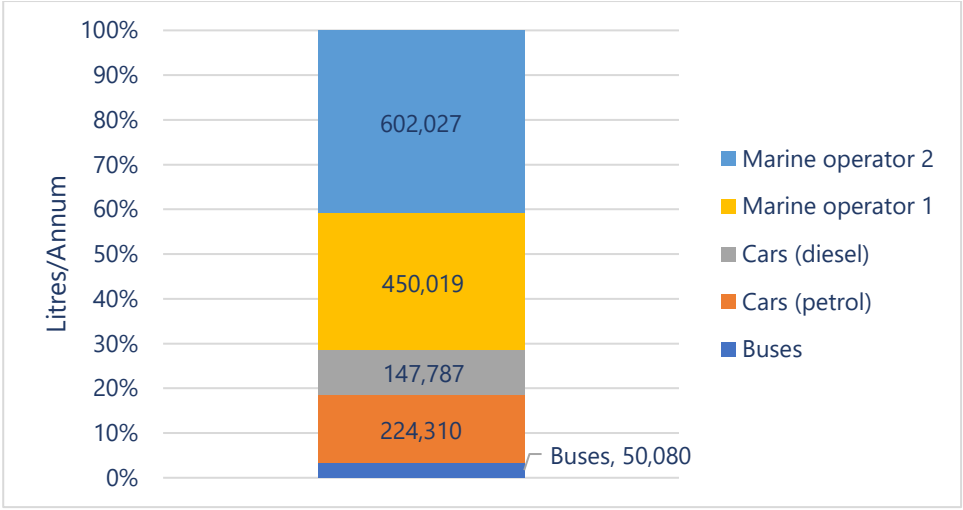

Figure 23: Fuel usage breakdown

Both diesel and unleaded fuels are used on-island at 28% and 72% respectively, based on the findings from the project survey. From discussions with council, it was identified that fuel stations on the island do not carry E10 fuel.

There are two service-stations on Magnetic Island. They are both provisioned by BP[47]. There are also nine hire car companies operating on the island. TCC reported that it successfully trialled biofuels in 2016 to replace the fuel used in its diesel fleet. At the time of reporting, this initiative has not been rolled out across council vehicles.

There are approximately 1,300 motor vehicles on the island[48], which range in vehicle types as found in the project survey (Figure 25). About half (49%) of the occupied private dwellings have one registered motor vehicle, 25% of dwellings have two registered motor vehicles and 8% had three or more registered motor vehicles. There are 12% of dwellings without a motor vehicle, which is twice the state average[49]. The project survey also quantified how residents prefer to travel around the island, as shown in Figure 24.

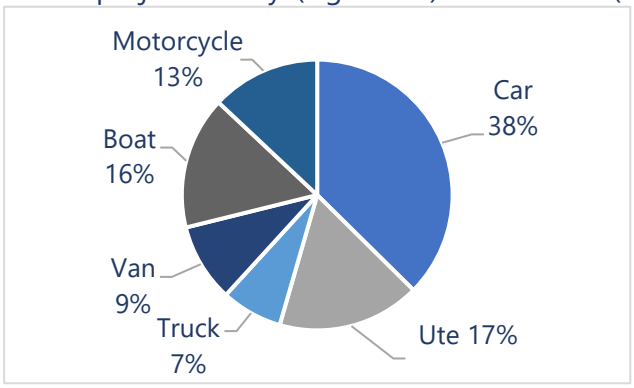

Figure 25: Breakdown of vehicle types

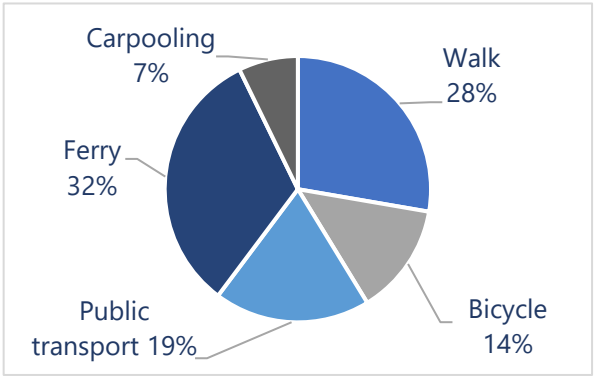

Figure 24: Alternative modes of transport used

[47] (True Local, n.d.)
[48] (Australian Bureau of Statistics, 2016)
[49] (Australian Bureau of Statistics, 2016)

Passengers have two options for transport to the island from the mainland; a passenger ferry operated by SeaLink and a vehicle ferry operated by Magnetic Island Ferries.

6.2. Walking Tracks and Cycle Paths

Queensland Parks and Wildlife Service (QPWS) and TCC are undertaking upgrades of pathways and trails to improve accessibility of the island on foot and by bicycle. In some of the built-up areas there are no footpaths and pedestrians must walk on the road.

It was observed during the sustainability assessment visit that electric bikes work well and are popular. There are however no publicly available charging stations around the island for bikes or electric vehicles. Moped scooters are available on the island for hire; however, they can be quite slow on the steep hills between suburbs and can slow down traffic. From discussions with council, it was identified that if electric moped scooters were used on the island, they may be limited in terms of capacity for use due to the steep gradient of the roads throughout the island, requiring powerful motors and large batteries. More powerful motors and batteries are available on the market, although can be expensive investments for the hire companies.

6.3. Vehicles

The major road from Nelly Bay to Horseshoe Bay is classed as a State road but is maintained by the local council[50]. Some stakeholders commented on the need to improve the roads, and to include separate zones for pedestrians and cyclists.

The project survey found that one resident has a privately owned electric vehicle charger and no other electric vehicle chargers are present on the island. 'Mini Mokes' were available for hire previously on the island, however, were phased out due to safety concerns. There are now more full-size cars and 4 wheel drives available for hire. This increase in larger car sizes raised concerns with residents due to the increased traffic on the roads. Some stakeholders suggested that a frequent, but smaller shuttle service for visitors would reduce the need and reliance on hire cars and increase safety on roads from the big buses. Stakeholders also suggested that electric, hybrid and fuel-efficient hire cars would be an advantage.

Visitors arriving on-island must transport their luggage to their hotels and may be unaware of the carrier/public transport service (SunBus) that exists, potentially increasing the use of taxis and hire cars.

Currently there are 1,315 cars registered to residents on Magnetic Island[49]. As actual fuel consumption figures were not available at the time of writing this report, it was assumed that each car travelled approximately 6km per day (average distance from each of the towns to the ferry terminal) for all purposes including work, school, leisure and daily routines. The number of car parks has increased on the island, which some stakeholders felt has "spoiled the natural beauty and 'green' values of the island". They reported that the council should be promoting untouched beauty and a relatively under-developed island, as well as the ability to walk everywhere on the island, rather than drive.

The Forts Walk Carpark Upgrade (a QPWS lead project) design was presented for consultation and feedback during the timeline of this project. The project team was able to observe a community consultation session during a visit to the island, which presented a new design, based on feedback

[50] (Queensland Government, 2019)

received. It appeared the community were supportive of the new design as it was less imposing on the surrounding environment and promoted safety of pedestrians and drivers.

6.4. Public Transport

SunBus (previously the Magnetic Island Bus Company) operates eight buses on the island coinciding with the ferry schedule for arrivals and departures. These were recognised as delivering an adequate service for tourists and residents, and project survey data indicates that 56% of respondents use this service. Stakeholders reported that the size of the buses meant that they often crossed the centre line of the road causing safety concerns. Residents also raised concerns about air and noise pollution.

In some places on Magnetic Island, the speed limit is 60km per hour, which is considered too fast by some. As a beach holiday destination there are many visitors travelling on foot and by bicycle and there are some concerns about safety.

The increased number of hire car operators on the island means that traffic is increasing in holiday seasons, and that public transport can be less efficient.

As the bus timetable coincides with ferry departures and arrivals, there are limited to no services available in between ferry arrivals and over the lunch period, meaning that it is not always convenient for residents or tourists to get around the island if they are not using the ferry.

Some stakeholders suggested that frequent, smaller shuttle buses may lead to a reduction in the number of cars and hire cars, and that electric buses could be utilised to reduce greenhouse gas emissions and noise pollution.

6.5. Marine Transport

Marine transportation makes up **2,839tCO_2-e** on average per annum of the total Magnetic Island emissions profile.

Townsville Port accommodates vessels with a length overall (LOA) of 238m, with the option for larger ships to anchor off Magnetic Island. There are 100 to 400 boats moored off Magnetic Island at any one time during peak periods. From discussions with council, it was revealed that Townsville has the highest per capita boat ownership in Australia, meaning the island can get many visitors as it is a tourism hotspot and excellent mooring location. Council informed that there are no refuelling stations on the island, so all boats must get their fuel from the mainland.

SeaLink Queensland provide tender services to transfer up to 300 passengers per ferry and work alongside Magnetic Island Ferries that provide a car and passenger barge service as well as the freight service for businesses and residents on the island. SeaLink operate 118 trips on average per week to Magnetic Island from Townsville taking approximately 20 minutes one-way[51]. As well as a vehicle, passenger and freight service, Magnetic Island Ferries operates day tours around the Townsville Region and transports waste from the island to Townsville. The vehicle barge runs every two hours to Magnetic Island throughout the week and allows walk on passengers without a car as well[52]. The barge operates approximately 52 trips per week, plus an additional 3 trips per fortnight for waste transport. Approximately 400,000 return passengers travel per annum using one of the marine operator's passenger services.

[51] (SeaLink, 2020)
[52] (Magnetic Island Ferries, 2020)

Figure 26 below outlines marine transport fuel usage and includes passenger ferries, vehicular ferries and marine logistics.

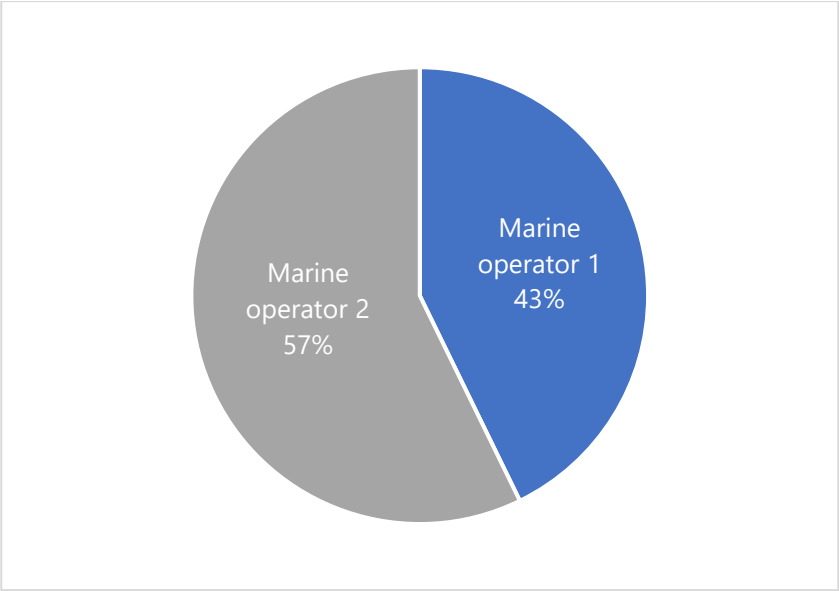

Figure 26: Townsville – Magnetic Island transportation fuel usage (L)

Some stakeholders have commented that ticket costs for the ferry/s are expensive, with no obvious concession available for those living on the island, however, one provider offers resident discounts via a separate booking page with a code[53]. This was confirmed through a 'What's on Magnetic Island' webpage for new island residents[54].

[53] (Magnetic Island Ferries, 2018)
[54] (What's on Magnetic Island, 2010)

7. RESILIENCE AND SELF-SUFFICIENCY

Climate resilience in this project was assessed by evaluating the community's exposure and sensitivity to changes in climate against their adaptive capacity (ability of the community to adjust to changes in climate). The project survey asked questions to the community including climate related impacts and costs, island mode estimations, vulnerability, preparedness and readiness, and recovery capacity. The results of this assessment were used to inform recommendations for projects that can assist in building the resilience of the community, its infrastructure and services.

The project also conducted a Risk Assessment evaluating Magnetic Island and its associated operations against 13 key criteria, the results of which can be found in Appendix 3: Magnetic Island Risk Assessment.

The following sections provide a background and assessment on the resilience and self-sufficiency of Magnetic Island, including current climate and climate change, projected climate change impacts, experienced events, and community preparedness and perceived resilience.

7.1. Overview of Resilience

The Magnetic Island community consider themselves a resilient community that come together when times get tough. Many residents have lived through severe weather-related events and felt comfortable they were prepared for any potential future events. There is a Magnetic Island Disaster Management Group as part of the Townsville Local Disaster Management Plan (TLDMP).

The main finding regarding resilience on Magnetic Island, is the complete reliance on the mainland for essential goods and services, such as electricity, water, food, medication and waste removal. The Magnetic Island community recognises this and want to work towards a future where the community is less dependent on the mainland for these essential goods and services. There is no emergency back-up power supply to the island, however a small number of residents have their own generators which would be used of required during a power outage. The water treatment plants on-island do have backup generators which can be used for prolonged power-outages.

The island has recently been impacted by storm surges/cyclones (January 2019) and is currently receiving funding under the QCoast2100 – Coastal Hazards Adaptation Program. The funding supports coastal councils in identifying coastal hazards and climate change risks through to the decision-making and implementation phases[55]. The island has experienced 11 natural disasters over the last 10 years (see

Table 8 – Section 7.4 Experienced Events), and both residents and businesses reported in the project survey that increasing insurance expenses are their biggest climate related impact.

7.2. Current Climate and Climate Change Projections

Just over half of the island (2,790ha) is protected under the Queensland Nature Conservation Act 1992 as the Magnetic Island National Park. There are also two smaller areas that are designated as conservation areas[56].

The island is located within the Great Barrier Reef World Heritage Area. It receives less rainfall than the Wet Tropics to the north and the Whitsunday Islands to the south, which makes Magnetic island

[55] (Queensland Government, 2018)
[56] (State of Queensland, 2018)

quite dry with a dense shrub type vegetation[57]. The island is home to Northern Australia's largest habitat of wild koalas.

Magnetic Island is the largest island in the Brigalow Belt bioregion[58]. It is likely that Magnetic Island represents the largest, most diverse assemblage of island flora in the dry tropics region of the Great Barrier Reef and contributes to the processes of dispersal, colonisation, and establishment of flora communities within the Great Barrier Reef World Heritage Area as a whole[59].

During the winter months (peak tourist season) the weather is dry with average maximum temperatures of 28.1°C. The temperature increases to 35°C during the wet season (summer months) with an increase in humidity and a greater likelihood of cyclones and storms.

The following figures show climate change projections for the Townsville City region for 2050 (data derived from the Queensland Future Climates Dashboard using scenario RCP 8.5) and are based on long-term regional changes over the reference period of 1986-2005[60] (current as of 2019).

7.2.1. Hot Days

Climate change projections indicate an increase in mean temperature by 0.82°C by 2030 and 1.55°C by 2050, as well as an increase in the number of hot days by 21 days per annum by 2050 for the Townsville region (including Magnetic Island), which is illustrated in Figure 27.

Increasing temperatures may lead to an increase in electricity consumption to aid in cooling a home or businesses through running fans or air conditioning, especially where there is limited passive cooling. Increased use in electricity consumption can put further strain on an already constrained energy network and could lead to an increase in carbon emissions.

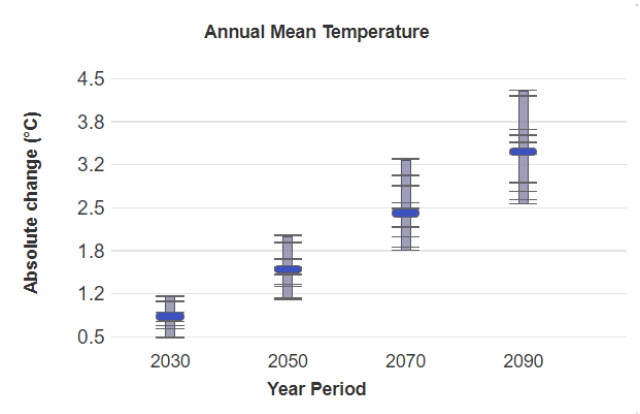

Figure 27: Projected Changes in Annual Mean Temperatures and Annual Hot Days for the Townsville City Local Government Area.

7.2.2. Precipitation

As shown in Figure 28 precipitation patterns are projected to change too with less rain projected on average, particularly during the traditional wet season.

[57] (Turner & Batianoff, 2007)
[58] (Queensland Government, 2013)
[59] (Turner & Batianoff, 2007)
[60] (Queensland Government, 2018)

Less projected rainfall may also require more residents and businesses to draw water from the water network for irrigation. The Townsville region, including Magnetic Island, is already subject to water restrictions during the dry season. Decreasing rainfall may see these restrictions further tighten in the future to ensure security of water for drinking.

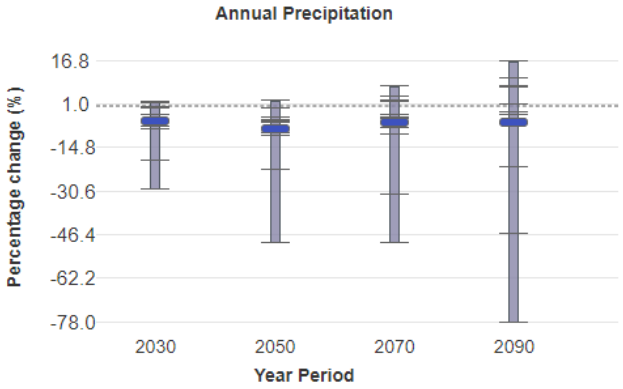

Figure 28: Projected Changes in Annual Precipitation for the Townsville City Local Government Area.

7.2.3. Heatwaves

As evident in Figure 29 heatwaves are projected to occur 10% more frequently by 2030, 33% more frequently by 2050 and last for longer periods of time.

As mentioned within section 7.2.1 – Hot Days, increasing and prolonged temperatures can lead to an increase in electricity demand, creating additional pressure on the grid and increasing carbon emissions.

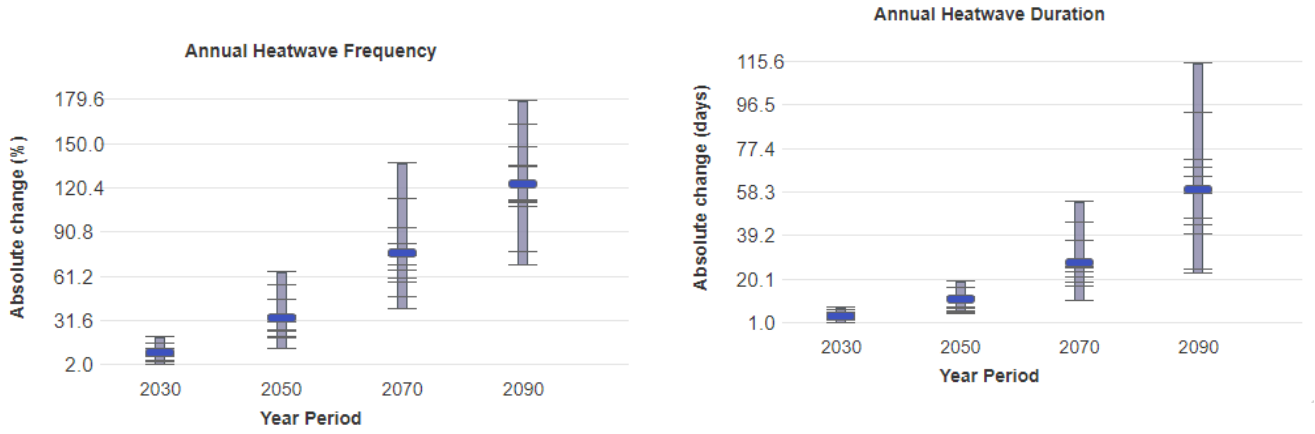

Figure 29: Projected Changes in Frequency and Duration of Heatwaves for the Townsville City Local Government Area.

7.2.4. Floods

As illustrated in Figure 30, the frequency and duration of floods is projected to moderately decrease by 2050. Conversely, drought events are projected to increase moderately both in frequency and duration. This will put a strain on water supply levels.

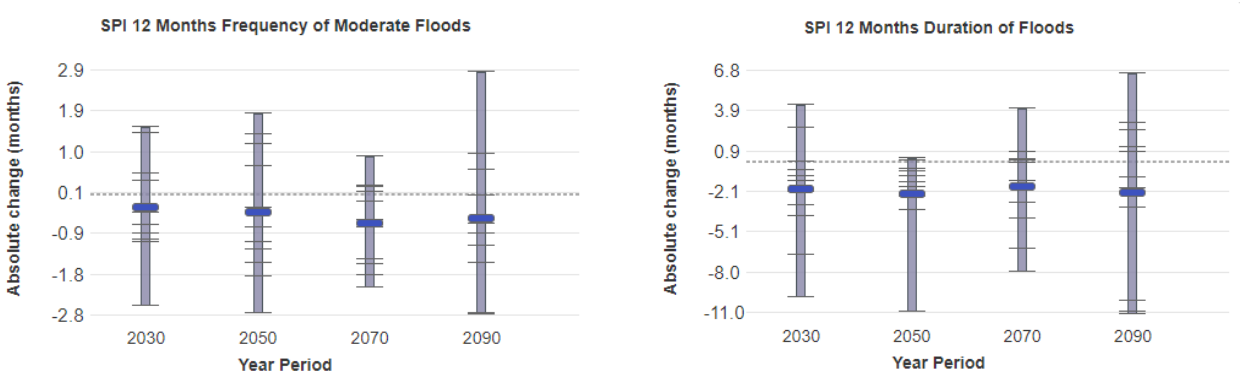

Figure 30: Projected Frequency and Duration of Floods for the Townsville City Local Government Area.

As can be seen in Figure 31, the sea level rise projections for 2100 extend on the current day highest tide, which is especially prominent around Cockle Bay Reef along the west coast of the island. This inundation scenario is in line with recent global emissions and observations of sea level rise which has a median sea level rise of 0.74 metres by 2100[61].

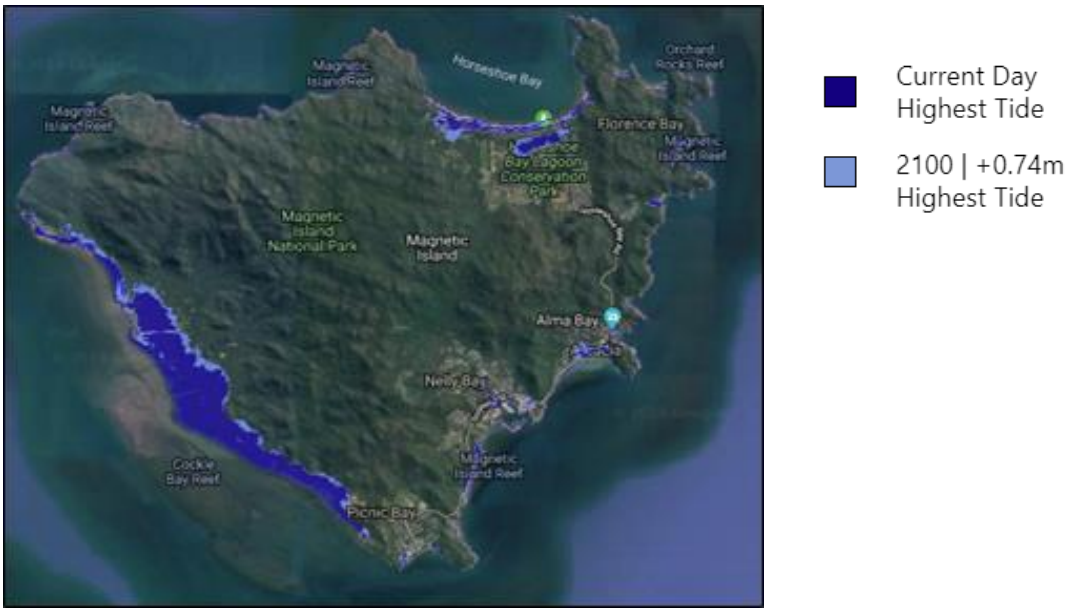

Figure 31: Sea level rise projections for Magnetic Island

Increased flood events can put the island at risk due to shoreline erosion and has the potential to cut off bays or other areas of the island. This has occurred previously on the island and is presented further in section 7.4 – Experienced Events. Observing an increase in frequency and intensity in these events may cause more physical and financial damage in the future.

7.3. Projected Climate Change Impacts

[61] (OzCoasts, 2019)

In 2012, a pilot project mapping climatic hazards identified the critical infrastructure across the island that will be susceptible to climate change impacts[62]. The majority of infrastructure servicing the island is located along the coastal fringe and may be vulnerable to coastal changes, including:

- Picnic Bay water treatment plant (WTP)
- Bolger Bay pump station
- Properties within the West Point, Nelly Bay and Horseshoe Bay areas may be subject to periodic risk of tidal inundation
- Properties within the Horseshoe Bay, Nelly Bay, Picnic Point/West Point localities are likely to affected by the 1% Annual Exceedance Probability (AEP) storm tide event; and
- By 2100, 37 (Horseshoe Bay), 61 (Geoffrey Bay), 44 (Nelly Bay), 47 (Picnic Bay) and 26 (West Point) properties are estimated to be affected by sea level rise or the 1% AEP storm tide event.

While this infrastructure is currently periodically affected by the 1% AEP storm tide event, it is estimated that projected sea level rise may lead to unacceptable risk by 2100.

Additionally, stakeholders engaged during this project identified further specific risks (anecdotal and non-exhaustive list of risks):

- Property within the Cockle bay area and the Esplanade at Picnic Bay is subject to coastal erosion and damage from flooding (run off and tidal);
- Ongoing damage to Pacific Drive at Horseshoe Bay from overland flow and coastal erosion;
- Flooding at West Point Road; and
- Erosion of tree roots at Nelly Bay.

The Coastal Hazard Adaptation Strategy (2012) identified a range of adaptation options, including land resumption, planning scheme modification, and the construction of sea levees [63].

Following on from the pilot project and as part of the QCoast 2100 initiative[64], TCC in collaboration with the Queensland Government is drafting a coastal change adaptation strategy for the Townsville region. Communities, including Magnetic Island, were asked to complete a survey to establish a baseline of their sentiment towards climate change, understanding of coastal hazards and the cultural, environmental and lifestyle values that relate to Townsville's coastline. This survey will inform further stakeholder engagement to develop a range of adaptation options for key infrastructure and areas within the region at risk[65].

Further risks to the island are detailed in the Risk Assessment in Appendix 3: Magnetic Island Risk Assessment.

7.4. Experienced Events

The Townsville region is prone to heavy precipitation events and cyclones which causes overland flow, flash flooding and damaging winds. Recent events over the last 10 years are listed in

Table 8.

[62] (Townsville City Council, p. 67)
[63] (GHD, 2012)
[64] (LGAQ & Department of Environment and Science, n.d.)
[65] (Townsville City Council, n.d.)

Table 8: Townsville Region Recent Disasters[66]

Date	Disaster Type	Name
Jan 2019	Flood, Storm	North and Far North Queensland Monsoon Trough
Dec 2018	Cyclone, Storm	Tropical Cyclone Owen
Feb 2018	Storm, Flood	North and Northwest Queensland Low
Mar 2017	Cyclone, Flood, Storm surge	Tropical Cyclone Debbie and associated rainfall and flooding
Apr 2014	Flood, Rainfall, Cyclone	Tropical Cyclone Ita and associated rainfall and flooding
Jan 2014	Cyclone	Tropical Cyclone Dylan
Mar 2012	Flood, Rainfall	Northern and Far Northern Queensland heavy rainfall and flooding
Jul 2011	Bushfire	Queensland Bushfires
Feb 2011	Flood	Queensland monsoonal flooding
Feb 2011	Cyclone	Tropical Cyclone Yasi
Oct 2010	Flood	Queensland Floods

Severe weather events have seen Magnetic Island physically cut off from the mainland for up to five days. On some occasions the island loses access to its energy and water supply, such as during Cyclone Yasi where residents were without power and water for five to ten days. As the water treatment and wastewater treatment plants rely on the mainland power supply these services were also not operational following the cyclone. Cyclone Yasi led to over 1 meter of sand accumulation over the park at Horseshoe Bay and part of the adjacent street.

During severe weather events the ferry services do not operate. Islanders have no way to get off the island, and emergency service providers from the mainland are unable to travel to the island until the event has passed. During these events people located in the more remote areas of the island can also be cut off from other parts of the island, which may impact their access to fuel, food and other supplies.

During project consultation, businesses reported that cyclones, flooding and droughts have led to reductions in the number of visitors to the island, business closures following an event during clean up and the need for repairs to damaged buildings and infrastructure. Some reported a loss of income as well as higher insurance premiums.

The significant issues reported by residents in the project survey include extensive mould and damage to properties and furniture and the subsequent cost of repair and cleaning required; environmental impacts such as coastal erosion and damage to trees and root systems; cost of alternative accommodation; and negative impacts to physical and mental health (see Figure 32).

[66] (Australian Government, n.d.)

Figure 32: Major climate impacts noted by Magnetic Island Residents.

Some residents were concerned with recent 'controlled burns' reportedly leading to harmful exposure to smoke as well as anxiety about the physical threat of fire to their properties.

Insurance premiums in northern Queensland are up to 42% higher than other parts of Australia due to the insurance market's assessment of risk in the region from its exposure to severe weather events and higher rebuilding costs[67]. Since 2011 the cumulative costs of disaster reconstruction for North Queensland is $951 million[68]. The recent flood in Townsville (February 2019) was thought to have caused over $100 million in damages to the Townsville region, some of which included Magnetic Island.[69]

In the project survey, over 34% of residents and 55% of businesses rated rising insurance costs as the largest climate change related impact they face. Some Islanders reported that their insurance premiums doubled following Cyclone Yasi (2011) and continue to increase following every event. Annual insurance premiums range between $2,157 and $7,658 per annum, a high variance due to the high variation in the risk of flood and cyclones on Magnetic Island[70]. Annual insurance premiums in Townsville range from $2,421 to $11,318, also with a high variance due to the risk of floods and cyclones in the region[70]. Many Islanders are concerned about the cost and availability of insurance. One resident reported paying $4,500 per annum with a $6,000 excess.

7.5. Resilience of Island Infrastructure

Nelly Bay Harbour was constructed in the mouth of Gustav Creek and has caused the build-up of sediments. A sediment trap has been used to divert the sand to the beach, and consequently, the Department of Transport and Main Roads (TMR) annually fund the transfer of sand to keep the Nelly Bay Harbour operational. A groyne has recently been constructed to reduce the movement of sand into the harbour, and reduce the need for dredging, which some stakeholders say has impacted the health of the reef.

All houses should be built to withstand category 4 cyclones, as required by QBuild standards in the Townsville Region. There is no specific design guide for buildings on Magnetic Island, however it

[67] (Insurance Council of Australia)
[68] (Queensland Reconstruction Authority, 2019)
[69] (Wainwright, Townsville flood crisis raises fears about economic recovery among business leaders, 2019).
[70] (Australian Government, 2019)

was observed during a drive around of the island that some houses were designed with energy efficiency principles in mind (see Section 3.2.3 Building Types and Design).

Major infrastructure and facilities on the island include the ferry terminal, apartment blocks around the marina, residential houses, road networks, wastewater treatment plants, power and water supply cables and telecommunications towers. Road networks are most at risk from climate related events, due to the higher flood risk from storm tide inundation, as mentioned above.

The island relies on major infrastructure to support basic services, such as food transportation, power, water supply and wastewater treatment, and rubbish removal and disposal. If marine services are unable to operate, repairs to critical infrastructure are hindered until services can operate again, which places the island residents and tourists at risk and may restrict access to basic services.

7.6. Community Preparedness and Perceived Resilience

7.6.1. Perceived Resilience

The survey asked residents and businesses to estimate how long they could survive in island mode. The results showed their perceived island mode duration was approximately 1 week on average for residents and 6 days on average for businesses, although both stakeholder groups had substantial variability in their responses.

Survey responses showed that Islanders felt they were moderately prepared for a severe weather event with 71% of residents and 69% of businesses rating themselves as moderately prepared. There is a general sense on the island that due to the frequency of natural disaster events, the longer-term members of the community have a high level of resilience in responding to a natural disaster event. It is however unclear how tourists or visitors would respond during a natural disaster event, especially those who are from interstate or overseas.

As all goods need to be transported from the mainland, including energy, potable water, fuels, food and waste removal, the Magnetic Island community have a very high reliance on the mainland.

As presented in Figure 33, the perceived resilience of the Magnetic Island community is relatively high. The community feel less confident about their access to capital and resources as well as rebuilding capacity. A key finding from this is low resilience due to reliance on food, water and energy from the mainland.

Approximately 43% of respondents rated their general readiness to a severe weather event and ability to recover from a severe weather event as moderate.

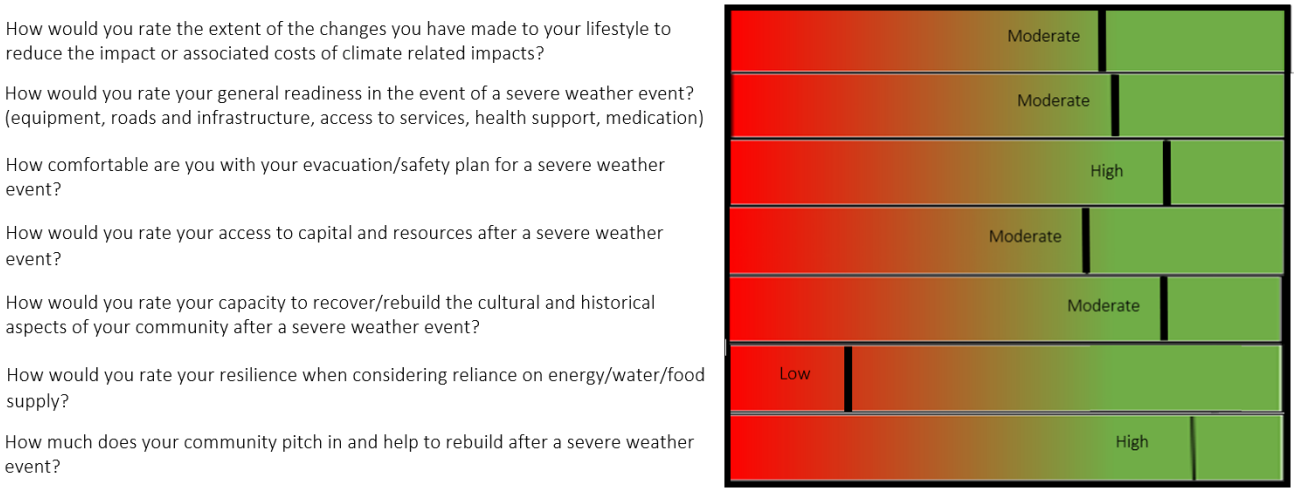

Figure 33: Magnetic Island community perceived resilience

Residents identified water supply, natural disasters, power generation and the island's reliance on the mainland for food, water, energy and medical services as their areas of significant concern. Several residents reported in the survey that they installed diesel generators to provide back-up power supply during emergencies.

Some businesses utilise older paper-based payment methods to ensure that they are not disadvantaged during power-cuts.

Magnetic Island has a Queensland Emergency and Rescue Service (QFES), State Emergency Services (SES) building, Queensland Ambulance Service, Police Station and Rural Fire Brigade, where service personnel are stationed throughout the week, in case of emergencies.

7.6.2. Evacuation Arrangements

The Magnetic Island Disaster Management Group manage and coordinate evacuation centres, and have the authority to declare a cyclone shelter on the island if necessary, as well as source staff to run the centres until Red Cross are available to support the group. The emergency centre is in Nelly Bay and the island does not currently have a specifically designated cyclone shelter.

Council maintains consultation with local stakeholders that represent vulnerable groups in the community to continually review the emergency warnings and communication processes so that they meet the needs of these groups[71]. Each of the bays on Magnetic Island has a Magnetic Island Community Care (MICC) Coordinator that prior to a disaster will check on older people currently receiving aged care services. A member of MICC is also on the Magnetic Island Disaster Management Committee.

Formal tourist-specific evacuation plans for Magnetic Island could not be found; however it is expected that visitors will follow the same plan as residents. Tourists are warned of an evacuation through tourism operators, accommodation providers and location-based emergency alerts. Townsville Local Disaster Management Group found that one of the caravan parks on the island

[71] (Townsville Local Disaster Management Group, 2019)

provides shelter for visitors in the park owner's home during a cyclone if required, and the park is readied for impact when a cyclone watch is issued and visitors are advised to leave[72].

Transport assistance may be required in the event of an evacuation including for persons requiring assistance including mobility impaired, medical transportation, delivery of supplies and resources, transportation of emergency service personnel and return of evacuees. The Evacuation and Transport Working Group is responsible for planning and coordinating evacuation and available transport needs in the event of an emergency or disaster[72]. The group includes representatives from TCC, DTMR, QFES, QAS, SES, Ergon Energy, Townsville Hospital and Health Service (THHS), Magnetic Island barge/ferry service, a taxi company, and a bus company.

7.6.3. Disaster Planning

The island falls under the TCC's Disaster Management Plan, with the Magnetic Island Disaster Management Group meeting at least annually to liaise with the Local Disaster Coordinator about developing and implementing community education programs[73].

7.6.4. Summary of Resilience and Self-Sufficiency

The island's economy is reliant on the domestic and international visitor market, which is at risk to changes induced by external factors, such as decreasing domestic air services from Townsville Airport (the closest airport to the island), increasing visitor expectations for a sustainable luxury island get-away and restrictions in place for development due to National Park zoning or COVID-19 travel restrictions as required by Queensland Health. Planning of the island in the future needs to be carefully considered by council, tourism operators and residents to ensure a strong and resilient tourism industry.

As the island has a mostly ageing population, with the majority of the island's residents relocating to the island to retire, the community consultation sessions identified that much planning and development was catered to this demographic.

The island has many community groups or associations, such as land care, planning, waste reduction, men's shed etc. with an overall feeling that community would work together to support one-another through an emergency or crisis. Those who have lived on the island through the natural disasters over the last decade or more, can recall times where this has been the case.

[72] (Townsville Local Disaster Management Group, 2019)
[73] (Townsville Local Disaster Management Group, 2019)

8. RISK ASSESSMENT

8.1. Introduction

EarthCheck conducted a high-level Risk Assessment for Magnetic Island as part of the Decarbonisation of the Great Barrier Reef Island project. The Sustainability Assessment informed the development of the Risk Assessment, which was then in turn considered in the Options Development and consequent project options, as seen in Figure 34.

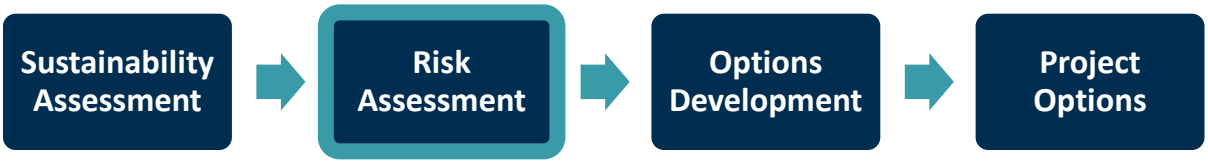

Figure 34: How the risk assessment fits in the project methodology

8.2. Methodology

The following method was applied by EarthCheck to assess the high-level risk of Magnetic Island against the 13 Key Performance Areas.

The EarthCheck Destination Standard identifies 13 Key Performance Areas for a region which were used as a base to identify risk aspects. To adapt these areas to this project, each of the Performance Areas were allocated to one of the Key Project themes, shown below in Table 9.

Table 9: Key Project Theme's correlation to EarthCheck's Destination Standard Key Performance Areas

Key Project Themes	EarthCheck Destination Standard 13 Key Performance Areas
Energy Production and Efficiency	1. Energy Efficiency, Conservation and Management 2. Greenhouse Gas Emissions
Water and Wastewater	3. Management of Freshwater Resources 4. Wastewater Management, Drainage and Streams
Waste and Recycling	5. Solid Waste Management
Transportation	6. Transport
Resilience and Self-Sufficiency	7. Air Pollution, Noise Control and Light Pollution 8. Ecosystem Conservation and Management 9. Land Use Planning and Development 10. Management of Environmentally Harmful Substances 11. Cultural and Social Management 12. Economic Management 13. Resilience

A **Risk** was defined as the chance of an environmental, cultural, social and/or economic impact happening as a result of the activities undertaken by or presence of the community.

An **Aspect** was defined as an element of the community that interacts or has the potential to interact with the environment, cultural/social activities and/or the economy.

Once the key performance areas had been mapped against the key project themes, and risks and aspects were defined, the following steps were followed to identify, define and evaluate the risks:

1. Identify actual and/or potential impacts with regards to aspects. This was informed by the Sustainability Assessment. EarthCheck's proprietary benchmarking software was used to catalogue, organise and contextualise the information.
2. Define categories representing the severity of actual and/or potential impacts (refer to Table 10).

Table 10: Severity Evaluation

Category	Definition
1	**Limited:** impact to a local area but no long-term effects; concern or complaints from neighbours; no injury to people; minor technical nonconformity but no legal nonconformity.
2	**Minor:** Localised short to medium term impact; minor contribution to global warming; minor and reversible human health impacts treatable with first aid; negative publicity from local media; minor breach of legal requirements.
3	**Medium:** Localised medium to long term impact; moderate contribution to global warming; moderate human health impacts requiring medical treatment; regional media attention; moderate breach of legal requirements with fine.
4	**Major:** Widespread, medium to long term impact; serious human health impacts; state-wide or national attention; major breach of legal requirements; major disruption to operations; Destination's reputation badly tarnished.
5	**Catastrophic:** Widespread, irreparable environmental, cultural, social and/or economic damage; loss of human life or long term human health effects; national attention; serious litigation.

3. Define categories representing the likelihood of impacts (refer to Table 11).

Table 11: Likelihood Evaluation

Category	Definition
1	**Rare:** Impact would occur only in exceptional circumstances.
2	**Unlikely/Annually:** Impact could occur but is not expected or will occur annually.
3	**Possible/Monthly:** Impact could occur or will occur on a monthly basis.
4	**Likely/Weekly:** Impact will probably occur in most instances.
5	**Certain/Daily:** Impact is expected to occur in most circumstances or will occur on a daily basis.

4. Define categories representing the risk evaluation (refer to Table 12).

Table 12: Risk Evaluation Matrix

Likelihood	Severity					
	1	2	3	4	5	Key
1	1	2	3	4	5	Low
2	2	4	6	8	10	Medium
3	3	6	9	12	15	High
4	4	8	12	16	20	Severe
5	5	10	15	20	25	Extreme

5. Determine the severity of potential and/or actual impacts and assign each to a severity category, which was informed by the Sustainability Assessment.
6. Determine the likelihood of potential and/or actual impacts and assign each to a likelihood category, which was also informed by the Sustainability Assessment.
7. Evaluate the risk by using the risk evaluation matrix

8.3. Analysis

In order for the Risk Assessment to be considered as part of the Options Development and consequent project options, the results were plotted into Figure 35 and Figure 36 which illustrate Magnetic Island's overall risk profile as well as the number of risks for each risk severity category broken down into the different project themes.

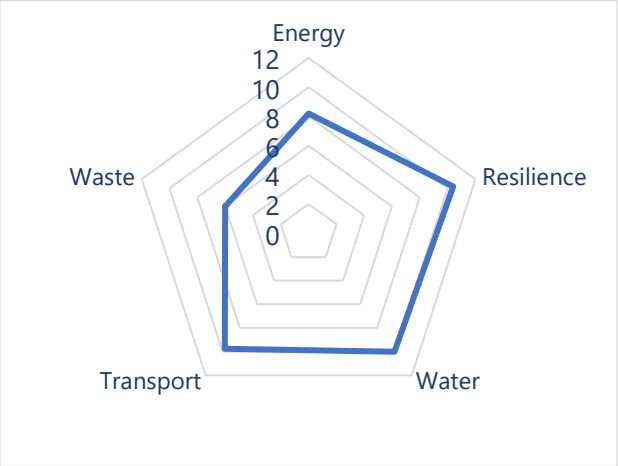

Figure 35: Risk profile for Magnetic Island

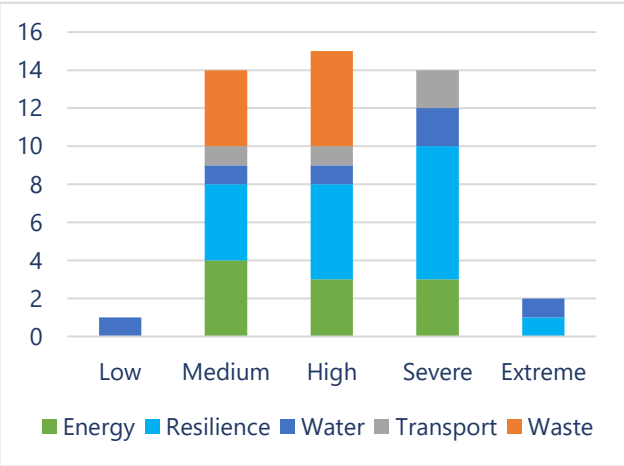

Figure 36: Risk breakdown for Magnetic Island

Magnetic Island's risk profile illustrated in Figure 35 is presented as an average of risk scores by theme. This shows the resilience, water and transport themes as having the highest risk profiles, followed by energy and waste respectively. Figure 36 shows that the "severe", "high" and "medium" risk categories as the most represented categories and include at least one risk from each theme (except "severe"). Only resilience and water have extreme risks identified by this Risk Assessment.

The Risk Assessment identified if there were current mitigation strategies in place for the risks identified at the time of the Sustainability Assessment. A summary table has been provided below of potential impacts with little to no current mitigating strategies observed (Table 13).

The potential impacts identified having either a high, severe or extreme risk with little to no current mitigating strategies observed, were considered when creating the long list of decarbonisation options in phase two of the project (see Technical Appendix: Options Report). This was done with the aim of providing potential solutions to assist with risk reduction on the island.

The full Risk Assessment can be referred to in Appendix 3 Magnetic Island Risk Assessment.

Table 13: Summary of Potential Impacts with little to no mitigation strategies observed

Risk Evaluation	**Potential Impact(s)**	**Current Minimisation / Mitigation Strategy Observed**
High	Depletion of natural energy resources through consumption of fuel.	Previous projects encouraged the installation of solar panels (30% of dwellings) across the island to reduce demand on non-renewable electricity.
	Use of diesel generators as back-up during peak loads, increasing GHG emissions.	Limited use of battery systems.
	Vehicle emissions causing air pollution and negatively impacting human health.	No current mitigating strategies observed.
	Depletion of freshwater resources through overconsumption. Increase in visitors will add pressure on natural resources.	Water conservation notices are provided in some hotels.
	Failures in operation of the wastewater treatment plant causing environmental damage and human harm.	On-island wastewater treatment plant operator to monitor and respond (operating personnel are however located in Townsville).
	Inability of local infrastructure to sufficiently respond to peak demand during tourism seasons (with regards to wastewater).	No current mitigating strategies observed.

	Lack of beach restoration programs increasing the risk of damage to nearby property during severe weather events.	Sand restoration projects at Horseshoe Bay. TCC planning for likely retreat. Also considered under the CHAP.
	Insufficient consideration of climate change risks in land use planning and development causing damage to property and infrastructure.	TCC began assessing coastal hazards in 2012 and has a strong knowledge of climate change risks for the island.
	Dependency on ferry company for waste removal, which if Magnetic Island is cut off from the mainland leads to an issue in the capacity of the waste transfer station.	Waste facility has additional built-in storage capacity if the island becomes cut-off.
	Costs associated with removing waste off-island as there is no on-island landfill.	Waste transfer station has been designed with additional storage in mind in case the island is cut off from the mainland, but there is no way to treat/manage the waste during the isolation period.
	Recycled waste disposed of in the general waste stream.	TCC provides fortnightly pick-up of recyclables.
	Greenhouse gas emissions from waste from the island sent to landfill on the mainland.	TCC has invested in landfill gas flaring at their landfills in Townsville.
	Difficulty in achieving consensus on sustainability goals and actions across many community organisations.	Large number of sustainability actions are being undertaken by community groups, currently not under an overarching framework and vision.
	Increased psychological issues from experiencing severe weather events.	Range of community groups to assist. Well serviced region in Townsville for disaster relief.
Severe	Impacts to critical energy pipeline infrastructure and mainland infrastructure during and following severe weather events creating a risk to livelihoods, human health and liveability.	No current mitigating strategies observed.
	Use/ reliance on non-renewable energy contributing to climate change.	Some residents (30%) and businesses have installed solar, but most rely on grid power from mainland. Those that do have solar power, cannot access electricity generation if the grid is down.
	Use of non-renewable fuel consumption in transportation to and from the island contributing to climate change.	Ferry operator has increased efficiency of vessels but still a total reliance on diesel.

	Potential for ozone depleting substances to release gases harmful to human health (e.g. from fridges, air conditioning equipment etc.).	No current mitigating strategies observed.
	Impacts to critical water pipeline infrastructure during and following severe weather events creating a risk to livelihoods, human health and liveability.	No current mitigating strategies observed.
	Water shortages on the mainland during periods of drought impacting livelihoods, human health and resilience on the island.	Water conservation program offered by TCC.
	Impacts to local ecosystems from excessive visitor numbers and from increased visitor infrastructure (including buildings, facilities, transport etc.)	Limited signage in National Park areas. Parking and congestion issues (e.g. Forts Walk Carpark, Horseshoe Bay).
	Impacts to local ecosystems from increased development on the island.	Environmental impacts assessed in planning and development applications.
	Coastal hazards including cyclones and storm activity causing coastal erosion and damage to infrastructure.	Extensive program of work to identify major areas at risk through the TCC Coastal Hazard Adaptation Program (CHAP).
	Reliance on external transport providers to bring visitors, workers and local residents on and off the island, including evacuations during severe weather events.	No current mitigating strategies observed.
	Poor condition of roads and connectivity of roads on the island limiting mobility during severe weather events.	No current mitigating strategies observed.
	High cost of insurance premiums increases cost of business impacting profitability or meaning that insurance is unaffordable and assets are uninsured, leading to greater vulnerability during severe weather events.	Insurance resilience programs are improving properties to reduce future claims. Queensland Reconstruction Authority (QRA) leading disaster resilience programs.
	In the instance of a severe weather event, the island is isolated from the mainland meaning that food cannot be delivered for the food outlets.	Limited community gardens and limited supply of stocked food items.
	Severe weather events leading to the island being cut-off from the mainland,	Paper based systems for payment of goods and services.

	and some parts of the community cut-off from the rest. This leads to a range of issues including evacuations for health reasons, access to power, water, roads cut to critical infrastructure, telecommunications etc.	MICC coordinator check elderly prior to weather event. Disaster Management Plans are in place. Frequency of events has led to increases in community preparedness.
	Increased frequency of severe weather events reduces time for ecosystems to recover between events leading to loss of environmental habitats and amenity.	TCC began assessing coastal hazards in 2012 and has a strong knowledge of climate change risks for the island.
Extreme	Lack of on-island freshwater/potable sources (including rain tanks) impacting self-sufficiency and resilience of island stakeholders.	Limited use of bore water for landscaping.
	High cost to defend and protect coastal areas and infrastructure leading to allocation of funds to high risk areas (not all assets/ areas can be protected).	TCC began assessing coastal hazards in 2012 and has a strong knowledge of climate change risks for the island in order to make an informed decision on priorities.

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APPENDIX 1 MAGNETIC ISLAND COMMUNICATION AND ENGAGEMENT PLAN

The following pages outlines the Communication and Engagement Plan that has been designed to inform the sustainability audit, options analysis and project options development. Included in the plan is a cultural engagement strategy for Magnetic Island.

OVERVIEW

EarthCheck led a team of consultants including ARUP, Regional Economic Solutions (RES) and Queensland Tourism Industry Council (QTIC) to deliver the Decarbonisation of the Great Barrier Reef Islands – Whole of Island Community Pilot Project for Magnetic Island. This project was carried out for the Department of Environment and Science (DES) in close collaboration with the Department of Aboriginal and Torres Strait Islander Partnerships (DATSIP).

Appropriate and respectful community and stakeholder engagement was key to the successful delivery of the Project and the sharing of community knowledge to understand issues and barriers and identify achievement opportunities for the island.

This Communications and Engagement Plan has been designed to inform the sustainability audit, options analysis and project options development. Included in this plan is a cultural engagement strategy for Magnetic Island prepared by RES (with review by QTIC) that:

- Recognises and respects cultural knowledge and experience
- Includes both men's and women's business and perspectives
- Is sensitive to historical and political experiences of First Nation peoples
- Is sensitive to Island specific cultural protocols and socio-economic issues

This plan presents the used engagement approaches and an outline of the communications and engagement with the community and key stakeholders, setting out the roles and responsibilities of players. A list of engaged stakeholders is also included.

1. PROJECT OBJECTIVES

The Project objective was to deliver a Great Barrier Reef (GBR) Decarbonisation Program for the island community of Magnetic Island. DES is helping GBR Island communities by identifying opportunities and project options to enable transition to low carbon economies and become more resilient to changes in climate. Magnetic Island presented unique challenges for decarbonisation and resilience with the added opportunity of learning from and incorporating First Nation community knowledge into the decarbonisation and resilience efforts.

The Whole of Island Community Pilot Project worked with the community to identify opportunities for new technologies, innovations and best practices, and ensure community has sufficient information (project options) to seek funding opportunities. These will reduce greenhouse gas emissions and provided additional benefits such as:

- Ownership of projects and input into the work going forward
- Identify opportunities for local employment and economic development
- Identify cluster opportunities for implementing solutions with neighbouring islands and communities

The project was constituted of three phases that led to the presentation of the Final Project options to the Island community. These phases were:

1. The Sustainability Assessment

The sustainability assessment involved off-site and on-site data collection on five key areas (energy, waste management, water, transport, and resilience). During the first on-island visit, the team spent three days engaging with the community and key stakeholders, building relationships as well as collecting a range of information (qualitative and quantitative).

2. The Options development

The options development involved compiling a list of options for reducing emissions, increasing resilience to climate change and identifying new opportunities. The impact and feasibility of each of these was evaluated by the project team and a panel of industry experts. During the second on-island visit, the community tailored these options and provided feedback to ensure alignment with key community needs.

3. The Project options development

The project options development involved developing packages for Magnetic Island. These went through a rigorous multi-criteria analysis which investigated on-island employment opportunities. During the third on-island visit, the community had the opportunity to tailor these project options and provide supplementary feedback to ensure appropriateness and project success.

Each of these phases involved communicating and engaging with key island stakeholders such as local councils, community leaders, as well as organisations and service providers.

2. COMMUNITY AND STAKEHOLDER ENGAGEMENT METHODOLOGY

Magnetic Island required a tailored engagement strategy to facilitate communications between the project team and the community. Understanding this for Magnetic Island and having an adapted stakeholder approach was a key success factor.

This was complemented by the widely accepted community engagement techniques as well as cultural engagement tools. The International Association for Public Participation (IAP2) Engagement spectrum which outlines the level of public participation by stakeholder groups depending on their level of interest in the project has guided the engagement techniques developed for the project.

The team used both approaches to communicate and collaborate with key stakeholders and community on Magnetic Island. These are described further below.

2.1 IAP2 and General Engagement Techniques

The Communications and Engagement Plan is based on the four pillars of the IAP2 Stakeholder Engagement Spectrum – Inform, Consult, Involve and Collaborate. For this project, the multiple engagement strategies outlined in the IAP2 framework were used as needed to maintain stakeholder engagement.

For the project to provide the most successful and beneficial outcomes, the consultation and engagement process with the stakeholders and communities on-island needed to build trust and gain support for any preferred options. The key stakeholders included the residential community, local Councils, business operators, transport providers, state and/or national government departments operating on the island as well as any tangible links to surrounding islands or the mainland. A detailed framework of the IAP2 approach is included in Section 4.

The key engagement tools identified in this framework that are relevant to the project include:

Inform

- Push and pull communications
- Project Website
- Local Media (paper, radio, TV, internet, social media)
- Public displays/exhibitions
- Existing community organisation networks
- Environment, recreation, sport, tourism and business networks
- Council's range of communication channels

Consult/Involve/Collaborate

- Project presentations
- Community forums and workshops
- Face to face meetings
- Surveys
- Community Drop in Sessions
- Emailing feedback
- Key Influencer Engagement
- Industry technical forum

3. COMMUNICATION AND ENGAGEMENT PLAN

The action plan for community engagement for Magnetic Island is based on the following principles that are used to gain maximum communication and engagement. These principles ensure the community is:

- Advised of the project intent and their thoughts sought
- Engaged in the Yarning Framework to help develop understanding and express their views
- Shown how this project could benefit the community
- Asked if they have had similar initiatives in the community previously
- Asked if there is First Nation cultural knowledge that people would like to share and have recorded
- Engaged in negotiating an engagement and decision-making process throughout the project stages and seek feedback regarding the planning and implementation processes
- Engaged in identifying and reviewing a range of opportunities that consider individual residents, businesses, community organisations and other stakeholder groups
- Provided with updates about the project and progress on milestones
- Advised of previous projects and or studies that have been considered and views or feedback will also be sought to ensure the results continue to be relevant

The following tables present the key communication and engagement considerations for Magnetic Island throughout the project. Table 1 provides an overview of the key stakeholder groups engaged in the project. Table 2 provides an overview of key actions implemented through each phase of the project.

Table 1: Key stakeholder groups for Magnetic Island

Community/ Stakeholder	Engagement
Government (State) Level of interest: Likely to be a very high level of interest due to alignment with policy objectives, opportunities for infrastructure enhancement and long-term planning and development	IAP2 Spectrum: Collaborate • Guide, support and facilitate project delivery • Review and feedback on reports and presentations including providing sign-off on key findings
Local Council Level of interest: Likely to be a very high level of interest due to alignment with policy objectives, opportunities for infrastructure enhancement and long-term planning and development	IAP2 Spectrum: Collaborate • Council will have multiple resources involved in the Project Operational Team • Council to take ownership of the project and help guide, support and facilitate project delivery • Council to assist with project-related communications and with venues for meetings and community gatherings (if possible)
Utility providers Level of interest: Likely to be a very high level of interest due to opportunities for infrastructure enhancement and long-term planning and development	IAP2 Spectrum: Collaborate • Ergon contact to be a member of Project Operational and Strategic Team • Guide, support and facilitate project delivery • Review and feedback on reports and presentations including providing sign-off on key findings
Community Associations Level of interest: Likely to be a medium - high level of interest due to community development outcomes, opportunities for infrastructure enhancement and long-term planning and development	IAP2 Spectrum: Collaborate • MICDA a member of Project Operational Team • Guide, support and facilitate project delivery • Review and feedback on reports and presentations including providing sign-off on key findings • Assist in the dissemination of project-related information throughout respective networks
Businesses (retail, accommodation, transport) Level of interest: Likely to be a medium – high level of interest as an opportunity to reduce business operation	IAP2 Spectrum: Involve • Participate in the project through all available avenues and provide input and feedback

Community/ Stakeholder	Engagement
costs and support resilience of Island business, tourism and future development	
Traditional owner representatives <u>Level of interest:</u> Likely to be a medium – high level of interest as reducing costs of living and supporting greater Island self-sufficiency and opportunity	IAP2 Spectrum: Involve • Lead community input and cultural knowledge into the project • Review and feedback on reports and presentations including providing sign-off on key findings
Community providers (schools, health, churches, sport) <u>Level of interest:</u> Likely to be a medium – high level of interest as reducing costs of living and supporting greater Island self-sufficiency and opportunity	IAP2 Spectrum: Involve • Participate in the project through all available avenues and provide input and feedback
Residents <u>Level of interest:</u> Likely to be a medium – high level of interest as reducing costs of living and supporting greater Island self-sufficiency and opportunity	IAP2 Spectrum: Involve • Participate in the project through all available avenues and provide input and feedback
Other stakeholder groups (technology providers, neighbouring Islands) <u>Level of interest:</u> Likely to be a medium level of interest as opportunities identified for these Islands may open be broadened to wider GBR region	IAP2 Spectrum: Inform • Inform

Table 2: Magnetic Island Communications and Engagement Plan

Audience / Recipient	Project Phase	Description	Creator / Organiser	QA	Approval	Distributor
Magnetic Island Stakeholder groups (Residents, Traditional Owners, Businesses, Community associations, Community providers, Transport operators, Other stakeholder groups)	1 Sustainability Assessment	Island-specific poster detailing project and first visit information such as time and place of drop in sessions. Shared via community groups, print and other	EC	RES, QTIC, Arup, DATSIP, DES, Council	DES	EC, Council, key stakeholders, media
		Posts (poster and ads) on various local social media pages: • Magnetic Island Community • MAGNETIC ISLAND • Magnetic Island- Buy/Sell/Swap • This Is Magnetic Island	EC	RES, QTIC, Arup, DATSIP, DES, Council	DES	EC, Council, key stakeholders
		Island-specific web page presenting the project, the timeline, the project team and other important resources	EC	RES, QTIC, Arup	DES	EC
		Community drop-in sessions to present project to community and collect qualitative and quantitative information about the island	EC	EC, RES, QTIC, Arup	none	EC, RES, QTIC
		Community groups president's meeting to present the project, generate engagement, ensure alignment and develop relationships • MICDA • MINCA • MIRRA • TMI • Zero Waste Magnetic Island	EC	EC, QTIC, DES, DATSIP	DES	EC

		Indigenous and Traditional Owner groups are met with to develop relationship, project buy-in and contextual information. Steps 1, 2 and 3 from the RES Yarning Framework were employed in this phase (Discover, Understand and Negotiate)	RES	RES	None	RES
		Online survey to collate island data regarding energy, water, waste, transport and resilience. Distributed in person and via email	EC	RES, QTIC, Arup	DES	EC, Council, Key stakeholder groups, media
		Data requests to key stakeholders to collate information concerning energy, water, waste, transport and resilience. Distributed via phone calls, interviews or email	EC	DES, Arup	DES	EC
	2 Options Development	Island-specific poster detailing the project and second visit information such as time and place of options development workshops. Shared via community groups, print and other	EC	RES, QTIC, Arup, DATSIP, DES, Council	DES	EC, Council, key stakeholders, media
		Posts (poster and ads) on various local social media pages: • Magnetic Island Community • MAGNETIC ISLAND • Magnetic Island- Buy/Sell/Swap • This Is Magnetic Island	EC	RES, QTIC, Arup, DATSIP, DES, Council	DES	EC, Council, key stakeholders

		Flyer presenting project methodology and structure updated for the second visit with key information. Hard copies only.	EC, RES, QTIC, Arup	RES, QTIC, Arup, DATSIP, DES	DES	EC, RES, QTIC, Arup
		Workshop briefing pack to prepare attendees for the workshop and guide the discussion	EC, RES, QTIC, Arup	RES, QTIC, Arup	DES	EC, Council, Key stakeholders
		Indigenous and Traditional Owner groups are met with to further develop relationship, project buy-in and contextual information. Steps 3, 4, 5 and 6 from the RES Yarning Framework were employed in this phase (Negotiate, Implement, Take Stock and The Future)	RES	RES	None	RES
		Workshops to present options short list and collect community input on gaps, applicability and other details	EC, RES, QTIC, Arup	EC, RES, QTIC, Arup	DES to approve content	EC, RES, QTIC, Arup
	3 Project Options Development	Island-specific poster detailing the project and third visit information such as time and place of project options development workshops. Shared via community groups, print and other	EC, RES, QTIC, Arup	RES, QTIC, Arup, Council, DATSIP, DES	DES	EC, Council, key stakeholders, media
		Posts (poster and ads) on various local social media pages: • Magnetic Island Community • MAGNETIC ISLAND • Magnetic Island- Buy/Sell/Swap • This Is Magnetic Island	EC	RES, QTIC, Arup, DATSIP, DES, Council	DES	EC, Council, key stakeholders

		Flyer presenting project methodology and structure updated for the third visit with key information. Hard copies only.	EC, RES, QTIC, Arup	RES, QTIC, Arup, DES, DATSIP	DES	EC, RES, QTIC, Arup, Council, Key stakeholders
		Workshop briefing pack to prepare attendees for the workshop and guide the discussion	EC, RES, QTIC, Arup	EC, RES, QTIC, Arup, DES, DATSIP	DES	EC, Council, Key stakeholders
		Indigenous and Traditional Owner groups are met with to further develop relationship, project buy-in and contextual information. Steps 3, 4, 5 and 6 from the RES Yarning Framework were employed in this phase (Negotiate, Implement, Take Stock and The Future)	RES	RES	None	RES
		Workshops to present project options and collect community input on gaps, applicability and other details	EC, RES, QTIC, Arup	EC, RES, QTIC, Arup	DES to approve content	EC, RES, QTIC, Arup
	4 Final Report	Island-specific poster detailing the project and final delivery information sessions such as time and place of final report presentation. Shared via community groups, print and other	EC, RES, QTIC, Arup	RES, QTIC, Arup, Council, DES, DATSIP	DES	EC, Council, key stakeholders
		Posts on various local social media pages: • Magnetic Island Community • MAGNETIC ISLAND • Magnetic Island- Buy/Sell/Swap • This Is Magnetic Island	EC	RES, QTIC, Arup, DATSIP, DES, Council	DES	EC, Council, key stakeholders

		Final community report and project options to be presented to key community contacts and project champions	EC, Arup	RES, QTIC, Arup, DES	DES, Council, Key stakeholders	EC
		Community meeting to present the project results, hand over the project options and thank the community for their engagement and welcome into their communities	EC	RES, QTIC, Arup, DES, DATSIP	DES, Council	EC
Townsville City Council	1 Sustainability Assessment	Project summary (4-pager) providing a detailed portrait of the project, the timeline, the project team as well as what councils and key stakeholders can do to help the project succeed	EC, RES	EC, RES, QTIC, DES, DATSIP	DES	EC
		Online survey to collate island data regarding energy, water, waste, transport and resilience. Distributed via SurveyMonkey platform	EC	RES, QTIC, Arup, DES, DATSIP	DES	EC
		Sustainability Assessment Report presenting the findings of the Sustainability Assessment phase and first site visit	EC	RES, QTIC, Arup, Council, DES	DES	EC
	2 Options Development	Workshop briefing pack to prepare attendees for the workshop and guide the discussion	EC, RES, QTIC, Arup	EC, RES, QTIC, Arup	DES	EC, Council, Key stakeholders
		Workshop to present options short list and collect Council input on gaps, applicability and other details	EC, RES, QTIC, Arup	EC, RES, QTIC, Arup	none	EC, RES, QTIC, Arup

	3 Project Options Development	Workshop briefing pack to prepare attendees for the workshop and guide the discussion	EC, RES, QTIC, Arup	EC, RES, QTIC, Arup	DES	EC
		Workshop to present project options and collect Council input on gaps, applicability and other details	EC, RES, QTIC, Arup	EC, RES, QTIC, Arup	DES	EC, RES, QTIC, Arup
	4 Final Report	Final report and project options to be presented to Council contacts	EC, RES	EC, RES, QTIC, Arup, Council	DES	EC
		Council meeting to present the project results, hand over the project options and thank the Council for their engagement	EC	EC, RES, QTIC, Arup	none	EC
Government and industry experts	2 Options Development	Options briefing pack to prepare distribution group for feedback and guide discussions	EC	EC, Arup, DES, DATSIP	DES	EC, DES, DATSIP
		Materials distributed to present options and collect input on project alignment, gaps, applicability and other details	EC	EC, Arup, DES, DATSIP	DES	EC, DES, DATSIP
	3 Project Options Development	Project options workshop briefing pack to prepare attendees for the workshop and guide the discussion	EC	EC, Arup, DES, DATSIP	DES	EC, DES, DATSIP
		Workshop / Survey to present project options and collect input on project alignment, gaps, applicability and other details	EC	EC, Arup, DES, DATSIP	DES	EC
Project Operational Group	Throughout project	Bi-weekly meeting to discuss latest deliverables, community engagement, ownership and project alignment.	EC	EC, RES, QTIC, Arup, DES, DATSIP	DES	EC

(See table 1 for members)						
Media	Throughout project	All communications with media will be managed by DES. Advice from DES media is that any news outlets should contact DES media at Media@des.qld.gov.au for any inquiries.	DES	EC, RES, QTIC, Arup, DES, DATSIP	DES	DES
		Local ads and communications to inform the community and generate engagement • MI News (Debbie Dennison) – half-page ad • What's On Magnetic Island newsletter (Les Sampson MICDA) for distribution and publication on their web pages	EC	EC, RES, QTIC, Arup	DES	EC

4. IAP2 APPROACH AND PROJECT ENGAGEMENT TECHNIQUES

IAP2 approach	
Engagement Principles	**Engagement was inclusive** which means ensuring that everyone who may have an interest in the outcome had an opportunity to participate.
	A **range of engagement techniques** were employed for industry, community and other stakeholders based on the IAP2 spectrum of inform, consult, involve, collaborate and empower.
	The **timing and purpose** of each stage of engagement was clearly linked to each stage of project options development.
	There was a clear commitment to the provision of **accurate and timely information**, and a process to confirm that feedback is being heard.
	The **diversity of views in the community** were acknowledged and respected in accordance with relevant procedures and customs for the island.
	Engagement was **flexible and responsive** community needs to ensure that the process builds buy in and ownership from stakeholders and community.
Engagement Objectives	Communicated **broadly to the community and key stakeholders** to inform them about the development and progress of the Project throughout its life-cycle.
	Worked directly with key stakeholders to ensure that their aspirations were understood, and their local knowledge and experience was integrated into the project options.
	Cuilt a strong partnership with the stakeholders throughout the development of the project options that enabled support and effective implementation.
	Ensured the **diversity of community voices** were reflected in the engagement process, and that **diverse opportunities** were created for the community to be informed about and have input into the development of the project options.
	Provided **clarity and transparency** about how community and stakeholder input has influenced the development of the project options.
Engagement approach	**Informing** This engagement approach focused on getting the message out to the community and key stakeholder groups of the project, that work had commenced, informed them of its priorities, and how and when all parties were able to get involved. An Engagement Strategy was implemented for the island. It presented an adapted approach, based on its history, culture, available communications streams and used a range of media channels, including: • Project Website • Local Media (paper, radio, TV, internet, social media)

IAP2 approach	
	• Existing community organisation networks • Council's range of communication channels • Community champions Push Communications Information about the project was sent or distributed to relevant stakeholders via a variety of methods. These included mainly e-mails and phone conversations to key stakeholders. Local communications streams were also harnessed to promote project awareness. Notifications were also sent in local media publications. Pull Communications The Project Website Page allowed a wide range of stakeholders to become and stay informed about the project, communicate with the project team as well as provide insight and feedback. The page was added onto the EarthCheck website and presents the project, the project team, the project partners and the project context. A link was made available to stakeholders and partners so they may link to it on their own websites and facilitate the spread of information about the project. Other pull communication methods included publications on local Council's websites or notice boards in various key locations on or around the island. Communication Streams This Project employed a variety of communication streams to achieve its IAP2 engagement approach objectives. These were adapted to the needs of the island.
	Consulting The purpose of this engagement approach was to conduct the sustainability audits and on-site research by successfully gathering high quality consultative input from the community and stakeholder groups. On-island and relevant off-island groups were included in this phase. Options for consultation included: • Community forums and workshops; • Face to face meetings; • Project webpages; • Sustainability audits • Online and offline surveys • Feedback register Communities We recognise the importance of developing an approach which provides for as wide a range of inputs as possible. This will need to recognise existing issues for all three islands such as location and socio-demographic groups.

IAP2 approach	
	Where applicable, community champions will be identified and involved to facilitate community engagement and ownership of the project. Presentations Presentations used in this project present key project findings, the sustainability options analysis as well as project options to island stakeholders. Furthermore, presentations will also be employed to convey information about the project progress and final deliverables to DES. Cultural sensitivities will be considered and how to best communicate information to diverse audiences. Industry and Stakeholders Industry stakeholders were identified. they were directly communicated if relevant to the project. These stakeholders are listed in the Stakeholder Register. Council Communication We recognise the importance of generating buy-in and input across senior officers and Council teams – all of whom will have a role in supporting the project options. Key contact points for the Council have been identified in the Stakeholder Register. Broader Industry and Technical Engagement EarthCheck engaged technical experts, relevant government agencies such as utility providers and relevant industry representatives such as suppliers of remote island infrastructure in the review and shortlisting of the options and cost benefit analysis of the project options. As part of this process EarthCheck facilitated up to four two-hour options review and project options development workshops in Brisbane inviting relevant participants to attend in person or via weblink. ARUP led engagement of technical experts, relevant stakeholders and/or relevant government agencies for pricing information for use in the project options.
	Involving The involving engagement approach focused on maintaining contact with stakeholders throughout the course of the project and fostering continued interest. Given the timescale over which the project options were prepared, this was an important consideration. As such, the project team proposed utilising the extensive network of existing communication channels to industry, stakeholders and community groups to maintain contact and provide regular updates. Options for involving could include: • Public displays/exhibitions of appropriate options (online/physical); • Open meetings;

IAP2 approach	
	• Online feedback through project webpages/social media; • Workshops; • Surveys; and • Direct feedback. <u>Community</u> Maintaining community buy-in and involvement is a key success factor for this project. For this, it was critical that there be an open and maintained communication stream between the project team and its stakeholders. Options for how this was achieved include: • Project Website/social media; • Open meetings; and • The opportunity for email questions and feedback. <u>Local businesses</u> Local businesses can be important players in a community. It is important to provide these stakeholders with a voice and the opportunity to provide feedback. For this, it is again important that there was open and maintained communication stream between the project team and its stakeholders. Options for how this was achieved include: • Project Website/social media; • Open meetings; and • The opportunity for email questions and feedback. <u>Other Stakeholders</u> Feedback from the community and stakeholders from the Options Workshops and the recommended responses fed into the final project options preparation. <u>Consultation Groups and Workshops</u> Consultation groups and workshops were a critical communication stream and engagement tool for this project. The island was visited to conduct a sustainability audit as well as during options review workshops and the project options presentations. These involved communicating, working and consulting with the community. Cultural sensitivity is a key aspect of this communication stream. RES and QTIC were heavily involved in this process to ensure culturally appropriate interactions with the many different cultural backgrounds involved in the project. This ensured good working relationships as well as promoted positive project outcomes.

IAP2 approach	
	Collaborating The final and perhaps most important stakeholder engagement approach focuses on collaboration – activity which engendered collective ownership of the project options and commitment to being implementation partners. The communication around the final project options provided an ideal opportunity to engender wider understanding and ownership. This was done through: • Council Briefings; • Key Influencer Engagement; and • Integration of feedback into project options.

5. MAGNETIC ISLAND STAKEHOLDER REGISTER

The stakeholder register is up to date as of 29.09.2020. Please refer to the project stakeholder register for the latest data.

Position	Business/organisation	Category
	4TO/Hot FM	Business and the business community
	4TTT	Business and the business community
	ABC	Business and the business community
	ABC TV	Business and the business community
Manager/Owner	Amaroo on Mandalay	Business and the business community
	Apex Camps Magnetic Island	Business and the business community
	Aquasearch Aquarium	Business and the business community
	Arcadia Beach Guest House and Car Hire	Business and the business community
	Arcadia Village Motel	Business and the business community
Owner	Arcadia Village Motel	Business and the business community
	Barefoot Art Food Wine	Business and the business community
	Base Backpackers Magnetic Island	Business and the business community
Owners	Batuta Gallery – Tribal Arts and Antiques	Business and the business community
	Beached on Magnetic	Business and the business community
	Beachside Magnetic Harbour Apartments	Business and the business community

	Beachside Palms Holiday Units	Business and the business community
	BlueHaven Holiday Rental	Business and the business community
	Boardwalk Restaurant and Bar	Business and the business community
	Bungalow Bay Koala Village	Business and the business community
	Butterfly House Graphic Design	Resident
	Canopy Chalets	Business and the business community
	Captain's Manor on Cook	Business and the business community
	Channel 7	Business and the business community
	Chris Chappell Consulting	Resident
	Cranky Curlew Productions	Resident
	Dandaloo Gardens	Business and the business community
	Duo Magazine	Business and the business community
Solar City Community Engagement Manager	Ergon Energy	Utility Providers
	Fire Station	Government (State)
	Fish N Fuels Outdoor Adventure and MI Rentals	Business and the business community
	Floriade on Magnetic Island	Business and the business community
	FoodWorks	Business and the business community
	Great Barrier Reef Marine Park Authority (GBRMPA)	Local Council
	Golf Course	Business and the business community
	Harbour Manager	Business and the business community
	Hire Car Company	Business and the business community
	Horseshoe Bay Ranch	Business and the business community
	Horseshoe Bay Rural Fire Brigade	Resident
	IGA	Business and the business community
Manager	Island Leisure Resort	Business and the business community
	JCU (Zero Waste Magnetic Island)	Community Association
	Kooyong Holiday Units	Business and the business community
	Live FM	Business and the business community
	Magnetic 4x4 Rentals	Business and the business community

	Magnetic Community News	Business and the business community
	Magnetic Hair	Business and the business community
	Magnetic Island Bed and Breakfast	Business and the business community
	Magnetic Island Community Care (MICC)	Community Association
President	Magnetic Island Community Development Association (MICDA)	Community Association
	Magnetic Island Community Development Association (MICDA)	Community Association
	Magnetic Island Community Development Association (MICDA)	Community Association
	Magnetic Island Country Club	Business and the business community
	Magnetic Island Disaster Management Committee	Community Association
	Magnetic Island Electrical	Resident
	Magnetic Island Ferries	Business and the business community
	Magnetic Island Hairport	Business and the business community
	Magnetic Island Holiday Units	Business and the business community
	Magnetic Island Magpies Junior AFL Club	Community Provider
	Magnetic Island YHA	Business and the business community
	Magnetic Limousines	Business and the business community
	Magnetic Retreat	Business and the business community
	Magnetic Sunsets	Business and the business community
	Magnetic Times	Business and the business community
	Mamma Roma	Business and the business community
	Man Friday Restaurant	Business and the business community
	Marguerites on Magnetic	Business and the business community
Director	Marina (Nelly Bay)	Business and the business community
	MI Lions Club	Community Association
Vice President	MI Nature Care Association (MINCA)	Community Association
	MI Nature Care Association (MINCA)	Community Association
President	MI Residents & Ratepayers Association (MIRRA)	Community Association

Vice President	MI Residents & Ratepayers Association (MIRRA)	Community Association
	MI Skip Services	Business and the business community
	MICDA	Community Association
	Myra's Bed and Breakfast	Business and the business community
	National Parks	Government (State)
	NENA	Traditional Owner representative
Manager	Noodies on the Beach	Business and the business community
Campaigns Manager	North Queensland Conservation Council	Community Association
	Oskar's Rain Forest Retreat	Business and the business community
	Pacos Beach Hut	Business and the business community
	Picnic Bay Hotel	Business and the business community
	Picnic Beach'scape	Business and the business community
	Prime Radio	Business and the business community
	Pro Dive Magnetic Island	Business and the business community
	QLD Police	Government (State)
	Queensland Fire and Emergency Services (QFES)	Government (State)
	Queensland Government Parks and Forests	Government (State)
	QPWS	Government (State)
	R & R Bar	Business and the business community
	Radio 4KIG-FM	Business and the business community
	Restaurant Le Paradis Brasserie & Take Away @ Nelly	Business and the business community
	Road Runner Scooter Hire	Business and the business community
	RSL	Business and the business community
	Saint Margaret's Anglican Church	Community Provider
	Samsara Holiday House	Business and the business community
	Scallywags	Business and the business community
	SEA-Esta	Business and the business community
	SeaLink Magnetic Island	Business and the business community
	SEW MAGNETIC	Business and the business community

	Shaka: Health Food Café on Magnetic Island	Business and the business community
	Shambhala Retreat	Business and the business community
	Smith & Elliot Retreat	Business and the business community
	Southern Cross 10	Business and the business community
	Stage Door Theatre Restaurant	Business and the business community
	State Emergency Services (SES)	Community Provider
	Success Magazine	Business and the business community
	SunBus (TransLink Bus Services)	Business and the business community
	Tempting on Magnetic	Resident
	The Early Bird	Business and the business community
	The Industry Advocate	Business and the business community
	Tourism Business Association (TOBMI) Providential Magic P/L	Business and the business community
	Tourism Magnetic Island	Community Association
	Townsville Bulletin	Business and the business community
CEO	Townsville Chamber of Commerce	Business and the business community
Senior Officer – Environmental Operations Management Environmental Services Section Planning, Environment and Cultural Services Division	Townsville City Council	Local Council
Technical Officer – Property Management Infrastructure Operations, Assets and Fleet	Townsville City Council	Local Council
Councillor (Magnetic Island)	Townsville City Council	Local Council
Coordinator Creek to Coral, Townsville Water and Waste	Townsville City Council	Local Council
Lead Council Contact and Manager of Environmental Services	Townsville City Council	Local Council
Mayor	Townsville City Council	Local Council

Deputy Mayor	Townsville City Council	Local Council
General Manager – Environmental Services Coordinator – Environmental, Sustainability and Solar Division of Planning, Environmental and Cultural Services	Townsville City Council	Local Council
CEO	Townsville City Council	Local Council
Director Tourism & Events	Townsville Enterprise	Business and the business community
	Townsville Sun	Business and the business community
	Traditional Owner	Traditional Owner representative
	True North Bed and Breakfast	Business and the business community
	Villa Kembali	Business and the business community
	Whats On Magnetic Island (MICDA)	Business and the business community
	WIN TV	Business and the business community
	Windspray on Maggie	Business and the business community
Director	Wulgurukaba Aboriginal Corporation	Traditional Owner representative
	Wulgurukaba People	Traditional Owner representative
	Wulgurukaba Yunbenun Aboriginal Corporation	Traditional Owner representative
	Zero Waste Magnetic Island	Community Association

APPENDIX 2 PROJECT SURVEY RESULTS

The following pages outline the project survey results that were used to inform the sustainability audit, options analysis and project options development. The survey allowed the different stakeholders to provide focused answers and quantitative data about life on the island.

Please note that word clouds have been used to display the data for open ended survey responses where there were more than 20 respondents. To view the full responses for those survey questions in Technical Appendix 3: Project Survey Results, please contact the Project Team.

RESIDENTS

Q1: What stakeholder group best corresponds to you?

ANSWER CHOICES	RESPONSES	
Resident	86.51%	186
Business / Organisation	12.56%	27
Transport provider	0.93%	2
TOTAL		215

Q2: Please select the number of people who live in your household:

ANSWER CHOICES	RESPONSES	
1-2	66.37%	75
2-4	29.20%	33
4-6	3.54%	4
6+	0.88%	1
TOTAL		113

Q3: How many months of the year is your house unoccupied?

ANSWER CHOICES	RESPONSES	
0 to 3 months	56.64%	64
3 to 6 months	4.42%	5
6 to 9 months	5.31%	6
9 to 12 months	33.63%	38
TOTAL		113

Q4: What is the makeup of your house?

	1	2	3	4	5 OR MORE	N/A	TOTAL	WEIGHTED AVERAGE
Rooms	5.31% 6	10.62% 12	29.20% 33	21.24% 24	32.74% 37	0.88% 1	113	3.66
Kitchens	86.73% 98	11.50% 13	0.88% 1	0.00% 0	0.00% 0	0.88% 1	113	1.13
Bathrooms	40.00% 44	49.09% 54	9.09% 10	0.91% 1	0.00% 0	0.91% 1	110	1.71
Living Areas	61.61% 69	29.46% 33	6.25% 7	1.79% 2	0.00% 0	0.89% 1	112	1.48
Garage (car spaces)	53.77% 57	21.70% 23	1.89% 2	3.77% 4	0.94% 1	17.92% 19	106	1.49

Q5: Do you actively and regularly participate in Island community events, associations or groups such as the local sporting club or Church?

ANSWER CHOICES	RESPONSES	
Yes	69.64%	78
No	30.36%	34
TOTAL		112

Q6: Do you participate in any initiatives with other Islands to share learnings and leverage off collective knowledge?

ANSWER CHOICES	RESPONSES	
Yes	20.91%	23
No	79.09%	87
TOTAL		110

Q7: What do you think are the most important issues facing your Island community in terms of sustainability and resilience?

Q8: Do you encounter any environmental or plant/animal issues on the Island? E.g. Insects invading homes or salt corrosion

ANSWER CHOICES	RESPONSES	
Yes	77.48%	86
No	22.52%	25
TOTAL		111

Q9: Please select which of the following features your house has:

ANSWER CHOICES	RESPONSES	
A/C unit	75.00%	84
Dishwasher	59.82%	67
Washing machine	96.43%	108
Dryer	54.46%	61
Television	91.07%	102
PV panels (solar power)	39.29%	44
PV panels with battery	7.14%	8
Solar hot water	24.11%	27
Gas hot water	21.43%	24
Electricity hot water	57.14%	64
Water tank/storage	15.18%	17
Efficient lighting	75.89%	85
Energy efficient appliances (energy star)	71.43%	80
Water efficient appliances	45.54%	51
Diesel generator	12.50%	14
Wind energy	0.89%	1
Passive design	59.82%	67
Insulation	59.82%	67
Electric vehicle charger	0.89%	1
Please specify if other or if you have multiple of any of these choices	15.18%	17
Total Respondents: 112		

Q10: In general, how old is most of your large electrical equipment?

ANSWER CHOICES	RESPONSES	
>1 year	5.36%	6
2-4 years	44.64%	50
5+ years	33.04%	37
10+ years	11.61%	13
I don't know	5.36%	6
TOTAL		112

Q11: What would make you invest in sustainability/energy efficient features in your house?

Q12: What would motivate you to reduce energy use and emissions? Please select any that apply:

ANSWER CHOICES	RESPONSES	
Reduced bills	80.37%	86
Reduced environmental pollution	70.09%	75
More efficient appliances	58.88%	63
Community led education and awareness program	29.91%	32
Government grants or subsidies	70.09%	75
Not important to me	2.80%	3
Total Respondents: 107		

Q13: Approximately how much do you pay for electricity every year?

Q14: Do you consider energy efficiency ratings when purchasing new equipment/appliances?

ANSWER CHOICES	RESPONSES	
Yes	96.40%	107
No	3.60%	4
TOTAL		111

Q15: Do you have a pool or jaccuzi?

ANSWER CHOICES	RESPONSES	
Yes	36.94%	41
No	63.06%	70
TOTAL		111

Q16: Do you share any energy generation equipment with your neighbours? E.g. generators or batteries

ANSWER CHOICES	RESPONSES	
Yes	3.64%	4
No	96.36%	106
TOTAL		110

Q17: Are you aware of or do you participate in any incentive schemes that encourage energy efficiency?

ANSWER CHOICES	RESPONSES	
Yes	25.23%	27
No	74.77%	80
TOTAL		107

Q18: Approximately how much rubbish do you generate every week?

ANSWER CHOICES	RESPONSES	
More than one wheelie bin	4.46%	5
One wheelie bin	24.11%	27
Half wheelie bin or less	71.43%	80
TOTAL		112

Q19: Do you recycle items such as plastic, paper and glass?

ANSWER CHOICES	RESPONSES	
Yes	96.43%	108
No	1.79%	2
If not, please provide details	1.79%	2
TOTAL		112

Q20: Do you compost kitchen scraps?

ANSWER CHOICES	RESPONSES	
Yes	72.32%	81
No	27.68%	31
TOTAL		112

Q21: Do you use Council facilities (waste transfer station) to dispose of your rubbish?

ANSWER CHOICES	RESPONSES	
Yes	90.00%	99
No	10.00%	11
TOTAL		110

Q22: Are you aware of or do you participate in any incentive schemes that encourage waste reduction?

ANSWER CHOICES	RESPONSES	
Yes	44.04%	48
No	55.96%	61
TOTAL		109

Q23: What are your main water consuming activities? (E.g. gardening, showers, laundry, washing, etc.) Please describe

Q24: Do you utilise rainwater capture at your property?

ANSWER CHOICES	RESPONSES	
Yes	18.02%	20
No	81.98%	91
TOTAL		111

Q25: Do you have any water saving appliances or features? Please select all that apply

ANSWER CHOICES	RESPONSES	
Dual flush toilets	91.67%	88
Low flow showerheads	66.67%	64
Low flow taps	29.17%	28
Efficient garden sprinklers	47.92%	46
Total Respondents: 96		

Q26: Do you consider water efficiency ratings when purchasing new equipment/appliances?

ANSWER CHOICES	RESPONSES	
Yes	85.59%	95
No	14.41%	16
TOTAL		111

Q27: Do you maintain household piping to prevent the impacts of rust or salt corrosion?

ANSWER CHOICES	RESPONSES	
Yes	34.26%	37
No	65.74%	71
TOTAL		108

Q28: Do you have a septic tank?

ANSWER CHOICES	RESPONSES	
Yes	45.54%	51
No	54.46%	61
TOTAL		112

Q29: Are you aware of or do you participate in any incentive schemes that encourage water usage reduction?

ANSWER CHOICES	RESPONSES	
Yes	33.64%	37
No	66.36%	73
TOTAL		110

Q30: How many vehicles do you own?

ANSWER CHOICES	RESPONSES	
1	51.38%	56
2	34.86%	38
3	11.01%	12
4 or more	2.75%	3
TOTAL		109

Q31: Do you own any of the following vehicle types? Please select all that apply

	SMALL (PETROL)	SMALL (DIESEL)	LARGE (PETROL)	LARGE (DIESEL)	HYBRID	ELECTRIC	N/A	TOTAL	WEIGHTED AVERAGE
Car	58.70% 54	5.43% 5	19.57% 18	13.04% 12	0.00% 0	0.00% 0	3.26% 3	92	1.87
Ute	16.67% 7	16.67% 7	11.90% 5	26.19% 11	0.00% 0	0.00% 0	28.57% 12	42	2.67
Truck	0.00% 0	5.56% 1	11.11% 2	0.00% 0	0.00% 0	0.00% 0	83.33% 15	18	2.67
Van	13.04% 3	13.04% 3	13.04% 3	0.00% 0	0.00% 0	0.00% 0	60.87% 14	23	2.00
Boat	41.03% 16	7.69% 3	10.26% 4	5.13% 2	2.56% 1	2.56% 1	30.77% 12	39	1.96
Motorcycle	43.75% 14	3.13% 1	0.00% 0	3.13% 1	0.00% 0	0.00% 0	50.00% 16	32	1.25

Q32: Do you use any alternative modes of transport? Please select all that apply

ANSWER CHOICES	RESPONSES	
Walk	82.88%	92
Bicycle	40.54%	45
On-island public transport	56.76%	63
Ferry	97.30%	108
Carpooling	21.62%	24
Total Respondents: 111		

Q33: How many vehicles and seagoing vessels does your household operate?

Q34: Approximately how much do you pay for fuel (vehicle or boat) every year?

Q35: Have you undertaken any actions to reduce transport energy use to/from and on the Island?

ANSWER CHOICES	RESPONSES	
Yes	36.70%	40
No	63.30%	69
TOTAL		109

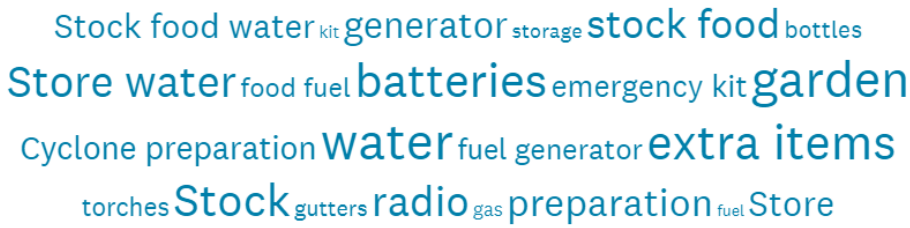
Q36: What have been your major climate related impacts and associated costs since 2010? (The physical impacts can include sea level rise, erosion, storm surges, heatwaves, flooding/rain events, reduced water quality/availability, cyclones, etc. The effects might include higher insurance premiums, income loss, health and wellbeing)

Q37: How many hours/days can you operate in "island mode"? (without outside support for energy, water, waste, food, communications, health services)

Q38: How frequently do severe weather events occur? Are they occurring more frequently and are there any stories passed down that can help us get ready?

Q39: What stands out as the biggest area of concern for your community in terms of resilience (vulnerability)?

Q40: What do you do to prepare for a severe weather event and what do you do to handle climate related impacts better?



Q41: Are there any mainland (or neighbouring island) businesses you are heavily reliant on?

ANSWER CHOICES	RESPONSES	
Food Providers	95.45%	84
Waste Providers	38.64%	34
Maintenance Companies	30.68%	27
Fuel Suppliers	64.77%	57
Total Respondents: 88		

Q42: Resilience Rating

	1 - NOT AT ALL	2 - LOW	3 - MODERATE	4 - HIGH	5 - VERY HIGH	N/A	TOTAL	WEIGHTED AVERAGE
How would you rate the extent of the changes you have made to your lifestyle to reduce the impact or associated costs of climate related impacts?	6.42% 7	19.27% 21	44.04% 48	20.18% 22	8.26% 9	1.83% 2	109	3.05
How would you rate your general readiness in the event of a severe weather event? (equipment, roads and infrastructure, access to services, health support, medication)	0.00% 0	13.64% 15	39.09% 43	30.00% 33	15.45% 17	1.82% 2	110	3.48
How comfortable are you with your evacuation/safety plan for a severe weather event?	4.55% 5	10.91% 12	35.45% 39	23.64% 26	23.64% 26	1.82% 2	110	3.52
How would you rate your access to capital and resources after a severe weather event?	1.85% 2	21.30% 23	43.52% 47	24.07% 26	8.33% 9	0.93% 1	108	3.16
How would you rate your capacity to recover/rebuild the cultural and historical aspects of your community after a severe weather event?	0.92% 1	19.27% 21	39.45% 43	24.77% 27	8.26% 9	7.34% 8	109	3.22
How much do you rely on the mainland for food/water/energy supply?	0.91% 1	6.36% 7	12.73% 14	27.27% 30	49.09% 54	3.64% 4	110	4.22
How much does your community pitch in and help to rebuild after a severe weather event?	0.91% 1	3.64% 4	11.82% 13	32.73% 36	45.45% 50	5.45% 6	110	4.25

Q43: Are there any other comments or suggestions you would like to provide to the project team regarding improving resilience and transitioning to a low-carbon economy on Magnetic Island?

BUSINESSES

Q45: Please select the type of business / organisation you operate:

ANSWER CHOICES	RESPONSES	
Supermarket or general store	3.85%	1
Retail store	3.85%	1
Church or religious group	0.00%	0
First Nations organisation	0.00%	0
Venue such as community hall or sports club	0.00%	0
Accommodation (Hotel/Motel/BB/Lodge/Camp)	38.46%	10
Restaurant / Cafe	7.69%	2
School	0.00%	0
Tour company	11.54%	3
Golf course	0.00%	0
Equipment or vehicle leasing	0.00%	0
Community services (fire, police, ambulance)	0.00%	0
Other	34.62%	9
TOTAL		26

Q46: What is your average capacity for overnight guests (including staff)?

ANSWER CHOICES	RESPONSES	
1 - 10 people	28.57%	2
10 - 20 people	28.57%	2
20 - 30 people	0.00%	0
30 - 50 people	0.00%	0
50+ people	42.86%	3
TOTAL		7

Q47: What facilities does your accommodation provide? Please select all that apply

ANSWER CHOICES	RESPONSES	
Self-contained apartments	50.00%	3
Motel style rooms	16.67%	1
Rooms with communal bathroom / kitchen facilities	50.00%	3
Swimming pool	50.00%	3
Gym, sauna, spa	0.00%	0
Dining facilities	0.00%	0
Total Respondents: 6		

Q48: If your business / organisation is a school, how many students and how many teachers are onsite for a one year period on average?

RESPONDENT 1	10423 pax in total over calendar year 2018

Q49: If your business / organisation is a restaurant or cafe, what is the number of restaurant covers (people who are eating at your facility) for a one year period on average?

RESPONDENT 1	19000
RESPONDENT 2	Quite variable and difficult to give exact number, certainly increasing though
RESPONDENT 3	8338 pax estimated over calendar year 2018

Q50: If your business / organisation is a golf course, what is the total property area of the golf course (hectares)?

RESPONDENT 1	N/A
RESPONDENT 2	N/A

Q51: If your business / organisation leases equipment or vehicles, what is the total number of vehicles/equipment hired in a one year period?

RESPONDENT 1	N/A

Q52: What is the total area under roof of your business / organisation? Area under roof - the total number of square metres (m2) of the organisation's interior area and undercover outdoor areas. If unknown, please provide a rough estimate of the size of your building in the best way you can.

RESPONDENT 1	3000
RESPONDENT 2	62 ft
RESPONDENT 3	15 x 10m
RESPONDENT 4	450
RESPONDENT 5	Estimated 1000m2
RESPONDENT 6	We have multiple buildings on site. Total estimated building size would be 800m2 over 20 buildings.

RESPONDENT 7	225 aq m under canopy cover
RESPONDENT 8	400m2
RESPONDENT 9	10x10
RESPONDENT 10	65
RESPONDENT 11	420
RESPONDENT 12	100

Q53: Please provide more information about your operations on Magnetic Island.

RESPONDENT 1	Operate accommodation and koala park attraction 35 a frame bungalows Camping ground Food and beverage Koala park tours
RESPONDENT 2	We did operate on Magnetic Island for 10 years and are now in Airlie Beach.
RESPONDENT 3	A cafe open for 8-10 mth each year
RESPONDENT 4	We are a traditional Bed and Breakfast providing accommodation speacilising in overseas travellers. We promote eco tourism in that it is an environment that is the jewel in our crown.
RESPONDENT 5	motel accommodation (no food)
RESPONDENT 6	We provide a residential accommodation camp in open dormitory/cabin style with catering and outdoor recreational activities for schools, sporting and corporate groups
RESPONDENT 7	tank space is 85 sq m, while I have a caged area where I keep microalgae stock cultures and about 15 aquaria for rearing of clownfish larvae (summertime), the main display of tanks is for tourism.
RESPONDENT 8	Concrete, water diversion, landscaping business hiring local residents and using Magnetic Island suppliers.
RESPONDENT 9	Health Retail
RESPONDENT 10	Hostel / Guest House

Q54: What would make you invest in these sustainability/energy efficiency features?

RESPONDENT 1	Information and grants
RESPONDENT 2	Getting help collecting environmental taxes ie not being forced to include in competitive ticket prices and it being treated more like entry to national parks eg in Tasmania where ticket collection is undertaken by the government.
RESPONDENT 3	If I believed in there effectiveness n viability
RESPONDENT 4	Government support
RESPONDENT 5	Grant funding as we are community not for profit
RESPONDENT 6	Depending on the cost as my business is small
RESPONDENT 7	Profitability
RESPONDENT 8	Information and necessity
RESPONDENT 9	Not sure, needs to be compelling

RESPONDENT 10	Cost Savings
RESPONDENT 11	Subsidy for putting in water tanks. Reducing the cost of replacing solar inverter. (One of the two we have has died).

Q55: What would motivate you to reduce energy use and emissions? Please select any that apply:

ANSWER CHOICES	RESPONSES	
Reduced bills	90.00%	9
Reduced environmental pollution	60.00%	6
More efficient appliances	50.00%	5
Community led education and awareness program	30.00%	3
Not important to me	0.00%	0
Total Respondents: 10		

Q56: What do you think are the most important issues facing your Island community in terms of sustainability and resilience?

RESPONDENT 1	Central point to disperse information Peak and off peak periods, hard to budget All small family business operations, tight budgets
RESPONDENT 2	Facing the island when we were there is the way eco accreditation tickets were given out to eg large boats which made a mockery of being environmentally accredited. No policing in the marina of yachts having holding tanks. Having a community that is behind environmentall friendly tourism.
RESPONDENT 3	Waste and infrastructure to support increased tourism
RESPONDENT 4	Society and its appetite for commercialism and over government
RESPONDENT 5	Keeping the island in its pristine managed environment so that there is a reason for guests and community to stay and visit on the island
RESPONDENT 6	cost of living here is higher than in Townsville so this is perhaps the most important issue.
RESPONDENT 7	All Level Government Influences
RESPONDENT 8	Water storage, coastline protection, care of our native animals and plants, better waste initiatives, community garden, community compost area, new residents thinking they know better than those of us that have been living here for generations.
RESPONDENT 9	Cost
RESPONDENT 10	Waste disposal and water

Q57: Do you actively and regularly participate in Island community events, associations or groups? Please provide details.

RESPONDENT 1	I was inaugural chair of TOBMI from 2009-2012. We managed to get the council to consider greening the ferry terminal area only to be undermined by a vocal local who continually attended meetings to undermine this kind of change.
RESPONDENT 2	No too busy currently in business
RESPONDENT 3	Active in many activities predominantly as a volunteer. Surf life saving, Magnetic Island State school,
RESPONDENT 4	We are starting to participate in island events
RESPONDENT 5	I have been on the committee for Tourism Magnetic Island, Inc. since it was formed over 10 yr. ago. I also am a committee member of the Townsivlle LMAC
RESPONDENT 6	Yes - Townsville Enterprise
RESPONDENT 7	Yes
RESPONDENT 8	Regulary sponsor and volunteer - sporting and school events
RESPONDENT 9	RSL Volunteering
RESPONDENT 10	Yes, I have previously been a festival director for the island, and I update whatsonmagneticisland.com.au each week, ... and I distribute information for MICDA

Q58: Do you participate in any initiatives with other Islands to share learnings and leverage off collective knowledge? Please provide details.

RESPONDENT 1	No, good idea
RESPONDENT 2	No
RESPONDENT 3	No too busy currently in business
RESPONDENT 4	No
RESPONDENT 5	No.
RESPONDENT 6	No
RESPONDENT 7	King Island
RESPONDENT 8	No but would love to be involved with this
RESPONDENT 9	No
RESPONDENT 10	No

Q59: What is your main operating cost? Please select one

ANSWER CHOICES	RESPONSES	
Electricity	80.00%	8
Waste removal	0.00%	0
Transportation / logistics	20.00%	2
Water	0.00%	0
TOTAL		10

Q60: Do you encounter any environmental or plant/animal issues on the Island? E.g. Insects invading homes or salt corrosion

ANSWER CHOICES	RESPONSES	
Yes	66.67%	8
No	33.33%	4
TOTAL		12

Q61: Have you identified or implemented any opportunities to reduce your use of energy, water or waste or to generate electricity through renewable sources?

ANSWER CHOICES	RESPONSES	
Yes	100.00%	12
No	0.00%	0
TOTAL		12

Q62: What would motivate you to reduce the energy use and emissions of your operations? Please select any that apply:

ANSWER CHOICES	RESPONSES	
Reduced bills	90.91%	10
Reduced environmental pollution	54.55%	6
More efficient appliances	45.45%	5
Community led education and awareness program	18.18%	2
Government grants or subsidies	54.55%	6
Not important to me	0.00%	0
Total Respondents: 11		

Q63: Please select which of the following elements your business has:

ANSWER CHOICES	RESPONSES	
A/C unit	63.64%	7
Dishwasher	36.36%	4
Washing machine	54.55%	6
Dryer	45.45%	5
Television	36.36%	4
PV panels (solar power)	27.27%	3
PV solar panels with battery	0.00%	0
Solar hot water	0.00%	0
Gas hot water	27.27%	3
Electricity hot water	45.45%	5
Water tank or other water storage	27.27%	3
Energy efficient lighting	81.82%	9
Energy efficient appliances (energy star)	72.73%	8
Water efficient appliances	18.18%	2
Diesel generator	27.27%	3
Wind energy	9.09%	1
Passive design (orientation, natural light/shade, air flow)	45.45%	5
Insulation	36.36%	4
Electric vehicle charger	0.00%	0
Please specify if other or if multiple of the same answer	0.00%	0
Total Respondents: 11		

Q64: When do you use most electricity? (Select all that apply)

ANSWER CHOICES	RESPONSES	
Weekdays	54.55%	6
Weekends	54.55%	6
Morning	36.36%	4
Afternoon	36.36%	4
Night	45.45%	5
Total Respondents: 11		

Q65: What are the main uses of this electricity? Please select all that apply

ANSWER CHOICES	RESPONSES	
Air conditioning	72.73%	8
Fridges/freezers	81.82%	9
Computers/televisions	27.27%	3
Lighting	45.45%	5
Hot water	36.36%	4
Total Respondents: 11		

Q66: Approximately how much do you pay for electricity every year?

RESPONDENT 1	$55000
RESPONDENT 2	Not known
RESPONDENT 3	Variable now due to large solar instal
RESPONDENT 4	4000
RESPONDENT 5	$17000
RESPONDENT 6	$16,900
RESPONDENT 7	$1500
RESPONDENT 8	$100000
RESPONDENT 9	2400 business and private
RESPONDENT 10	6000.00
RESPONDENT 11	7500
RESPONDENT 12	$2,800

Q67: What would encourage your operations to reduce the amount of energy consumed?

RESPONDENT 1	Bill reduction, signage for guests
RESPONDENT 2	We are already working on that 100%
RESPONDENT 3	Lowering the cost of smart technologies. Its still in its infancy and as early adopters initial costs remain significant

RESPONDENT 4	Install battery stored solar paneling that reduces consumption on my property and not sold back to the grid and inflated pricing and meter charges etc.
RESPONDENT 5	difficult to reduce it in my situation
RESPONDENT 6	subsidies
RESPONDENT 7	Information and availability
RESPONDENT 8	Incentives to implement power saving devices.
RESPONDENT 9	I need no encouragement; I need options
RESPONDENT 10	.... can I say that you didn't have 'pools' in your list of electricity uses above, or washing machines and dryers (especially for BnB's and accommodation places). ... we reduce the amount of energy used as much as possible - REF: Solar Cities Program a few years back.

Q68: In general how old is your electrical equipment?

ANSWER CHOICES	RESPONSES	
>1 year	0.00%	0
2-4 years	58.33%	7
5+ years	33.33%	4
10+ years	8.33%	1
TOTAL		12

Q69: Would you consider the energy efficiency rating of an appliance before purchasing?

ANSWER CHOICES	RESPONSES	
Yes	100.00%	12
No	0.00%	0
TOTAL		12

Q70: Approximately how much rubbish does your operation generate every week? Please select:

ANSWER CHOICES	RESPONSES	
Half wheelie bin or less	33.33%	4
1 wheelie bin	0.00%	0
2 wheelie bins or more	66.67%	8
TOTAL		12

Q71: What are your main waste items?

RESPONDENT 1	Food waste, cardboard,
RESPONDENT 2	we have wraps with recycled paper - mainly bottles from our licensed bar
RESPONDENT 3	Varied packaging related to stock n food prep
RESPONDENT 4	Glass and plastic bottle
RESPONDENT 5	bottles and cans (recyclable and non recyclables)
RESPONDENT 6	kitchen waste
RESPONDENT 7	plastic packaging
RESPONDENT 8	Cardboard
RESPONDENT 9	Materials packaging
RESPONDENT 10	packaging, labels.
RESPONDENT 11	packaging
RESPONDENT 12	Food/drink packaging

Q72: Do you recycle items such as plastic, paper and glass?

ANSWER CHOICES	RESPONSES	
Yes	91.67%	11
No	8.33%	1
TOTAL		12

Q73: Do you compost any organic or food waste?

ANSWER CHOICES	RESPONSES	
Yes	50.00%	6
No	50.00%	6
TOTAL		12

Q74: Do you use Council facilities (waste transfer station) to dispose of your rubbish?

ANSWER CHOICES	RESPONSES	
Yes	91.67%	11
No	8.33%	1
TOTAL		12

Q75: What would encourage your operations to reduce the amount of waste generated?

RESPONDENT 1	have a government more proactively supporting recycling. Airlie Beach has only just introduced kerbside recycling.
RESPONDENT 2	It's much harder to reduce waste as more business means more waste but we need to educate our guests and visitors to the island better
RESPONDENT 3	Facilities to enable us to do so on the island.
RESPONDENT 4	N/A
RESPONDENT 5	Legitimate recycling initatives
RESPONDENT 6	well, the waste comes to us, it is not like we generate the waste.
RESPONDENT 7	Cannot easily control guest habits
RESPONDENT 8	We repurpose as much plastic as possible, but many Islanders are discouraged as the TCC don't recycle the items we put into our yellow recycling bin. If this could be fixed, it would be a MAJOR incentive.

Q76: Are you aware of or do you participate in any incentive schemes that encourage waste reduction?

ANSWER CHOICES	RESPONSES	
Yes	25.00%	3
No	75.00%	9
TOTAL		12

Q77: Approximately how much water does your operation use every day?

RESPONDENT 1	Lots
RESPONDENT 2	unknown
RESPONDENT 3	Not sure
RESPONDENT 4	Not sure
RESPONDENT 5	Unknown
RESPONDENT 6	300 litres freshwater
RESPONDENT 7	?
RESPONDENT 8	10l
RESPONDENT 9	not much
RESPONDENT 10	varies with guest count
RESPONDENT 11	???

Q78: What are the main uses of water? Please provide details.

RESPONDENT 1	Guest showers, commercial kitchen food and beverage
RESPONDENT 2	drinking water
RESPONDENT 3	Coffee machine and dishes
RESPONDENT 4	Washing laundry, guest use and evaporation of the swimming pool
RESPONDENT 5	guests showering
RESPONDENT 6	Showers, kitchen, cleaning
RESPONDENT 7	washing / cleaning and adding to tanks to cover evaporation in saltwater tanks
RESPONDENT 8	Cleaning
RESPONDENT 9	Washing tools
RESPONDENT 10	sink, washing up
RESPONDENT 11	showers, washing
RESPONDENT 12	Laundry for AirBnB and garden

Q79: Do you collect and use your own water?

ANSWER CHOICES	RESPONSES	
Yes	25.00%	3
No	75.00%	9
TOTAL		12

Q80: Do you have any water saving appliances or features? Please select all that apply

ANSWER CHOICES	RESPONSES	
Dual flush toilets	90.00%	9
Low flow showerheads	60.00%	6
Low flow taps	30.00%	3
Efficient garden sprinklers	50.00%	5
Total Respondents: 10		

Q81: Do you maintain piping to prevent the impacts of rust or salt corrosion?

ANSWER CHOICES	RESPONSES	
Yes	45.45%	5
No	54.55%	6
TOTAL		11

Q82: Do you have a septic tank?

ANSWER CHOICES	RESPONSES	
Yes	58.33%	7
No	41.67%	5
TOTAL		12

Q83: Do you consider water efficiency ratings when purchasing new equipment/appliances?

ANSWER CHOICES	RESPONSES	
Yes	91.67%	11
No	8.33%	1
TOTAL		12

Q84: What would encourage your operations to reduce the amount of water consumed? Please detail

RESPONDENT 1	Financial and guest awareness
RESPONDENT 2	already answered
RESPONDENT 3	Subsidies
RESPONDENT 4	Government grants to purchase and install
RESPONDENT 5	difficult to reduce in my situation
RESPONDENT 6	?
RESPONDENT 7	maybe the landlord to pay for his responsibilities
RESPONDENT 8	Being allowed by TCC to use grey water. We were told that we had to connect to the sewer mains, hence even the kitchen sink and laundry water don't get reused.

Q85: How many vehicles do you own?

ANSWER CHOICES	RESPONSES	
1	27.27%	3
2	36.36%	4
3	27.27%	3
4 or more	9.09%	1
TOTAL		11

Q86: Do you own any of the following vehicle types? Please select all that apply

	SMALL (PETROL)	SMALL (DIESEL)	LARGE (PETROL)	LARGE (DIESEL)	HYBRID	ELECTRIC	N/A	TOTAL	WEIGHTED AVERAGE
Car	44.44% 4	22.22% 2	22.22% 2	11.11% 1	0.00% 0	0.00% 0	0.00% 0	9	2.00
Ute	28.57% 2	28.57% 2	14.29% 1	28.57% 2	0.00% 0	0.00% 0	0.00% 0	7	2.43
Truck	0.00% 0	33.33% 1	0.00% 0	33.33% 1	0.00% 0	0.00% 0	33.33% 1	3	3.00
Van	0.00% 0	0.00% 0	0.00% 0	50.00% 1	0.00% 0	0.00% 0	50.00% 1	2	4.00
Boat	60.00% 3	0.00% 0	0.00% 0	20.00% 1	0.00% 0	0.00% 0	20.00% 1	5	1.75
Motorcycle	100.00% 3	0.00% 0	0.00% 0	0.00% 0	0.00% 0	0.00% 0	0.00% 0	3	1.00

Q87: Approximately how much do you pay for fuel (vehicle or boat) every year?

RESPONDENT 1	20000
RESPONDENT 2	$3000 pa
RESPONDENT 3	Minimal on the island
RESPONDENT 4	3000
RESPONDENT 5	$1000
RESPONDENT 6	$6,100
RESPONDENT 7	$2000
RESPONDENT 8	$4000
RESPONDENT 9	Heaps
RESPONDENT 10	7500.00
RESPONDENT 11	1200
RESPONDENT 12	TOO MUCH!

Q88: Have you undertaken any actions to reduce transport energy use to/from and on the Island?

ANSWER CHOICES	RESPONSES	
Yes	50.00%	6
No	50.00%	6
TOTAL		12

Q89: What have been your major climate related impacts and associated costs since 2010? (The physical impacts can include sea level rise, erosion, storm surges, heatwaves, flooding/rain events, reduced water quality/availability, cyclones, etc. The effects might include higher insurance premiums, income loss, health and wellbeing)

RESPONDENT 1	Storms cyclones Increased insurance
RESPONDENT 2	Higher insurance premiums, stronger cyclones (more intense with massive flooding) due to climate change Greatly impacts tourism numbers
RESPONDENT 3	Drought, floods and cyclone readiness
RESPONDENT 4	The last rain event in February 2019 resulted in the insurance company not willing to renew the insurance. We are one of many tourism businesses in North Queensland experiencing this phenomenon. Still under review.
RESPONDENT 5	Cyclonic after effects of cyclones including rain events.
RESPONDENT 6	Cyclone Yasi ~ 8 yr ago was a major problem and late Jan. to early Feb 2019 was the flooding in our area that caused problems including many display fish died and had to be replaced
RESPONDENT 7	Cyclones
RESPONDENT 8	High
RESPONDENT 9	higher insurance premiums - it's a con job!
RESPONDENT 10	Rain: $1300 for storm drainage repairs, loss of guest bookings, mould removal
RESPONDENT 11	Insurance premiums doubled after Cyclone Yasi, and each cyclone/major event after that, they have risen dramatically. This is a HUGE annual cost to everyone on Magnetic Island. Loss of income is expected after a major event like this, as services need repair, and time is taken for the clean up.

Q90: How many hours/days can you operate in "island mode"? (without outside support for energy, water, waste, food, communications, health services)

RESPONDENT 1	3 days
RESPONDENT 2	n/a
RESPONDENT 3	Minimal
RESPONDENT 4	Unsure of this question. Best guess one month
RESPONDENT 5	14 days
RESPONDENT 6	I have a genset to power outages. We have a rainwater tank for drinking
RESPONDENT 7	Personal - days Business - a few hours
RESPONDENT 8	5
RESPONDENT 9	Have done 3-4 days using generator etc. Maximum probably 1 week.
RESPONDENT 10	7

RESPONDENT 11	Working hours/days = 0 (I need the internet/electricity/water to work) Survival = 5 days approx.

Q91: How frequently do severe weather events occur? Are they occurring more frequently and are there any stories passed down that can help us get ready?

RESPONDENT 1	Bi annual large storm
RESPONDENT 2	Almost annually
RESPONDENT 3	At least twice per year
RESPONDENT 4	On average one weather event every 2 to 3 years.
RESPONDENT 5	Annually around January/February.
RESPONDENT 6	Every few years there is a severe event and I believe this is increasing.
RESPONDENT 7	5 year frequency
RESPONDENT 8	Large fires in 70s. Slow burn offs for the win
RESPONDENT 9	In the 20 years I have being on the Island there have being 3 impact cyclones to my recollection. I don't believe this is any more or less then historically occurring.
RESPONDENT 10	Perhaps you can source this from ABS?
RESPONDENT 11	I can't say. I've been here since 2005. It would seem normal to me, possible slightly higher rate of cyclones, but older residents will be better informed.

Q92: What stands out as the biggest area of concern for your community in terms of resilience (vulnerability)?

RESPONDENT 1	Cyclones
RESPONDENT 2	Vulnerability - we sustained $40,000 damage to our boat in Cyclone Debbie due to 2 boats not being tied up properly. Also lack of government will to get a national climate policy and introduce legislation that forces the judicial system to include climate change
RESPONDENT 3	Cyclone
RESPONDENT 4	Government and decisions made by non islanders
RESPONDENT 5	Insurance companies attitude, they take your money when nothing happens and when something does they do not want to know you.
RESPONDENT 6	Evacuation from the island
RESPONDENT 7	Cyclone damage to reduce visitors to the island
RESPONDENT 8	Equal government funding/assistance compared to Capital Cities
RESPONDENT 9	Cyclone or disaster shelter ASAP
RESPONDENT 10	Complacency and ignorance - certainly surrounding cyclones

RESPONDENT 11	Lack of electricity, water, and health services. (Food we can stockpile if necessary).

Q93: What do you do to prepare for a severe weather event and what do you do to handle climate related impacts better?

RESPONDENT 1	Store Generators
RESPONDENT 2	baton down the hatches - literally. We have no control over the above two mentioned issues.
RESPONDENT 3	Make sure all flying debris is tied down
RESPONDENT 4	Follow recommended cyclone procedures, reduce energy consumption, work worth nature not against it
RESPONDENT 5	Assess the need for evacuation of guests to the mainland, take down all shade covers and install hoarding around vulnerable glass areas. Stock up on food/battery items.
RESPONDENT 6	"Tie everything down that could be taken away in the wind. Barracade doors and put shutters on windows for the house.
RESPONDENT 7	Ensure business is ready to support community in case of disaster
RESPONDENT 8	We have a cyclone kit always checked at beginning and end of season
RESPONDENT 9	All the steps recommended in cyclone preparedness. Put away. Tie down. Fill up water. Extra fuel. Cash out. Store food. Alternate light source. Generator power. Bunker down.
RESPONDENT 10	Have a generator and water storage vessels/containers
RESPONDENT 11	Store water where possible, increase food stores (and storm supplies), clear the yard, top up petrol, and prep for flood.

Q94: Are there any mainland (or neighbouring island) businesses you are heavily reliant on?

ANSWER CHOICES	RESPONSES	
Food Providers	100.00%	8
Waste Providers	62.50%	5
Maintenance Companies	12.50%	1
Fuel Suppliers	62.50%	5
Total Respondents: 8		

Q95: Resilience Rating

	1 - NOT AT ALL	2 - LOW	3 - MODERATE	4 - HIGH	5 - VERY HIGH	N/A	TOTAL	WEIGHTED AVERAGE
How would you rate the extent of the changes you have made to your lifestyle to reduce the impact or associated costs of climate related impacts?	0.00% 0	16.67% 2	50.00% 6	16.67% 2	8.33% 1	8.33% 1	12	3.18
How would you rate your general readiness in the event of a severe weather event? (equipment, roads and infrastructure, access to services, health support, medication)	0.00% 0	8.33% 1	50.00% 6	41.67% 5	0.00% 0	0.00% 0	12	3.33
How comfortable are you with your evacuation/safety plan for a severe weather event?	0.00% 0	8.33% 1	16.67% 2	50.00% 6	25.00% 3	0.00% 0	12	3.92
How would you rate your access to capital and resources after a severe weather event?	16.67% 2	41.67% 5	16.67% 2	25.00% 3	0.00% 0	0.00% 0	12	2.50
How would you rate your capacity to recover/rebuild the cultural and historical aspects of your community after a severe weather event?	0.00% 0	18.18% 2	45.45% 5	27.27% 3	0.00% 0	9.09% 1	11	3.10
How much do you rely on the mainland for food/water/energy supply?	0.00% 0	0.00% 0	25.00% 3	8.33% 1	58.33% 7	8.33% 1	12	4.36
How much does your community pitch in and help to rebuild after a severe weather event?	0.00% 0	0.00% 0	33.33% 4	25.00% 3	41.67% 5	0.00% 0	12	4.08

Q96: Are there any other comments or suggestions you would like to provide to the project team regarding improving resilience and transitioning to a low-carbon economy on Magnetic Island?

RESPONDENT 1	electric cars - should have been done long ago as a pilot study if you want to truly say you are trying.
RESPONDENT 2	Government policy and guidance
RESPONDENT 3	Solar energy is the biggest reducer of energy loss and it could generate enough electricity to run the island if an investment was made to do so.
RESPONDENT 4	this seems all very "feel good" but the reality is, energy use by 2500 people is really a pittance of the population.
RESPONDENT 5	Just allow quite a bit of time for your Info Sessions. Islanders are very good about talking about these things ;)

APPENDIX 3 MAGNETIC ISLAND RISK ASSESSMENT

The assessment on the following pages provides an overview of Magnetic Island's Risk Assessment, including current observed strategies to mitigate or minimise potential and/or actual impacts with regards to the 13 Key Performance Areas.

KPA	Aspect	Potential Impact(s)	Likelihood	Severity	Risk Evaluation	Current Minimisation/ Mitigation Strategy	Link to Project Option/s
Energy Efficiency, Conservation and Management	**Use of and reliance on fuel**	Depletion of natural energy resources through consumption of fuel.	2 – Unlikely	4 - Major	8 – High	Previous projects encouraged the installation of solar panels (30% of dwellings) across the island to reduce demand on non-renewable electricity.	PO 2: Low Emission On-Island Shuttlebus PO 6: Energy Efficiency Retrofits PO 7: Green Hydrogen Transport Demonstration Project PO 9: Waste Transfer Station Installation of Solar PV PO 12: Solar Hot Water Systems PO 14: Solar PV Rooftop Systems PO 16: Low Emission Marine Transport PO 17: Microgrid Feasibility Study Rec. E2: Pilot research for renewable fuels from cooking oil or biomass Rec. T18: Car share for local community
		Reliance on diesel/ petrol delivery from the mainland which may impact on self-sufficiency/ resilience for Islanders.	2 – Unlikely	3 - Medium	6 – Medium	Back-up reserves of diesel. Some redundancy in diesel generators at the residential level and on State or Council owned buildings (e.g. wastewater treatment plants).	

		Potential increase in diesel/ petrol costs lead to issues of affordability.	2 – Unlikely	3 - Medium	6 – Medium	No current mitigating strategies observed.	
		Potential for leakage or spillage of fuels causing environmental damage.	2 – Unlikely	2 - Minor	4 – Medium	Large storage of diesel at fuel station under strict controls.	
	Energy supply	Impacts to critical energy pipeline infrastructure and mainland infrastructure during and following severe weather events creating a risk to livelihoods, human health and liveability.	3 – Possible	5 – Catastrophic	15 – Severe	No current mitigating strategies observed.	PO 6: Energy Efficiency Retrofits PO 14: Solar PV rooftop Systems PO 17: Microgrid Feasibility Study Rec. R4: Cyclone rating assessment Rec. R13: Whole of island resilience plan
	Inefficient and outdated equipment and buildings	Inefficient equipment (e.g. air-conditioning units) leads to increased energy use and cost.	3 – Possible	2– Minor	6 – Medium	The Solar Cities project has increased energy efficiency awareness and practices both non-residentially and residentially.	
Greenhouse Gas Emissions	**Carbon emissions associated with energy use**	Use/ reliance on non-renewable energy contributing to climate change.	5 – Certain	3 – Medium	15 – Severe	Some residents (30%) and businesses have installed solar, but most rely on grid power from mainland. Those that do have solar power, cannot access electricity generation if the grid is down.	PO 2: Low emissions Shuttlebus PO 4: Path Networks to Support Active Transport PO 9: Waste Transfer Station Installation of Solar PV PO 12: Solar Hot Water Systems PO 14: Solar PV Rooftop Systems PO 16: Low Emission Marine Transport

							Rec. E2: Pilot research trial for renewable fuels from cooking oil or biomass Rec. E7: Solar powered A/C with no grid return for commercial systems
		Use of non-renewable fuel consumption in transportation to and from the island contributing to climate change.	5 – Certain	3 – Medium	15 – Severe	Ferry operator has increased efficiency of vessels but still a total reliance on diesel.	PO 16: Low Emission Marine Transport Rec. E2: Pilot research trial for renewable fuels from cooking oil for biomass Rec. T3: Efficient boat propellers upgrades Rec. T4: Efficient boat coatings
		Potential for ozone depleting substances to release gases harmful to human health (e.g. from fridges, air conditioning equipment etc.).	4 – Likely	3 – Medium	12 – Severe	No current mitigating strategies observed.	PO 11: Energy Demand Management Incentive Scheme PO 12: Solar Hot Water Systems PO 14: Solar PV Rooftop Systems Rec. E7: Solar powered A/C with no grid return for commercial systems
	Capacity of renewable energy systems	Use of diesel generators as back-up during peak loads, increasing GHG emissions.	3 – Possible	3 – Medium	9 – High	No current mitigating strategies observed.	PO 9: Waste Transfer Station Installation of Solar PV PO 14: Solar PV Rooftop Systems Rec. E7: Solar powered A/C with no grid return for commercial systesm

Air Pollution, Noise Control & Light Pollution	**Air pollution**	Elevated sound from vehicles and ferries causing noise pollution and negatively impacting human health.	3 – Possible	1 – Limited Impact	3 – Medium	No current mitigating strategies observed.	
		Vehicle emissions causing air pollution and negatively impacting human health.	3 – Possible	3 – Medium	9 – High	No current mitigating strategies observed.	PO 1: Electric Bicycle Rental Service PO 2: Low Emission On-Island Shuttlebus PO 4: Path Networks to Support Active Transport PO 7: Green Hydrogen Transport Demonstration Project Rec. E2: Pilot research trial for renewable fuels from cooking oil or biomass Rec. T18: Car share scheme for local community
Management of Freshwater Resources	**Water usage**	Lack of on-island freshwater/potable sources (including rain tanks) impacting self-sufficiency and resilience of island stakeholders.	5 – Certain	4 – Major	20 – Extreme	Limited use of bore water for landscaping.	PO 18: Water Smart Demonstration Community
		Impacts to critical water pipeline infrastructure during and following severe weather events creating a risk to livelihoods, human health and liveability.	3 – Possible	5 – Catastrophic	15 – Severe	No current mitigating strategies observed.	PO 18: Water Smart Demonstration Community Rec. R4: Cyclone rating assessment Rec. R13: Whole of island resilience plan

		Depletion of freshwater resources through overconsumption. Increase in visitors will add pressure on natural resources.	2 – Unlikely	4 – Major	8 – High	Water conservation notices are provided in some hotels.	PO 5: Sustainability and Environmental Education PO 10: Destination Management Plan PO 18: Water Smart Demonstration Community Rec. E19: Central control system for accommodation providers on-island
	Water availability	Water shortages on the mainland during periods of drought impacting livelihoods, human health and resilience on the island.	3 – Possible	4 – Medium	12 – Severe	Water conservation program offered by TCC.	PO 18: Water Smart Demonstration Community Rec. R13: Whole of island resilience plan
	Water quality	Increased use of bore water and rainwater tanks (where applicable) for potable water supply with insufficient treatment leads to health risks.	2 – Unlikely	2 – Minor	4 – Medium	No current mitigating strategies observed.	
Wastewater Management, Drainage and Streams	**Stormwater Drainage**	Contamination of waterways (including surrounding reefs) by storm water polluted by oil, grease, litter and sediment.	2 – Unlikely	2 – Minor	4 – Medium	No current mitigating strategies observed. All storm water drains into ocean without filtering and or treatment. No storm water drains observed.	
	Wastewater treatment	Failures in operation of the wastewater treatment plant causing environmental damage and human harm.	1 – Rare	5 – Catastrophic	5 – High	On-island wastewater treatment plant operator to monitor and respond (operating personnel are however located in Townsville).	N/A *Not within project scope*
		Inability of local infrastructure to sufficiently respond to peak demand during tourism seasons.	2 – Unlikely	4 – Major	8 – High	No current mitigating strategies observed.	PO 10: Destination Management Plan

Ecosystem Conservation and Management	**Ecosystem health**	Impacts to local ecosystems from excessive visitor numbers and from increased visitor infrastructure (including buildings, facilities, transport etc.)	4 – Likely	3 – Medium	12 – Severe	Limited signage in National Park areas. Parking and congestion issues (e.g. Forts Walk Carpark, Horseshoe Bay).	PO 5: Sustainability and Environmental Education
		Impacts to local ecosystems from increased development on the island.	3 – Possible	4 – Medium	12 – Severe	Environmental impacts assessed in planning and development applications.	PO 5: Sustainability and Environmental Education
Land Use Planning and Development	**Coastal vulnerability**	Coastal hazards including cyclones and storm activity causing coastal erosion and damage to infrastructure.	4 – Likely	4 – Major	16 – Severe	Extensive program of work to identify major areas at risk through the TCC Coastal Hazard Adaptation Program (CHAP).	PO 5: Sustainability and Environmental Education PO 6: Energy Efficiency Retrofits Rec. R4: Cyclone rating assessment Rec. R10: Overall beach erosion plan
		Lack of beach restoration programs increasing the risk of damage to nearby property during severe weather events.	3 – Possible	3 – Major	9 – High	Sand restoration projects at Horseshoe Bay. TCC planning for likely retreat. Also considered under the CHAP.	PO 5: Sustainability and Environmental Education PO 6: Energy Efficiency Retrofits Rec. R4: Cyclone rating assessment Rec. R10: Overall beach erosion plan Rec. R11: Revegetation Rec. R18: Ongoing coastal clean-ups
	Planning Regulations	Insufficient consideration of climate change risks in land use planning and development causing	2 – Unlikely	4 – Catastrophic	8 – High	TCC began assessing coastal hazards in 2012 and has a strong knowledge of climate change risks for the island.	PO 5: Sustainability and Environmental Education PO 6: Energy Efficiency Retrofits

		damage to property and infrastructure.					Rec. R4: Cyclone rating assessment Rec. E13: Adopt best practice building code for island
Transport	**Island accessibility**	Dependency on ferry company for waste removal, which if Magnetic Island is cut off from the mainland leads to an issue in the capacity of the waste transfer station.	3 – Possible	3 – Medium	9 – High	Waste facility has additional built-in storage capacity if the island becomes cut-off.	PO 9: Waste Transfer Station Installation of Solar PV PO 13: Organic Waste Recycling Feasibility Study PO 19: Glass Recycling Feasibility Study Rec. WS1: Increase buying of bioplastic/ paper disposable items Rec. WS4: Phase out single use items Rec. WS14: Plastic repurposing Rec. R13: Whole of island resilience plan
		Reliance on external transport providers to bring visitors, workers and local residents on and off the island, including evacuations during severe weather events.	4 – Likely	3 – Medium	12 – Severe	No current mitigating strategies observed.	Rec. R13: Whole of island resilience plan
	On-island transportation	Poor condition of roads and connectivity of roads on the island limiting mobility during severe weather events.	4 – Likely	3 – Medium	12 – Severe	No current mitigating strategies observed.	PO 1: Electric Bicycle Rental Service PO 4: Path Networks to Support Active Transport Rec. T13: Infrastructure upgrade (roads)

		Current state of on-island transport provides restricted access for those with disabilities (e.g. wheelchairs, elderly) limiting visitation of some people.	2 – Unlikely	3 – Minor	6 – Medium	No current mitigating strategies observed.	
Solid Waste Management	**Waste storage**	Costs associated with removing waste off-island as there is no on-island landfill.	4 – Certain	2 – Minor	8 – High	Waste transfer station has been designed with additional storage in mind in case the island is cut off from the mainland, but there is no way to treat/manage the general or recycled waste during the isolation period.	PO 5: Sustainability and Environmental Education PO 13: Organic Waste Recycling Feasibility Study PO 15: Glass Recycling Feasibility Study Rec. WS1: Increase buying of bioplastic/ paper disposable items Rec. WS14: Plastic repurposing
	Waste disposal	No disposal facilities for visitors travelling in motorhomes which may increase illegal disposal of sewerage and waste, potentially harming the environment, or limit their stay, potentially impacting the local economy.	3 – Possible	1 – Limited Impact	3 – Medium	No current mitigating strategies observed.	
		Illegal disposing of construction waste in coastal areas damaging the environment (as reported by a stakeholder)	3 – Possible	1 – Limited Impact	3 – Medium	No current mitigating strategies observed.	

		Contamination of beach areas with non-bio-degradable waste.	3 – Possible	1 – Limited Impact	3 – Medium	Once a year there is a big clean-up day organised by community groups.	
		Recycled waste disposed of in the general waste stream.	5 – Certain	2 – Minor	10 – High	TCC provides fortnightly pick-up of recyclables.	PO 5: Sustainability and Environmental Education PO 15: Glass Recycling Feasibility Study Rec. WS14: Plastic repurposing
		Greenhouse gas emissions from waste from the island sent to landfill on the mainland.	5 – Certain	2 – Minor	10 – High	TCC has invested in landfill gas flaring at their landfills in Townsville. Separation of green waste from landfilled waste which is kept on the island for mulching.	PO 15: Glass Recycling Feasibility Study PO 16: Low Emission Marine Transport Rec. WS1: Increase buying of bioplastic/paper disposable items Rec. WS4: Phase out single use items Rec. WS14: Plastic repurposing
Management of Environmentally Harmful Substances	**Storage of harmful substances**	Costs to dispose of construction and industrial waste is high potentially leading to illegal storage, risks of spills and illegal disposing.	3 – Possible	1 – Limited Impact	3 – Medium	No current mitigating strategies observed.	
Cultural and Social Management	**Island Governance**	Difficulty in achieving consensus on sustainability goals and actions across many community organisations.	4 – Likely	2 – Minor	8 – High	Large number of sustainability actions are being undertaken by community groups, currently not under an overarching framework and vision.	PO 5: Sustainability and Environmental Education PO 11: Energy Demand Management Incentive Scheme

Economic Management	**Social and economic viability**	High cost of insurance premiums increases cost of business impacting profitability or meaning that insurance is unaffordable and assets are uninsured, leading to greater vulnerability during severe weather events.	5 – Certain	3 – Medium	15 – Severe	Queensland Reconstruction Authority (QRA) leading disaster resilience programs.	PO 6: Energy Efficiency Retrofits Rec. R13: Whole of island resilience plan
		High cost to defend and protect coastal areas and infrastructure leading to allocation of funds to high risk areas (not all assets/ areas can be protected).	5 – Certain	4 – Major	20 – Extreme	TCC began assessing coastal hazards in 2012 and has a strong knowledge of climate change risks for the island in order to make an informed decision on priorities.	PO 6: Energy Efficiency Retrofits Rec. R10: Overall beach erosion plan Rec. R13: Whole of island resilience plan
		High cost of energy and water reduces returns and investment for business.	3 – Possible	2 – Minor	6 – Medium	No current mitigating strategies observed.	
		Reduced visitor numbers to the island due to negative media stories about severe weather events.	3 – Possible	2 – Minor	6 – Medium	No current mitigating strategies observed.	
Resilience	**Food availability**	In the instance of a severe weather event, the island is isolated from the mainland meaning that food cannot be delivered for the food outlets.	4 - Likely	3 – Medium	12 – Severe	Limited community gardens and limited supply of stocked food items.	PO 3: Establishment of a Native Plant Nursery PO 8: Aquaculture Production Feasibility Study Rec. R13: Whole of island resilience plan

	Severe weather events	Severe weather events leading to the island being cut-off from the mainland, and some parts of the community cut-off from the rest. This leads to a range of issues including evacuations for health reasons, access to power, water, roads cut to critical infrastructure, telecommunications etc.	4 – Likely	4 – Major	16 – Severe	Paper based systems for payment of goods and services. MICC coordinator check elderly prior to weather event. Disaster Management Plans are in place. Frequency of extreme weather events has led to increases in community preparedness.	PO 12: Solar Hot Water Systems PO 14: Solar PV Rooftop Systems Rec. E2: Pilot research trial for renewable fuels from cooking oil or biomass Rec. R13: Whole of island resilience plan
		Increased psychological issues from experiencing severe weather events.	4 – Likely	2 – Minor	8 – High	Range of community groups to assist. Well serviced region in Townsville for disaster relief.	N/A *Not within project scope* Rec. R9: Ongoing management of islander wellbeing
	Climate change	Increased frequency of severe weather events reduces time for ecosystems to recover between events leading to loss of environmental habitats and amenity.	4 – Likely	4 – Major	16 – Severe	TCC began assessing coastal hazards in 2012 and has a strong knowledge of climate change risks for the island.	PO 5: Sustainability and Environmental Education PO 6: Energy Efficiency Retrofits Rec. R11: Revegetation Rec. R13: Whole of island resilience plan