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Pacific Safety of Navigation Project

Risk assessment for Arutanga Anchorage, Aitutaki, Cook Islands

April 2019

PACIFIC SAFETY OF NAVIGATION PROJECT

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Pacific Safety of Navigation Project: Risk assessment for Arutanga Anchorage, Aitutaki, Cook Islands

April 2019

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Executive summary

The Cook Islands is a signatory to the International Convention for the Safety of Life at Sea (SOLAS), of which Chapter V Regulation 13.1 requires the contracting governments to provide "such Aids to Navigation (AtoN) as the volume of traffic justifies and the degree of risk requires."

The Cook Islands is one of the 13 targeted Pacific Islands countries and territories of the Pacific Safety of Navigation Project implemented by the Pacific Community (SPC) and funded by the International Foundation for Aids to Navigation (IFAN), whose aim is to improve safety of navigation in the Pacific region through enhanced AtoN capacity and systems.

During Phase 1 of the project, in 2017, the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) and SPC developed the simplified IALA risk assessment tool (SIRA), a simple qualitative tool to enable smaller states to meet their international obligation of providing AtoN by conducting waterways risk assessments.

During Phase 2 of the project, in October 2018 SPC conducted a risk assessment of the Arutanga Anchorage area, on the island of Aitutaki, using the SIRA tool. This report details the risks identified, the estimated costs in the event of an incident, the risk control options suggested, and their costs.

Arutanga Anchorage at Aitutaki is one of the major international ports in Cook Islands, and was identified as a priority for the risk assessment by the Ministry of Transport. The port consists of one domestic jetty and an anchorage for yachts. The port receives two container ships on a three-weekly cycle. Domestic ferries rarely call at the port. The Police Maritime Division patrol boat makes regular calls. Several cruise ships call at Arutanga each year, as well as between 40 and 60 recreational yachts.

Aitutaki's maritime stakeholders identified four possible scenarios: one collision in the Arutanga passage, one grounding, one allision, and one foundering scenario. For each scenario, the cost of the incident was estimated and a risk score was given, taking into account the probability of the incident happening and its potential impact on the country. Risk control options were then identified. The risk scores for the scenarios under the current situation were then compared with the new risk scores if the risk control options were put in place.

Scenario	Risk score	Risk control option	New risk score
Collision			
Head-on collision of two vessels in the passage at night	9	Community awareness program on safety, and awareness material distributed; regular safety inspections of small boats; enforcement of the Small Boat Safety Regulation; a maximum speed limit in the channel set and enforced	6
Grounding			
Grounding of vessels on the hard bottom in the passage	16	Dredging to deepen and straighten the channel; more markers and lights; updated charts	8
Allision			
Allision of vessels with AtoN at night	8	Advise the Fishing Club to reorient lights and reduce brightness; Ports Authority to issue a public notice not to leave headlights on while on the wharf; improve channel marks and lighting	2
Foundering			
Foundering of the barge during unloading operations	9	Regular training for barge captains, and regular change of captain during the barge operations; guideless on operations in bad weather developed and followed; regular meetings before operations; and zero tolerance on staff suspected of being under the influence of alcohol	3

The main outcome of the risk assessment process in Aitutaki was five recommendations which aim to reduce the risks to safety of navigation to an acceptable level for stakeholders. The recommendations and the costs of their implementation are outlined below.

Recommendation 1 To reduce the risk of head-on collision at night between two vessels navigating the channel, it is recommended to provide community awareness training on small boat safety, to carry out regular safety inspections of small boats, to enforce the Small Boat Safety Regulation, and to set and enforce a maximum speed limit in the channel	
Cost Community awareness training	NZD 20,000 per year
Boat Master training across the Cook Islands	NZD 50,000 (bi-annual)
Full-time boat inspector in Aitutaki	NZD 30,000 per year

Recommendation 2 To reduce the risk of grounding on the hard bottom in the channel, it is recommended to dredge and straighten the main channel and install new channel markers	
Cost Dredging the channel and instalment of AtoN	NZD 1 million

Recommendation 3 To reduce the risk of vessels alliding with AtoN in the channel at night, it is recommended to review and adjust the lighting at Arutanga Anchorage, and to place a public notice directing motorists not to park on the wharf with lights on	
Cost Synchronised channel markers at Arutanga Anchorage, repositioning the Fishing Club lights, and Ports Authority issue of public notice on the wharf	NZD 30,000
Annual maintenance	NZD 1500

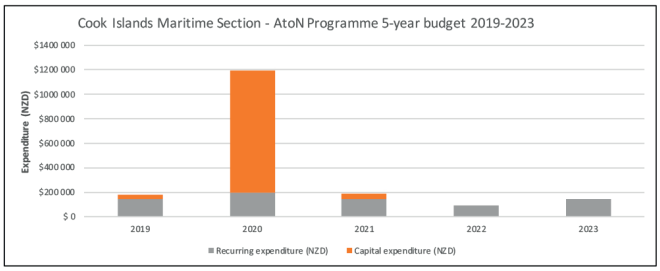
Recommendation 4 To reduce the risk of the barge foundering during unloading operations, it is recommended to provide training for the barge captains, ensure regular change of captains during barge operations, develop and follow guidelines on operations during bad weather conditions, hold regular meetings before operations, and observe zero tolerance for staff suspected to be under the influence of alcohol	
Cost Training	NZD 30,000 per year (3 trainings over 5 years)
Drafting guidelines to be followed during bad weather conditions	No cost – part of Port Authority's responsibility

Recommendation 5 To further improve safety of navigation in Arutanga Anchorage, it is recommended to upgrade AtoN around Vaipae and Tautu jetty to meet IALA standards	
Cost Channel marks	NZD 30,000
Annual maintenance	NZD 1500

As part of the Pacific Safety of Navigation's work on supporting the Ministry of Transport, an AtoN programme 5-year budget plan for the delivery of safety of navigation services for the whole of the Cook Islands was drawn up to assist in the Ministry's budget planning process (Annex E). The budget plan demarcates spending according to capital expenditure and recurring expenditure.

Cook Islands Maritime Section - Ministry of Transport
AtoN Programme 5-year budget 2019-2023

	Capital expenditure (NZD)	Recurring expenditure (NZD)	Total expenditure (NZD)
2019	$30 000	$144 154	$174 154
2020	$1 000 000	$192 654	$1 192 654
2021	$42 600	$140 633	$183 233
2022	$0	$94 154	$94 154
2023	$0	$144 154	$144 154
	$1 072 600	$715 749	$1 788 349



* Currently, Cook Islands does not collect light dues from vessels
* Costings of risk control options covered under Aitutaki Safety of Navigation Risk Assessment have been factored in:
  - In 2019, review entrance lights scheme to Arutanga port, adjust Aitutaki Fishing Club background lighting, and installation of public notice board to mitigate risk of allisions;
  - In 2020, dredging of Arutanga port channel
  - In 2021, purcahse of LED Lights for channels in Vaipae and Tautu, Aitutaki to meet IALA standards
  - In 2019, 2020 and 2021, conduct training for Boat Master qualifications
  - In all years, establishment of a full time inspector position to ensure the enforcement of Small Boats Safety Regulation
  - In all years, conduct community awareness trainings

1 Background

In early 2016, with support from the International Foundation for Aids to Navigation (IFAN), the Pacific Community (SPC) started the Pacific Safety of Navigation Project in 13 Pacific Island countries and territories (PICTs)[1]. The project aims to improve safety of navigation in the Pacific region through enhanced aids to navigation (AtoN) capacity and systems, and hence support economic development, shipping and trade in the Pacific region through safer maritime routes managed in accordance with international instruments and best practices.

During Phase 1, which ended in July 2018, SPC worked in close collaboration with the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) to conduct technical, legal and economic assessments in the 13 PICTs, to identify needs and gaps in these areas. Another significant output of Phase 1 was the development of a new tool for risk assessment in small island developing states, the simplified IALA risk assessment tool (SIRA). In June 2018, IALA trained personnel in 12 of the 13 PICTs on the use of SIRA to conduct AtoN risk assessments in their countries.

Phase 2 of the project builds on the Phase 1 assessments and tools developed, to further assist in building capacity to develop and maintain AtoN in PICTs. Activities include conducting risk assessments (as required by Regulation 13 of the International Convention for the Safety of Life at Sea – SOLAS); developing safety of navigation policy and a legal framework; improving budgetary management; and supporting regional coordination related to safety of navigation in the Pacific.

In October 2018, the Cook Islands Ministry of Transport invited SPC to assist in conducting a risk assessment of Arutanga Anchorage, on the island of Aitutaki, which is the country's second most visited port by both international and domestic vessels. This report describes the risk assessment, which was carried out using the SIRA methodology.

The Cook Islands is a maritime nation, with a large percentage of citizens working in or around the maritime

1 Cook Islands, Kiribati, Federated States of Micronesia, Marshall Islands, Nauru, Niue, Palau, Samoa, Solomon Islands, Tonga, Tokelau, Tuvalu and Vanuatu.

industry. Shipping is critical to the economic and social welfare of the people of the Cook Islands, and safe navigation is vital to secure this welfare and to protect the environment.

The Cook Islands is a signatory to the International Maritime Organization (IMO) Safety of Life at Sea (SOLAS) Convention. Regulation 13 of Chapter V of the 1974 SOLAS Convention (as amended) states that "each Contracting Government undertakes to provide, as it deems practical and necessary either individually or in co-operation with other Contracting Governments, such aids to navigation as the volume of traffic justifies and the degree of risk requires."

The SIRA risk management process comprises five steps that follow a standardised management or systems analysis approach:

1. identify hazards
2. assess risks
3. specify risk control options
4. make a decision
5. take action.

SIRA is intended as a basic tool to identify risk control options for potential undesirable incidents that the Cook Islands should address as part of its obligation under SOLAS Chapter V Regulation 12 and 13. The assessment and management of risk is fundamental to the provision of effective AtoN services.

The assessment involved a stakeholder meeting as a first step, to gather the views on hazards and risks in the Arutanga Anchorage area from those directly involved with or affected by AtoN service provision. Information provided by this step was then used by Cook Islands Maritime Technical Manager and IALA SIRA certified officer Mr Saungaki Rasmussen and SPC to complete a full risk assessment matrix based on four identified possible scenarios.

2 Description of the waterway

Arutanga Anchorage is one of the major international ports in Cook Islands, and was identified as a priority by the Ministry of Transport for risk assessment. The port has one domestic jetty and an anchorage for yachts.

Access to the domestic jetty is through a very shallow and narrow (up to 7 m wide) passage. The port can be accessed only at high tide by local vessels and yachts with a maximum draft of 1.5 m. The domestic wharf also has very shallow depths alongside, ranging from 1.3 to 1.8 m. This shallow passage poses a major challenge for international and domestic vessels. These vessels moor offshore and cargo is transferred onto a barge to be taken to the port. During bad weather conditions, barge operations are suspended and vessels may anchor offshore for days, in some cases departing for other ports without unloading cargo. This has a very significant effect on the local economy as goods and services are often not delivered on time.

Visibility can be reduced to few hundred meters in bad weather, which often occurs between the months of November and April. Hazards around the port include shoals, a narrow and winding channel, big swells and a strong tidal flow at the entrance of the channel, poorly marked and unlit AtoN, and background lights from the Fishing Club, all of which can cause problems for maritime traffic.

Arutanga Anchorage receives two container ships on three-weekly cycles. The vessels discharge up to 30 twenty-foot equivalent units (TEUs) onto a large barge for transfer to Arutanga Wharf through the narrow Arutanga passage. The barge can carry two loaded TEUs. The average turn-around time for the container ships is 24 hours.

There are two domestic ferry service providers in the Cook Islands, however ferry arrivals at Aitutaki were reported to be sporadic, occurring sometimes only once a year. The Police Maritime Division operates the Pacific-class patrol boat Te Kukupa which makes regular calls principally to check on fishing activity.

Several cruise ships call at Arutanga each year. The vessels are too large to enter the port and use their tenders to take passengers ashore. Between 40 and 60 recreational yachts call at Aitutaki per year

Chart NZ 955 shows Aitutaki at a scale of 1:60,000 and Arutanga Anchorage at a scale of 1:15,000.

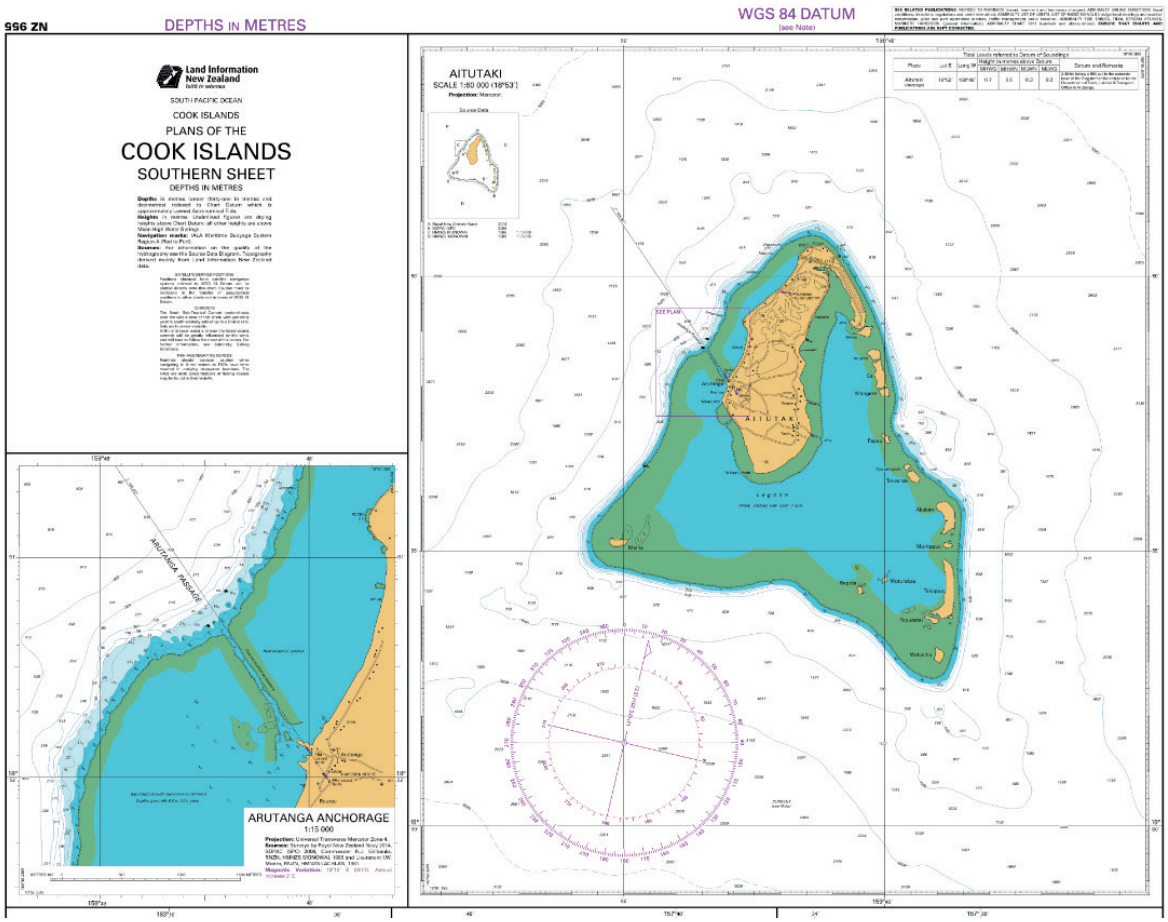


Figure 1. **Chart of Aitutaki at a scale of 1:60,000 and Arutanga Anchorage at a scale of 1:15,000.**

3 Stakeholder meeting

As the first step of the SIRA process, a stakeholder meeting was organised in Aitutaki on 22 October 2018, which aimed to gather the points of view of individuals, groups and organisations involved with or affected by AtoN service provision in Arutanga Anchorage. The stakeholders included the Ports Authority, shipping agents, maritime police, maritime safety administration, fishers and others (Annex A). During the workshop the participants were divided into groups according to their experience and background. They then helped identify potential hazards and possible scenarios in Arutanga Anchorage using the latest chart of the port, other tools such as marine traffic data, and their experience.

4 Hazards and risks

A hazard is something that may cause an undesirable incident. Risk is the chance of injury or loss as defined as a measure of 'probability or likelihood' and 'severity or impact'. Examples of injury or loss include an adverse effect on health, property, the environment or other areas of value.

The purpose of the stakeholder meeting was to generate a prioritised list of hazards specific to Arutanga Anchorage. For the risk assessment, SPC and the Cook Islands Maritime Technical Manager Mr Saungaki Rasmussen worked together to discuss the risks associated with the identified hazards and identify risk control options and recommendations.

The list of hazards identified for Arutanga Anchorage is given in Annex B.

4.1 Types of hazards

Twenty-two different hazards were identified and were grouped into the following six categories:

- natural hazards, such as floods, storms, earthquakes, biological hazards and other natural phenomena;
- economic hazards such as inflation, depression, and changes in tax and fee levies;
- technical hazards such as system or equipment failure, fire, explosion, obsolescence, air/water pollution, failure of communications systems and degradation of data quality;
- human factors such as errors or omissions by poorly trained, fatigued or stressed persons, linguistic challenges, violations, sabotage and terrorism;
- operational hazards such as groundings, collisions, striking and other unwanted events; and
- maritime space hazards, such as competing uses for maritime space leading to increasingly crowded waterways.

The above six types of hazard have the capability of generating seven different types of losses:

- health losses including death and injury;
- property losses including real and intellectual property;
- economic losses leading to increased costs or reduction of revenues;

- liability loss resulting when an organisation is sued for an alleged breach of legal duty; such cases must be defended even if no blame is assigned. Liability losses are capable of destroying or crippling an organisation;
- personnel loss when services of a key employee are lost;
- environmental losses (negative impact on land, air, water, flora or fauna); and
- loss of reputation or status.

4.2 Risk factors

Any risk analysis needs to consider the range of factors that contribute to the overall risk exposure. Table 1 lists some of the factors that could be taken into consideration when identifying hazards for waterways and ports.

Table 1. Risk factors relating to marine navigation.

Ship traffic	Traffic volume	Navigational conditions	Waterway configuration	Short-term consequence	Long-term consequence
Quality of vessels	Deep draught	Night/day operations	Depth/draft/ under-keel clearance	Injuries to people	Health and safety impacts
Crew competency	Shallow draught	Sea state	Channel width	Oil spill	Lifestyle disruptions
Traffic mix	Commercial fishing vessels	Wind conditions	Visibility obstructions	Hazardous material release	Fisheries impacts
Traffic density	Recreational boats	Currents (river, tidal, ocean)	Waterway complexity	Property damage	Impacts on endangered species
Nature of cargo	High speed craft	Visibility restrictions	Bottom type	Denial of use of waterway	Shoreline damage
Participation rate in routing systems, such as VTS	Passenger ships	Ice conditions	Stability (siltation)		Reef damage
		Background lighting	AtoN mix and configuration		Economic impacts
		Debris	Quality of hydrographical data		

Risk is evaluated to allow attention to be focused on high-risk areas, and to identify and evaluate factors which influence the level of risk. Once all the risks have been assessed, they are then evaluated in terms of the documented needs, issues and concerns of the stakeholders, and the benefits and costs of the activity, to determine the acceptability of the risk.

Zero risk is not often realised, unless the activity generating the risk is abandoned. Rather than striving to reduce the risk to zero, authorities should reduce the risk to 'as low as reasonably practicable' (ALARP; Figure 2).

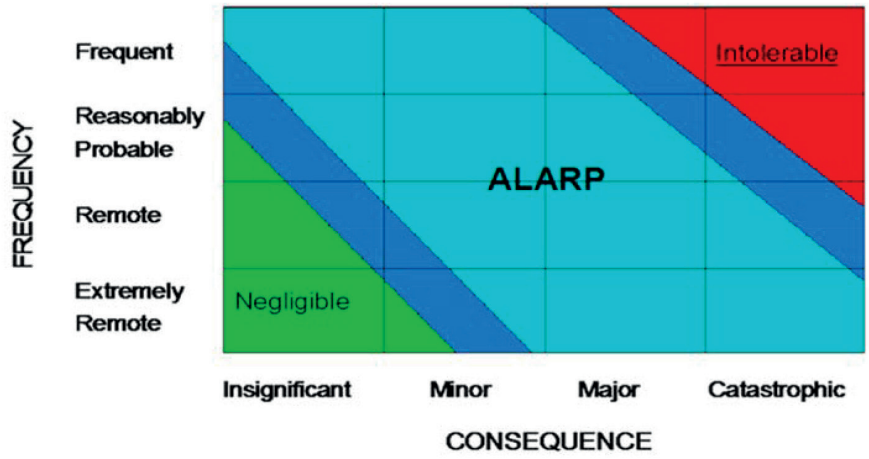


Figure 2. Graphical representation of the levels of risk. The risk level boundaries (negligible/ALARP/intolerable) are purely illustrative.

It is important to remember that, when communicating with stakeholders about risk, perception is usually different to reality. People make judgements of the acceptability of a risk based on their perceptions, rather than on scientific factors such as probability. The public's perception of a risk may be influenced by many things, including age, gender, level of education and previous exposure to information on the hazard. Public perceptions of risk may therefore differ from those of technical experts.

5 Scenarios

During the stakeholder meeting and discussions with Mr Rasmussen, 22 hazards were identified which could lead to a number of different incidents and scenarios. Each hazard was considered carefully and the scenarios it could cause were identified and recorded. The scenarios were classified into four different categories: collision, grounding, allision and foundering. Annex C lists the identified scenarios.

5.1 Collision

The probability of collision depends on navigational conditions, waterway configuration, and type and volume of traffic. The basic types of collisions are head-on, overtaking, bend, merging and crossing collisions. An analysis of the routes and their geometry, combined with the volume and mix of traffic for Aitutaki, revealed one probable collision scenario: head-on collision in the passage during night transit, which is very likely due to the winding channel and the lack of navigational lights.

5.2 Grounding

The probability of grounding depends on many factors, including bathymetry around the port area, the draft of the vessels accessing the port, failure of AtoN, and meteorological conditions such as prevailing wind speed and direction. Grounding on the hard bottom was an identified possible scenario for Arutanga Anchorage. This is due to shallow depths in the passage, which pose a greater risk in bad weather conditions when the westerly swells increase to 3 m at the entrance channel. Other contributory factors to this scenario are the failure of the lead lights in the main Arutanga passage, technical failures on board the vessels and possible crew incompetency.

5.3 Allision

The possibility of a vessel striking a fixed human-made object such as a wharf or AtoN depends on the position of such structures along the routes and the density of traffic. One allision scenario was identified for Arutanga Anchorage. Vessels accessing the channel at night can allide with the channel markers due to the background lights from the Fishing Club that limit visibility for pilots of the incoming vessels (Figure 3).

Figure 3. Background lights from the Fishing Club at Arutanga Anchorage.

5.4 Foundering

Foundering is defined as a vessel sinking that is not the result of an earlier collision; for example, a vessel might founder if its cargo shifts during bad weather. The risk of foundering at Arutanga Anchorage was identified for the barge during unloading operations. This could occur during bad weather due to the stability of the barge and the lack of competence of the crew on board the vessels (Figure 4).

Figure 4. Barge operations offshore from Arutanga Anchorage.

6 Probability and impact

SIRA specifies five levels of probability (Table 2) and five levels of impact that each type of scenario would create (Table 3). Each scenario is allocated a score for both probability and impact, and the risk value is calculated from the product of these scores. In this step of the process, the probability and consequences associated with each scenario were estimated and discussed with the Maritime Technical Manager.

Table 2. Levels of probability specified for the simplified IALA risk assessment tool (SIRA).

Classification	Score	Probability
Very rare	1	Very rare or unlikely, will occur only in exceptional circumstances and not more than once every 20 years
Rare	2	Rare, may occur every 2–20 years
Occasional	3	Occasional, may occur every 2 months to 2 years
Frequent	5	Frequent, may occur once every week to every 2 months
Very Frequent	5	Very frequent, may occur at least once every week

Table 3. Levels of impact specified for the simplified IALA risk assessment tool (SIRA).

Description	Score	Service disruption criteria	Human impact criteria	Financial criteria	Environment criteria
Insignificant	1	No service disruption apart from some delays or nuisance	No injury to humans; possible significant nuisance	Loss, including third-party losses, of less than USD 1000	No damage
Minor	2	Some non-permanent loss of services such as closure of a port or waterway for up to 4 hours	Minor injury to one or more individuals, may require hospitalisation	Loss, including third-party losses, of USD 1000–50,000	Limited short-term damage to the environment
Severe	3	Sustained disruption to services such as closure of a port or waterway for 4–24 hours	Injuries to several individuals requiring hospitalisation	Loss, including third-party losses, of USD 50,000–5,000,000	Short-term damage to the environment over a small area
Major	4	Sustained disruption to services such as closure of a major port or waterway for 1–30 days or permanent or irreversible loss of services	Severe injuries to many individuals or loss of life	Loss, including third-party losses, of USD 5,000,000–50,000,000	Long-term to irreversible damage to the environment over a limited area
Catastrophic	5	Sustained disruption to services such as closure of a major port or waterway for months or years	Severe injuries to numerous individuals and/or loss of several lives	Loss, including third-party losses, of over USD 50,000,000	Irreversible damage to the environment over a large area

7 The acceptability of risk

Having determined probability and impact scores by consensus, the risk values are calculated by multiplying these scores, as shown in the matrix in Table 4. To determine whether the risks are acceptable or not, SIRA specifies four colour-banded levels of risk (Table 5). These colours are superimposed on the matrix in Table 4.

Table 4. Risk value matrix.

		PROBABILITY / (LIKELIHOOD)				
		Very Rare (1)	Rare (2)	Occasional (3)	Frequent (4)	Very frequent (5)
CONSEQUENCE (IMPACT)	Catastrophic (5)	5	10	15	20	25
	Major (4)	4	8	12	16	20
	Severe (3)	3	6	9	12	15
	Minor (2)	2	4	6	8	10
	Insignificant (1)	1	2	3	4	5

Table 5. Categories of risk, and action required.

Risk Value	Risk Category	Action Required
1 – 4	Green	Low risk not requiring additional risk control options unless they can be implemented at low cost in terms of time, money and effort.
5 – 8	Yellow	Moderate risk which must be reduced to the *"as low as reasonably practicable"* (ALARP) level by the implementation of additional control options which are likely to require additional funding.
9-12	Amber	High risk for which substantial and urgent efforts must be made to reduce it to "ALARP" levels within a defined time period. Significant funding is likely to be required and services may need to be suspended or restricted until risk control options have been actioned.
15-25	Red	Very high and unacceptable risk for which substantial and immediate improvements are necessary. Major funding may be required and ports and waterways are likely to be forced to close until the risk has been reduced to an acceptable level.

8 Risk control options

The objective of the risk assessment was to identify risk mitigation options for each undesirable incident that would, if implemented, reduce the risk to a level as low as reasonably practicable (ALARP) and which would be acceptable to stakeholders. Before any risk control decisions were made, they were communicated through the stakeholder consultation process. The risks were evaluated in terms of the overall needs, issues and concerns of the stakeholders. The mitigation options include:

- new or enforcement of existing rules and procedures;
- improved and charted hydrographical, meteorological and general navigation information;
- enhanced AtoN service provision;
- improved radio communications; and
- improved decision support systems.

Table 6 shows the risk scores for the scenarios under the current situation at Arutanga Anchorage, and the new risk scores after mitigating the risk. The detailed risk control options for Arutanga Anchorage are shown in the risk control matrix in Annex D.

Table 6. Risk control options for Arutanga Anchorage, and changes in risk score.

Scenario	Risk score	Risk control option	New risk score
Collision			
Head-on collision of two vessels in the passage at night	9	Community awareness program on safety, and awareness material distributed; regular safety inspections of small boats; enforcement of the Small Boat Safety Regulation; a maximum speed limit in the channel set and enforced	6
Grounding			
Grounding of vessels on the hard bottom in the passage	16	Dredging to deepen and straighten the channel; more markers and lights; updated charts	8
Allision			
Allision of vessels with AtoN at night	8	Advise the Fishing Club to reorient lights and reduce brightness; Ports Authority to issue a public notice not to leave headlights on while on the wharf; improve channel marks and lighting	2
Foundering			
Foundering of the barge during unloading operations	9	Regular training for barge captains, and regular change of captain during the barge operations; guideless on operations in bad weather developed and followed; regular meetings before operations; and zero tolerance on staff suspected of being under the influence of alcohol	3

9 Costing the risk control options

The outcomes of the risk assessment are essentially qualitative and subjective, based on the expert opinions of the stakeholders. The next step is to reach consensus on which risk control options to action. The risk control options are prioritised to facilitate the decision-making process.

Costing of the options is part of the decision-making process. Most of the control options identified require funding. Costs must cover capital, labour and other resources needed for planning and implementation, as well as costs of operation and maintenance throughout the life cycle under consideration. Maintenance is important

to ensure that AtoN equipment and systems continue to perform at the levels required for mariners to safely navigate the waterways.

The control measures need to be both effective in reducing risk, but also cost-effective. The cost of the measures should not normally exceed the reduction in the expected value of the loss.

The cost of the options should be evaluated over a time frame equivalent to the economic or useful life of the facilities and assets associated with the option.

10 AtoN programme 5-year budget plan (2019–2023)

For the Ministry of Transport to provide excellent AtoN services in the Cook Islands, an adequate level of resources needs to be allocated to AtoN installment, maintenance and management. The SIRA team held meetings with key stakeholders (Annex A) to discuss the budgeting process.

The ports in Rarotonga and Arutanga Anchorage are run by the Cook Islands Ports Authority, and the responsibility of AtoN management lies with the harbour master in each port. The Authority does not have a dedicated AtoN budget. In the event of an AtoN failure, the harbour master informs the Port Authority's procurement and/or maintenance sections to mobilise maintenance or purchase new equipment. The General Manager of the Port Authority, Mr Bim Tou, was consulted on the installation, upkeep and resourcing of AtoN. He expressed that, given the relatively few AtoN that it is tasked to look after, the Port Authority is within its means to manage and upkeep the AtoN.

The Port Authority does not charge light dues; instead it has a marine service charge that covers the range of services that it provides to vessels calling at its ports. Discussions were held regarding the possibility of introducing light dues, but shipping companies have recently expressed their unease with current port charges and it was felt that adding light dues might be an even greater burden. However, the Port Authority would be open to considering this in the future.

The Ministry of Transport is responsible for AtoN in the outer islands, and there is currently no dedicated budget for AtoN. In discussions, the Secretary of Finance Mr Garth Henderson said that the Ministry of Finance is willing to consider a submission for AtoN funding from the Ministry of Transport in the national budget.

An AtoN programme 5-year budget plan was drawn up in consultation with the Ministry of Transport's Director of Maritime Mr Junior Ngatokorua, and the Maritime Technical Manager Mr Saungaki Rasmussen. The budget takes into account aspirations to increase the level of AtoN services in the whole of the Cook Islands. It also includes the costed risk control options from the risk assessment above. These have been staggered over a 5-year period to spread the costs. It is suggested that the AtoN programme 5-year budget plan be used to assist the Ministry of Transport in its own budget submission and discussions for funding in the national budget.

A summary and detailed tables of the AtoN programme 5 -year budget plan are given in Annex E.

11 Recommendations

A key outcome of the risk assessment undertaken in Aitutaki is five recommendations that aim to reduce the risks to safety of navigation to an acceptable level for the stakeholders.

Recommendation 1 (addressing collision scenario)

Head-on collision at night between two vessels navigating the channel is a likely scenario because of the narrow and winding channel and lack of small boat safety compliance.

It is recommended that:

- a community awareness program on safety is introduced, including awareness materials produced and circulated among the communities;
- training is provided for Boat Master qualification;
- a full-time inspector is hired in Aitutaki
- regular safety inspections of the vessels are carried out;
- the Small Boat Safety Regulation is enforced; and
- a maximum speed limit in the channel is set and enforced.

The costs to implement this recommendation are as follows:

Recommendation	Amount (NZD)
Community awareness training program on small boat safety	20,000 per year
Training for Boat Master qualification	50,000 per bi-annual training
Hire of a full-time inspector in Aitutaki	30,000 per year

Recommendation 2 (addressing grounding scenario)

Grounding on the hard bottom in the channel can occur because of the shallow depth and the narrow and winding passage, technical failures on vessels, crew competencies, bad weather conditions and lead light failures.

It is recommended that the channel is dredged to a suitable depth and straightened. It is also recommended that new channel markers with appropriate lights are installed and charts updated.

The costs to implement this recommendation are as follows:

Recommendation	Amount (NZD)
Dredge and straighten the main channel	1 million

There will be no maintenance costs following dredging since the siltation rate in the channel is very low.

Recommendation 3 (addressing allision scenario)

Vessels navigating the channel at night can allide with the AtoN. Significant factors contributing to this scenario are dazzling of vessel crew by lights from the Fishing Club or headlights of vehicles parked on the wharf facing the channel, and the lack of proper channel markers and lights.

It is recommended that the lights at the Fishing Club are reoriented to shine in a different direction and their brightness is reduced, and that the Ports Authority issues a public notice at the wharf directing motorists not to park on the wharf with lights on. The channel should also be marked and lit appropriately.

The costs to implement this recommendation are as follows:

Recommendation	Amount (NZD)
Review and adjust lighting at Arutanga Anchorage	30,000
Annual maintenance	1500

Recommendation 4 (addressing foundering scenario)

Foundering of the barge during unloading operations was a major concern for stakeholders. This might happen because of improper loading of cargo, bad weather conditions or crew competency and judgement.

It is recommended that regular training is provided for the barge captains, with regular change of captains during barge operations. It is also recommended that guidelines on operations during bad weather conditions be developed and followed. It is further suggested to hold regular meetings before operations, and observe zero tolerance for staff suspected to be under the influence of alcohol.

The costs to implement this recommendation are as follows:

Recommendation	Amount (NZD)
Training of barge captains	30,000 per year (three trainings over 5 years)
Drafting guidelines to be followed during bad weather conditions	No cost – part of Port Authority's responsibility

Recommendation 5 (AtoN)

A site visit was organised with the Department of Fisheries' Senior Fisheries Officer Mr Richard Story, who provided a boat to tour and inspect all the AtoN in the port of Arutanga, and around Vaipae and Tautu jetty. It was noted that most of the AtoN in Arutanga Anchorage did not comply with IALA standards. There were a lot of temporary AtoN installed to guide local fisherman in and out of channels on the eastern side of the island. Some of them had temporary lights, but did not meet IALA standard (Annex F).

It is recommended that all the AtoN marking the channels to be upgraded to IALA standards.

The costs to implement this recommendation are as follows:

Recommendation	Amount (NZD)
Upgrade AtoN around Vaipae and Tautu jetty to meet IALA standards	30,000
Annual maintenance	1500

Annex A. Stakeholders in the Arutanga Anchorage risk assessment

Safety of Navigation Risk Assessment Stakeholder Meeting (Phase II) - Arutanga, Aitutaki, Cook Islands, 23th October, 2018							
	Name	Job title	Organisation	Gender	Age range	Phone	Email address
	Ned Howard	Secretary of Transport	Ministry of Transport	M	56-over	53810	
	Emi Carl	Supervisor	Ports Authority - Aitutaki	F	36-45	54050	ports@aitutaki.net.ck
	Tereapii Maki Kavana	Parliamentarian - Arutanga/Ni	Cook Islands Parliament	M	56-over	80655	apiimaki@gmail.com
	Tekura-Moeroa Toni Bishop	Mayor (Konitara Tuiara)	Aitutaki Island Council (AIG)	M	56-over	75955	
	Kauariki Henry	Police Officer	Aitutaki Police	M	36-45	79885	kauariki.henry@police.gov.ck
	Tai Tuaiti	Island Council Representative	Aitutaki Island Council (AIG)	M	46-55	72391	moonlight_charter@hotmail.com
	Clive Baxter	Manager	Aitutaki Stevedoring	M	46-55	54025	
	Mana Makimane	Ship Agent	Excil Shipping & Matsons	M	36-45	75220	tailimited2018@gmail.com
	Tapita Solomona-Tikiteine	Labour OSH Officer	Ministry of Internal Affairs	F	46-55	78200	tapita.tikiteina@cookislands.gov.ck
	Tereapii Williams	Deputy Mayor	Aitutaki Island Council (AIG)	M	56-over	31290	
	Mii Jacob	Manager Assistant	Excil Shipping & Matsons	F	46-55	31221	mii.makimare@gmail.com
	Metuakore Bobbie Strickland	Registered Nurse	Aitutaki Hospital - Public Health	F	56-over	51957	
	Celia Manapori-Mayor	Registered Nurse	Aitutaki Hospital - Public Health	F	46-55	50117	celia4real@gmail.com
	Onu Hewett	Scuba Dive Operator	Bubbles Below Dive	M	36-45	53919	bubblebelow@aitutaki.net.ck
	Richard Story	Senior Fisheries Officer	Department of Fisheries - Aitutaki	M	56-over	55525	
	John Baxter	Shipping agent/Fisherman	Fisherman	M	56-over	54430	baxter@aitutaki.net.ck
	Ngatokorua Rota Ariki	Island Council Representative	Aitutaki Island Council (AIG)	M	36-45	50507	nrota@airport.gov.ck
	John Jessie	Harbour Master	Ports Authority - Rarotonga	M	36-45	71429	john.jessie@cookislands.gov.ck
	Charlie Taamo	SDA Pastor	Aitutaki SDA Church	M	56-over	79888	charlie456@gmail.com
	Temanu Unuka	Island Council Representative	Aitutaki Island Council (AIG)	M	56-over	51214	
	Saungaki Rasmussen	Maritime Technical Manager	Ministry of Transport	M	46-55		saungaki.rasmussen@cookislands.gov.ck
	Tepaeru Cameron	Island Council Representative	Aitutaki Island Council (AIG)	F	56-over	31007	tepaeru.cameron@cookislands.gov.ck

Annex B. Hazards identified for Arutanga Anchorage

Hazard		Remarks
Natural	Safe minimum depth (m)	On the chart, in the Arutanga channel
	Proximity of danger (NM)	The Arutanga channel is very narrow and the reef constitutes a danger
	Tide, wind, wave and tidal flow effect	When the wind shifts to the west and the north
	Minimum visibility (NM)	During cyclone season, heavy rain can cause reduced visibility
	Background lighting	Coming into the Arutanga passage, the Fishing Club causes background lighting issues + cars have lights on parked in front of the pier
Economic	Insufficient AtoN funding issues	Ports Authority doesn't have funding for maintenance of AtoN
Technical	Shipborne navaid failure	Small boats often have navaid failures, such as no navigation lights, no radio, no safety equipment
	Quality and validity of charted information	Minor changes should be made available to LINZ and broadcasted through MSI
	Loss of vessel control	Because of the narrow Arutanga passage; lack of maintenance
	Loss of connectivity	Poor VHF coverage on the eastern part of the island/lagoon
	AtoN failures	
Human	Crew competency	Some sailors are not trained and yet navigate in and around Aitutaki Lagoon
	Safety culture	
	Influence of alcohol and/or drugs	During festive season
	Political issues?	Interference
	Culture or language issues	Especially yachties – seasonal issue
Operational	Impact of small vessels	When small vessels speed up in the lagoon
	Fishing activities	Fishing in the Arutanga channel
	Seasonal activities	Yachts, lagoon tours, kitesurfing, etc.
	Poor promulgation of MSI	Poor communication to MSI coordinator from the island
	Poor response to marking new danger	No emergency wrecks marks
Maritime space	Crowded waterway issues	Snorkelling activities

Annex C. Possible scenarios identified for Arutanga Anchorage

Scenarios		Remarks
Collision	Head-on collisions in the passage at night	No navigation lights
Grounding	Grounding on hard bottom in the passage	Due to: • shallow depths and narrow passage • AtoN failures (lead lights) • technical failures/crew competencies • rough conditions
Allision	Small vessels hitting the AtoN	Due to background lighting
Foundering	Barge operations	Due to container storage, equipment falling overboard

Annex D. Risk assessment matrix for Arutanga Anchorage

Note: Follow the examples in G1138 Annex C but amend them to match the real situation in the zone under assessment

Aitutaki - Cook Islands

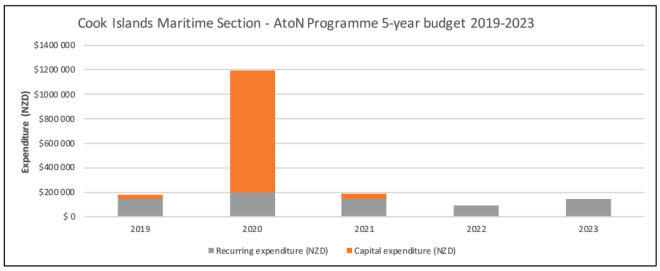
	Scenario	Description of incident (what happened)	Root cause (hazard)	Consequences (short and long term)	Existing risk control measures	Probability score	Consequence score	Risk score	Cost of incident (NZD)	Further risk control options	New probability score	New consequence score	New risk score	Cost of risk control option (NZD)	Remarks
	1. COLLISION														
1.1	Head-on collision in the passage at night	Two vessels navigating the channel collide into each other	No navigation lights on the vessels; the channel is too narrow	Lost of life; enviromental damage; lost of vessels	Small Boat Safety Regulation (2014); Aitutaki fisheries by-law	3	3	9	1 milion	Community awareness programs on safety, inc. awareness materials produced and distributed; regular safety inspections; enforcement of Small Boat Safety Regulation; maximum speed limit in the channel	2	3	6	100,000 (1 full time inspector, 3 boat master's training, publications, etc.)	ALARP
	2. GROUNDING														
2.1	Grounding on hard bottom in the passage	A vessel navigating the channel runs aground	Shallow depth, narrow channel, winding passage; technical vessel failures/crew competencies; rough weather conditions; AtoN failures (lead lights)	Channel blocked; container unloading delay; economic loss; environmental damage (oil spillage); injuries (tourists from cruise ships accessing channel in dinghies)	Lead lights, chart, channel markers	4	4	16	2.5 milion	Dredging to deepen and straighten the channel; more lights and more markers; updated nautical publications	2	4	8	1 milion	ALARP + oceanographic studies fro the Aitutaki Lagoon have already been done by SPC SPAC in 2008
	3. ALLISION														
3.1	Allision with AtoN	A vessel navigating the channel at night hits an AtoN	Background lights at Fishing Club and cars parked with headlights on at the wharf	Minor damage to the vessels; damage to AtoN; environmental damage to the corals; injuries to crew	None	4	2	8	100,000	Advise Fishing Club to change light direction and brightness; Ports Authority to issue a public notice not to leave headlights on while on the wharf; change intensity and configuration of channel lights	1	2	2	30,000	ALARP
3.2	Allision with wharf	The barge hits the wharf during operations	Wind, crew competency, panic, carelessness of crew	Damage to the barge; damage to the wharf; damage to crane; damage to goods in the containers	Temporary fenders on the wharf and the barge; personal protective equipment; limits for barge operations according to wind speed and direction	2	2	4	500,000	Widen the berthing area; restrict other vessels from entering during barge operation; more fenders	2	1	2	Part of the marina plan	ALARP
	4. FOUNDERING														
4.1	Foundering of barge during unloading operations	The barge, after being loaded, founders on its way to the wharf	Incorrect loading; weather conditions; crew decisions	Economic loss (lost of containers, lost of barge); loss of life and injuries	Barge captain trained; limits for barge operations according to wind speed and direction	3	3	9	2 milion	Regular training for more barge captains, and continuous change of the operators during the barge operations; guidelines on operations during bad weather developed and followed; regular meetings before operations; zero tolernace of staff under the influence of alcohol	1	3	3	30,000NZC	ALARP

Annex E. Cook Islands Ministry of Transport AtoN programme 5-year budget (2019–2023)

Cook Islands Maritime Section - Ministry of Transport

AtoN Programme 5-year budget 2019-2023

	Capital expenditure (NZD)	Recurring expenditure (NZD)	Total expenditure (NZD)
2019	$30 000	$144 154	$174 154
2020	$1 000 000	$192 654	$1 192 654
2021	$42 600	$140 633	$183 233
2022	$0	$94 154	$94 154
2023	$0	$144 154	$144 154
	$1 072 600	$715 749	$1 788 349



* Currently, Cook Islands does not collect light dues from vessels
* Costings of risk control options covered under Aitutaki Safety of Navigation Risk Assessment have been factored in:
  - In 2019, review entrance lights scheme to Arutanga port, adjust Aitutaki Fishing Club background lighting, and installation of public notice board to mitigate risk of allisions;
  - In 2020, dredging of Arutanga port channel
  - In 2021, purcahse of LED Lights for channels in Vaipae and Tautu, Aitutaki to meet IALA standards
  - In 2019, 2020 and 2021, conduct training for Boat Master qualifications
  - In all years, establishment of a full time inspector position to ensure the enforcement of Small Boats Safety Regulation
  - In all years, conduct community awareness trainings

2019				
		Cost (NZD)	Cost (NZD)	Notes
Capital expenditure				
Procurement				
	Review entrance lights scheme to Arutanga port and adjust Aitutaki Fishing Club background lighting	30,000		As part of recommendations in the Aitutaki SoN risk assessment to mitigate risk of allision, replace channel lights, change the direction and brightness of lights at the Fishing Club, plus issue a notice to switch off headlights at the wharf when not in use. LED AtoN lights are generally fully sealed units with no moving parts, thus requiring little or no maintenance over their long lifetime
Total capital expenditure			30,000	
Recurring expenditure				
	Full-time boat inspector	30,000		As part of recommendations in the Aitutaki SoN risk assessment, hire of a full-time boat inspector to carry out enforcement of Small Boat Safety Regulation, especially around maximum speed limit in the channel, to help mitigate risk of collisions
Training and awareness				
	Training of barge captains and operators in Aitutaki	30,000		As part of recommendations in the Aitutaki SoN risk assessment, training of barge captains to better understand limits for barge operations according to wind speed and direction
	Community awareness training	20,000		As part of recommendations in the Aitutaki SoN risk assessment, community awareness programs on safety for all of Cook Islands to mitigate risk of collisions
	Boat master training	50,000		• As part of recommendations in the Aitutaki SoN risk assessment, annual boat master training to be conducted in several locations across Cook Islands to mitigate risk of collisions
Risk assessment meetings				
	Air fares	4000		• The first 2 and half years will constitute risk assessment and raising awareness on safety of navigation in the islands of the Southern Group: Mauke, Atiu, Mitiaro, Magaia and Palmeston • Estimation for 2 people on return flights, to travel to 2 islands in the Southern Group in 2019, 2 islands in 2020 and 1 island in the first half of 2022
	Accommodation	2560		• Travel allowances for department staff on scheduled maintenance and awareness visits • Estimated $160 per person/per night across 4 nights, per trip
	Daily subsistence allowance – DSA (travel to outer islands)	800		• DSA for two travelling staff • Estimation for 2 people to travel to 2 islands in the Southern Group. Normal government DSA rate of $50 per person applies. Approx 4 days per island visit
	Catering	1320		• Catering cost for holding stakeholder awareness and consultation meetings • Estimation of $55 pp for approx. 12 pax, across two islands
	Transport hire and fuel	660		• Cost of vehicle hire and fuel during 2 island visits • Estimated $70 per day to hire and $50 fuel cost per island @ an estimated 4 days per island trip
	Venue hire	700		• Estimated $350 per venue hire
	Printing	100		• Cost of printing materials for meetings
	Contingency	4014		• 10% of all other costs as contingency
Total recurring expenditure			144,154	
Value added tax				
TOTAL			**174,154**	

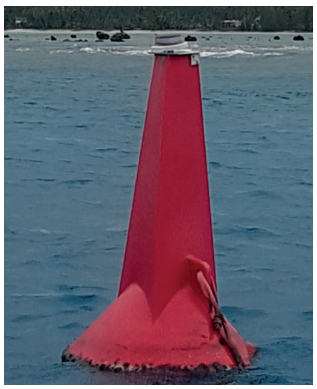
2020			
	Cost (NZD)	Cost (NZD)	Notes
Capital expenditure			
Procurement			
Dredging of Aitutaki channel	1,000,000		– As part of recommendations in the Aitutaki risk assessment, dredging to straighten Aitutaki channel, installation of lights and markers to mitigate the risk of grounding
Total capital expenditure		1,000,000	
Recurring expenditure			
Full-time boat inspector	30,000		As part of recommendations in the Aitutaki SoN risk assessment, hire of a full-time boat inspector to carry out enforcement of Small Boat Safety Regulation, especially around maximum speed limit in the channel, to help mitigate risk of collisions
Aitutaki channel lights maintenance			
Maintenance of Arutanga port channel lights	1500		Maintenance costs specifically for Arutanga Port channel lights installed as part of 2019 risk control options. Amount is estimated as a percentage of replacement asset value (RAV). Given a manufacturer's recommended maximum life-cycle of 20 years for such an asset, an RAV of 5% is taken
Training and awareness			
Training of barge captains and operators in Aitutaki	30,000		As part of recommendations in the Aitutaki SoN risk assessment, training of barge captains to better understand limits for barge operations according to wind speed and direction
Community awareness training	20,000		As part of recommendations in the Aitutaki SoN risk assessment, community awareness programs on safety for all of Cook Islands to mitigate risk of collisions
Risk assessment/awareness meetings			
Air fares	4000		The first 2 and half years will constitute risk assessment and raising awareness on safety of navigation in the islands of the Southern Group: Mauke, Atiu, Mitiaro, Magaia and Palmeston Estimation for 2 people on return flights, to travel to 2 islands in the Southern Group in 2019, 2 islands in 2020 and 1 island in the first half of 2022
Accommodation	2560		Travel allowances for department staff on scheduled maintenance and awareness visits Estimated $160 per person/per night across 4 nights, per trip
Daily subsistence allowance – DSA (travel to outer islands)	800		• DSA for two travelling staff • Estimation for 2 people to travel to 2 islands in the Southern Group. Normal government DSA rate of $50 per person applies. Approx. 4 days per island visit
Catering	1320		• Catering cost for holding stakeholders awareness and consultation meetings • Estimation of $55 pp for approx. 12 pax, across two islands
Transport hire and fuel	660		Cost of vehicle hire and fuel during 2 island visits Estimated $70 per day to hire and $50 fuel cost per island @ an estimated 4 days per island trip
Venue hire	700		• Estimated $350 per venue hire
Printing	100		• Cost of printing materials for meetings
Contingency	101,014		• 10% of all other costs
Total recurring expenditure		192,654	
Value added tax			
TOTAL		**1,192,654**	

2021				
		Cost (NZD)	Cost (NZD)	Notes
Capital expenditure				
Procurement				
	Purchase of LED Lighthouse	7600		Proposed purchase of 5 new beacons to be installed across all 5 islands in Southern Group
	Freight/customs	5000		Estimated via http://www.seafreightcalculator.com
	Purchase of LED Lights for Vaipae and Tautu jetty to meet IALA standards	30,000		As part of recommendations in the Aitutaki SoN risk assessment, installation of LED lights at the Vaipae and Tautu channels on Aitutaki will bring the quality of AtoN services up to IALA standards
Total capital expenditure			42,600	
Recurring expenditure				
	Full-time boat inspector	30,000		As part of recommendations in the Aitutaki SoN risk assessment, hire of a full-time boat inspector to carry out enforcement of Small Boat Safety Regulation, especially around maximum speed limit in the channel, to help mitigate risk of collisions
Aitutaki channel lights maintenance				
	Maintenance of Arutanga port channel lights	1500		Maintenance costs specifically for Arutanga port channel lights installed as part of 2019 risk control options. Amount is estimated as a percentage of replacement asset value (RAV). Given a manufacturer's recommended maximum life-cycle of 20 years for such an asset, an RAV of 5% is taken
Training and awareness				
	Training of barge captains and operators in Aitutaki	30,000		As part of recommendations in the Aitutaki SoN risk assessment, training of barge captains to better understand limits for barge operations according to wind speed and direction
	Community awareness training	20,000		As part of recommendations in the Aitutaki SoN risk assessment, community awareness programs on safety for all of Cook Islands to mitigate risk of collisions
	Boat master training	50,000		As part of recommendations in the Aitutaki SoN risk assessment, boat master training to be conducted in several locations across Cook Islands to mitigate risk of collisions
Risk assessment/awareness meetings				
	Air fares	2000		The first 2 and half years will constitute risk assessment and raising awareness on safety of navigation in the islands of the Southern Group: Mauke, Atiu, Mitiaro, Magaia and Palmeston Estimation for 2 people on return flights, to travel to 2 islands in the Southern Group in 2019, 2 islands in 2020 and 1 island in the first half of 2022
	Accommodation	640		• Travel allowances for department staff on scheduled maintenance and awareness visits • Estimated $160 per person/per night across 4 nights, per trip
	Daily subsistence allowance - DSA (travel to Outer Islands)	400		• DSA for two travelling staff • Estimation for 2 people to travel to 2 islands in the Southern Group. Normal government DSA rate of $50 per person applies. Approx. 4 days per island visit
	Catering	660		• Catering cost for holding stakeholder awareness and consultation meetings • Estimation of $55 pp for approx. 12 pax, per island meeting
	Transport hire and fuel	330		• Cost of vehicle hire and fuel during 2 island visits • Estimated $70 per day to hire and $50 fuel cost per island @ an estimated 4 days per island trip
	Venue hire	350		• Estimated $350 per venue hire
	Printing	50		• Cost of printing materials for meetings
	Contingency	4703		• 10% of all other costs
Total recurring expenditure			140,633	
Value added tax				
TOTAL			**183,233**	

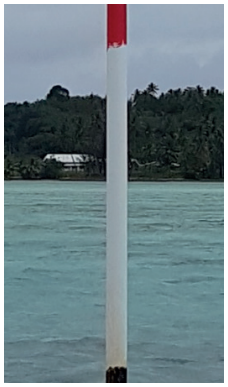
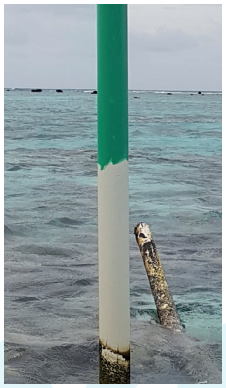
2022				
		Cost (NZD)	Cost (NZD)	Notes
Capital expenditure				
Procurement				
Total capital expenditure			0	
Recurring expenditure				
	Full-time boat inspector	30,000		As part of recommendations in the Aitutaki SoN risk assessment, hire of a full-time boat inspector to carry out enforcement of Small Boat Safety Regulation, especially around maximum speed limit in the channel, to help mitigate risk of collisions
Aitutaki channel lights maintenance				
	Maintenance of Vaipae and Tautu Channel lights	1500		Maintenance costs specifically for Vaipae and Tautu channel lights installed as part of 2021 risk control options. Amount is estimated as a percentage of replacement asset value (RAV). Given a manufacturer's recommended maximum life-cycle of 20 years for such an asset, an RAV of 5% is taken
	Maintenance of Arutanga port channel lights	1500		Maintenance costs specifically for Arutanga port channel lights installed as part of 2019 risk control options. Amount is estimated as a percentage of replacement asset value (RAV). Given a manufacturer's recommended maximum life-cycle of 20 years for such an asset, an RAV of 5% is taken
Training and awareness				
	Training of barge captains and operators in Aitutaki	30,000		As part of recommendations in the Aitutaki SoN risk assessment, training of barge captains to better understand limits for barge operations according to wind speed and direction
	Community awareness training	20,000		As part of recommendations in the Aitutaki SoN risk assessment, community awareness programs on safety for all of Cook Islands to mitigate risk of collisions
Risk assessment/awareness meetings				
	Air fares	4000		The first 2 and half years will constitute risk assessment and raising awareness on safety of navigation in the islands of the Northern Group: Penrhyn, Rakahanga, Manihiki, Pukapuka, Nassau Estimation for 2 people on return flights, to travel to 2 islands in the Northern Group in 2022, 2 islands in 2023 and 1 island in the first half of 2024
	Accommodation	2560		Travel allowances for department staff on scheduled maintenance and awareness visits Estimated $160 per person/per night across 4 nights, per trip
	Daily subsistence allowance - DSA (travel to Outer Islands)	800		• DSA for two travelling staff • Estimation for 2 people to travel to 2 islands in the Northern Group. Normal government DSA rate of $50 per person applies. Approx. 4 days per island visit
	Catering	1320		• Catering cost for holding stakeholders awareness and consultation meetings • Estimation of $55 pp for approx. 12 pax, across two islands
	Transport hire and fuel	660		• Cost of vehicle hire and fuel during 2 island visits • Estimated $70 per day to hire and $50 fuel cost per island @ an estimated 4 days per island trip
	Venue hire	700		• Estimated $350 per venue hire
	Printing	100		• Cost of printing materials for meetings
	Contingency	1014		• 10% of all other costs
Total recurring expenditure			94,154	
Value added tax				
TOTAL			**94,154**	

2023				
		Cost (NZD)	Cost (NZD)	Notes
Capital expenditure				
Procurement				
Total capital expenditure			0	
Recurring expenditure				
	Full-time boat inspector	30,000		As part of recommendations in the Aitutaki SoN risk assessment, hire of a full-time boat inspector to carry out enforcement of Small Boat Safety Regulation, especially around maximum speed limit in the channel, to help mitigate risk of collisions
Aitutaki channel lights maintenance				
	Maintenance of Vaipae and Tautu channel lights	1500		Maintenance costs specifically for Vaipae and Tautu channel lights installed as part of 2021 risk control options. Amount is estimated as a percentage of replacement asset value (RAV). Given a manufacturer's recommended maximum life-cycle of 20 years for such an asset, an RAV of 5% is taken
	Maintenance of Arutanga Port Channel lights	1500		Maintenance costs specifically for Arutanga Port channel lights installed as part of 2019 risk control options. Amount is estimated as a percentage of replacement asset value (RAV). Given a manufacturer's recommended maximum life-cycle of 20 years for such an asset, an RAV of 5% is taken
Training and Awareness				
	Training of barge captains and operators in Aitutaki	30,000		As part of recommendations in the Aitutaki SoN risk assessment, training of Barge captains to better understand limits for barge operations according to wind's speed and direction
	Community awareness training	20,000		As part of recommendations in the Aitutaki SoN risk assessment, community awareness programs on safety for all of Cook Islands to mitigate risk of collisions
	Boat master training	50,000		As part of recommendations in the Aitutaki SoN risk assessment, Boat Master trainings to be conducted in several locations across Cook Islands to mitigate risk of collisions
Risk assessment/awareness meetings				
	Air fares	4000		• The first 2 and half years will constitute risk assessment and raising awareness on safety of navigation in the islands of the Northern Group: Penrhyn, Rakahanga, Manihiki, Pukapuka, Nassau • Estimation for 2 people on return flights, to travel to 2 islands in the Northern Group in 2022, 2 islands in 2023 and 1 island in the first half of 2024
	Accommodation	2560		• Travel allowances for department staff on scheduled maintenance and awareness visits • Estimated $160 per person/per night across 4 nights, per trip
	Daily subsistence allowance - DSA (travel to Outer Islands)	800		• DSA for two travelling staff • Estimation for 2 people to travel to 2 islands in the Northern Group. Normal government DSA rate of $50 per person applies. Approx. 4 days per island visit
	Catering	1320		• Catering cost for holding stakeholder awareness and consultation meetings • Estimation of $55 pp for approx. 12 pax, across two islands
	Transport hire and fuel	660		• Cost of vehicle hire and fuel during 2 island visits • Estimated $70 per day to hire and $50 fuel cost per island @ an estimated 4 days per island trip
	Venue hire	700		• Estimated $350 per venue hire
	Printing	100		• Cost of printing materials for meetings
	Contingency	1014		• 10% of all other costs
Total recurring expenditure			144,154	
Value added tax				
TOTAL			**144,154**	

Annex F. Aids to navigation in Aitutaki

Number on buoy: **Feature name:** **Description:** **Light characteristics:** **Position (WGS84):** **Comments:**	None Port-hand mark Buoy Red 3s FL(3s) 18°51.289S, 159°48.414W This buoy marks the entrance to the passage	
Number on buoy: **Feature name:** **Description:** **Light characteristics:** **Position (WGS84):** **Comments:**	None Starboard-hand mark Buoy Green 3s FL(3s) 18°51.304S, 158°48.455W This buoy marks the entrance to the passage. The buoy is partially submerged which suggests that the anchor chain is not of the right length. Needs maintenance	
Number on buoy: **Feature name:** **Description:** **Light characteristics:** **Position (WGS84):** **Comments:**	None Port-hand mark Spar Red 3s FL(3s) 18°51.365S, 159°48.373W No top mark, red light working, needs maintenance	
Number on buoy: **Feature name:** **Description:** **Light characteristics:** **Position (WGS84):** **Comments:**	None Starboard-hand mark Spar Green 3s FL(3s) 18°51.385S, 159°48.380W No top mark, green light working, needs maintenance	

Number on buoy: **Feature name:** **Description:** **Light characteristics:** **Position (WGS84):** **Comments:**	None Port-hand mark Spar None 18°51.395S, 159°48.352W No top mark, no light, needs urgent maintenance	
Number on buoy: **Feature name:** **Description:** **Light characteristics:** **Position (WGS84):** **Comments:**	None Port-hand mark Spar None 18°51.420S, 159°48.335W No top mark, no light, needs maintenance	
Number on buoy: **Feature name:** **Description:** **Light characteristics:** **Position (WGS84):** **Comments:**	None Port-hand mark Spar None 18°51.447S, 159°48.314W No top mark, no light, needs urgent maintenance	
Number on buoy: **Feature name:** **Description:** **Light characteristics:** **Position (WGS84):** **Comments:**	None Port-hand mark Spar None 18°51.469S, 159°48.300W No top mark, no light, needs urgent maintenance	

Number on buoy: **Feature name:** **Description:** **Light characteristics:** **Position (WGS84):** **Comments:**	None Port-hand mark Spar None 18°51.520S, 159°48.268W No top mark, no light, needs maintenance	
Number on buoy: **Feature name:** **Description:** **Light characteristics:** **Position (WGS84):** **Comments:**	None Port-hand mark Spar Red 3s FL(3s) 18°51.435S, 159°48.284W No top mark, light working, needs maintenance	
Number on buoy: **Feature name:** **Description:** **Light characteristics:** **Position (WGS84):** **Comments:**	None Starboard-hand mark Spar None 18°51.491S, 159°48.309W No top mark, needs maintenance	
Number on buoy: **Feature name:** **Description:** **Light characteristics:** **Position (WGS84):** **Comments:**	None Starboard-hand mark Spar None 18°51.543S, 159°48.274W No top mark, needs urgent maintenance	

Number on buoy: **Feature name:** **Description:** **Light characteristics:** **Position (WGS84):** **Comments:**	None Port-hand mark Spar None 18°51.557S, 159°48.245W No top mark, needs urgent maintenance	
Number on buoy: **Feature name:** **Description:** **Light characteristics:** **Position (WGS84):** **Comments:**	None Port-hand mark Spar Red 3s FL(3s) 18°51.600S, 159°48.218W No top mark, light working, needs urgent maintenance	
Number on buoy: **Feature name:** **Description:** **Light characteristics:** **Position (WGS84):** **Comments:**	None Starboard-hand mark Spar None 18°51.643S, 159°48.274W No top mark, needs urgent maintenance	
Number on buoy: **Feature name:** **Description:** **Light characteristics:** **Position (WGS84):** **Comments:**	None Port-hand mark Spar None 18°51.643S, 159°48.180W No top mark, needs urgent maintenance	

Number on buoy: **Feature name:** **Description:** **Light characteristics:** **Position (WGS84):** **Comments:**	None Port-hand mark Spar None 18°51.704S, 159°48.143W No top mark, needs urgent maintenance	
Number on buoy: **Feature name:** **Description:** **Light characteristics:** **Position (WGS84):** **Comments:**	None Port-hand mark Spar Red 3s FL(3s) 18°51.743S, 159°48.123W No top mark, light working, needs urgent maintenance	
Number on buoy: **Feature name:** **Description:** **Light characteristics:** **Position (WGS84):** **Comments:**	None Starboard-hand mark Spar None 18°51.630S, 159°48.086W No top mark, needs urgent maintenance	
Number on buoy: **Feature name:** **Description:** **Light characteristics:** **Position (WGS84):** **Comments:**	None Starboard-hand mark Spar None 18°51.648S, 159°48.203W No top mark, needs urgent maintenance	

The following are some of the temporary AtoN that are placed on the eastern side of the island to guide the local fisherman from the villages of Vaipae and Tautu. No GPS positions were taken.

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