Runway Safety Area Improvement and Road Realignment Project:

A compilation of supporting documentation for the lagoonside dredging at the airport water reservoirs,
Amata Kabua International Airport, Majuro,
Republic of the Marshall Islands

April 2012

1. Introduction

The purpose of this document is to compile the supporting environmental information on the Runway Safety Area (RSA) and Road Realignment Project (RRP) including the assessment of dredging options and responses to points raised by the public. This document also supports and builds on the 2007 Environmental Impact Assessment (EIA) prepared for the RSA and RRP at the Amata Kabua International Airport (AKIA). The 2007 EIA was prepared pursuant to the Republic of the Marshall Islands (RMI) Environmental Impact Assessment Regulations 1994, the National Environmental Protection Act 1984 (NEPA), Earthmoving regulations 2004, Coast Conservation Act 1988 (CCA) and the Draft Coastal Management Framework 2006. The EIA included an appended report describing biological reconnaissance surveys of terrestrial and reef environs. Furthermore, reference has been made to other publicly available reports and studies which have been cited throughout the document.

The RMI Ports Authority (RMIPA) has used Federal Aviation Administration's (FAA) Environmental Orders: 1050.1E; *Environmental Impacts: Policies and Procedures* and 5050.4B; *National Environmental Policy Act (NEPA) Implementing Instructions for Airport Actions* as a guide to preparing environmental documentation to satisfy RMI environmental laws and regulations. The project is proposed to enhance the RSA at AKIA to comply with FAA and International Civil Aviation Organization (ICAO) Annex 14 airport design standards. As an independent nation, the RMI is not subject to U.S. laws unless specifically provided for by the Compact of Free Association. The U.S. National Environmental Policy Act (US NEPA) does not apply to RMI projects funded with discretionary monies from the Airport Improvement Program (AIP) in the RMI. AIP discretionary funding is not among the activities covered by the Compact of Free Association 1985, as amended or its subsidiary agreements that requires compliance with US NEPA.

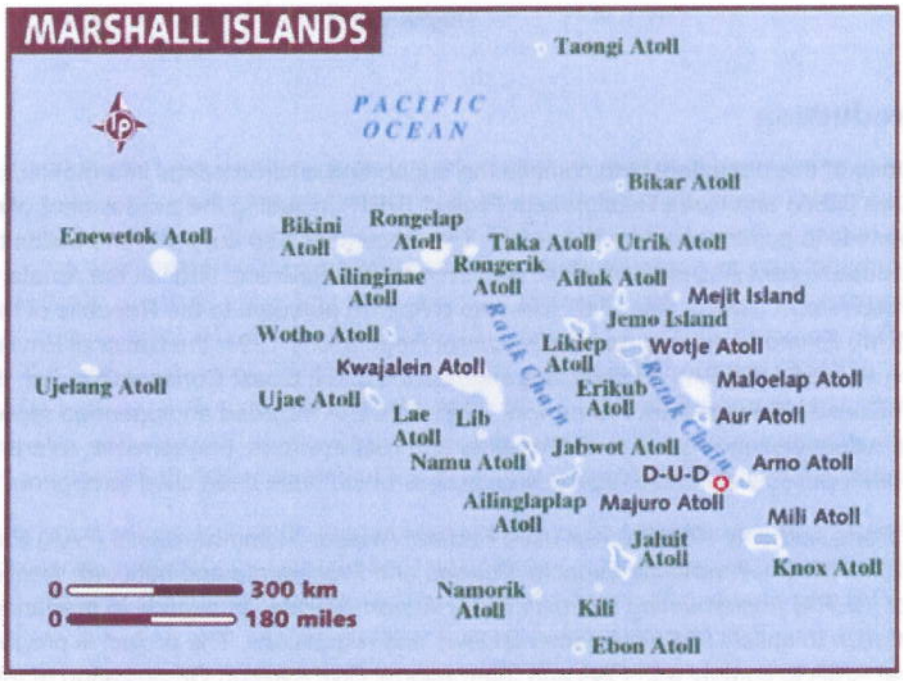
2. Background

2.1 Project Location

The RSA and Road Realignment Project are located on the atoll of Majuro, capital of the RMI. The site for the dredging to provide fill for the project is within the Majuro Lagoon. As such, the project is within the territorial waters of the RMI and the project will be undertaken in accordance with the laws and regulations of the RMI.

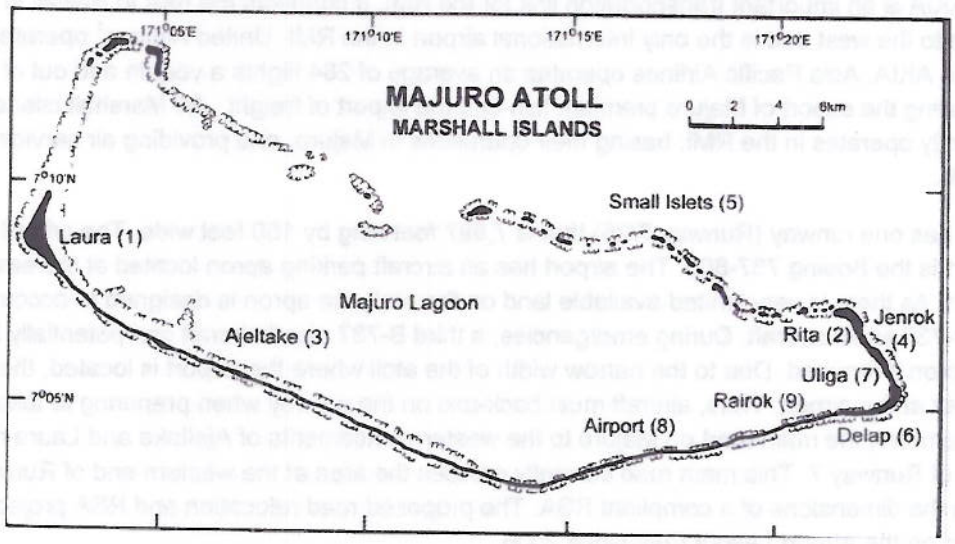
The RMI consists of 29 atolls, each made up of many islets and 5 islands in the central Pacific between 4 degrees and 14 degrees north, and 160 degrees and 173 degrees east. The total number of islands and islets in the whole Republic is approximately 1,225, spreading across a sea area of more than 750,000 square miles. The total land area is about 70 square miles. The mean height of the land is about 7 feet above sea level. The population of the RMI in 2007 was estimated to be 52,671. Figure 1 below shows the location of Majuro Atoll in the south eastern quarter within the RMI.

Figure 1: Map of the Republic of Marshall Islands



Majuro Atoll is located in the Equatorial Pacific region (171 degrees longitude east; 7 degrees latitude north). Significant areas of Majuro are urbanized and densely populated. The population of Majuro in 2007 was estimated to be 30,000 which is more than half of the total population of the RMI. Majuro is the national capital, the center of commerce and is host to the major communications links and ports of entry. Concrete residential and commercial buildings together with sealed roads have featured prominently in the south-eastern part of the atoll from Rita to the airport. Figure 2 below shows the location of the airport, in the south east of the atoll, relative to the central business areas of Delap and Uliga further to the east.

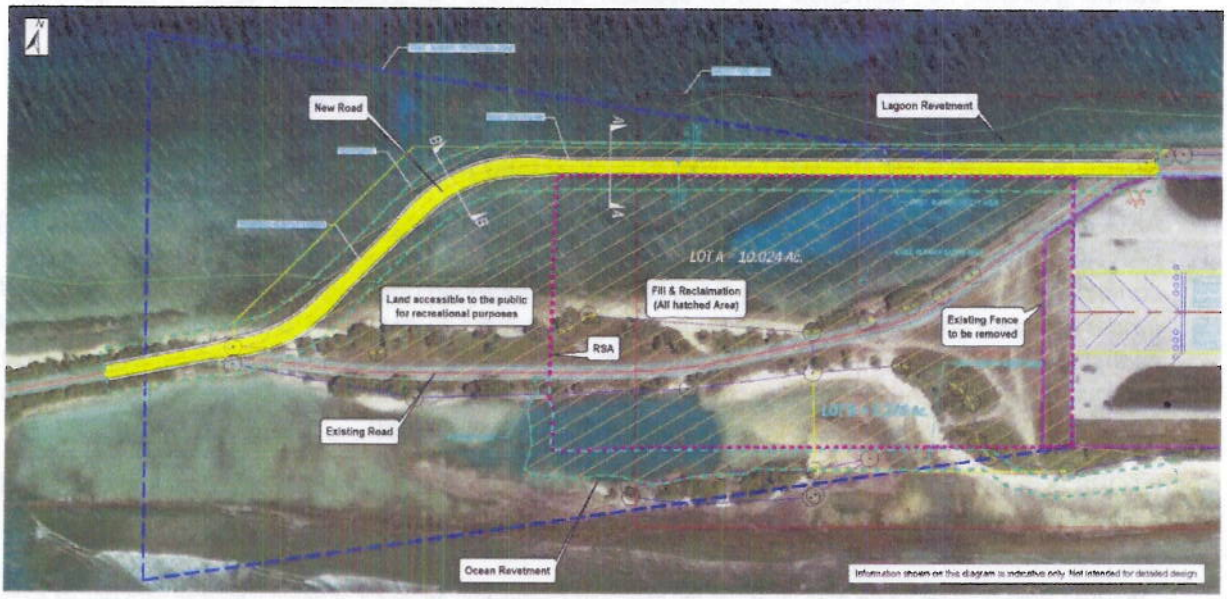
Figure 2: Map of Majuro Atoll



The atoll is elongated in shape and extends approximately 25 miles east to west and 6 miles north to south. Majuro is approximately 160 square miles in area with a lagoon of about 150 square miles.

The Project site, shown in Figure 3 below, is at the western end of Runway 7 at AKIA. The main road, being the subject of the road realignment, can be seen in the figure traversing east to west on the northern side of the runway and passing through the existing non-FAA compliant RSA.

Figure 3: West End of Runway 7 (Project Site)



2.2 Need for the Project

The AKIA is an important transportation link for the RMI. It connects the RMI to Hawaii in the east and Guam to the west and is the only international airport in the RMI. United Airlines[1] operates 400 flights per year to AKIA. Asia Pacific Airlines operates an average of 284 flights a year in and out of AKIA facilitating the export of Majuro premium fish and the import of freight. Air Marshall Islands (AMI) currently operates in the RMI, basing their operations in Majuro, and providing air service to the outer islands.

AKIA has one runway (Runway 7/25) that is 7,897 feet long by 150 feet wide. The critical aircraft for the airport is the Boeing 737-800. The airport has an aircraft parking apron located at the east end of the airport. As there is very limited available land on the atoll, the apron is designed to accommodate only two B-737 sized aircraft. During emergencies, a third B-737 sized aircraft can potentially be parked on the apron if required. Due to the narrow width of the atoll where the airport is located, there is no parallel taxiway at the airport. Thus, aircraft must back-taxi on the runway when preparing to take off. Furthermore, the main road on Majuro to the western settlements of Ajeltake and Laura runs parallel and north of Runway 7. This main road currently crosses the area at the western end of Runway 7 that is within the dimensions of a compliant RSA. The proposed road relocation and RSA projects have been shown on the Airport Layout Plan since 2006.

The proposed road relocation and RSA improvement projects are consistent with the Airport Layout Plan (ALP). The approved ALP does not show any future extensions of Runway 7/25. Therefore the proposed RSA and road relocation projects will not inhibit any future proposed development at the airport.

Currently, the national carrier Air Marshall Islands (AMI) operates a 34 passenger DeHavilland Dash-8 aircraft and two 18 passenger Dornier 228 aircraft. Japan Air Lines (JAL) provides intermittent charter flights using a Boeing 767 aircraft. General Aviation, at this airport, is for the most part limited to transiting aircraft, i.e., deliveries, that on occasion utilize AKIA as a refueling stop for small, general aviation and turbojet aircraft on route usually to either Australia, Asia, Hawaii, or mainland US. Even though the number of flight operations per year is slight, AKIA does have some corporate jet activity which is a steady contributor to the overall aircraft operations at AKIA. The airport is capable of accommodating all propeller driven aircraft, turboprop, business jets and small to mid-size turbo jet aircraft (e.g., Boeing 737, Boeing 727) and large wide body jets such as Boeing 767, 747 and 777.

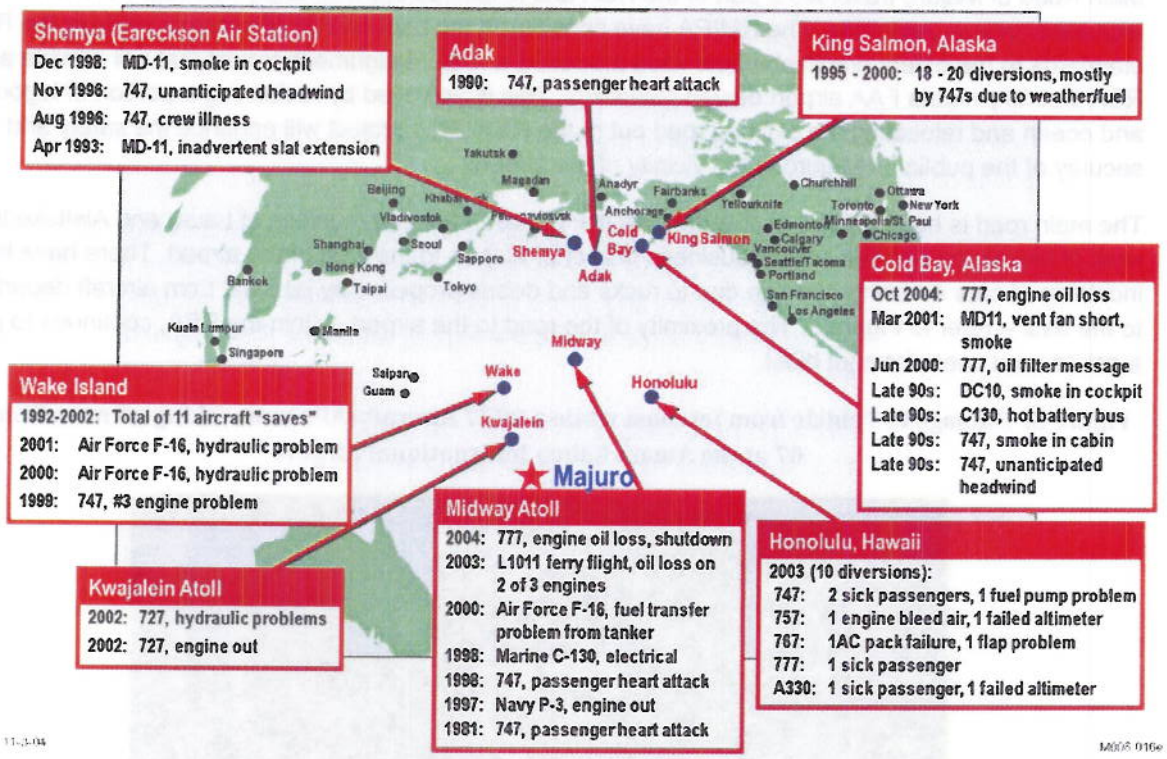
AKIA is an important airport in the Pacific Ocean for extended range twin-engine operations (ETOPS). FAA AC 120-42A states "*... extended range operations are those flights conducted over a route that contain a point further than one hour flying time at the approved one-engine inoperative cruise speed (under standard conditions in still air) from an adequate airport*". The ETOPS portion of flight is described as that portion of a fight that begins the first moment an aircraft is greater than one hour flying time at the approved single-engine inoperative cruise speed from the nearest adequate airport, and ends the last moment it is greater than one hour from the nearest adequate airport.

ETOPS is necessary for aircraft with only two engines i.e. United Airlines B737 aircraft in the event of an engine failure during flight. The AKIA is in the flight path of a number of airlines and could usefully

[1] The 2011 Draft Masterplan for AKIA identifies the operators Continental Airlines. Continental merged with United Airlines in 2012.

provide emergency landing facilities to these flights. For an airport to be designated as an ETOPS alternate airfield, it must have the capabilities, services and facilities to safely support an ETOPS operation. AKIA qualifies as an ETOPS alternate airfield. Other ETOPS alternate airfields in the Pacific include Kwajalein, Wake and Midway Islands and these have been used a number of times for emergencies in the past (Figure 4). Kwajalein and Wake Islands are US Military bases and therefore have restrictions to the use of their airports to civilian aircraft operators.

Figure 4: Use of Diversion Airports in the Vicinity of Majuro



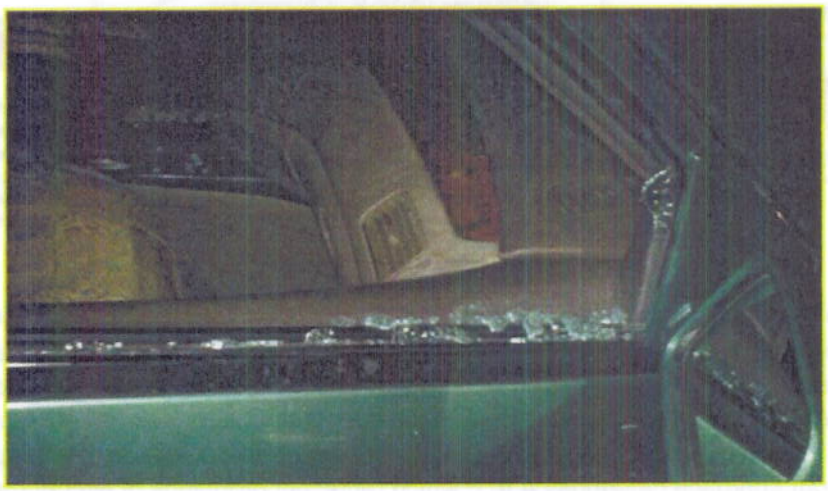
Chapter 1 of FAA Advisory Circular (AC) 150/5300-13, *Airport Design* defines a Runway Safety Area (RSA) as "an identified surface surrounding the runway prepared and suitable for reducing the risk of damage to airplanes in the event of an undershoot, overshoot or excursion from the runway." Table 3-3 of the FAA AC includes the required RSA dimensions for an airport such as AKIA, serving large commercial aircraft in Approach Categories C and D, which are shown below. Chapter 1 of the AC defines aircraft approach categories A to E which represent groupings of aircraft based on 1.3 times their stall speed in their landing configuration at the certified maximum flap setting and maximum landing weight under standard atmospheric conditions.

RSA Dimensions	Approach Category C and D (feet)
RSA Width	500
RSA Length prior to Landing	600
RSA Length Beyond the Runway	1,000

The RSA at AKIA currently does not meet the FAA's RSA standard for width and length. In addition, the Main Road of Majuro traverses a part of the RSA and is located approximately 400 feet from the extended runway centerline. The RMIPA have considered the best course of action to achieve the RSA standards to the extent practicable and have proposed a road realignment project that will provide an RSA that fully meets FAA airport design standards. This is achieved by reclaiming a portion of lagoon and ocean and relocating the existing road out of the RSA. This project will enhance the safety and security of the public on Majuro in the vicinity of the airport.

The main road is heavily used as it is the only link between the communities of Laura and Ajeltake to the west of the airport and the central business district of Majuro to the east of the airport. There have been incidents of cars suffering damage due to rocks and debris propelled by jet blast from aircraft departing to the east – refer to Figure 5. The proximity of the road to the airport, within the RSA, continues to pose a risk to road users from jet blast.

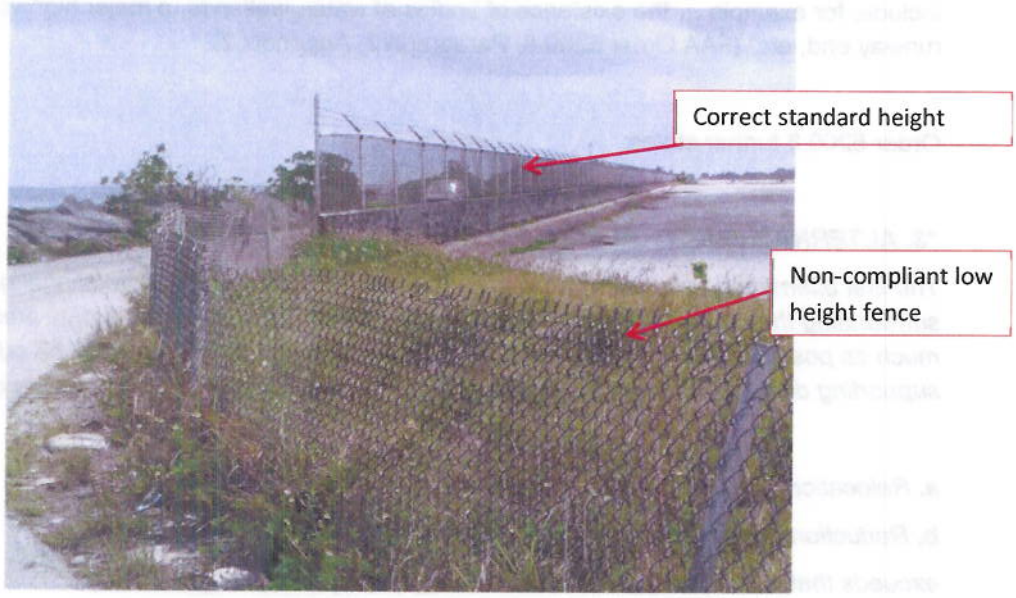
Figure 5: Damage to Vehicle from Jet Blast while a B727 Aircraft (APA) was taking off from Runway 07 at the Amata Kabua International Airport



In addition, security of the airport is a concern as the fence on the western side of the airport is only approximately 4 feet high due to the close proximity of the road to the end of the runway within the RSA - Refer to Figure 6. A 4 feet high fence does not provide adequate security to keep people and animals out of the runway environment. ICAO and Transportation Security Administration (TSA) audits of the AKIA have identified the security fencing as being an issue that requires attention by RMIPA as a matter

of priority. Security fencing is generally required to be 8 feet high chain link topped with 3 strand barbed wire to provide the necessary security for the airport.

Figure 6: The correct standard height fence (top of picture) at the side of the runway and the non-compliant low height fence (foreground) at the end of the runway.



The additional RSA will also provide greater accessibility for the firefighting and rescue equipment during aircraft incidents at AKIA.

Therefore, the primary need for the project is to enhance airport safety, improve airport security and enhance the safety of the travelling public on the main road of Majuro.

2.3 Proposed Works

2.3.1 Description of the Road Realignment and RSA Project

The RMI is the grantee of funding from the FAA under the Airport Improvement Program (AIP) to enhance safety of the AKIA by providing a RSA that meets FAA airport design standards to the extent practicable. The RMIPA is responsible for the administration of AIP funded projects at AKIA.

RMIPA plans to undertake works associated with the realignment of the Airport Road at AKIA to accommodate the Runway Safety Area (RSA) as outlined in FAA airport design standards. The proposed project includes reclamation of parts of the lagoon and the ocean with fill material to provide a graded and compacted RSA and will relocate the main road outside of the RSA.

A number of alternatives to the project and the methodology were considered. The determination of practicable alternatives is described below and the analysis of reasonable alternatives is described in Section 3 of this report.

FAA Order 5200.8, *Runway Safety Area Program*, dated 1 October 1999, states the objective of the Order is, in part, to assist airport sponsors at federally obligated airports and all RSAs at airports certificated under Title 14, Code of Federal regulations (CFR) part 139 to conform to the standards contained in AC 150/5300-13 *Airport Design*, to the extent practicable. FAA Order 5200.8 outlines criteria to be considered in evaluating the viability or RSA alternatives. These factors include historical records of accidents, airport plans as reflected in current and forecast operations, design aircraft, the extent to which the existing RSA complies with the standard, and site constraints. "Site constraints ... include, for example ... the existence of bodies of water, wetlands, a major highway, a railroad at the runway end, etc" (FAA Order 5200.8, Paragraph 2, Appendix 2).

Order 5200.8 further states:

"3. ALTERNATIVES TO BE CONSIDERED.

The first alternative to be considered in every case is constructing the traditional graded area surrounding the runway. Where it is not practicable to obtain the entire safety area in this manner, as much as possible should be obtained. Then, the following alternatives shall be addressed in the supporting documentation. The applicability of these alternatives will vary, depending on the location.

a. *Relocation, shifting, or realignment of the runway.*

b. *Reduction in runway length where the existing runway length*

exceeds that which is required for the existing or projected design aircraft,

c. *A combination of runway relocation, shifting, grading,*

realignment, or reduction

d. *Declared distances.*

e. *Engineered Materials Arresting Systems (EMAS)."*

FAA Order 5200.8, Paragraph 3, Appendix 2

For the Road Relocation and RSA Improvement Project at the airport, the RMIPA has determined its preferred alternative is to relocate the main road on Majuro Atoll out of the existing RSA and improve the RSA to meet FAA Airport Design Standards. This project is being pursued by the RMI Government in order to reduce the opportunity for people using the Main Road on Majuro as it passes by the airport from being harmed by debris propelled into the air by jet blast from an aircraft taking off and to reduce the exposure of people using the road to an aircraft that overshoots the runway end and stops in the RSA.

The first issue to be considered in evaluating alternatives is whether it is practicable to obtain a standard RSA. Practicable is defined in the Merriam-Webster dictionary as 'capable of being done or

accomplished; feasible.' Based upon approvals of the environmental impact assessment, environmental management plan, and dredging sites D and E by the RMI EPA, the agency with jurisdiction by law, there are no site or environmental constraints that render a full 1,000 foot long and 500 foot wide RSA impracticable at AKIA. This supplemental documentation indicates that alternative mitigation measures were carefully evaluated and that the proposed project includes reasonable steps to minimize harm, including those from sourcing and placing fill material. See Sections 4.3.5 and 4.3.6 below for more detail. Therefore it was not necessary to study in detail the alternatives of decreasing the length of the RSA; relocating, shifting, or realigning the runway; reducing the runway length, implementing declared distances, and installing standard engineered arresting systems (EMAS).

Relocation, shifting or realignment of the runway. As described in Section 1 of this document and the 2007 EIA, AKIA is located on Majuro Atoll, the Airport property consumes the entire width of the narrow atoll. The construction of a new aircraft hangar and the Aircraft Rescue and Fire Fighting (ARFF) station required reclamation of a portion of the Majuro Lagoon north of the runway. As noted in Section 2.2, due to the narrow width of the atoll where the airport is located, there is no parallel taxiway, thus aircraft must back-taxi on the runway when preparing to takeoff. Beyond each end of the runway, the atoll narrows substantially. Therefore, any proposed relocation, shifting or realignment of the runway would require substantial reclamation of either the Majuro Lagoon to the north, the Pacific Ocean to the south or a combination of both. This alternative would be substantially greater in cost and scope compared to the proposed action.

Reduction in runway length. As stated in Section 2.2, the design aircraft for AKIA is the Boeing 737-800. The RMIPA's Airport Layout Plan for AKIA states the mean maximum temperature at the airport is 82 degrees Fahrenheit, and has a published runway length of 7,897 feet. While the design aircraft is the B-737-800, larger wide body aircraft such as the Boeing 747, 767 and 777 also use the airport. Therefore shortening the runway to have the main road outside of the RSA would require reduction of the runway by at least 1,000 feet since the road enters the RSA immediately at the west end as shown on Figure 3. A reduction of this amount of runway length would adversely affect RMI's ability to accommodate large aircraft for ETOPS flights. Considering the remote location of the RMI in the Pacific Ocean and the substantial stage length distances to various overseas destinations such as Hawaii, Guam, New Zealand, and Australia, along with the relatively warm temperatures at the airport year around due to the equatorial location of the RMI, reduction in runway length for departures would adversely affect the maximum payload existing aircraft operators would have at AKIA.

Implement Declared Distances. Where it is impracticable to provide the clearances and dimension for RSAs to meet FAA Airport Design Standards, another acceptable means of creating an equivalent RSA is by using declared distances. Declared distances are defined in Chapter 1 of FAA Advisory Circular 150/5300-13, Airport Design, as "*the distances the Airport operator declares available and suitable for satisfying an aircraft's takeoff run, takeoff distance, accelerate-stop distance, and landing distance requirements.*" Typically, this concept involves declaring that some portion of the existing runway pavement is unavailable for specific operations, and is instead used to provide and RSA meeting applicable FAA design standards. Declared distances are also used where different runway lengths are defined for each direction of operation (i.e. when displaced thresholds are present). Pilots use these

declared distances, along with weather data and aircraft performance characteristics, to make determinations such as the maximum allowable takeoff or landing weight of the aircraft or the maximum payload and range for a flight. Declared distances at airports are considered in the Operations Specifications of commercial aircraft operators that are part of the air carrier certificates. Pilots of commercial aircraft are required to comply with such specifications. In this situation, the specified distance available for a particular operation such as landing may be different in each direction on the same runway pavement.

Considering the remote location of the RMI in the Pacific Ocean and the substantial stage length distances to various overseas destinations such as Hawaii, Guam, New Zealand, and Australia, along with the relatively warm temperatures at the airport year around due to the equatorial location of the RMI, reduction in runway length for departures would adversely affect the maximum payload existing aircraft operators would have at AKIA. Further this alternative does not relocate the main road away from the end of the runway and would not meet RMI's purpose and need to enhance the safety of people using the main road on Majuro around the airport.

Install Standard Engineered Materials Arresting Systems (EMAS). When it is not practicable to create an RSA that meets applicable FAA standards, consideration may be given to enhancing the safety of the area beyond the runway end with the installation of an EMAS. An EMAS is a specialized system installed in the RSA beyond the runway end, made of high-energy-absorbing materials. When an aircraft overruns the runway, these materials are crushed, absorbing the forward momentum of the aircraft and decelerating and arresting the aircraft's movement. The FAA requires that an EMAS be engineered to decelerate the runway's design aircraft at exist speeds of 70 knots without causing significant damage to the aircraft or injuries to the passengers.

The use of Engineered Materials Arresting Systems[2] (EMAS) was discounted as an unreasonable alternative because it would be prohibitively expensive to import and difficult to maintain due to a lack of expertise and resources on the island. Furthermore, due to the need to reclaim portions of the lagoon and ocean, concerns would continue that EMAS would not provide an equivalent level of safety. Currently there are no Pacific Island airports using EMAS because of these challenges.

The RSA will be filled and graded to conform to FAA Standards to the extent practicable. The RSA needs to be 500 feet wide and 1,000 feet long beyond the end of the runway. To meet this standard, part of the lagoon and the ocean will need to be filled and graded. Initial estimates reported in the 2007 EIA indicated that approximately 73,400 cubic yards of fill would be required on the lagoon side, and 21,000 cubic yards of fill material will be needed on the ocean side. This totaled an estimated 94,400 cubic yards of fill to be required. Consideration was given to alternatives with less volume of fill required. These are discussed in Section 3 of this report. As the design has progressed from concept to more detailed design phases there have been reassessments of the required fill volume. The estimated volume in 2009, which was the basis for the price of imported fill, was 126,200 cubic yards. Following further detailed design the estimates were revised to 119,900 cubic yards of fill for the lagoon side and 21,900 cubic yards of fill on the ocean side, giving a revised total of 141,800 cubic yards of fill.

[2] EMAS refers to high energy absorbing materials of selected strength which reliably and predictably crush under the weight of an aircraft. This material is designed to safely stop an aircraft in an emergency situation.

To protect the fill from wave attack, a 2,000 feet long rock revetment is proposed to be constructed along the length of the proposed reclamation. The revetment will cover the entire portion of new road that is constructed over what is currently open water. A total of 29,900 tons of rock is required to construct this revetment.

The proposed works also include the installation of a security fence that complies with ICAO and TSA standards on the west end of the runway. The fence will be constructed of 10 gauge, galvanized steel, chain link fabric, and at a height of 8 feet. It will be topped with three strands of barbed wire, which will be installed at a forty-five degree angle outward. The length of the proposed security fence will be approximately 2,500 feet.

2.4 Summary of Legislative Framework

The Project is within the territorial waters of the RMI and will be undertaken in accordance with the laws and regulations of the RMI. The RMI has a similar regulatory regime to the US that requires the project proponent to characterize the impacts, to consider alternatives and to provide mitigation of the effects of the project.

The relevant pieces of RMI legislation are the National Environmental Protection Act 1984 (NEPA), the Coast Conservation Act 1988 (CCA) and their implementation regulations. This legislative framework is consistent with other frameworks internationally. The Environmental Impact Assessment Regulations 1994 (EIA Regs) establish the framework to implement Part IV of the NEPA and Section 11 of the CCA by setting out standard procedures for the preparation and evaluation of an EIA for proposed public and private development activities that may affect the quality of the environment of the Republic.

An EIA is defined in section 4 of the EIA Regs as a written environmental analysis of a public or private proposed development activity imposed at the discretion of the Authority[3] as set forth in the regulations. The EIA may either be a Draft EIA, a Revised EIA or a Final EIA. Following receipt of a Preliminary Proposal[4] the RMIEPA may require further information and may meet with relevant regulatory agencies, Ministries and the proponent. Should the Authority consider the effects of a proposed activity may have a significant effect on the environment, an EIA would then be required. However, the General Manager of the Authority has discretion[5] to waive any aspect or aspects of the EIA requirements and contents enumerated in Parts III[6] and IV[7] of the EIA Regs upon sufficient showing that the fulfillment of certain requirements may be onerous or unnecessary.

The process of review and approval of a Draft EIA is set out in Part V of the EIA Regs. This process requires public notice of the Draft EIA and that the RMIEPA may convene a public hearing or hearings for facilitating public involvement in the EIA process. The General Manager of the RMIEPA[8], with the assistance of the proponent, Government and non-Government personnel as required, assess and consider public comments. The General Manager determines the need, or otherwise for revision of the Draft EIA.

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[3] The Authority is the RMI Environmental Protection Authority.
[4] Pursuant to Section 5 of the EIA Regs
5 Pursuant to Section 8(d) of the EIA Regs
[6] Part III of the EIA Regs describes the detail required in an EIA.
[7] Part IV of the EIA Regs sets out the EIA format and content.
[8] Pursuant to Section 29 (b) of the EIA Regs.

Having considered all of the information on the Project, its potential environmental effects and mitigation and monitoring provided by the proponent and deemed necessary by the General Manager of the RMIEPA, the Chairman of the RMIEPA either approves or disapproves the EIA.

Part VI of the EIA Regs describes the process after EIA approval. Section 35 of the EIA Regs provides for each regulatory entity, including the RMIEPA and at their sole discretion, the ability to require plans and specifications for the construction of the proposed activity. Such plans and specifications require approval of the RMIEPA and include:

- A description of required mitigation and monitoring measures that includes an Environmental Protection Plan (also referred to as an Environmental Management Plan or EMP).
- Plans modified after completion of the construction of the development activity to indicate the actual construction history, called "As built plans".
- Other technical information as required.

The management of potential environmental effects during the implementation phase of the Project will be undertaken in accordance with the EMP. The EMP is to be approved, and its implementation monitored, by the RMIEPA.

The purpose of the EMP is to describe the environmental management and monitoring procedures to be implemented. It is fundamental to ensuring the commitments given in obtaining approval for the Project are carried out through the construction phase. The EMP details who, what, where, when and how environmental management and mitigation measures are to be implemented. The implementation of environmental controls will, to the extent practicable, follow industry best standard practice.

2.5 Project Timeline

2006 – Project planning began.

May 2006 – RMI Cabinet approve the RSA and Road Realignment Project as proposed by RMI Ports Authority

April 2007 – Design Services commenced.

September 2007 – A scoping report and original draft EIA for the RSA and Airport Road Realignment is submitted for approval with RMIEPA for construction of the reclamation and rock wall including the importation of rock and fill material. The draft EIA was also provided to Government Ministries and agencies to review and provide comments.

October 2007 – the scoping report was approved by RMIEPA. The draft EIA Document was then amended to include RMIEPA comments and requests.

March/April 2008 – Draft EIA and Scoping report public comment period.

April 2008 – A Public Hearing on the draft EIA was held 24th April. Topics that were raised by attendees related to concerns around the loss of the informal picnic area and general support for importation of fill and rock armor.

May 2008 – RMIEPA approves the EIA and the EIA is issued as final. The EIA for the project was approved by the RMIEPA provided that the rock boulders for the armor stone revetment and the fill material for the reclamation requirements of the project were to be imported from outside of the RMI.

May/June 2009 – Invitations for Bids were publicly advertised internationally and e-mailed specifically to 4 contractors, (2 from RMI, 1 from Hawaii and 1 from China) who had previously shown interest in the proposed works. There was a sole bidder (Pacific International Incorporated) for the works. RMIPA was advised that the reasons contractors outside of the RMI did not submit a bid were due to restrictions associated with not being able to source materials locally, high cost to mobilize to site and competition with interest in the larger Guam Military buildup contracts purported to be emerging at the same time. Cost estimates, based on a revised estimate of 126,200 cubic yards of fill, for the proposed works were provided by the contractor in the sum of approximately $21 million which exceeded project funding, and was twice what was previously estimated by engineers for the project.

July 2009 – The project was deferred by the FAA due to funding constraints. The cost prohibitive item in particular was the proposed fill material to be imported from outside of the RMI given the substantial volume required for the reclamation.

October 2009 – The RMIPA, in direct consultation with the RMIEPA, investigated options for sourcing fill material locally from within the RMI, and particularly from within the airport leased area in an effort to reduce project costs and to make bidding on the project more attractive to international contractors.

April 2010 – A sediment assessment was undertaken by RMIEPA with the assistance of University of Hawaii Sea Grant Extension Agent based at the College of the Marshall Islands. The survey identified potential borrow sites for sand and gravel within the lagoon in the vicinity of the airport leased area. The SOPAC 2007 (Technical Note on Marine Aggregates Assessment in Selected sites of the Majuro Lagoon Rim, Republic of the Marshall Islands) and University of Hawaii Sea Grant (UHSG) Study[9]reports were included as part of the bid documents.

June 2010 – Invitations for Bids were publically advertised internationally for a second time. 6 contractors showed interest; 2 contractors from RMI, 3 from Guam and 1 from Hawaii.

July 2010 - Similarly to the first bidding of the project, there was only one bid received.

November 2010 – FAA concurred with the RMIPA to award the construction contract to the sole bidder for $15.8 million.

December 2010 – Construction Contract was executed.

March 2011 – Notice to Proceed issued to Pacific International Incorporated (PII).

March 2011 – A revised site plan showing proposed dredging methodology and associated Environmental Management Plan is submitted by the contractor to RMIEPA for consideration. Refer to Appendix 1 Drawing 'Site Development Plan 1 (RSA Site)' which shows the dredging area to the north of the RSA reclamation area.

[9] The RMIEPA requested technical assistance from the UHSG College program as to the nature of the sedimentary deposits within the airport lease area and its potential use for reclamation.

April 2011 – RMIEPA issues a permit (13th April 2011) for the project to use a borrow site located immediately offshore of RSA reclamation site, with a dredging depth of 30 feet or greater. The revised site plan for the works included the construction of a causeway parallel to the RSA reclamation site in order for dredging machinery to access the 30 feet depths. Refer to Appendix 1 Drawing 'Site Development Plan 1 (RSA Site)' which shows the dredging area to the north of the RSA reclamation area.

July 2011 – RMIEPA were advised by RMIPA that dredging activities at the previously approved site were on hold while concerns raised by members of the public in relation to the dredging sites and methodology were addressed in consultation with the stakeholders. The main issues raised by the public related to dredging and potential effects of the dredging on coral. Members of the public expressed their opinion that they preferred the fill to be sourced from offshore dredge sites or imported from outside of the RMI.

July 2011 – Cost estimates for dredging options, including importation of fill from outside of the RMI, offshore dredging in depths greater than 30 feet and near shore dredging in depths less than 30 feet were reviewed and provided by PII in a letter to RMIPA dated 27th July 2011. The estimates provided for offshore dredging and importation of fill material from outside of the RMI exceeded the 2009 original bid amount which had been rejected by the FAA for project funding.

July to October 2011 – Alternative local nearshore dredging options are investigated by RMIPA. Three (3) alternative dredge sites were considered: Ajeltake (Mile 17 to 18); the Maren Aetok area adjacent to the RSA site; and the eastern end of the airport runway-lagoon side reservoirs. Both Ajeltake and Maren Aetok are located outside of the airport lease area, which proved difficult to obtain landowner consent and access to the private sites.

October 2011 – A revised site plan and EMP were submitted to RMIEPA showing a near shore dredging site inside the airport lease area. The area proposed for dredging in the revised site plan called for dredging of the reef hardpan adjacent to the shoreline- refer to Appendix 1 Drawing 'Site Development Plan 2 (Airport Reservoir)'. The method was based on the lagoon quarry that PII had been operating for a number of years under RMIEPA oversight at Lojemwa. Because the shoreline of the area was being severely eroded and the water reservoirs and the access road to and from the airport threatened, the new site plan proposed to utilize leftover rocks from the dredged hardpan to install an armor stone revetment as shoreline protection.

As the nature of the proposed works had changed significantly to those originally proposed, the RMIEPA advised the RMIPA that a public hearing would need to be conducted to consider the alternative site proposed lagoon side of the airport water reservoirs.

October 2011 – Second Public hearing held on 25th October 2011.

October to November 2011 – Public comment period. During the public comment period, the RMIPA, RMIEPA and contractor (PII) discussed dredging location and methodology options as discussed elsewhere in this document.

November 2011 – Meetings were held with RMIEPA, RMIPA, PII and the specialist involved in the UHSG Extension survey of aggregates in the Majuro lagoon to discuss the comments received and concerns raised during the public hearing and comment period. As a result of the meeting, a new option

involving the dredging in the area east of the terminal and adjacent to the water reservoirs but outside of the reef hardpan area was discussed and agreed as the preferred option going forward. It was considered that sufficient information on this site had been provided other than that required in the EMP[10].

This option was subsequently presented by the RMIEPA to their Board of Directors for consideration.

December 2011 – RMIEPA Board of Directors approved near shore dredge site inside airport lease area with conditions on 9th December 2011. This is labeled as Site E refer to Appendix 1 'Site Development Plan 4 (Airport Reservoir)' drawing.

December 2011 to April 2012 – RMIPA has been considering comments made by members of the public and the US Government agencies.

[10] See Section 2.4 of this document for a description of the RMIEPA's role, responsibilities and discretion on these matters.

3. RSA and Road Realignment Alternatives Considered

The following alternatives to the RSA and Road Realignment Project were described in the '2007 Draft EIA', that was approved by RMIEPA May 2008, where both the fill and rock were to be imported. The options considered range from "No Action"; relocating the road and not making the road to meet FAA and ICAO standards; partial relocation of the road and full relocation of the road to meet FAA and ICAO standards.

3.1 Alternative 1 – Road realignment adjacent to the RSA and construction of a standard RSA (the filling and grading of RSA to conform to AC 150/5300-13 Section 305) (Proposed Action).

In this alternative RMIPA proposed to reclaim a portion of the lagoon at Majuro and a portion of Oceanside reef to meet FAA airport design standards for a graded RSA beyond the approach end of Runway 7 at AKIA. The area of reclamation is approximately 9 acres and was initially estimated to require 94,400 cubic yards fill material[11]. Under this alternative, a portion of the main road would be outside of the RSA on fill material into the Majuro Lagoon and the Pacific Ocean and security fencing would be installed.

Materials will be required for the reclamation and road realignment to provide protection from wave action on both sides (lagoon and ocean sides).

Methods of sourcing fill material and placement are described further below.

3.2 Alternative 2 - Road realignment in the form of a causeway, which would be located adjacent to the boundary of the RSA.

Under this alternative the primary objective is to relocate the road outside of the RSA to the extent practicable. The RSA itself would not be enhanced under this alternative. This alternative would not require the land inside the road causeway to be filled. The primary focus of this alternative would be to provide greater separation between road users and the end of the runway at the airport to enhance safety and minimize jet blast effects. This would solve the problem of flying debris mobilized by jet blast hitting cars on the main road and also requires less reclamation fill than should the RSA be provided. The existing RSA would remain unchanged and not be compliant with FAA airport design standards. The security fence on the western side would also remain unchanged.

3.3 Alternative 3 - Building a wall to protect automobiles from jet blast with no improvement to the existing roadway.

Under this alternative the safety of road users would be provided for by providing protection from jet blast. The RSA would remain unchanged and not be compliant with FAA airport design standards. The security fence on the western side of the airport would also remain unchanged.

3.4 Alternative 4 – No action

Pursuant to Section 21 of the RMI EIA Regulations 1994, the implementing regulations of the RMIEPA, the no action alternative has been considered.

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[11] Subsequent more detailed designs revised this estimate to a total of 126,200 cy and then 141,800 cy of fill as discussed in the Project Timeline section of this report.

Under the no action alternative, the Road Realignment Project would not happen. The RSA would remain non-compliant with FAA airport design standards and the road would remain in the same location with people subject to jet blast. The security fence on the western side of the airport would also remain unchanged.

3.5 Discussion of Alternatives to RSA and Road Realignment Project

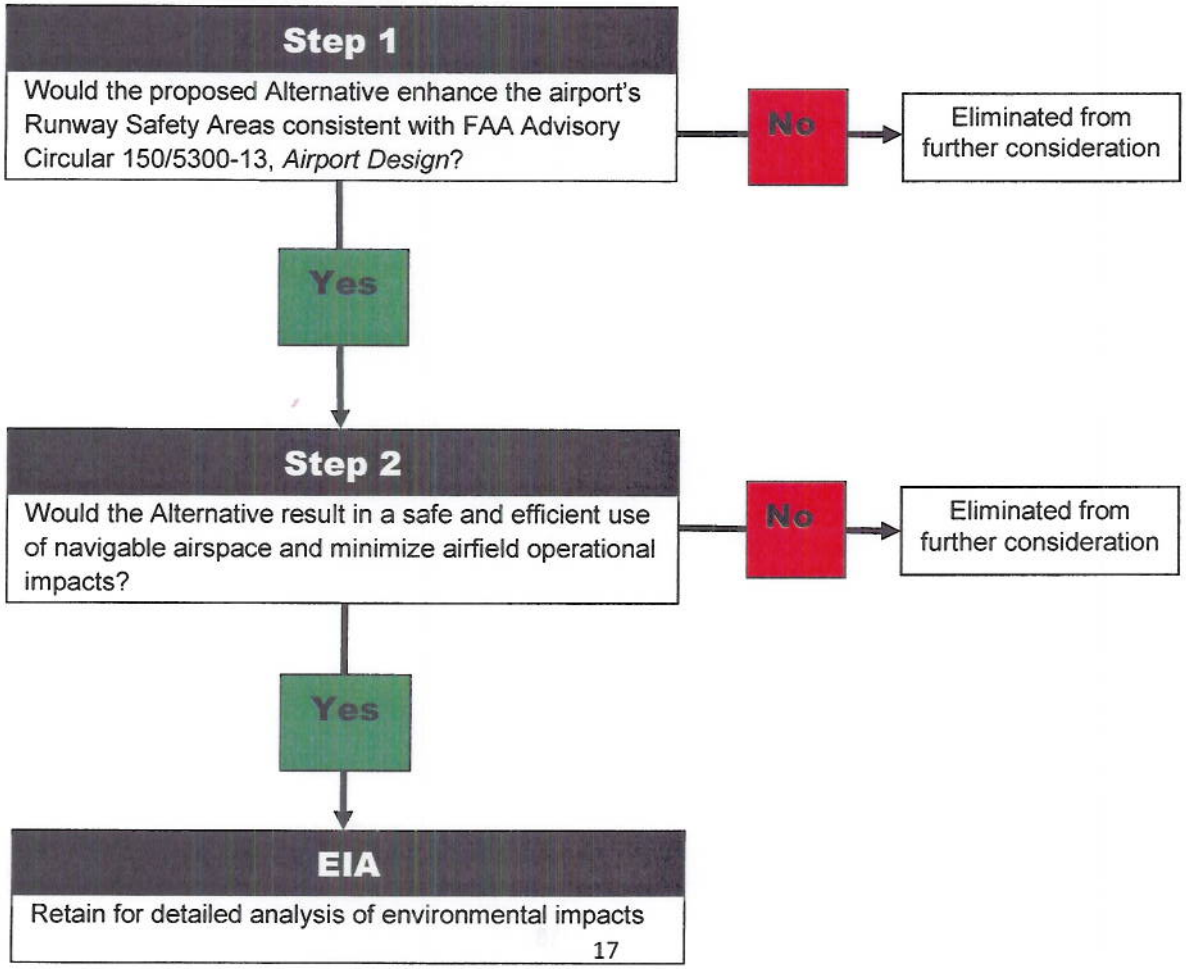
Once it was determined that a full RSA was practicable, a two-step alternatives evaluation process was used by the RMIPA to evaluate the proposed action and determine if there were other reasonable alternatives.

The first step – *will the alternative meet the purpose and need to provide an RSA that meets FAA airport design standards and relocate the main road further away from the end of the runway?*

The second step – *would the alternative result in a safe and efficient use of navigable airspace and minimize airfield operational impacts?*

The following figure (Figure 7) provides a graphic depiction of the alternatives analysis investigation steps.

Figure 7: Process for the Assessment of Alternatives to the RSA and Road Realignment Project



Based on the assessment process above, Alternatives 2 and 3 were eliminated from further consideration as the RSA would remain unchanged and inconsistent with FAA Advisory Circular 150/5300-13, *Airport Design.* In addition, Alternative 3 proposes a wall to minimize jet blast would introduce an obstruction to air navigation. Therefore Alternatives 2 and 3 are not reasonable alternatives and have been eliminated from further consideration.

Alternative 1, the proposed action, and Alternative 4, no action, were retained for further evaluation.

Alternative 4 was not recommended because it fails to address the issue of public safety. This alternative does not provide the means to ensure safety for aircraft landing and taking off from the airport. It also fails to address the safety of the community of Majuro who use the airport roadway daily. This road runs directly into the airport RSA, exposing vehicles to jet blast and puts them into harm's way should an aircraft have trouble and over shoot the runway.

Under Alternative 1, additional analysis on the source of fill material and method of extraction were evaluated. The following Section 4 describes the consideration of fill material source options.

4. Material Source Options (Subsequent to EIA 2008 Approval)

The following fill material source options were discussed at the meeting between RMIPA and RMIEPA in July 2011:

1. Importing the fill material from off-island
2. Dredging from offshore and potential sites
3. Nearshore dredging and potential sites

4.1 Option 1 – Importing Fill Material from off Island

Under this option fill material would be imported from a country other than the RMI. As part of the bidding process the RMIPA identified potential countries to import fill from. These included Nauru, Philippines or China, Pohnpei, Kosrae, Palau, Yap and Guam. It was determined that Nauru has no fill material available. Only rock is available and so Nauru was eliminated as a potential import source. Pohnpei, Kosrae, Palau, Yap and Guam do not have sufficient fill material available. These countries also tend to import fill materials for their own needs. The Philippines or China are options but importation would need to be via container ships rather than barges – with a maximum of 30,000 tons per ship. Using an average of 1.215 tons per cubic yard for moist earth, this would result in approximately 6 ship loads to import the 141,800 cubic yards required for the proposed works. The ship turn-around time is 30 to 45 days with an average unload time of 10 days. It is noted that there are charges of $10,000 per day for any unloading days in excess of 10 days so there is a project cost risk with any delays.

The Delap Dock facility on Majuro is the only available dock facility, and is not large enough to manage the quantities of material from such large ships. Also there would be substantial impact from the 14,000 truckloads of fill material that would need to be transported from the dock to the fill site on the public road and bridge. Hence the ships would need to transfer material to a barge and then unload the barge at the RSA causeway and use an excavator and trucks to haul to the reclamation site. This would then result in the double handling of material and would increase the time taken to complete the reclamation.

In addition, the RMI is a group of isolated atolls and the placement of foreign fill material to the RMI poses a potential biosecurity risk. Furthermore, as vessels from other countries may discharge ballast water or have material attached to vessel hulls (such as encrusting organisms), and foreign material could introduce organisms and minerals that could be hazardous to native plants, fish and corals.

Although this option would not require a dredging permit from the RMIEPA, there would still be potential environmental and social impacts caused by the movement of materials from ships to the proposed reclamation site such as impacts from traffic.

This option for fill material source was rejected because of the biosecurity concerns of imported material coupled with the logistics of shipping the volume of material required for fill over a substantial distance, plus the substantial challenges of offloading material from either a cargo vessel or barge at the RSA site. While technically feasible, each step to the importation of fill material from another country adds considerable cost to the project. In the original bid price (2009) the importation of fill was $9.1 million (126,200cy at $72.42/cy). The contractor has estimated that costs to import fill from outside of the RMI will now cost $16.3 million (141,800cy at $115/cy). If this option is accepted it will result in a total project cost of $27 million. As previously mentioned in this document, the FAA considered the 2009 bid price (approximately $21 million) to be unacceptable and they consequently rejected the RMIPA's application

for project funding from the AIP. The RMIPA is unable to progress the project in the absence of the grant funding. The cost ($27 million) to import fill material is therefore likely to still be unacceptable by the FAA and the RMIPA.

4.2 Option 2 – Offshore Dredging

Potential offshore sites were identified specifically for the RSA and Road Realignment Project by RMIEPA and focused on areas around the airport to minimize cost of the project and minimize disruption to traffic on the main road. Sites recommended in the UHSG and SOPAC (Appendix 5) reports were reviewed. While other potential sites may exist elsewhere in Majuro, the materials are not likely to meet the requirements for fill in terms of composition. Also the RMI Government has experienced resistance from landowners regarding removal of material not controlled directly by the RMI Government. A recently proposed government project to construct important additional water reservoirs on private land was unable to proceed due to difficulties with resolving issues with the landowners.

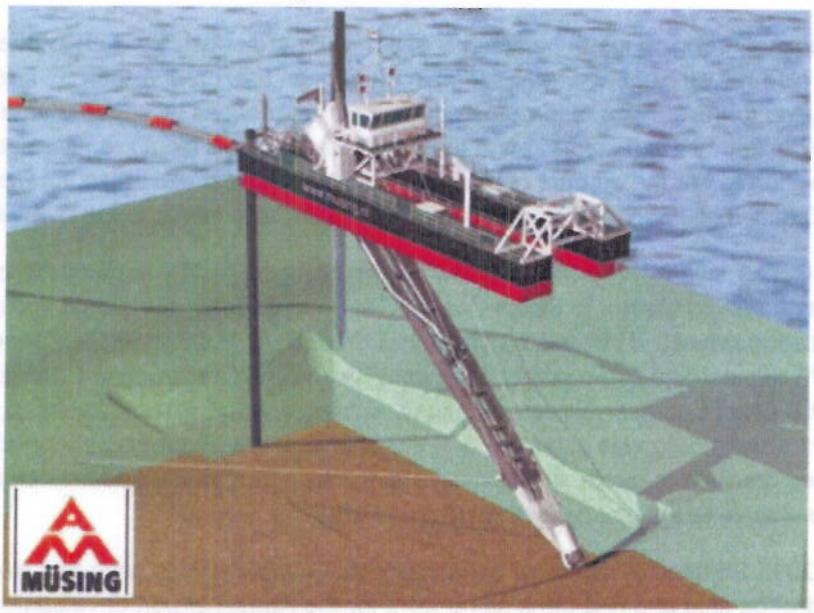
Under this option the material required for the RSA project would be sourced from the sand and gravel deposits in the lagoon in water depths greater than 30 feet. Below depths of 30 feet, coral growth is not as prolific and therefore effects from the dredging would not be as damaging to coral. Offshore dredging methodologies still have environmental impacts as they are indeterminate in the material they extract and result in the seabed and all of the fauna and flora (including the coral at this depth) being extracted. Generally dredging for material at greater depth also requires specialized equipment.

4.2.1 Suction Dredge

Offshore dredging of material from depths greater than 30 feet could be undertaken by a suction dredge mounted on a barge. Suction dredges operate by sucking water and sediment up through a long tube, like some vacuum cleaners but on a larger scale.

A cutter suction dredger (CSD) is a stationary dredger mounted on a purpose built barge which makes use of a "cutter head" to loosen the material to be dredged. It pumps the dredged material ashore or to a barge via a pipeline. The main limitation of a CSD is the wave conditions that it can work in. Since it is a stationary dredger it is affected by waves. Sites such as Ajeltake which are exposed to the waves generated by the predominant north easterly winds will therefore be difficult for CSD to operate during some common sea conditions. Figure 8 below illustrates the operation of a CSD.

Figure 8: Illustration of a Cutter Head Suction Dredge



In July 2011 Arthur Kilander of Portable Hydraulic Dredging, Inc, an experienced cutter head suction dredging subcontractor, visited the site and reviewed the Technical Note on Marine Aggregates Assessment in Selected sites of the Majuro Lagoon Rim, Republic of the Marshall Islands, prepared by SOPAC in September 2007. He advised that he would not bring his equipment to work at any of the sites in Majuro until further investigative work was carried out to confirm that his equipment and methodology was suitable.

Previous experience with a cutter suction dredge that PII purchased and imported for work in the Majuro Lagoon in 2010 resulted in poor performance due to the consolidated material within the sand and gravel deposits. The work was for the Airport Rescue and Fire Fighting (ARFF) facility reclamation. The problem was that the extraction process was inefficient due to the buried consolidated material in the sand and gravel deposits. The cutter head had problems with cutting the buried consolidated material at the required rate, resulting in delays to the project. The material that was able to be extracted was suitable for the reclamation project, but the rate of extraction was too slow to be economically viable.

Even if further investigations proved suitable to suction dredge at Rita or Delap (the sites identified as potentially suitable for dredging of depths greater than 30 feet in the SOPAC 2007 report) the dredging methodology would include the suction dredge and equipment, an additional 2 barges, a tug boat and further handling work and time to remove material from the barges. This increases the cost of dredging by a factor of 2 to 3 compared with land based near shore dredging.

4.2.2 Clam Shell Bucket Dredging

Clam Shell bucket dredging involves a grab dredger which picks up seabed material with a clam shell bucket that hangs from an onboard crane or a crane barge. The clamshell bucket is usually mechanically operated and the opening and closing action is operated by a cable (Figure 9). Similarly to cutter head

suction dredging, clam shell bucket dredging would require an additional 2 barges, a tug boat and further handling work and time to remove material from the barges.

Clamshell bucket dredging is not particularly effective if hard substrate is encountered. Clam shell bucket dredging is also not efficient at depths found in the lagoon (i.e. greater than 30 feet) as by the time the bucket is pulled to the surface; a large percentage of material has washed out due to water circulation through the bucket as it is raised through the water column. This would require substantially increased time of operation to win the amount of material required for the project than if it was sourced at depths less than 30 feet. The increased time of operations would also increase the overall cost of the project.

Kwan Sing Construction Corporation carried out the dredging for the reclamation of the Pohnpei Airport Extension as a sub-contractor to Penta Ocean. The total quantity of material dredged was similar to the RSA reclamation project. They used a clam shell dredger on a barge as their principal method of dredging. PII requested a sub-contract price from Kwan Sing Construction Corp. and met with Francis Fok, Owner & Chief Engineer, Eduardo Estigoy, Manager, and Ben-Hur Tolentino, President in Manila in August 2011. Kwan Sing was given the SOPAC studies and bathometric information of the Majuro lagoon. They declined to quote and advised that the type of material and the contour of the sea bottom were not conducive to the clamshell dredging carried out at Pohnpei.

In October 2011 PII hired a Japanese consultant, Mr Yutaka Shimizu, who had owned and operated a clam shell dredge ship and had done some work for the Kansai airport development. He was asked to evaluate other locations in the Majuro lagoon as recommended in the SOPAC report. His evaluation was similar to the advice from Kwan Sing Construction Corp. He considered that clam shell and suction dredging would probably work with large equipment, but the due to the high set up costs of the large equipment it would not be financially viable for the size of the project.

Figure 9: A mechanical clamshell bucket

4.2.3 Summary of Offshore Dredging as an Option

Despite the bids for the work being publicly advertised internationally two separate times, there was only a sole bidder each time – a locally based contractor. The sole bidder for the project does not have the necessary equipment to undertake offshore dredging in depths greater than 30 feet and therefore additional costs would be incurred for the equipment and the 5-6 months additional time estimated as being required for sourcing additional equipment. The relative small scale of the RSA and Road Realignment Project means that the project is not appealing or economically viable for larger dredging companies with suction dredging equipment suitable for this kind of dredging.

In addition, the more complicated offshore operational, logistical and silt mitigation requirements will significantly increase costs compared to dragline dredging from the near shore. The estimate of costs provided by PII to the RMIPA for offshore dredging in depths greater than 30 feet for the RSA site was $11.8 million (141,800cy at $83.60/cy) in July 2011. If this option was accepted then this would result in a total project cost of $23 million (includes $0.5 million cost of 5 – 6 month additional time).

Offshore dredging is not considered to be economically viable by the RMIPA for the RSA project and has been rejected as an option for the proposed project.

4.3 Option 3 – Nearshore Dredging

Under this option, sites near the shore and in depths less than 30 feet were considered, including hardpan reef mining (refer to Figure 15). Dredging in the near shore would consist of dragline dredging, similar to that used by PII's quarry site and what has occurred in the RMI in the past. Dragline dredging is usually undertaken from a shore based location or from a specifically constructed causeway. A figure of a typical dragline dredge set up is shown in Figure 10 below.

Figure 10: Example of a Dragline Dredging Operation

Majuro Lagoon has had continued physical and biological anthropogenic (human induced) alterations over the past 50 years. Many of the physical alterations are associated with the development of Majuro's residential and commercial areas (e.g. the central business district Delap Uliga Darrit (DUD) of Majuro) on the islands located along the southern side of the atoll rim (from DUD to Laura in the west). The northern islands of the atoll due to their isolation (not accessible by road) have been subjected to considerably less anthropogenic disturbances.

The U.S. National Oceanic and Atmospheric Administration (NOAA) report on the state of coral reef ecosystems in the RMI[12] states that the coral reef ecosystems in the Marshall Islands are in excellent condition. The outer and less populated atolls in particular support healthy and diverse communities of marine life. However, in recent years the coral reefs of the Marshall Islands have become increasingly threatened by pressures of fishing, climate change and sea level rise, increased urbanization and loss of cultural traditions. Furthermore, coral reefs near the population centers at Majuro atoll (30,000) and Ebeye (15,000) are far more impacted by fishing and pollution than other parts of the RMI.

Coral growth within the Majuro Lagoon has been investigated in the past and results indicate that there are a number of factors affecting the health of corals in Majuro. In particular, coral health deteriorates closer to urban centers due to anthropogenic factors such as pollution, nutrient enrichment and boat

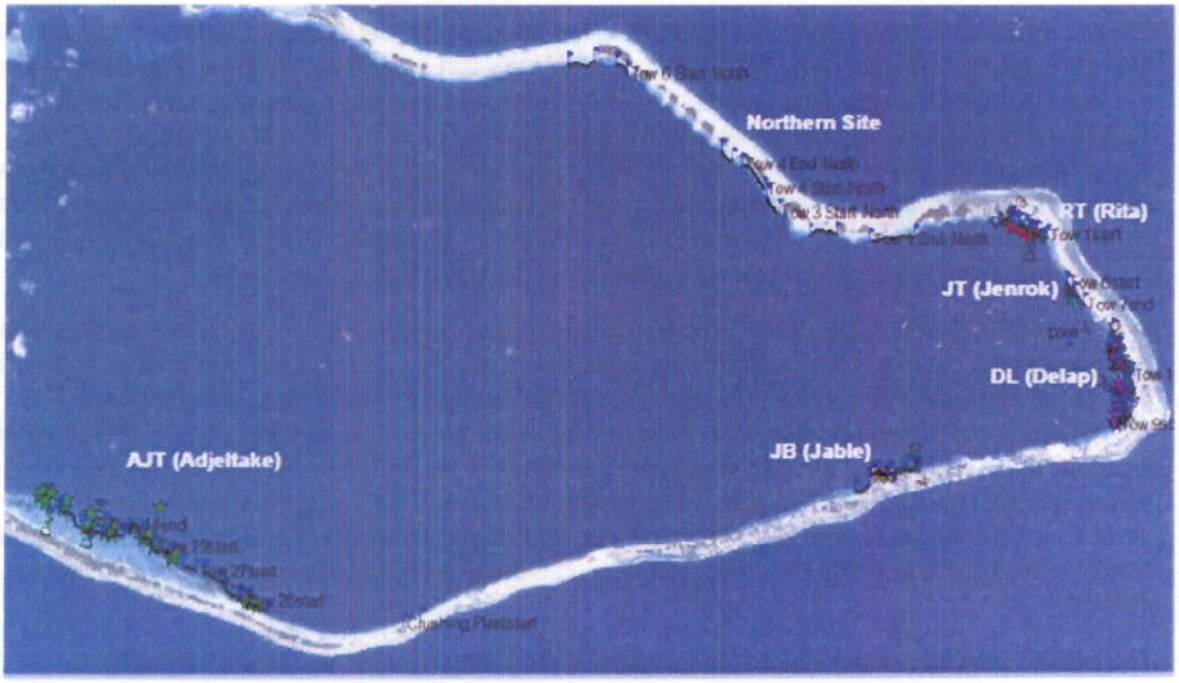
[12] Beger, Maria; Jacobson, Dean, Pinca, Silvia, et al, The State of Coral Reef Ecosystems of the Republic of the Marshall Islands; cited in The State of Coral Reef Ecosystems of the United States and Pacific Freely Associated States. U.S. National Oceanic and Atmospheric Administration, pages 387-417, 2008.

groundings. The May 2008 EU-SOPAC Rapid Biological Marine Assessment report[13] discusses the results of a marine biological assessment of five sites (Rita RT; Jenrok JT; Delap DL; Jabel JB and Ajeltake AJT – see Figure 11). In addition, seven inshore lagoon reef sites associated with the northern fringing reef between Rita and Calalin Island were investigated (Figure 13). A Rapid Biological Marine Assessment is a survey that provides a quick assessment of the biological value of an area.

Garbage both from residential (e.g. diapers, plastic bags, cans, washing machines) and commercial (rebar, lumber, concrete) sources was commonly found at all sites assessed, with large rubbish piles found at the assessment sites RT, JT and DL. Plastics and nuisance flotsam and jetsam were also prevalent on all shores neighboring the assessment sites.

The report found that the marine biodiversity and hard coral health at the southern sites of Majuro atoll (AJT, JB, DL, JT and RT) varied considerably. The marine biodiversity and hard coral health at the sites located on the northern side of the Majuro Lagoon have been subjected to considerably less anthropogenic impacts and maintain relatively healthy reef systems. In general, the biological integrity and marine biodiversity of the lagoon marine benthic habitats and associated organisms improves further away from the population centers of the atoll (from east to west – authors personal observations, 1992 – 2007)[13].

Figure 11: Sites Investigated in the May 2008 EU-SOPAC



[13] Lindsay, Stephen, *Rapid Biological Marine Assessment of the Proposed RMI-EPA Sand and Aggregate Dredging Site Locations within Majuro Lagoon, Republic of the Marshall Islands*, Pacific Islands Applied Geoscience Commission - SOPAC Technical Report 409, page 22, May 2008

The 2008 EU-SOPAC Rapid Biological Marine Assessment report[13] (page 22) states that there are a number of biological (e.g. predators, pathogens) and abiotic factors (e.g. sea water temperature) that have been reported to be detrimental and cause mortality in hard corals (Figure 12).

Figure 12: Coral Damage from Crown of Thorns Starfish (left) and Macro Algae Beds (Halimeda sp)(right) (Source: EU-SOPAC Rapid Biological Marine Assessment report, May 2008)

These organisms and processes are a natural component of any reef system and are associated with the reef systems of Majuro Atoll. The Crown of Thorns starfish, a predator of corals, had an outbreak in the years 2003-2008 in the western half of the Majuro Lagoon and was reported to have caused considerable coral mortality (personal observations, Jacobson, 2007[14]). The May 2008 EU-SOPAC Rapid Biological Marine Assessment report[13] notes on page 23 that the majority of Majuro based marine dive tourism operators utilize the reefs associated with passes and outside reef locations which have considerable higher live coral cover and that the only site investigated out of the five southern sites that is utilized by local tourism operators is RT because of the shipwreck in that location[13].

In the May 2008 EU-SOPAC Rapid Biological Marine Assessment report, physical damage was noted as being evident in the hard coral communities assessed (e.g. hard coral removal, reclamation activities, boat groundings, rubbish and anchors) and hard coral stress and mortality was witnessed and was linked to past and present dredge operations (e.g. opposite the islands garbage dump). This report cites a census in 2002 which estimated the national population to be 73,630 of which approximately 50 percent (37,000 people) live in Majuro. According to Goldberg, Adams and Albert, *et al*, less than 1 percent of the corals at Majuro have been lost due to dredging, however, 30-50 percent has been lost due to disease. 30 percent of Majuro's oceanic (non-lagoon) reefs have been adversely affected by disease[14].

The reports cited above indicate that the major threats to Majuro coral are factors attributed to anthropogenic impacts such as disease, pollution, introduction of invasive species, and physical impacts

[14]Cited in Goldberg, Jeremy; Adams, Katrina, Albert, Julita, et al, Status of the Coral Reefs of the World: 2008, Chapter 14 Status of Coral Reef Resources in Micronesia and American Samoa, page 205, 2008, http://www.docstoc.com/docs/32522944/14-STATUS-OF-CORAL-REEF-RESOURCES-IN-MICRONESIA-AND

from boat groundings, fishing, anchors and dredging. This is evidenced in the less healthy state of the corals investigated at the five southern sites compared with the less accessible northern sites. Dredging is noted as an adverse impact on corals but is not seen to be a major factor in their decline. The May 2008 EU-SOPAC Rapid Biological Marine Assessment report[15] notes that all dredging operations in the coastal marine area cause environmental disturbance and have the potential to degrade the environmental integrity of both the target area and the nearby surrounding reef systems. The intensity and duration of the impacts is site specific and generally decreases once the dredging operation is terminated. The 2008 EU-SOPAC Report states "*the lagoon areas associated with the five sites assessed and the northern reefs sites are not biologically pristine, however benthic coral reef communities show considerable resilience to these anthropogenic factors*". The report goes on to state that impacts can be significantly reduced through careful on site planning, management and monitoring.

The report describes the biodiversity of site JB, being the closest to the proposed dredge site, (Refer to Figure 11 above) as low to medium and was not considered unique in the Majuro Lagoon. On the other hand, the biodiversity at the AJT site, in proximity to previously considered dredge sites, is described as medium to high and although not unique to the lagoon, contains a healthy functioning reef. These reef areas and adult colonies would play an important role in the long-term recruitment of corals throughout the lagoon. Section 4.3.6 of this report discusses the condition of the preferred site (Site E) noting that it has been previously dredged as part of the airport and reservoir construction in the early 1970s and the coral has, to a degree and subject to a range of anthropogenic stressors, regenerated.

At a regional and national level the literature suggests that there is an extensive resource of excellent quality coral reef ecosystem. The damage or potential loss of a relatively small area of coral reef ecosystem as a consequence of this project, in an area that has already been significantly degraded by a range of other anthropogenic stressors, has been considered in this broader context.

4.3.1 Nearshore Dredge Sites Investigated

Potential nearshore sites were identified specifically for the RSA and Road Realignment Project by RMIEPA[16] and focused on areas around the airport to minimize cost of the project and minimize disruption to traffic on the main road. There is a strong cultural association to the land by landowners. The RMI Government has previously experienced resistance from landowners to the removal of material not controlled directly by the RMI Government. Based on this experience the RMI government has been hesitant to use eminent domain to obtain the land necessary for dredging. Nearshore extraction of materials for fill has been an important concern raised by landowners and other concerned citizens on Majuro. While the Government of the Republic of the Marshall Islands has the power of Eminent Domain, it exercises this authority carefully in full consideration of traditional cultural ownership of lands and the seabed extending into the lagoon and the ocean. Consequently, RMIPA evaluated sites near the airport that were controlled by the RMI Government (through a lease agreement). Figure 13 shows the potential nearshore and offshore dredging sites investigated.

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[15] Lindsay, Stephen, *Rapid Biological Marine Assessment of the Proposed RMI-EPA Sand and Aggregate Dredging Site Locations within Majuro Lagoon, Republic of the Marshall Islands*, Pacific Islands Applied Geoscience Commission - SOPAC Technical Report 409, page 22, May 2008.

[16] The RMIEPA requested technical assistance from the UHSG College program as to the nature of the sedimentary deposits within the airport lease area and its potential use for reclamation.

Figure 13: Near shore and Offshore Dredging Sites Investigated

- **Site A** is the Ajeltake, Mile 17 site.
- **Site B** is east of the PII quarry and west of the RSA Project reclamation site. Refer to Appendix 1. Drawing 'Alternate Quarry and RSA Site Plan'
- **Site C** is the original permitted dredging site approved by EPA in April 2011. Refer to Appendix 1 Drawing 'Site Development Plan 1 (RSA Site)'
- **Site D** is east of the airport terminal and includes the area adjacent to the water reservoirs. This is restricted to hard pan mining. Refer to Appendix 1. Drawing 'Site Development Plan 2 (Airport Reservoir)'.
- **Site E** is the preferred option. Site E is adjacent to the water reservoirs, outside of reef hardpan. Refer to Appendix 1. Drawing 'Site Development Plan 4 (Airport Reservoir)'.
- **Site F** is at Delap.
- **Site G** is at Rita.

At a national level, the state of corals in the RMI is generally good. However, locally, near areas of human habitation or activity, the state of corals has deteriorated for several reasons including pollution from garbage and algae that feeds on nutrients introduced into the lagoon from human activities. Since Majuro Atoll is the National Capital of the RMI and accommodates the majority of the human population of the RMI, there is little land on the southern islands of Majuro Atoll that are not directly used or undisturbed. There are residential land uses immediately east of the fresh water reservoirs near Site E, RMI's preferred dredging site. The land uses in this area are similar to other areas on Majuro considering type of use and density of population.

The 2007 EIA identified the picnic area west of the runway for the source material for the RSA and Road Relocation project. This site, Site C, was approved for use by the RMIEPA. In response to suggestions made by members of the public concerning the corals located in this area, the RMIPA decided to select Site E as its preferred location for source material for the RSA and Road Relocation project. The RMI EPA's evaluation of each of these sites is discussed in more detail in the following paragraphs.

4.3.2 Site A – Ajeltake

The Ajeltake site is at Mile 17. It has been identified through consultation with the public and is noted in the Pacific Islands Applied Geoscience Commission (SOPAC) 2007 report as having aggregate material that is suitable. The RMI Government does not control this site and so landowner approval would be required. While the Government of the Republic of the Marshall Islands has the power of Eminent Domain, it exercises this authority carefully in full consideration of traditional cultural ownership of lands and the seabed extending into the lagoon and the ocean.

In a letter to the RMIPA in July 2011, the contractor estimates that approximately 14,000 dump truck loads would be required to haul the fill material weighing approximately 170,000 tons in total from Ajeltake to the project site. The heavy vehicle traffic on the main road will cause damage to the existing road. If material is transported to the project site via a barge then additional acquisition of the necessary equipment would be required by the contractor, resulting in further delays and costs to the project.

The Ajeltake site sediment analysis (SOPAC, 2007) indicates the bulk of this sediment is considered poor to medium quality for fill material due to the significant presence of Halimeda (weak and friable calcareous algae). Halimeda rich sediments are considered poor construction materials as they tend to disintegrate easily during the dredging / extraction and haulage operations. They can disintegrate to finer sediment particles hence contribute to elevated silt and mud contents in sand.

In a letter from the contractor to RMIPA in July 2011, the contractor states that a cost estimate for dredging at this site was not able to be provided as the site is outside of the airport lease area and it is not clear whether or not the numerous private landowners abutting the lagoon area would be willing to grant access to the site and/ or require compensation. Additionally, it is not clear how the fill material will be transported from the Ajeltake area to the airport site a distance of 5 miles, and this will add to the cost of dredging this site.

Due to the poor quality of the material as fill material and the uncertainties around potential cost of dredging site A, this site has been rejected.

4.3.3 Site B – East of PII Quarry Site in Lojemwa and West of the RSA Project Site Mining the Reef Hardpan

Site B is east of the existing PII quarry site in Lojemwa (See Site Plan B in Appendix 1). Drawing 'Alternate Quarry and RSA Site Plan'. Dredging would be undertaken in a similar way to that used at the quarry, which the RMIEPA has previously approved and the environmental impact is known. The surface of the hardpan reef would be harder to break and dredge compared to dragline dredging, and hauling by road would still be required from the dredging site to the project site (albeit it is a much shorter distance compared to Sites A, F and G). A rock revetment would be provided for shore protection as part of dredging this site.

The proposed methodology associated with this option involved dredging of the hardpan in an effort to avoid the sub-tidal areas that coral inhabit. Figure 14 is an example of what the hardpan looks like at low tide and Figure 15 provides an example of the method used to mine the hard pan area.

A temporary mound would be constructed to provide a platform for the crane to work from (so it does not submerge at high tide). The crane would be equipped with an 8 cubic yard dragline bucket. The breaking of the hard reef surface would be carried out by hydraulic breakers mounted on excavators prior to the crane being able to dig deeper using the dragline bucket. Buffer zones of approx. 50 ft. would be established from the existing shoreline to the dredging site; and from the dredging site to the live coral area as illustrated in Site Development Plan 2 (Appendix 1).

The cost of this nearshore hardpan dredging (including the additional remediation revetment construction work) was estimated at $8.8 million (141,800cy at $62/cy) and a total project cost of $19.4 million.

The site east of the PII Quarry is not controlled by the RMI Government and therefore landowner approval would be required to dredge in this location. Therefore, the same issues relating to the use of the power of Eminent Domain identified at Site A apply here.

The landowners' consents were requested for this option, but consent was not forthcoming. Therefore Site B has been eliminated as an option.

4.3.4 Site C – Original Permitted Dredging Site at the RSA Reclamation and Road Realignment Project Site

This area is directly adjacent to and on the lagoon side (north) of the RSA project site. It is within the airport lease area and therefore under Government control and was the subject of the permit approved in April 2011 by the RMIEPA, refer to Appendix 1. Drawing 'Site Development Plan 1 (RSA Site)'.

Following the public comment period as part of the EIA process, concerns were raised about the effects that dredging the site would have on the coral. Public feedback suggests that the density of the coral in this location is greater than the preferred site (Site E) because it has not been previously disturbed. For this reason it was decided by the RMIPA that Site C is not preferred to source material from.

The cost of near shore dredging adjacent to the RSA site (Site C) was bid by the contractor originally at $3.9 million (now at $5.1 million due to Change Order 002) as part of the overall $15.8 million bid. This total contract price of $15.8 million was accepted and the Contract was awarded to Pacific International, Inc. (PII) in March 2011.

Offshore dredging at this site was also reviewed – refer to Section 4.2 of this report for methodology and a preliminary evaluation of the potential effects. The cost for offshore clamshell dredging from a barge at this location was estimated at $22.5 million (141,800cy at $83.60/cy).

4.3.5 Site D – East of Terminal adjacent to Water Reservoirs, Mining the Reef Hardpan

Site D is the area adjacent to the water reservoirs and extends west towards the airport terminal. The site is within the control of the RMI Government. The area proposed for dredging was restricted to reef hardpan along the shoreline. This option, and preferred option (Site E), proposed: A) the construction of a 3600 feet long revetment to protect the land, main road and water reservoirs; and B) the provision of a new "picnic area" and beach (with safe and easy beach access) similar to what will be lost through the

construction of the RSA. Recreational facilities included would be picnic facilities and an armor rock spur to encourage the accumulation of beach sand. These facilities would be provided on the lagoon side of the airport road at the eastern end of the runway- refer to Appendix 1. Drawing 'Alternative Site Water Reservoir (Option 2)'.

The proposed methodology associated with this option involved dredging of the hardpan in an effort to avoid areas that coral inhabit. Figure 15 below provides an example of the method used to mine the hard pan area. The work would be undertaken by constructing a temporary loading ramp/causeway from the shore into the lagoon similar to the temporary causeway shown in the drawing titled 'Site Development Plan 1' (Appendix 1) using approximately 11,000 cubic yards of material excavated from the proposed area of reclamation. This would be used to offload machinery and materials from a barge.

Figure 14: The hard pan reef at low tide in the area adjacent to the airport reservoirs looking west towards the airport terminal

A temporary mound would then be constructed to provide a platform for the crane to work from (so it does not submerge at high tide). The crane would be equipped with an 8 cubic yard dragline bucket. The breaking of the hard reef surface would be carried out by hydraulic breakers mounted on excavators to allow the crane to dig deeper using the dragline bucket. Buffer zones of approx. 50 ft. would be established from the existing shoreline to the dredging site; and from the dredging site to the live coral area as illustrated in Site Development Plan 2 (Appendix 1).

Hauling between the proposed dredging site and the project site would still be required – but at a much shorter distance than from Sites A, F and G to the project site.

Included in the proposed dredging was the construction of a rock revetment along the shore to protect from wave attack. This option was presented in a revised site plan (Refer to Appendix 1, Drawing 'Alternate Site Water Reservoir (Option 2)') and environmental management plan submitted to the RMIEPA and the subject of a subsequent public hearing (25 October 2011).

Issues were raised through the public comment period related to this option and are detailed in the section below. The main issues related to effects on coral, climate change considerations, shoreline erosion and land ownership. In particular, landowners objected to the dredging of hardpan and would not provide approval.

As a result of concerns raised during the public review process RMIPA eliminated this fill material source option.

Figure 15: Mining of hard pan along the edge of the lagoon fringing reef near Majuro airport, 2007. Photo by D. Jacobson, cited in "The State of the Coral Reef Ecosystems of the Republic of the Marshall Islands", 2008. Note that the area dries at low tide and therefore live corals are not affected

4.3.6 Site E - East of Terminal adjacent to Water Reservoirs, excluding Reef Hardpan (Preferred Option)

Following the second public hearing on 25 October 2011 the RMIEPA, RMIPA, PII and the specialist involved in the UH Sea Grant Extension survey of aggregates in the Majuro lagoon met to discuss the comments received and concerns raised during the public hearing and comment period. As a result of the meeting, a new option involving the dredging in the area east of the terminal and adjacent to the water reservoirs but outside of the reef hardpan area was discussed and agreed as the preferred option. It was considered that sufficient information on this site had been provided other than that required within the EMP[17].

The site is located in the same general location as Site D, however the primary difference is that the hardpan along the shoreline is not proposed to be dredged and will be left intact. The extent of the dredging along the shore was reduced to a maximum length of approximately 1800 feet, and in order to achieve the amount of material required, extended further into the lagoon. The contractor is currently reviewing the areal extent of dredging and anticipates a substantial reduction in the size of the area to be dredged. The contractor will submit this revised proposal with a significantly reduced impact to the RMIEPA as part of the EMP approval process.

[17] See Section 2.4 of this document for a description of the RMIEPA's role, responsibilities and discretion on these matters.

This sub-tidal area was previously disturbed for construction of the freshwater reservoirs east of the airport. No records are available to identify the quantity of material abstracted or the exact date this work was undertaken. It is, however, reported anecdotally that the work was undertaken circa 1971. No hardpan will be disturbed or removed under the current proposal at this location. Figures 16 and 17 below illustrate the intertidal hardpan area at Site E.

Figure 16: Hard pan along the edge of the lagoon at Site E

Figure 17: Hard pan along the edge of the lagoon at Site E

This option also includes the construction of a 3600 feet long revetment to protect the land, main road and water reservoirs; the provision of a new "picnic area", and safe beach access similar to what will be lost through the construction of the RSA and as generally proposed at Site D. Recreational facilities included would be picnic facilities and an armor rock spur to encourage the accumulation of beach sand. These facilities would be provided on the lagoon side of the airport road at the eastern end of the runway - refer to Appendix 1, Drawing 'Site Development Plan 4'.

The work would be undertaken by constructing a temporary loading ramp/causeway from the shore into the lagoon similar to the temporary causeway shown in the drawing titled 'Dredging Site Development Plan 5' (refer to Appendix 1) using material excavated from the proposed area of reclamation. This would be used to offload machinery, including the 200-ton dragline crawler crane and materials from a barge.

The material for the temporary causeway will then be used for the construction of temporary elevated mounds on the sub-tidal and -hardpan reef for the crane to operate on so that it does not submerge during high tide.

The crane, equipped with an 8 cubic yard dragline bucket, will operate on the temporary mound. Dredged materials will be stockpiled at the area illustrated in the drawing 'Site Development Plan 4' (refer to Appendix 1). The loading and hauling will be carried out by dump trucks, loaders and excavators.

Any corals that have re-established themselves in this area will be affected. However, if coral is present, it has regenerated since the mining activities that have been undertaken in this location in the past. There will be unavoidable adverse impacts on any coral present in the dredge area by this proposal, but it is likely that the area will regenerate in a similar way to that which has occurred in the past. As

previously discussed, the coral at this location has been impacted by a variety of anthropogenic stressors. As described in section 4.3 of this document, the health of corals depends upon several factors, in particular coral health deteriorates closer to urban centers due to anthropogenic factors such as pollution, nutrient enrichment, and boat groundings. The land area of Majuro Atoll immediately east of the fresh water reservoirs is dominated by residential land uses. Consequently, the health of those corals that have re-established in the area since the disturbance in the 1970s is not as good as those parts of Majuro atoll that have less effects from human activity such as the northern islets of Majuro.

It is proposed to rehabilitate the site in line with the best practice directions of the EMP. Rehabilitation of the coral reef has two main purposes. To provide the coral reef structure and shelter that has been lost, and to also re-propagate any potentially ecologically significant species that may have been lost as a result of the dredging. Coral reef rehabilitation will take a number of years to re-establish, even with advanced techniques of coral transplantation to encourage immediate settlement on replacement substrate structure. This regenerative process will be accelerated with remediation measures such as the provision of hundreds of hollow concrete 'coral reef balls' that immediately provide habitat for fish and rock like structures for coral to grow on.

Reef balls are pre-cast concrete hollow semi-hemispherical balls with pore spaces cut at irregular intervals. The pore spaces and internal area of the balls are design to re-provide the 'natural' pore spaces and habitat areas that may be expected from a fully-formed natural coral reef. Coral colonization onto reef balls depends on factors such as the prevailing ocean current and the ability for coral polyps to naturally migrate to the area. It is possible that coral colonization on reef balls can be as good, or better than natural substrate as there is less competing growth than on the natural substrate. Further site-specific investigation of the ability for near-by coral polyps to re-colonize the affected area may be required.

An illustration of a reef ball is shown in Figure 18 and Figure 19. Non-profit organizations such as The Reefball Foundation can provide technical advice to help plan the use of resources for the best results. Resources available for this project include a $100,000 fund set aside for mitigation purposes including, but not limited to reef balls. Reef balls have been successfully used in over 59 countries.[18]

If natural re-colonization is determined to be limited, then it is possible to intervene through transplantation. Provided that the prevailing ocean current is likely to transport coral polyps across the affected site, the installation of reef ball units is expected to provide a good substrate for coral species to settle and colonize. With the provision of just the reef ball units, previous international experience[19] of installed reef balls show very good re-colonization of coral onto reef ball units across a period of 5-6 years. However, the rate of re-colonization is likely to be dependent on a number of site specific factors including species available, depth of water, storm events, and rate of coral polyp provisioning across the site on the reef ball units.

Coral transplantation success rates have been estimated to be at 60% by Sustainable Oceans International (SOI) (refer to the website www.sustainableoceans.com.au) which is again dependent on species and site factors. Transplantation of coral species onto coral reef balls can provide some assistance for coral polyps to be distributed across the affected area in cases where natural transport currents are likely to limit the rate of spread of coral across the affected site from other natural sources. Transplanted coral 'fronds' can also provide additional reef structure at a faster rate than if

[18] Refer to http://www.reefball.org for further information.

19 See www.sustainableoceans.com.au

natural re-colonization is relied upon. It is difficult to quantify how successful transplantation of individual coral fronds may be in accelerating the re-colonization process.

At this stage, it is considered that the installation of reef ball units to provide immediate access to shelter and habitat for coral reef biota is of a higher priority than the transplanting of coral fronds onto each individual reef unit.

Figure 18: A concrete 'Coral Reef Ball' prior to placement on a sandy sea bed

The dredging cost of this option was estimated by the as being approximately $9.1 million (141,800cy at $64,50/cy). Included in the cost is the remediation works such as the construction of a $2.8 million rock revetment along the shoreline using armor stone and the coral remediation discussed above. The rock revetment will provide protection for the shoreline, main island/airport road, and the water reservoirs which are currently threatened by coastal erosion – refer to Figure 20. Figure 21 shows an example of a rock revetment. Total cost for this option was estimated at $19.8 million. Refer to Section 6.2 for a list of the mitigation measures proposed for this option – Site E.

Given the already modified nature of the site from previous dredging in the 1970s, the location of the site relative to the RSA, the existing control the RMI Government has over the site and the cost of this option being acceptable for project funding by FAA, Site E is selected as the preferred option for sourcing fill material.

Figure 19: A concrete 'Coral Reef Ball' with established coral regenerating (Source http://www.reefball.org).

Figure 20: A King Tide at the Reservoir Site

Figure 21: Existing revetment demonstrating protection achieved for the road and other infrastructure. The airport ARFF building is in the background

4.3.7 Site F – Adjacent to Delap

It is unclear from the SOPAC 2007 report what the nature of the material is under the surface at Delap. Further borings or similar would be required to be undertaken to ascertain the nature of the materials to determine their suitability for use as fill. If consolidated material was encountered then this would extend the project duration as dredging operations would be stopped or slowed. A standard CSD would not be able to be used for consolidated material and even a much larger CSD, at increased cost, may have issues dredging consolidated material.

Material dredged from Delap would likely be transported to the project site via heavy vehicles travelling along the main road of Majuro. The movement of heavy vehicles through the main central business district of Majuro could pose safety issues for people and also damage the road. There would be costs associated with the transportation of fill material from the dredging site to the project site. An alternative to land transport would be to pump water saturated fill to a barge to then pump this fill from the barges to the RSA reclamation or nearby land to allow excess water to drain from the fill. To undertake this exercise two additional specialist barges with pumps would be required and a tug boat to move the barges around. If pumping saturated fill to land was required, an area suitable for the fill to drain to a suitable water content to be used in the reclamation would be required. These issues all add to the project costs and program delays.

The RMI Government does not control this site and so landowner approval would be required. The same comments relating to Eminent Domain previously expressed are also relevant in the context of this site.

For these reasons Site F has been eliminated from further consideration by the RMIPA.

4.3.8 Site G – Adjacent to Rita

It is unclear from the SOPAC 2007 report what the nature of the material is under the surface at Rita. Further borings or similar would be required to be undertaken to ascertain the nature of the materials to determine their suitability for use as fill. As with Site F, if consolidated material was encountered then this would extend the project duration as dredging operations would be stopped or slowed. A standard CSD would not be able to be used for consolidated material and even a much larger CSD, at increased cost, may have issues dredging consolidated material.

Material dredged from Rita would likely be transported to the project site via heavy vehicles travelling along the main road of Majuro. The movement of heavy vehicles through the main central business district of Majuro could pose safety issues for people and also damage the road. There would be costs associated with the transportation of fill material from the dredging site to the project site. An alternative to land transport would be to pump to barge to then pump to RSA reclamation or nearby land for dewatering. Dewatering of the dredged material would be required in order for water to be drained out prior to being used for fill material. To do this two additional specialized barges with pumps would be required and a tug boat to move them around. If pumping to land then a dewatering facility would be required. This all adds to project costs and program delays.

The RMI Government does not control this site and so landowner approval would be required. While the Government of the Republic of the Marshall Islands has the power of Eminent Domain, it exercises this authority carefully in full consideration of traditional cultural ownership of lands and the seabed extending into the lagoon and the ocean.

For these reasons Site G has been eliminated from further consideration by the RMIPA.

The following table summarizes the assessment of options.

Table 1: Summary of Assessment of Options

Fill Source/ Site	Cost $Million	Dredge Method	Reason not Preferred
Imported	27	Not Applicable	The cost, logistics, biosecurity risk and time are major constraints to this option.
Site A	Uncertain	Offshore Clamshell	The quality of fill, impacts of traffic and uncertainty of owners' approvals constrain this option.
Site A	Uncertain	Nearshore Dragline	The impacts of traffic and uncertainty of owners' approvals constrain this option.
Site B	19.4	Nearshore Hardpan Mining	Withholding of landowners' approvals constrain this option.
Site C	15.8	Nearshore Dragline	Public concern over the impacts on coral in this location constrains this option.
Site C	23	Offshore Clamshell	The cost, logistics and time constrain this option.
Site D	19.5	Nearshore Hardpan Mining	Public concern over the impacts of hard pan mining and uncertainty over land owners' approvals in this location constrain this option.
Site E	19.8	Nearshore Dragline	Preferred and chosen option.

Fill Source/ Site	Cost $Million	Dredge Method	Reason not Preferred
Site F	Uncertain	Cutterhead Suction Dredge	The impacts of traffic, uncertainty of owners' approvals, uncertainty of material suitability and uncertainty of methodology constrain this option.
Site G	Uncertain	Cutterhead Suction Dredge	The impacts of traffic, uncertainty of owners' approvals, uncertainty of material suitability and uncertainty of methodology constrain this option.

5. Public Involvement

5.1 Pre-assessment Consultation

In June 2007 the RMIPA environmental consultants sent out pre-assessment consultation letters to interested and concerned parties. In November and December 2007, e-mails were also sent to people and agencies. Appendix B of the 2007 Draft EIA included a list of people and agencies consulted, including College of Marshall Islands, RMI Historic Preservation office, RMIEPA, and Government ministries. The RMIPA's environmental consultant conducted this pre-assessment consultation for a 6 month period between June to December 2007. The letters contained an attachment outlining the project, including project need and description of proposed works.

A number of responses to the pre-assessment consultation were received. Some of the points raised by the RMIEPA via e-mail include:

- Request for options to mitigate the loss of public recreation areas (picnic area)
- Requests to avoid dredging from the abundant and diverse areas of coral at the edge of the reef
- A preference for importation of fill and rock material.

The College of the Marshall Islands responded that suction dredging is not likely to be a valid option in the RMI due to lack of suitable equipment.

Dolores deBrum Kattil recommended that the proponent use best management practices for the works and wanted the consideration of the fragile environment in the importation and placement of materials, and for replanting and coastal protection measures to be considered.

Majuro Atoll Waste Company (MAWC) outlined the types of construction waste that would be accepted by the MAWC and the associated costs for disposal. MAWC also commented that the Government was trying to fund a suction dredge in the hopes that dragline dredging could be ceased by October 2008.

5.2 Original EIA Public Review

The original 2007 Draft EIA was made available for public review between March and April 2008.

5.3 First Public Hearing

A Public Hearing was held in April 2008 to discuss and consider the application for the project, including the importation of fill. There were no objections raised and those present supported the importation of fill material. The loss of recreational area was raised in the Hearing and there was a stated desire by the public for the recreational area to be reinstated elsewhere.

5.4 Stakeholder Meetings

Meetings held with concerned members of the public in June/July 2011 identified a number of concerns with the proposed works that had been approved by the RMIEPA. Concerns related to the previous RMIEPA approved dredging site to source material for the reclamation.

As a result, at a meeting on July 4, 2011, the RMIPA officially informed RMIEPA that the RSA and Road Realignment Project were being delayed in order to explore other dredging site options for the project.

5.5 Public Comment Period

A 30-day public comment period for the Site D option commenced on October 13 and closed on November 11, 2011. Written comments were received from members of the public and from USEPA, NOAA and FWS.
The written comments are provided in full in Appendix 3 and summarized in the table included in Appendix 2, including responses to concerns raised.

A summary of the issues raised through the public comment period includes issues relating to:

- The potential impact on coral
- Coastal hazards created at the shoreline by the deepening of the seabed adjacent to the coast.
- The potential impact on coastal inundation already observed in the location from climate change sea level rise
- Heavy vehicle traffic on the main road causing further damage to the main public road
- Land ownership issues
- The potential impacts of dredging the reef hardpan.

Written comments were received from the following organizations and members of the public. Dr. Dean Jacobson - College of the Marshall Islands, Jerry Kramer, United States Environmental Protection Agency, United States Fish and Wildlife Service, United States National Oceanic and Atmospheric Administration. See Appendices 2 and 3 for responses to comments and copies of the submitted letters.

5.6 Second Public Hearing

A public hearing on the dredge site was held in the conference room of the Nitijela Building in Majuro on October 25, 2011 to discuss the Site D option.

In summary, the issues raised during public hearing related to:

- Coastal shoreline stability – concerns were raised in regards to dredging of reef hardpan and near to long term impacts on shoreline stability
- Consistency of the proposal with National Climate Change Policy
- Landowner consultation and rights to near shore areas and dredging activities
- Traffic effects related to transporting materials to and from dredge site to reclamation site
- How monitoring and enforcement of dredging activities would be undertaken by the RMIEPA
- The effect of dredging of reef hardpan.

5.7 Post Hearing Consideration

Meetings were held with RMIEPA, RMIPA, PII and the specialist involved in the UHSG survey of aggregates in the Majuro Lagoon to discuss the comments received and the concerns raised during the public hearing and comment period. As a result of the meeting, a new option involving the dredging in

the area east of the terminal and adjacent to the water reservoirs, but outside of the reef hardpan area was agreed as the preferred option going forward[20].

This option was subsequently presented by the RMIEPA to their Board of Directors for consideration. The Board subsequently approved the Site E option on the 9th December 2011.

[20] See Section 2.4 of this document for a description of the RMIEPA's role, responsibilities and discretion on these matters.

6. Response to Concerns Raised and Mitigation

6.1 Response to Comments

Each of the public comments received as part of the RMI Environmental Impact Assessment Process for the local dredging have been summarized and a response to each comment provided in the table in Appendix 2: 'Summary of Public Comments – RSA Road Realignment Project' (the comments spoken in Marshallese have been translated to English).

A CD with a video recording of the second Public Hearing has been included in Appendix 3 to this document.

6.2 Mitigation

The management of potential environmental effects during the implementation phase of the Project will be undertaken in accordance with an Environmental Management Plan (EMP). The EMP is approved, and its implementation will be monitored by the RMIEPA.

The purpose of the EMP is to describe the environmental management and monitoring procedures to be implemented. It is fundamental to ensuring the commitments given in obtaining approval for the Project are carried out through the construction phase. The EMP details who, what, where, when and how environmental management and mitigation measures are to be implemented. The implementation of environmental controls will, to the extent practicable, follow industry best standard practice.

The following mitigation measures are proposed as part of the preferred option at Site E. The measures listed below describe the impact, and then describe the proposed mitigation action to reduce the identified impact.

1) The dredging of the area at Site E will result in a localized deepening of the seabed in that part of the coast. The deepening of the seabed will result in less energy dissipation from waves and the shoreline will be subject to increased wave attack. The increased wave attack may exacerbate shoreline erosion in this location. To mitigate the impact of seabed deepening and increased wave attack, the proponent proposes to construct a rock revetment seawall along the shoreline. The rock revetment will provide protection for the shoreline, the main island road to the airport and western Majuro, and the Majuro water reservoirs by armoring the shoreline and protecting it from wave attack. The rock revetment will also assist in reducing storm surge wave run-up and coastal inundation of the land during storms of high tide (also called King tides) events as can be seen in Figure 21.

2) This risk of shoreline erosion and coastal inundation will be exacerbated by sea level rise caused by climate change. Climate change considerations will be incorporated into the design of the rock revetment protection structure by providing additional height based on International Panel on Climate Change (IPCC) sea level rise projections to accommodate rising sea level so that the risk of erosion and coastal inundation is reduced.

3) The project will result in the loss of an existing area on airport leased land that is currently used by the public informally for recreation. This area is commonly referred to as the "picnic area" and "public park". Refer to Figures 22 to 24. To mitigate the loss of this informal recreational area, a new recreational area and picnic location will be established to the east of the airport, on the

lagoon side of the road, with access steps over the proposed rock revetment to facilitate public use of the shore.

Figure 22: Area of Man Made Pond used for Recreation at the Western end of the Airport

Figure 23: Debris Dumped in the Vicinity of the Recreational Area

Figure 24: Debris Dumped in the Vicinity of the Recreational Area

4) The proposed rock revetment will have an impact on the current beach area at the reservoir site used by the public for recreation, which may result in a reduction of sandy beach area over time as sea level rises. To mitigate any loss of beach area able to be used by the public, it is proposed to design the rock revetment structure with a rock groyne at the western end. The purpose of the rock groyne is to trap sediment that moves along the shore with alongshore currents in this area so that over time sediment builds up against the groyne, forming a beach.

5) The contractor, as outlined through an Environmental Management Plan submitted to the RMI EPA for approval, will document with photographs the condition of the corals and seabed for the area to be dredged for the proposed project both before and after works.

6) To encourage and accelerate fish habitation and coral growth in the location of dredging (Site E), it is proposed that a coral remediation project (such as the installation of coral reef balls) will be undertaken following dredging activities. Non-profit organizations such as The Reefball Foundation can provide technical advice to help plan the use of resources for best results. Resources available for this project include a $100,000 fund set aside for mitigation such as, but not limited, to this purpose. Reef balls have been successfully used in over 59 countries. Refer to http://www.reefball.org for further information.

7) Coral relocation/propagation will be reviewed as a method to speed up coral regrowth. This will be subject to an evaluation of cost benefit with other options such as the coral reef balls. Refer to http://www.reefball.org for further information.

8) A Surface Traffic Management Plan will be incorporated as part of the Environmental Management Plan for the project to address impacts of heavy vehicle movements on the pavement of the main road associated with the transport of fill material from Site E to the project site.

9) A Traffic Management Plan will be incorporated as part of the Environmental Management Plan for the project to address impacts of heavy vehicle movements on the pedestrian and vehicular traffic on the main road associated with the transport of fill material from Site E to the project site.

10) The contractor will install a silt fence and maintain it in good working condition during dredging works to minimize impacts of sedimentation released into the water column during disturbance of the seabed.

7. RMIEPA Decision

The following text is from the RMIEPA's Decision Document for AKIA Road Realignment Dredge Site and Methodology, letter to RMIPA dated February 23 2012.

At its meeting on December 9, 2011 the RMIEPA Board of Directors met and considered the following options as a basis for decision on the RSA dredge site:

1) To allow for near shore dredging at the recently revised site located lagoon side of the airport reservoirs (Lot A and B) with no additional conditions and allowing the project to commence with no further delays;

2) To allow near shore dredging at the recently revised site located lagoon side of the airport reservoirs (Lot A and B with additional conditions to address the comments received by members of the public during the comment period;

3) To require offshore dredging.

The Board took the following issues into consideration:

- Offshore dredging would involve further extension of the project and costs implications might jeopardize the continuation of the project;
- Importation option - not likely to be financially feasible given the deferral of the project in 2009 due to high costs of importing fill material;
- The alternative dredge site was revised to take place at the near shore area of Lot A and B (Kiniloke and Nakan Wetos) to take into consideration concerns from adjacent landowners to the dredging activities. Signed petitions from landowners approving the project were received for Lots A and B.
- The Aviation requirement and need to extend the Runway Safety Area.

- The subject stretch of shoreline was also identified as an area that is prone to coastal inundation during king tide events and the project offers mitigation effort which involves the construction of a revetment to protect the shoreline and the water reservoir land from future inundation.

The RMI Board of Directors approved Option 2 – to allow near shore dredging at the recently revised site (referred to in this document as Site E) located lagoon side of the airport reservoirs (Lot A and B) with additional conditions to address both the comments received by members of the public during the comment period.

This decision was made by the RMI EPA Board of Directors consistent with RMI's NEPA and other applicable laws and regulations of the Republic of the Marshall Islands.