Proposed New Airport on Tioman Island: A Critical Analysis

Prepared by: Reef Check Malaysia, with inputs from partners and stakeholders

1. Background

Since it was registered in 2007, Reef Check Malaysia has become established as a leader in marine resource conservation in Malaysia. Its activities are organised around four core programmes:

- EcoAction: training survey divers and conducting coral reef surveys at over 200 locations around Malaysia to monitor coral reef health
- Management: working with stakeholders to improve the management of coral reefs and other marine ecosystems in Malaysia to secure long-term conservation goals
- Science: conducting studies on reef resilience and rehabilitation to better understand coral reefs and their impacts
- Advocacy: raising awareness of the importance of marine ecosystems and the valuable ecosystem services they provide.

Reef Check Malaysia's efforts now focus on improving the management of marine resources, with an emphasis on involving local stakeholders in management. RCM has field teams in five locations, working with local stakeholders to encourage greater participation in management and to reduce impacts to coral reefs and other marine ecosystems:

- Tioman Island: we have had a team on Tioman for ten years, building ecological and community resilience. We are currently working on a three-year programme to prepare Tioman for accreditation under the IUCN Green List standard
- Mantanani island: we are working with local stakeholders to improve the management of the island's marine resources (eliminate fish bombing and establish a marine managed area) and diversify the economy away from over-reliance on fishing and mass tourism
- Johor Islands: a five-year programme to build a sustainable tourism destination and protect marine resources around the Johor islands
- Redang Island: replicating the success of the community-based conservation programme on Tioman Island to a new community
- Semporna: gateway to the famed dive destination Sipadan island; we are working with local communities on several islands to improve waste management and reduce impacts to coral reefs and other marine ecosystems.

2. The Airport Story

Without going into detail about the long and complex history of the airport (which can be found here) we raise the question: **should we be building an airport on Tioman island?**

There are three key parts to the answer to this question: environmental, social and economic:

- The EIA only considers the damage caused by the construction of the runway and support buildings. We believe it should be more holistic and look at the potential long-term loss due to increased numbers of tourists.

  - During busy periods, it is difficult to get rooms; water shortages are not uncommon; power outages likewise. What will be the impact of a four-fold increase in visitor numbers?
  - Where will they stay, and what damage to biodiversity and ecosystem services will result from the construction of resorts, roads and other infrastructure?
  - How will sewage pollution be managed, given that there is no integrated sewage treatment on the island today?
- The EIA claims that local communities have been consulted about the airport; we believe the consultation process is deeply flawed, producing results that cannot be relied upon. Our people working on Tioman report a lack of comprehensive coverage of local populations by surveys; findings on socio-economic outcomes rely on inadequate data.
- We believe that the economic losses from lost biodiversity and ecosystem services will be greater than the economic value of the increase in tourism that the airport will bring. Do the economics of an airport on Tioman really stack up?

Finally, there are significant errors in the EIA itself: the hydraulic survey data is out of date; marine ecosystem mitigation measures are questionable; and the marine survey contains grossly inaccurate lists of species (including some known to be native to the Caribbean and African waters).

Should such a large, high-impact project be allowed to proceed given these errors in the very impact assessment that is supposed to describe the impacts on biodiversity and ecosystems?

This document presents:

- A narrative report on the issues relating to the airport
- A critique of the hydraulic survey
- A critique of the marine survey.

RCM does not support this airport project as we believe that the value of the island's biodiversity outweighs any economic value that the airport might bring.

At the very least, we believe that a review should be conducted of the economic value of the project, balanced against a true assessment of the island's biodiversity. Given Malaysia's commitments to protecting its biodiversity, should we really be building this airport, given the attendant damage to the island's biodiversity, both during construction and in the following years?

3. Narrative Report

The views below are those of RCM's senior staff, who have been working on Tioman for the last 10 years, and other stakeholders with knowledge of the EIA process.

3.1 The Statement of Need in the EIA

The statement of need says the airport is needed to boost tourism and help businesses recover after the pandemic. But at the same time, the report states that for the next 7 years businesses in Kg Paya and Kg Genting will experience a loss of tourists and income due to the construction of the airport. Construction debris, dust, noise, vibrations, silt, vessel traffic, soil erosion, pollution, degradation of the forest, marine ecosystem and biodiversity will cause lower tourist arrivals and businesses, which are the buttress of the local socio-economy, will suffer. This loss of tourists might even be experienced by other villages as well due to the image Tioman will suffer. The EIA report states that the beach and the view at Genting and Paya will be impacted not only during construction but during the operation phase as well hence forever leaving a negative impact on these two villages and another reason for tourists to avoid these locations, causing hardship to the resort and local business communities.

Is there really a demand for an airport? Even when Berjaya Air was operating in Tioman, less than 15% of tourists arrived by air. During the focus group discussions, the local leaders questioned the need for the airport, stating that Tioman did not have enough facilities to cope with more tourists. Locals' leaders and the community said they wanted good access, infrastructure, amenities and facilities such as roads, water, electricity, better school facilities, upgraded clinic, sewage and solid waste treatment systems since all these were partly or completely lacking on the island.

They were worried that Tioman would become a commercial area instead of a vacation destination and that the impacts of the project would disrupt the local economy both during the construction and operation phases. Local leaders also raised their concerns regarding the negative impacts of the project, specifically on their quality of life and the marine ecosystem. There were no townhall meetings conducted with local villagers to discuss this project only focus group discussions were conducted with selected individuals. While the EIA states that all families in Paya and Genting were consulted, many say they were not consulted. The local communities do not agree with the airport; even when the RKK 2030 Tioman was published, it received 69 objections regarding the Tioman airport, and 30 % of the objections received were regarding transportation plans on Tioman.

The EIA clearly states that Pulau Tioman will need a lot more development of infrastructure and facilities to cater for the anticipated increase in the number of tourists. The requirements include connectivity, electricity, water supplies, sewage treatment systems, waste management system and telecommunication systems in order to sustain the future tourism industry of the island with the new airport.

The EIA report has some very obvious errors, such as bird species (black hornbill), turtle species (*Caretta caretta*), the giant clam (*Tridacna derasa*), fish species (*Apogon retrosella*, Coryphopterus glaucofraenum, Halichoeres chierchiae and more) and coral species (*Acropora palmate*, *Acropora cervicornis*, and more) that **do not exist on Tioman**, in fact not even in Malaysia.

The report also has errors where figures and references are missing, such as in chapter 7, section 7.5. Again, this shows that this study is haphazard, done badly in a rush and needs to be done again. It seems like the report was done in haste by people that are not experts in the topic and has been rushed just to get approval. Considering all these mistakes, **the EIA should not be accepted** and should be redone by experts.

3.2 Social-Economic Impacts

During the operations of the airport, water pollution, dust, noise, vibrations, and light pollution will cause lower tourist arrivals and businesses, which are the buttress of the local economy. If left uncontrolled, dust, noise, vibration and water pollution will have adverse effects on public health and well-being. Potential respirational health impacts are linked to the presence of very fine airborne fines, as they affect the respiratory and cardiovascular systems.

Blasting activities are going to cause vibration and sound pollution that are above the threshold values set by DOE, in Kg Paya. Another impact will be the airborne dust, which is also known as the particulate matter of less than 0.01 mm or 10 microns (PM10) and less than 0.0025 mm or 2.5 microns (PM2.5) in size, as they can be inhaled into the lungs, causing health-related issues such as cough, visual impacts, and nuisance to communities living near to the Project site.

Although these impacts are considered short-term, occurring only during construction, they could nevertheless greatly affect the local community. The transfer of fines from air to surface water can result in water pollution. Considering that the villagers in Paya and Genting rely on natural streams as their main source of water, this could be a major issue.

Noise and vibrations from planes landing and taking off could also affect the communities' psychological well-being at Kg Genting and Kg Paya.

With more people on the Island, including visitors and tourists, there is a propensity that various infectious diseases, social ills and petty crimes will proliferate.

About 46.83% of the project site is estimated to have high erosion risk with potential rates of >600t/ha/yr. Soil erosion from the quarry and structural construction activities will inevitably cause soil erosion, resulting in shallowing of rivers and can lead to flash floods in Kg Genting and Paya, causing damage and death.

Because of the presence of many workers in Kg Paya and Kg Genting during the construction phase, these two villages could have their social and physical infrastructures stretched to the limit. If infrastructure and utilities are not upgraded or maintained in tandem with the expected population increase, it will adversely affect the quality of life of the people of Pulau Tioman and the tourism industry of the Island.

Owing to its proximity to the airport, the communities in Kg Genting and Kg Paya will experience visual impacts, feeling that their line of vision has been intruded upon. As the Project site is located on and off the coast of Kg Paya and Kg Genting, sea traffic will increase to transport construction materials and machineries to the site. This may increase the risk to local boats and ferry operators.

The report says that a connecting road will be built from Tekek to Genting. Yet no EIA has been submitted for this construction. Where will this road run through, and how will it impact the houses and businesses in Paya and Genting?

The report says the water catchment plant in Tekek must be upgraded to cope with the rise in demand for freshwater during the operations phase of the airport. Yet it doesn't say when this will be done and how it will be funded. The report says an additional 1107 rooms will be needed on Tioman to cope with the projected number of visiting tourists. The island lacks basic infrastructure such as sewage treatment plants to even cope with the current number of tourist. How will it cope with the exponential increase in tourist arrivals?

3.3 Ecological Impacts

Sound pollution, vibration, light pollution, chemical pollution, oil and sewage will impact the coral reefs in the area not only during the construction period but also during operations. Other polluting discharges, such as from vessels, machineries and equipment, will also affect marine water quality. Fuel and chemical spills will cause water pollution and could cause hypoxic conditions killing all marine life in the area. Accidental spillage at sea can also contaminate the water and endanger marine life. Barges and other vessels may release bilge water which is a mixture of water, sludge, lubricants, oil residue, chemicals, various inorganic salts, and metal.

Land reclamation will totally change the current hydrodynamics and may cause beach erosion and sedimentation in the future. Soil erosion from the quarry and structural construction activities will inevitably cause soil erosion, resulting in shallowing of rivers and degrading the marine environment.

Total suspended solids in the river flows are expected to exceed the baseline class 11A/11B of NWQS for rivers and class II of MMWQS in coastal waters. As the rivers are short, all the sediments could flow into the sea immediately, causing high turbidity in the seawater that will affect light penetration and lower photosynthesis, thus limiting growth and productivity and changing the entire marine ecosystem. In the quarry process, chemicals from spent explosives can contaminate the soil and other water bodies.

Semi-treated and untreated sewage from vessels will cause high Biological Oxygen Demand, ammonia and faecal coliform, which will cause low dissolved oxygen levels and deteriorate water quality. During the operation of the project, sewage effluent could be the main water pollution source if the stp fails or when backflow occurs since the discharge outlet is located 1km at sea.

Untreated water discharge, such as wastewater from airplanes and the airport, will be generated during maintenance, including ground support mobiles and equipment (baggage tractors, refuelers, busses, tugs and tractors), workshops and washing airplanes. Untreated wastewater will cause impedance and reduced water quality from oil and grease, heavy metal etc.

The report says the study area only had 355,078m2 of corals, but an area that large is already considered significantly important and able to provide multiple ecological roles such as nursery ground, feeding ground, and even provide protection against coastal erosion. The report says large, massive clusters can be found off Kg Paya and Genting; massive corals are slow-growing, and large ones can be hundreds of years old. It would not be possible to transplant these large massive colonies.

The loss of physical habitat would mean the loss of ecosystem services provided, considering that coral reef ecosystems take millions of years to grow and form; this has long-term impacts on the overall area and on Tioman. This included a reduction in coral recruitment as fewer corals are available to spawn, the loss of marine productivity due to the loss of nursery and feeding areas for marine life, lower productivity levels, and disruption to the food web and nutrient cycle. Corals not directly within the reclamation site will still be affected as they suffer from physical damage to their structure and degradation due to poorer water quality resulting from the sand-filling activities.

The loss of biodiversity can disrupt important ecological processes such as predation, competition, and symbiosis, which can have knock-on effects on the entire ecosystem. Reduced habitat complexity will reduce the ability of reefs to protect shorelines. The potentially compounding properties of each impact mean that corals may be less able to respond to natural impacts like storms. Given the nature of the Project, corals inhabiting within and near the Project boundary will be impacted directly by reclamation works and, in turn, cause stress to other marine life, which depend on coral reefs for a source of food and shelter.

Impacts from construction are expected to reach Pulau Renggis and Pulau Jahat. Marine life in the areas adjacent to the project site is going to undergo behavioural changes due to vibration, water pollution, sound pollution, light pollution, erosion, sedimentation, siltation and ecosystem changes. It would affect feeding habits, reproduction habits, physiological stress and migration patterns.

The diversity and abundance of marine life in Pulau Tioman could be affected despite all the above-mentioned mitigation measures being taken. Coral reefs are the most sensitive and vulnerable among other marine organisms. The loss of marine habitat, productivity and lowering of marine organisms within the airport plinth is unavoidable.

3.4 Additional Comments

3.4.1. Where will the worker quarters and base camp be located? Section 8.12.2(c), page 8-12-6, says worker quarters should be more than 500m from the existing kampungs in order to minimize social conflicts. So, where will the worker quarters be located? Will a new site need to be cleared to build the worker quarters?

3.4.2. The Statement of Need and Social Impact Assessment Sections 8.12.1 and 8.12.2 use the tourism downturn during COVID-19 as the reason why the airport is needed to help the tourism industry recover. In actual fact, the tourism industry is now actively recovering from the pandemic, and tourism is in full swing.

Therefore, on the contrary, the new airport will cause a severe detrimental impact on tourism instead of helping the operators to recover from the pandemic. They don't need the airport to help them recover from COVID-19.

3.4.3. Section 8.12.1(iv) says it is "likely that many tourists would like to stay near airports for convenience…" This sounds like a very odd assumption that tourists want to stay next to an airport. On the contrary, tourists want to visit a pristine, tranquil and scenic beach, certainly not with a noisy airport in front of the beach or beside their chalet! (This is not a city airport!)

3.4.4. Section 8.12.3(ii) on the loss of beachfront assumes that "the view of a wide-open sea will be partially blocked by the runway", when in actuality, **the runway blocks over half of the bay in front of Kg Genting**. The visual impact will be very significant. The EIA does not adequately address visual impacts in an area of outstanding natural beauty.

3.4.5. Did the SIA or social assessment in the EIA interview visitors and tourists to get their opinion of the new airport and whether they would want to stay at a resort at Kg Paya and Kg Genting knowing that the airport is right in front of them?

3.4.6. Will locals and tourists on boats be allowed to pass near the end of the runway, or will there be a restricted zone surrounding the airport where it is not allowed to trespass? If it is the latter, access by sea to Kg Genting could be restricted and cause inconvenience to the people.

3.4.7. Figure 8.15.1 shows best management practices for roads when there are no roads at Kg Paya and Kg Genting! (It seems to show that the BMP is copy-paste from a typical EIA for land-based activity, whereas the Tioman airport is mostly marine-based activities.)

3.4.8. A road will be built to link the site to Tekek village and Genting village, which will involve cutting the hillside all the way from Tekek to Genting. Much of this route is very heavily forested and hilly. Is this road part of the airport project or a separate project? The road will cause a lot of impacts, too and should be part of any EIA for the airport. It is not clear whether this has been taken into consideration.

3.4.9. How will utilities (electricity and water) be supplied to the airport? Will new electricity cables and water pipelines be built from Tekek all the way to the new airport? Will these be built on land along the coastline or submarine cables and pipelines? Where is the impact assessment for these activities?

It is our opinion that, while not specific to the construction of the runway and airport facilities, these associated services and facilities are essential for the project, and the project could not proceed without them. Therefore, they should be considered as part of the project and should be part of the EIA.

4. National planning requirements

The following is extracted from the National Physical Plan.

KD Action 2.2D: Regulating reclamation and land reclamation activities in coastal areas

The practice of land reclamation and reclamation on the coast has a wide-ranging environmental, socio-cultural and geopolitical impact. These activities should be well planned and strictly regulated to avoid the loss and degradation of coastal and marine habitats, including the value of biodiversity and ecosystem services, which ultimately also affects the source of income and the quality of life of the local population.

Reclamation and land reclamation of coastal areas also cause the risk of sedimentation and soil erosion along the coastline. Therefore, any reclamation and land reclamation activities in the coastal area must comply with the guidelines set in order to meet the requirements of the area and take into account the level of environmental sensitivity and the permitted development conditions.

The steps in regulating reclamation and land reclamation activities in coastal areas are as follows:

1. Any reclamation and land reclamation activities are not allowed in the following areas:
   I. Marine habitats and natural coastlines that have been gazetted as Protected Areas
   II. Environmentally sensitive areas (KSAS) Level 1 and Level 2 according to the KSAS framework (refer to Action KD 2.2A)
   III. Coastal Protection Zones that have been identified in NPP 4 (refer to Table 5-6 and Plan 5-11).
   IV. Reclamation prohibited areas and high biodiversity value, according to RFZPPN-2.
   V. Other recognized areas that have high biodiversity, cultural and socioeconomic value.

   However, reclamation and land reclamation activities are allowed for two types of development as below:
   I. Development of infrastructure of national interest (such as ports, airports, coastal dams and power stations)
   II. Development for the sake of national security and safety

2. Land reclamation and land reclamation activities can be considered in the Coastal Development Zone area with the specified conditions (refer to Table 5-6 and Plan 5-11)

3. Implement project planning involving reclamation or land reclamation activities that have a high impact and are of national interest to be included in state development documents to ensure that they are carefully planned and in accordance with land use requirements.

4. Any planning of reclamation and land reclamation activities also needs to carry out studies as follows:
   I. Social and environmental cost-benefit analysis (SCBA) as a basis for evaluating and comparing the benefits and effects of the project as a whole from economic, social and environmental aspects. The evaluation of the benefits of biodiversity and ecosystem services needs to use the TEV method to find out the total value of natural capital that will be affected by reclamation and land-clearing activities. The assessment should at least take into account:
      - impact on erosion and sedimentation along the coastline through hydrological engineering and coastal hydraulic analysis
      - impact on coastal natural habitats and marine ecology as well as animal and plant populations
      - impact on fishery resources
      - impact on the source of income and quality of life of the local community.
   II. The risk of climate change, including sea level rise for a period of not less than 100 years
   III. The suitability of the design with the shape of the existing coastline
   IV. The use of recycled materials that do not pollute and have a negative impact on the environment
   V. Availability of routes for local residents to coastal areas (except for prohibited areas)

5. Create a guarantee of biodiversity replacement
   The developer needs to ensure that the loss of biodiversity in the affected area will be replaced with a similar value to achieve the goal of "no net loss of biodiversity". The level of replacement is based on the characteristics of local biodiversity and the method of replacement needs to be jointly negotiated and approved by technical agencies.

6. Ensure that development proposals involving land reclamation and reclamation activities are raised for advice and consideration from the National Physical Planning Council.

5. A critique of the hydraulic survey

Some comments on the hydraulic study submitted to support the EIA submission for the newly proposed airport in Pulau Tioman:

- The study is thought to have been carried out in 2006-2007, however, no information on the issue/submission date to Jabatan Pengairan dan Saliran (JPS) Malaysia is available
- The report does not include a hydraulic subject specialist that is responsible for the study and project proponent
- The data collected for the study include:
    - Measurements of currents at one location for a short period (around 6 days during only one specific tidal period) carried out in 2006
    - Bathymetric survey without details of the date of the works and no reference to the Licensed Surveyor who carried out the works
    - No other data was collected for the study
- No details on sensitive receptors are presented
- No monitoring works are described
- No detailed impacts and mitigation measures are proposed; only high-level

Based on the above, it is considered that the study **does not meet** Jabatan Pengairan dan Saliran Malaysia guidelines that require that (our comments in red):

- A recent hydraulic study is carried out to evaluate potential impact and define mitigation strategies; the report is valid for less than 2 years. (The appended coastal hydraulic report in the Tioman EIA is expected to be older than 2 years based on the baseline results presented i.e. year 2006.)
- Name, Address, Telephone Number, Fax Number and email of the Project Proponent, Sub-Consultant and Main Consultant (if applicable) must be clearly stated. (No information is provided)
- Project Proponent and Consultant shall sign a Declaration Form or Confirmation Form for each hydraulic study carried out, and the form can be obtained from the office of River Basin and Coastal Zone Management Section, JPS Malaysia. (No information included)
- The consultant shall acquire comment and approval officially from JPS before data collection works are carried out. (No information on JPS feedback and approval is provided.)
- Environmental Sensitive Area must be shown clearly in the project area. (No information provided)
- All data for modelling shall not be more than 2 years from the date of the data collection work. (Data is older than 2 years)
    - Water Level Measurements shall be carried out for at least two weeks to include the spring and neap tides. (No water level measurements available)
    - The velocity measurements shall be carried out for at two locations at least 3 days each during the spring and neap tides. For calibrating 2-D models, the measurements can be made at the appropriate depth of the water column to obtain the representative velocity. (Currents measured for a short period of time only and for a tidal condition at one location only.)
    - No sediment grab or water samples have been collected for the study.
- It is recommended that the modelling scenarios include three climatic seasons (NE, SW and inter-monsoon). (This type of assessment is not presented)
- Monitoring is required for this type of studies to ensure that impacts are within the limits as predicted. (No monitoring works are proposed)
- Upon review of the coastal hydraulic report, JPS issues a letter with their views and comments. (No letter could be found in the EIA study)

To conclude, the report overall provides high-level information to support a feasibility assessment. The hydraulic report **does not meet** the JPS required to support an EIA for submission to authorities (such as JPS, DOE, LKIM, etc.)

6. A critique of the marine survey.

6.1 Mitigation Measures

1. Unsuitable methodology for counting corals = LIT transects are not great; belt surveys should have been used to determine coral density, diversity and demographic structure
2. Improper and arbitrary application of standard metrics = poorly calculated health metrics were used to determine reef health, demographic data entirely missing, and false baseline principles were used (i.e., coral health weighted against coralline algae)
3. Incorrect species ID = Caribbean species recorded, many incorrect documentation with photographs clearly showing different species from what is stated, outdated species and genus names (i.e., Favia is Dipsastraea since 2016, listed as Favia, thus unclear what it is)
4. Incorrect execution of surveys = transects were going away from the shore; they should have been running parallel to it in a staggered fashion and across depth zonation. This reduced the number of corals counted greatly, minimizing the possible impacts of the airport.
5. Poor and confusing writing, insufficiently describing the issues and impacts and failing to clearly state how the data were recorded, measured, and analyzed.
6. Insufficient documentation of abiotic and biotic impacts – vulnerability assessment is highly questionable as methodology is not explained properly and risk factors are not detailed; generally, no clear conclusion is given as to how much the coral reef ecosystem would decline.
7. Incorrect and misleading citations of literature, falsely supporting arguments made in the report = e.g., deep water corals guidebook used to reference protocol for relocating corals
8. Unreasonable suggestions of mitigation measures that are not based on local assessments, and the proposed mitigation plan is very poorly defined and described, further failing to clearly state the key facts and figures (i.e., no cost assessment, no exact number of corals relocated, no timeline, etc).

Major flaws of the proposed mitigation measure to relocate corals

A. **Only species with an IUCN status of near threatened, vulnerable, endangered, and critically endangered will be relocated.**

This is arbitrary and will reduce the number of corals saved because:

1. The IUCN concept is not suitable for corals as the concept of species does not work for corals (i.e., the way coral species are identified is highly inaccurate), and current species-specific population data is not conclusive, on top of constantly changing due to enormous pressure on coral reefs.
2. IUCN status does not accurately reflect the status and risk of extinction of coral reefs – which are one of the most threatened marine ecosystems in the world.
3. It would select only 54 species out of the 122 total identified species = 44%.
4. It does not consider the local population risks of individual species (i.e., might not be classified as vulnerable but might be locally on the verge of extinction).
5. It does not consider the ecological function and role of species, specifically in the local context.
6. It disregards many of the most common and important reef-building corals, such as Porites rus, P. lutea, etc.
7. It does not consider the ecological connectivity of the site and whether the corals at the proposed site provide other reef sites with coral larvae (this goes for all other benthic organisms).
8. It does not take into account the amenability of species with the proposed transplantation method. It assumes it will work, but this is clearly an insufficient argument.

9. It is not based on any studies and data from Malaysia that would otherwise indicate the success or failure of the proposed transplantation.
10. It does not refer to any published studies that actually support the proposed transplantation method and measure – i.e., what is the assumption that this will work and what data supports it?

B. Recipient Site Selection

The described site selection criteria are solely based on the assumption that it is out of reach of the chosen airport site and thus assuming it is safe from the negative impacts.

However, the following criteria need to be considered when doing any coral panting, relocation, and transplantation:

a) Actual need of planting corals at the receiving sites
b) Water quality and the receiving sites
c) Human disturbances at the receiving sites
d) Biophysical factors of the receiving sites
e) Corallivores at the receiving sites
f) Faunal assemblage at the receiving sites
g) Substrate composition of the receiving sites
h) Substrate availability for restoration of the receiving sites
i) Ecological connectivity of the receiving sites
j) Natural recruitment of the receiving sites
k) Suitability of the restoration method with the topography of the receiving sites
l) Socio-economic value of the receiving sites
m) Accessibility of the receiving sites
n) Algae turfs of the receiving sites

The EIA merely states that some of the above will be measured and monitored but does not specify monitoring methods and benchmark criteria that will determine the suitability of the site.

Thus, in conclusion, the EIA entirely **fails** to evaluate the suitability of the receiving site with the proposed relocation process. It further did not specify whether the relocation site will be monitored for success (this is only mentioned for nurseries/coral farms).

C. Nursery and relocation method

The EIA proposes to follow protocols established for deep-sea corals (800-1,300 m) by NOAA, but these deep-water coral reefs are nothing like tropical shallow-water coral reefs, therefore demonstrating a clear lack of how to move corals safely and effectively.

PVC pipe nurseries are proposed, with biannual monitoring, to only use coral pieces of suitable size. Further, it is stated that corals will be cut into smaller pieces at the original site - which is bad practice.

In summary:

1. The nursery method is **outdated** (i.e., better methods available). The choice of nursery is entirely arbitrary, and it is not stated as to why this specific type of nursery was used and why it is better than other designs (i.e., no data or references were presented).
2. The method suggested introduces permanent plastic structures.
3. The relocation site proposed is susceptible to waves and storms.
4. The relocation site proposed is very susceptible to biofouling which would increase mortality.

5. The method suggested is actually unnecessary as corals should be directly relocated and transplanted, and perhaps only a fraction of the corals should be placed in nurseries to build a stock of nursery corals for actual coral restoration programs.
6. The nursery phase would increase mortality rates, as nursery mortality is very common and could potentially outweigh the positive impacts of relocating corals.
7. Although the report states that the method will be standardized to accommodate multiple growth forms, this seems very unreasonable, and it is not clearly stated how this will be achieved.
8. Coral rubble will be relocated to the nursery sites to attract service organisms, but this is clearly increasing risks of the coral rubble killing corals and other benthic organisms that are already on site as the rubble would move during storms, waves and surges.
9. The EIA falsely deduces that *"the presence of spats, genets or relative size increases indicates acceptance to the new environment conditions*" – this is assumptive and not backed up by any data. Furthermore, growth does not indicate that the coral's physiology and metabolism are performing as they should in the native environment, nor does it mean that the ecological function is being fulfilled. Overall, a very poor criterion.
10. No potential risks are listed; therefore, the effectiveness of this project has been entirely left out of the discussion, and it is a mere assumption that mitigation will work.

The EIA further does not state how corals will be eventually planted into the reef!

D. **Cost Assessment of the Mitigation Project**

UNEP estimated that 1 ha of coral reef costs ~150,000 USD to restore. Presently, the Tioman airport is 186.36 ha large, of which 76% will be built over the sea= 141.63 ha * 150,000 = 21,245,040 USD total cost of restoration (!).

- The report did not specify a timeline, estimated man hours, scuba dives and required equipment to complete the relocation.
- It did not detail when the mitigation should take place.
- It did not specify how long the nursery phase would last, whether the nursery would be maintained and whether it would be eventually removed.
- Nursery maintenance is a huge cost factor for the proposed mitigation measure, but it was not mentioned or discussed as to how it will be maintained to fulfil its role.

The proposed mitigation measures are, therefore, **highly inadequate and incompatible with the objective to maintain and save coral colonies at risk from the construction**. With the proposed intervention, only a tiny fraction of the coral assemblage will be relocated to nurseries, where they will inevitably experience nursery-related mortality.

Overall, without a clear statement of how many corals will be relocated, how big the nurseries will be, and how exactly corals will be planted to natural reef sites, it seems unlikely that more than 10% of corals will be relocated, and as much of the relocated colonies will suffer mortality, the total output of the mitigation measure (as based on the vague EIA) might only save 1% of the corals.

6.2 Marine Survey

Marine scientists in Malaysia have reviewed the Marine Survey in the EIA report and have noted numerous errors.

Of most concern is the fact that many of the species identified as present in Tioman and listed in the EIA report **are not found in Malaysian waters**. This brings into question the validity of the marine survey and whether it should be accepted by DoE.

Detailed comments are shown in **Appendix 1**.

Appendix 1: Comments on the Marine Survey, including species NOT found in Malaysia

References in Report	Statements in Report	Problems	Remarks/Comments
02 Tioman Airport EIA Vol II Main Text F			
Page 6-13-45	Fish visual census conducted using video	In UMMaritime (2007) report, the species was identified in-situ and noted in the waterproof polyester sheets. For the unidentified species, underwater photographs and notes were taken for further comparisons with illustrations and references	Different methods were used in both study and can be very biased to compare the two because most of the fishes that hide will be difficult to be recorded with the video
Page 6-13-46	Reliance on CFDI is **void due to the lack of reef continuity and weather**	Not really a problem with UMMaritime (2007) report because CFDI is based on the number of species of the 6 families observed in the areas and can be used for 3 categories of sites	The author didn't understand the basic concept of CFDI
Page 6-13-46	Only 125 species of coral reef fish species observed, compared to 207 in 2007 survey, with a 40% decline	Different methods were used in both surveys - video in this study and in situ observation in 2007. The number of species observed directly will be higher because the scientist will be able to look into holes and crevices, which is not possible with video, which mainly covers above the reef areas	To say the decline of fish because of environmental factors is very much invalid because low accuracy method used and the questionable expertise of the author of current reports **(Refer to species comments)**
Page 6-13-47	CFDI value range from 140-199 and to be considered as moderate and decrease by 38.8%	Wrong usage of CFDI value: it is supposed to be only using only 6 common families of coral reef fishes (Chaetodontidae, Pomacanthidae, Pomacentridae, Labridae, Scaridae, and Acanthuridae). Decreased number of species is mainly resulted by low accuracy method used and	Wrong interpretation of CFDI

		inexperienced observers in the current study (refer to above).	
Page 6-13-47	Only 4 commercial species were observed in the study (Scaridae, Lutjanidae, Mugillidae and Sphyraenidae) as compared to 11 in 2007 (–Dasyatidae (Stingray) – 1 sp., -Lutjanidae (snapper) –5 sp., -Caesionidae (Fusilier) –4 sp., -Haemulidae (Sweetlips) –1 sp., -Lethrinidae (emperors) –1 sp., -Carangidae (jacks) –3 sp. -Serranidae (groupers) -6 sp., -Kyphosidae (Rudderfish) -1 sp. -Scaridae (Parrotfish) – 1sp., -Sphyraenidae (Barracuda)-1 sp. and -Mugilidae (Mullet)- 1 sp.)	9 commercial fish families were actually observed in current study. They left out other commercial families: Caesionidae – 1sp Carangidae – 2 sp Mullidae – 1 sp Nemipteridae – 7 sp Serranidae – 8 sp	
Comments on coral reef fish species identified, based on www.fishbase.org			

Table 6.13.12: Species composition of Reef fish within Project Area

Page	Species	Problems/Remarks	Actual distribution of the species
Page 6-13-47	*Apogon retrosella*	Wrong identification as species is not distributed in Pulau Tioman	Eastern Central Pacific: Gulf of California to Southern Mexico
	Ecsenius bimaculatus	Wrong identification as species is not distributed in Pulau Tioman	Western Pacific: known only from the Philippines and the adjacent northeast Borneo (Sabah), Malaysia.
	Selar boops, Gnatonodon speciosus	Wrong family, supposed in Carangidae, not Caesionidae	
Page 6-13-48	*Amblyeleotris rhyax*	Wrong identification as species is not distributed in Pulau Tioman	Western Pacific: New Britain and the Philippines.
	Cryptocentrus bulbiceps	Wrong identification as species is not distributed in Pulau Tioman	Western Pacific: Australia.

	Coryphopterus glaucofraenum	Wrong identification as species is not distributed in Pulau Tioman	Western Atlantic: North Carolina, USA and Bermuda to Santa Catarina, Brazil ; throughout the Caribbean Sea.
Page 6-13-49	*Halichoeres chierchiae*	Wrong identification as species is not distributed in Pulau Tioman	Eastern Central Pacific: Gulf of California to Panama.
	Ostorhinchus cavatiensis, O fasciatus, O sealei	Wrong family, supposed in Apogonidae, not Opistognahidae	
	Chromis notata	Wrong identification as species is not distributed in Pulau Tioman	Western Pacific: southern Japan, Ryukyu Islands, Taiwan, and China.
	Chromis margaritifer	Wrong identification as species is not distributed in Pulau Tioman	Pacific Ocean: Christmas Island and northwestern Australia in the eastern Indian Ocean to the Line and Tuamoto islands.
	Pomacentrus vatosoa	Wrong identification as species is not distributed in Pulau Tioman	Western Indian Ocean: Madagascar.
	Pomacentrus emarginatus	Wrong identification as species is not distributed in Pulau Tioman	Western Central Pacific: Waigiu (off west New Guinea) and Palau.
	Pomacentrus caeruleus	Wrong identification as species is not distributed in Pulau Tioman	Western Indian Ocean: East Africa (south to Durban) to Maldives
Page 6-13-50	*Abudefduf natalensis*	Wrong identification as species is not distributed in Pulau Tioman	Western Indian Ocean: Mauritius, Réunion, Madagascar and South Africa (from Kwazulu to Transkei).
	Pomacentrus melanochir	Wrong identification as species is not distributed in Pulau Tioman	Indo-Pacific: Indonesian islands of Bali, Flores, Timor, Buru, Sulawesi, and Ambon
	Parma oligolepis	Wrong identification as species is not distributed in Pulau Tioman	Western Pacific: eastern Australia between Cape Tribulation, Queensland and Sydney, New South Wales.
	Neoglyphidodon carlsoni	Wrong identification as species is not distributed in Pulau Tioman	Western Central Pacific: Fiji, Ouvéa Atoll, Loyalty Islands and Tonga
	Chaetodontoplus mesoleucus	Wrong family, supposed in Pomacanthidae, not Pomacentridae	

	Amphiprion akindynos	Wrong identification as species is not distributed in Pulau Tioman	Western Pacific: eastern Australia (Great Barrier Reef and Coral Sea, northern New South Wales), New Caledonia, and Loyalty Islands, Tonga
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Page 54	CFDI value in the 2007 survey was 209, and in this study, 147.	Wrong usage of CFDI value: it is supposed to be only using only 6 common families of coral reef fishes (Chaetodontidae, Pomacanthidae, Pomacentridae, Labridae, Scaridae, and Acanthuridae) not the total species observed. The decrease number of species mainly resulted from low accuracy method used and inexperienced observers in the current study (refer to above).	
Page 53	Fish survey methods	No clear references were provided on references used to identify the coral reef fish species	This led to many wrong identifications and wrong localities of species observed
Comments of coral reef fish identifications based on Table 7: fish species identified from transect site E01-21 in Pulau Tioman (04 Tioman Airport EIA Vol IV Appendices F (part 1) Attachment 6 -M)			
Page	Species	Problems	Remarks
Page 63	Selar boops	Probably Scolopsis sp	Wrong identification
Page 64	Chromis ternatensis (1st picture)	Probably Neopomacentrus cyanosoma	Wrong identification
Page 65	Chromis notata	Chromis cinerascens (pic 1 and 2) C. atripectoralis (pic 3)	Wrong identification: Chromis notata in southern Japan, Ryukyu Islands, Taiwan, and China.

P 66	Chromis fumea	Neopomacentrus anabatoides	Wrong identification
	Chromis margaritifer	Probably Pomacentrus chrysurus	Wrong identification Chromis margaritifer is distributed in Pacific Ocean: Christmas Island and northwestern Australia in the eastern Indian Ocean to the Line and Tuamoto islands.
P 67	Pomacentrus vatosoa	Dischistodus sp	Wrong identification Pomacentrus vatosoa is in Western Indian Ocean: Madagascar.
P 68	*Pomacentrus emarginatus*	Dascyllus sp (pic 1) Plectroglyphidodon sp (Pic 2)	Wrong identification *Pomacentrus emarginatus* is in Western Central Pacific: Waigiu (off west New Guinea) and Palau.
	Pomacentrus caeruleus	Pomacentrus coelestis	Wrong identification Pomacentrus caeruleus is in Western Indian Ocean: East Africa (south to Durban) to Maldives
	Pomacentrus melanochir	Stagestes sp.	Wrong identification *Pomacentrus melanochir* is in Indo-Pacific: Indonesian islands of Bali, Flores, Timor, Buru, Sulawesi, and Ambon
	Pseudanthias squamipinis	Pomacentrus moluccensis	Wrong identification
P 69	Platax orbicularis	Platax teira	Wrong identification
	Amblyeleotris rhyax.	Probably Amblyeleotris diagonalis	Wrong identification Amblyeleotris rhyax is in Western Pacific: New Britain and the Philippines
P 70	Amblygobius cheraphilus	Valenciennea muralis	Wrong identification
	Cryptocentrus bulbiceps	Cryptocentrus fasciatus	Wrong identification Cryptocentrus bulbiceps is in Western Pacific: Australia.
P 72	Valenciennea helsdingenii	Ecsenius sp	Wrong identification

P 73	Epinephelus sexfasciatus	Cephalopholis boenak	Wrong identification
	Epinephelus coeruleopunctatus	Plectropomus sp	Wrong identification
	Epinephelus coides	Epinephelus quoyanus	Wrong identification
	Cephalopholis argus	Cephalopholis cynostigma	Wrong identification
P 74	Cephalopholis microprion	Plectropomus sp	Wrong identification
	Epibulus brevis	Doesn't look like slingjaw wrasse	Wrong identification
P 75	Cheilodipterus quinqueleneatus	Pic 2 Cheilodipterus artus	Wrong identification
	Ostorhinchus cavitensis	Ostorhinchus cyanosoma	Wrong identification
	Ostorhinchus fasciatus	Probably Rhabdamia sp	Wrong identification
P 76	*Apogon retrosella*	Taeniamia sp	Wrong identification *Apogon retrosella* is in Eastern Central Pacific: Gulf of California to southern Mexico
	Apogon endekataenia	Probably Ostorhinchus cavitensis	Wrong identification
P 77	Opistognathus aurifrons	Ptereleotris sp	Wrong identification Opistognathus aurifrons is in Western Central Atlantic: southern Florida, USA and Bahamas to Barbados and northern South America.
P 80	*Abudefduf natalensis*	Amblyglyphidodon sp	Wrong identification *Abudefduf natalensis*is in Western Indian Ocean: Mauritius, Réunion, Madagascar and South Africa (from Kwazulu to Transkei).
	Parma oligolepis	Dascyllus sp	Wrong identification *Parma oligolepis* is in Western Pacific: eastern Australia between Cape Tribulation, Queensland and Sydney, New South Wales.
	Neoglyphidodon melas	Dascyllus sp	Wrong identification
P 81	*Neoglyphidodon carlsoni*	Dascyllus sp	Wrong identification *Neoglyphidodon carlsoni* is in Western Central Pacific: Fiji, Ouvéa Atoll,

			Loyalty Islands and Tonga
P 83	Gerres oyena	Ptereleotris sp	Wrong identification
	Amphiprion melanopus	Amphiprion frenatus	Wrong identification Amphiprion melanopus is in Pacific Ocean: Eastern Indonesia (Bali and Sulawesi eastward), south-eastern Philippines, Papua New Guinea, eastern Queensland, Coral Sea, Solomon Islands, Vanuatu, New Caledonia Palau and Islands of Micronesia.
P 84	*Amphiprion akindynos*	*Amphiprion clarkii*	Wrong identification *Amphiprion akindynos* is in Western Pacific: eastern Australia (Great Barrier Reef and Coral Sea, northern New South Wales), New Caledonia, and Loyalty Islands, Tonga
P 86	Lutjanus vitta	Pic 1: Scolopsis sp	Wrong identification

In addition to the above, 7 species of coral identified as present during the marine survey are NOT found in Indo-Pacific waters:

1. Acropora cervicornis - Atlantic
2. Acropora palmata - Atlantic
3. Clavularia carpediem - Endemic to the Mediterranean
4. Mussa angulosa - Atlantic
5. Pseudodiploria strigosa - Atlantic
6. Porites furcata - Atlantic
7. Diodogorgia nodulifera - Atlantic