ENVIRONMENTAL IMPACT ASSESSMENT TO UPGRADE/RENOVATION OF VESSEL LOADING JETTY AT STO GO-DOWN (PLOT NO 2) AND SHORE PROTECTION OF THE (PLOT NO 111), AT K. THILAFUSHI, MALDIVES

PREPARED FOR
STO.
Prepared by DCP PVt. LTD

EIA CONSULTANT
MAHMOOD RIYAZ PHD (EIA03/07)

November 2016

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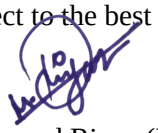
Declaration of the Consultant:

I certify that the statements made in this Environmental Impact Assessment are true, complete and correct to the best of my knowledge and available information at the time of writing this report.



Mahmood Riyaz (EIA03/07)
November2016

بسم الله الرحمن الرحيم

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ستيٹ ٹريڈنگ آرگنائزيشن پ.ل.ث

State Trading Organization plc

Registration Number: **C-186/2001**

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9th November, 2016

Declaration of the Proponent:

As the proponent of the proposed environmental impact assessment for the proposed EIA to upgrade/renovation of vessel loading jetty at STO go-down (plot no 2) and shore protection of the (plot no 111), at K. Thilafushi, Maldives, I guarantee that I have read the Environmental Impact Assessment report thoroughly and that to the best of my knowledge all information provided here is accurate and complete.

Yours sincerely,

Muslih Maseeh

General Manager

sto SINCE 1965 51 YEARS OF SERVICE

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Acronyms used in the text

BOD	Biological Oxygen Demand
COD	Chemical Oxygen Demand
FOH	Front of the House (guest rooms, reception restaurant, arrival pavilion etc)
DNP	Department of National Planning
EPA	Environmental Protection Agency
EPAA	Environmental Protection and Preservation Act
MHTE	Ministry of Housing, Transport and Environment
MSL	Mean Sea Level
NPC	National Planning Council
MYS	Ministry of Youth and Sports

1 ސާރާ ޚުލާސާ

1. މިއީ ކ. ތިލަފުށިން ސްޓޭޓް ޓްރޭޑިންގ އޯގަނައިޒޭޝަން (އެސް.ޓީ.އޯ) އަށް ދޫކޮށްފައިވާ ޕްލޮޓް 2 އާއި ޕްލޮޓް 111 ގެ ތޮށި މަރާމާތު ކުރުމަށް ކުރެވޭ މަސައްކަތުގެ ސަބަބުން ތިމާވެއްޓަށް އަސަރު ކުރާނެމިންވަރު ބަލައި ވަޒަންކުރުމަށްޓަކައި އެސްޓީއޯގެ ފަރާތުން ތައްޔާރުކުރި އީއައިއޭ ރިޕޯޓެވެ. މިމަޝްރޫއުގެ އެދިޔާރަކީ އެސް.ޓީ.އޯ އެވެ.

2. ކ. ތިލަފުށިން ސްޓޭޓް ޓްރޭޑިންގ އޯގަނައިޒޭޝަން (އެސް.ޓީ.އޯ) އަށް ދޫކޮށްފައިވާ ޕްލޮޓް 2 އާއި ޕްލޮޓް 111 ގެ ތޮށި މަރާމާތު ކުރުމަށް ކުރެވޭ މަސައްކަތުގެ ތެރޭގައި ހިމެނެނީ މިގޮތުން ޕްލޮޓް 2 ގައި އޮތް ތޮށިގަނޑު ނަގައި، ސީޓް ޕައިލް ކޮށްގެން އާތޮށިގަނޑެއް ލުމާއި، މިގޮތުން އިންވައިރަންމަންޓަލް ތޮށިގަނޑު 20 މީޓަރަށް ބޭރަށް ނެރުމާއި، އެސަރަހައްދުގައި ފަސްއެޅުމެވެ. ޕްލޮޓް 111 ގެ މަރާމާތުގެ ތެރޭގައި ހިމެނެނީ މިހާރު ތޮށިފަހަރާ މަގަމު ތޮށި ނަގައި ބޭރިޔަށް އާ ތޮށިބެއް ލުމާއި އެސަރަހައްދު ހިމާޔަތް ކުރުމެވެ. މި ބޭރިޔަށް ބޮނޑުކޮނޑު ނެރުމާއި ތޮށިބެއް ލުމާއި އެސަރަހައްދު ހިމާޔަތް ކުރުމެވެ. އިހުއިގެ ރިޕޯޓާ ފުޅާކުރުމާ ގުޅޭގޮތުން ކުރެވޭ މަސައްކަތް ފުރުޞަތުގައި ހަމަޖެހުނު ކުރުމަށް ކަނޑައެޅުނު ޕްރޮޖެކްޓްގެ ކުރިން އެގްރީމަންޓެއް ހަދާފައިވާނެއެވެ. އަދި ދިވެހިރާއްޖޭގެ ތިމާވެށި ހަމަޖެހުމުގެ ޤާނޫނު (93/4) ގެ ދަށުން ތަކެތި އުފެއްދުމުގެ ކުރިން ތިމާވެށްޓަށް އަސަރުކުރާނެ މިންވަރު ބަލައި ވަޒަންކުރަންޖެހެއެވެ.

3. މިރިޕޯޓް ތައްޔާރު ކުރެވިފައިވަނީ 2012 ވަނައަހަރު މިނިސްޓްރީ އޮފް ހައުސިންގ އެންޑް އެންވަޔަރަންމަންޓް ގެޒެޓްކޮށްފައިވާ ތިމާވެށްޓަށް އަސަރު ކޮށްފާނެ މިންވަރު ބެލުމާ ބެހޭ ގަވާއިދާއި، 2016 ވަނަ އަހަރު އެގަވާއިދަށް ގެނެވުނު އިސްލާހު ތަކާއި އެއްގޮތްވާގޮތުގެ މަތިންނެވެ. ކ ތިލަފުށީގައި ހިނގާ މިޕްރޮޖެކްޓްގެ ސަބަބުން ތިމާވެށްޓަށް ގެއްލުންނާއި އަދި އިޖްތިމާޢީ-އިޤްތިސާދީ ގެއްލުންތަކާ ބަހައިގެ އަދި ނުބައިއަސަރު އަސަރުތައް މިރިޕޯޓުގައި ވަޒަންކޮށް ހަމަޖައްސާފައިވާނެއެވެ. މިރިޕޯޓުގެ މައިގަނޑު ހޯދުންތައް ބިނާވެފައިވަނީ ތިލަފުށީގައި މިކަމާގުޅޭ ގޮތުން ކުރެވުނު ސާވޭތަކުން ހޯދުނު މަޢުލޫމާތާއި ، އެރިޔާގެ ތިމާވެށީގެ ހާލަތާއި، ކަމާގުޅޭ ފަރާތްތަކާ އާއި ކުރެވުނު މަޝްވަރާތަކާއި ފީލްޑް ވިޒިޓްތަކާއި ހޯދުނު މަޢުލޫމާތު ދިރާސާކޮށް ޕްރޮޖެކްޓާއި ގުޅޭ ތަކެތި ބެލުމަށްފަހުގައެވެ.

4. ހުށަހަޅާފައިވާ ޕްރޮޖެކްޓްގެ ހުރިހާ މަސައްކަތެއް ހިނގާނީ ކ. ތިލަފުށިން ސްޓޭޓް ޓްރޭޑިންގ އޯގަނައިޒޭޝަން (އެސް.ޓީ.އޯ) އަށް ދޫކޮށްފައިވާ ޕްލޮޓް 2 އާއި ޕްލޮޓް 111 ގެ ސަރަހައްދުގެ ތެރޭގައެވެ. ކ. ތިލަފުށަކީ ގެދޮރު ހުސް ރަށެއް ކަމުގައި ވީނަމަވެސް އިންޑަސްޓްރިއަލް ރަށެއްގެ ގޮތުގައި ބޭނުންކުރެވޭ ރަށެކެވެ. މިރަށުގެ ތިމާވެށި ހާލަތުގައި ބަދަލު އައިސްފައިވާނެއެވެ. ތިލަފުށީގެ ހުޅަނގު ބައި ހިއްކާފައިވާ ތަނެއް ކަމުން ތިމާވެށި އިންސާނުންގެ އަމަލުތަކުގެ ސަބަބުން ބަދަލުވެފައިވާނެއެވެ. މިޕްރޮޖެކްޓް ފަށަން ނިންމާފައިވާ ސަރަހައްދުގައި ބާރުވެރި އަސަރެއް ކުރާނެ ތަކެތި ހުރިކަމެއް ނުފެނެއެވެ. މިހެންކަމުން މިޕްރޮޖެކްޓްގެ މަސައްކަތުގެ އަސަރު ކުޑަވާނެ ކަމަށް ލަފާކުރެވެއެވެ.

5. ހުށަހަޅާފައިވާ ޕްރޮޖެކްޓްގެ މަސައްކަތުގެ ސަބަބުން ތިމާވެށްޓަށް އަސަރުކުރާނެ މިންވަރު ބޮޑުކަމެއް ނެތެވެ. އިމާރާތް ކުރުމުގެ މަރުޙަލާގައި ބޮޑެތި އެއްޗެހި ގެންގުޅުމާއި ބޮޑެތި ތަކެތި އުފުލުމުގެ ސަބަބުން ތިމާވެށްޓަށް މިންވަރު ބޮޑުނޫން ބާވަތުގެ އަސަރުތަކެއް ކުރެވިދާނެއެވެ. މިގޮތުން ކުރިމަތިވާ (ކުޑަކުޑަ) އަސަރުތައް ޕްރޮޖެކްޓް ތަރައްގީކުރުމުގެ މަސައްކަތާއި އެކީ ބޭނުންކުރަން ފެންވަރު ކުރާނެ ކަންތައްތަކެވެ. އަނެއްބައި ގޮތުގައި (ދާއިމީ) އަސަރުތަކަކީ މަސައްކަތުގެ ސަބަބުން ތިމާވެށީގެ ދެމެހެއްޓުމާ ގުޅޭ ވަރަށް ކުޑަ އަސަރު ކަމުގައި ވަނީ.

6. މިމަސައްކަތް ކުރަން ފެށުމުން ރަށުގެ ސަރަހައްދުގެ ތިމާވެށީގެ ހާލަތަށް އަންނަ ނުބައި އަސަރުތައް ބަލައިލުމަށް ފަރުގެ ފަރާތުން ތަފާތު ކަންކަން ކަނޑައަޅާފައިވާ ގޮތްތައް މިރިޕޯޓުގައި ފާހަގަކޮށް ހިމަނާފައިވާނެއެވެ. އަދި އެކަންކަން ރަނގަޅު ކުރުމަށްޓަކައި ބޭނުންވާ ފިޔަވަޅުތައް ވެސް މިރިޕޯޓުގައި ހިމަނާފައިވެއެވެ. ހުށަހެޅިފައިވާ ޕްރޮޖެކްޓްގެ ސަބަބުން ތިމާވެށްޓަށް ނުރައްކާ އަސަރެއް ކުރިމަތިވެދާނެ ކަމަށް ފާހަގަ ނުކުރެވުނު ނަމަވެސް، ތިމާވެށީގެ ހާލަތު ބެލެހެއްޓުމަށް ފިޔަވަޅުތައް ނެގުމަށް ލަފާކުރެވޭ މަސައްކަތްތަކުގެ ކުރިން ދަނޑިވަޅުން ތިމާވެށީގެ ހާލަތު ބެލުމަށްފަހު އެކަށީގެންވާ ފިޔަވަޅު އެޅިދާނެއެވެ. ތިމާވެށީގެ ސަރަހައްދު ބެލެހެއްޓުމަށް ކުރިއަށް ގެންދާ މޮނިޓަރިންގ ޕްރޮގްރާމް ތަކަކީ ވަރަށް މުހިންމު ކަންތަކެކެވެ. މިގޮތުން ޕްރޮޖެކްޓްގެ ހަރަކާތްތައް އެންމެ ފަހުން ބެލެހެއްޓުމަށް ރިޕޯޓުގައި ތިމާވެށީގެ މޮނިޓަރިންގ ޕްރޮގްރާމެއް ހުށަހަޅާފައިވާނެއެވެ. ރިޕޯޓުގައި ހިމެނޭ ކަންކަމުގެ އިތުރުން ބޭނުންވާ މަޢުލޫމާތު ކަނޑައަޅައި ކުރިއަށް ގެންދެވޭނެ ކަމަށް ފާހަގަކުރެވެއެވެ.

7. ހުށަހަޅާފައިވާ މަސައްކަތްތައް ކުރުމުގައި ބަދަލުގެންނަވާފައި ކަމަށް ވަގުތުކޮށް ބޭނުންކުރާނެ ބާރުބޮޑު މިދިޔަ ބަރުދަން ވަޒަންކުރުވިފައިވާނެއެވެ. މިމަޝްރޫއު ނިންމުމާއި، މިހާރު ޕޯޓުގެ ހުށަހަޅާފައިވާ ގޮތުގައި ވަޒަންކުރުވާނެއެވެ. މިގޮތުން މިދިޔަސާލުން ބޮޑަށްފެނި މިހާރު ހުށަހަޅާފައިވާ ގޮތަށް ޕޯޓުގައިހުރި ކުރުމުގެ މަސައްކަތް ގޮތުގައި ބޭނުންކުރާ އެންމެ ބަރުދަނު ގޮތް ކަމުގަ އެވެ.

8. މިދިޔަސާލުން ދަށުގެ ގޮތުން މިމަޝްރޫއު ކުރިއަށް ގެންދިޔުމަށް ބޭނުންވާ ފިނޭންސިއަލް ސަރުކާރުގެ ސަޕޯޓިވް އިޖާޒަތް ބޭނުންވާ ގޮތުގެ ތަފާސްހިސާބު ނެގުމަށް ކޮށްފައިވާ ކުރުމުގައި ގެނދޭ އޮފީހުގެ ޕްރޮސެސް އެންމެފަހުގެ މަރުހަލާގައި ޖެހިފައިވަނީ.

9. ތަފާސްހިސާބު އަސަރު ފޯރާނެ ވަޒަންކުރުން ބޮޑު މިދިޔަގައި ފަރާތް ކުންފުނިން ގެންދާ ކޮންޓްރެކްޓަރު ބިނާކުރާ ތިމާވެށީގެ އަސަރުތައް މިންވަރު ކުރުމަށް ހުށަހަޅާފައިވާ ޕްރޮޖެކްޓް އަދި ދިޔަގައި ފަރާތް ކުރުވާ ސަރުކާރުގައި ފަރާތް ކުރުވާ ކުންފުނިތަކަށް ފުރިހަމަކުރުން ދިއުމަށްޓަކައި ހުށަހަޅާ ފައިވާ ގޮތަށް ކ. ތިލަފުށި ސްޓޯރ ބޯޓުލޯޑިންގ ޖެޓީއާއި ބަނދަރުގެ (އެސް.ޓީ.އޯ) އަށް ޖެޓީގައިވާ ޕްލޮޓް 2 އާއި 111ގެ މަރާމާތުގެ މަސައްކަތް ކުރުން ތިމާވެށީގެ ގޮތުން ބޮޑުއަސަރު އެކުލެވޭ ކަމަށް ބަލައިގެން ދާނެއެވެ. މިހެންކަމުން ހުށަހަޅާފައިވާ ގޮތަށް މިމަޝްރޫއު ކުރިއަށް ގެންދިޔުމަށް އިޖާޒަތު ގޮތުން ދޭނީ ފައިދާގެކަން ލިބި ތަފާސްހިސާބު ގޮތުން ލިބޭ ގެއްލުންތަކުގެ ކުޑަ ކުރުމަށް ކަމަށް ފާހަގަކުރެވިފައެވެ.

2 NON TECHNICAL SUMMARY

1- This is the Environmental Impact Assessment (EIA) report carried out for the State Trading Organisation (STO) for the proposed upgrade/renovation work for vessel loading jetty at STO go-down (plot no 2) and shore protection work (plot no 111). The project involves removal of existing quaywall, Extension of shoreline 20m from the existing quaywall boundary, sheet pilling and back filling Plot No 2. Main renovation work in Plot no 111 involves removal of existing seawall and construction of a new revetment by using rock boulders. The EIA was prepared as fulfillment of the requirement by the Environmental Protection Agency under the dredging and reclamation regulation (Regulation 2013/R-15) for granting permission for the project. Environmental Impact Assessment (EIA) of development projects is a requirement by the Environmental Protection and Preservation Act (EPPA) (law 4/93) of the Government of the Republic of Maldives.

2- This report has been prepared in accordance with the Environmental Impact Assessment Regulations published by the Ministry of Environment and Energy 2012 and covers both negative and positive environmental and socio-economic impact arising from the proposed upgrade/renovation work for vessel loading jetty at STO go-down (plot no 2) and shore protection work (plot no 111). Major findings of this report are based on information gathered during the field inspection of both the existing environment and possible effects of the project activities, through extensive literature review and experiences gained from similar projects elsewhere in the Maldives.

3- The proposed project activity will take place in K Thilafushi Industrial Island Plot no 2 and Plot no 111. Thilafushi is located at the west of Gulhifalhu and east of Giraavaru Resort. The island was initially reclaimed for land fill purposes, but has been further developed to carter for industrial use. The reclaimed island was later turned into the industrial hub of the Maldives and a larger proportion was reclaimed by sand filling from the inner lagoon. The industrial potential of Thilafushi grew big and Thilafushi Corporation was formed in 2009 to change the garbage island to the potential industrial hub for light and heavy industrial needs.

4- During the preparation of the EIA report an impact matrix, which is a standard tool for identifying the possible impacts of project activities, has been created for proposed upgrade/renovation work for vessel loading jetty at STO go-down (plot no 2) and shore protection work (plot no 111). The activities carried out during the construction and post-construction or operational phases are arrayed against a selection of environmental factors that may be affected directly or indirectly as a result of project activities.

5- The environmental impact assessment study for the proposed upgrade/renovation work for vessel loading jetty at STO go-down (plot no 2) and shore protection work (plot no 111) shows there are two main activities that would cause significant negative environmental impacts are pile driving, backfilling, seawall construction and concrete work in Plot 2 and Coastal protection work (construction of rock boulder revetment) in Plot 111.

6- Of these a long term impact would be from pile driving, backfilling, seawall construction and concrete work in Plot 2. Sedimentation on lagoon and reef physical damage to benthic fauna and habitat loss and change in near shore flow pattern are some of the impacts. These impacts would be cumulative occurring over long period of time and so can be managed through proper monitoring. Based on the scale of coastal protection projects that is taking place in Maldives, impacts associated with this activity is insignificant.

7- Construction of rock boulder revetment adjacent to the shoreline will temporarily increase the sedimentation on the north eastern side but the impact would be short term and negligible. However, the positive socio economic impacts from the proposed development outweigh the temporary negative impacts of project.

8- The study has evaluated alternative options for the project activities and evaluated potential option of alternative sources for fill material, alternative coastal protection structures. Based on the similar project activities elsewhere in the Maldives the report found, that the Thilafushi will recover from the impacts will re-establish a new ecological balance soon. Even though there is no very significant impact from this project after the report has come-up with an extensive monitoring programme that will keep on monitoring coastal and marine environmental changes associated with the project and make necessary adjustment based on the findings of various measured environmental parameters suggested in the monitoring plan.

9- The study found that the proposed project is in line with key legal and policies maintained by the Government authorities and EPA including Environmental Protection and Preservation Act, EIA Regulations, and land-use plans developed for Thilafushi Industrial Island by Thilafushi Cooperation.

10- Therefore on the basis of this environmental impact assessment study and the impact mitigation measures proposed in the report will be duly implemented and recommendations are given due consideration, it is concluded that the benefits of the proposed upgrade/renovation work for vessel loading jetty at STO go-down (plot no 2) and shore protection work (plot no 111) in Thilafushi will substantially outweigh its imposition on the environment

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3 INTRODUCTION

3.1 BACKGROUND

State Trading Organization (STO), with its subsidiaries, joint ventures and associates is the largest public company and nation-wide supplier of staple food, construction material, cooking gas and engaged wide variety of business. STO is the main supplier of construction material such as river sand aggregate and cement to Maldives. Scarcity of land in the capital island Male many of STO business particularly businesses that require large storage areas is shifted to Thilfasuhi, reclaimed land 9.5k north west of Male. STO being the leader in importing construction materials nation-wide, STO was among the first to invest and develop wharf facility supplemented with warehousing facilities for bulk construction items such as aggregate, steel and roofing sheets in Thilafushi.

This project is designed to upgrade/ renovate the existing local vessel loading jetty (seawall constructed by using sand and cement bags) at Thilafushi at STO go down site (Plot no 2) and the shore protection of the north empty land (Plot no 111).

STO land Plot 2 in Thilafushi is mainly used for the handling of construction related cargo in terms of dispatch to the local islands and Male. The jetty / quaywall play a major part in the logistics of local distribution of STO construction materials. The seawall jetty was constructed around 1999~2000 using sand cement bags. The existing seawall has broken down and it is no longer feasible to use for loading and unloading construction material.

STO land Plot 111 is mainly used for storage of construction material particularly river sand and aggregate. The area was protected by sea was constructed using sand and cement. The area is exposed to stronger wave action hence it has been severely eroded and largely damaged.

These two plots are strategically important infrastructures for the logistical works of STO construction material distribution network. Damage of these coastal structures that are protecting the land plots is hindering the operation to supply construction material to Maldives. Therefore this EIA addresses the proposed upgrade/renovation work for vessel loading jetty at STO go-down (plot no 2) and shore protection work (plot no 111), at. Thilafushi.

3.2 PURPOSE OF THE EIA

Given the potentially adverse environmental impacts associated with proposed upgrade/renovation work for vessel loading jetty at STO go-down (plot no 2) and shore protection work (plot no 111), at. Thilafushi, the proponent has requested the consultant the preparation and submission of an Environmental Impact Assessment (EIA) report to EPA to comply with the Environmental Protection and Preservation Act (4/93) and EIA Regulations 2012.

The objective of the EIA study is:

a) To provide an assessment of the potential environmental effects of the proposal and to determine which of these, if any are likely to result in a significant effect on the environment and to propose ways and means of avoiding, mitigating and or compensating the perceived negatives effects of the project;

b) To provide necessary information to EPA applicable to the proposed development; and

c) To assess how the proposals have been developed to achieve a satisfactory level of environmental performance in line with the EIA Regulations

3.3 EIA REPORT AND EIA IMPLEMENTATION PROCESS

In general the objective of an EIA report is to address the environmental concerns of the development project. The EIA will help to achieve efficient planning, aid in identifying impacts and their potential mitigation measures. The EIA report will also help to promote informed environmental and sound decision making during the development of the project.

The aim of the EIA is to identify, describe and assess in an appropriate manner, proposed development, in accordance with the provisions of guidelines and regulations of the GoM, the direct, indirect and residual effects of the project on the following factors:

- Physical and chemical characteristics of the earth (soil, landform, unique physical features), water (marine and underground), atmosphere (air quality and climate),

- biological conditions including flora (trees/shrubs and endangered species), fauna (birds, land animals, coral and endangered animals) habitats (environmentally sensitive areas protected area etc);

- cultural factors including aesthetic and human interest (scenic views and vistas, wilderness qualities, landscape design, historical and archaeological sites and objects), and cultural status (employment); and

- ecological relationships including eutrophication, disease and insect vectors, and introduction of alien species etc..

This EIA report has been prepared by Dr. Mahmood Riyaz a registered EIA consultants (Registration no 03/07) at EPA was contracted by the proponent. EIA preparation process is as follow:

1- The consultant prepares EIA application form with necessary relevant documentations for the proponent for submission to EPA, and the proponent submits the application along with project brief and a draft TOR.
2- EPA calls for a scoping meeting with proponent, consultant and relevant stakeholders from government agencies to finalise the draft TOR of the EIA study
3- The consultant undertakes literature review and gathers relevant data and information on the project.
4- Consultant undertakes the field assessment work
5- The consultant analysis data and information gathered and identify environmental impacts, determine mitigation measures, rationally evaluate and suggest alternatives and limitations and propose a monitoring plan.
6- The consultants discuss major findings with the proponent and suggest possible changes to the project/project component.
7- Based on the discussion with the proponent the consultant reviews the EIA and makes necessary changes to the document.
8- The proponent should provide written commitment to undertake mitigation measures and post-development environmental monitoring as per the EIA report.
9- The consultant submits the final EIA to the proponent who subsequently will submit to EPA for review and to issue decision note.

Once the decision note is issued from EPA the proponent is obligated to implement the EIA and matters highlighted in the decision note. Also the proponent shall implement the periodic monitoring programme during construction and operational phase of the project and submit monitoring report as indicated in the EIA report.

3.4 SCOPE OF THE EIA

The scope of this EIA is based on the consultations held during the scoping meeting at the Environmental Protection Agency on 9th June 2016. The approved ToR highlighted 9 major tasks to be covered including;

1. Description of the proposed project;
2. Legislative and regulatory considerations;
3. Description of the existing environment
4. Stakeholder consultation
5. Potential impacts of the proposed project;
6. Alternatives to the proposed project;
7. Mitigation and management of negative impacts;
8. Development of monitoring plan; and

.

A copy of the ToR is attached in Annex 1. The EIA report closely followed the approved ToR for the assessment.

3.5 PROJECT SETTING

K. Thilafushi is a reclaimed island located 9.5km North West of Male at the western periphery of North Male Atoll. Thilafushi island was designated as a dumping ground for construction debris and household wastes generated in Male and nearby resorts and inhabited islands. Reclaimed land in Thilafushi is being used for industrial activities, importing and stockpiling of construction materials and warehousing facilities and other industrial and commercial activities. The proposed site STO land plot 2 is located on the western side on inside the inner lagoon of Thilafushi Falhu. Land plot 111 is located on the eastern side facing the atoll lagoon (Figure 1).

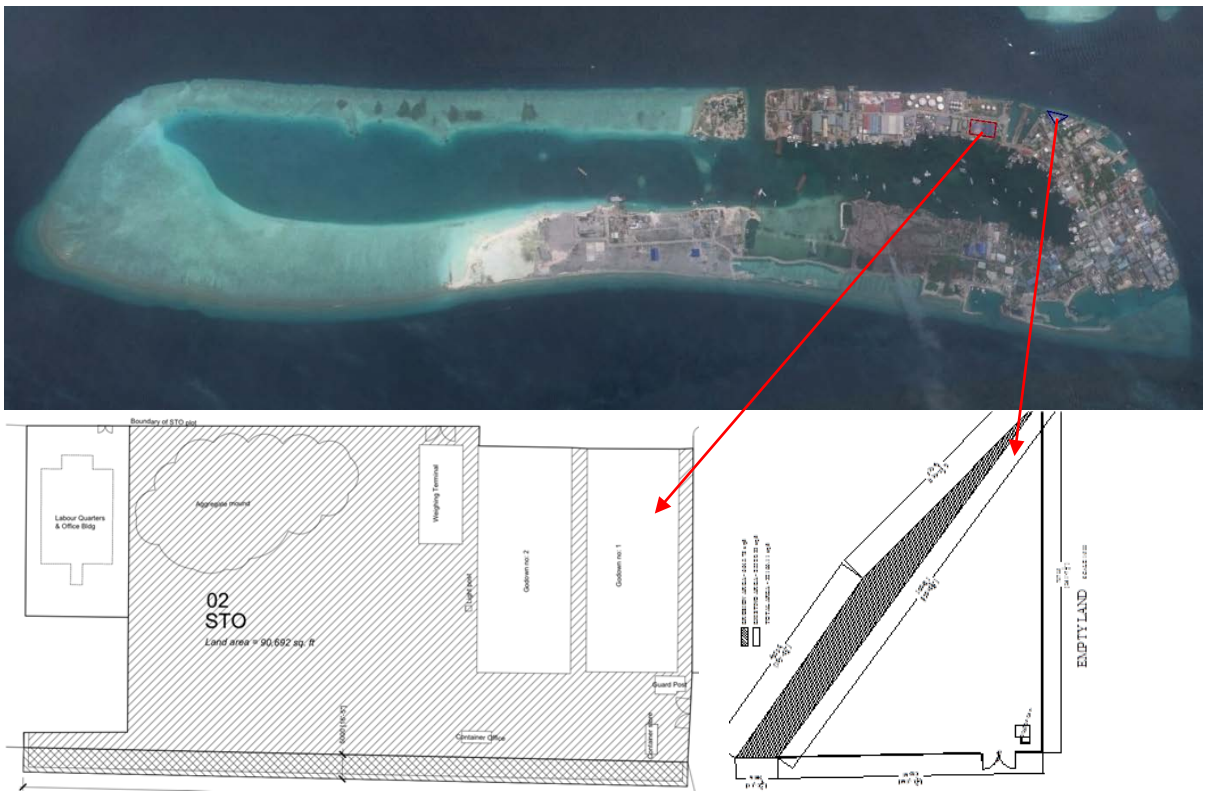

Figure 1: Map showing the location STO land plot 111 and Plot no 2 in K.Thlafushi

3.6 PROJECT JUSTIFICATION

STO being the leader in importing construction materials nation-wide, STO was among the first to invest and develop wharf facility supplemented with warehousing facilities for bulk construction items such as aggregate, steel and roofing sheets in Thilafushi.

This project is designed to upgrade/ renovate the existing local vessel loading jetty (seawall constructed by using sand and cement bags) at Thilafushi at STO go down site (Plot no 2) and the shore protection of the north empty land (Plot no 111).

STO land Plot 2 in Thilafushi is mainly used for the handling of construction related cargo in terms of dispatch to the local islands and Male. The jetty / quaywall play a major part in the logistics of local distribution of STO construction materials. The seawall jetty was constructed around 1999~2000 using sand cement bags. The types of vessels that area envisaged to use this facility are with draft requirement of 3.5~4.0m at MSL. The loading vehicles are mainly 50-ton mobile crane and 15-ton trucks.

The existing seawall has broken down and it is no longer feasible to use for loading and unloading operation Damage of seawall is hindering smooth logistical operations and affecting the supply of construction material to various parts of the Maldives which consequently delays supply of construction material to construction work sites

STO land Plot 111 is mainly used for storage of construction material particularly river sand and aggregate. The area was protected by a seawall constructed using sand and cement. Large part of the

seawall being broken and part of the land has been eroded on this site. This is causing exposure of stored construction material for direct weathering from salt and spray, also the material is potentially carried away into the sea by the run-off from heavy rain event.

These two plots are strategically important infrastructures for the logistical works of STO construction material distribution network. Damage of these coastal structures that are protecting the land plots is hindering the operation to supply construction material to Maldives. Therefore there is an urgent need to renovate and restore the function of particularly the seawall jetty/ quay wall to be able to alongside bathing of vessels with 3.5~4.0m draft at MSL. This EIA addresses the proposed upgrade/renovation work for vessel loading jetty at STO go-down (plot no 2) and shore protection work (plot no 111), at. Thilafushi.

3.7 PROJECT SCOPE SUMMARY

The project mainly involves upgrade/renovation work for vessel loading jetty at STO go-down (plot no 2) and shore protection work (plot no 111), at Thilafushi. The proposed project covers the following activities

- Mobilisation
- Demolition of the existing seawall;
- Backfilling the area (Plot 2)
- Pilling of the sea wall (plot 2) and construction of shore protection using rock boulders in Plot (111)
- Demobilization;

3.8 REVIEW OF RELAVANT STUDIES

As part of relevant literature review and preparation of the report, the following EIA studies on coastal protection and dredging and reclamation work in Thilafushi have been reviewed and used as reference;

> *EIA for Land reclamation at Thilafushi Industrial Zone Plot S8-136, by Water Solutions Pvt.Ltd 2016*
>
> *EIA for the proposed land reclamation of Thilafalhu, Thilafushi, by Sandcays Pvt. Ltd 2011*

Most reports on coastal modification could be considered as relevant and appropriate reference material to understand the types, degrees and magnitudes of environmental impacts and potential mitigation measures for the upgrade/renovation work for vessel loading jetty at STO go-down (plot no 2) and shore protection work (plot no 111), at Thilafushi.

3.9 EIA IMPLEMENTATION METHODOLOGIES

This study was based mainly on data collected during a field investigation 3rd September 2016 by the consultant. Field studies have been undertaken using methods generally employed for EIA studies in the Maldives. Environmental impacts are predicted by use of widely used descriptive checklists and its significances are evaluated by the use of Leopold matrices. Expert judgment and professional opinion as well as review of relevant EIA studies have also been widely used throughout the impact assessment and evaluation process. These methods are described in detail at the relevant section of this EIA Report.

4 DESCRIPTION OF THE PROJECT

4.1 THE PROPONENT

The proponent of the project is State Trading Organisation (STO). The two land plots, Plot no 2 and Plot no 111, are leased to STO. Upgrade/renovation work for vessel loading jetty at STO go-down (plot no 2) and shore protection work (plot no 111), will be financed by STO and the actual work will be carried out by a contractor. Selection process of the contractor is on-going.

4.2 PROJECT LOCATION AND BOUNDARY

The proposed project takes place in Thilafushi Island in Male' Atoll. Thilafushi is located on the south western edge of North Male' Atoll. The island is located at the geographic coordinates of 73°25'50"E 04°10'59"N. Thilafushi is a reclaimed island is located in a very large reef system known as Thilafalhu which has an approximate area of 350 ha. The closet inhabited island is Villingili which is located 6.1 km east of Thilhafushi (Figure 2). The proposed development will take place at the vessel loading jetty at STO go-down (plot no 2) on the western side and (plot no 111) located on the eastern side

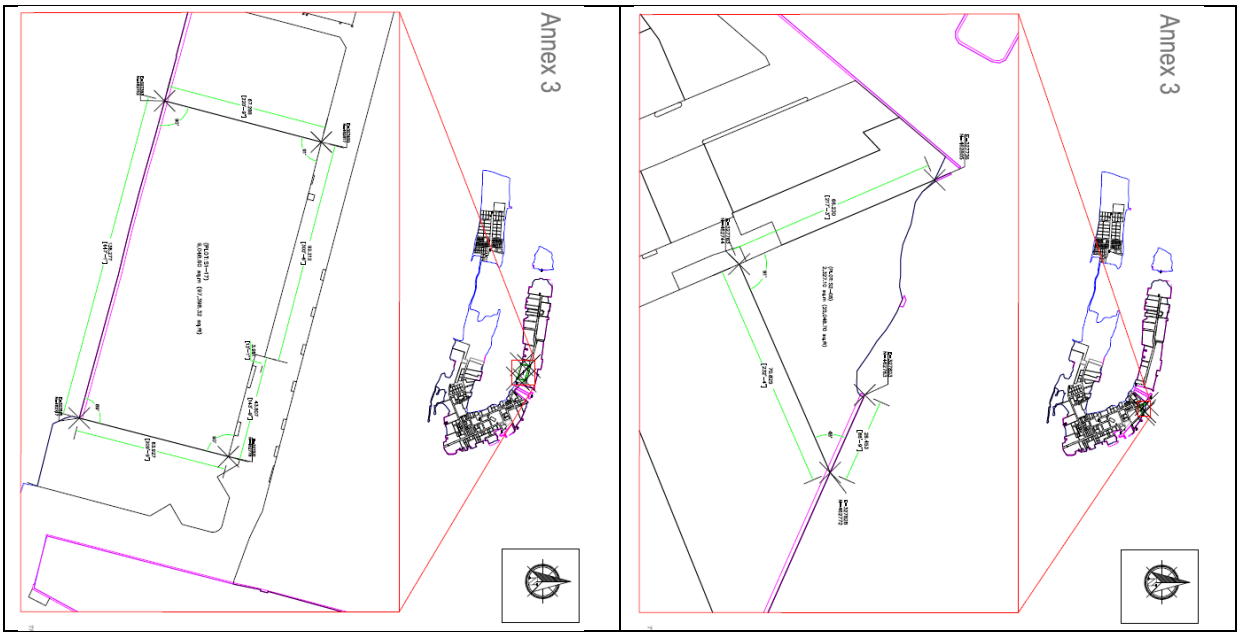

Figure 2: Project Boundary. The project boundary is confined to Thilafushi STO plot 2 and Plot 111 with geographic coordinates a magnified map will be provided in the Appendix

Figure 3: Project impact footprint, for Plot no 2 and Plot no 111

4.3 MAIN DEVELOPMENT FEATURES OF THE PROJECT

The proposed upgrade/renovation work for vessel loading jetty at STO go-down (plot no 2) and shore protection work (plot no 111) involves the following.

4.3.1 Plot no 2

Main development activities of the proposed project that will take place in plot no 2 (Figure 4 –Figure 6) involves the following:

- Removal of existing quaywall
- Extension of shoreline 20m from the existing quaywall boundary
- Sheet pilling (9m and 12m long piles)
- Backfilling the area
- Concrete work of the qyawall (250mm concrete slab with 50mm blinding)
- Installation of bollards
- Decommissioning

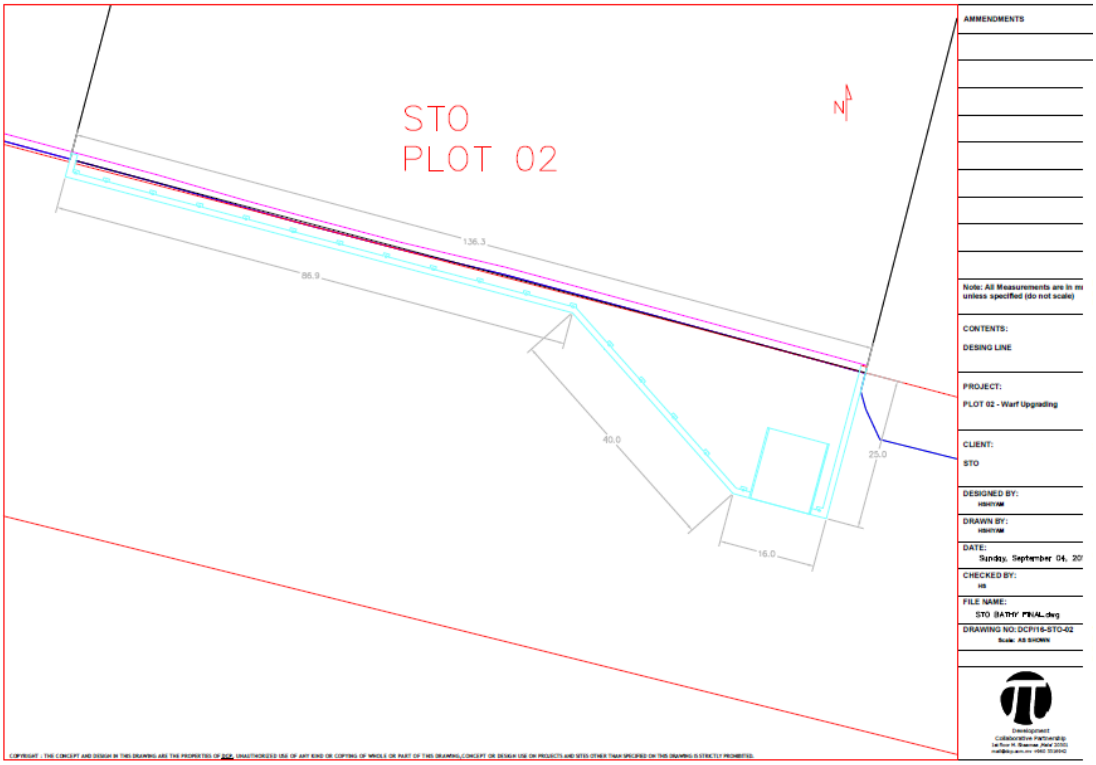

Figure 4: STO Plot 2, design line detail

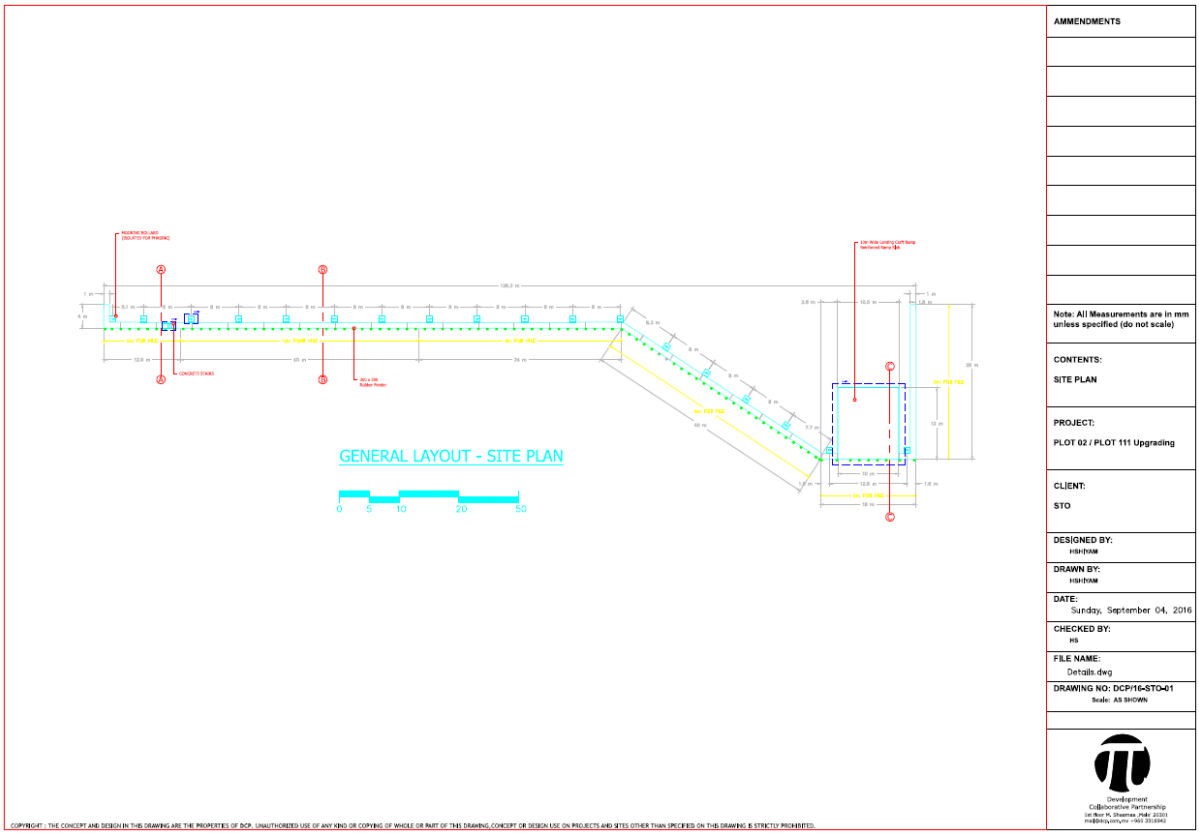

Figure 5: STO plot 2 General layout of the quaywall

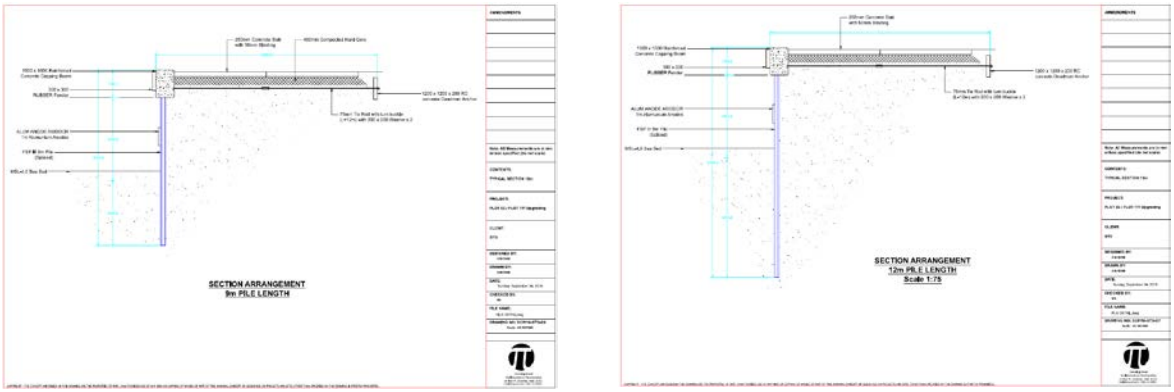

Figure 6: Section arrangement 9m and 12 m pile.

4.3.2 Thilafushi Plot 111

Main renovation work in Plot no 111 involves the following

- Removal of existing seawall
- Construction of a new revetment by using rock boulders (Details shown in Figure 7 and Figure 8.)
- Decommissioning

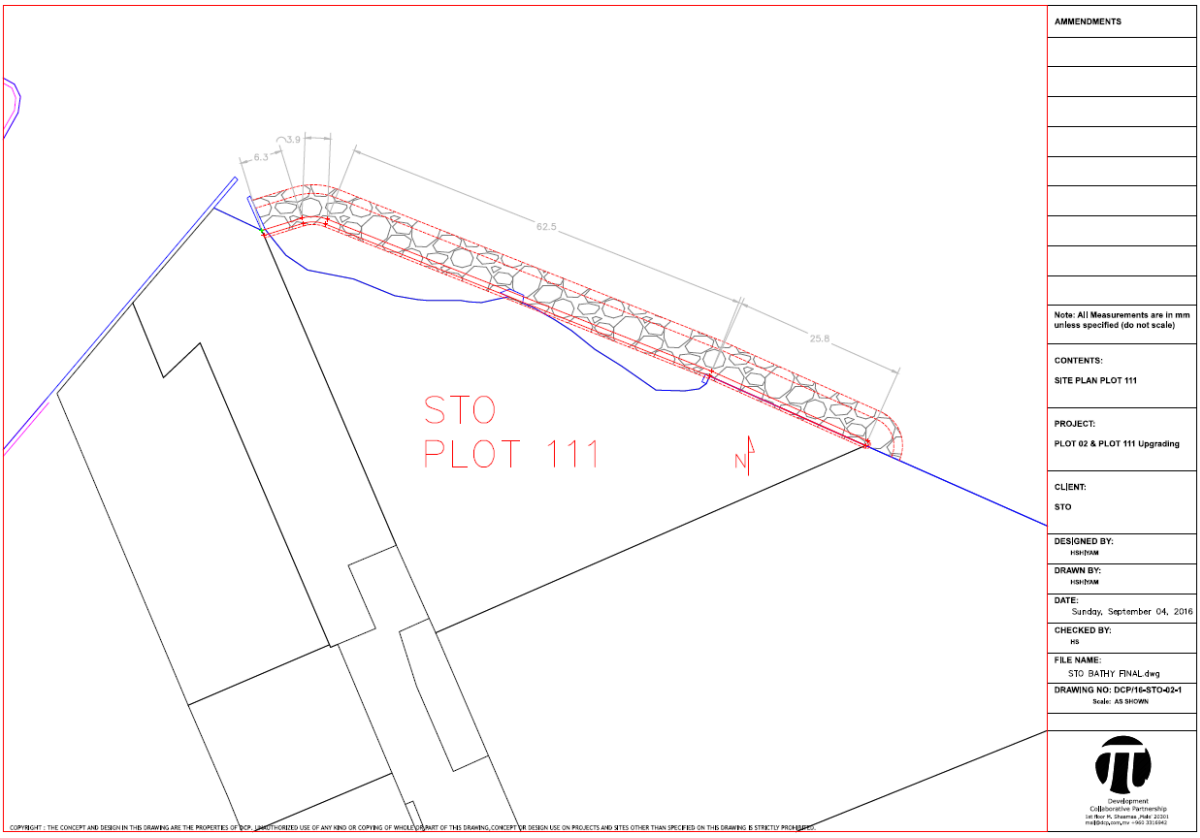

Figure 7: STO Plot 111 site plan

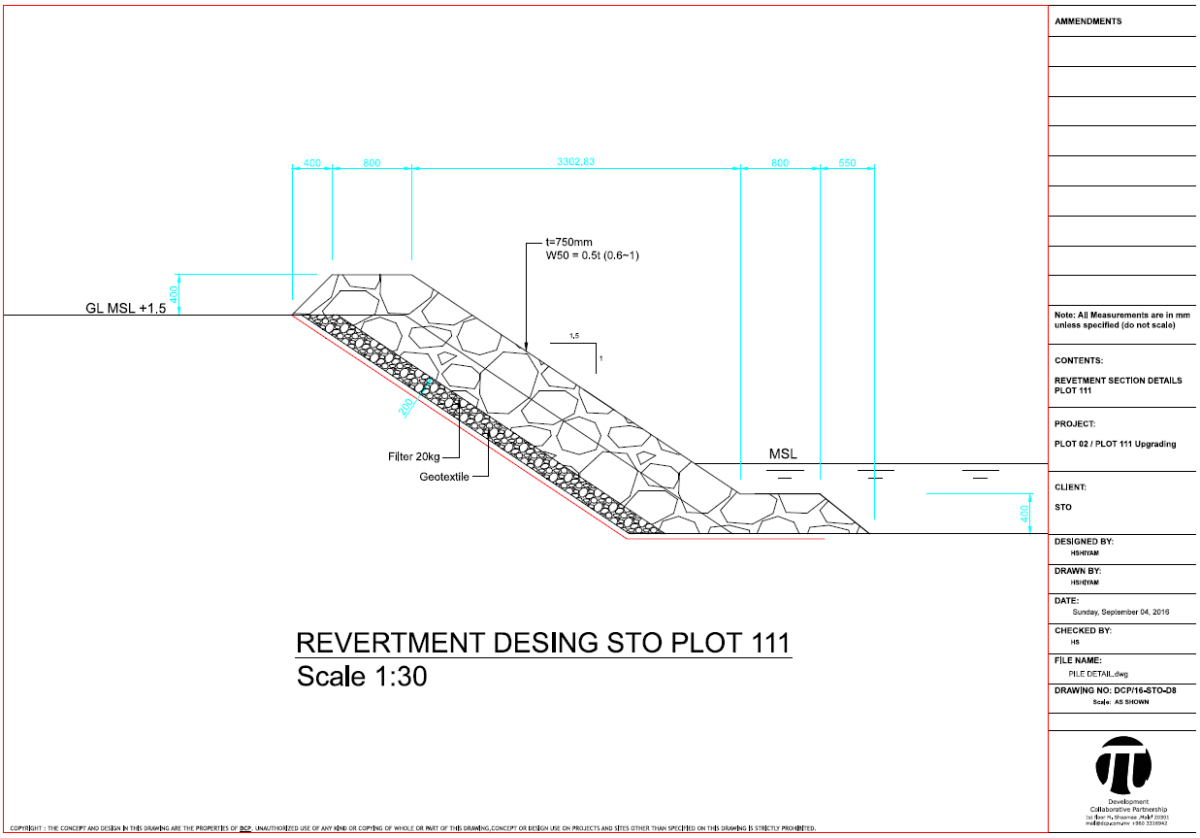

Figure 8: STO plot 111 revetment details

4.4 MAJOR CIVIL WORKS

4.4.1 Initial mobilisation and site preparation

Site mobilisation of the construction equipment, can be easily brought into the island through the existing harbour. The proposed construction work requires use of heavy machinery and special equipment. Some of these include excavators, lorries, trucks, loaders and the like (Figure 9). Since this is a very small project the workforce involved with the project would be very small within the range of 10-15. The workforce can be accommodated on STO facilities in Thilafushi or can be commuted regularly from Male in Thilafushi Ferries.

Figure 9: Typical heavy machinery and equipment that will be used for football ground levelling work

4.5 SOURCES FOR BACK MATERIAL

Most of the western lagoon of Thilafushi has already been dredged therefore does not have fill material required to backfill the Plot 2 quaywall area. Potential sources for backfill sand were explored and one of the very promising options would be to use the imported sand and gravel stored in the plot 111. Estimated volume of sand required for backfilling in plot 2 is 5880 m^3 material. The fill volume will be sourced from the demolition of the existing quaywall approximately 4230m3 and the remaining amount from trimming of the seawall 1650m^2 in Plot 111.

4.6 WASTE MANAGEMENT

Construction waste that will generated from demolition of the existing seawall in plot 2 will be used as a fill material in the same are. Also the demolition waste mainly rock will be used a backfill material in plot 2. Other waste generated in the area will be collected and appropriately disposed of at Thilafushi waste yard. The contractor is also required to work towards better management of waste so the volume of waste to be disposed would be reduced. All domestic wastes from the construction activities, that is from the construction works will enter the present waste management cycle in Thilafushi, which is only domestic waste. All other wastes such as hazardous wastes like waste oil, grease and construction waste alike will be stockpiled at the project site and disposed off at designated areas in Thilafushi.

4.7 HEALTH AND SAFETY

The main health and safety issues during the construction stage would be in the operation of heavy machinery and equipment such as excavator loaders cranes etc. Falls and accidents due to carelessness in the project site has been a concern in many construction sites and must be addressed during the planning and implementation stages.

Occupational health and safety issues will be dealt with at all times during the construction phase of the proposed project. Protection of employees from likely adverse effects will be one of the core duties of the Proponent or Contractor. Health and safety briefings will be undertaken on a regular basis. All machineries and equipment must be operated by trained and experienced personnel wearing necessary safety gears.

Noise levels felt by workers can be a health issue too. However, noise levels at the project site would not be too high and would be intermittent and not continuous. Therefore, acceptable average daily exposure levels would not be exceeded for construction workforce. Noise will be restricted to site and no public complaints will arise due to noise. Work activities can even be undertaken at night.

4.8 PROJECT SCHEDULE

The project is expected to take 8 months to complete including the time needed for seeking necessary approvals. The main milestones include; obtaining approvals, mobilization, and onset of work, pilling backfilling and concrete work in Plot 2 and construction of rock boulder revetment in site 111. Table 1 shows the project schedule.

Table 1: Project Schedule – Indicative

Project -Jetty renovation STO go (Plot no 2) and shore protection (Plot no 111)

Today's Date: 11/04/16 0

Start Date: 09/30/16

Ser.	Tasks	Start	End	Duration days
1	EIA preperation and approval	09/30/16	11/19/16	50
2	Contract award preliminary survey	11/25/16	12/25/16	30
3	Mobilisation	12/25/16	01/09/17	15
4	Removal of existing quaywall	01/10/17	02/24/17	45
6	Sheet pilling (9m and 12m long piles)	03/01/17	03/31/17	30
7	Backfilling the area	04/01/17	04/21/17	20
8	Concrete work of the qyawall	04/22/17	05/07/17	15
9	Construction rock boulder revetment	05/05/17	06/04/17	30
10	Installation of bollards	06/05/17	06/25/17	20

Table 2: Matrix of major inputs to the project

Input resource(s)	Source/type	How to obtain resources
Workers	Skilled and semi-skilled labour, Manager (1) Supervisor (1) Excavator Operator (2), Loader operator (1), , Driver (2), Labourer (4) total of 11 people, skilled and semi-skilled 7 and unskilled labourers 4.	Trained and licensed staff of the contactor
Machinery (excavator, , operational tools)	02 excavator 01 loader 04 Lorries 02 diesel tank 1000 litre 01 small dingy	To be obtained and operated by the contractor. Contractor will be required to bring to the site machines in good working conditions to avoid loss of time due to breakdown of machines, vehicles and equipment.
Construction material	Sheet piles 9m and 12m long, iron bars cement sand aggregate, rock boulders	To be imported
Output	**Anticipated quantities**	**Comments**
Quay wall, rock boulder revetment,	Quaywall length 86m Revetment length 98.2m	To be used for loading and unloading of construction material Protection of the Plot boundaries
Wastes	Minor amount	No wastes during the excavation will be allowed to be dumped into the sea. Solid wastes and human wastes will be managed through the existing wastewater and solid waste management system in Thilafushi

Waste oil and lubricants	Minor amount	Gathered and disposed at designated area in Thilafushi
Noise and light	Localized	Excavator and truck operation will generate some noise during the project execution. Work will not be carried out late into the night to avoid disturbance.
Plastics and packaging waste	Minor amount	Managed through existing waste management system in Thilafushi

5 REGULATORY CONSIDERATIONS

This is section highlights relevant government stakeholders, their roles and reviews relevant legal framework applicable to the proposed project.

5.1 MINISTRY OF ENVIRONMENT, ENERGY & WATER

The Ministry of Environment and Energy (MEE) is key Ministry in the government mandated with the protection of the environment. Environmental responsibilities assigned to MEE includes formulating environmental policies, coordinating, preservation and management of the environment throughout the country, and enforcing Environmental Protection and Preservation Act (EPPA) (04/93). Under Article 5(a) of EPPA, Environmental Impact Assessment (EIA) is mandatory for projects that may cause potential harm to the environment. The EIA report has to be submitted to the EPA for approval before commencement of a project. As per this legislation, any project that has any undesirable impact on the environment can be terminated without compensation by MEE.

5.2 ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA is the key regulatory body on environment, which is an autonomous body formed under the umbrella of MEE. It is mandated with implementing the EIA process in the Maldives, implementing the Environment Act and subsequent regulations on behalf of MHE, regulating water and sanitation, biodiversity conservation, waste management and coastal zone management. Also, it is responsible for developing environmental standards and guidelines in the country.

5.3 LEGAL FRAMEWORK

Four regulations pertaining to the proposed project have been reviewed and the project's conformity to these have been assessed.

a) EIA Regulations 2012
b) Regulations on cutting down of Trees
c) Regulation on Dredging and Reclamation
d) Regulation and Waste Management

5.3.1 EIA Regulations 2012

The most important governing law as far as the environmental impact assessment is concerned is Environment Protection and Preservation Act (Law No. 4/93) (EPPA).

EPPA mandates all development projects in the Maldives to undertake an Environmental Impact Assessment prior to undertaking any such project.

Further the EPPA states an impact assessment study shall be submitted to the relevant Government authority before implementing any development project that may have a potential impact on the environment.

It goes on to say that the relevant Authority of Government shall formulate the guidelines for environmental impact assessment and shall determine the projects that need such assessment as mentioned in above.

The law also gives power to the relevant Government authority to terminate any project that has any undesirable impact on the environment. A project so terminated shall not receive any compensation.

According to the EPPA waste disposal, oil and poisonous substances any type of waste, oil, poisonous gases or any substance that may have a harmful effect on the environment shall not be disposed within the territory of the Maldives.

Government of Maldives reserves right to claim compensation for all the damages that area caused by the activities that are detrimental to the environment.

Environment Impact Regulations, 2012 & other relevant regulations

Under the provisions of EPPA the Government of Maldives has formulated and gazetted Environmental Impact Assessment Regulations (2012) detailing the EIA process and the EIA preparation.

In addition to EIA regulations, other relevant regulation will be followed in development and implementation of the proposed project. These regulations include ban on coral mining. Coral mining from house reef and atoll rim reef has been banned since 1990. Sand mining from any island has also been banned since March 2000.

The EPPA, EIA Regulations and other relevant regulations will be duly taken into consideration in preparing the EIA report and in the implementation of the project.

5.3.2 Regulation on Dredging and Reclamation

Regulation on Reclamation and Dredging of Islands Lagoons (Regulation 2013/R-15) came into effect in April 2013. The regulation requires having permission of EPA on projects requiring alternation of the island, either by reclamation of dredging. Specifically the regulation requires producing scaled-maps of the island before and after the proposed intervention. Special provisions have been made on protected and sensitive area restricting changes to the environment of the islands.

The project does not involve dredging or significant reclamation. The backfilling of quaywall at land plot 2 can be considered as minor reclamation.

5.3.3 Regulation and Waste Management

Waste management Regulation (No. 2013/R-58) is more recent coming into effect on 6 February 2014. The regulation was gazetted on 05 August 2013. The regulation provides set of comprehensive guidelines on collecting, storing, transporting and managing waste. In the preamble its states the objective of the regulation is in line with the Article 22 of the Constitution which requires that development activities designed for achieving socioeconomic targets should ensure that environment and its constituent living component is not compromised and that resources are utilized effectively.

The regulation talks of the responsibilities of collection, transport, treating and storage of waste. It also talks of management centres and landfill sites and managing hazardous waste. Various sectors and entities (including tourist resorts) encouraged having their own waste management plans consistent with the Regulation.

EPA is the implementing agency of environmental law and the implementing agency of the EIA regulation.

Wastes produced from the project will be disposed in compliance to this regulation.

6 METHODOLOGIES

The study approach involved undertaking data collection through field surveys and literature review.

The project scoping was carried out to narrow down the project issues to those requiring detailed analysis. The process involved discussions with stakeholders on key project issues. The primary data was collected through the qualitative and quantitative methods of data collection. Qualitative data was collected through filed visits/site walks and stakeholder consultations. Specific methodologies adopted to assess various aspects of the environment have been discussed in details in the respective sections of this report.

The secondary data was collected through literature reviews which included a study of the following:

Policies, Acts and Regulations;
Aerial photographs and satellite images; and
Similar project study documents
Geotchnical investigation report by Fali Investment Pvt. Ltd

In undertaking baseline studies using available data, knowledge and experience have been used. Key issues have been identified during scoping as given in the TOR. Based on the scoping need for further in-depth studies and additional data requirement were identified. To avoid delay in decision making and to provide a conservative estimate of environmental impacts a short term data collection and use of existing data were adopted.

6.1 MARINE ENVIRONMENT

6.1.1 Bathymetry survey

Equipment and tools used

- Global Positioning System (GPS)
- Still photograph camera
- Multi beam echo sounder

Standard bathymetric survey was done using multi beam high accuracy echo sounder and DGPS to record the depths and position. Tide prediction obtained from the Maldives Meteorological Services was used to relate the field measurements to the Mean Sea Level. Bathymetry survey was conducted in site 2 only as the work involved in plot 111 is on the shoreline. Survey methodology is explained below:

- The bathymetry of the survey area was carried out using differential GPS-enabled echo sounder attached to a dinghy.
- The survey was carried out on a 5m by 10m grid for the survey.
- The measurements were then be processed in the office using Surfer software to generate the contour map and then imported into AutoCAD to overly over the GPS co-ordinate data.
- All measurements were related to Mean Sea Level (MSL), which was computed using tide prediction data obtained from the National Meteorological centre (Male' International Airport tide data was used for this exercise)

6.1.2 Waves and Currents

Generalised wave predictions and wave pattern predicted using hindcast for the Indian Ocean was obtained from weather information providing sites. Wave height for Thilafushi was estimated using wind frequency data for Hulhule Island and similar studies in nearby reefs.

6.1.3 Geotechnical Assessment

Geotechnical information was obtained from an investigation conducted by ELS (Sri Lanka) from 20th Feb. to 23rd Feb. 2010. Two boreholes were cored to a depth of 18.5m using advanced rotary drills with overburden cutting tools to extract the disturbed soil samples along the quay wall perimeter, only about 2m inland.

A general evaluation of the nature of the soil formation and rock quality encountered was investigated using the data revealed at site, using engineering analysis and conducting soil laboratory tests at the ELS geotechnical laboratory.

6.2 CLIMATE

Official meteorological observations services in Maldives are limited to airports. A total of 10 airports are in operation, however meteorological observation takes place only on 5 airports. They are Hanimaadhoo in the north, Ibrahim Nasir International Airport in the centre, Kahdhdhoo, in the south centre, Kaadedhdhoo, in the south, and Gan Island in the extreme south. Observation routinely monitored and measured include, wind speed and direction, daily minimum and maximum temperature, humidity, cloud cover. Monitoring of sea-level height takes place only in Hulhule (central), Hanimaadhoo (North) and in Gan Island (in south).

For the purposes of this EIA report meteorological observations from the Hulhule, Ibrahim Nasir International Airport, which is located approximately 9km east of Thilafushi was used for description of the general weather conditions on the central part of the Maldives.

6.3 IMPACT ASSESSMENT METHODOLOGY

The environmental impacts that may be associated with the proposed upgrade/renovation work for vessel loading jetty at STO go-down (plot no 2) and shore protection work (plot no 111) are predicted by using a simple matrix. Dredging for various reasons such as harbour development, extract sand and reclamation, beach nourishment etc., is very common in the Maldives. People are very familiar with the environmental impacts associated with the development. Due to its necessity socio economic benefit of the proposed upgrade/renovation work for vessel loading jetty at STO go-down (plot no 2) and shore protection work (plot no 111) overweight environmental concerns. Impacts from various activities of the proposed project both construction and operational phases have been identified through consultation with the project management team, field surveys, observations and assessment, as well as based on field experience and expert opinion on similar development projects in the country.

Other sources of information have been used wherever possible. Data collected during field surveys can be used to predict outcomes of various operational and construction activities on the various related environmental components. Data presented in this report can also be used as a baseline for environmental monitoring of the project activities.

7 EXISTING ENVIRONMENTAL CONDITIONS

7.1 INTRODUCTION

This section covers the existing environment of Thilafushi island, with special description of the two project sites and the factors that would most likely be impacted from the proposed upgrade/renovation work for vessel loading jetty at STO go-down (plot no 2) and shore protection work (plot no 111). The key components covered in this section are as follows.

- General geology and geographic setting of Thilafushi
- General meteorological conditions
- Geotechnical condition of the proposed site
- Existing condition of two sites proposed for upgrade and renovation

7.2 GEOLOGY AND GEOGRAPHY

Thilafushi is located at the west of Gulhifalhu and east of Giraavaru Resort, at the coordinates of 04'10'58'' N and 73'26'47''E. the island was initially reclaimed for land fill purposes, but has been further developed to carter for industrial use.

Thilafushi was a typical Faro with a central lagoon surrounded by a shallow reef flat. In early 1992 reclamation of Thilafushi Falhu started by using garbage as a main fill material from Male and nearby resorts and islands. The reclaimed island was later turned into the industrial hub of the Maldives and a larger proportion was reclaimed by sand filling from the inner lagoon. The industrial potential of Thilafushi grew big and Thilafushi Corporation was formed in 2009 to change the garbage island to a the potential industrial hub for light and heavy industrial needs. Therefore large companies in the Maldives have acquired land to expend their industrial activities in the islands. The general environment of Thilafushi is also described in many reports and literature as well as reference to the following report is made if the reader wishes to refer.

- EIA for the Permanent Sand Borrow Site for Repairing and Leveling of Roads at K. Thilafushi (MEECO, 2015)
- EIA for the Proposed Reclamation of Thilafalhu, Kaafu Atoll, Maldives (Sand Cays, 2011)
- EIA for the proposed Land Reclamation at Thilafushi Industrial Zone Plot S8-136, (Water Solutions Pvt.Ltd, 2016)

7.3 OBJECTIVES

The purpose of this was to assess the existing environmental conditions of the island, including marine and land environment. Further, study of existing environment also involved undertaking review of available literature to understand long term trends in climatological regime and natural hazard incidents. These assessments would not only enable avoiding impacts to the environment as a result of the project but also would contribute to better planning recommendations for the proposed project. This is critical in assessing potential impacts and to determine the actual extent of damage should an unforeseen impact occur during the implementation phase.

The objectives of the present assessment were to:

1. Determine the general abiotic and biotic conditions of the marine and terrestrial environment of the project area;
2. determine the geological and geomorphological characteristics of the project area;
3. assess the changes that will be associated with the proposed project;

4. propose mitigation measures to avoid, minimise potential effects from the proposed project; and
5. Propose monitoring arrangements to measure effectiveness of the proposed mitigation measures

7.4 METEOROLOGY AND CLIMATE

The Maldives, in general, has a warm and humid tropical climate with average temperatures ranging between 25oC to 30C (MHAHE, 2001) and relative humidity ranging from 73 per cent to 85 per cent. The country receives an annual average rainfall of 1,948.4mm. Table 1.1 provides a summary of key meteorological findings recorded for Maldives.

Monsoons of Indian Ocean govern the climatology of the Maldives. Monsoon wind reversal plays a significant role in weather patterns. Two monsoon seasons are observed: the Northeast (Iruvai) and the Southwest (Hulhangu) monsoon. Monsoons can be best characterized by wind and rainfall patterns. These are discussed in more detail in the following subsections. The southwest monsoon is the rainy season which lasts from May to September and the northeast monsoon is the dry season that occurs from December to February. The transition period of southwest monsoon occurs between March and April while that of northeast monsoon occurs from October to November. The monsoons in Maldives are best defined in the northern part of the country where a distinct monsoon seasons including the strong southwest monsoon from June through September and a noticeable northeast monsoon from December through February occurs.

The nearest station to Thilafushi where the meteorological records have been consistently gathered over the years is the facility located in Hulhule' INIA. As the distance of this station is only 9 kilometers from Thilafushi, the meteorological data obtained from the Airport is deemed representative for this project study. Some important meteorological data are summarized as following Table 3.

Table 3: summary of important meteorological data

Parameter	Data
Average rainfall	9.1mm/day in May, November 1.1mm/day in February 1900mm annual average
Maximum rainfall	184.5 mm/day in October 1994
Average air temperature	30.0°C in November 1973 31.7°C in April
Extreme air temperature	34.1°C in April 1973 17.2°C in April 1978
Average wind speed	3.7m/s in March 5.7m/s in January, June
Maximum wind speed (1966 – 2010)	31.9m/s in November 1978
Average air pressure (1992 – 2010)	1012 mb in December 1010 mb in April

7.4.1 Winds

Summary wind data since 1964 (Figure 10) indicate that the Maldives experience west to northwest winds (225^0–315^0) from April to November during the *Hulhangu* monsoon with a mean wind speed of 5.1 m s^{-1}. In contrast the *Iruvai* monsoon, from December to March, is characterized by winds from the east-northeast (45^0–90^0) with a mean wind speed of 4.9 m s^{-1}. Wind strength is most variable during the crossover between northeast and westerly monsoons with mean wind speed falling to 3.5 m s^{-1} in March (Department of Meteorology, 1995) (see Figure 10).

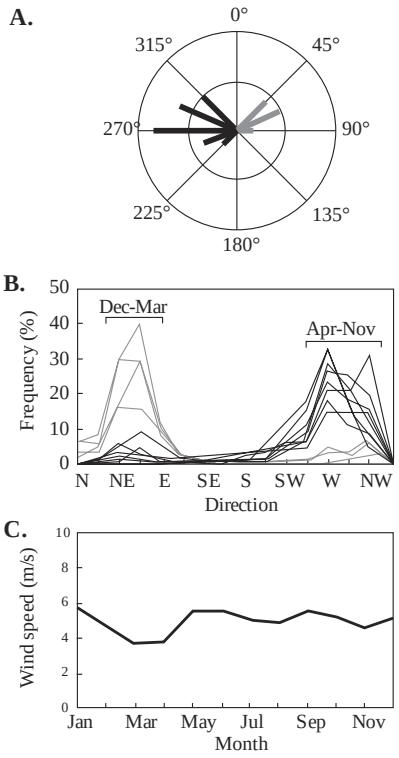

Figure 10: Summary of wind data for the Maldives showing A) 30-year mean percent frequency wind direction B) 30-year mean monthly percent frequency wind direction; C) 30-year mean monthly wind speed. Climate data from Government of Maldives, Department of Meteorology, 1995 adapted from Kench et al; (2009).

7.4.2 Hydrology

7.4.2.1 Waves

Satellite altimetry derived wave climate data over a ten-year period for the region (Young, 1999) indicates the dominant swell approaches from southerly directions. On a seasonal basis, swell is from the south-southwest from April to November with a peak significant wave height (Hs) of 1.8 m in June, and from the south to southeast directions from November to March with minimum Hs of 0.75 m in March (Figure 11). Overall wave energy was greatest on all islands during the westerly monsoon (Young, 1999).

In General, the wave climate around Male', Villingili and Thilafushi it is only the south coast which is affected by these long periodic swell waves reaching the outer reef edge. The other shores of Thilafushi does not encounter swell waves, and only gets affected by wind waves generated locally within Male' Atoll itself and as such limited by the natural fetch length.

Some lower residual swell waves reach the south-eastern periphery of Thilafushi after some refraction from Villingili island reef. Most of the eastern coast will be protected by some degree by the reef

plateau known as Gulhi Falhu located between Villingili and Thilafushi. It is worthy to note that the inner lagoon, being enclosed by reef reclamation of Thilafushi will remain protected from the wave climate as described above. Even ripples that make inwards from the approach channel do not retain much turbulence at the area of the proposed wharf improvement.

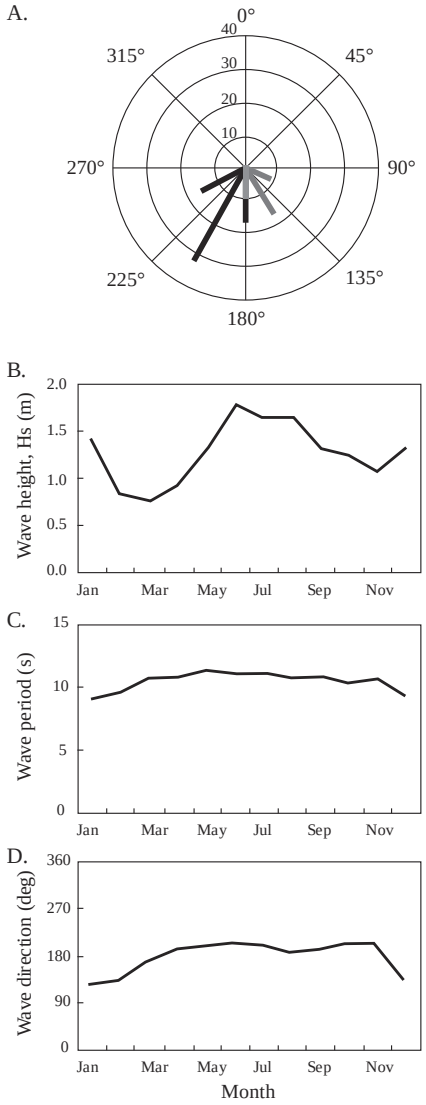

Figure 11: Ten year mean monthly ocean swell for the Maldives showing (A) wave direction for April to November (black lines) and December – March (gray lines) (B) wave height (C) wave period (D) wave direction. Data from Young (1999) adapted from Kench and Brander, (2006).

7.4.2.2 Tide

The Maldives is subjected to a semidiurnal microtidal regime with spring and neap tidal ranges of 1.2 m and 0.6 m respectively. The highest astronomical tide was recorded as 0.64 m above the mean sea level and the lowest astronomical tide was recorded as 0.56 m below the mean sea level. Tidal variation of 1.2 m from lowest to the highest tide levels were recorded in the country (see Table 4). This suggests that there is a maximum clearance of structures of 0.9 m above maximum tidal limit. Tidal fluctuations (rise and fall of tides) cause changes in current flow pattern around the island and bring subsequent changes in physical aspects of the shoreline. At low tide water movement is very

slow, therefore low tide period is considered to be a good time to conduct dredging and reclamation work.

Table 4: Tidal variations for the Maldives with respect to mean sea level

Tide Level	*Referred to MSL*
highest astronomical tide (HAT)	+0.64
mean higher high water (MHHW)	+0.34
mean lower high water (MLHW)	+0.14
mean sea level (MSL)	0.00
mean higher low water (MHLW)	-0.16
mean lower low water (MHLW)	-0.36
lowest astronomical tide (LAT)	-0.56

7.4.2.3 Currents

Currents which affect the sea area around the Maldives are caused by one or more of the following systems:

a) Oceanic currents
b) Tidal currents
c) Wind-induced currents
d) Wave-induced currents

The oceanic currents flowing across the Maldives are notorious for their strength. The exposure of the Maldives to the vast Indian Ocean ensures that an immense body of water is constantly flowing across the plateau on which the atolls are built. In the Arabian Sea, as one gets closer to the equator, the prevailing winds become more and more indicative of the oceanic surface current. Thus, wind (especially during monsoons) can be a major factor affecting current velocity and direction, and currents can be of great strength (wind-induced currents). For example: currents in the channels near Malé have been recorded at 4 knots or more. Inside an atoll, current speeds are more settled. Oceanographic currents are driven by two monsoonal winds, namely the westerly and north easterly wind. The westerly flowing current tend to dominate from January to March while the easterly currents dominate from May to November. The changes in current flow patterns occur in April and December. The current velocities are about 0.5 m/s, only in May values may increase to 0.8 m/s.

The vertical water movements associated with the rise and fall of the tide are accompanied by horizontal water motion termed tidal currents. These tidal currents have the same periodicities as the vertical oscillations, but tend to follow an elliptical path and do not normally involve simple to- and-from motion. Generally the tidal currents are eastward in flood and westward in ebb. Tidal currents, which flow according to the height of the tide, are generally not strong. There is a strong diurnal influence, which governs the tides in the Maldives, but in general the tidal range is less than 1m.

7.5 COASTAL AND MARINE ENVIRONMENT

7.5.1 BATHYMETRY

Bathymetry survey was conducted in STO plot 2 only as the work involved in plot 111 is on the shoreline (Figure 12). The bathymetry of the survey area was carried out by DCP Pvt. LTd. using differential GPS-enabled echo sounder attached to a dinghy. The survey was carried out on a 5m by

10m grid for the survey. All measurements were related to Mean Sea Level (MSL), which was computed using tide prediction data obtained from the National Meteorological centre (Male' International Airport tide data was used for this exercise)

The bathymetry survey shows that the depth of the area is within the range of -15 to 8.5m. The lowest depth recorded -1.5m is adjacent to the existing quay wall and the lagoon basin gets deeper as towards the reef to a maximum of 8.5m at the central and deepest area. The bottom is covered with fine silt (mud) and fine grained coral sand.

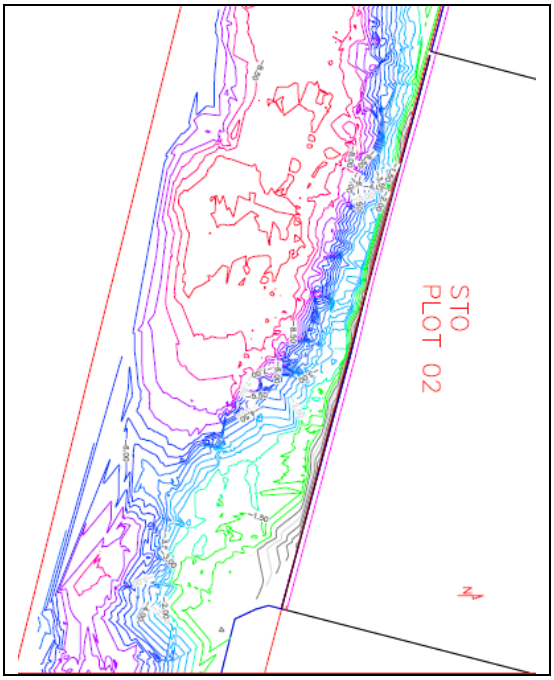

Figure 12: Bathymetry of STO plot 2 area showing the depth contours, survey conducted by DCP. Pvt. Ltd. (magnified version of the bathymetry map is provided in Annex)

7.6 WATER QUALITY

Two water samples one from STO plot 2 lagoon and STO plot 111 were taken and Water quality was assessed at the Male Water and Sewerage Company's Water Quality Assurance Laboratory using standard methodologies. Geographic coordinated of the sample and the results are given in Table 4 and the original tests results are given in Annex 5. It is recommended to use the monitoring data during the project implementation against the baseline information in assessing the environmental impacts

Table 5: Water quality laboratory analysis results

	Plot 2	Plot 111
Geographic location	73°26'43.48"E, 4°11'5.22"N,	73°26'54.67"E, 4°11'6.78"N
Physical appearance	Clear with particles	Clear
pH	8.12	8.17
Nitrate(mg/l)	3.6	3.6
Sulphate(mg/l)	2650	2700
Phosphate(mg/l)	<0.05(LoQ 0.05 mg/l)	0.06

Total Dissolved solids (mg/l)	26400	26300
Salinity (mg/l)	34.75	34.67
Turbidity	0.507	0.135

7.7 GEOTECHNICAL CONDITION

The information provided in this part of the report is extracted from the geotechnical study conducted by ELS (Sri Lanka) from 20th Feb. to 23rd Feb. 2010.

7.7.1 Stress parameters of the soil:

- The top layers above 11.0m consist of fine to coarse angular to sub rounded coral sand with varying "N" values from the Standard Penetration Test (SPT), that indicate varying degree of hardness at various depths.
- A soil stratum of loose to medium dense coral was encountered at a depth ranging between 11.00m to 14.5m, attaining higher SPT values.
- Beyond this depth lies the rock level formation.
- As no clay or silt material was found, this soil is treated as "cohesion less" soil, for which value c = 0.

Table 6: In-situ tests to Relative Density of Cohesion less Soils that will be referred in this project

Relative Density	'N' value	Cone Penetration Test ('q_s' MN/m2)	Angle of internal friction (Ø' Degrees)
Very loose	0-4	2.5	25
Loose	4 – 10	2.5 – 7.5	28
Medium Dense	10 – 30	7.5 – 15.0	30
Dense	30 – 50	15.0 – 25.0	36
Very Dense	Over 50	Over 25.0	41

Source: British Steel sections plates and commercial steels (Piling Handbook 7th edition, 1997).

The outcomes of investigations classify the soil as loose to medium at the probable piling depth of 12m. Based on the relationship from the tabulation, the angle of internal friction (Ø') = 30 degrees. This will be used as a design parameter for pile design.

In the event of achieving a good degree of compaction of the reclamation section behind the piles, the angle of friction can be extended to a further 5 degrees.

7.7.2 Rock quality:

The nature of rock layer was investigated as follows:

Recovery ratio = (length of core recovered)/ (theoretical length of rock cored)
Rock Quality Designation
(RQD) = (∑ length of recovered pieces ≥ 4 inches)/ (Theoretical length of rock cored)

The full results of the geotechnical investigation shows a very poor rock quality in Borehole -1 (RQD: 5- 15%) and fair to poor rock quality in Borehole – 2(RQD: 55- 25%). A recovery ratio of 1 will indicate presence of intact rock, and for highly fractured rocks, the recovery ratio may be 0.5 or smaller. For a better description of the RQD with respect to rock quality, the following relationship could be used:

Table 7: Standard Rock quality description

RQD	Rock Quality
0 – 0.25	Very poor
0.25 – 0.5	Poor
0.5 – 0.75	Fair
0.75 – 0.9	Good
0.9 - 1	Excellent

Source: Principles of Foundation Engineering (3rd Edition), By: Braja M. Das

7.7.3 Existing condition of Quay wall in STOP plot 2 site

The following pictures shows the existing condition of the quaywall, which is broken into pieces in various parts and the whole quaywall is inclined due to scouring and under cutting. The following Figure 13 and Figure 14 shows the nature of operations and the status of the quaywall.

Figure 13: Nature of heavy operation in STO Plot 2 loading and unloading sea and land transportation and storage of construction material.

Figure 14: Existing quay wall broken into pieces unsafe to use, totally destroyed

7.7.4 Existing condition of STO plot 111

STO land plot 111 in Thilafushi is currently used for storage of construction material mainly sand and aggregate in Jumbo bags. The coastal protection shore adjacent revetment has damaged and the stored construction material is washing ashore (Figure 15 and Figure 16).

Figure 15: land and seaward boundary of the STO plot 111, showing damaged seawall and subsequent washing away of stored construction material

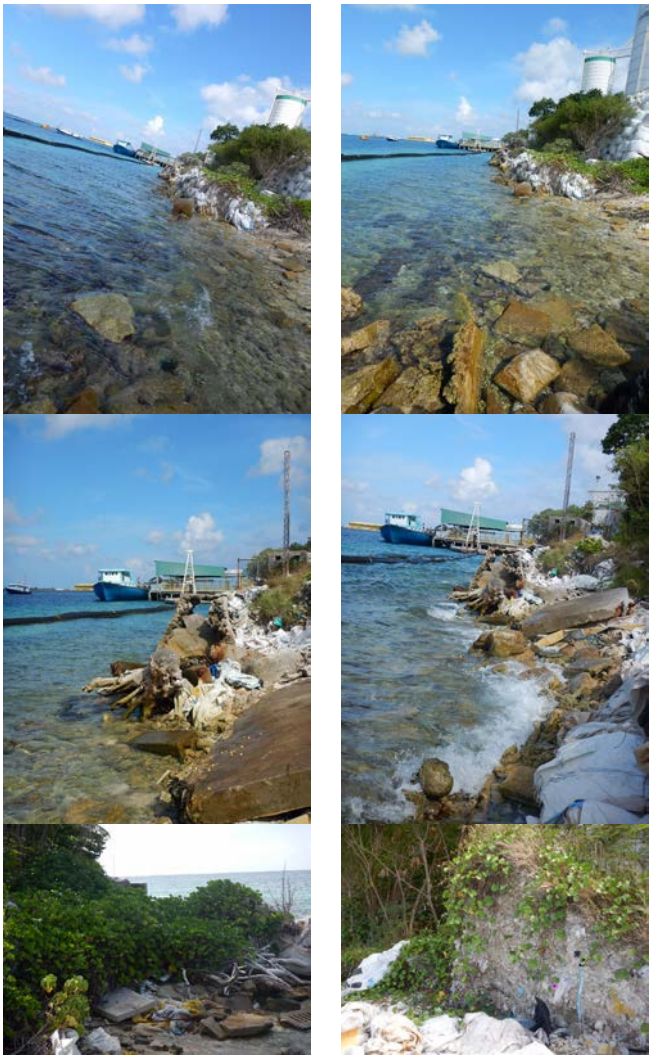

Figure 16: Damages seawall STO plot 111

8 SOCIO-ECONOMIC ENVIRONMENT

8.1 GEOGRAPHIC CONTEXT

Thilafushi is located in North Malé Atoll approximately 6.3 kilometer north west of Malé in North Malé Atoll. Malé atoll consists of two Atolls North and south Malé Atoll. There are 9 inhabited island in both North and South Malé Atoll administratively known as Kaafu Atoll. The two atolls host over 40 operational tourist resorts and few industrial islands.

8.2 POPULATION STRUCTURE

The resident population of Kaafu Atoll (excluding Male, resort and industrial islands) according to the census 2014, is 14092 in the 9 inhabited islands and the resident population of Malé is 153,904 of which 85,438 are male and 68,466 are female. The total population of Malé as per the senses 2007 is over 130,693 inclusive of migrant population from islands and foreigners who are not registered as in Malé. Figure 17 shows registered population of inhabited islands in Kaafu atoll excluding Malé.

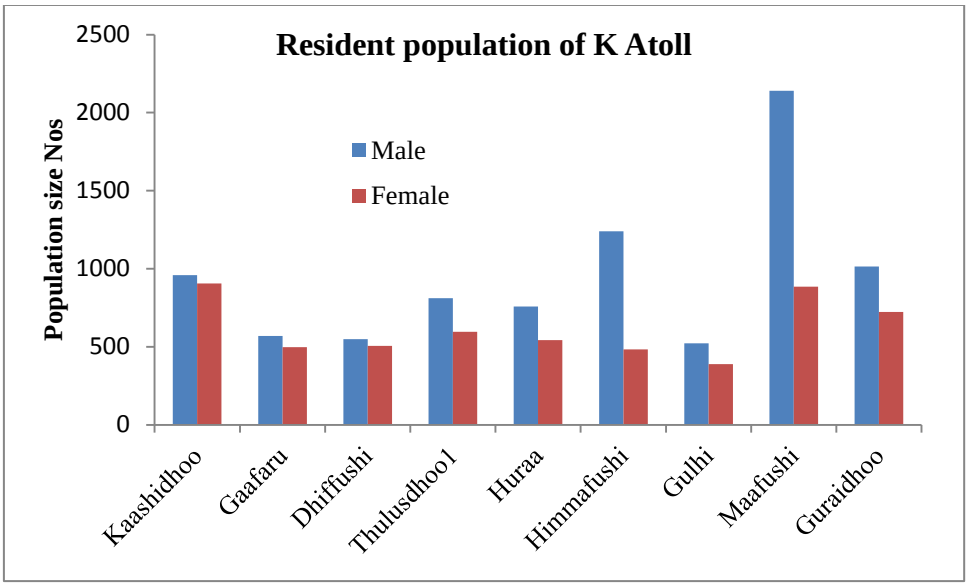

Figure 17: Registered population of inhabited islands in Kaafu Atoll

8.3 EMPLOYMENT

According to the DNP census 2007 economically active population of Kaafu atoll is 9595 which is about 32 % of the total population of the Atoll. As per the statistics 92% (8843 people) of the economically active population is employed. Majority of the employed people, approximately 44% are employed in tourism sector. Figure 18 shows distribution of employment sectors occupied by Kaafu Atoll population.

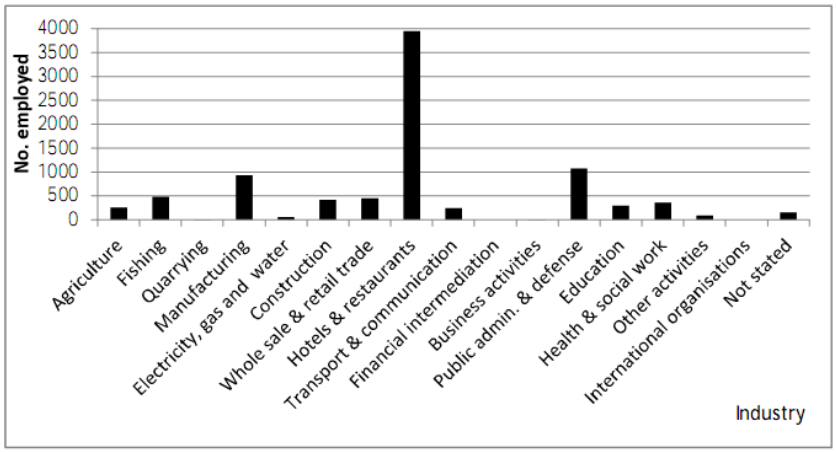

Figure 18: Number of people employed in industrial sectors

8.4 SOCIOECONOMIC BENEFITS

These two plots are strategically important infrastructures for the logistical works of STO construction material distribution network. Damage of these coastal structures that are protecting the land plots is hindering the operation to supply construction material to Maldives. Therefore there is an urgent need to renovate and restore the function of particularly the seawall jetty/ quay wall to be able to alongside bathing of vessels with 3.5~4.0m draft at MSL.

This work is expected to bring a number of socio-economic benefits to the local communities as well as assist in the overall development of the Maldives particularly infrastructure development projects. These include direct and indirect benefits including both direct and indirect employment during both construction and operation phases. Indirectly development of infrastructure and service facilities is some of the benefits that the communities of the Atoll are expected to obtain as a result of the development of the resort in the Atoll.

In general the proposed development will increase the direct employment for the people of Kaafu Atoll and stimulate local economy, through providing small business opportunities particularly for the supply and transport of construction material in Kaafu Atoll.

9 STAKEHOLDER CONSULTATION

The scoping meeting to determine the scope of the EIA report was held on 1st September 2016 at EPA. During the meeting the stakeholder were identified and the scope of the EIA report was determined.

Methods used for stakeholder consultation include direct communication and formal meeting such as the scoping meeting and meeting with MWSC.

9.1 KEY STAKEHOLDER

As per the TOR the key stakeholders identified are

1- Thilafushi Cooperation Limited (TCL)
2- Maldives water and Sewerage Company (MWSC)
3- Development Cooperative Partners pvt. Ltd (DCP Engineers)

9.2 EIA SCOPING MEETING

EIA scoping meeting was held on the 1st of September 2016. Most of the stakeholders apart from MWSC that is listed in the TOR was present in the meeting (meeting attendance is in Annex x). The meeting was chaired by Ms. Safa Ahmed, Assistant Director EPA. The engineer from DCP gave a briefing on the proposed renovations and explained the design details and answered the technical questions. EPA clarified if dredging is required to obtain material for backfilling the jetty in Plot 2 in response the consultant said that no dredging or reclamation work will be required and backfill material will be obtain from the existing sand stock in the island. TCL requested to properly mark the boundary of the sites and use TCL approved boundaries in the maps. TCL also requested that to look at the possibilities of protecting the northern end, which is not within the boundary of STO Plot 111. The northern boundary is within the land plot allocated for MWSC and TCL requested to negotiate with them and protect the area on cost sharing basis. List of meeting attendees are in Annexes.

9.3 CONSULTATION WITH MWSC

Stakeholder consultation with MWSC was held on 10th October 2016 in a meeting held at STO main office. The meeting was attended by STO, DCP, MWSC and the consultant. Representative from STO introduced the meeting and the consultant explained the issue raised during the scoping meeting. MWSC was in the idea that the land plot leased by TCL therefore they will protect the land from erosion to ensure that the total area allocated in the contract is always maintained. DCP explained that once land is rented it is the duty of lessee to protect the land from erosion and maintain the rented area. With this clarification MWSC in principle agreed that the extension of the proposed seawall to protect STO land plot to include the few meters of shoreline within the boundary MWSC is in their interest. They also agreed that the EIA process should continue and MWSC and STO will negotiate potential cost sharing to include protection of the adjacent shoreline that fall within MWSC land plot boundary.

Name	Designation	Contact No
Ms. Aiminath Rifqa	Business Development (MWSC	
Mr. Mohamed Ali Irshad	Manager Bossiness Development(MWSC)	
Mr. Mohamed Fiasal	Manager Property Management (MWSC)	
Mr. Rusthum Mohamed	Operations (MWSC)	
Mohamed Mujahid	Manager STO	

Mr. Zain	Manager STO	
Dr. Mahmood Riyaz	Consultant	7890307
Mr. Hussain Shiyam	Engineer DCP Pvt. LTD	7773889

9.4 MAIN CONCLUSIONS FROM THE STAKEHOLDER DISCUSSIONS

Most of the concerns raised during the scoping meeting was addressed and discussed with the relevant authorities and the following are the outcomes of the discussions;

The boundary maps used to delineate the boundary of STO plot 2 and Plot 111 in this report are TCL approved maps.

As requested by TCL proposed shoreline protection seawall of STO will extend to cover the length of coastline within MWSC boundary as well.

STO and MWSC will mutually agree to share the cost of protection that will cover the boundary line MWSC.

STO will provide the design details and anticipated costs with MWSC

10 POTENTIAL IMPACTS AND MITIGATION MEASURES

This section of the report identifies the potential environmental impacts and possible issues that could arise from implementation of proposed upgrade/renovation work for vessel loading jetty at STO go-down (plot no 2) and shore protection work (plot no 111). Their identification of potential impacts does not mean that they would necessarily occur or that they could not be successfully mitigated. The proposed other works include transportation of dredged material, earthwork and ground levelling of the sports arena.

Possible impacts arising from the construction and operation works are categorized into reversible and irreversible impacts. Reversible and irreversible impacts are further categorized by intensity of impacts (negligible, minor, moderate and major) for identifying best possible remedial (mitigation measures) action to be taken. Below are the impact categories

- Negligible: the impact is too small to be of any significance (Reversible)
- Minor: the impact is undesirable but accepted (Reversible)
- Moderate: the impact give rise to some concern but is likely to be tolerable in short-term, or will require value judgment as to its acceptability (May or may not be Reversible)
- Major: the impact is large scale giving rise to great concern; it should be considered unacceptable and requires significant change or halting of the project (Irreversible)

Severity of impact is assessed by reviewing the engineering design, detailed site plan as well as comparison of development with the existing environment and construction methodologies employed. Mitigation measures are derived based on the site specific assessment as well as similar project elsewhere in the Maldives. Impact identification matrix is provided in Table 8. Potential impacts and their mitigation measures and detail discussion is the following sections. Table 9 gives a summary of impacts their magnitude reversibility and duration.

10.1 IMPACT IDENTIFICATION

The following section describes in detail and discusses the main potential environmental impacts that have been identified and predicted for the proposed upgrade/renovation work for vessel loading jetty at STO go-down (plot no 2) and shore protection work (plot no 111). Identified potential impacts are divided into construction phase and operation phase environmental impacts.

10.2 LIMITATION/UNCERTAINTY OF IMPACT PREDICTION

The methods used to predict and evaluate the environmental impacts that may be associated with the proposed upgrade/renovation work for vessel loading jetty at STO go-down (plot no 2) and shore protection work (plot no 111) may not be the most comprehensive. The main shortcoming of these methods is that impacts are predicted by reviewing the survey data collected during the field visits and information revealed by the designers and engineers, therefore the assumptions have been made to predict the impacts which may or may not be accurate. Also, the data collected during the field visit is limited, which subsequently limits the overall understanding of even the short term environmental conditions (wave condition, currents, and littoral movement). Nonetheless, within the time limitation of EIA field data collection and report preparation the methods used are concise and provide a general overview as well as the range of impacts that can affect the environment.

Table 8: Impact identification matrix

	Construction phase Activities						Operational phase	
Impact	Demolition of existing structures	Work force	Pile Driving and concrete work	Backfilling and construction of seawall	Equipment and vehicle maintenance	Demobilization	Use of Qua wall	Waste management
Noise	-	-	-	-	**X**	-	X	
Dusting -Air Quality	-	X	-	-	-	-	X	-
Coastal process	X	X	-	X	**X**	-	-	
Terrestrial flora	X	X	X	X	**X**	X	X	-
Ground water	X	X	X	X	**X**	X	X	-
Soil	X	X	X	-	-	-	X	-
Marine water	-	X	-	-	-	-	-	-
Hydro dynamics	X	X	-	X	**X**	X	-	X
Marine habitat and Fauna	-	X	-	-	**X**	-	-	-
Socio-economic	+	+	+	+	+	-	X	-

Key: (-) Negetive impact (+) Positive impact (X) no impact

10.3 IMPACTS AND MITIGATION MEASURES

Construction phase can be considered as the period in any developmental project that causes major direct and indirect long and short-term impacts on the environment. Anticipated potential direct and indirect environmental impacts from the proposed upgrade/renovation work for vessel loading jetty at STO go-down (plot no 2) and shore protection work (plot no 111) include the following:

- Mobilization of Equipment and Labour
- Pile driving and concrete work
- Hydrodynamic regime
- Backfilling and construction of seawall
- Noise, Vibrations and Air Pollution
- Equipment & vehicle maintenance

The following paragraphs will provide detailed impacts and mitigation measures during the construction phase of the project.

10.3.1 Impacts from Mobilization of Equipment and Labour

Mobilization of dredging set Excavator and other heavy equipment and machinery needed for the proposed upgrade/renovation work for vessel loading jetty at STO go-down (plot no 2) and shore protection work (plot no 111) will have minor impact on the marine and coastal environment. The major impact of the mobilization would be aesthetic unattractiveness of the vehicles and equipment camp site. Due to the nature of Thilafushi being an industrial island, this impact will remain unnoticed. Disposal of minor amounts of hazardous waste and sewage may be a concern but use of the existing systems in the island, e.g., sewerage system, water and waste disposal mechanism will make the impact negligible

10.3.2 Pile driving , backfilling Seawall construction and concrete work

Pile driving backfilling, seawall construction and concrete work from the proposed upgrade /renovation work for vessel loading jetty at STO go-down (plot no 2) and shore protection work (plot no 111) will have a direct irreversible negative impact to the ecological habitat in the area. Direct impact of this activity is limited to Thilafushi STO plot 2 and plot 11 lagoon and may extend to the reef depending on the weather conditions and work methodology.

Given below are relevant impacts that should be considered:

1. Physical damage on lagoon benthic fauna and loss of habitat: The effect of this would be in the immediate to medium term with the loss of substrate and its fauna.
2. Disturbance to the area during backfilling activity in plot 2: Release of sediments and potential loss of the faunal composition underneath sediment material will undoubtedly occur.
3. Coastal structures will change in the flow patterns. The unexpected outcome may be erosion or accretion elsewhere in the island.

In order to minimize the impact from sedimentation, back filling should be completed in shortest time possible. Backfilling ought to take place after installation of piles will contains the sedimentation within the back filling area only. Backfilling and seawall construction work should undertake during low tides or slack tides to minimize the release of sediment to the area.

10.4 IMPACTS TO CORAL REEF

The coral reef flat on the north eastern part of Thilafushi where Plot 111 lies is within 50m from the shoreline. The sewall construction activity will generate minor amount of sediment during the replacement of the new rock boulder revetment. Short-term minor sedimentation impact from the the seawall construction activity is expected. Thus, the immediate negative impact of sedimentation during revetment construction will be reversed within a short time period.

10.4.1 Hydrodynamic regime

The proposed upgrade/renovation work for vessel loading jetty at STO go-down (plot no 2) and shore protection work (plot no 111) is likely to change near shore hydrodynamic regime due to installation of coastal structures.

This change in hydrodynamics is considered minor and is not expected to affect coastline much as the remaining plots are also protected with hard coastal structures. However, it is proposed to have in place a monitoring program against the baseline set up for this study should an unforeseen changes occur to the beach especially during unusual weather.

10.5 IMPACTS TO COASTAL MORPHOLOGY AND AESTHETIC VALUE

The turbidity associated with the backfilling and installation of coastal structures will probably be restricted largely to the bottom, and the immediate vicinity of the two land plots. A plume will still be visible around the backfilling area in Plot 2, given the nature of the island the plume will not significantly noticed due to the high turbidity of Thilafushi Lagoon. The overall significance of this impact will vary from person to person, but on a precautionary basis is regarded as being moderate.

10.6 NOISE, VIBRATIONS AND AIR POLLUTION

During the mobilisation of equipment and operation of the proposed upgrade/renovation work for vessel loading jetty at STO go-down (plot no 2) and shore protection work (plot no 111) it is anticipated that significant noise will be generated. Minor ground vibration is anticipated during pile driving movement of excavators and operation of heavy vehicles. Furthermore, noise vibrations may alter species behaviour. In addition, dust and emissions from vehicle and machinery exhausts will degrade the air quality. With proper mitigation measures, it is unlikely that noise, vibration and air pollution impacts will cause long term effects such as human health risks leading to increased public and private health costs.

10.6.1 Equipment & vehicle maintenance

Impacts: All sorts of motorized equipment, requiring fuel, lubrication and maintenance will be used on the site. Many will be fitted with lead batteries. Therefore the potential accidental spillage and contamination of the soil and the sea by hydrocarbons as well as the careless disposal of batteries exists during the construction period.

10.7 SOLID WASTE MANAGEMENT & DISPOSAL

Impacts associated with solid waste are the most important environmental impacts with greatest concern during the operations phase of the project. Inadequate methods of solid waste disposal during the operation phase of the project will generate a number of impacts on the area. For instance, waste such as garbage, plastic bags, glass and plastic bottles, aluminum cans and other discarded by the from the boats and ships generate marine pollution in the surrounding area, which in turn will have detrimental impacts on coral reefs as well as on reef fish populations. However, proper garbage management practices will be implemented at the site and permanent staff to look after the beach will be kept in the area. Adequate number of dustbins will be placed in various parts therefore issues related to improper solid waste disposal will be avoided. It is anticipated that dedicated staff will be engaged to collect and dispose of waste on daily basis to the waste management Site in Thilafushi.

Mitigation Measures:

- dedicated staff will be engaged to collect and dispose off waste from the are to the waste disposal site in Thilafushi on daily basis
- Proper signage will be kept for the workers and bot crew on ways to reduce and avoid solid waste disposal other than designated areas
- Dustbins for collection of different types of waste will be placed in various areas.
- Metals, glassware, plastics, paper and organic waste like leaves and twigs will be separated from other materials.

10.8 POTENTIAL POSTIVE IMPACTS

Potential positive impact of the project would be creation of short term employment opportunities for the locals during the construction period. These two plots are strategically important infrastructures for the logistical works of STO construction material distribution network. Damage of these coastal structures that are protecting the land plots is hindering the operation to supply construction material to Maldives. Therefore there is an urgent need to renovate and restore the function of particularly the seawall jetty/ quay wall to be able to alongside bathing of vessels with 3.5~4.0m draft at MSL.

10.9 NEGATIVE IMPACTS

1- Loss of benthic biota at the sheet pilling and revetment construction area.
2- Short-term sedimentation and turbidity due to back filling activity in Plot 2.
3- Possible impacts on pelagic environment due to suspended sediments.
4- Increased noise levels due to operation of heavy vehicles for construction operations.

10.10 IMPACT MITIGATION MEASURES

Table 6 below lists the potential impacts identified above in Section 10 and describes the corresponding mitigation measures that should be put in place during implementation of the proposed upgrade/renovation work for vessel loading jetty at STO go-down (plot no 2) and shore protection work (plot no 111). In summary the impact mitigation measures proposed should entail:

1) Pile driving in Plot prior to back filling will minimise sediment suspension and dispersal at the backfilling area.
2) In order to minimize the impact from sediment, backfilling and revetment construction should be completed in shortest time possible. These activities ought to take place during low tides or slack tides to minimize the release of sediment to the area.
3) During the project activities and operational phases, all efforts should be made to prevent the intentional or accidental spill of oil, waste oil and hazardous materials release into the environment which could lead to further damage to the marine environment.
4) Contractor should take steps to ensure that there is no dumping of oily waste from heavy vehicles or land-based activities related to the project. Careful consideration should be given to the requirements for storage and appropriate disposal of waste oil.

10.11 CUMMULATIVE IMPACTS

The proposed upgrade/renovation work for vessel loading jetty at STO go-down (plot no 2) and shore protection work (plot no 111) is largely a renovation project where structures are already in place and it has to be replaced due to fatigue and damaged due to old age. The project activities in Plot 2 is within the dredged lagoon which is already a deteriorated and construction and dredging work is continuous is various land plots in the area therefore, The coral reef and lagoon environment may not fully recover from these impacts. Therefore the cumulative impact from the proposed project activities on the marine environment will be negligible compared to the scale of similar activities undertaking in various land plots in Thilafushi Island.

10.11.1 Mitigation Cost Elements

The mitigation measures associated with significant costs, beyond those of pilling and other heavy vehicle equipment rental and deployment is identified below in Table 6 along with the major cost elements. Costs are based on the estimation of the magnitude activity

Table 9: Significant impacts, mitigation measures and associated costs

Phase	ACTIVITY	IMPACTS	IMPACT PREDICTION			MITIGATION MESURES	Mitigation				
			Magnitude	Reversibility	Duration		cost (MVR)	Benefit	Expertise	Responsibility / Manpower	Equipment /technology timing
Construction phase	1. Pile driving, backfilling seawall construction and concrete work	Sedimentation on lagoon and reef Physical damage to benthic fauna and habitat loss Chang in near shore flow pattern	M	R	M-L	Backfilling after installation of piles will contains the sedimentation within the back filling area Backfilling and seawall construction during low tides or slack tides to minimize the release of sediment to the area Avoid operation of heavy machinery out of construction area or boundary Use a silt screen to	Silt curtain 2,000 USD	Reduce sedimentation	Environmental protection	Contractor	Silt curtain installation
	Coastal protection work (construction of rock boulder revetment)	Hydrodynamic regime Sediment movement pattern Coastal morphology and aesthetics Sedimentation of coral reef	M	I	M-L	Long term monitoring during construction an operation phase	Monitoring cost provided in relevant section	Take mitigation action in a timely manner	Environmental protection Financial savings	Environmentalist	Monitoring equipment
		Noise vibration and air pollution	L	R	S	Heavy machinery operated only during mid to low tide Avoid use of heavy machinery during night hours		Avoid public nuisance	Environmental protection	Contractor	Timing

Operational Phase	Solid waste management	Quaywall operation area	H	R	S	dedicated staff will be engaged to collect and dispose of waste from the beach Adequate number of dustbins will be placed	Plug into existing waste disposal system	Keep the area clean	Environmental protection	proponent	Recruitment 3-4 staff
	Quaywall user impacts	Used oil, oil from vessels food organic, inorganic and hazardous materials	M	R	S	Adequate signage will be kept in place. All garbage or wastes of domestic in nature generated on site will be transported to Thilafushi waste disposal site.	Staff salary 144,000 MVR/year			Proponent	

Key

Magnitude	Reversibility	Duration
H=High	I=Reversible	L= Long Term (Over 10 years)
M=Medium	R=Reversible	M=Medium term (Over 5 years)
L=Low		S=Short term (Below 5 years)

11 ALTERNATIVES

11.1 NO DEVELOPMENT OPTION

It is believed that a number of environmental impacts will be generated from the proposed upgrade/renovation work for vessel loading jetty at STO go-down (plot no 2) and shore protection work (plot no 111). Although no impacts on the environment will be associated if the proposed development does not go ahead, the development will bring numerous beneficial socio-economic impacts to the infrastructure development process. These two plots are strategically important infrastructures for the logistical works of STO construction material distribution network. Damage of these coastal structures that are protecting the land plots is hindering the operation to supply construction material to Maldives. Therefore the proposed upgrade/renovation work for vessel loading jetty at STO go-down (plot no 2) and shore protection work (plot no 111) is important for the nation to build necessary infrastructures and maintain the pace of construction industry.

Given the range of benefits that the proposed development will bring to the country, the proposed development project has been considered important. Development can take place only within the limits of the environment and the society. Hence, the aim is to ensure that all project activities are undertaken without any adverse long term irreversible environmental damages that cannot be mitigated. Preferred alternatives discussed below has been selected based on the above broad development concept.

11.2 DEVELOPMENT OPTION

Having decided and followed the development option of the proposed project one has to consider the alternative options for upgrade/renovation work for vessel loading jetty at STO go-down (plot no 2) and shore protection work (plot no 111) that would have least environment impact. Following have been considered for the alternatives.

11.3 ALTERNATIVE COASTAL PROTECTION STRUCTURES

Possible options have been considered for quaywall on the lagoon ward side STO plot 2 and coastal protection on the outer reef periphery on the north eastern side in Plot 111. Potential alternatives for coastal protection on the two plots include: (a) concrete quaywall, (b) steel sheet pile with concrete capping beam (c) geotextile quaywall with concrete capping beam for the Plot 2 and for plot 111 potential options are : (a) rock boulder Revetment (b) Quaywall (c) Offshore breakwater.

Of these options, for the Plot 2, the steel sheet pile quaywall would be necessary at the plot 2 where heavy load related operations will take place also large ship loaded with construction material, cranes and other heavy duty vehicles will be operating this area. Therefore deep sheet piles is necessary to be driven to adequate depth identified by the Engineer.

For the Plot 111, revetments and quaywalls both will work in this area as the main purpose of the structures is protect the boundary of the land plot. However on the NE side no mooring or bathing will take place, quaywalls would not be suitable and more costly. There is no enough space between the shoreline and reef to place a breakwater. Also placement of a breakwater on the reef flat will have direct and indirect negative impact on the coral reef in the area. Therefore rock boulder revetment adjacent to the shoreline would be the most suitable option for the protection of the Plot 111.

11.4 PREFERRED ALTERNATIVE

From the alternative options analysed for coastal protection of the two STO sites in Thilafushi Plot 2 and Plot 111the proffered option of STO Plot 2 is steel sheetpile with concrete capping beam and for Plot 111 rock boulder revetment.

11.5 ALTERNATIVE SOURCE FOR MATERIAL

Sourcing fill material in Thilafushi is extremely difficult; therefore one of the potential source is the existing pile of imported sand lying in the Plot 111. The sand been in rain and exposed to wind for a fairly long time therefore it might no longer be good enough to meet with the engineering standards for construction sand.

12 MONITORING

Environmental monitoring is essential to ensure that post-construction and operational impacts are known and eliminated in a timely manner. Dealing with impacts earlier would save money and also help planning and operationalize the process.

The parameters that are most relevant for monitoring the impacts that may arise from the proposed project are included in the monitoring plan. These include sea water (pH, dissolved oxygen, electrical conductivity turbidity, dissolved oxygen, phosphates, nitrates and BOD), sediment deposition. Monitoring the shoreline changes that may occur due to the medium to long term impacts from the changes in coastal processes.

Table 10: Coastal Process monitoring schedule

Parameter	Indicators	Baseline / Reference Values	Method / Technique	Frequency	Estimated cost in USD
Shorelines (high / low tides)	Beach morphology	Baseline to be re-established immediately after construction is complete	Differential GPS	Bi-annually in the first two year and yearly thereafter	100/ trip
Currents	Nearshore currents	Baseline to be collected immediately constructions are over, especially on western side	Drogue survey	Bi-annually in the first two year and yearly thereafter	100/trip

Table 11: Coral reef monitoring schedule

Parameter / Method	Frequency of Monitoring	Purpose	Estimated cost (USD)
Benthic cover by major life forms (live, dead, rock rubble, seagrass and sand)	Annually	Indicative of the changes in the live coral cover	150/trip
Fish population / visual census	Annually	To assess broad scale change in the ecological status of the coral reefs (increase / decrease of herbivores, etc)	

Table 12: Water Quality monitoring schedule

Type	Parameters	Locations	Frequency	Estimated cost (USD)

In situ monitoring / sampling and testing from a laboratory	Dissolved oxygen Turbidity (NTU) Nitrates Sulphates COD TDS	All locations marked	Bi-annually	400/ set of tests

12.1 MONITORING COSTS

It is understood that costs of monitoring be borne by the proponent. It is also understood the mitigation measures would be accommodated in the contract costs. A commitment letter confirming compliance on mitigation measures is given in Annex 4.

12.2 MONITORING REPORT

A detailed environmental monitoring report is required to be compiled and submitted to the Environment Protection Agency annually, based on the data collected for monitoring the parameters included in the monitoring programme given in this report.

The report will include details of the site, strategy of data collection and analysis, quality control measures, sampling frequency and monitoring analysis and details of methodologies and protocols followed.

13 CONCLUSIONS

The environmental impact assessment study for the proposed upgrade/renovation work for vessel loading jetty at STO go-down (plot no 2) and shore protection work (plot no 111) shows there are two main activities that would cause significant negative environmental impacts. Those, in order of significance, are:

1. Pile driving, backfilling, seawall construction and concrete work in Plot 2
2. Coastal protection work (construction of rock boulder revetment)

Of these a long term impact would be from pile driving, backfilling, seawall construction and concrete work in Plot 2. Sedimentation on lagoon and reef physical damage to benthic fauna and habitat loss and change in near shore flow pattern are some of the impacts. These impacts would be cumulative occurring over long period of time and so can be managed through proper monitoring. Based on the scale of coastal protection projects that is taking place in Maldives at the time of this writing, impacts associated with this activity is insignificant.

Construction of rock boulder revetment adjacent to the shoreline will temporarily increase the sedimentation on the north eastern side but the impact would be short term and negligible. However, the positive socio economic impacts from the proposed development outweigh the temporary negative impacts of project.

The study has evaluated alternative options for the project activities and evaluated potential option of alternative sources for fill material, alternative coastal protection structures. Based on the similar project activities elsewhere in the Maldives the report found, that the Thilafushi will recover from the impacts will re-establish a new ecological balance soon. Even though there is no very significant impact from this project after the report has come-up with an extensive monitoring programme that will keep on monitoring coastal and marine environmental changes associated with the project and make necessary adjustment based on the findings of various measured environmental parameters suggested in the monitoring plan.

Therefore on the basis of this environmental impact assessment study and the impact mitigation measures proposed in the report will be duly implemented and recommendations are given due consideration, it is concluded that the benefits of the proposed upgrade/renovation work for vessel loading jetty at STO go-down (plot no 2) and shore protection work (plot no 111) in Thilafushi will substantially outweigh its imposition on the environment.

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15 ANNEXES

Annex 1: EIA Terms of Reference (ToR) Approved by EPA

Annex 2: Land plot boundary approved by Thilafushi Cooperation

Annex 3: Bathymetry map

Annex 4: Commitment letter from the proponent

Annex 5: Water quality laboratory test results

Annex 6: Stakeholder consultation list

بسم الله الرحمن الرحيم

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Environmental Protection Agency

203-EIARES/60/2016/10

Terms of Reference for Environmental Impact Assessment to upgrade/renovation of vessel loading jetty at STO go-down (Plot no 2) and shore protection of the (Plot no 111), K. Thilafushi, Maldives

The following is the Terms of Reference (ToR) following the scoping meeting held on 01/09/2016 for undertaking the EIA for the proposed *Refurbishment Works at STO Plot 2 and Plot 111 in Thilafushi, Kaafu Atoll. The proponent of this project is State Trading Organization Limited.*

While every attempt has been made to ensure that this TOR addresses all of the major issues associated with development proposal, they are not necessarily exhaustive. They should not be interpreted as excluding from consideration matters deemed to be significant but not incorporated in them, or matters currently unforeseen, that emerge as important or significant from environmental studies, or otherwise, during the course of preparation of the EIA report.

1. **Introduction and rationale** –Describe the purpose of the project and, if applicable, the background information of the project/activity.Objectives of the development activities should be specific and if possible quantified. Define the arrangements required for the environmental assessment including how work carried out under this contract is linked to other activities that are carried out or that is being carried out within the project boundary. Identify the donors and the institutional arrangements relevant to this project. .

2. **Study area –** Submit a minimumA3 size scaled plan with indications of all the proposed infrastructures. Specify the agreed boundaries of the study area for the environmental impact assessment highlighting the proposed development location and size.

3. **Scope of work**– Identify and number tasks of the project including preparation, construction and decommissioning phases.

Task 1. Description of the proposed project – Provide a full description and justification of the relevant parts of the upgrade and renovation of the loading jetty of Plot no2 and the coastal protection work of Plot no 111 that will be covered in the project, using maps at appropriate scales where necessary. The following should be provided (all inputs and outputs related to the proposed activities shall be justified):

The main activities of the upgrade and renovation of the loading jetty of Plot no2 and the coastal protection work of Plot no 111 are:

- Demolition of the existing loading/unloading jetty in Plot 2 and the seawall in Plot 111;
- Construction of the loading jetty and coastal protection structure
- Environmental monitoring during construction activities;
- Measures to protect environmental values during construction and operational phase of the loading jetty
- Project management (include scheduling and duration of the project and life span of facilities; communication of construction details, progress, target dates, construction/operation/closure of labour camps, access to site, safety, equipment and material storage, fuel management and emergency plan in case of spills)

Upgrade and renovation of the loading jetty:

- Design details of loading jetty (s) on a map;
- Justification for the design;
- Dimensions and characteristics construction material;
- Method and equipment used for construction, and operational control procedures;
- Justification for selecting the methods and equipment;
- Duration of renovation activity;
- Labour requirements and (local) labour availability;
- Housing of temporary labour, and
- Emergency plan in case of spills (diesel, grease, oil)

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Email: secretariat@epa.gov.mv
Website: www.epa.gov.mv
ގްރީން ބިލްޑިންގ، ހަންދުވަރީ ހިންގުން
މާލެ، ދިވެހިރާއްޖެ 20392

Coastal protection of Plot 111

- Design details of the coastal protection including dimension and construction material
- Justification of the proposed design

Task 2.Description of the environment – Assemble, evaluate and present the environmental baseline study/data regarding the study area and timing of the project.Identify baseline data gaps and identify studies and the level of detail to be carried out by consultant. Consideration of likely monitoring requirements should be borne in mind during survey planning, so that data collected is suitable for use as a baseline. As such all baseline data must be presented in such a way that they will be usefully applied to future monitoring. The report should outline detailed methodology of data collection utilized.

The baseline data must be collected before construction and from at least two benchmarks. All survey locations shall be referenced with Geographic Positioning System (GPS) including water sampling points, reef transects, vegetation transects and manta tows sites for posterior data comparison. Information should be divided into the categories shown below:

Climate

- Temperature, rainfall, wind, waves, evaporation rates (including extreme conditions)
- Risk of hurricanes and storm surges;

Geology and geomorphology

- Bathymetry (bottom morphology) (use maps);
- Characteristics of seabed sediments to assess direct habitat destruction and turbidity impacts during construction;

Hydrography/hydrodynamics (use maps)

- Tidal ranges
- Sea water quality measuring these parameters: temperature, pH, salinity, turbidity, sedimentation rate, phosphate, nitrate, ammonia, sulphate, BOD and COD.

Ecology

- Identify marine protected areas (MPAs) and sensitive sites or endangered species
- Benthic and fish community monitoring around the island (see appendix for monitoring guidelines);
- Seascape integrity, and

Hazard vulnerability:

- Vulnerability of area to flooding and storm surge.

All data must be collected as per the requirements of the EPA Data Collection Guidelines (published on www.epa.gov.mv). The report should outline detailed methodology of data collection utilized.

Task 3. Legislative and regulatory considerations – Identify the pertinent legislation, regulations and standards, and environmental policies that are relevant and applicable to the proposed project, and identify the appropriate authority jurisdictions that will specifically apply to the project. Legal requirements:

- Dredging and coastal modification permit from EPA
- Approval letter from Thilafushicooperation to carry out all the project components in the site.

Task 4. Potential impacts (environmental and socio-cultural) of proposed project, incl. all stages – The EIA report should identify all the impacts, direct and indirect, during and after construction, and evaluate the magnitude and significance of each. Particular attention shall be given to impacts associated with the following:

Impacts on the natural environment

- Changes in erosion/sedimentation patterns flow velocities/directions, which may impact shore zone configuration/coastal morphology;

- Loss of marine bottom habitat, in the coastal protection site due to renovation/construction of seawall and coastal structures in (temporary) loss of bottom life, which may impact fish stocks and species diversity and density of crabs, shellfish etc.;
- Impacts of noise, vibration and disturbance;
- Impacts on unique or threatened habitats or species (coral reefs, sea turtles etc.), and
- Impacts on landscape integrity/scenery.

The methods used to identify the significance of the impacts shall be outlined. One or more of the following methods must be utilized in determining impacts; checklists, matrices, overlays, networks, expert systems and professional judgment. Justification must be provided to the selected methodologies. The report should outline the uncertainties in impact prediction and also outline all positive and negative/short and long-term impacts. Identify impacts that are cumulative and unavoidable.

Task 5. Alternatives to proposed project – Describe alternatives including the *"no action option"*should be presented. Determine the best practical environmental options.Alternatives examined for the proposed project that would achieve the same objective including the "no action alternative". This should include but not limited toalternative design, alternative equipment/machinery for construction, alternative disposal sites and alternative containment measures. All alternatives must be compared according to international standards and commonly accepted standards as much as possible. The comparison should yield the preferred alternative for implementation. Mitigation options should be specified for each component of the proposed project.

Task 6.Mitigation and management of negative impacts – Identify possible measures to prevent or reduce significant negative impacts to acceptable levels. These will include both environmental and socio-economic mitigation measures with particular attention paid to sedimentation control and future changes in coastal processes. Mitigation measures to avoid or compensate habitat destruction caused by construction of new structures will have to be considered, e.g. temporal sediment control structures, coastal protection structures to reduce erosion, coral reconstruction and MPA replacement areas. Measures for both construction and operation phase shall be identified. Cost the mitigation measures, equipment and resources required to implement those measures. The confirmation of commitment of the developer to implement the proposed mitigation measures shall also be included. In cases where impacts are unavoidable arrangements to compensate for the environmental effect shall be given.

Task 7. Development of monitoring plan (see appendix)– Identify the critical issues requiring monitoring to ensure compliance to mitigation measures and present impact management and monitoring plan for coastal modification, beach morphology, sediment movement around the island.Ecological monitoring will be submitted to the EPA to evaluate the damages during construction, after project completion and every three months thereafter, up to one year and then on a yearly basis for five years after. The baseline study described in task 2 of section 2 of this document is required for data comparison. Detail of the monitoring program including the physical and biological parameters for monitoring, cost commitment from responsible person to conduct monitoring in the form of a commitment letter, detailed reporting scheduling, costs and methods of undertaking the monitoring program must be provided.

- Water quality, especially turbidity;
- Condition of the sensitive ecosystems and marine resources;
- Re-colonization of the benthic organisms in the borrow areas;
- Erosion and accretion;

Task 8. Stakeholder consultation,– Identify appropriate mechanisms for providing information on the development proposal and its progress to all stakeholders including, government authorities, engineers/designers, Thilafushi Cooperation Limited, MWSC and other adjacent industrial communities. The EIA report should include a list of people/groups consulted, their contact details and summary of the major outcomes.

Presentation- The environmental impact assessment report, to be presented in digital format, will be concise and focus on significant environmental issues. It will contain the findings, conclusions and recommended actions supported by summaries

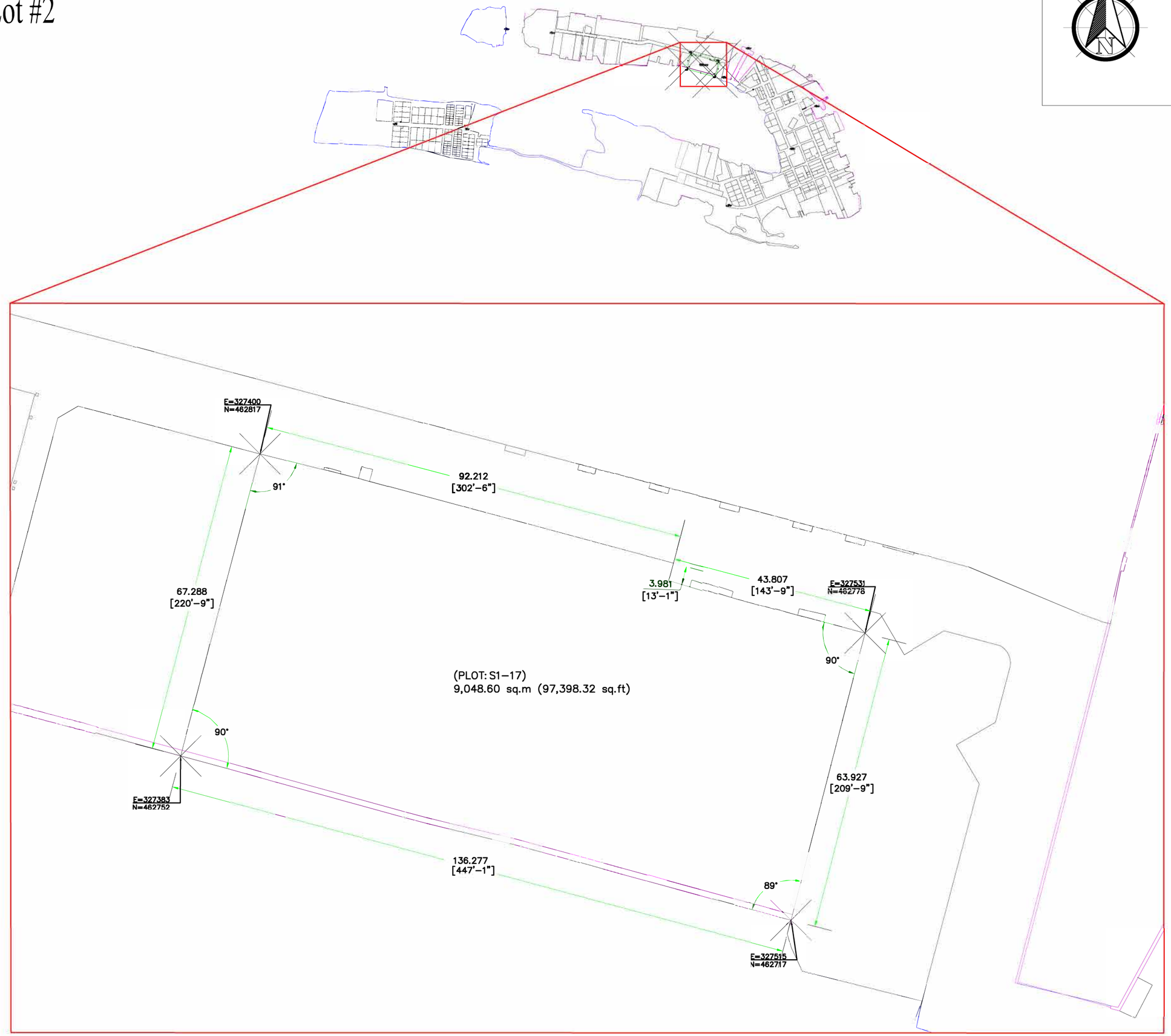
of the data collected and citations f or any references used in interpreting those data. The environmental assessment report will be organized according to, but not necessarily limited by, the outline given in the Environmental Impact Assessment Regulations, 2012 and subsequent amendments.

Timeframe for submitting the EIA report – The developer must submit the completed EIA report within 8 months from the date of this Term of Reference.

01 September 2016

Annex 2: Land plot boundary approved by Thila/ushi Cooperation

PLot #2



GENERAL NOTES:

1-The boundary corners are determined from the marks visible at the time of the survey. this includes building corners, boundary wall corners & fences .

2-The Drawing units are in meters.

3-WGS 84 UTM zone 43 north.cordinate system.

4-Vertical datum is in mean seal level.

DOCUMENT HISTORY

Revision	Date	Drawn By	Checked By

TENANT :

State Trading Organization.

PROJECT TITLE :

Thilafushi Existing Map

DRAWING TITLE :

State Trading Organization Layout

SCALE :

1:800 as shown

SURVEYED DATE:

10 December 2013

SURVEYED BY:

MTCC

Drawn By : Ahmed Nihureer

Checked By : Mohamed Azim

DRAWING TITLE :

Thilafushi Cadastral Survey Map

PLOT DETAILS:

Plot No: S1-17 (old plot no: 02.)

Agreement No:

Existing Land usage (Based on 2013 Survey)
Land Area : 9,048.60 sq.m (97,398.32 sq.ft)

Drawing Number : SFS1-17/12JUN14-V1

Revision Number : V1

VERIFIED BY THILAFUSHI CORPORATION LIMITED :

Name : Ahmed Nihureer

Signature :

VERIFIED BY LESSEE :

Name :

Signature :

Thilafushi Corporation Limited
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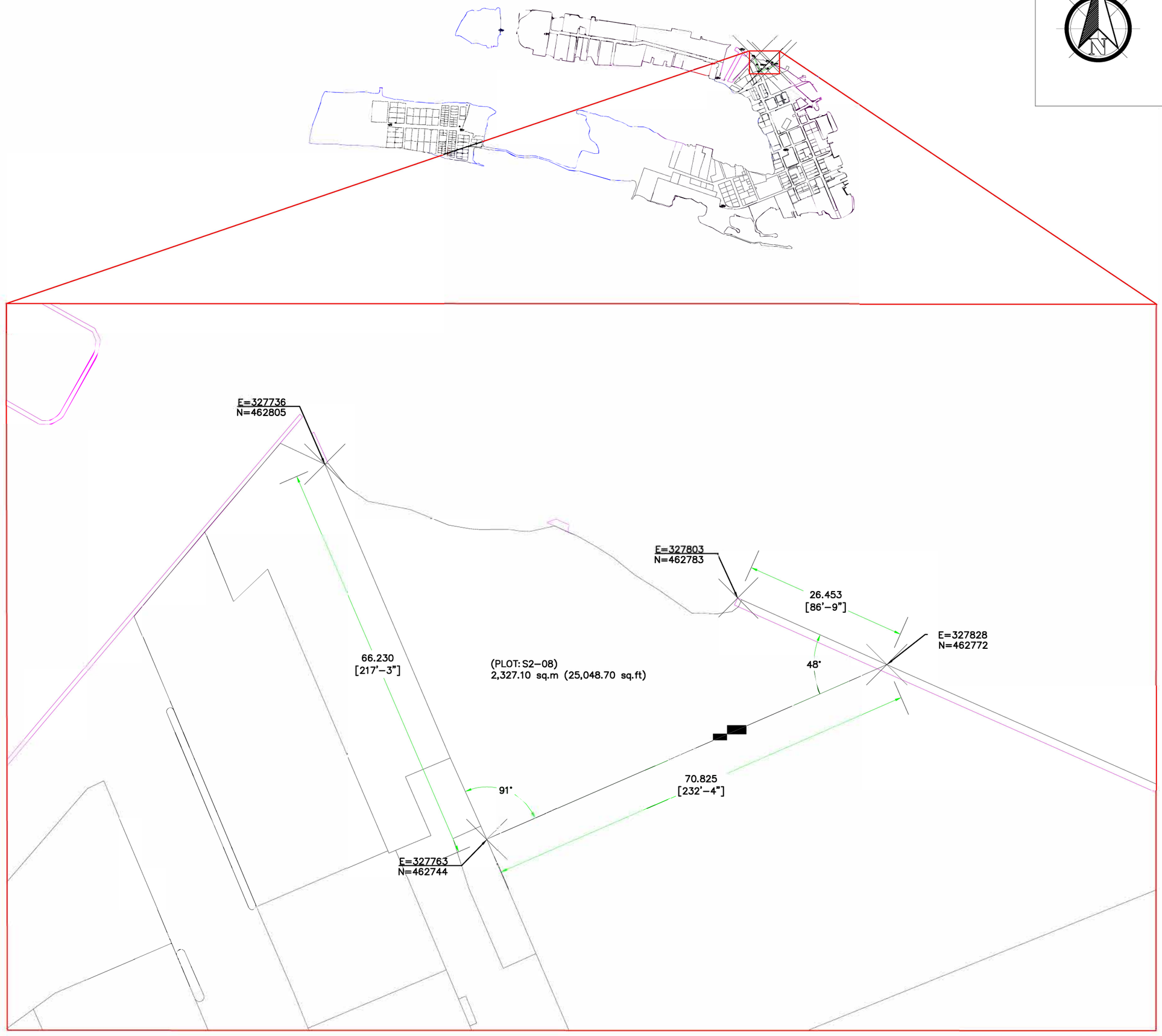
Tel +960 3307513 , Fax:+960 3307514
www.tcl.com.mv

Annex 2: Land plot boundary approved by Thilafushi Cooperation PLOT #111



GENERAL NOTES:

1-The boundary corners are determined from the marks visible at the time of the survey. this includes building corners, boundary wall corners & fences .

2-The Drawing units are in meters.

3-WGS 84 UTM zone 43 north.cordinate system.

4-Vertical datum is in mean seal level.

DOCUMENT HISTORY

Revision	Date	Drawn By	Checked By

TENANT :

State Trading Organization.

PROJECT TITLE :

Thilafushi Existing Map

DRAWING TITLE :

State Trading Organization Plot Layout

SCALE :

1:600 as shown

SURVEYED DATE:

10 December 2013

SURVEYED BY:

MTCC

Drawn By : Ahmed Nihureer

Checked By : Mohamed Azim

DRAWING TITLE :

Thilafushi Cadastral Survey Map

PLOT DETAILS:

Plot No: S2-08 (old plot no:111)

Agreement No:

Existing Land usage (Based on 2013 Survey)
Land Area : 2,327.10 sq.m (25,048.70 sq.ft)

Drawing Number : SFS2-08/17JUN14-V1

Revision Number : V1

VERIFIED BY THILAFUSHI CORPORATION LIMITED :

Name : Ahmed Nihureer

Signature :

VERIFIED BY LESSEE :

Name :

Signature :

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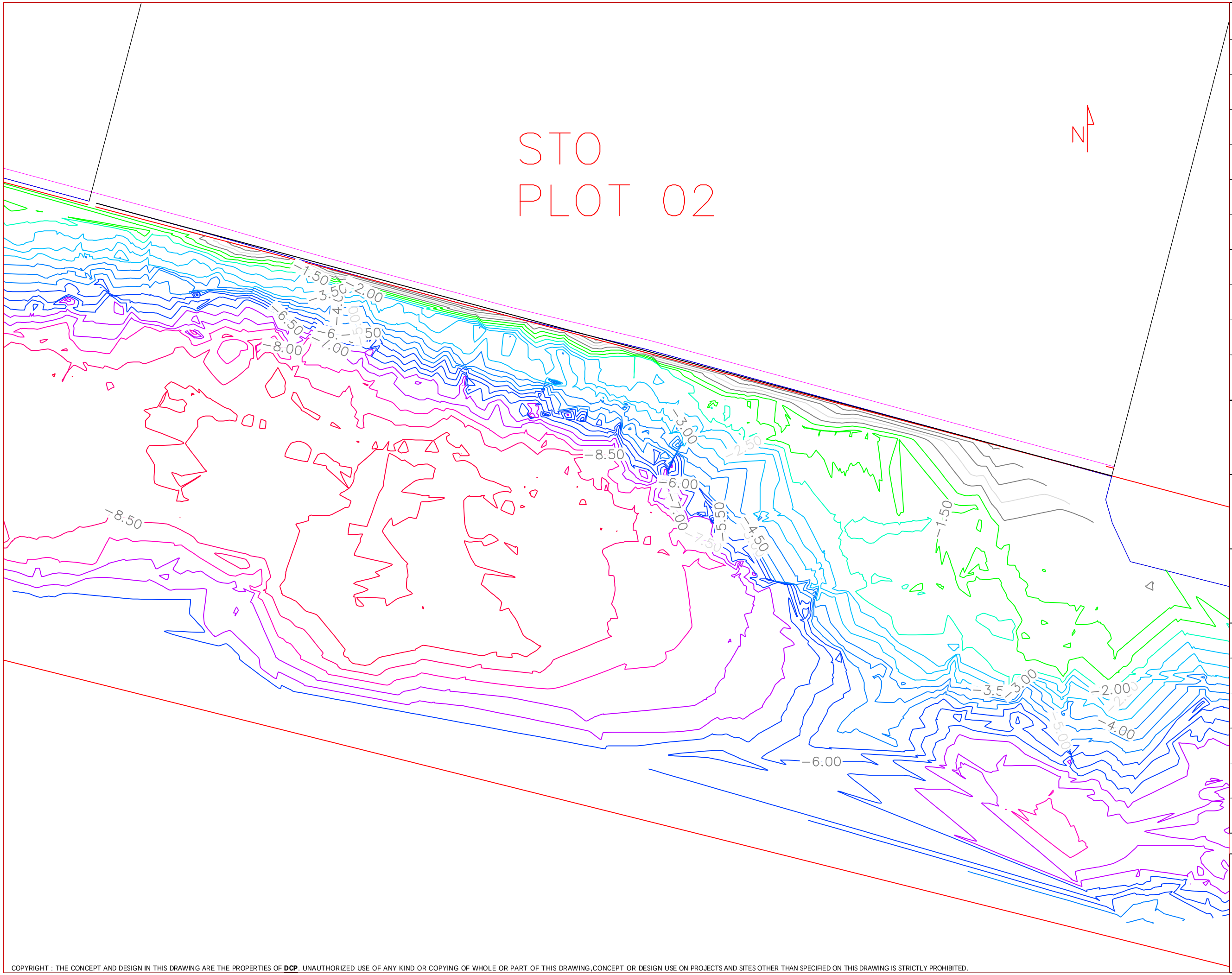
STO
PLOT 02



Annex 3: Bathymetry map

AMMENDMENTS

Note: All Measurements are in mı
unless specified (do not scale)

CONTENTS:

Bathymatry as at 4.8.16

PROJECT:

PLOT 02 - Warf Upgrading

CLIENT:

STO

DESIGNED BY:
HSHIYAM

DRAWN BY:
HSHIYAM

DATE:
Sunday, September 04, 20

CHECKED BY:
HS

FILE NAME:
STO BATHY FINAL.dwg

DRAWING NO: DCP/16-STO-01
Scale: AS SHOWN

Development
Collaborative Partnership
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mail@dcp.com.mv +960 3316942

بسم الله الرحمن الرحيم

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evolving with you

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State Trading Organization plc

Registration Number: **C-186/2001**

60-BD/174/2016/6

9th November, 2016

Mr. Thoriq Ibrahim
The Minister
Ministry of Environment and Energy
Ameenee Magu, Maafannu,
Malé-20392, Republic of Maldives

Dear Mr. Thoriq Ibrahim,

Re: EIA – EIA TO UPGRADE/RENOVATION OF VESSEL LOADING JETTY AT STO GO-DOWN (PLOT NO 2) AND SHORE PROTECTION OF THE (PLOT NO 111), AT K. THILAFUSHI, MALDIVES

As the proponent responsible for environmental compliance for the above project, I hereby give our financial commitment to implement the monitoring plan, undertake the mitigation measures recommended and to comply with the issues identified in the Environmental Impact Assessment Report submitted to your agency.

Yours sincerely,

Muslih Maseeh

General Manager

sto
51
YEARS OF SERVICE

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ދާދި 20345، ދިވެހިރާއްޖެ
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ޓެލެކްސް: 77006 STO MF

Annex 5: Water quality laboratory test results

Male' Water & Sewerage Company Pvt Ltd
Water Quality Assurance Laboratory
FEN Building 5th Floor, Machangoalhi, Ameeneemagu, Male', Maldives
Tel: +9603323209, Fax: +9603324306, Email: wqa@mwsc.com.mv

MWSC

WATER QUALITY TEST REPORT

Test Report No: 301526/2016/01

Customer Informations : *DCP*
M.Shaamaa, 1st Floor,
Jawaahiru Hingun,
Male'
Rep.of Maldives

Date: 11/10/2016

Sample Description / Location~	Thilafushi		TEST METHOD	UNIT
	STO Site Plot 02	STO Site Plot 101		
Sample Type~	Sea water			
Sampled Date~	3/10/2016			
Sample Received Date	10/10/2016			
Test Requisition Form No.	900165742			
Sample No.	826658	826659		
Date of Analysis	10/10/2016 - 11/10/2016			
PARAMETER	**ANALYSIS RESULT**			
Physical Appearance	Clear with particles	Clear	Visual	-
Nitrate	3.6	3.7	Method 8171 (Adapted from HACH DR5000 Spectrophotometer procedure Manual)	mg/L
pH	8.12	8.17	Method 4500-H+ B. (adapted from Standard methods for the examintation of water and waste water, 21st edition)	-
Sulphate	2650	2700	Method 8051 (Adapted from HACH DR5000 Spectrophotometer procedure Manual)	mg/L
Salinity	34.75	34.67	Method 2520 B. (adapted from Standard methods for the examintation of water and waste water, 21st edition)	‰
Phosphate	<0.05 (LoQ 0.05mg/L)	0.06	Method 8048 (Adapted from HACH DR5000 Spectrophotometer procedure Manual)	mg/L
Temperature	21.9	21.9	Electrometry	°C
Total Dissolved Solids (TDS)	26400	26300	Electrometry	mg/L
Turbidity	0.507	0.135	HACH Nephelometric Method (adapted from HACH 2100N Turbidimeter User Manual)	NTU

Keys:
mg/L: Milligram Per Liter, ‰: Parts Per Thousand, °C: Degree Celcius, NTU: Nephelometric Turbidity Unit
LoQ: Limit of Quantification

Checked by:	Approved by:
Afnan Farooq Laboratory Executive	Mohamed Eyman Senior Technical Officer

Notes:
Sampling Authority: Sampling was not done by MWSC Laboratory
This report shall not be reproduced except in full, without written approval of MWSC
This test report is ONLY FOR THE SAMPLES TESTED.
~ Information Supplied by the customer

**********END OF THE REPORT**********

Annex 6: Stakeholder consultation list (Scoping meeting attendees list)

Environmental Protection Agency
Male', Rep of Maldives

Meeting: Proposed Refurbishment Works at STO Plot 2 and Plot 111

Date: 01 September 2016

Time: 11:00 a.m.

MEETING ATTENDANCE

	Name	Designation	Office	Email	Phone No.	Signature
01	MOHAMED WASEEM	MANAGER PROJECTS IMPLEMENTATION	TCL	mohamed.waseem@tcl.com.mv	7791677	
02	AHMED NIUSHAD	MANAGER	STO	Ahmed.[illegible]@sto.[illegible].net	9100050	
03	Mohamed Zain Easa	Officer	STO	mohamed.zain@sto.maldives.net	7497790	
04	Mohamed Rizan	Consultant	—	Mohamed.Rizan@gmail.com	7890327	
05	Hussain Shiyam	Designer	DCP	hhshiyam@gmail.com	7773889	
06	Hussain Ibrahim	Asst. Env. officer	EPA	hussain.[illegible]@epa.gov.mv	9184724	
07	Safa Ahmed	Assistant Director	EPA	safa.ahmed@epa.gov.mv	3335949	
08						
09						
10						