ENVIRONMENTAL IMPACT ASSESSMENT FOR ISLAND ACCESS AND JETTY CONSTRUCTION PROJECT IN FULHADHOO, BAA. ATOLL

Prepared For:
Ministry of Housing and Infrastructure

PREPARED BY:

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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.

Dr. Mahmood Riyaz (EIA03/07)
12th July 2017

Declaration of the Proponent

1 ސާރު ޚުލާސާ

1. މިރިޕޯޓަކީ، ބ.ފުޅަދޫގައި ވަދެ ނިކުމެވުމަށްޓަކައި ބޭނުންކުރާނެ ޝަރަކާއި ރަރަށް އަރައި ފޭބުމަށް ފާލަމާއި ތަރައްޤީ ކުރުމުގެ މަސައްކަތް މިނިސްޓްރީ އޮފް ހައުސިންގ އެންޑް އިންފްރާސްޓްރަކްޗަރ އިން އެރަށުގައި ފުރުމުގެ ކުރިން އެ މަސައްކަތުގެ ސަބަބުން ތިމާވެށްޓަށް ކުރާނެ އަސަރު ދެނެގަތުމަށްޓަކައި ތައްޔާރު ކުރެވިފާ އެންވަޔަރަންމަންޓް އިމްޕެކްޓް އެސެސްމަންޓް (އީއައިއޭ) ރިޕޯޓެވެ. މަޝްރޫއުގެ ޕްރޮޕޯނެންޓަކީ މިނިސްޓްރީ އޮފް ހައުސިންގ އެންޑް އިންފްރާސްޓްރަކްޗަރއެވެ. ބ. ފުޅަދޫގައި ވަދެ ނިކުމެވުމަށް ޝަރަކާއި ރަރަށް އަރައި ފޭބުމަށް ފާލަމާއި އެޅުމުގެ ޢަމަލީ މަސައްކަތް ކުރިޔަށްގެންދާ އުސޫލުން ބަޔާނުކުރާ ކަނޑައަޅާފައިވާ ޓަރމްސް އޮފް ރެފަރެންސް (އީ.ޕީ. އޭ. ޓީ. ސީ) އާއެވެ.

2. ރިޕޯޓް ތައްޔާރުކުރި މިމަސައްކަތުގެ ކޮންސަލްޓެންޓް ފަރާތުން ހައުސިންގ މިނިސްޓްރީއިން އާންމުކޮށް ކުރި އިއުލާނާ އާއި ގުޅިގެން ބީލަމަށް ހުށަހަޅައިގެން ބީލަން ކާމިޔާބު ކުރި ޕްރިޕެއަރސް ކޮންސަލްޓިންގ އިންނެވެ.

3. މިރިޕޯޓް ތައްޔާރުކޮށްފައިވަނީ މަޝްރޫޢުގެ ޕްރޮޕޯނެންޓް އެންވަޔަރަންމަންޓަލް ޕްރޮޓެކްޝަން އެޖެންސީއާ ދެމެދު އެއްބަސްވެފައިވާ ޓާރމްސް އޮފް ރެފަރެންސްގެ މަތިންނެވެ.

4. ބ. ފުޅަދޫގެ ދުވަސްފެތުމާގައި 2010 ވަނަ އަހަރު ވަނީ ފާލަމެއް އަޅާފައެވެ. މި ފާލަން އެޅީ ސަރުކާރުން ތަކެތި ދިނުމުން ރަށުގެ ރައްޔިތުންނެވެ. މި ސަރަހައްދުގެ މަސައްކަތް ކުރެވިފައިނުވެ. ރަށުގެ ދުވަސްފެތުމާގައި ތަނު ގަދަކަމުން ވަޅުނުލާ އުޅުމާއި ފާލަމާ ކައިރިކޮށް ބޯނުން ކުރުމުގައި ރަށުގެ ރައްޔިތުންނަށް ދިނަމުން ދަތިތަކާއި ކުރިމަތިވެފައެވެ. މިހުސްކުރުން ރަށަށް އަރައި ފޭބުމަށް މިފާލަން ބޭނުން ކުރެވޭނީ އަހަރުގެ މަދުދުވަސްކޮޅެވެ. އަދި ރަށަށް ވަދެ ނިކުމެ އަރާ ފައިބާނެ ފަސޭހަ ގޮތެއް ހޯދުމަށް ވެސް ދިޔުމަކީ ރަށުގެ ރައްޔިތުންގެ އެދުމެއް ބޮޑު އެދުމެވެ.

5. މިކަން ރައްޔިތުންނަށް ހައްލުކޮށްދިނުމުގެ ގޮތުން އެރަށުގެ ދުވަސް ފެތުމާގައި މީހުން އަރާ ފައިބުމަށް ހުރަސްގޮސް 50މ ދިގުމިން ފާލަމެއް އެޅުން ނުވަތަ ހޮޅުއްޔެއް ކަނޑައި ކުރިމަތީން ފާލަމުގެ ކުރިމަތިން ކުޑަ ބަނދަރެއް ނުވަތަ ފުނިކުރުމަށްޓަކައި ސަރުކާރުން މިމަޝްރޫއު އެކުލަވާލާ ތަރައްޤީ ކުރުމުގެ މަސައްކަތް ކުރުމަށް ވަނީ ނިންމާފައި ދަނޑި މަސައްކަތް ވަނީ އެމް.އާރ.ޑީ.ސީ އާއި ހަވާލު ކުރައްވާފައެވެ. މިމަޝްރޫއު ގެ ބޭނުމަކީ އަހަރުގެ ހުރިހާ ދުވަސްވަރެއްގައިވެސް ބ ފުޅަދޫއަށް ވަދެނިކުމެ ފަސޭހަކަމާއި ރައްކާތެރިކަމާއެކު ހޯދުމުގެ ވަސީލަތްތައް ފޯރުކޮށްދިނުމެވެ. އަދި ރައްޔިތުންނަށް ރަނގަޅު ބަނދަރެއް ލިބުން ޖެހޭތީ ދިރުމުގެ މުސްތަޤުބަލަށް ބޭނުންވާ ހޮލިޑޭ ވެރިޔާ ކުރިއެރުމުގެ މަސައްކަތް ކުރަން ކުރިއަށް ފޭބުން ޕްރޮގްރާމް ކުރާނެ ގޮތުން އެހީތެރިވާނެ ރަނގަޅު ބަނދަރެއް ލިބުމާ ވިޔަފާރީގެ ފުރުޞަތުތައް ހޯދުމަށް އެހީތެރިވާނެ ކަމަށް ލަފާކުރެވެއެވެ.

6. މިރިޕޯޓުގައި ބ. ފުޅަދޫގައި ވަދެ ނިކުމެވުމަށް ޝަރަކާއި ނުކަން ފުންކުރުމާއި ރަރަށް އަރައި ފޭބުމަށް ފާލަމެއް އެޅުމާއި އަދި ކަނޑުގެ ނަގާލާ ގޮނޑުދޮށަށް އެޅުމުގެ ސަބަބުން ތިމާވެށްޓަށް ކުރާނެ އަސަރުތަކާ ބެހޭގޮތުން ފާހަގަކޮށްފައިވާ ވާހަކައެވެ. ހައުސިން މިނިސްޓްރީ އިން ހުށަހަޅައިފައިވާ ރަށުގެ ދުވަސް ފެތުމާ ގައި 24މ ފުޅާ 624މ ދިގު ޝަރަކާއި ކަނޑައި ފުންމިން 31.15މ ދިގު، 4މ ފުޅާ ޖީ-ޓީޖީއާއި އެކާ ޖީ ޓީޖީގެ ކުރިމަތިން 40މ ދިގު 40މ ފުޅާ ތަންކޮޅެއް ކޮނުމަށެވެ. ކޮންނަ ތަންކޮޅާއި ޝަރަގެ ފުންމިނުގައި ހައިޓައިޑަށްވުރެ 3- މ ހުންނަ ގޮތަށެވެ. މިތަނުން ކޮނޭގޮން ނަގާވެލި ޖީ-ޓީޖީގެ ބެކްފިލް އަދި ބޯޓުންނަކަށް އިތުރުފާހަގަ ކުރެވިފައި ރަށުގެ ގޮނޑުދޮށުގައި އޮތް ގިރާސޮދަރަތައް ދެނުތަކަށް އެޅުމަށެވެ. ބ.

ފުޅަދޫގައި ތަރައްޤީކުރުމަށް ހަމަޖެހިފައިވާ ޝަރުޠާއި، ފާލަމާއި، ކުރުމަށް ހުށަހަޅާފައިވާ ތަންތަނުގެ މިންތަކަކީ އާއްމު ގޮތެއްގައި އަރައި ފޭބުމުގެ ދަތިކަން ދިމާވާ ރަށްތަކަށް ޔަޤީން ކުރުމަށްޓަކައި ހައްސަން މިނިސްޓްރީން ގެންގުޅޭ މިންގަނޑުތަކާއި ހުރިހާ ރަށެއްގައިވެސް ބޭނުންކުރާ އުސޫލުތަކުގެ މައްޗަށް ބިނާކޮށް ކަނޑައަޅާފައިވާ މިންތަކެކެވެ.

7. ބ. ފުޅަދޫއަށް އަރައި ފޭބުން ފަސޭހަކޮށް ތަން ގާއިމްކުރުމުގެ ގޮތުން ވަދެ ނިކުތުމަށް ނަރަކާއި ހަރަށް އަރައި ފޭބުމަށް ފާލަމެއް އެޅުމަށް ހިންގާ މިމަޝްރޫޢުގެ ސަބަބުން ތިމާވެއްޓަށް ކުރިމަތިވާނެ މައްސަލަތައް ދެނެގަތުމަށްޓަކައި ބޭނުންވާ ދިރާސާތައް ވެސް މިރިޕޯޓް ތައްޔާރުކުރުމުގެ މަސައްކަތުގެ ތެރޭގައި ފުރިހަމަ ކުރެވިފައެވެ. އެގޮތުން އެއްގަމާއި މޫދާއި ގުޅުންހުރި ތަފާތު ދިރާސާތަކާއި ވަނީ ފުރިހަމަ ކުރެވިފައެވެ. އޭގެ އިތުރުން އިޖުތިމާޢީ ގޮތުންނާއި ރަށުގެ މުޖުތަމަޢާއި ބައްދަލުވުމުން މައުލޫމާތު މިރިޕޯޓުގައި ހިމަނާފައި ވާނެއެވެ. މިގޮތުން އެއްކުރެވުނު މައުލޫމާތުގެ ތަފްސީލުގައި ހިމެނެނީ:

ހ. ރަށުގެ ގޮނޑުދޮށާއި، މަސައްކަތް ކުރުމަށް ހަމަޖެހިފައިވާ ސަރަހައްދާއި ތިމާވެށީގެ ގޮތުން ބަލާއިރު އަސަރު ފޯރާފާނެކަމަށް ލަފާކުރެވޭ ސަރަހައްދުގެ މޫދާއި މޫދުގައިވާ ދިރުމާއި ތަފާތު ހާލަތުތަކުގެ މައުލޫމާތު އެއްކުރެވުނެވެ.

ށ. ގޮނޑުދޮށުގައި ވެލި ދަތުރުވާ ގޮތާއި ބީޗް ޕްރޮފައިލް އާއި މަސައްކަތް ކުރާ ސަރަހައްދުގެ މޫދުގެ ފުންމިން އަދި އެސަރަހައްދުގެ އޮޔާއި ރާޅުގެ ދިރާސާ ކުރެވުނެވެ.

ނ. މޫސުމާ ބެހޭ މައުލޫމާތު އެއްކޮށް ތަޙްލީލުކޮށް ދިރާސާ ކުރެވުނެވެ.

8. މިދިރާސާތަކުން ހޯދުނު މައިގަނޑު ކަންތައްތައް ތިރީގައި އެވަނީއެވެ.

ހ. މަޝްރޫޢު ހިންގުމަށް ހުށަހަޅާފައިވާ ސަރަހައްދުގެ ފުންމިން ހިކިދިޔައިރުވެސް 3 މީޓަރަށްވުރެ ފުންވެ. މިހެން ކަމުން އެސަރަހައްދު ކަނޑުގެ ލަހަރު ބޮޑުވެއެވެ.

ށ. ރަށުގެ ދެކުނު ފަރާތު އަބަދުވެސް އަދި ވައިން ހާއްސަ ގޮތެއްގައި ހުޅަނގު މޫސުމުގައި ވަރަށް ގަދަވެއެވެ. ފަޅުގައި އަޅާފައިވާ ދޮނިބައެއް ބޭރުގެ އުޑުވަރުގައި ރައްޔިތުން ދުވާލު ދުވަސްވަރު ކަމުގައިވާ އަޅުގަނޑުމެންގެ އާދަޔެވެ.

ނ. ހުޅަނގު ފަރާތުން ވަދެ ނިކުތުމަށް އޮންނަ ސަރަހައްދު ބޮޑުތަން ކުޑަކަމާއި އަތޮޅުގެ އެތެރެއިން ވަރަށް ދުރުވެ. މިގޮތުން ފުޅަދޫއިން ގޮއިދޫއަށް ދިޔުމަށް 2 ގަޑިއިރު އަދި އޭދަފުށިން ދިޔުމަށް 2.30 ގަޑިއިރު ހޭދަވެއެވެ.

ރ. ޢާއްމު ގޮތެއްގައި ރަށުގެ މީހުން ގޮއިދޫއަށް ދާން ބޭނުން ކުރަނީ ޑިންގީއެވެ. ނަމަވެސް ގަދަ ދުވަސްވަރު ދަތުރު ފަޅުތެރޭން ޑިންގީގައި ގޮއިދޫއަށް ދާން އުނދަގޫވެ. އޭގެ ބަދަލުގައި އޮޑިދޯނި ފަހަރު ފަޅުތެރެ މަގުވެ. ނަމަވެސް ހިތި ދިރާސާގައި އުޅުގަނޑު ބަރުވާނެ ހިޔާލުވެއެވެ.

9. ޖަލްސާގައި ފާހަގަ ކުރެވިފައިވާ ކަންތައްތަކަށް ރިޔާއަތްކޮށް ތަރައްޤީކުރުމުގެ އެދުމުގެ މަތިން ސަރުކާރުން ހުށަހަޅާފައިވާ ގޮތަށް ވަކި ނިކުމެވަން ނުކަރާއި ރަށަށް އަރައި ފޭބުމަށް ގާތްވެފައި އެތުރަން ހިނގާ މިމަސައްކަތުގެ މަސައްކަތް ރަށުގެ އުމުރުފުރާތަށް ބަދަލު ކުރުމަށް ވަކި ހުރަހެއް މި ރިޕޯޓުގައި ފަޅުން ކުރެވިފައެވެ. އަދި މިކަމަށް ހައްސާސްވާ މިނިސްޓްރީގެ އިޢުލާނުން ނިޔާކަންވެސް ވަކި ސަލާމަތުން މުޅިންގައި ހުރަކަތްފައެވެ.

10. މިހެން ކަމުން މި އިޖުރާއަތު ރިޕޯޓް ބަލާއިރު ކުރެވުނު މިވަގު ރަށުގައި ވަޒަނު ހިތާ އަދި އަރައި ފޭބުން ގެނެސް ބ. ފުޅަދޫ އަށް ކަނޑުދަނޑުވެސް ބޭނުންވާ ކަމަށް ބަލައި އެގޮތަށް ބަރުވެގެންނެވެ.

11. ހުށަހަޅާފައިވާ މަޝްރޫޢުގެ މަސައްކަތުތަކުގެ ސަބަބުން ތިމާވެށްޓަށް އަސަރުކުރާ މިންވަރު ބެލުމަށްޓަކައި އިމްޕެކްޓް މެނޭޖްމަންޓް އެއްބަސްވުމުގެ ކުރިން ކުރެވޭނެ. މިގޮތަށް އިމްޕެކްޓް މެނޭޖްމަންޓް އަކީ ޕްރޮޖެކްޓްގައި ތިމާވެށްޓަށް އަސަރުކުރާ މިންވަރު ބެލުމަށްޓަކައި ބޭނުންކުރާ ބާރުތަކެވެ. މިފަދަބާރުތަކާ އެއްފަރާތްގައި (ރަހަތާ) އޮންނަނީ ޕްރޮޖެކްޓް ތަރައްޤީކުރުމުގެ މަސައްކަތާއި އެކަން ބޭނުންކުރަން ފެށުމުން ކުރާ ކަންތައްތަކެވެ. އަނެއްފަރާތްގައި (އޮފްސެޓަން) އޮންނަނީ މިޕްރޮޖެކްޓްގެ މަސައްކަތް ތަކެއް ސަބަބުން ތިމާވެށީގެ އެކިއެކި ސަރަހައްދުތަކާއި ތަންތަނާއި މާހައުލަށް އަސަރުކޮށް މިންވަރެވެ.

12. ހުށަހަޅާފައިވާ މަސައްކަތްތަކުގެ ސަބަބުން ތިމާވެށްޓަށް އެންމެ ބޮޑު ނޭދެވޭ އަސަރެއް ކުރާނެ ކަމަށް ފާހަގަ ކުރެވުނީ ނެރުކޮންނާއި ޖެޓީ ކުރިމަތިން ކަނޑަށް ފަޅުކެޑުމާ ފުންކުރުމުންނެވެ. ތިމާވެށީގެ ގޮތުން ބަލާއިރު މިއީ ދިރުމުއްދަތަކާއި ދިރޭތަކެތި މުޅި ތިމާވަށަށް އަސަރުކުރާނެ ކަމެއް ނުވާ ކަމެކެވެ. މިމަސައްކަތްތަކުގެ ސަބަބުން ދިރުން ތިމާވެށްޓަށް ނޭދެވޭ އަސަރެއް ކުރާނީ ކަނޑުގެ ފަޅުކުރުމުގެ ބަދަލުގައި ކުރެވޭ ވެލި ބެހޭގޮތުން ދިޔައި ފަސް ޖެހޭ ބާރަށް ބީރާ ސަރަހައްދުން އެތެރެވުމުގެ މަސައްކަތްތަކުގެ ސަބަބުން ދިރުމާ ތިމާވެށީގެ މައްސަލަތަކެވެ. މީގެ ކުރުމުއްދަތަކަށް ދިރުމާ ނިސްބަތުން ކުޑަ އަސަރެއް ކުރުމަށް ފާހަގަ ކުރެވޭނެވެ.

13. ފާހަގަކުރެވުނު ކަންކަން ރަނގަޅު ކުރުން ނުވަތަ ކުޑަ ނެރުވީ އަސަރު ކުޑަ ކުރުމަށްޓަކައި އެޅިދާނެ ފިޔަވަޅުތައް ވެސް މިރިޕޯޓުގައި ހިމަނާފައިވާނެއެވެ. ތިމާވެށްޓަށް ހާއްސަކޮށްގައި ފަޅުތެރެއާއި ގޮނޑުދޮށުގައި ވެލިދޮއްރުވާ ގޮތަށް އަންނަ ބަދަލުތަކެއް މޮނިޓަރކުރުން ޕްލޭނާއި މިރިޕޯޓުގައި ހިމަނާފައިވާނެއެވެ. މިފަދަ މޮނިޓަރިން ޕްލޭނާއި ބޭނުމަކީ ތިމާވެށްޓަށް ކުރާއަސަރު ދެނެގަތުމާއި ދަރަޖަ ދެނެގަތުމާއި ވިލާވެސް އަލަށް އެކަނިކަން ރަނގަޅުކުރުމުގެ ފިޔަވަޅު އެޅުމެވެ. މިގޮތަށް ޕްރޮޖެކްޓްތަކުން ރައްޔިތުގެ ބަންޑާރުނަގައި ހިންގާފައިވާ މަޝްރޫޢުތަކުގެ ތިމާވެށްޓަށް ފޯރާނެ ނޭދެވޭ ކުރިމަތިލާ އަސަރުތަކެއް ތިމާވެށި ވަރަށްއަވަހަށް ރަނގަޅުވެ އިސްލާހުކަމެއް ބޮޑުކަމަށް އަލުންހާލަތު ކުރެވޭކަން ވަކިވާގޮތަކަށް ކުރެވިފައެވެ.

14. ހުށަހަޅާފައިވާ މަސައްކަތްތަކުން ކުރުމުގައި ބަދަލުގެނެވިދާނެ ކަމަށް ތަފާސްކުރާ ބައެއްކަންތައްތަކެއް މިރިޕޯޓުގައި ބަހުސްކޮށް ވަކި ކުރެވިފައިވާނެއެވެ. މިމަޝްރޫޢު ނިޔަލްގާއި، މިހާރު މި ރޮދި މަޝްރޫޢުގެ މަސައްކަތްތަކުގެ ބަދަލުގައި އުމުރުފުރާތަށް ބަދަލުކުރާއި ގެޔާ ދިރުނާސާކަން މިނޫން ވަކިއަކަށްކުރި ފާއިތުވާ. މިގޮތުން މިދިރާސާއިން ބޮޑަށްވެސް ހުށަހެޅި މަޝްރޫޢު ގެ މަސައްކަތްތަކުގެ އުމުރުފުރާތަކުގެ ބަދަލު ކުރުމަށް އެންމެ އެކަރިޔާނާ ގޮތްކަމަށް ގޮތެއްގެ. މިގޮތުން މިމަސައްކަތް ކުރުމުގެ ނަމަ ކަންމާ ފަޅުތެރެއާއި ފުރުފަހަނަސްކުރިއާ ފުރާވާ ކުރުމުގެ ސަބަބުން ތިމާވެށްޓަށް ކުރާ ނުރަވާ އަސަރު ބޮޑުކަމުގައި ވިސްނުމެއް ހަރުއްސާއޮންނަން މިތަން ހަރަކާ ގޮތުގައި ބޭނުން ކުރާނެ އަހަނަގާ އެތެރެ ފަރާތުގައި ހަރަކާ އަދި ފެހަކަ ވަށައިގެން ޒާއިލު ކާރޫބާރަށް ފޮށިއަޅާ. އަދި އެމީ ހަރުއްސައަށް އެންމެ ބޮޑު

ގޮތަކުގައި ވެސް ފާހަގަކުރެވެއެވެ. އަދި އެސަރަހައްދުގައި އެކަން ކުރާއިރު ތިމާވެށީގެ ގޮތުން ކުރާ ނުރަގަޅު އަސަރުތައް ކުޑަކުރުމަށް އެޅިދާނެ އިތުރު ފިޔަވަޅުތައްވެސް މިރިޕޯޓުގައި ފާހަގަކޮށްފައިވާނެއެވެ.

15. ބ. ފުޅަދޫއަށް ވަދެ ނިކުތުމަށް ނެރަކާއި ބަނދަރު އަދި ޖެޓީއެއް ފާލަމެއް އެޅުމަށްޓަކައި އެކުލަވާ ލެވިފައިވާ މަޝްރޫޢުގެ މަސައްކަތްތަކުގައި ތަންފީޒުކުރުމުގެނަމަ ބަދަލު އަދި ޖެޓީގެ ދިމާވެފައިވާ ދަތިތަކާއި ހައްލުވެ ގިނަގުނަ އިޖްތިމާއީ ފައިދާ ތަކެއް ލިބޭ އަދި ބަނ ތަރައްޤީކުރަން ކުރިއެރުވުމުގެ އިތުރު ފުރުސަތުތަކެއް ތަނަވަސްވާނެއެވެ. މިކަމުގެ ސަބަބުން އިޤްތިޞާދީ ފުރުސަތުތައް އިތުރުވެ ހުޅުވި ތަނަވަސް ވެގެންދާނެއެވެ. ގައުމީ ފެންވަރުގައި އިޤްތިޞާދު ބަނދަރުކުރުމުން ބ. ފުޅަދޫގެ ހިއްސާ އެއް ސަބަބުން ބަނދަރުވެގެން ދާނެއެވެ. ވަދެ ނިކުތުމަށް ނެރަކާއި ބަނދަރު އަދި ޖެޓީއަށް ފާލަމެއް އެޅުމުގެ ސަބަބުން ނުލިބޭ ތިމާވެށީގެ މައްސަލަތައް ހައްލު ކުރުމަށް އަސަރުތަކާ ފިޔަވަޅުތައް ތަރައްޤީގެ ސަރުކާރު ގޮތުން އަމަލުން ގެންދާނެއެވެ. މިރިޕޯޓުގައި ފާހަގަކުރެވުނު ބޮޑެތި ގެއްލުން ނުރައްކާ ޖެޓީގެ މައްސަލަ ހައްލުވެ މިރިޕޯޓުގައި ބޮޑުވެފައިވާ މުނިސިޕަލް ފާރުގެ ފައިދާތައް ތިމާވެށްޓަށް ގެއްލުން ކުޑަ ގޮތަކަށް މި މަޝްރޫޢު ކުރިއަށް ގެންދެވިދާނެ ކަމަށް ފެނެއެވެ.

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2 NON TECHNICAL SUMMARY

1. The proponent of B. Fulhadhoo Island access and Jetty development project is the Ministry of Housing and Infrastructure (MHI). The Ministry is the government's responsible body for the development and regulate the housing and infrastructure of the country. Maldives Road Development Cooperation (MRDC) has been contracted to undertake the jetty and access channel construction work in B. Fulhadhoo.

2. Two freelance EIA consultants has been contracted through public bidding process to provide preparation services of an Environmental Impact Study (EIA) by (MHI) for the jetty and access channel construction work project in B. Fulhadhoo Island.

3. The assessment addresses specific key issues stated in the Terms of Reference (ToR) as agreed between EPA and the Proponent following the scoping meeting held on the matter.

4. A jetty has already been developed in the Southern side of Fulhadhoo in 2010. The existing jetty was built by the island community when the Government provided construction material harbour. The existing jetty is difficult to use during the SW Monsoon when the sea is rough and the lagoon on the western side is exposed to refracted fetch waves during the westerly monsoon period. Therefore the island is inaccessible during rough weather condition. To overcome the accessibility issues of the island community has requested the Government to develop proper island access facilities (jetty and an access) on the island. This project is implemented to develop island access and a jetty on the southern side of the island to enable an alternative island access to use during rough weather conditions.

5. The need for access for the island has been recognised by the government and proposed to develop a jetty and cut an access channel on the southern side to provide safe access for the vessels operating to and from B. Fulhadhoo Island.

6. The study investigates impacts associated with the proposed channel dredging and jetty construction of B. Fulhadhoo and areas for disposal of dredged material. The proposed access channel will have a width of 24m and a length of 624m and the entrance channel which will be cut through the reef into the atoll lagoon will lead to a small rectangular shaped dredged area (mooring basin) 40mx40m, for vessel turning and temporary mooring purposes. The proposed mooring basin and the access channel will be dredged to maintain an average depth of -3m with respect to the MSL. A total of approximately 16660m^3 of dredged material is expected to be produced. This material will be used for jetty backfill and the excess will be used for the nourishment of the beach on the northern coast of the island which at present is undergoing severe erosion.

7. Main focus this reports is to document the general baseline condition surrounding island and particularly the proposed area for channel dredging and jetty construction. The following studies have been carried out as part of this assessment.

    a. Assessment of the marine and coastal species and habitats in surrounding impact areas.

    b. Coastal processes.

    c. Wave and shoreline assessment study to evaluate the potential for the proposed channel dredging and jetty construction to impact adjacent shorelines.

d. Climatic and oceanographic conditions of the project site.

8. Findings from the environmental studies are summarized as follows;

   a) Southern side of the island is very rough throughout the year, particularly during the onset of SW monsoon where the moored vessels on the southern side may have to be manned 24/7 during the period
   b) Difficult to use the existing jetty on the southern side, particularly cannot stay alongside with the jetty due to the strong wave action.
   c) A normal trip by a normal Dhoni from the access on the southern side will take approximately 2 hours to go from Fulhadhoo to Goidhoo and over 2.30 hour to Eydhafushi.
   d) Usually people travel to Goidhoo Island in small boats Dinghy's through the deep lagoon on the southern side, during rough weather the southern side is extremely rough and cannot be used for small Dinghy's. The alternative route for them to go to Goidhoo is through the shallow lagoon on the northern side. The northern side can be used most of the time but due to the shallowness it may become unusable at low tide.

9. With the above mentioned concerns and grievances the island community requested to shift the proposed island access channel and small mooring basin to northern side of the island

10. This EIA has been carried out on the basis that it is necessary to carry out the jetty construction and island access project in B. Fulhadhoo to facilitate socio-economic development and easy access to the island.

11. 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 development project in B. Fulhadhoo Island. 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.

12. The environmental impact assessment study shows there are two main activities that would cause minor to moderate negative environmental impacts. Those, in order of minor to moderate impact, are:

    1. Channel and mooring basin dredging

    2. Jetty construction and backfilling

13. Of these a long term impact would be from dredging and backfilling of jetty area and nourishment of eroded beach on the northern side of the island. Potential erosion/accretion and adjustment of the existing beach to create a new equilibrium with the surrounding environmental conditions are likely to extend to medium to long term. These impacts would be cumulative occurring over long period of time and so can be managed through proper monitoring and addressing them in a timely manner. Based on the scale of dredging and beach nourishment work projects that is taking place in Maldives, impacts associated with the proposed dredging activity is insignificant. The positive socio economic impacts from the proposed development outweigh the temporary negative impacts of dredging.

14. The study has evaluated alternative locations for the project and recommended shifting the project from the proposed location from southern side to northern side of the island. Even though there is relatively insignificant impact from this project the report has come-up with an extensive monitoring programme that will keep on monitoring coastal and marine

environmental changes associated with the development to make necessary adjustment based on the findings of various measured environmental parameters suggested in the monitoring plan.

15. Therefore, on the basis of this environmental impact assessment study and the impact mitigation measures in the report will be duly implemented and recommendations are given due consideration, it is concluded that the benefits of island access development project on the selected location in northern side of in B. Fulhadhoo will substantially outweigh its imposition on the environment.

*****

3 INTRODUCTION

3.1 BACKGROUND AND CONTEXT

This Environmental Impact Assessment (EIA) addresses the proposed harbour development in B. Fulhadhoo. Two freelance EIA consultants prepared this document in accordance with the EIA Regulations (2012) and Regulation on Dredging and Reclamation (Regulation 2013/R-15) of the Environmental Protection Agency (EPA). This EIA provides a focused assessment of the proposed island access, mooring basin dredging and jetty construction work in terms of existing environmental conditions and potential environmental impacts to the surrounding near shore marine environment and shorelines as detailed in the Terms of Reference (TOR) for undertaking EIA for this project. TOR is given in Annex 1.

Studies conducted to evaluate the proposed island access and jetty construction project in Fulhadhoo include coastal mapping, assessment of the marine habitat, assessment of existing environment of the area proposed for development, assessment of island dynamics using satellite image aerial photography, wave and shoreline impact assessment studies of the area.

Island community of Fulhadhoo constructed an access jetty with the assistance from the Government on the southern side of B. Fulhadhoo in early 2010. The Jetty was developed on the southern side because it was envisaged that the natural deep lagoon on the southern side of the island can be used as harbour and mooring space for the boats and Dhonis. At that time it was felt that only a single jetty would suit the island access need. However, since the early days of commencement of jetty operations there has been difficulties to approach and keeping boats and Dhoni alongside the jetty particularly during the SW monsoon period due to exposure of the area to regenerated fetch waves within the atoll island on the southern side of Fulhadhoo Island (***Figure 1***). Due to this the people of island have difficulty in mooring the boats on the southern side particularly during the rough weather period. The shallowness of the northern lagoon and accessibility difficulties, and the large size of the boats it was difficult to shift to the northern lagoon during rough sea periods. To overcome this issues the small population in the island attempted to develop and alternative access point on the northern side of the island. The community people used equipment (excavator) brought into the island by some contractors to uproot palm trees from the island to be transplanted in Reethirah resort during the time of Reethirah Resort development. Making use of the opportunity they managed to cut a channel through the reef flat on the North eastern tip of the island (***Figure 3***).

With these limited resources the island community managed to cut a fairly narrow, approximately 10m wide 2-3m deep, channel that can only be used by an expert to navigate through the shallow reef. They also dredged a small area on the northern provide sheltering for the vessels for loading unloading passengers and goods to and from the island. The dredged area and the channel were not properly engineered and protected and the northern side of the island being exposed to high oceanic swell particularly during the NE monsoon consequently the dredged area became filled with sediment and unsuitable for use.

The people of Fulhadhoo have always been opting for a harbour in the island. The island has over 37 large fleet of vessels mostly used for Yellowfin tuna and grouper fisheries. As a response for this request the Government proposed to development of a T-jetty, dredge an access path and a small mooring basin in front of the T-section of the jetty on the southern side of the island (***Figure 2*** and ***Figure 3***).

Figure 1: Existing B. Fulhadhoo southern side and the existing jetty exposed to strong wave action

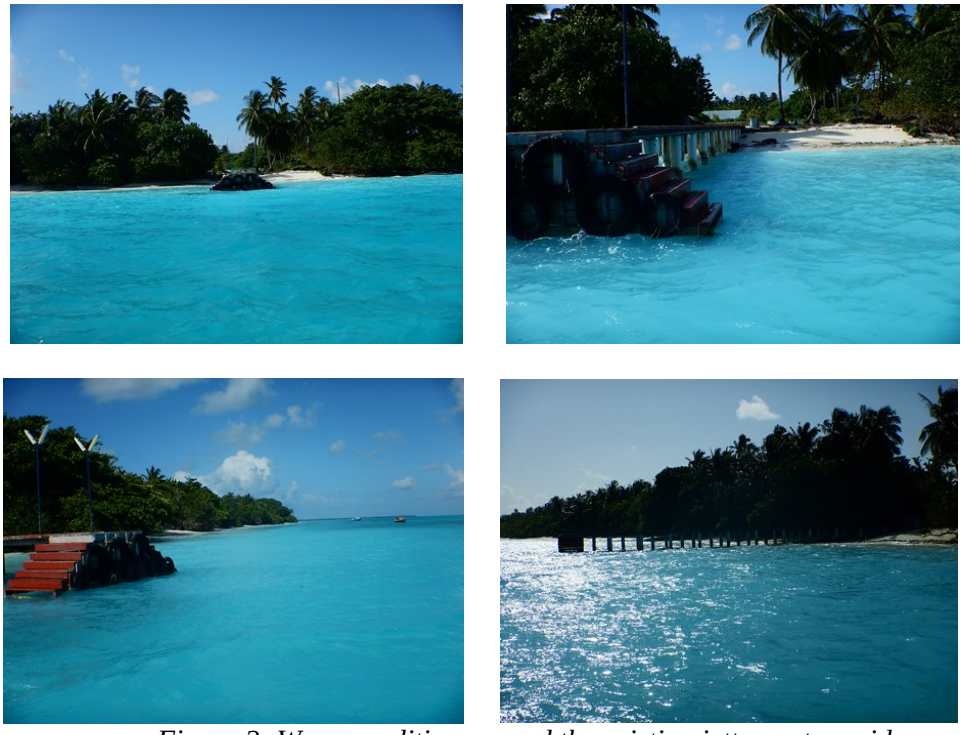


Figure 2: Wave condition around the existing jetty western side

During the stakeholder consultation the people of Fulhadhoo expressed their disappointment for selecting the proposed location for the island access, without discussion with the community and without their opinion on this. They also shared the following disadvantages of having an access on the southern side of the island:

1- Very rough throughout the year, particularly during the onset of SW monsoon where the moored vessels on the southern side may have to be manned 24/7 during the period

2- Difficult to use the existing jetty on the southern side, particularly cannot stay alongside with the jetty due to the strong action.
3- Most of people living if Fulhadhoo have their relatives working or studying in Eydhafushi and/ or Goidhoo island. Trip by a normal Dhoni will take approximately 2 hours to go from Fulhadhoo to Goidhoo and over 2.50 hour to Eydhafushi.
4- Usually people travel to Goidhoo Island in small boats Dinghy's through the deep lagoon on the southern side, during rough weather the southern side is extremely rough and cannot be used for small Dinghy's. The alternative route for them to go to Goidhoo is through the shallow lagoon on the northern side. The northern side can be used most of the time but due to the shallowness it may become unusable at low tide.

With the above mentioned concerns and grievances the island community requested to shift the proposed island access channel and small mooring basin to northern side of the island. These concerns have been conveyed to the Housing Ministry and prior to the EIA scoping meeting and it was agreed that the peoples need will presented as an alternative location for the proposed project. Housing Ministry has no objection in principal to shift the proposed development northern side as requested by the island community. Furthermore, a proper safe access to the island is a basic necessity that needs to be developed to in each island to provide freedom of movement as well as to facilitate socio-economic development of the island. Therefore, this This EIA has been carried out on the basis that it is necessary to carry out the jetty construction and island access project in B. Fulhadhoo to facilitate socio-economic development and easy access to the island.

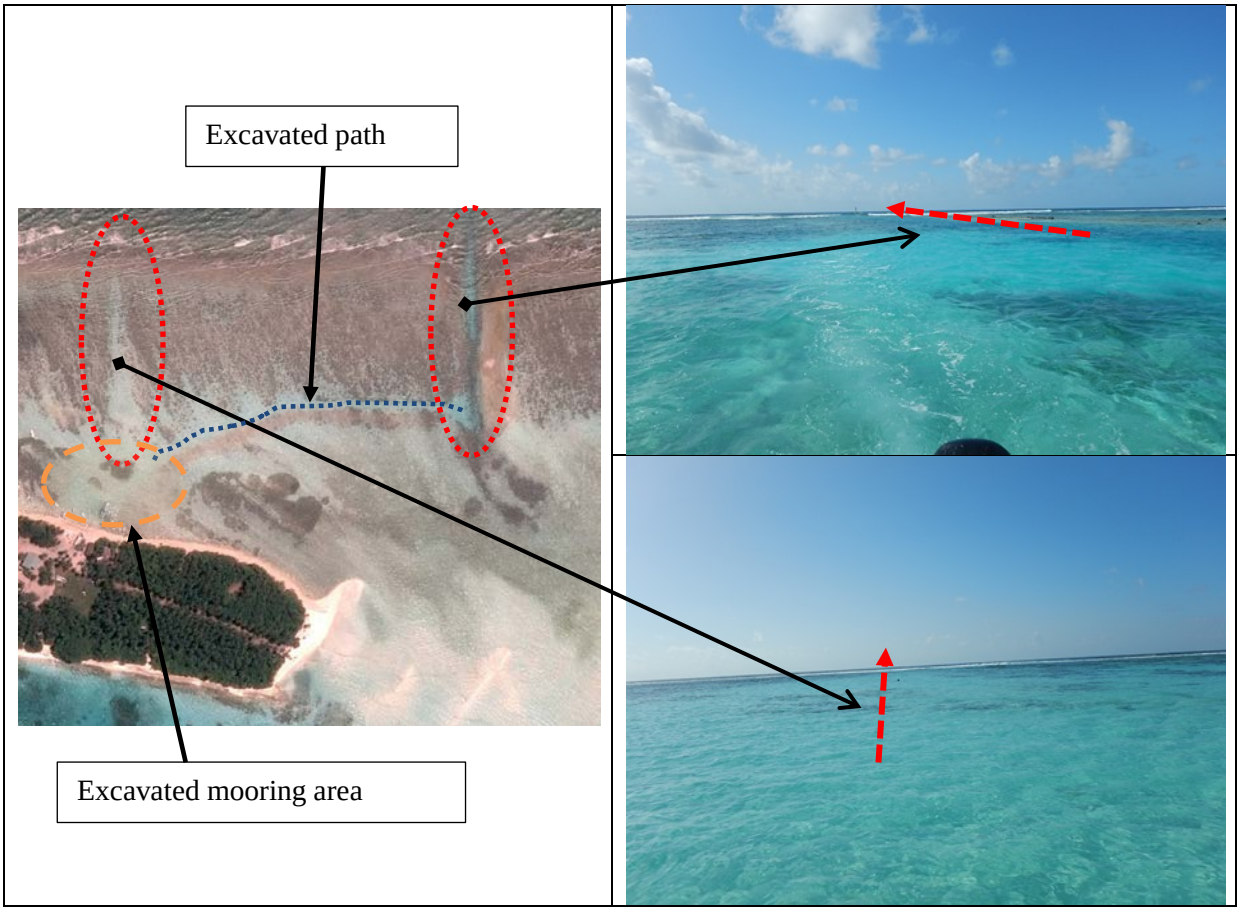


Figure 3: North eastern end of B. Fulhadhoo showing the existing access channels on the northern side NE tip of the island (top right) and manually dredged shallow access (bottom right) .

.
The government has proposed to develop access to the island through construction of a 31m long T-jetty with 4m wide walkway approximately 70m east of the existing jetty on the Southern side B Fulhadhoo. Cut a 24m wide, 624.13m long access channel and 40m X 40m dredged deeper area at the end of the T-Jetty enough for vessel manoeuvring, turning and temporary mooring on the western side of the island (***Figure 4***). Both the access channel and the small mooring basin will be dredged to have a depth of -3m at low tide.

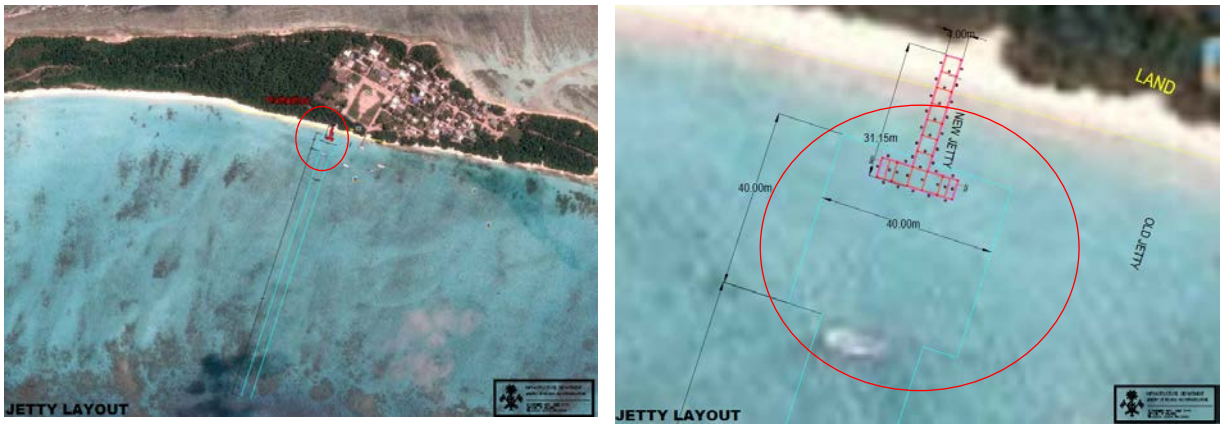


Figure 4: Proposed location for the new access channel and jetty development, a magnified map will be provided in Annex 2.

3.2 PURPOSE OF THE EIA

Given the potentially adverse environmental impacts associated with dredging and the other works in the marine environment at B. Fulhadhoo, the proponent has hired a freelance EIA consultant through public bidding process and assigned 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 PROJECT SETTING

B. Fulhadhoo is administratively located in Baa Atoll which is formed of geographically three atolls separated by narrow deep channels. The Central part of B. Atoll (Geographic Baa atoll) consist of most of the inhabited islands and the northern B. Atoll has only one inhabited island (Kudarikilu) and

the Southern B atoll which is Goidhoo atoll has three inhabited islands. Fulhadhoo is one of the three islands in Goidhoo Atoll. The two remaining islands are Goidhoo and Fehendhoo islands. The proposed jetty and entrance channel dredging is proposed on the southern side of the island at the atoll lagoon ward side.

Visual observations and studies conducted on site revealed that the proposed area for access path and the mooring area is deep, within the range of 2.5-3m at low tide. Bottom sediment in the lagoon consists of coral fragments and medium to fine grained coral sand and debris. Southern side of Fulhadhoo is accessible and there is no need to cut an entrance channel and to deepen it particularly the areas earmarked for dredging is already deep enough to allow large vessels into the lagoon. However the southern side is extremely rough and cannot be used for mooring vessels without proper protection. The people of the island has indicated that if the proposed development takes place on the southern side of the island it will not be usable and beneficial for the island community. Therefore they have suggested moving the proposed development to the northern side. Therefore, the shifting of the island access channel and jetty, which was planned to be developed on the southern side will be discussed as an alternative to originally proposed plan. This EIA has been carried out on the basis that it is necessary to carry out the jetty construction and island access project in B. Fulhadhoo to facilitate socio-economic development and easy access to the island.

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 11th June 2017. Following the scoping meeting, the Consultant drafted a ToR which was finalized and endorsed by the EPA. The approved ToR highlighted 8 major tasks to be covered including;

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

A copy of the ToR is attached in Appendix 1. The EIA for the island access and jetty development project in B. Fulhadhoo closely followed the approved ToR for the assessment.

The scoping meeting was attended by the representatives of the following organisations;

1. Ministry of Housing and Infrastructure;
2. Environment Protection Agency; and
3. B. Fulhadhoo Council members (attendance list is attached in Annexes)

3.5 PROJECT JUSTIFICATION

B. Fulhadhoo is an inhabited island with a registered population of approximately 300 people, out of which only 187 people are residing in the island located on Baa Goidhoo Atoll. The island shares single atoll reef with Goidhoo and Fehendhoo islands and two more uninhabited vegetated islands. Island access has been the major issue the community is facing towards development and prosperity.

Island community of Fulhadhoo constructed an access jetty with the material assistance from the Government on the southern side of B. Fulhadhoo in early 2010. The Jetty was developed on the southern side because it was envisaged that the natural deep lagoon on the southern side of the island can be used as harbour and mooring space for the boats and Dhonis. At that time it was felt that only a single jetty would suit the island access need. However, since the early days of commencement of jetty operations there has been difficulties to approach and keeping boats and Dhoni alongside the jetty particularly during the SW monsoon period due to exposure of the area to regenerated fetch waves within the atoll island on the southern side of Fulhadhoo Island. Therefore the people of the island have been opting for a proper access to the island. Since this is an inhabited island the island should be accessible all the time throughout the year. Island access related developments such as harbours, access channel and jetties, in an inhabited island, are considered to be the most important infrastructure everyone craves for and viewed as a necessity for the development of the island to open up to the rest of the country. Therefore such development projects are socially-driven project to improve the livelihoods of people who have been waiting impatiently for a proper harbour. The primary objective of the project is to develop access to the island, and provide safe mooring facilities for the island communities. Access to the island is envisaged to bring economic growth and will improve living conditions of people of Fulhadhoo Island.

The people of Fulhadhoo have always been opting for a harbour in the island. The island has over 27 large fleet of vessels mostly used for Yellowfin tuna and grouper fisheries. As a response for this request the Government proposed to development of a T-jetty, dredge an access path and a small mooring basin in front of the T-section of the jetty on the southern side of the island

Location of the proposed alternative access jetty and access channel is on the southern side t of the island. This is the ocean lagoon ward side where the area is exposed regenerated fetch waves within the atoll island throughout the year and particularly during the SW monsoon.

Visual observations and studies conducted on site revealed that the proposed area for access path and the mooring area is deep, within the range of 2.5-3m at low tide. Southern side of Fulhadhoo is accessible and there is no need to cut an entrance channel and to deepen it particularly the areas earmarked for dredging is already deep enough to allow large vessels into the lagoon. However the southern side is extremely rough and cannot be used for mooring vessels without proper protection.

In terms of the design, the proposed design is a standard island access facility infrastructure with an access channel, jetty and a small dredged area for vessel manoeuvring at the end of T-Jetty.

The people of the island have indicated that if the proposed development takes place on the southern side of the island it will not be usable and beneficial for the island community. Therefore they have suggested moving the proposed development to the northern side. Therefore, the shifting of the island access channel and jetty, which was planned to be developed on the southern side, will be discussed as an alternative to originally proposed plan. This EIA has been carried out on the basis that it is necessary to carry out the jetty construction and island access project in B. Fulhadhoo to facilitate socio-economic development and easy access to the island

Fulhadhoo Island is an elongated island. Therefore any shore perpendicular structure or dredged basin (channel and dredged area) will disrupt the natural longshore sediment transport regime. Also leaving the dredged area and the channel unprotected will result in sedimentation and infilling of dredged basin. The proposed design will therefore disrupt the sediment movement around the island and may cause sediment starvation in another part of the island or a neighbouring island which may consequently lead to severe erosion, which needs to be addressed at a later stage. Therefore coastal changes and dynamics should be closely monitored after the development to address erosion issues appropriately. Given the specific circumstances of B. Fulhadhoo a compromise need to be made between environment and peoples need.

3.6 PROJECT BOUNDARY ANDSTUDY AREA

Major construction and B. Fulhadhoo island access infrastructure development activities will take place in the boundary shown in ***Figure 5***. Study area and project impact boundary is shown in ***Figure 6*** and ***Figure 7***.

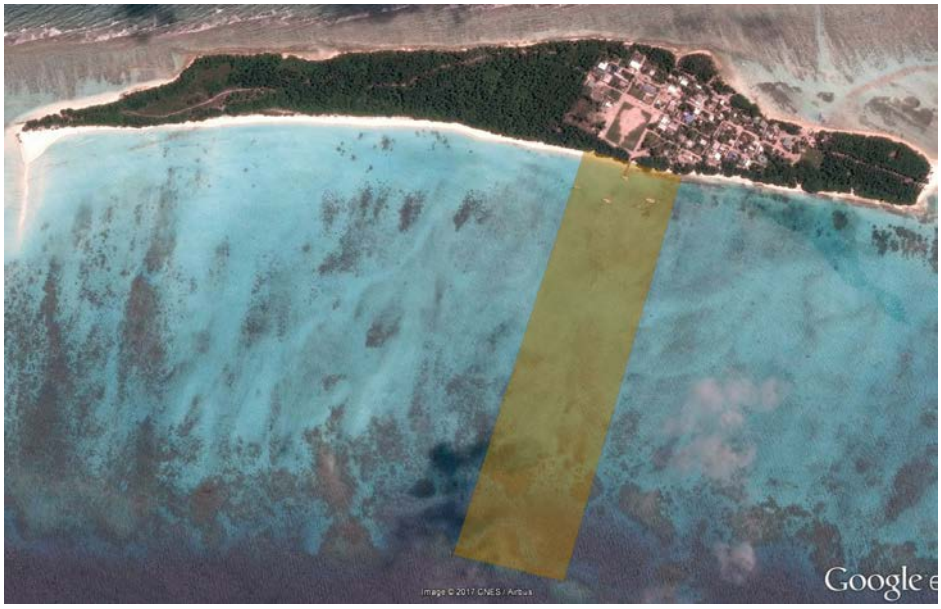


Figure 5: B. Fulhadhoo island access and Jetty construction proposed project boundary

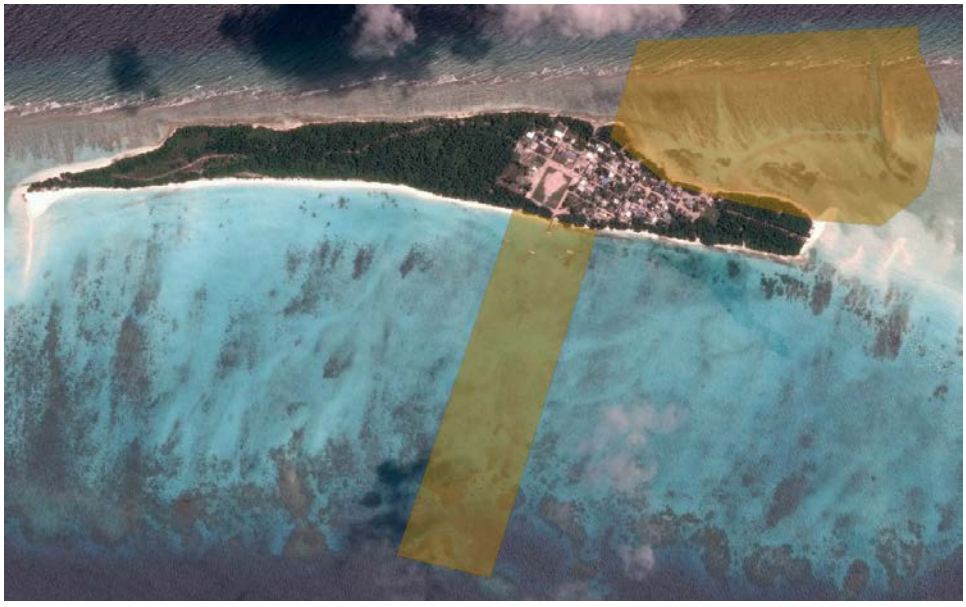


Figure 6: B. Fulhadhoo island access and Jetty project study area

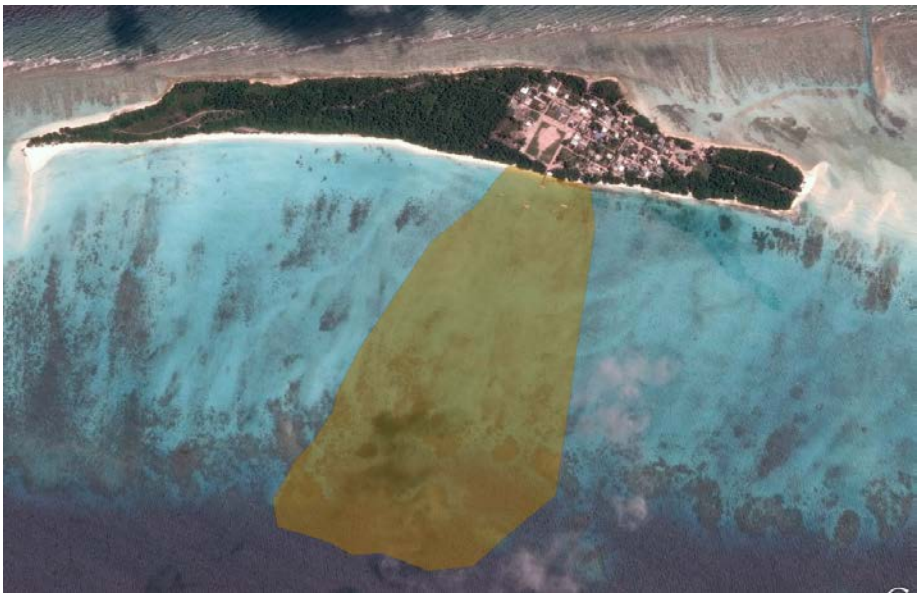


Figure 7: B. Fulhadhoo island proposed access and Jetty project impact boundary

3.7 METHODOLOGY

Field studies have been undertaken using methods generally employed for EIA studies in the Maldives. This study was based mainly on data collected during a field investigation mission from 1-8-10 June 2017, by the consultant. Field studies have been undertaken using methods generally employed for EIA studies in the Maldives. Environmental impacts are predicted by using descriptive checklists and its significances are evaluated by the use of 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.

3.8 REVIEW OF RELEVANT STUDIES

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

Environmental impact assessment for proposed access channel and boat mooring basing development in B. Fehendhoo, Baa. Atoll by Zuhair M (2016).

Environmental impact assessment for harbour development in B. Fainu island, Raa. Atoll by Riyaz M (2014).

Environmental Impact Assessment For Proposed Levelling And Earthworks Of Football Arena In Nadella, South Huvadhu Atoll by Riyaz M. (2016.

Environmental impact assessment for beach nourishment and maintenance dredging of access channels and harbour in Thulhaagiri island by Riyaz M. and M. Shiham (2014)

4 DESCRIPTION OF THE PROJECT

4.1 THE PROPONENT

The proponent of B. Fulhadhoo harbour development project is the Ministry of Housing and Infrastructure. The Ministry is the government responsible body for the development and regulate the housing and infrastructure of the country. Jetties and access channels being a public infrastructure the Ministry's mandate in relation to infrastructure development projects is at three levels.

- National Harbour and Reclamation Programme, which involves the construction of major harbours and reclamation projects in the country
- Access Improvement Programme, which was initiated in 2004 with a scope to provide a minimum access to all islands that had no means of a proper access
- Repair and Rehabilitation Programme, which was initiated following the catastrophic event of December 2004 tsunami that damaged a large number of harbours and jetties. This programme was initially implemented by National Disaster Management Centre (NDMC) and later handed over to the Ministry of Housing and Environment.

Harbour development project of all the inhabited islands fall under access improvement programme of which Fulhadhoo has been current government's campaign promise.

Maldives Road Development Cooperation (MRDC) has been contracted to undertake the jetty and access construction work in B. Fulhadhoo.

4.2 PROJECT LOCATION AND BOUNDARY

B. Fulhadhoo is located on the northern side of Goidhoo Atoll. The island is located at the north rim of the atoll at Longitude 72.935196°, Latitude 4.884890° (Figure 8) at the eastern half of the atoll. The Island is elongated and the orientation of the island is E-W and is found in a single reef (Atoll) that shares three inhabited islands and four uninhabited vegetated small sand cays. The island has approximately 1.7km in length and the width varies the widest part is 244m. The approximate land area of Fehendhoo is 28.5 ha. Closest inhabited island located within the vicinity of Fulhadhoo Island include Goidhoo and Fulhadoo located on the east.

The entrance channel and mooring basin dredging and jetty construction is proposed to take place on the southern side of the island 50m west of the existing jetty .

The project boundary is confined to B. Fulhadhoo Island and the reef and lagoon environment in which the island is found (***Figure 6***).

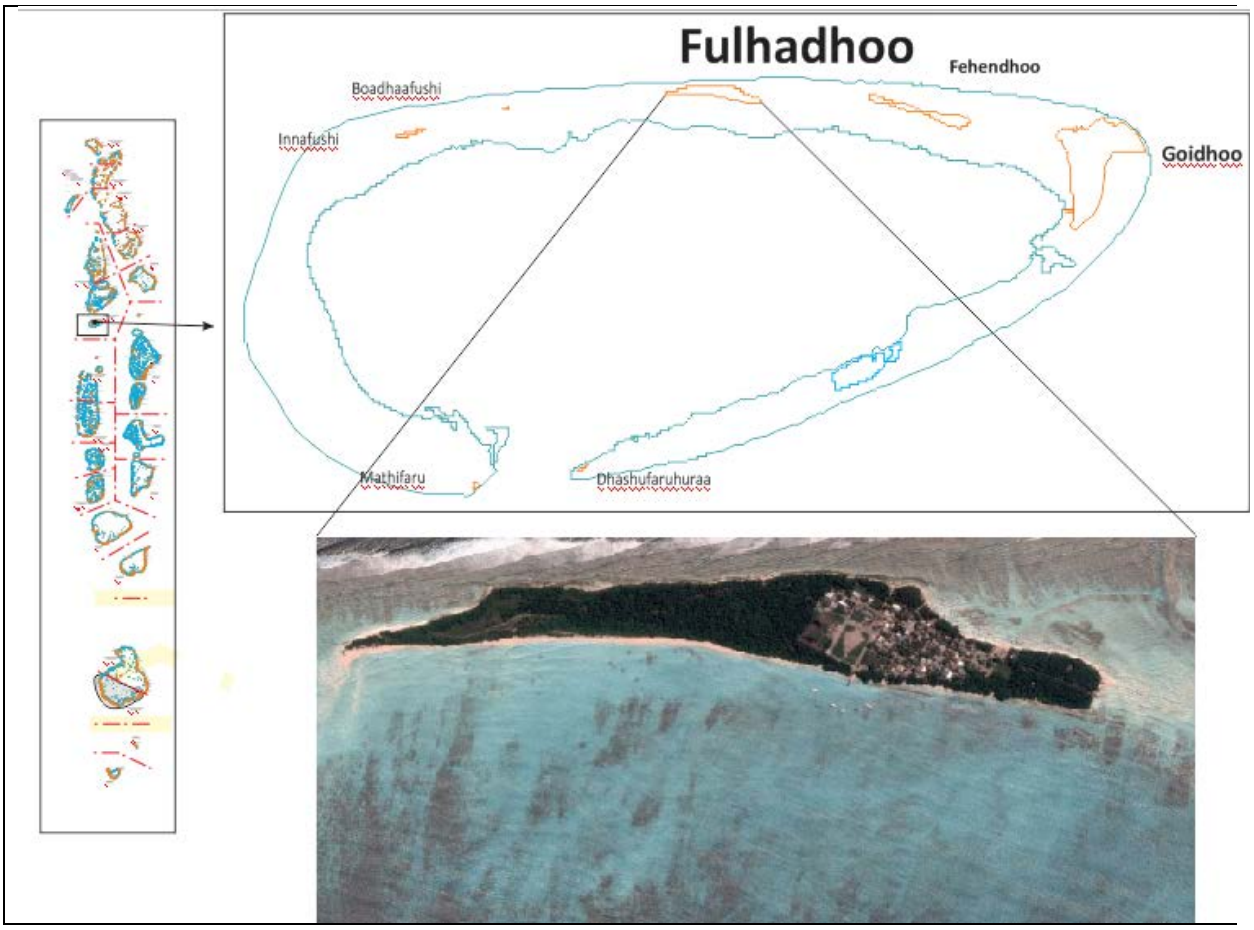


Figure 8: Location of B. Fulhadhoo Island in Baa Atoll

4.3 PROJECT OUTLINE AND SITE PLAN

The proposed design is a standard island access related infrastructure government develops in islands with the population size of Fulhadhoo. Island access related structures include an access channel, small mooring area and a jetty. Fulhadhoo access is designed to allow for safer access and turning of marine vessels and to accommodate slightly larger vessels (***Figure 9*** and ***Figure 10***). To do so the initial proposal of the Government includes the following components

- Construction of 31.15m long T-jetty with 4m width walkway
- Ground levelling the jetty area.
- Dredging near Jetty area 40m width & 40m length area
- Dredging new entrance channel 24m width & 624.13m length

Dredging would seek to achieve depths of up to -3m with respect to the MSL in the entrance channel and similar depth within the harbour basin.

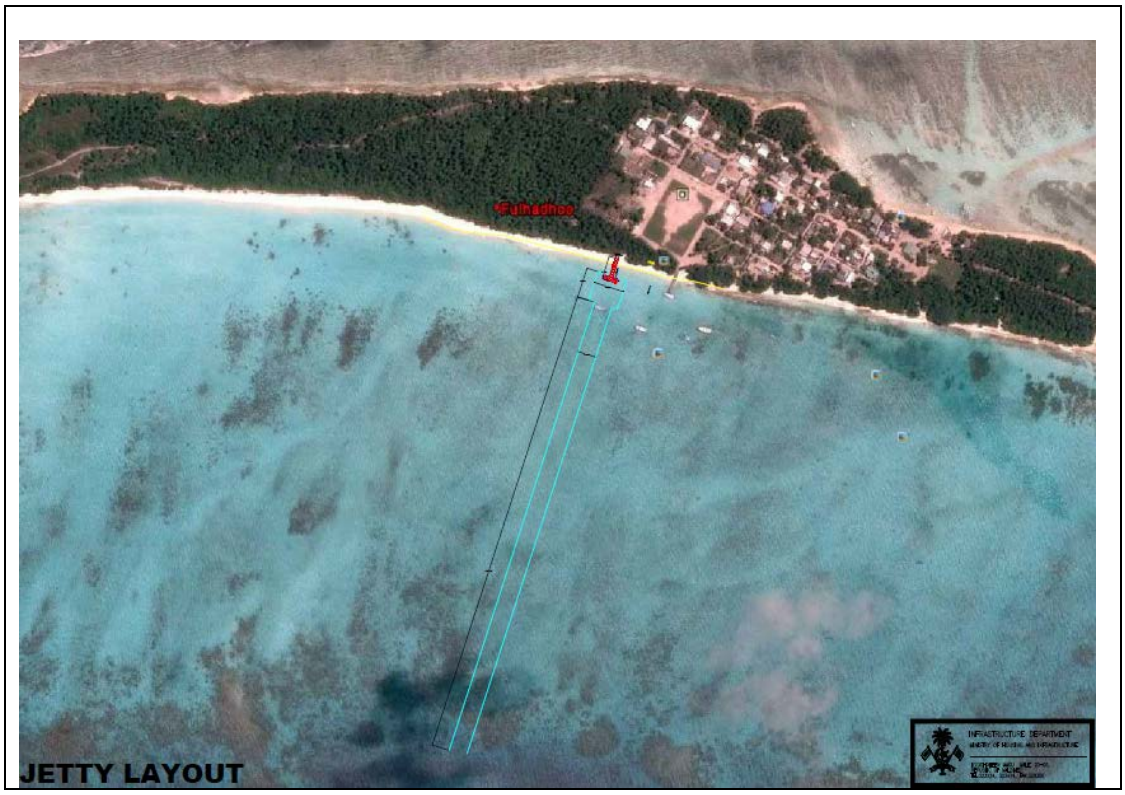


Figure 9: Conceptual drawing and location of the proposed access channel and jetty

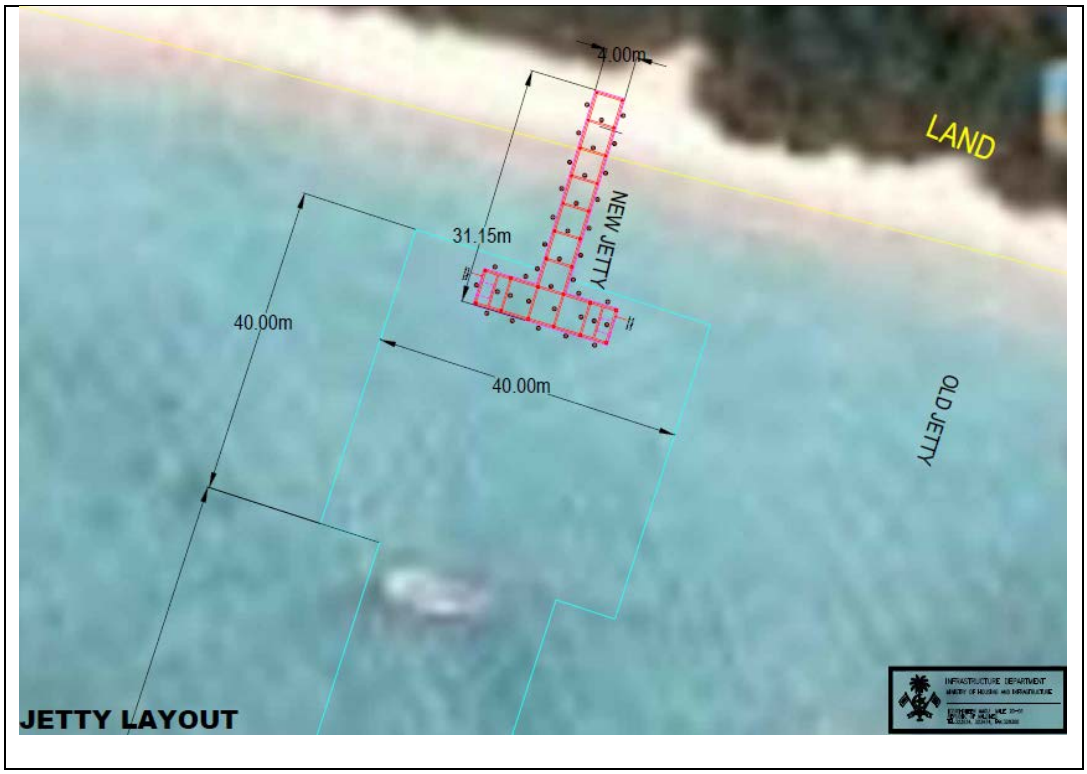


Figure 10: Details of the proposed access and jetty development in Fulhadhoo

Field verification of the proposed location for access path and the mooring area revealed the following

- The area is already deep enough, within the range of 2.5-3m at low tide.
- Bottom sediment in the lagoon consists of coral fragments and medium to fine grained coral sand and debris.
- Southern side of Fulhadhoo is accessible and there is no need to cut an entrance channel and to deepen it particularly the areas earmarked for dredging is already deep enough to allow large vessels into the lagoon.
- Southern side is extremely rough and cannot be used for mooring vessels without proper protection.

Based on the above observation and the status of the southern side of Fulhadhoo, people of the island has indicated that if the proposed development takes place on the southern side of the island it will not be usable and beneficial for the island community. Therefore they have suggested moving the proposed development to the northern side

4.4 MAIN DEVELOPMENT FEATURES OF THE PROJECT

The following are main development features of Fulhadhoo access and jetty development project:

1. Dredging of a small turning basin (40m length X 40m wide) located at the tip of the T-jetty achieve -3m with respect to MSL
2. Dredging a 24m wide 624.13 m long entrance proposed on the western side (proposed by Government), channel length on the northern side is 211m (proposed by people) depth of -3m
3. Construction of 31.15m long T-jetty with 4m width walkway
4. Use the dredged material for ground levelling of the jetty area (proposed by Government)
5. Use the dredged material for backfill the Mooring basing and the excess for replenishment of eroded areas on the northern side.

Above features are depicted in the (***Figure 10***). Since this is the main access point for the island to be used for transport and access to the island. The proposed size is considered to be adequate for the current traffic volumes as well as estimated future traffic to the island. The people of the island are hoping to increase the size of the mooring area to a size of a small harbour to create enough space for their vessels to be anchored. Therefore, they have suggested increasing the size of the mooring area to be at least 150ftx200ft which will be enough for the vessels in the island.

4.5 MOORING AREA BASIN

An excavator on barge will be used to dredge proposed areas to obtain the desired depths. The excavator will transfer the dredged material on the dump truck which finally ends up on the stockpile location. A detailed bathymetry of the basin will be compiled by contractor before work commencement. Areas that need to be excavated will be identified and marked with floating buoys. It is planned to complete all activities within the scope of this project in 365 days.

4.5.1 The Entrance Channel

The proposed dredging project intends to excavate the entrance channel to achieve the required depth of -3m with respect to MSL at low tide. At present area proposed by the Government southern side of Fulhadhooo, the depth is already more than the depth that will achieved through dredging. Mooring basing and entrance channel dredging can only take place if the project is shifted to the northern side as suggested by the island community. Details of their proposal will be discussed in the alternatives

section of this report. The average depth of the reef flat on the northern side is 0.7- 1m during mid-tide.

4.5.2 Jetty Works

Footing of the jetty will be made from concrete columns placed on pre-cast concrete footings. The footing will be made on land and placed using the barge. The columns will be transported to the jetty area on trucks or excavators. Existing roads of the island would be used for this purpose whenever possible. Once the concrete columns are in place, in-situ beams will be cast to receive timber deck. Details drawings of the jetty are provided in Annex 4.

4.5.3 Ground levelling of Jetty area

Dredged material will be used for ground levelling of the jetty and backfill for mooring area and the excess material will be used to replenish the eroding beach on the northern side of the island.

4.6 VOLUMES AND TYPES OF SEDIMENT TO BE DREDGED

Location proposed for island access and jetty construction work by the Government does not require additional dredging as the area is already deep enough. But the area proposed by the people on the northern side of the island requires dredging. From existing depth information for the small mooring area entrance development has been estimated that a total of 16660m^3 of dredged material will be generated by the proposed works. The dredged material will be used for backfill material for mooring basing and T-jetty base and the excess will be used to replenish the eroded areas on the northern beach of the island .

The disadvantages of dredging are potential short-term impacts to water quality. During dredging operation, some sediment becomes suspended into the water column. This sediment can then be carried by the current until it settles out of the water column. However, it is not possible to control sediments entirely because the work is done underwater and every dredge leaves some residual material on the bottom.

4.7 TIMINING

Timing of the dredging is proposed to be coincided during the period between August and November to allow the sediment plume to move south and north ward influenced by the predominant wind direction and ocean currents to the plume to reach the deep ocean. The proposed dredging schedule is given below in ***Table 1***

4.8 ACCIDENTS AND HAZARDS

A major risk associated with the project is the impact on marine environment from the proposed island access and Jetty construction work. The construction works will be carried out using excavators placed on a barge, which will be floating during the entire operation. It is a possibility that the barge may run on to the reef flat during low tide, however, this can be avoided with work scheduling at high tide. There will be excavation involved so possibility of sedimentation of coral during construction is inevitable. Deployment of precast pad-column units will replace the natural seabed at direct construction footprint of the proposed structures, which cannot be avoided.

4.9 PROJECT SCHEDULE

The project is expected to take 130 days to complete including the time needed for seeking necessary approvals. The main milestones include; obtaining approvals, mobilization, and onset of work, jetty

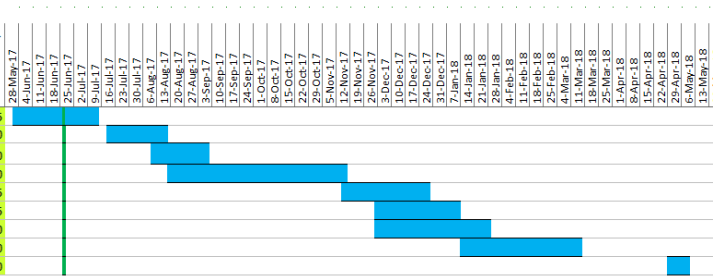
works and entrance channel dredging works, and demobilization. ***Table 1*** shows the project schedule and project inputs and outputs are given in ***Table 2***.

Table 1: Project Schedule – Indicative

Project - B Fulhadhoo Island Access and Jetty Project work schedule

Today's Date: 06/27/17 0
Start Date: 05/30/17

Ser.	Tasks	Start	End	Duration days
1	EIA preperation and approval	05/30/17	07/14/17	45
2	Contract award preliminary survey	07/19/17	08/18/17	30
3	Mobilisation	08/10/17	09/09/17	30
4	Start dredging work	08/20/17	11/18/17	90
5	Concrete precasting	11/15/17	12/30/17	45
6	Transportation of precasts	12/01/17	01/15/18	45
7	Beach levelling work	12/01/17	01/30/18	60
8	Jetty Construction	01/15/18	03/16/18	60
15	Decomissioning	04/30/18	05/10/18	10



4.10 PROJECT INPUT AND OUTPUTS

Table 2: Matrix of project major inputs and outputs

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), Welder (1), Driver (2), Carpenter (2), Bar bender (2), Masion (2) Labourer (11) Cook (1) Cook helper (1) total of 27 people, skilled and semi skilled 16 and unskilled labourers 11.	Trained and licensed staff of the contactor
Machinery (excavator, barge, operational tools)	02 excavator 02 dump trucks 01 loader 01 Concrete machine 01 Barge 01 Workshop container 01 Office Container 03 Diesel tank 5000l 01 Welding Genset 20KvA	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.
Output	**Anticipated quantities**	**Comments**
Mooring basin	Small mooring area basin 40m x 40m average depth	

	of -3m will be achieved	
Entrance channel	28m long and 211m wide with an average depth of -3m, channel	Dredged material will be used for jetty area levelling, backfill for mooring basin and the excess to replenish the eroded beach on the northern side of the island
T-Jetty	Total length of the jetty sections 31.15m	Built using concrete, jetty columns will be pre-caste on land and transported to the site
Dredged material	Major quantity 1660m^3 approximately	Levelling the jetty base, backfill for mooring basin and excess material will be used to replenish the eroded beach on the northern side.
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 on the island
Waste oil and lubricants	Minor amount	Gathered in a barrel and sent to Thilafushi through existing waste management system
Noise and light	Localized	Excavator and truck operation will generate some noise during the project execution. If work is carried out in the night lights will be necessary in the harbour area. Work will not be carried out late into the night to avoid disturbance to local population.
Plastics and packaging waste	Minor amount	Managed through existing waste management system of the island

5 ADMINISTRATIVE AND REGULATORY FRAMEWORK

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

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 MINISTRY OF HOUSING AND INFRASTRUCTURE

The Ministry of Housing and Infrastructure is mandated to undertake reclamation, harbour development and coastal protection infrastructures as per the government policies. The Ministry of Housing and Infrastructure has a harbour and jetties development programme where there are minimal requirements for harbours and jetties in local inhabited islands. The Access Improvement Programme, which was initiated in 2004, had a scope to provide minimum access to all islands that had no means of a proper access. The Ministry undertakes all coastal infrastructure projects except those specifically focused on shore protection. Depending on the environmental conditions of specific islands, breakwaters or side quay walls would be provided to make the harbour basin safe from adverse conditions.

Although there are no published local guidelines the Ministry uses British standards for coastal structures specifications. The environmental requirements considered are those provided by Ministry of Environment and Energy such as that of Dredging and Reclamation Regulation.The environmental criteria for each project are, however, defined according to the findings of the Environmental Impact Assessment, which is required to be undertaken for each and every harbour project.

5.4 LEGAL FRAMEWORK

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

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

5.4.1 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.

5.4.2 Regulation on Cutting down Trees

Cutting down and relocating of mature trees is regulated in Maldives under the by-law on cutting down, uprooting, digging out and export of trees and palms from one island to anotheB. In the preamble of the law, made in pursuant to Law No. 4/93, it states the purpose of the law is to educate citizens and developers about the importance of trees including sound management to maintain trees and provide standards for the preservation of trees in the Maldives.

Under the law certain tree are prohibited to remove from island. They include:

- The coastal vegetation growing around the islands extending to about 15m into the island
- All trees and palms growing in mangroves and wetlands spreading to 15m of land area
- All trees in Government protected areas

- Trees that are being protected by the Government in order to protect species of animal / organisms that inhabit on such trees
- Trees / palms those are unusual in nature.

The law states that prior permission must be obtained for removal and/or relocation of 10 or more trees or palms. For indiscriminate removal and land clearances and EIA Decision Note is required. The size of the trees and palms that are allowed to be relocated should have more than 15feet from lowest point to the crown spread for palms and 8 feet from the lowest point to the trunk to tip of the highest branch for trees other than palms.

The law also states that cutting down and uprooting of the trees shall be made under supervision of the island / atoll offices (in the current context Atoll / Island Councils).

The project does not involve removal of any tree from the island hence the regulation will be fully complied to.

5.4.3 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.

According to the new enforcement arrangement made since November application for Dredging and Reclamation Permit for the projects has to be submitted along with the EIA/Addendums to the Environmental Protection Agency. Therefore the application for Dredging and Reclamation Permit for this project is submitted together with the EIA report.

5.4.4 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.

5.4.5 Summary

In summary, the proposed project will comply with all applicable environmental regulations requirements, relevant legislation, and legal and regulatory statutes. The EIA process ensured that this project has followed relevant laws and regulations and the scoping meeting and the stakeholder consultations enabled all related stakeholders participate in the process.

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, public and stakeholder consultations and direct consultation with the people of the island. Stakeholder discussions were conducted to collect as much relevant information and views. 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
Previous project study documents

In undertaking baseline studies using available data and knowledge have been used. Key issues have been identified during scoping as given in the TOB. Based on the scoping need for further in-depth studies and additional data requirement were identified. Local knowledge was used as much as possible to ensure key questions are addressed in the assessment. Ideally minimum of two monsoon periods (NE and SW) of data is desirable for a study of this nature to understand seasonal variability and environmental change. However 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 DREDGING REQUIREMENTS AND WORK METHODOLOGY

6.1.1 Dredging Method

Dredging works under this project involves the following three steps; excavation, transport and disposal.

6.1.2 Excavation

It involves dislodgement of and removal of sediments and/or rocks from sea bottom of the dredge areas. An excavator on a barge will be used to dredge the material by mechanical actions. The dredging will be performed utilizing a CAT 330 hydraulic excavator equipped with Young's 3.3-yd3 hydraulic bucket. The excavator will transfer the dredged material on the dump truck which finally ends up on the site of utilisation. A detailed bathymetry of the basin will be compiled by contractor before work commencement. Areas that need to be excavated will be identified and marked with floating buoys. Dredging will progress from entrance into the shallow areas.

6.1.3 Transport of Excavated Material

Transporting materials from the dredging area to the site of utilisation, will be achieved as follows. Sediments will be dumped into dump trucks to transfer into utilisation site; Excavator with appropriate bucket size has been recommended due to the relatively small size of the area requiring dredging and due to relative simplicity of the methodology for not having to do much pre-work preparation and to shorten the job schedule.

6.1.4 Disposal Site

Dredged material transported by dump trucks will be disposed off to the designated areas for levelling jetty base, backfill for mooring basin and to replenish the eroded areas on the northern side (***Figure 30***). Once the material is disposed off to the site proper ground levelling and spreading of the load is carried out by manually and using various equipment.

6.2 MARINE ENVIRONMENT

6.2.1 Reef and Surveys

Equipment and tools used

- Handheld Global Positioning System (GPS)
- Still photograph camera
- Underwater writing sheets
- Digital globe multispectral and Panchromatic satellite data

Status of coral reef was assessed from area proposed for the development. Due to time limitation photographic assessment was made. The reef flat on the northern side is extremely shallow hence not suitable for snorkelling or swimming due to the shallow depth of the area. Photographs are taken from the reef edge and which has an average depth of 0.7-1.2 meter.

6.2.2 Bathymetry

Bathymetric survey of the area proposed for island access and jetty construction in Fulhadhoo, reef were carried out by using echo sounder and a GPS. Differential GPS technique is used for correction of GPS locations points. Echo sounder measurements are corrected and related to the mean sea-level for the area. Bathymetry of the surveyed area is in shown ***Figure 11***

6.2.3 Waves and Currents

Generalised wave predictions and wave pattern predicted using hindcast for the Indian Ocean was obtained from weather information providing sites. Site specific near shore wave characteristics for B. Fulhadhoo was measured using a RBR wave Gauge location shown in ***Figure 11***.

6.2.4 Coastal Dynamics

Combination of remote sensing and GIS technology and field mapping and ground truthing were used to assess the long term coastal and morphological changes of the islands. Google earth historical image sequence was co-georeferenced with the survey data and comparatively evaluated using GIS technology to assess the long term geomorphological developments of the island. Changes in the shoreline from 2002-2014 was documented using Google earth images. Beach profiles are taken from the shoreline of the area proposed for development.

6.2.5 Geology, Sediment, Marine Benthic Assessment

Due to the homogenous nature of the geological characteristics of Maldivian Atolls, site specific investigation for reef and lagoon geomorphology was not conducted whereas coring studies conducted elsewhere in the Maldives was reviewed. Visual observations were also made during the field on the geomorphological aspects of the island lagoon and reef. Coral communities and the coral reefs at the entrance channel and within the proposed access channel and jetty development area were assessed by combination of boat patrolling, and underwater visual observations. The proposed site for development of the jetty and the access channel is homogenous consists of medium hard consolidated calcareous rock/conglomerate reef platform that is usually found ocean ward side reef-flats.

6.3 TERRESTRIAL ENVIRONMENT

6.4 CLIMATE

Official meteorological observations services in Maldives are limited to airports. A total of 11 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, Kaadehdhoo, 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 coveB. Monitoring of sea-level height takes place only in Hulhule (central), Hanimaadhoo (North) and in Gan Island (in south). Apart from the official meteorological observations, number of resort islands and individuals are installing portable mobile weather stations. Such weather stations are providing real time measurements to famous weather forecasting sites such as www.wunderground.com and www.windfindeB.com. Data collected from these stations are now publicly available from those internet sites.

In the absence site specific weather data the normal procedure is to obtain whatever is available from the nearest weather station in an airport and apply it to the site assuming that average climate conditions do not show much variation between different islands. For the purposes of B. Fulhadhoo EIA meteorological observations from the Hanimaadhoo, which is located approximately 104km north of Fulhadhoo was used for description of the general weather conditions on the northern part of the Maldives. Data obtained from portable weather stations installed in N. Irufushi Islands, approximately 35km south east of Fulhadhoo, was used for description of specific local climate condition of Fulhadhoo Island.

6.5 IMPACT ASSESSMENT METHODOLOGY

The environmental impacts that may be associated with the proposed island access and jetty construction project on B. Fulhadhoo Island are predicted by using a simple matrix. Island and access development is a very common and necessary infrastructure development that is needed in almost all the islands of the Maldives. People are very familiar with the environmental impacts associated with the development. Due to its necessity socio economic benefit of harbour development always 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.

6.6 DATA GAPS

In the Maldives it is common to expect a detailed environmental analysis for an EIA to be undertaken in a relatively short period of time. Therefore, limitation of the time spent on site has been the key limiting factor to get a more detailed assessment on all environmental aspects surrounding the island. Given the seasonal climatic variations in Maldives and the differences in island dynamics and climate settings in individual islands such a short time frame is too little to assess selected aspects of the environment. This problem is compounded by the absence or extreme difficulty in obtaining grey literature (held in technical reports in some government officers) and of long-term studies in other parts of Maldives. Hence, most EIA's end up being based on an environmental snapshot of specific point in time. However, experienced EIA specialists can deliver a close match to reality based on a number of similar assessments and expert judgments of the team. In this regard, the following gaps could be identified in information.

- Absence of long-term site specific or even regional data (at least1- 2 years). Most critical data include current, wave and coastal dynamics.
- Absence of historical and long-term records on reef and lagoon environment.

These gaps are seriously considered in the assessment and care has been taken to address the issue in designing mitigation measures and the monitoring programme. Nonetheless, most of the assessments, including sea water quality, island dynamics, reef health, bathymetry were done in accordance with the TOR and other relevant information are collected through literature review to reflect closest match to existing environment of the island at the time of these assessments.

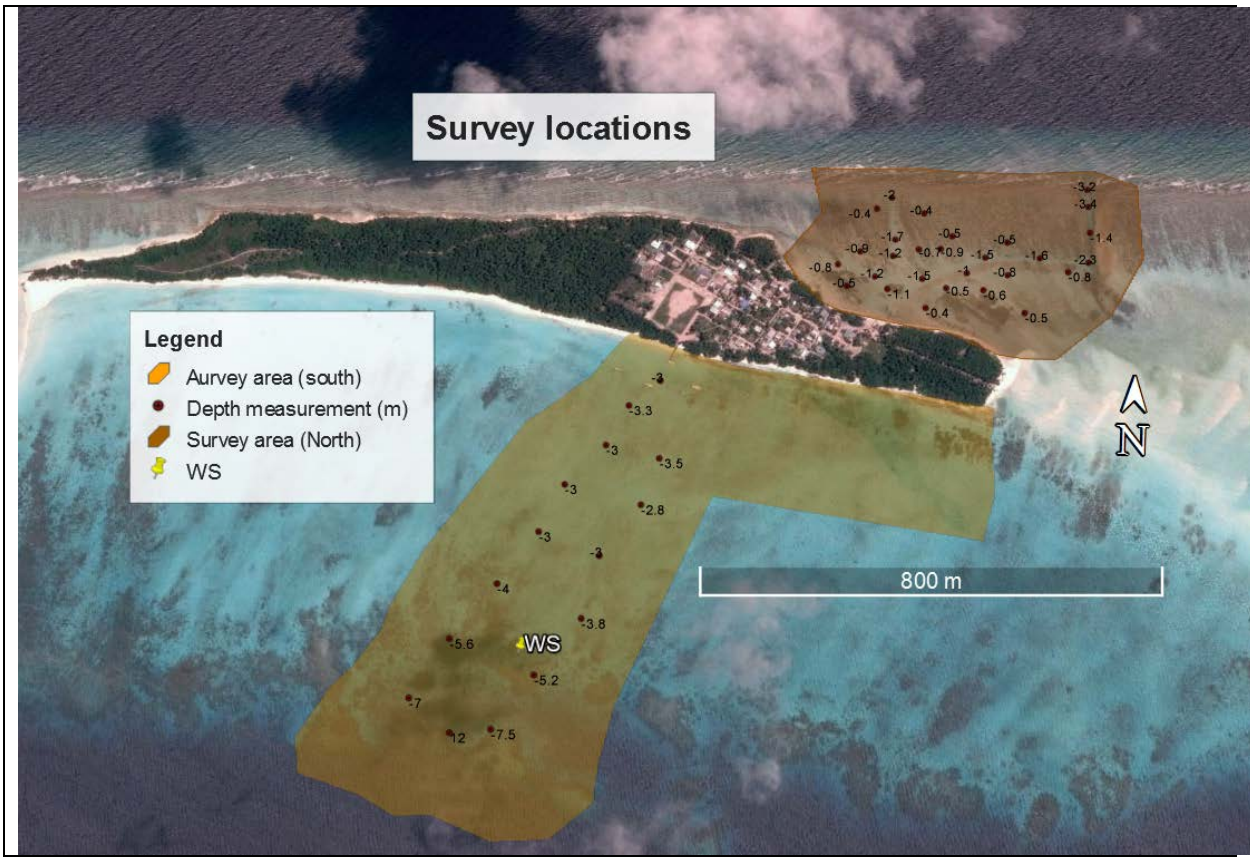


Figure 11: Mapping and survey area locations of Fulhadhoo

7 EXISTING ENVIRONMENTAL CONDITIONS

7.1 OBJECTIVES

The purpose of this was to assess the existing environmental conditions of the coastal environment of the area proposed for island access and jetty construction in Fulhadhoo Island. 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 current assessment is more focussed on locations planned for entrance channel dredging, jetty construction and associated activities.

7.2 METEOROLOGY AND CLIMATE

7.2.1 Temperature

The daily average temperatures rarely drop below 25°C and rarely go above 32°C. The warm period of the year is from March to May with an average daily high temperature above 31°C. The hottest day of the year is during April, with an average high of 32°C and low of 28°C.

The cool periods lasts from October/November to January with an average daily high temperature below 30ºC. The coldest day of the year is around mid-December, with an average low of 26°C and high of 30ºC. The sea surface temperature in the Indian Ocean in July 2014 is recorded to be around 29-30°C.

The annual average rainfall is approximately 1,950mm. As Maldives lies on the equator, Maldives receives plenty of sunshine throughout the year. Significant variation is observed in the climate between the northern and the southern atolls. The annual average rainfall in the southern atolls is higher than the northern atolls. In addition, greater extremes of temperature are also recorded in the southern atolls. On average southern atolls receive 2,704 hours of sunshine each year. ***Table 3*** provides a summary of key meteorological findings for Maldives.

Table 3: Key meteorological features of the Maldives

Parameter	Data
Average Rainfall	9.1mm/day in May, November 1.1mm/day in February
Maximum Rainfall	184.5mm/day in October 1994
Average air temperature	30.0 C in November 1973 31.7 C in April
Average wind speed	3.7 m/s in March 5.7 m/s in January, June
Maximum wind speed	W 31.9 m/s in November 1978
Average air pressure	1012 mb in December 1010 mb in April

Seawater surface temperatures (SST) are usually 28-29ºC, but can reach 30 or more in shallow near shore areas. The Maldives are reported to experience a mixed layer of relatively saline water (36 ‰) from Arabian Sea which mixes with occasional intrusion of 34 ‰ waters from Bay of Bangal.

7.2.2 Monsoons

The climate of Maldives is characterised by the monsoons of Indian Ocean. Monsoon wind reversal significantly affects weather patterns. Two monsoon seasons are observed in Maldives: the Northeast (*Iruvai*) and the Southwest (*Hulhangu*) monsoon. The parameters that best distinguish the two monsoons are wind and rainfall patterns. The southwest monsoon is the rainy season while the northeast monsoon is the dry season. The southwest monsoon occurs from May to September and the

northeast monsoon is from December to February. The transition period of southwest monsoon occurs between March and April while that of northeast monsoon occurs from October to NovembeB.

7.2.3 Winds

The wind conditions for the islands are dominated by monsoons. These winds approach with great constancy, primarily from the northeast and southwest directions. Some seasonal changes occur within this pattern, as a result of the relative position of the sun and the earth's surface. In general, these seasonal changes in the annual wind regime may be described as follows:

Strong winds and gales are infrequent although storms and line squalls can occur, usually in the period May to OctobeB. During stormy conditions gusts of up to 60 knots have been recorded at Malé (data from Maldives Meteorological Services).

Wind speed is usually higher in central region of Maldives during both monsoons, with a maximum wind speed recorded at 18 ms-1 for the period 1975 to 2001. Mean wind speed is highest during the months May and October in the central region. Wind analysis indicates that the monsoon is considerably stronger in central and northern region of Maldives compared to the south (Naseer, 2003). Annual averages shows that wind directions are mostly in W (32%) and E (11%) and NW (10%).

Wind data obtained from Hdh. Hanimaadhoo has been compared with the local conditions recorded in Irufushi Island 35 km south east of Fulhadhoo to see the wind direction and speed variation that can take place over a considerable distance (***Figure 12***).

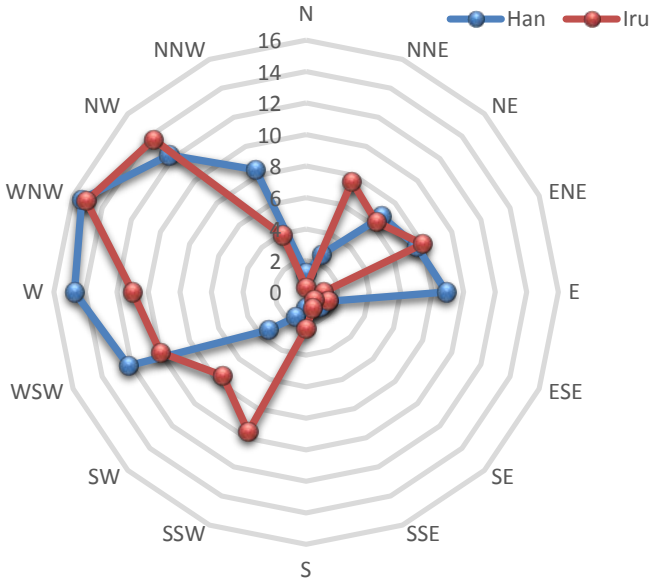


Figure 12: Wind data analysis for N.Irufushi Island and HDh Hanimaadhoo Island; closest islands to B. Fulhadhoo for which weather data is available

The comparison showed significant variation between the wind records from Hanimaadhoo and Irufushi Island in dominant wind direction and speed.

Wind data comparison shows that 73% of the wind is blowing between SSW and NW directions in Irufushi while 69% of the wind direction is concentrated between SWS- NNW directions in Hanimaadhoo Island. Also 15% of the westerly wind has WNW direction in Irufushi while 15-12% of the dominating wind direction in Hanimaadhoo is W and WNW direction. Wind speed recoded from Irusfushi shows that the average wind speed is lower than Hanimaadhoo throughout the year

except in June and July, where wind speed is similar or very close between the two islands during this period.

Figure 13 shows monthly local variations in wind characteristics between Hdh. Hanimaadhoo and N. Irufushi which is 104 km north east of B.Fulhadhoo. Considering the distances between B. Fulhadhoo and Hanimadhoo and Irufushi weather conditions is B. Irufushi is more likely to prevail in B. Fulhadhoo.

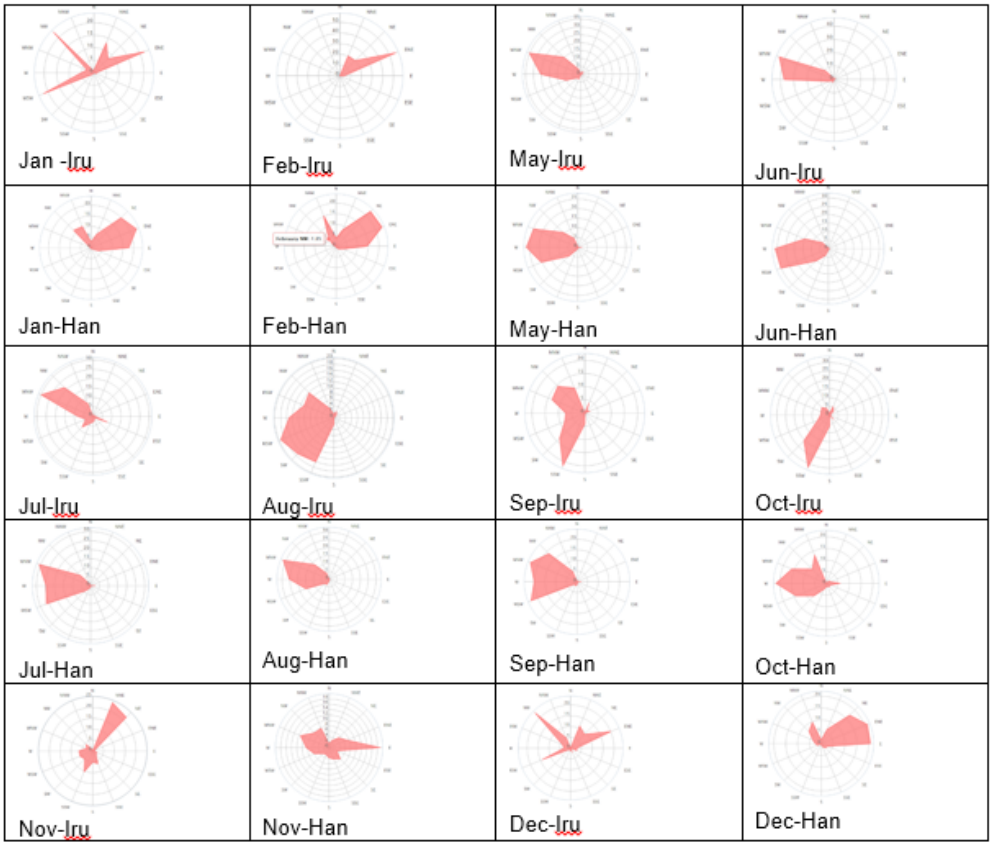


Figure 13: Monthly local variations in wind characteristics between Hdh. Hanimaadhoo and N. Irufushi (Han=Hanimaadhoo, Iru=Irufushi).

Considering the predominant wind directions for both islands studied, the following can be generalised for the expected wind directions prevailing in B. Fulhadhoo.

a) January to July: Winds are primarily from the NW to ENE.
b) August to October: Winds are mainly from the North West to SSW.
c) November to December: Winds are primarily from the NNE to ENE.

Accordingly it is proposed to carry out the excavation activities during the period between the month of August and October considering the existing location of the harbour.

7.2.4 Rainfall

The wet season- southwest monsoon runs from mid-May to November. In this season Maldives experiences torrential rain. Central, Southern and Northern parts of the Maldives receive annual average rainfall of 1924.7mm, 2277.8mm, and 1786.4mm, respectively. The highest rainfall ever

recorded in the Maldives with in 24 hour period was recorded on 9th July 2002 at Kaadedhdhoo Meteorological Office and amounts to 219.8mm of rainfall. The fact that the Maldives is located at the equator, Maldives receives plentiful of sunshine throughout the year. On average Southern atolls (Gan) of the Maldives receives 2704.07 hours of sunshine each year. Furthermore, on average central (Hulhule) parts of the country receives 2784.51 hours of sunshine per year (MMS).

The probability that precipitation will be observed at Hulhule varies throughout the year. Precipitation is most likely around September 9, occurring in 57% of days. Precipitation is least likely around March 1, occurring in 18% of days (See Figure 14).

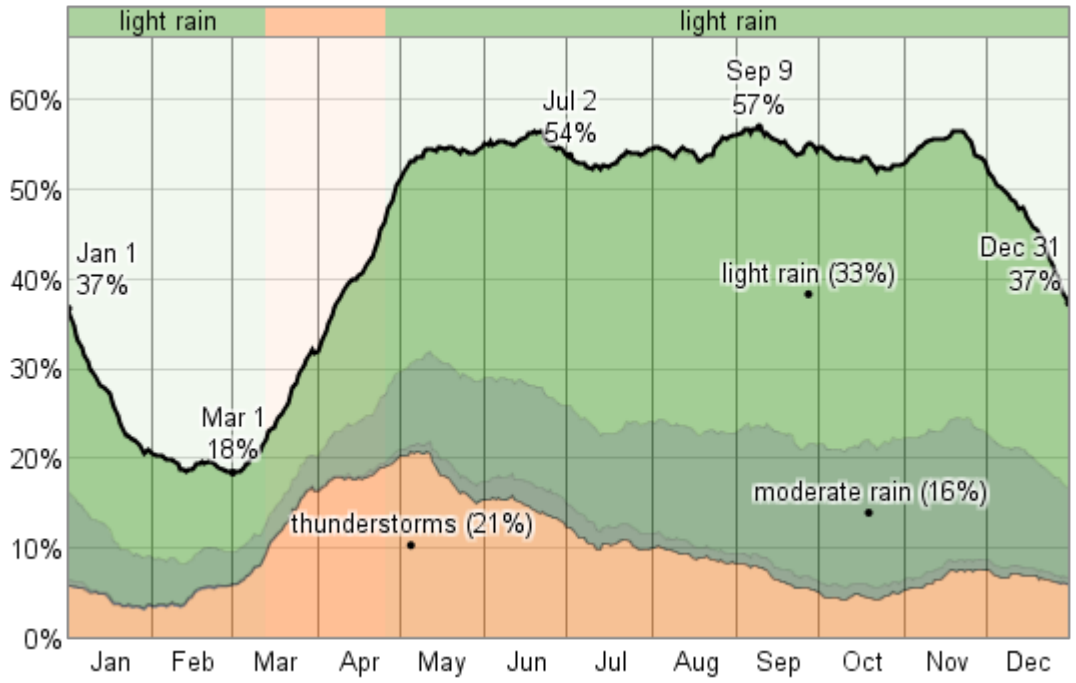


Figure 14: Probability of Participation at some point in the day for Hulhule, Maldives (weatherspark.com).

Wind and rain fall pattern expected for B. Fulhadhoo show that the higher wind speed during southwest monsoon is co-incided with higher precipitation. Since the dredging has been proposed to be undertaken during the period between September – December, planning for dredging should expect rough weather conditions that may occur during the period

7.3 TIDES, CURRENTS AND WAVES

7.3.1 Tides

Tides experienced in Maldives are mixed and semi-diurnal/diurnal. Typical spring and neap tidal ranges are approximately 1.0m and 0.3m, respectively. Maximum spring tidal range in the central atolls is approximately 1.1m. There is also a 0.2m seasonal fluctuation in regional mean sea level, with an increase of about 0.1m during February to April and a decrease of 0.1m during September to November. Like in most other atolls, semidiurnal tides are experienced in B Atoll - that is two high tides and two low tides a day. The tide varies from place to place, depending on the location and on the shape and depth of the basin, channels and reefs and also time of the year. Tidal variations in Maldives are presented in ***Table 4***.

Table 4: Tidal variation observed at Velaanaa International Airport (Mean levels reported by the Maldives Meteorological Services).

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

Astronomical tides are related to the motion of the earth-moon-sun system, and have a range of periodicities. 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 1.2m from lowest to the highest tide levels were recorded in the country. 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.

7.3.2 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 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.

On a more local scale, especially on the reef flats, wave-induced currents (cross-shore and/or long-shore) also form an important factor affecting the current regime.

7.3.3 Waves

The swell and wind waves experienced on the Maldives are governed mainly by the two monsoon periods. Swell caused by cyclonic storms in the area west of Australia may also reach the southern atolls of the Maldives on occasion.

The swells and wind waves experienced by the Maldives are conditioned by the prevailing biannual monsoon wind directions, and are typically strongest during April – July in the south-west monsoon period. During this season, swells generated north of the equator with heights of 2-3m with periods of 18-20 seconds have been reported in the region.

The Maldives also experiences swells originating from cyclones and storm events occurring well south of the equatoB. It is reported that the swell waves from southeast to south-south-east occur due to strong storms in the southern hemisphere in the area west of Australia with direction towards the Maldives.

Local wave periods are generally in the range 2-4 seconds and are easily distinguished from the swell waves. Due to the shallow depths on the reef flat, significant wave breaking (energy dissipation) will take place at the reef's edge, reducing the wave height of waves, which pass over the reef flat. A general swell forecast and swell periods are available from various weather related websites. These forecasts are very general and it does not reflect local variations in wave period and wave height (***Figure 15***).

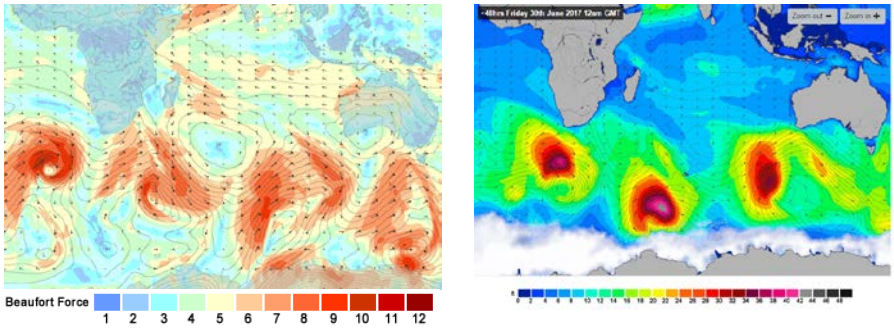


Figure 15: Generalised wave height (right) and wind direction and speed (left) prediction for the Indian Ocean on 28th June 2017 (http://magicseaweed.com/, accessed 28th June 2017)

As per the wind record observations Fulhadhoo Island is subjected to average wind speed of 4-10 knots. Wind speed of 4-6 knots can generate small wavelets with glassy appearing crest without breaking. Wind speed of 7-10 knots can generate large white-capped fetch waves. Irufushi Island shows that wind speed around Fulhadhoo and Irufushi area could reach 20-40 knots at gale, rain and thunderstorms periods. This means that Fulhadhoo region has potential to generate medium-high waves with long wave lengths. The proposed site for development of island access and jetty is exposed to wind generated waves during NE monsoon and during transition periods. It is also expected to experience residual swell waves throughout the year. The western side experiences wind-induced regenerated waves originating from atoll lagoon during SW monsoon and residual waves approaching the reef from the western side.

Site specific wave measurement was conducted for 24 hours (8-9 June 2017) in the near-shore area on the northern side of Fehendhoo, by installing a RBR Solo wave gauge in the area proposed for island access and jetty construction (***Figure 16***). A total of 345 samples with a burst rate of 2Hz at 0.05 minutes interval were taken. General specification and wave statistics on the northern side of Fehendhoo is shown in ***Table 5***. Wave height (***Figure 18***), average & 1/10 wave height, and wave energy is shown in ***Figure 17***. The wave gauge was installed at 0.7m depth during the low tide the

water level was below the reach of the gauge therefore no records were obtained. Extreme peaks shown in the record is probably due to waves created by passing boats.

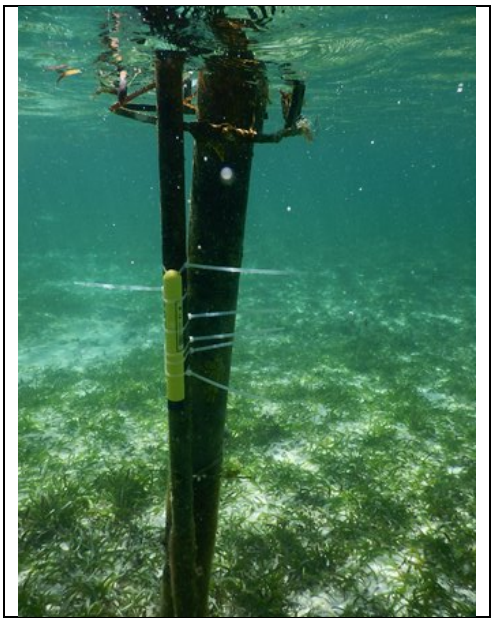


Figure 16: RBR Solo wave measurement device (Wave Gauge) deployed in shallow water

Table 5: Measured near-shore wave statistics, eastern side R Fehendhoo refer to Figure x for location of wave gauge

Channel	Value	Average	Std	Period m/s	unit
Pressure	10.21117	10.33946	0.099373		dbar
Sea pressure	0.078672	0.20696	0.099373		dbar
Depth	0.078188	0.205688	0.0987624		m
Tidal slope	-0.15089	-0.02267	0.0908128		m/hour
Significant wave height	0.021379	0.034689	0.0116822	4.578	m
Maximum wave height	0.033302	0.061227	0.0295683	1	m
Average wave height	0.012921	0.020912	0.0063952	2.629	m
1/10 wave height	0.029492	0.046271	0.0173311	6.611	m
Wave energy	0.850487	2.453689	1.9322808		J/m²

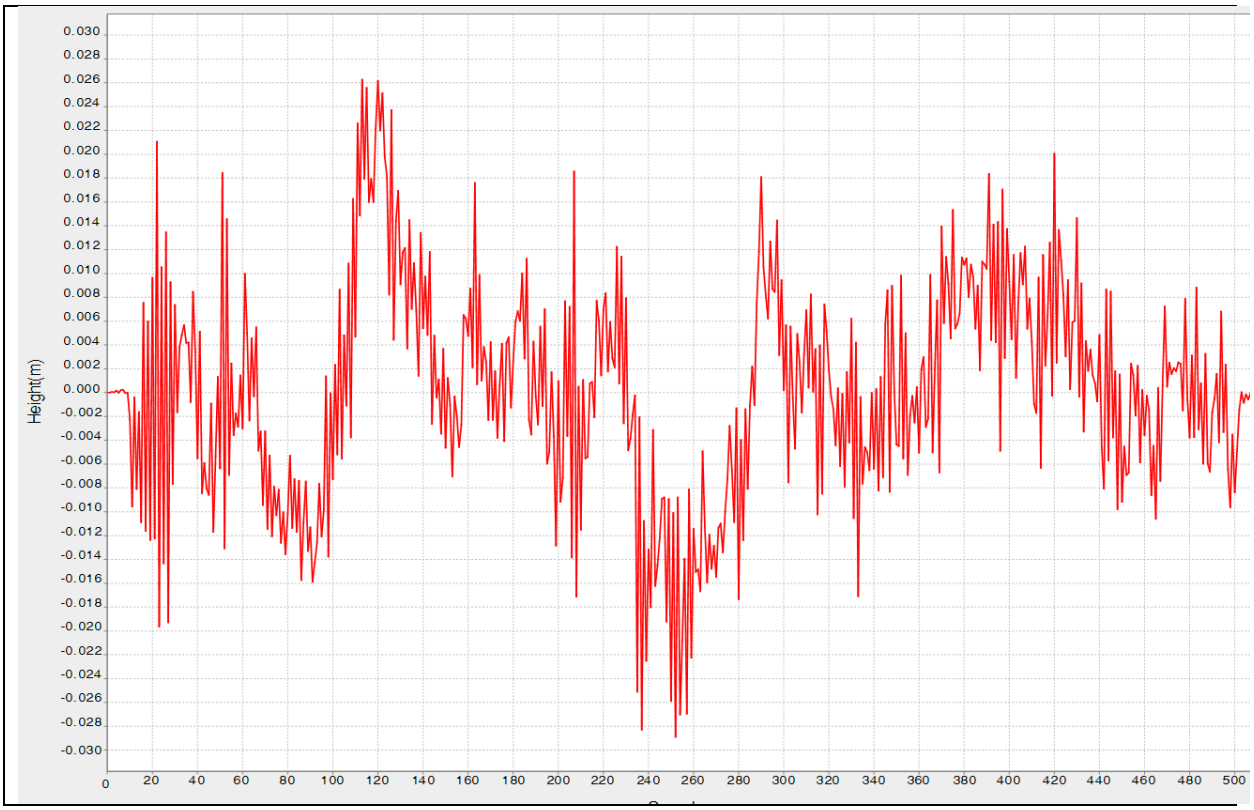


Figure 17: Near-shore wave heights eastern side of Fehendhoo

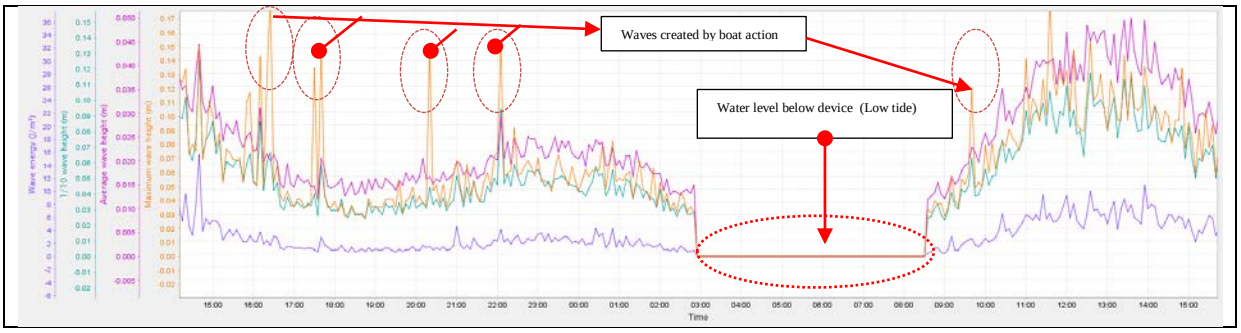


Figure 18: Average, 1/10 wave height and wave energy at Fehendhoo Northern side.

7.4 ISLAND MORPHOLOGY AND COASTAL ENVIRONMENT

Historic Digital Globe, Google Earth images (2003-2016) and island surveys are comparatively evaluated using GIS technology to assess the beach dynamics of the island. Co-georeferencing technique of historical digital globe images taken in various months of the year was used to map the beach end of the island and overlaid to quantify long term changes in island area. Both seasonal and monthly changes in beach erosion, accretion and sediment dynamics were quantified using this technique.

Figure 19 shows beach end change and dynamics over time in the island and a magnified view of the designated beach area for the proposed development. A comprehensive sequence of digital globe images are available from 2003-2016. The result shows that the overall area of the island in 2002 and

2016 remained very close (29.5ha in 2003 and 88. 5 ha in 2016). Sequence of images of also shows the two entrance channels currently used by the locals to access the island does existing even in 2003 images but the channel on the north eastern tip of the island was deepened. Compared to the seagrass cover on the Fehendhoo and Goidhoo northern lagoon of Fulhadhoo seagrass cover is low. The sequence of images shows a very dynamic sand spit at both eastern and western end of the island. The sand spit on the western end seems extremely dynamic, elongated sand-bank attached to the western end form around the end of westerly monsoon and disappears with the onset of NE monsoon. The sand spit that forms on the eastern end of the island shows N-S swivel movement seasonally (***Figure 20*** and ***Figure 21***).

Comparison of beach dynamic and the prevailing wind condition in B. Fulhadhoo it could be presumed with great degree of certainty that that at the end of SE monsoon the sand spit on the western end accretes and gets elongated west-wardly. Also on the northern side the beach gets wider at the onset of transition period and SW monsoon, beach formed on the southern side of the island becomes narrower with net shift in sediment eastward of the island. Beach width is more evenly distributed around the island during SW monsoon period.

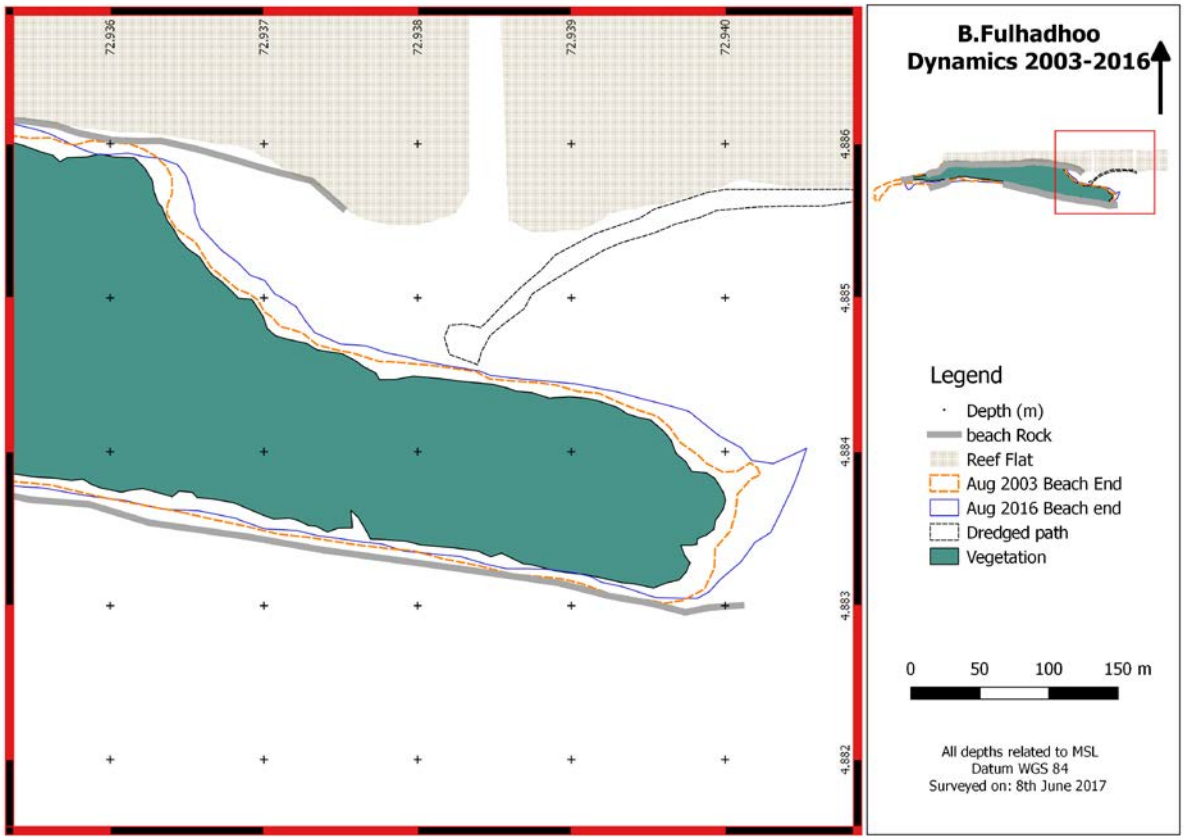


Figure 19: B. Fulhadhoo beach dynamics (2003-2016) showing beach change, magnified view of the proposed project site, not the extensiveness of beachrock.

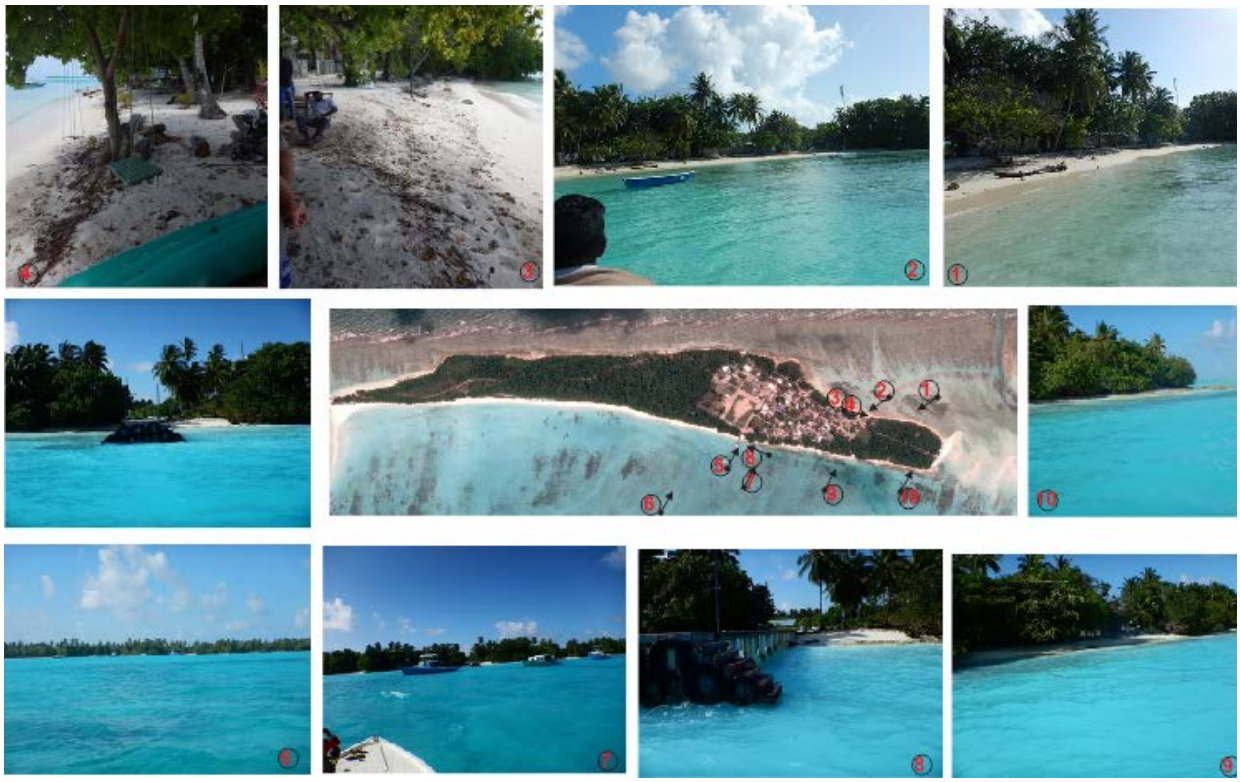


Figure 20: Beach condition around the island

Figure 21: The Northern coast of Fulhadhoo undergoing severe erosion

As mentioned earlier proposed activities is not suitable to be undertaken on the southern side of Fulhadhoo. Assuming that the proposed island access package (channel mooring basin and the jetty) is shifted and implemented on the northern side, as suggested by the island community. From the

observed sediment movement pattern, island geomorphology, and beach dynamics it is very likely that if a channel is dredged on the northern side may get filled with sand and become shallower in both SW and NE monsoon periods during the sediment transportation process. Presence of seagrass on the northern side of the island will dampen the sediment deposition process. However there is a risk of seagrass invasion if the water around the area becomes stagnant and the flow movement is slow. Coastal erosion may to take place on the northern side as the sediment that goes into the dredged area does not return back seasonally as has been the case in similar situations. Therefore the natural process that has been taking place in Fulhadhoo beach will be disrupted with the change in near shore hydrodynamics of the island.

Beach rock, which is considered to be an indicator of erosion, is exposed on the all around the island. The proposed mooring area and the backfill beach replenishment area seem to have had chronic erosion problem and bay-like curvature has been formed on the west side of the island. Beach rock is exposed all around the island.

7.5 BATHYMETRY

Lagoon depth of the area initially proposed for island access channel and jetty construction work in Fulhadhoo was checked measured by using handheld echo sounder and a fairly detailed survey was conducted on the northern side where the island community is proposing to shift the island access mooring basin and the jetty.

Echo sounder measurements are corrected and related to the mean sea-level for the area. Depth of the shallow lagoon on the southern side ranges 12-3m while the deep atoll lagoon is over 30m. Hence, initially proposed dredging would not be suitable for the southern side. Depth of the reef-flat and the lagoon on the northern side of Fulhadhoo is fairly uniform ranged within 0.5 to -1.5m. The depth of the area proposed for access channel and jetty development by the island community of Fulhadhoo is within the range of -0.5 to -1.5m ***Figure 22***. There are two access channels making an entrance path through reef on the ocean ward side. The channel on north eastern end of the island is deeper within the range of 2.5-3.4m and the channel was excavated few years back. The second channel which is approximately 350m east is manually dug and the depth is within the range of 1.2-2m. These two channels are currently used by the locals to access the island. Manually made narrow path that is little deeper than surroundings exists between the two access channels. This is the pathway used by the locals to drive the boats to shore. Water depth of the path is within 1.1-1.6m at low tide. Water depth of the surrounding areas is less than a meter deep ***Figure 23***. The reef flat proposed for access channel and jetty development totally exposed at low tide and the lagoon area has a depth of -0.5to -0.9m at mid tide.

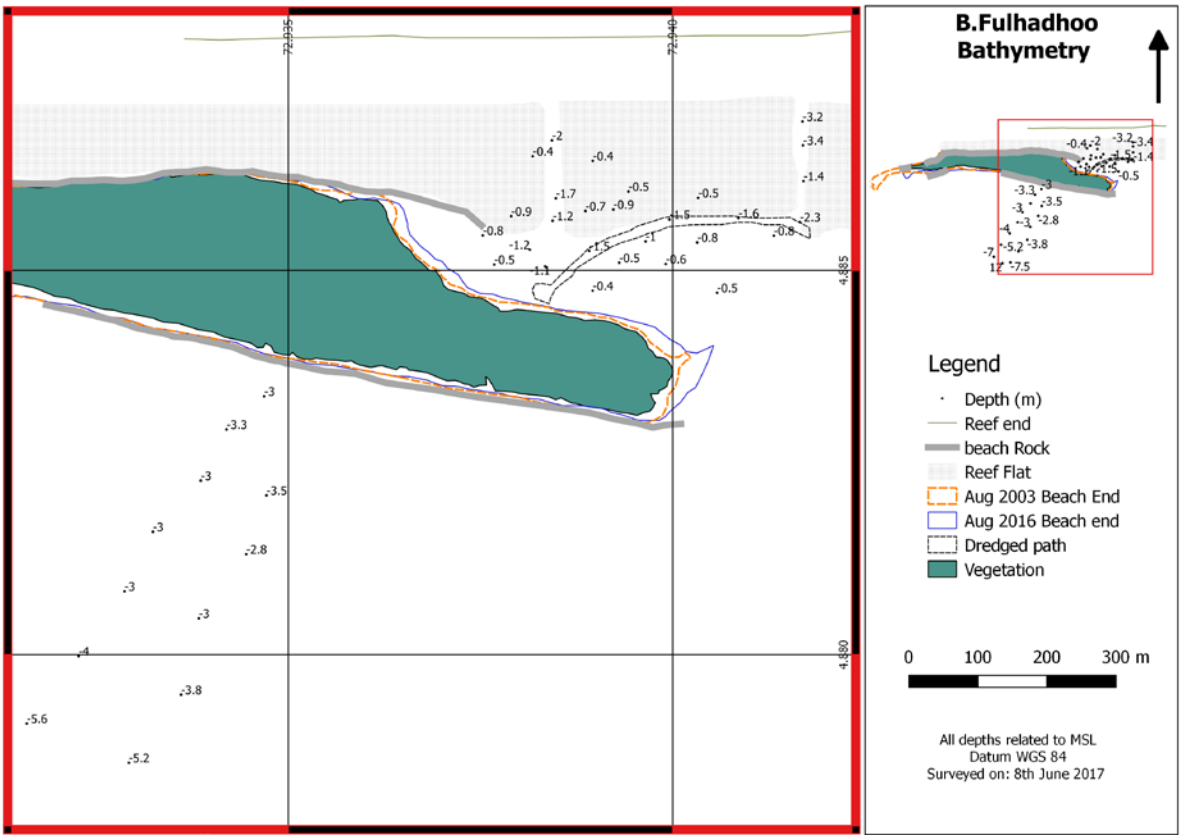


Figure 22: Bathymetry of the area proposed for access channel on southern side and the area suggested by the people on the northern side B. Fulhadhoo.

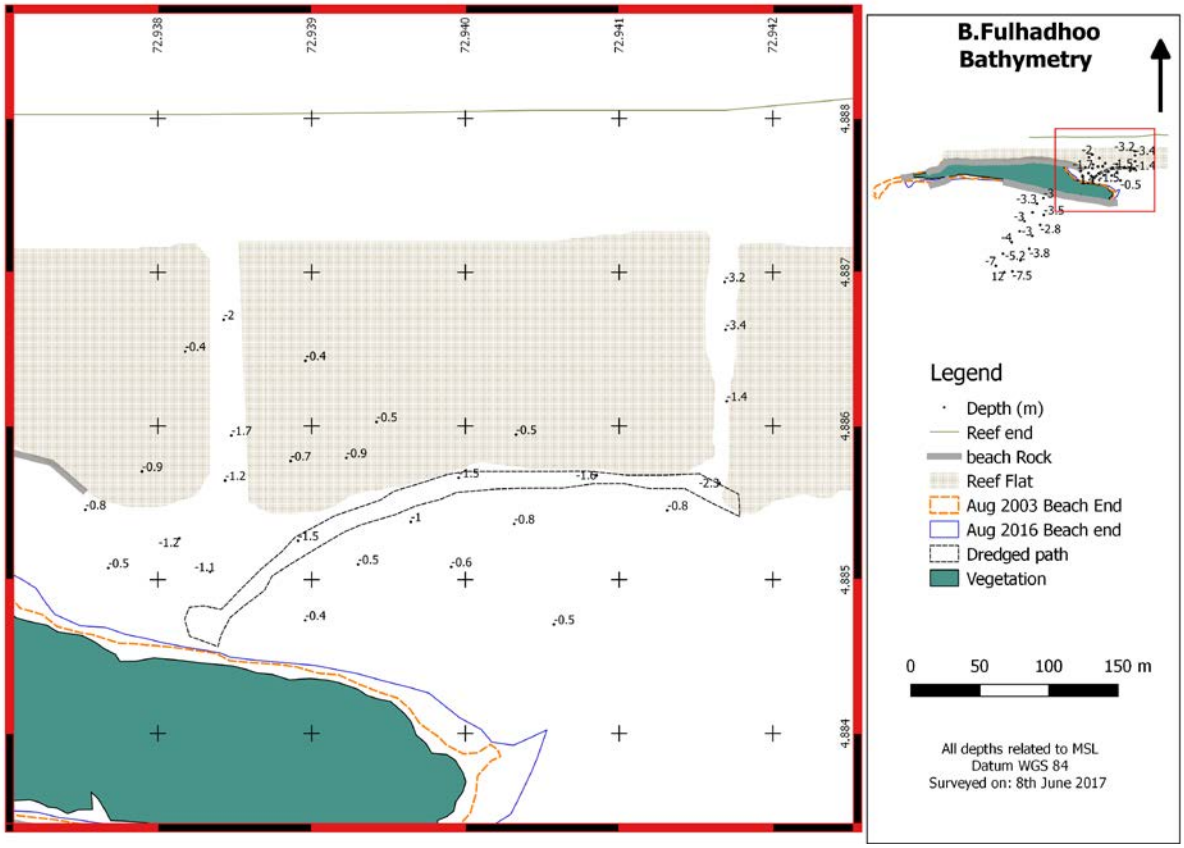


Figure 23: B. Fulhadhoo magnified view of the water depth on the northern side showing the access channels and pathways

7.6 MARINE ENVIRONMENT

As stated in the introduction island of Fulhadhoo is located in the small natural atoll of Goidhoo Atoll, south of Baa atoll. The atoll itself is oval in shape with its long axis oriented east-west direction. The pointed end of the atoll faces to the east. Fulahdhoo is located on the northern segment of the atoll reef.

The fore-reef on the oceanward side is well-developed with spur and groove formation - evidence to the high energy nature of the northern side. There is also a narrow pass to the eastern end of the island, which appear to have been man made. The developing sand-spits in the eastern section of the island has made the area quite shallow rendering this narrow pass unusable.

The proposed area of development is on the south facing the atoll lagoon which runs all around the internal periphery of the Goidhoo atoll. The width of the lagoon across Fulhadhoo island 700-750 m form the shore. The section of lagoon facing Fulhadhoo mostly clear except for few patches reefs at edges.

The sequence of satellite images available of Google Earth shows since 2001 there are no major changes proposed area of development. The depth of area 3.5m close to the shore but gradually deepens to about 4.5m towards lagoon edge just before the atoll lagoon.

7.6.1 Methods and Approaches

Standards approaches were used to obtain qualitative and quantitative information on the existing marine environment. Timed swims were conducted along the area starting from the shallow to the reef edge. Faunal composition in the visual field were also noted. Swims were done for 10 mins. Three such swims were performed and the data were pooled to give an aggregated count to provide general feel of the faunal composition of the area.

Images were captured at third stroke of the swim maintaining the camera in a horizontal plan as much as possible. Using the images, a coarse relative cover of 5 categories (live coral, dead coral, soft coral, sand, rock/rubble) were estimated.

7.6.2 Substrate Cover

Image analysis was not done since most of the images show soft sandy bottom. In some part dead branching coral crumbling into rubble were visible. In the section closer to the edge there were colonies of the compacted acropra formation and brain coral (Porites) (***Figure 24*** and ***Figure 25***).

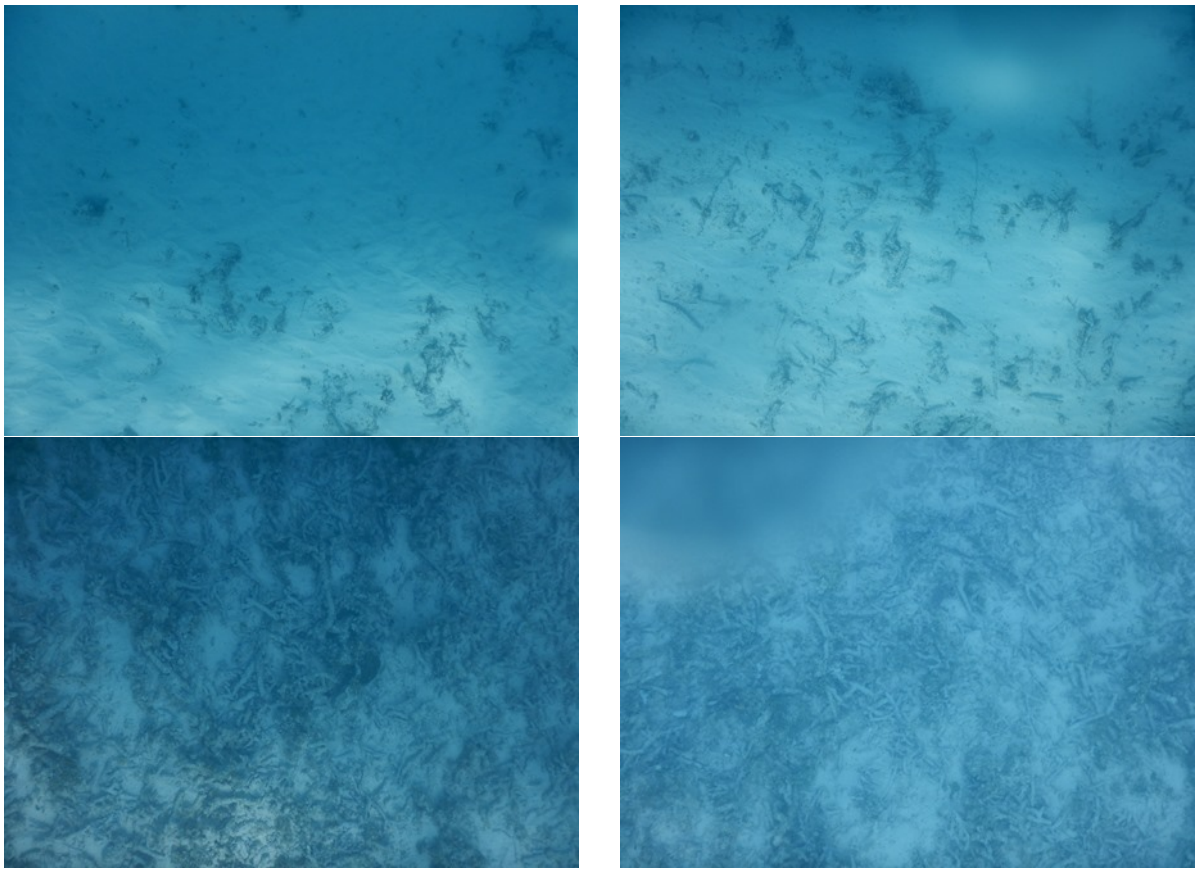


Figure 24: substrate composition on the southern side of Fulhadhoo lagoon

Figure 25: Substrate cover on the northern side of Fulhadhoo lagoon

7.7 MARINE WATER QUALITY

Water quality was assessed at the Male Water and Sewerage Company's Water Quality Assurance Laboratory using standard methodologies. Marine water samples are collected and water quality has been assessed to establish the baseline condition for Fulhadhoo Island during field visit . The results would be useful for future monitoring and comparison ***Table 6***.

Table 6: Baseline for Fulhadhoo seawater

Location	72.936117°, 4.884661°
pH	8.22
Salinity	34.22
Temperature	20.8
TDS	26100
Turbidity (NTU)	0.353

7.8 PROTECTED AREAS

The Whole of Baa atoll is within the core area of Baa Atoll Biosphere reserve. There are 9 Core areas in the biosphere reserve. Two areas are within Godhood Atoll. They are Goidhoo Koaru and

Mathifaru huraa on the south western natural entrance of the atoll (***Figure 26***). These two area are far from the proposed project in Fulhadhoo are unlikely to be impacted.

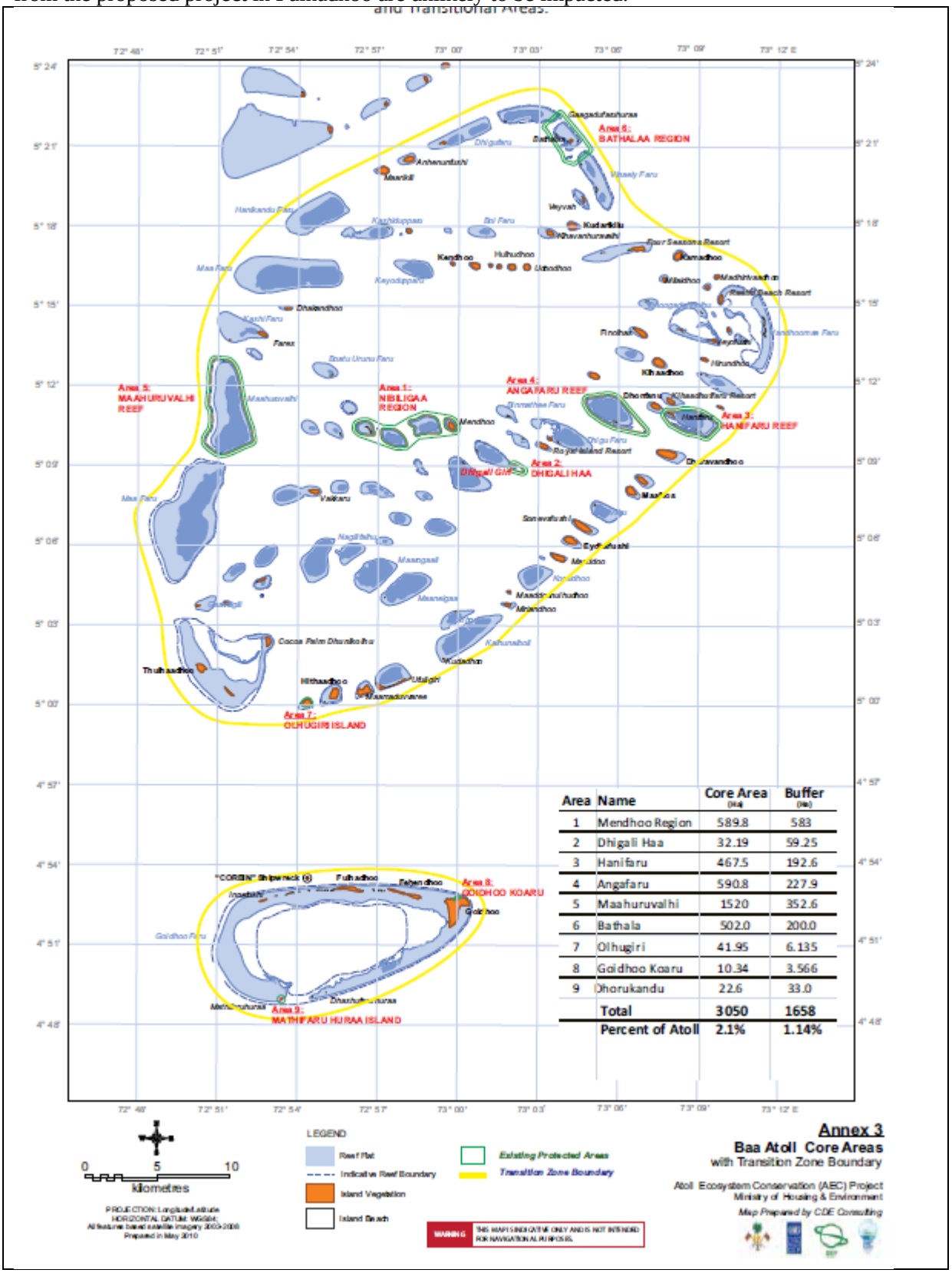


Figure 26: A map of Baa atoll including the Core Area, Buffer Zones and Transitional Areas.(source: Zonation System for the Baa Atoll Plan of Management, 2011)

8 SOCIO-ECONOMIC ENVIRONMENT

8.1 INTRODUCTION

B. Fulhadhoo is administratively located in Baa Atoll which is formed of geographically three atolls separated by narrow deep channels. The Central part of B. Atoll (Geographic Baa atoll) consist of most of the inhabited islands and the northern B. Atoll has only one inhabited island (Kudarikilu) and the Southern B atoll which is Goidhoo atoll has three inhabited islands. Fulhadhoo is one of the three islands in Goidhoo Atoll. The two remaining islands are Goidhoo and Fehendhoo islands. Fulhadhoo is the furthermost island to the capital of Baa Atoll Eydhafushi. Registered population of the island is approximately 300 and the residing population of the island is 187 people only. Island accessibility is the main issues that need to be addressed as a matter of priority.

8.1 HISTORICAL ACCOUNT

French yacht Cobin is grounded on Goidoo atoll closer to Fulhadhoo island. Famous historian Pyrad De Lavel travelled and came to Maldives on board that yacht. The yacht ran aground on July 2nd 1902. The Cobin wreck is located on the shallow reef between Fulhadhoo and Innafushi island.

Historically Fulhadhoo island used for lifetime banishment of criminals particularly women.

8.2 ECONOMY AND POPULATION

Major economic activities of Fulhadhoo are fisheries, mainly grouper fishery, employment in resorts and other parts of the country and construction, trade and tourism. The island has three guest houses operational at present. The island has fairly large fleet of seagoing vessels compared to other islands in the Atoll. Approximately 27 boats and Dhoni are operating from the island 8 boats out the fleet are engaged in grouper Fisheries. The island famous for cultural and traditional activities such as Boduberu, Langiri, Maafathi neshun and Dhandijehun

8.3 EDUCATION

There is only one school on the island. The school was established on 20th February 1997. The school approximately 25 student, two foreign and two local teachers. This is primary level school teasching up to grade 7. Majority of the students from the island are studying either in Eydhafushi or in Male.

8.4 HEALTH

Health services started in the island in October 2008, where a private house was rented by the government and service of family health officer and community health officer was provided for the island. Fulhadhoo Health Center was established on 23rd October 2010. A family health officer, community health officer and a nurse are providing the health services to the island. Simple and most basic health care such as dressing, wounds, diabetes test, IV and injection fluid for patients. Also some very basic medicines are available in the Health Centre.

8.5 ELECTRICITY

Electricity for the island is provided by FENAKA. There are two generator sets each with 32 KVA capacity. Monthly average usage is 10,700 kWh and approximately 60,000 litre of diesel fuels is consumed to generate electricity in the island. (Maldives energy outlook, MEE, 2013).

8.6 SOCIO-ECONOMIC BENEFITS

Island access related developments such as harbours, access channel and jetties, in an inhabited island, are considered to be the most important infrastructure everyone craves for and viewed as a necessity for the development of the island to open up to the rest of the country. The primary objective of the project is to provide access to the island, and provide safe mooring facilities. Access to the island is envisaged to bring economic growth and will improve living conditions of people of Fulhadhoo Island. Therefore the proposed development project in B. Fulhadhoo is an important infrastructure development project that will open-up the island and improve travel and trade and movement of people to and from the island.

9 STAKEHOLDER CONSULTATION

The scoping meeting to determine the scope of the EIA report was held on 11th June 2017 at EPA. During the meeting the stakeholders were identified and the scope of the EIA report was determined. Methods used for stakeholder consultation include direct communication and interviews with locals in B. Fulhadhoo, formal meeting such as the scoping meeting, island council and the people of B. Fulhadhoo.

9.1 KEY STAKEHOLDER

As per the TOR the key stakeholders identified are

1- Fulhadhoo islands council
2- People of Fulhadhoo and boat owners island
3- Ministry of Housing and Infrastructure
4- Environmental Protection Agency

9.2 EIA SCOPING MEETING

EIA scoping meeting was held on the 11th June 2017. Most of the stakeholders were present in the meeting (meeting attendance is in Annex 4). The meeting was chaired by Ms. Fathimath Reema, Director EPA. The consultant gave a briefing on the proposed development of access channel and a jetty on the north eastern end of B. Fulhadhoo and explained the difficulty the people of island is going through during the rough monsoon season particularly May June and July.

The consultant visited the island prior to the scoping meeting on 8st of June and shared the views and discussions held with the local people and the meeting with island council and boat owners. He also stressed about the importance of visiting the islands and getting the island community opinion on the proposed development prior to designing the development projects. He also highlighted the importance of visiting island during difficult time particularly during rough weather conditions to see and experience the difficulties people area facing in islands. He said that usually government authorities and agencies visit islands at nice and calm weather conditions, so they have difficulties to assess and comprehend the real situation in the islands, no matter how hard people explain to them. He also pointed out some of the issues with the drawings submitted by the MHI and also shared the views of the island council and people with regard to relocation of the jetty to the northern side of the island. He pointed out the consultation with the people of the island has indicated that the proposed location is not very suitable and particularly rough during the SW monsoon, the proposed area is deep enough no need for dredging, the existing jetty on the southern side is seldom used by the people particular during rough weather conditions. Therefore; they have suggested relocating access channel and to the northern side. He also shared a briefing about the discussion and consultation had with the people of the island.

The newly elected President of B. Fulhadhoo council present in the meeting reiterated the view the of the consultant and mentioned that the location of the proposed access and jetty was decided without consultation with the people of island. He also mentioned that during the discussion with MHI official visited the island a month back, they have indicated that they wanted the access channel and jetty to be located on the northern side.

MHI noted the concerns of the island council and mentioned that they have no objection to shifting the location of the jetty and bring changes to the proposed plan as long as the changes does not increase the project budget, or within the limitation of the budget. They also requested further discussions with the council straight after the scoping meeting.

EPA noted that the proposed location for the development island access and jetty in B Fulhadhoo is on the western side of the island. They also pointed out that once the access is developed on the northern side it will be accessible and usable based on the experience of the local people.

In the light of the discussions held in the scoping meeting, EPA requested to provide options for alternative location for the access and jetty and recommend the preferred locations in the EIA report.

9.3 CONSULTATION WITH MHI

Formal consultation with MHI, the proponent of the project, was held on the 11th June prior to the EIA scoping meeting to give a briefing about the main findings from the field visit to B. Fulhadhoo and the consultations held with the people and island council. The consultant conveyed concerns of the people and council and expressed need to relocate the access and jetty to the northern side of the island. The southern side is already deep enough and does not need dredging an access channel but the proposed location is exposed to ocean regenerated fetch waves during the SW monsoon. The proposed location for the access on the southern side makes the travelling distance longer, (2 hour more) is for most common destinations of Fulhadhoo people main islands in Ba atoll, than if the access to the island is provided from the northern side of the island. The consultant conveyed views expressed in the stakeholder consultation meeting in which the people of the island are opting for a reasonable size harbour (100x150m) on the northern side. If that request cannot be accommodated then they requested to relocate the proposed access channel, small mooring basin and the jetty (as per the government proposed dimensions) to the northern side of the island. As a matter of principle MHI expressed their willingness to accommodate people's need and had no objection to fulfill the people's request as long as the adjustment proposed is within the budgetary limitations. They also expressed that they will discuss the matter further with council to ensure that people's needs fulfilled.

9.4 CONSULTATION WITH FULHADHOO COUNCIL AND PEOPLE

Stakeholder consultation with Fulhadhoo Island Council was held on the 9nd of June 2017 night 14:00 pm at the Council Office during the field visit (***Figure 27***). The meeting was held prior to the field visit and survey of the proposed location for island access and jetty construction in B. Representatives of the general public, a selected group of youth, senior citizens, former boat owners, present council members, women's committee etc., are invited for the meeting (***Figure 27***). A list of attendees to the meeting is given in Annex 4. Council president gave a brief introduction about the meeting. He said that he was utterly surprised to see the location of the access and Jetty and disappointed that the government had gone thus far in planning without consulting with the community. They said it is very clear from the proposed plan that the people who prepared the design and drawing had no idea about the local conditions in Fulhadhoo. Also they believe that no one from island would have suggested providing island access from the western side. They are also on the opinion that if the access and jetty is developed as the proposed plan it will not be usable for the island community. Then the consultant gave a briefing about the project and the proposed dimensions of the channel, small mooring area and the jetty. He also briefed about the EIA process and the role of stakeholder consultation in environment related decision making. The consultant explained the process and shared some of the observations from the field assessment. Then the floor was open for discussions.They also shared the following disadvantages of having an access on the southern side of the island:

1- Very rough throughout the year, particularly during the onset of SW monsoon where the moored vessels on the southern side may have to be manned 24/7 during the period
2- Difficult to use the existing jetty on the southern side, particularly cannot stay alongside with the jetty due to the strong wave (back and forth strong surge) action.
3- Most of the people living if Fulhadhoo have their relatives working or studying in Eydhafushi And / Or Goidhoo Island. Trip by a normal Dhoni from the access on the south will take approximately 2 hours to go from Fulhadhoo to Goidhoo and over 2.50

hour to Eydhafushi. While a trip from northern access will take less than an hour to go to Eydhafushi by a normal Dhoni.

4- Usually people travel to Goidhoo Island in small boats Dinghy's through the deep lagoon on the southern side, during rough weather the southern side is extremely rough and cannot be used for small Dinghy's. The alternative route for them is to go to Goidhoo through the shallow lagoon on the northern side. The northern side can be used most of the time but due to the shallowness it may become unusable at low tide.

With the above mentioned concerns and grievances the island community requested to relocate the proposed island access channel and small mooring basin to northern side of the island. The community is opting for a full-fledged harbour on the northern side because the island has fairly large fleet vessels and most of the people are engaged in grouper fishery. The community also shared with the consultant their proposed design for island harbour and access development on the northern side (***Figure 28***). The design suggested in the alternatives sections of this report has incorporated island community design with the standard dimensions adopted by MHI island access project for Fulhadhoo and has considered further east ward expansion of the mooring basin into a larger harbour in the future.

Figure 27: Stakeholder consultation B. Fulhadhoo Council members and representation of general public

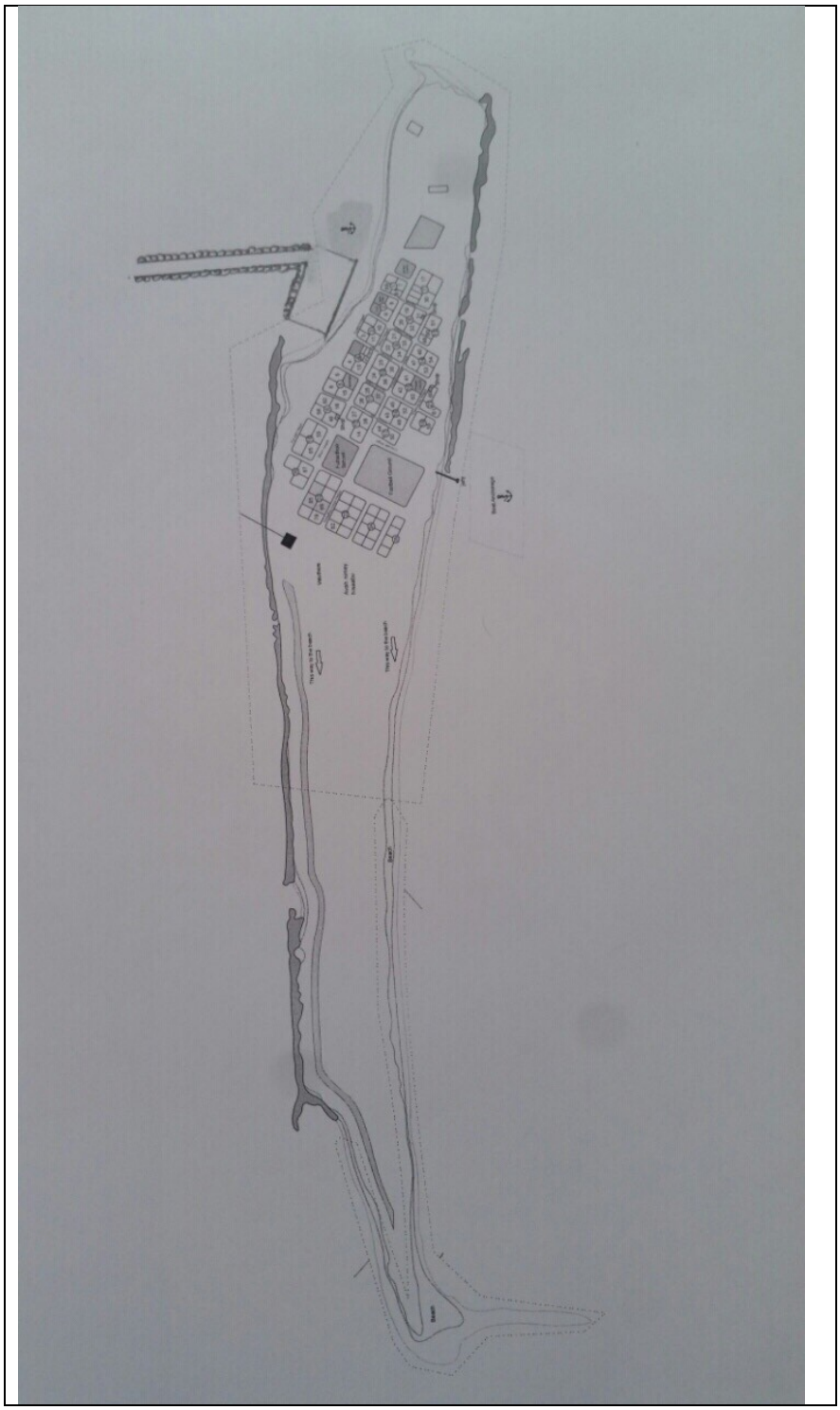


Figure 28: Harbour concept design by the island community in Fulhadhoo.

9.5 MAIN CONCLUSIONS FROM THE STAKEHOLDER DISCUSSIONS

Everyone agrees that access to the island is the most urgent need for the island.

The most appropriate for the island would be to have a full-fledged harbour and access on the northern side of the island

Everyone agrees that the proposed access and jetty construction work is not suitable for the southern side of the island and it would not be usable appropriately if developed on the southern side

Everyone agrees to relocate the proposed access and jetty development work

The community should have been consulted prior to the access and jetty design and awarding construction contract.

MHI has no objection for the proposed changes to project and expressed willingness to accommodate people's need and fulfill the people's request as long as the adjustment proposed is within the budgetary limitations.

Table 7: list of stakeholder consultation

Name	Address/Designation	Contact No
Ahmed Asif		
Mohamed nadheem		
Mohamed Haleem		
Ali Azhar		
Hassan niyaaz		
Ahmed jaleel	Venue	
Mohamed nasyr	Soorajvilla	
Abdul Hamydh	Asseyri	
Mohamed nizam	Rediumge	
Ali nasèer/	Guldhasthage	
Ali Riyaz		
Ibrahim shiyam		
Mohamed Mauroof		
DB. Mahmood Riyaz	Consultant	7890307
Ms. Nafha Aujaz	Environment Analyst (MHI)	7721554
Aroosha Hashim	Assit. Project Office (MHI)	
Mariyam Shidha	Snr Research Officer (EPA)	
Aiminath Mohamed	Asst. Project Officer (EPA)	
Moosa Naseem	Fehendhoo Council (president)	
Ali Azhar	Asst. Director (Fulhadhoo Council)	
Ahmed Asif	Fulhadhoo Council (member)	7787992
Hussain Rashad	Rasgetheem Council (President)	
Fathimath Reema	Director (EPA)	
Hashim Nabeel	Project officer (EPA)	

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 the dredging works using an excavator. In describing the impacts the report considers the possibility of undertaking project activities on the northern side of Fulhadhoo as discussed in the alternatives section. As mentioned earlier if the project is implemented on the southern side then the impact of the access channel and mooring basin dredging can be avoided. 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 backfilling and replenishment of eroded areas on the northern coast of the island and construction of a jetty using pad-column structure.

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 reversibility significance and cost.

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 island access and jetty construction project in B. Fulhadhoo. 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 cutting the access channel, dredging and jetty construction work on B. Fulhadhoo Island 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 Activities
Impact	Site setup and mobilization	Work force	Dredging	Jetty construction	Backfilling and beach replenishment	Equipment and vehicle maintenance	Demobilization	Operation of access Channels and jetty
Noise	-	-	-	-	-	X	-	-
Dusting -Air Quality	-	X	-	-	-	-	-	-
Coastal process	X	X	-	-	-	X	-	X
Terrestrial flora	X	X	X	X	X	X	X	X
Ground water	X	X	X	X	X	-	X	X
Soil	X	X	X	X	X	-	X	X
Marine water	-	X	-	-	-	-	-	-
Hydrodynamics	-	X	-	-	-	X	X	-
Marine habitat and Fauna	-	X	-	-	-	X	-	-
Natural hazard risk and safety	X	X	X	+	X	X	X	+
Employment	+	+	+	+	+	+	-	+

(-) 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 island access channel, mooring basin and jetty development project in B. Fulhadhoo includes the following:

- Mobilization of Equipment and Labour
- Access channel dredging, and subsequent sedimentation
- Hydrodynamic regime
- Marine habitat and coastal environment
- Noise, Vibrations and Air Pollution
- Greenhouse Gas Emissions
- 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 on a barge and other heavy equipment and machinery needed for the project in B. Fulhadhoo 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. 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 Dredging, beach nourishment and subsequent sedimentation

Cutting and dredging of entrance channel and the small mooring area 40x30m on the northern side of B. Fulhadhoo Island and jetty levelling work on the eastern side of the island will have a direct irreversible negative impact to the ecological habitat in the area. Direct impact of this activity is limited to B. Fulhadhoo reef only.

Given below are relevant impacts that should be considered:

1. Physical damage on live coral and loss of live coral: 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 dredging activity: Release of sediments and potential loss of the faunal composition underneath sediment material will undoubtedly occur.
3. Dredging and jetty construction will change in the flow patterns. Tidal flows can be quite significant on the shallow reef flats and deeper areas will dampen the flow. The unexpected outcome may be erosion or accretion of the island or coastal areas.

In order to minimize the impact from sediment, dredging should be completed in shortest time possible. Dredging ought to take place during low tides or slack tides to minimize the release of sediment to the area.

10.4 IMPACTS TO CORAL REEF

Cutting an access channel through the reef flat and dredging a mooring area will result in the short-term irreversible loss of the existing coral communities living on the affected area. It should be borne in mind that less than 5% of the corals on the reef-flat are presently comprised of live corals. The potentially negative impacts on the associated fish species are thought to be less severe given that that there are adequate reef ecosystems on the island house reef to which they may retreat. Over time, recruits of the coral species and other sessile benthic fauna are likely to recolonize the fresh rock face of the now deepened area and adjusted ecosystem would be established. Thus, the immediate negative impact of the proposed activities would be reversed over the long-term period.

Without turbidity barriers the currents and the wave action mostly generated by wind particularly during the North East monsoon in and around are would promote rapid sediment transport of turbid waters away from the immediate area and into the ocean. This will tend to reduce the time period over which undisturbed coral species would have to endure deteriorated water clarity.

The construction of jetty columns in the lagoon, channel and mooring basing dredging will have an impact on corals. Jetty construction would kill some of the coral that fall on the foot print of the structure however the installation of columns will create new hard substrate suitable for new coral growth.

Use of dredged material for backfilling and on the eroded coast will not result in having to lose any live corals as a direct result since the area consist only of dead corals and debris. Noticeable numbers of crabs have been observed to live the coral crevices. Since they are highly mobile creatures they will

move away from the disturbed area and retreat into elsewhere on the coast. However, sedentary organisms falling in the area of beach replenishment will be negatively impacted.

10.4.1 Hydrodynamic regime

The proposed development on the eastern part of the island can influence the shoaling characters and wave energy in and around the northern coast of the island through refraction and redirection of the incident waves. Cutting channel through the reef flat and dredging a mooring area will increase the depth within the area and is likely to change the overall hydrodynamic regime within B. Fulhadhoo western coast due to increase in water depth. Further, the dredged areas are likely to act as sediment sinks and therefore lagoon may take a number of years to stabilize against the prevailing conditions.

Proposed activities on the northern coast of Fulhadhoo will in general increase wave heights and reduces currents in and near the dredged areas. The following identifies these changes more specifically to their areas;

Dredging of the access channel will have a limited impact on the wave conditions. The mooring area basin may slightly increase the amount that wave energy expended on the northern shore, resulting in a slight increase in the amount of wave energy reaching the beach. This increase may bring more filling material into the deep areas result frequent maintenance dredging of the channel and the mooring area basin. However, it is proposed to have in place a beach monitoring program against the baseline set up for this study should an unforeseen changes occur to the beach.

The proposed construction jetty on pad-and-column structures will not obstruct the long shore currents transporting sediment around the island.

10.5 IMPACTS TO COASTAL MORPHOLOGY AND AESTHETIC VALUE

The wave direction, wave height and current changes are expected to change the beach slightly under normal conditions but not significant. Fulhadhoo north and north eastern beach is highly dynamic and will respond to changes in the hydrodynamic conditions. The changes that are expected to occur due to the dredging will likely remain within.

The turbidity associated with the excavation will probably be restricted largely to the bottom, and the immediate vicinity of the dredging area. A plume will still be visible around the dredging operation. It is possible that the visual impact will be moderately severe and localised. The overall significance of this impact will vary from person to person, but on a precautionary basis is regarded as being moderate. Whilst there is a lack of residential island near the dredging site and people will be not be able to see the equipment and the dredging area and associated plume could be not become visible to the people.

10.6 DREDGED SAND DISPOSAL

The dredged material is proposed to be used for backfilling, jetty levelling and the excess will be used to replenish the eroded areas on the northern side of the island. With supply of sand to the eroded coast beach will be created. Trucks will carry dredged materials on the existing road network on the island. The material to the site will be supplied by trucks. One of the main concerns with regards to the dredged material disposal is the impacts on water quality, which include those associated with increased turbidity, decreased dissolved oxygen levels, and visual impacts. Dredged material disposal typically has a short term (several hours to days) impact on the water column following discharges of solids and solutes during the transportation process and excavations. The greatest proportion of dredged material consists of negatively buoyant solids that sink as a turbid suspension through the

water column to the sea floor. Dissolved constituents of dredged material are entrained in the turbulent water associated with the convective descent.

10.7 NOISE, VIBRATIONS AND AIR POLLUTION

During the mobilisation of equipment and operation of heavy machinery for dredging and beach nourishment work, it is anticipated that significant noise will be generated. Minor ground vibration is anticipated during movement of excavators and heavy vehicles. Furthermore, noise vibrations may alter species behaviour. In addition, dust and emissions from vehicle and machinery exhausts will degrade the air quality. However, these impacts will be short term and can be mitigated to avoid nuisance to the locals in the island. 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.

10.7.1 Equipment & vehicle maintenance

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.

10.8 POTENTIAL POSTIVE IMPACTS

Potential positive impact of the project would be on creation of employment during construction period particularly for locals. The project will have a noticeable impact economically to B. Fulhadhoo Island as it will resolve the difficulties faced by the islanders to access the island and safe mooring areas for vessels and reduce the transportation cost through smooth access and operations of boats and launches and minimize damage by accidental grounding to the boat caused by shallow water depth of the area. This in turn will contribute to overall economic growth of B. Fulhadhoo and islands in the region.

1. Island accessibility opening up of the island
2. Better income generation opportunities to the region
3. Better employment opportunities in the region
4. Improved navigational safety and transport at local level
5. Improved regional economy as a result of the improved facility

10.9 NEGATIVE IMPACTS

1- Loss of coral head and benthic biota and seagrass at lagoon and its entrance channels and mooring area basin in the reef flat.
2- Short-term sedimentation and turbidity over coral along dredged area due to suspension and dispersal of fine sediments.
3- Possible impacts on pelagic environment due to suspended sediments.
4- Impaired visual/seascape impacts from the presence of the dredging equipment.
5- Increased noise levels in the area due to dredging operations.

10.10 IMPACT MITIGATION MEASURES

Table 11 below lists the potential impacts identified above describes the corresponding mitigation measures that should be put in place during implementation of the proposed dredging works at B. Fulhadhoo. In summary the impact mitigation measures proposed should entail:

1) Good dredging practice to minimise sediment suspension and dispersal at the dredging sites.
2) Coinciding the dredging activity for the period September and December is important to avoid the rough weather condition of the SW Monsoon and to force the plume to move away from the house into the ocean.
3) Deployment of a turbidity barrier across the beaches and the work site as appropriate depending on location and currents.
4) Environmental monitoring of the project to ensure use of turbidity barriers, disposal of dredged material only at approved sites, and turbidity level do not exceed the local standards.
5) The contractor shall be mandated that appropriate turbidity barriers be deployed at all times during dredging, disposal and construction to ring each and all of the dredging, construction and water disposal activities. The type of barriers selected should take into consideration the shallowness of the area and the prevailing wave and current conditions. The extent of each area ringed should also be carefully determined in order to maximise the effectiveness of the barrier, especially during the proposed dredging activities.
6) Blasting shall be avoided.
7) Sand-bag bund shall be constructed associated with the use of the dredged material for the backfilling and replenishment of eroded beach area on the northern coast.
8) 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.
9) Contractor should take steps to ensure that there is no dumping of oily waste from 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 MITIGATION COST

The mitigation measures associated with significant costs, beyond those of dredge equipment rental and deployment, and good dredging practice, is identified below in Table 9 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

ACTIVITY	IMPACTS	IMPACT PREDICTION			MITIGATION MESURES	Mitigation cost (MVR)
		Magnitude	Revers ibility	Duration		
1. Cutting entrance channel Excavation of channel and mooring areas	Loss of benthic biota and seagrass	L	R	M		
	Modification of current and wave pattern	L	R	S		
	Sedimentation from dredging	M	R	M	Deploy turbidity barriers to prevent sedimentation on seagrass and coral colonies Dredging should be completed in shortest time	10,000 cost of barrier

					possible. Dredging during low tides or slack tides	
	Attenuation of light in water column	L	R	S	Apply above measures to control sediment dispersion	
	Increased ambient noise level	L	R	S	All construction work that produces significant noise should be undertaken during day time to minimize noise pollution. Provide ear muffs for construction workers to wear when using machinery that produce significant noise.	1,000 cost of earmuffs
2. Dredged material disposal	Increased ground water salinity	L	R	S	Leave the material in rain prior to disposal	
	Leakage of sediments during transport to disposal site	L	R	S	Containing the sediment in the truck to minimize leakage	2,000 cost of leak proof rubber sheet
3. Social impact: the people	Provide island accessibility	H	R	M	Major positive impact of the project	
	Employment	M	R	S	Short term employment	

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

Not implementing the proposed island access channel small mooring area and the jetty implies that the local population of Fulhadhoo will not be able to access the island easily. The locals will face considerable challenges as to basic need of accessing the island. There is no alternative to achieving socio-economic development without proper safe access to the island and developing an access channel mooring are and jetty to access the island is considered to be a necessity. However, the proposed location for the development of island access channel, mooring basin and jetty construction on the southern side the island is not suitable for various reasons discussed in detail in this report. Therefore shifting the proposed development to the northern side will bring much of the anticipated socio –economic benefits of the project.

It is believed that a number of environmental impacts will be generated from the proposed development access channel, small mooring area and jetty in Fulhadhoo. Although no impacts on the environment will be associated if the proposed development does not go ahead, the development will grant accessibility to the island, which is a basic need, throughout the year in all weather conditions. The project will open up the island and will bring more economic opportunities and contribute directly and indirectly to health, wellbeing and growth of the community.

Given the range of benefits that the proposed development will bring the project has been considered important and "No-Development" Option has been considered not favorable for the proposed development and decided to go ahead with the alternative development option discussed in this section.

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 OPTIONS

11.2.1 Relocation of proposed island access

As mentioned in the report the initial request for the development of access and jetty construction work in Fulhadhoo was selected without discussions with the people of the island. Proposed area for access channel dredging and mooring basin is already deep if not deeper than water depth that can be achieved from dredging. Also there is already a fairly robust jetty in the same area. However, the southern side is extremely rough and the existing jetty cannot be used. Even-though the water depth of the lagoon on the southern side can accommodate larger vessels, wave action in the lagoon is making it difficult to use the lagoon for mooring Dhonis and boats. Southern lagoon of Fulhadhoo is not suitable for mooring particularly during rough weather conditions. The existing jetty is rarely approachable or usable due to rough wave action. The proposed access to the southern side very far from the frequently travelled destination islands in the atoll eg: Eydhafush Thulhaadhoo, Hithaadhoo and Goidhoo (***Figure 29***)

Above are the main reasons for requesting to relocating the proposed island access, mooring area and jetty development in Fulhadhoo. The main advantage of the proposed new location is that from experience the islanders have learned that the location is the calm area (point) that can be used for island access throughout the years in almost all weather conditions. The area has been used, and still using, by the locals to anchor their vessels during. Closer to the islands frequently travelled by the

island community. Therefore they strongly believe that proposed new location would be the best location to create island access and mooring facilities in Fulhadhoo.

MHI in principal have agreed to relocate the proposed island access to the new location during the scoping meeting.

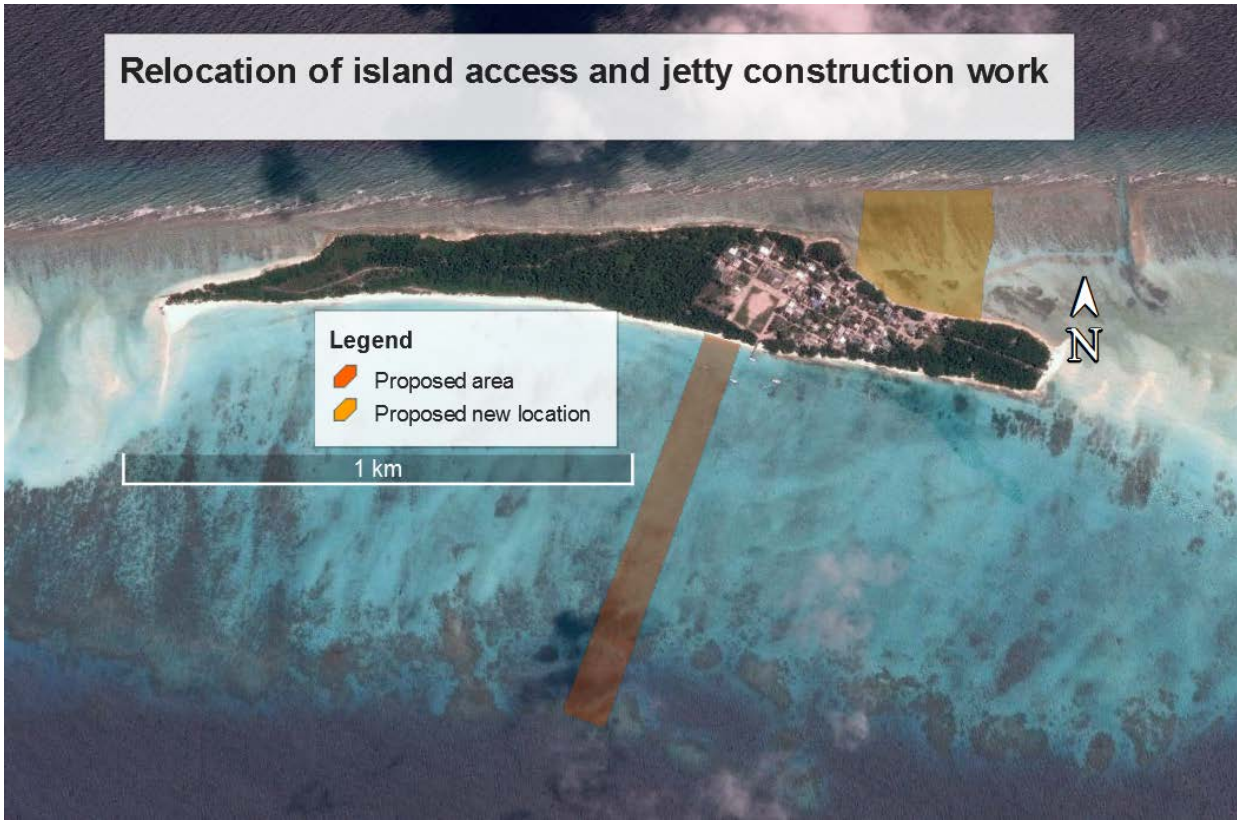


Figure 29: Showing the proposed location and the alternative relocation area at the eastern coast of B. Fulhadhoo.

11.2.2 Existing environment of the proposed new location for island access

The proposed new location for island access is on the eastern side centrally located on the northern coastline of Fulhadhoo. The area is extremely shallow 0.5-1m reef flat. No live corals are found. Reef -flat has a hard substrate the lagoon area consist of rubble and medium to coarse size coral sand. Small seagrass patches are found in the near-shore areas. The outer reef is exposed for oceanic swells. Even the new location might have access difficulties some days of the year during the NE monsoon period.

11.2.3 Alternative location analysis

Two potential location to accommodate the island access and jetty development project in Fulhadhoo is analyzed (***Figure 30***). Initially proposed island access and jetty location on southern side and proposed new location (relocation) are evaluated as an alternative analysis for the project based on environmental and socioeconomic criteria including:

- Practicality and usability

- Economic viability
- Environmental justifiability
- Social acceptability
- Sustainability

Figure 30: Relocation and alternative access design options Fulhadhoo

Based on the above five criteria, location of island access, mooring basin and jetty on southern side and northern side of the island are weighed with scores given for each each location 1 to 5. The purpose of developing a scoring system is weight the options to obtain a favourable location on the criteria proposed by considering alternatives in terms of accessibility, economic viability (cost of construction), environmental justifiability and social acceptability Table 10. Based on these three components the island package on the northern side and southern side of Fulhadhoo are presented below;

1- With access channel and small mooring area (requires dredging) 31.15m long 4 m wide T-jetty with 40x40m mooring basin and 24m wide 624m long channel dredged material used leveling and replenish the eroded beach (Southern side)
2- Access channel and small mooring area (requires dredging) 31.15m long 4 m wide T-jetty with 40x40m mooring basin and 24m wide 207m long channel dredged material used for backfill (northern side)

The total for all factors gives an overall weight of the location Table 11. The highest total score provides the most desirable and preferred alternatives and vice versa.

Table 10: Alternative access design

Criteria	Northern side	Southern side
Practicality and usability	Easy access Rough at times (rarely) Boats can anchor alongside the jetty Depth limit by dredging Close to the urban area of the island Limited space for anchoring May become filled with sediment (maintenance time to time)	Rough most of the days of the year Large space for anchoring Difficult to approach and moor alongside the jetty unusable days are more than usable days Existing jetty rarely used Far from the other islands in the Atoll and Goidhoo

	Not rough once inside the mooring area Closer to the other islands in the Atoll	
Economic viability	Channel and mooring area dredging required Dredging cost Maintenance dredging may be required from time to time May need protection to prevent filling maintenance dredging may required	A jetty is already constructed No dredging required Very strong and costly coastal protection might provide calms area
Environmental feasibility	Channel and mooring basin dredging Change in the hydrodynamic of the coastline May trigger erosion Frequent filling of the dredged area Sedimentation and associated problems to the reef Mitigation cost higher	No dredging very minimal destruction to reef flat Minor hydrodynamic changes to the coast Unlikely to trigger erosion Mitigation cost lower Less practical, unlikely to be useful
Social acceptability	Close to the urban area Currently used by the locals to anchor their boats Mooring basin too small Extra safety once inside the mooring area Limited mooring area	Far from urban area and other islands of the atoll Anchor far from the jetty, dinghy's are required to go to Dhoni
Sustainability	Environmental damage associated with dredging May cause long term erosion problem Overall development cost and the maintenance cost will likely be higher	No dredging, less environmental damage, overall cost will be less Unlikely to cause major erosion problem Aesthetically more acceptable

1.1.1 Assessment of the weights of options for alternative design

The following Table 11 shows the weighted scores of the alternative access design analysis exercised for the proposed for the island access and jetty construction project in B. Fulhadhoo .

Table 11: Weighted scores of alternative location analysis

Criteria	Northern side	Southern side
Practicality and usability	4	1
Economic viability	1	2
Environmental justifiability	3	4
Sustainability	3	3
Social acceptability	5	1
Total	**16**	**11**

Based on the options analysis construction of island access and jetty on northern side scored higher than the southern side. Although the score of economic viability and environmental justifiability of the project on the southern side is higher, practicality, usability, social acceptability and the sustainability score of the project shifting to the northern side scored more. Therefore alternative option in favor of developing the island access and the jetty on northern side of Fulhadhoo was preferred because it is socially more acceptable, practical and usable hence more sustainable in the long terms than the originally proposed option to develop the island access on the southern side of the island.

1.1.2 Preferred Alternative

The preferred alternative design for island access in Fulhadhoo is therefore the option to relocate the island access and jetty project on the northern side of the island

1.1.3 Mitigation measures for the preferred alternative

The mitigation measure for this option would more or less same as the mitigation measure analysed for the project in the relevant section. As the major envisaged impact from the preferred option would impacts associated with channel and mooring basin dredging and sedimentation from backfilling and beach replenishment work. Two design options are shown in Figure 25.

1.1.4 Impact foot print

Impact foot print based on the preferred option to develop B. Fulhadhoo island access and jetty construction project on the northern side of the island is shown in ***Figure 31***. The impact of the project is most likely to be confined to the northern side of the island only.

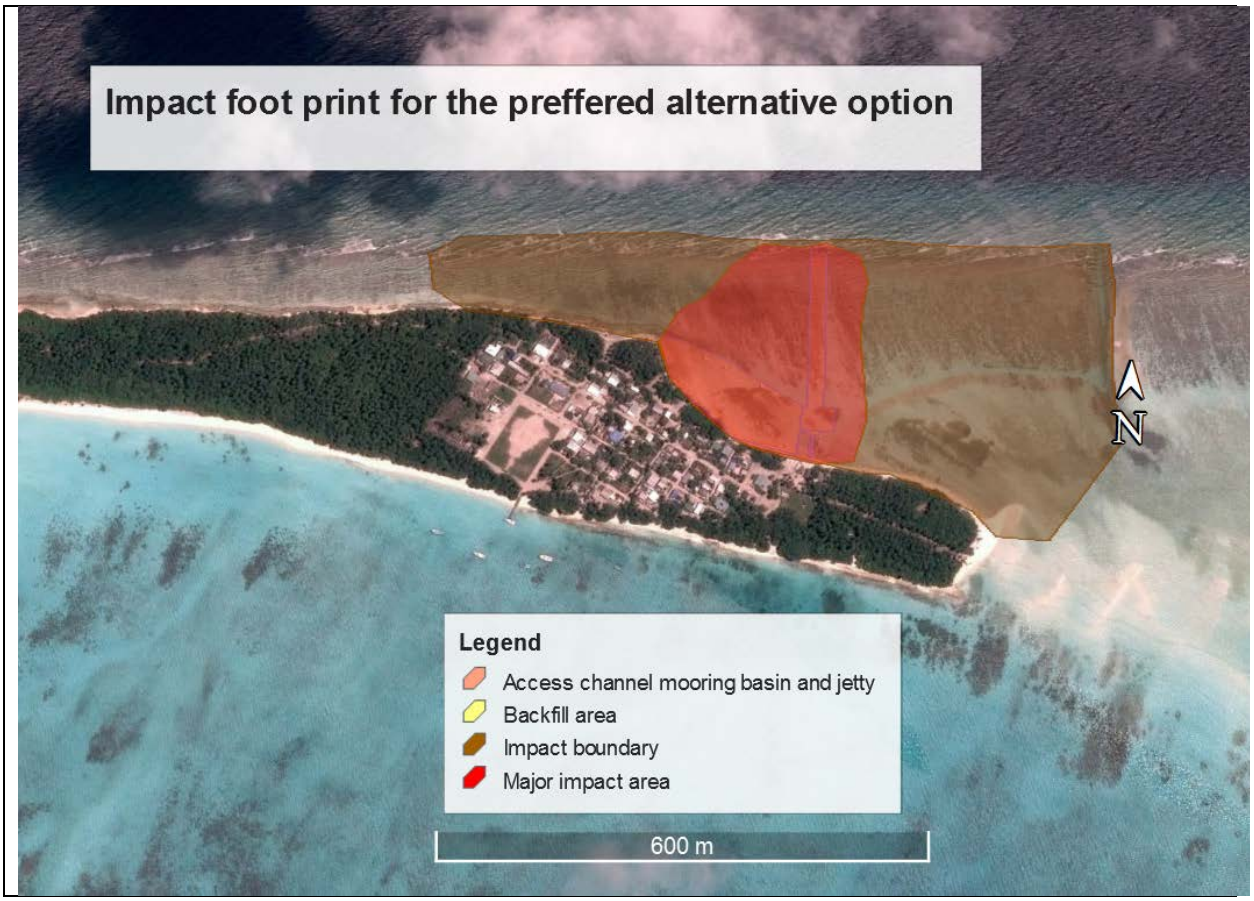


Figure 31: Impact foot print for the preferred alternative location

12 ENVIRONMENTAL MONITORING PLAN

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 (turbidity, sulphate, 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.

The purpose of environmental monitoring plan (EMP) is to monitor or control the environmental effects of the proposed project. It should be based on compliance, verification, feedback, and know-how. It is therefore suggested that the Contractor carries out the EMP. The EMP should be able to provide responses to the following three questions:

a) Why is monitoring being conducted?
b) What specifically is being carried out?
c) How are the data and information to be used in planning and decision-making?

Table 12, ***Table 13*** and ***Table 14*** shows the details of the proposed monitoring aspects including the monitoring parameters, indicators, baseline, proposed methods, frequency and estimated costs

Table 12: Monitoring of the shoreline, beach profiles and coastal environment

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 years after completing the dredging activities.	100/ trip
Beach profiles	coastal changes	Requires to re-establish the baseline following the construction	Beach profile surveys	Bi-annually in the first two years after completing the dredging activities.	100 / trip
Currents	Nearshore currents	Baseline to be collected immediately constructions are over, especially on southern side	Drogue survey	Bi-annually in the first two years after completing the dredging activities.	100/trip

Table 13: Monitoring of the reef environment

Parameter / Method	Frequency of Monitoring	Purpose	Estimated cost (USD)
Benthic cover by major life forms (live, dead, rock rubble and sand)	Once six months after dredging	Indicative of the changes in the live coral cover	200/trip
Fish population / visual census	Once six months after dredging	To assess broad scale change in the ecological status of the coral reefs (increase / decrease of herbivores, etc.)	

Table 14: Monitoring of the sea water quality

Type	Parameters	Locations	Frequency	Estimated cost (USD)
In situ monitoring / sampling and testing from a laboratory	Dissolved oxygen Turbidity (NTU) Nitrates Sulphates TDS	All locations marked	Bi-annual	200/ 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 6.

12.2 MONITORING REPORT

Based on the data collected, a detailed monitoring report will be compiled annually and submitted to the relevant government authorities for compliance. The report will include methodologies and protocols followed for data collection and analysis, quality control measures and indicate the uncertainties.

Table 15: A tentative schedule for submission of EIA monitoring report to EPA

	2017	2018				2019				2020			
	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Monitoring report, Operational Phase													

13 CONCLUSIONS

This EIA has been carried out on the basis that it is necessary to carry out island access , channel and mooring basin dredging and T- jetty construction work in B. Fulhadhoo and to maintain the required depth to provide safe navigation, access accommodate vessels travelling to the island. The environmental impact assessment study shows there are two main activities that would cause minor to moderate negative environmental impacts. Those, in order of minor to moderate impact, are:

1. Channel and mooring basin dredging
2. Jetty construction and backfilling

Of these a long term impact would be from dredging and beach backfilling and nourishment of eroded beach on the northern side of the island. Potential erosion/accretion and adjustment of the existing beach to create a new equilibrium with the surrounding environmental conditions are likely to extend to medium to long term. These impacts would be cumulative occurring over long period of time and so can be managed through proper monitoring and addressing them in a timely manner. Based on the scale of dredging and beach nourishment work projects that is taking place in Maldives, impacts associated with the proposed dredging activity is insignificant. The positive socio economic impacts from the proposed development outweigh the temporary negative impacts of dredging.

The study has evaluated alternative locations for the project and recommended shifting the project from the proposed location from southern side to northern side of the island. Even though there is relatively insignificant impact from this project the report has come-up with an extensive monitoring programme that will keep on monitoring coastal and marine environmental changes associated with the development to 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 in the report will be duly implemented and recommendations are given due consideration, it is concluded that the benefits of island access development project on the selected location in northern side of in B. Fulhadhoo will substantially outweigh its imposition on the environment.

14 REFERENCES

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15 ANNEXURES

Annex 1: Approved Terms of Reference (ToR) for the Project

Annex 2: Approved site plan

Annex 3: Jetty construction detail plans

Annex 4: List of participants in council meeting and scoping meeting

Annex 5: Seawater quality test

Annex 5: Commitment letter from the proponent

Annex 6: Letter from B. Fulhadhoo Atoll Council

Annex 8: Details of consultants contributions to the report

Annex 9: Bathymetry

Annex-1.

بسم الله الرحمن الرحيم

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Environmental Protection Agency EPA

No: 203-EIARES/138/2017/88

Draft Terms of Reference for Environmental Impact Assessment for Jetty construction and island access project, B Fulhadhoo South Maalhosmadulu Atoll

The following is the Terms of Reference (ToR) following the scoping meeting held on 11/06/2017 for undertaking the EIA of the proposed Jetty development a Project at B. *Fulhadhoo South Maalhosmadulu Atoll.* The proponent if the project is *Ministry of Housing and Infrastructure.*

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 to the project** -Describe the purposed artificial beach development project and, if applicable, the background of the project and the tasks already completed. Clearly identify the rationale and objectives to enable the formulation of alternatives. Define the arrangements required for the environmental assessment and how coordination between other consultants, project engineers, contractors and government institutions will be carried out.

2. **Study area** - Submit a minimum A3 size scaled plan with indications of the proposed infrastructure. Specify the agreed boundaries of the study area for the environmental impact assessment highlighting the proposed development location, size and important elements of the proposed jetty development project. The study area should include adjacent or remote areas, such as relevant developments and nearby environmentally sensitive sites (e.g. coral reef, sea grass, marine protected areas, special birds site, sensitive species nursery and feeding grounds). Relevant developments in the areas must also be addressed including residential areas, all economic ventures and cultural sites.

3- **Scope of work**- Identify and number tasks of the project including site preparation, construction and decommissioning phases. The following tasks shall be completed:

Task 1. Description of the proposed project – Provide a full description and justification of the relevant parts of 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 proposed development are:

- Construction of 31.15m long T-jetty with 4m width walkway.
- Ground leveling the jetty area.
- Dredging near Jetty area 40mX40m square area.
- Dredging new entrance channel 24m width & 624.13m length
- Measures to protect environmental values during construction and operation phase;

Environmental Protection Agency
Green Building, 3rd Floor, HandhuvareeHingun
Male', Rep. of Maldives, 20392
Tel: [+960] 333 5949 [+960] 333 5951
Fax: [+960] 333 5953
Email: secretariat@epa.gov.mv
Website: www.epa.gov.mv

- 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)

jetties, and lagoon area:
- Justification for the selection of these locations;
- Labour requirements and (local) labour availability;
- Housing of temporary labour, and
- Emergency plan in case of spills (diesel, grease, oil)

The EIA report should investigate possibilities for alternatives:
- Operation and positioning options;
- Alternative locations: have these been considered and if so, give arguments why these alternatives have not been selected, and

Power water, and sewerage:
- Sources of power and water during the construction phase ;
- Detail solid waste disposal mechanisms, equipment used and periodicity (how often?).

Waste management:
- Materials to be collected and management, waste reduction and recycling;
- Transportation mechanisms and costs;

Ground levelling and beach nourishment activities:
- Access channel and mooring area size, location, including oceanographic justification and map;
- Quantity of dredged material;
- Beach nourishment details including locations and width
- Ground levelling work

Task 2. Description of the environment – Assemble, evaluate and present the environmental baseline study/data regarding the study area and timing of the project (e.g. monsoon season). 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 will 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 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

- Shoreline of the construction area
- Vegetation line of the construction area
- Offshore/coastal geology and geomorphology (use maps);
- Bathymetry (bottom morphology) (use maps);
- (Seasonal) patterns of coastal erosion and accretion (see appendix for monitoring details), and
- Characteristics of seabed sediments to assess direct habitat destruction and turbidity impacts during construction;

Hydrography/hydrodynamics (use maps)

- Tidal ranges and tidal currents;
- Wave climate and wave induced currents;
- Wind induced (seasonal) currents;
- Sea water quality measuring these parameters: temperature, pH, salinity and turbidity

Ecology

- Identify marine protected areas (MPAs) and sensitive sites such as breeding or nursery grounds for protected or endangered species (e.g. coral reefs, spawning fish sites, nurseries for crustaceans or specific sites for marine mammals, sharks and turtles). Include description of commercial species, species with potential to become nuisances or vector.
- Benthic and fish community monitoring around the impact area ;

Socio-economic environment

- Demography: total population, sex ratio, density, growth and pressure on land and marine resources;
- Income situation and distribution
- Economic activities of both men and women (e.g. fisheries, home gardening, fish processing, employment in industry, government);
- Seasonal changes in activities;
- Land use planning, natural resource use and zoning of activities at sea;
- Accessibility and (public) transport to other island;
- Services quality and accessibility (water supply, waste/water disposal, energy supply, social services like health and education);
- Community needs;
- Sites with historical or cultural interest or sacred places (mosques, graveyard).

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. Include permits and approvals in the EIA document.

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

- Impacts on marine habitats including damages to coral reefs and seagrass communities, fish stocks, protected areas and protected species;
- Changes in erosion/sedimentation patterns, which may impact shore zone configuration/coastal morphology;
- Temporary sediment dispersal in water column (turbidity at the dredging site, beach noursihment areas and jetty construction areas), possibly resulting in changes in visibility, smothering of coral reefs and benthic communities and affecting fish and shellfish etc.;
- Impacts on landscape integrity/scenery.

Impacts on the socio-economic environment

- Impacts on employment and income, potential for local people to have (temporary or long term) job opportunities (and what kind) in the execution of the works;
- Disturbance to local natural resource users such as fishing areas, other tourism ventures;
- Impacts to nearby industrial establishments;
- Impact equity (economic activities, employment, income);

Construction relatedhazards and risks

- Pollution of the natural environment (e.g. oil spills, discharge of untreated waste water and solid waste, including construction waste);
- Risk of accidents and pollution on workers and local population.

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". The report should highlight how the location was determined. 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. Mitigation measures to avoid or compensate habitat destruction, e.g. temporal sediment control structures, coastal protection structures to reduce erosion. 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– 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;
- Erosion and accretion changes;
- Temporal sedimentation rates on nearby coral reefs, benthic system and seagrass beds;
- Condition of the sensitive ecosystems and marine resources;
- Environmentally sound removal of dredging and other equipment including construction materials, and
- Employment of available local labour force.

Task 8. Stakeholder consultation, Inter-Agency coordination and public/NGO participation) – Identify appropriate mechanisms for providing information on the development proposal and its progress to all stakeholders, government authorities such as Ministry Environment and Energy, Ministry of Housing and Infrastructure, Island and Atoll Council, local community, government agencies, engineers/designers, development managers and members of the general public. The EIA report should include a list of people/groups consulted, their contact details and summary of the major outcomes.

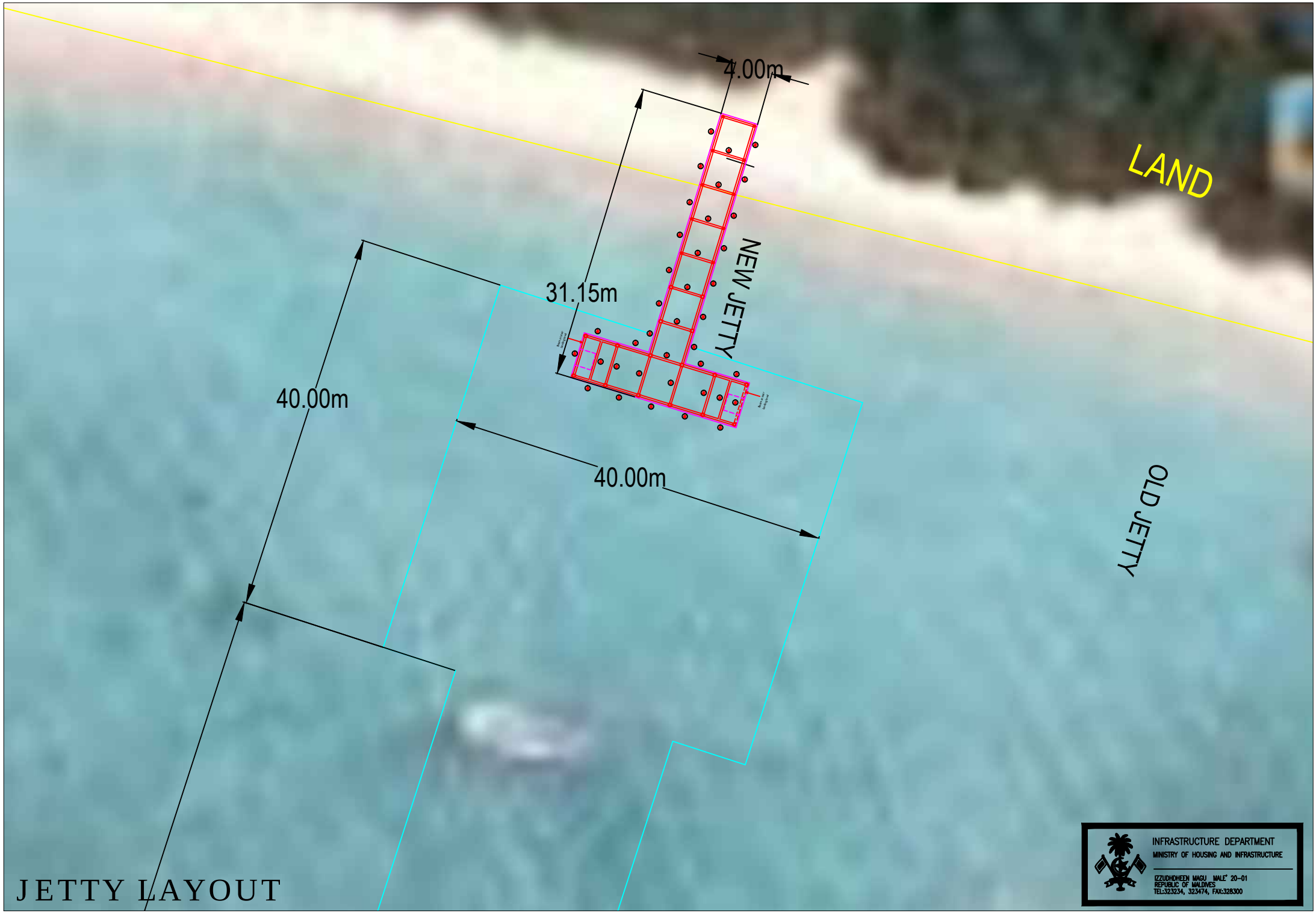
Presentation- The environmental impact assessment report, to be presented in digital format, will be concise and focus on significant environmental issues. It will contain the findings, conclusions and recommended actions supported by summaries of the data collected and citations f or any references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

Timeframe for submitting the EIA report – The developer must submit the completed EIA report within 6 months from the date of this Term of Reference.

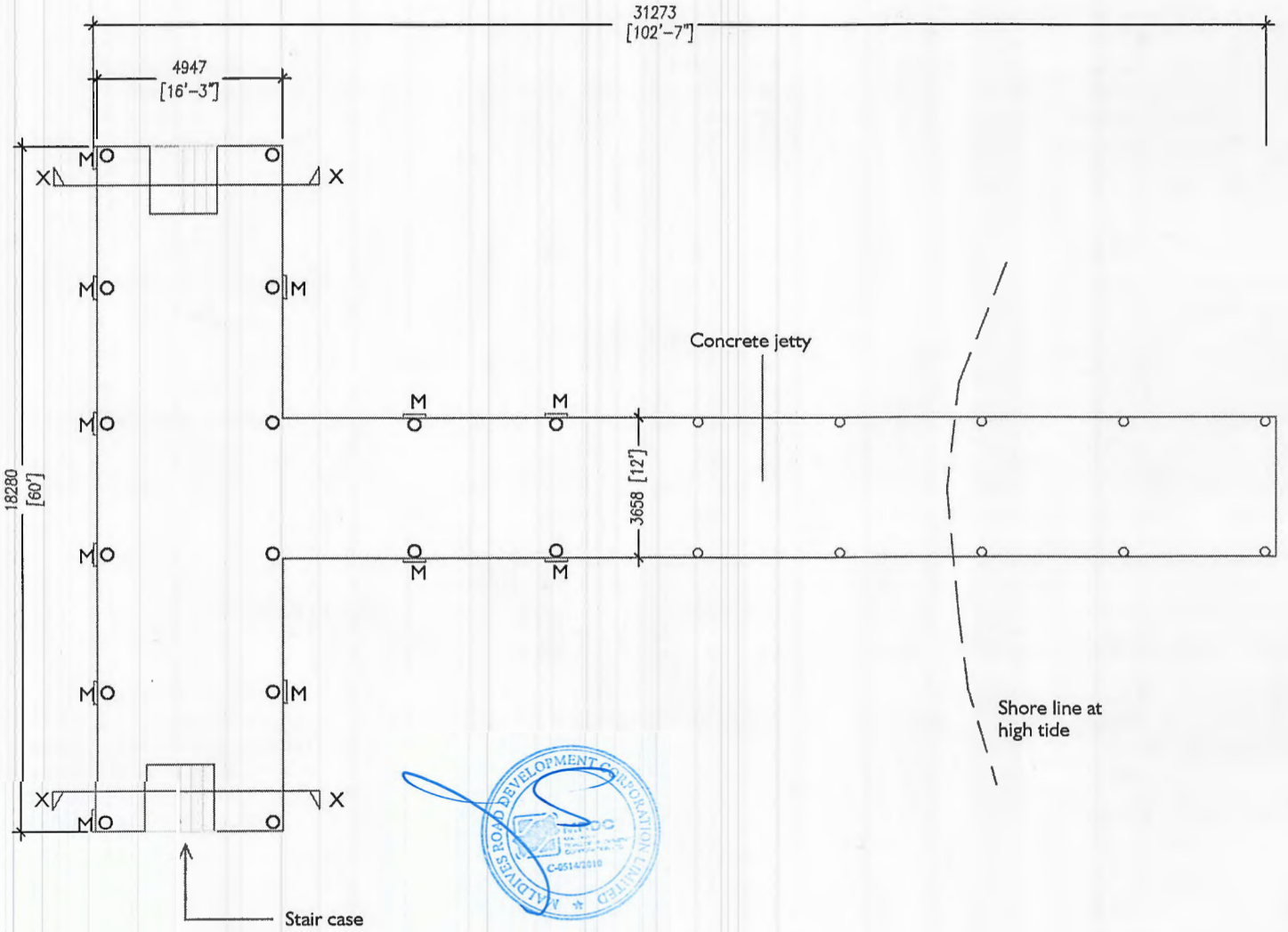
18 June 2017

Annex-2.


*Fulhadhoo
INFRASTRUCTURE DEPARTMENT
MINISTRY OF HOUSING AND INFRASTRUCTURE
IZZUDHEEN MAGU MALE' 20-01
REPUBLIC OF MALDIVES
TEL:323234, 323474, FAX:328300
JETTY LAYOUT



JETTY LAYOUT

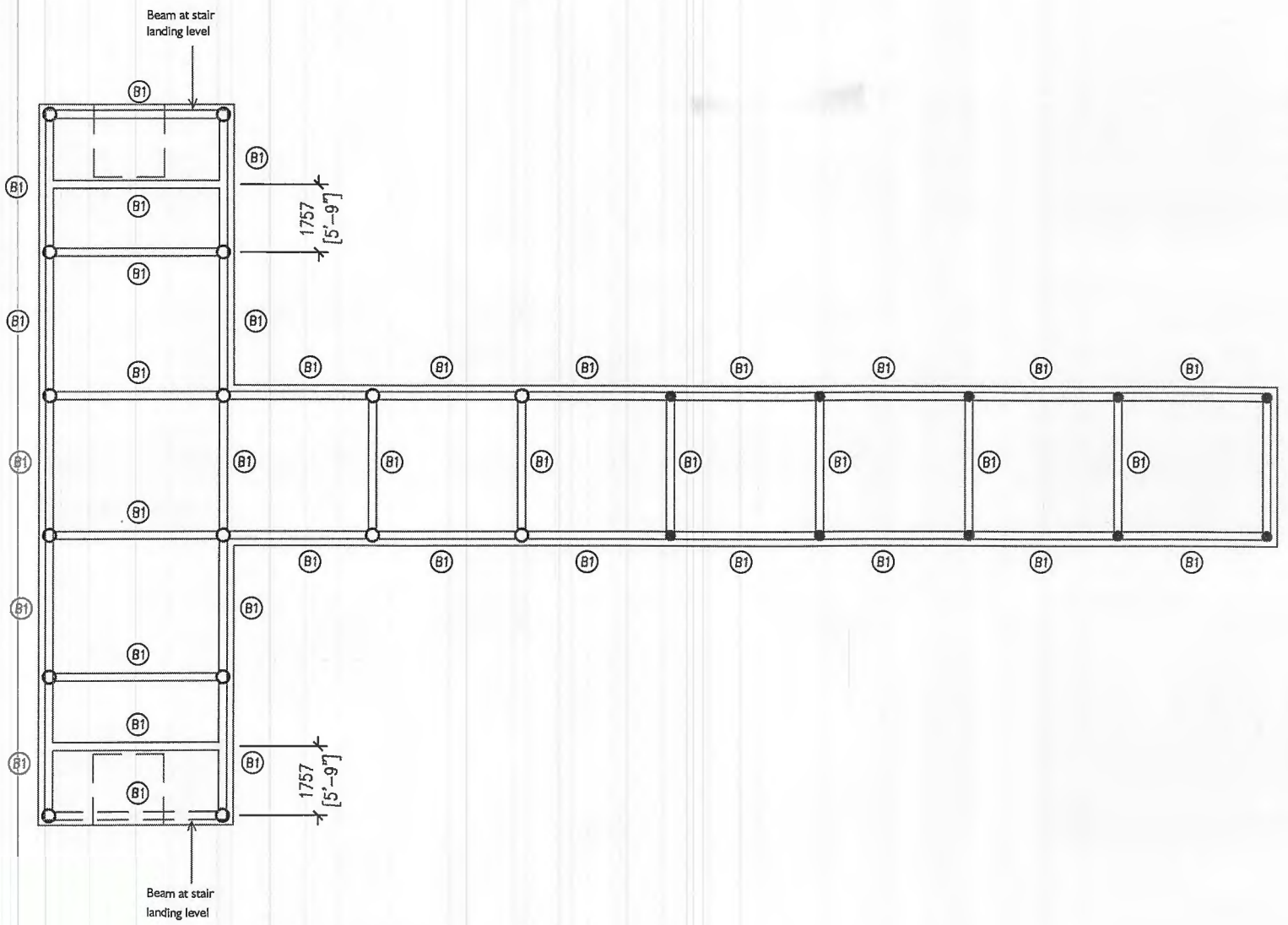


JETTY PLAN

SCALE 1:250

Note;
M-Mooring Hook

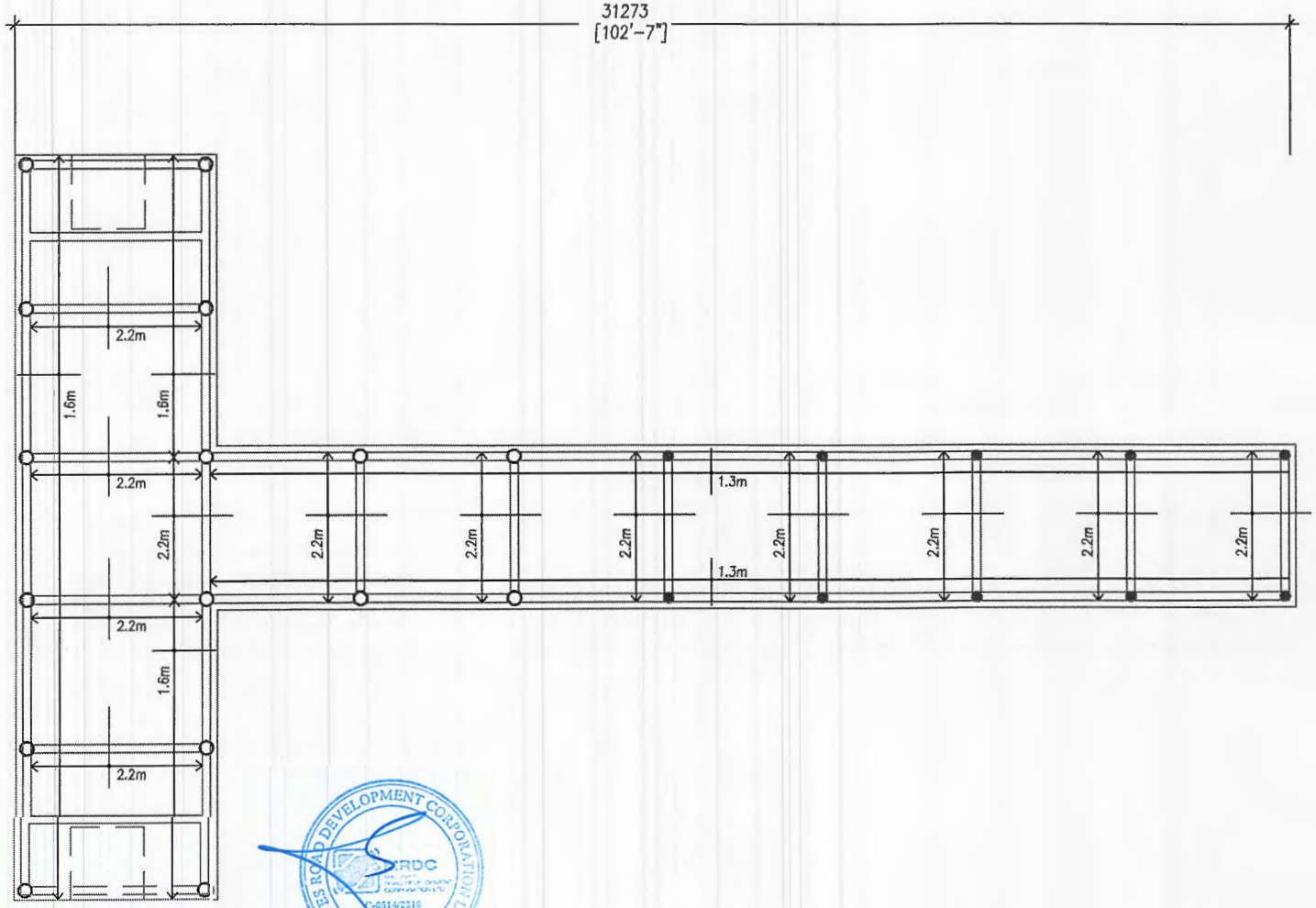
INFRASTRUCTURE DEPT.



BEAM PLAN

SCALE 1:250

INFRASTRUCTURE DEPT.

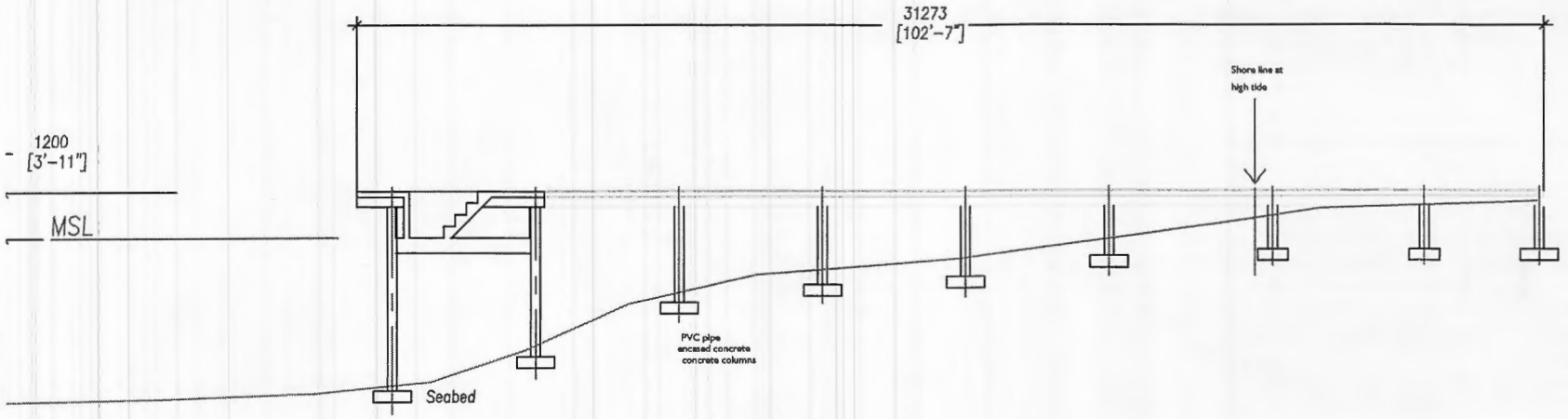


SLAB REINF. PLAN

SCALE 1:250

SLAB
150MM THICK
BOTTOM T12 @ 150 B/W
TOP T12 @ 200 B/W + T12 @ 200 AS SHOWN
COVER 35mm

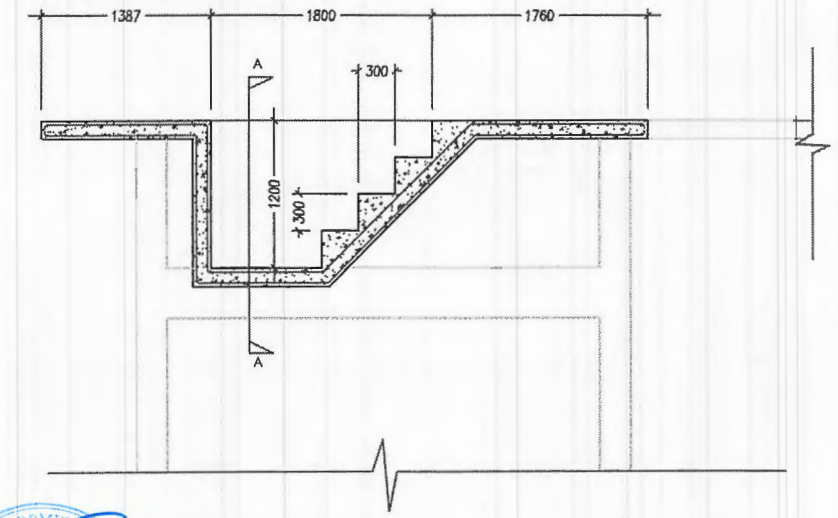
INFRASTRUCTURE DEPT.



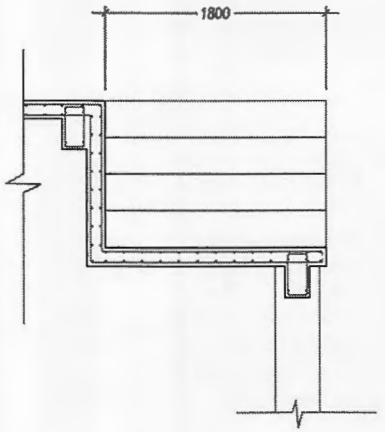
MINISTRY OF HOUSING AND INFRASTRUCTURE
REPUBLIC OF MALDIVES

MALDIVES ROAD DEVELOPMENT CORPORATION LIMITED
MRDC
C-051-4/2020

INFRASTRUCTURE DEPT.
MINISTRY OF HOUSING AND INFRASTRUCTURE



SECTION X-X

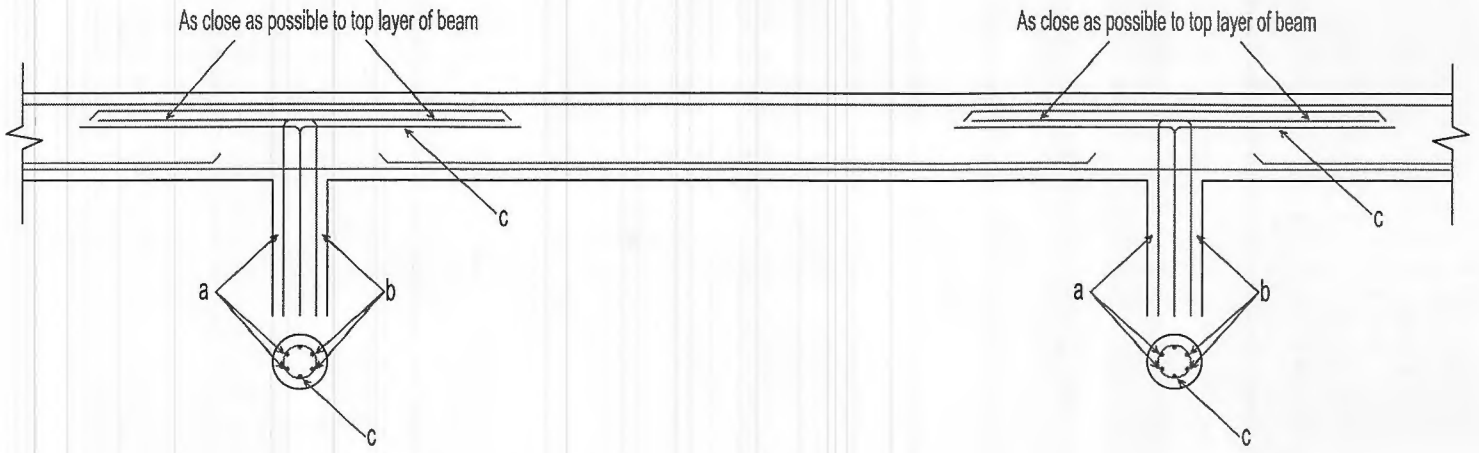


SECTION A-A

STAIR CASE DETAIL

SCALE 1:50

INFRASTRUCTURE DEPT.

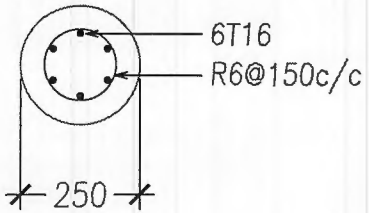


Note: Shear links not shown for clarity

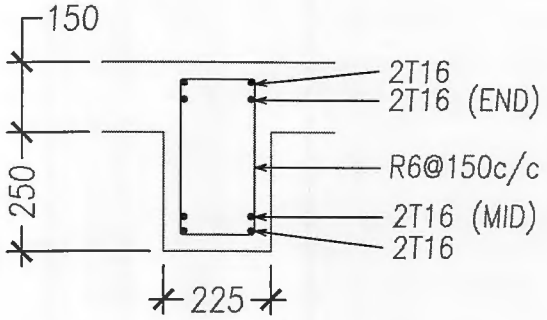
COLUMN - BEAM FIXED CONNECTION DETAIL

SCALE 1:25

INFRASTRUCTURE DEPT.



CIRCULAR COLUMNS
All encased in PVC pipes



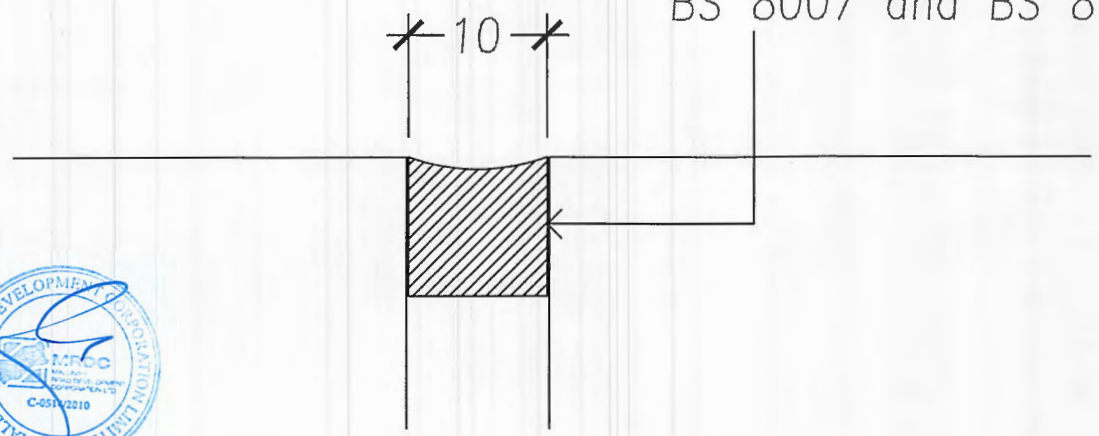
B1

NOTE:
COLUMN CONCRETE COVER = 50mm
BEAM CONCRETE COVER = 40mm
Foundation for circular columns are
1200 x 1200 x 300
T12@150 BW at bot

STRUCTURAL DETAIL

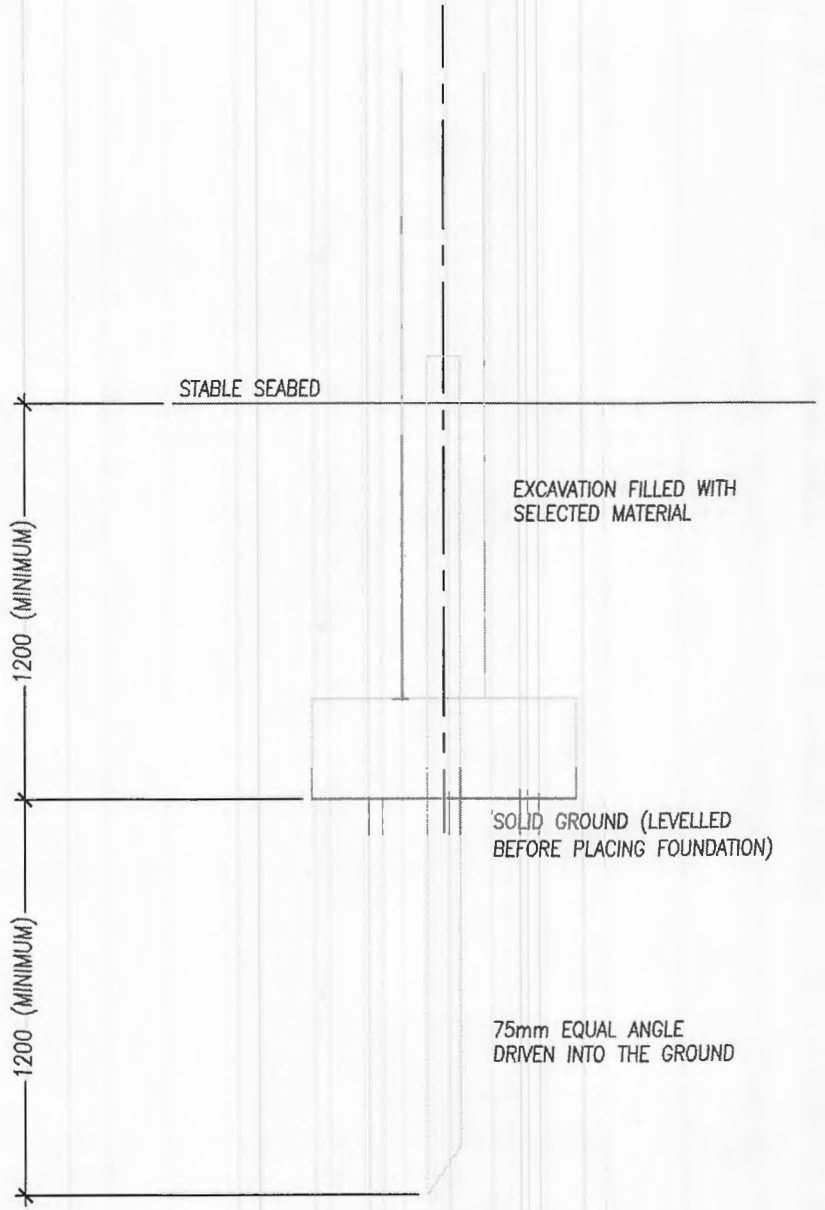
SCALE 1:20

INFRASTRUCTURE DEPT.



EXPANSION JOINT

INFRASTRUCTURE DEPT.



FOUNDATION PAD DETAIL

SCALE 1:20

INFRASTRUCTURE DEPT.

Environmental Protection Agency
Male', Rep of Maldives

Meeting: Jetty construction in ADh. Mandhoo, 12. Rasgetheemu, B. Fehendhoo and B. Fulhadhoo
Date: 11/06/2017
Time: 13:00

MEETING ATTENDANCE

	Name	Designation	Office	Email	Phone No.	Signature
01	Mahmood Rijaz	Consultant		Mahmood Rijaz@gmail.com	7781039	
02	Nafha Anjaz	Environment Analyst	MHI	enu@housing.gov.mv	7721554	
03	Anoosha Hashim	A. Project officer	MHI	enu@housing.gov.mv		
04	Mariam Shidha	Snr Research Officer	EPA	mariyam.shidha@epa.gov		
05	Aminath Mohamed	Asst. Project officer	EPA	aiminath.mohamed@epa.gov		
06	MOOSA NASEEM	President	Fehendhoo Council			
07	ALI AZHAR	Asst Director	Fulhadhoo Council	baafulhadhoo@gmail.com	7775808	
08	AHMED ASIF	Council	fulhadhoo Council	"	7787992	
09	HUSSAIN RASHAD	council Rees	R. RASGETHEEMU	RASGETHEEMOFFICE@gmail.com	7777409	
10	Farhana Fahmy	Senior Research officer	EPA	farhana.fahmy@epa.gov.mv	9874988	
11	Fathimath Reenu					
12	Hashim Nabeel					

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

WATER QUALITY TEST REPORT

Report No: 500173891

Customer Information:
Mahmood Riyaz
H.Hithifaiy

Report date: **15/06/2017**
Test Requisition Form No: **900175736**
Sample(s) Recieved Date: **13/06/2017**
Date of Analysis: **13/06/2017 - 13/06/2017**

Sample Description	Rasgatheem	Fehendhoo	Fulhadhoo	**TEST METHOD**	**UNIT**
Sample Type	Sea Water	Sea Water	Sea Water		
Sample No	83187020	83187021	83187022		
Sampled Date	05/06/2017	05/06/2017	05/06/2017		
PARAMETER	**ANALYSIS RESULT**				
Physical Appearance	Clear with particles	Clear with particles	Clear with particles		
pH	8.21	8.06	8.22	Method 4500-H+ B. (adapted from Standard methods for the examintation of water and waste water, 21st edition)	-
Salinity	34.43	34.09	34.22	Method 2520 B. (adapted from Standard methods for the examintation of water and waste water, 21st edition)	‰
Temperature	20.9	20.6	20.8	Electrometry	°C
Total Dissolved Solids	26200	26000	26100	Electrometry	mg/L
Turbidity	0.763	0.258	0.353	HACH Nephelometric Method (adapted from HACH 2100N Turbidimeter User Manual)	NTU

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

Checked by

Afnan Farooq
Laboratory Executive Gr.1

Approved by

Mohamed Eyman
Assistant Manager, Quality

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 provided by the customer

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

Proponents Declaration

Re: EIA for Island access and Jetty project in B.Fulhadhoo

As the proponent of the proposed project we guarantee that we have read the report and to the best of our knowledge, all information relevant to this project in terms of project description, project construction works and operational aspects provided here are accurate and complete.

As the Proponent of the project; we assure you our commitment to undertake the proposed mitigation measures and monitoring programme given in the report.

Signature:

Name: Fathimath Shaana Farooq

Designation: Director General

On behalf of: Ministry of Housing and Infrastructure

Date: 09 July 2017

Annex-7.

بسم الله الرحمن الرحيم

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ތ ފުލުގެ، ބާއަތޮޅު، ދިވެހިރާއްޖެ

Secretariat of the South Maalhosmadulu Fulhadhoo Council

323-MIS/2017/16 :ނަންބަރ

ފުވައްސ ހަދާ ގަކް ފަހަރަކަށް

ތާވަލީ ކަނޑާ ދިއުން ބަދަލު ދިނުން

ކަނޑާ ނަން:

Draft environmental impact assessment for island access and jetty construction project in Fulhadhoo , Baa· Atoll

ބަލަހައްޓާ ފަރާތް: ތަބަދަލު ވާހަކަ

ދަތުރު: ކައުންސިލްގެ ކަންތައް

ކަނޑާ ނަން: ފުލުގެ ކައުންސިލްގެ ލިޔަންފަ

ތާރީޚް: 3 ފެব്രുവരി 2017 ގަ: 1:00

ސޮއި

ލިޔުއްވި ފަރާތުގެ ނަން ނުވަތަ ކުރީގައި ދިވެހި ބަސް ބަދަލުކުރާ ގޮތް

3 ފެব്രുവരി 2017

Secretariat of Southmaalhosmadulu Fulahadhoo Council ދެކުނުމަޑުއުލުދޫ ފުނަދޫއިރ ފުލުގެ ކައުންސިލްގެ ލިޔަންފަ

Tel: 6600057, Fax:6600057 ފޯނ: 6600057، ފެކްސ: 6600057

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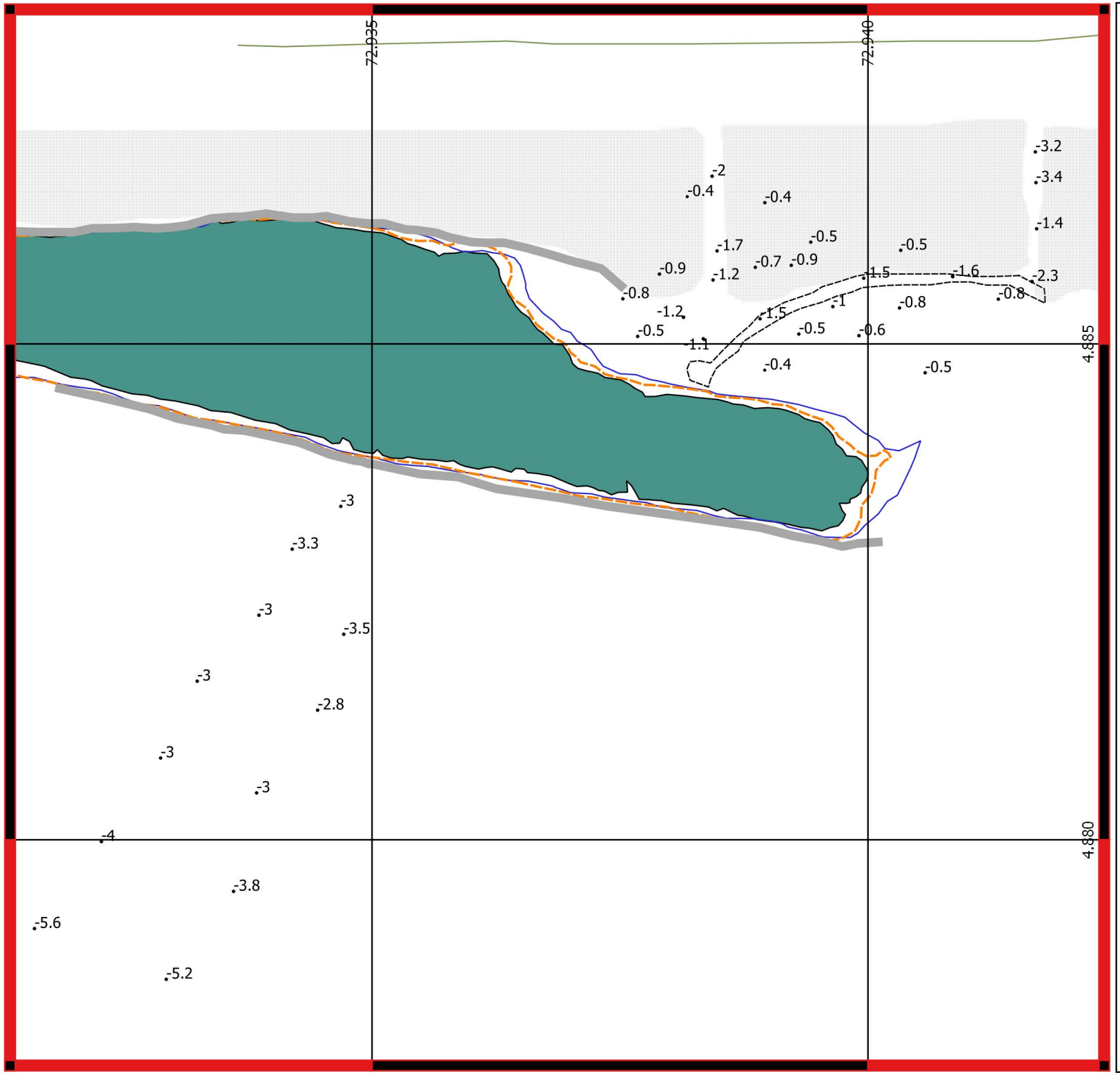
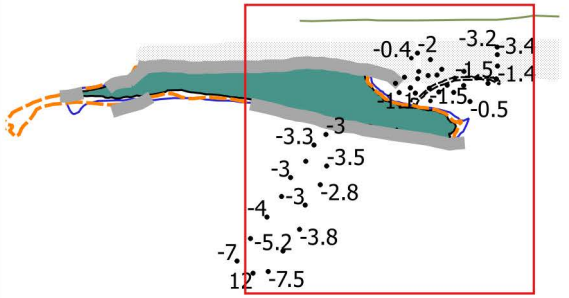
Chapter	Name of Consultant	Registration No.	Signature
Introduction	Dr. Mahmood Riyaz	(EIA 03/07)	
Project Description	Dr. Mahmood Riyaz	(EIA 03/07)	
Administrative and regulatory framework	Dr. Mahmood Riyaz Dr. Mohamed Shiham Adam	(EIA 03/07) (EIA 01/07)	
Methodology	Dr. Mahmood Riyaz Dr. Mohamed Shiham Adam	(EIA 03/07) (EIA 01/07)	
Existing Environment	Dr. Mahmood Riyaz Dr. Mohamed Shiham Adam	(EIA 03/07) (EIA 01/07)	
Stakeholder consultation	Dr. Mahmood Riyaz	(EIA 03/07)	
Potential impacts and mitigation measures	Dr. Mahmood Riyaz Dr. Mohamed Shiham Adam	EIA 03/07) (EIA 01/07)	
Alternatives	Dr. Mahmood Riyaz	(EIA 03/07)	
Environmental Monitoring plan	Dr. Mahmood Riyaz	(EIA 03/07)	
Conclusions	Dr. Mahmood Riyaz	(EIA 03/07)	



B.Fulhadhoo Bathymetry



Legend

- Depth (m)
- Reef end
- beach Rock
- Reef Flat
- Aug 2003 Beach End
- Aug 2016 Beach end
- Dredged path
- Vegetation

0 100 200 300 m

All depths related to MSL
Datum WGS 84
Surveyed on: 8th June 2017