ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

For

ESTABLISHMENT OF A KATSUOBUSHI PROCESSIING FACILITY IN HITHADHOO, ADDU CITY

December 2015

Prepared for

Yours Maldivian Addu Katsuobushi Pvt. Ltd.

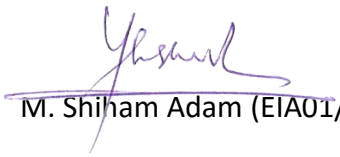
Consultants

M Shiham Adam (EIA01/07)

Mohamed Ahusan

Consultant's Declaration

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



M. Shiham Adam (EIA01/07)

27 December 2015

Proponent's Declaration

As the proponent of the proposed project, I guarantee that I have read this Environmental Impact Assessment report thoroughly and that, to the best of my knowledge, all the information provided in it is accurate and complete. I further assure my commitment to the environmental monitoring plan and associated costs proposed in this report.

Name: MOOSA ASIM

Designation: DIRECTOR

Date: 31-12-15

Table of Contents

1. Non-technical summary (Dhivehi)

1. ތިމާވެއްޓަށް އަސަރު ކުރާ މިންވަރު ބަލާން ކުރާ މި ރިޕޯޓަކީ، އައްޑޫ އަތޮޅު ހިތަދޫގެ އާރު. އޭ. އެފް ސަޕްލައިޒްގެ ފުއަރިސް ކޮމްޕެނީއަށް އައްޑޫ ކަޓްސުބުޝި ޕްރޮސެސިންގ ފެސިލިޓީ އެއް ޤާއިމްކުރުމާ ބެހޭގޮތުން އެކަމަށް ހިންގުމަށް ހުށަހެޅިފައިވާ ކަޓްސުބުޝި އުފައްދާ ފެކްޓަރީގެ ސަރަޙައްދުން ތިމާވެއްޓަށް ކޮށްފާނެ ނެގެޓިވް އަސަރު ދެނެގަނެ އެ އަސަރުތަކެއް ވިޔަސް ކުޑަކުރެވޭނެ ގޮތްތައް ހުށަހެޅުމަށް ތައްޔާރުކޮށްފައިވާ ރިޕޯޓެކެވެ. މި ރިޕޯޓަކީ މިނިސްޓްރީއޮފް އެންވަޔަރަންމަންޓް އެންޑް އެނަރޖީ އިން މި މަޝްރޫއަށް ހުއްދަ ދިނުމަށްބަލައި ފިޔަވަޅު ކުރަންޖެހޭ ބައެކެވެ.

2. ދިވެހިރާއްޖޭގެ ތިމާވެށި ހިމާޔަތްކުރުމާއި ބެހޭ ޤާނޫނު (4/93) ގެ ދަށުން ދިވެހިރާއްޖޭގައި ހިންގާ އެކި އެކި ތަރައްޤީގެ މަޝްރޫއުތަކުން ތިމާވެއްޓަށް ނުރައްކާގެ އަސަރެއް ކުރާތޯ ބެލުމަށްޓަކައި "ތިމާވެއްޓަށް އަސަރު ކުރާ މިންވަރު ބަލާންކުރާ ރިޕޯޓް" ހަދަންޖެހޭ ގޮތެއްގެ މަތިން، ތަރައްޤީކުރުމުގެ ކުރިން ޖެހިފައެވެ. މިގޮތުން، މި ރިޕޯޓް ތައްޔާރުކުރެވިފައިވަނީ "ތިމާވެއްޓަށް އަސަރު ކުރާ މިންވަރު ބަލާންކުރުމަށް ރިޕޯޓް ހެދުމާއިބެހޭ ގަވާއިދު – 2012، ގައި ކަނޑައަޅާފައިވާ ގޮތުގެ މަތިންނެވެ. މި ރިޕޯޓްގައި މައިގަނޑުގޮތުގައި ހިމެނިފައިވަނީ މަޝްރޫއު ހިންގާ ސަރަޙައްދު ތަނަށް ޖިއޮގްރަފިކަލްގޮތުން އެއްކޮށްލެވިފައި ހުރި މައުލޫމާތާއި މި މަޝްރޫއުގެ އެކިއެކި ބައިތަކުގެ ސަބަބުން ތިމާވެއްޓަށް ކުރާނެކަމަށް ލަފާކުރާ އަސަރުތަކެވެ.

3. ތަރައްޤީގެ މި މަޝްރޫއު ހިންގުމަށް ހަމަޖެހިފައިވަނީ އައްޑޫ އަތޮޅު ހިތަދޫގެ ހުޅަނގު ދެކުނުން ސަރަޙައްދުގައެވެ. މި މަޝްރޫއު ހިންގުމަށް ހަމަޖެހިފައިވާ ބިމަކީ ރަށުގެ މިފަރާތުގެ ގޮނޑުދޮށުން ގޮތްގަނޑުކޮޅު 65 މީޓަރު އެތެރޭގައިވާ ބިމެކެވެ. މިއީ ރާއްޖޭގެ ރަށްރަށުން އާއްމުކޮށް ފެންނަ ބޮޑެތިގަސްތަކާއި، ކުރުފޮތިގަސް ހިމެނޭ ގަސްގަހާ ހެދިފައިވާ ސަރަޙައްދެކެވެ. އަދި މިއީ ރަށުގެ އާބާދީވާ ސަރަޙައްދާއި ދުރު، ދަނޑުވެރިކަން ފަދަ އިންޑަސްޓްރިއަލް މަސައްކަތްތަކަށް ކުރާ ސަރަހައްދެކެވެ.

4. ކަޓްސުބުޝި އުފެއްދުމަށް ބޭނުންވާ ރާމަސް ގެނެވޭނީ ހަމަޖެހިފައިވާ އައްޑޫއަތޮޅުގެ މަސްވެރިންގެ ފަރާތުންނެވެ. މިކަމަށް ބޭނުންކުރާ ހަމައެކަނި ކަޅުބިލަމަސް ކަޅުގައި ޖެއްސޭ، މަސްވެރިން އަތުން މަސްގަނނަ އިރު އޮފްލޯޑްގެ މަސްވެރިކަމުގައި ބާނާފައި ހުންނަ އެހެނިހެން ބާވަތްތަކެއް ވެސް (މިސާލަކަށް ކަންނެލި)، މަސް ވިއްކުމަށް ހިފަވަރު ދިރުމުގެ ގޮތުން ގެދަން ހަމަޖެހިފައެވެ. ކަޅުބިލަމާއި އެކު ގަނނަ ކަންނެލި ބޭނުންކުރާނީ އެހެނިހެން ބާވަތްތަކުގެ ތަކެތި އުފެއްދުމަށްޓަކައި އަތޮޅުގެ ރައްޔިތުންނަށް ވިއްކުމަށް ހަމަޖެހިފައެވެ.

5. ދިވެހިން ކުރާ ކަނޑުމަހުގެ މަސްވެރިކަމަކީ މުޅި އިންޑިއާ ކަނޑަށް ފުޅާވެފައިވާ އާބާދީއަކުން ކުރާ މަސްވެރިކަމެއްކަމުން، މި އާބާދީ އިން ކުރާ މަސްވެރިކަން ރާވައި ބަލަހައްޓަނީ މަސްވެރިކަމުގެ ސަރަހައްދީ ޖަމްޢިއްޔާއެއް ކަމުގައިވާ އިންޑިއަން އޯޝަން ޓޫނާ ކޮމިޝަން (އައި.އޯ.ޓީ.ސީ) އިންނެވެ. ކަޅުބިލަ މަހަން 2014 ވަނަ އަހަރު ހުރިހާ ސްޓޮކް އެސެސްމަންޓް ދައްކާގޮތުގައި އިންޑިއާ ކަނޑުގެ ކަޅުބިލަމަހުގެ މަސްވެރިކަން ކުރެވޭނީ މި ބަވަތުގެ ވަރުގެ އާބާދީއަކުން ގެއްލުންނުވާ މިންވަރަކަށެވެ. ނަމަވެސް 2015 ވަނަ އަހަރުގެ ރިޕޯޓުކުރަ ކަންކަމުގެ ސްޓޮކް އެސެސްމަންޓް ދައްކާގޮތުގައި ރިޕޯޓުކުރަ ކަންކަމުގެ ސްޓޮކް ވަނީ އާބާދީއަށް ހިނގުކަން އަންނަ މިންވަރަށް މަސްވެރިކަން ކުރެވިފައެވެ. އަދި މި ކަންކަމުގެ މަސްވެރިކަން މިވަގުތު ކުރެވެމުންދަނީ އާބާދީއަށް ގެއްލުންނުވާ މިންވަރަށްވުރެގިނައިންނެވެ.

6. މި ހުށަހެޅޭ ތަރައްޤީގެ މަޝްރޫޢަކީ ކަޓްސުއޯބުޝި އުފެއްދުމަށްޓަކައި ބޭނުންކުރާނީ 100 ގުނަ 100 ފޫޓުގެ އިމާރާތަކާއި، ބޭނުންވާ އިތުރު ފެސިލިޓީ އަދި، މުވައްޒަފުން ދިރިއުޅުމަށް އެޅޭ އިމާރާތެއް އެކައި ހިންގުމަށް ހުށަހަޅާ މަޝްރޫޢުއެކެވެ. މިކަމަށް ބޭނުންކުރުމަށް ހަމަޖެހިފައިވާ ތަކެތި ބޭރުން އެތެރެކުރެވޭ ތަކެއްޗެވެ. އިމާރާތްކުރުމަށް ބޭނުންކުރާ ތަކެތި، މަސައްކަތް މިހާރު އަދި އުފެދޭ ކުނި އުފެދުމަށް ބޭނުންކުރާ މަދުވެރި މިކަމަށް ހުރިހާ ވެއްޖެ.

7. ކަޓްސުއޯބުޝި އުފެއްދުމުގެ އުސޫލަކީ މަސްކުރުނބޮޅިގައި އުފެއްދޭ ކުނީގެ ތަކެތިގައި މަހިގަނޑުތެރޭގައި ހިފެހެއްޓި އޮސްޓިން ފަސްގަނޑު ނުވަތަ ގޮވަސް ސާފުކުރުމުން އުފެދޭ ކަރުދާސް ބޯފެނަށްވެ. މީގެ އިތުރުން މަސް ކާނެގުގެ މަސްގަނޑުގައި ތާ ފެންއި، މަސް ދިރި ޖެހުމަކުން ދަރު އެންދުމުގެ ސަޕްލައި އަޅާ، އަދި މުވައްޒަފުން ދިރިއުޅޭ އިމާރާތުން އުފެދޭ ނަޖިސް ފެނަކީވެސް މި މަސްދޫއިގެ ސަރަޙައްދު އުފެދޭ ތަކެތި ކަމުގައިވެ.

8. ފެކްޓަރީއިން އުފެދޭ ކުނީގެ ތެރެއިން، ކަރުދާސް ފަދަ ކުނިވާ ބާވަތުގެ ތަކެތި ކުނިފުހުގެ ކުރިން، ތިލަ ނުވާނެ ފަރާތް ޓްރީޓްމަންޓް އަކައި ބަންދު ކުރުމަން ވަރު ޖަވާއިދުން، ކަނޑަށް އެކަށީގެންވާ ގޮތަކަށެވެ. މިގޮތަން އެކުލެވޭ ހަމަޖެހިފައިވާ ފެކްޓަރީ ހިންގަން ފާހަގަ ފެރަވަމަ އަރަހުއެވެ އެކަމަށެވެ. އެއީގެ ފެހެން މި ތަކެތިން ދަނޑުވެރިކަން ބޭނުންކުރާ ގަސްކާނާ އުފެއްދުމަށް ވަނީ ހަމަޖެހިފައެވެ. ތަފްސީލް ފެކްޓަރީ ސާފުކުރުމުން އުފެދޭ ފެން ބޭނުންކުރާ ހަމަޖެހިފައިވާ ހާލަތުގައި ފާހަގަ ޑިފެންސް. އަދި މުވައްޒަފުން ދިރިއުޅޭ އިމާރާތުން އުފެދޭ ނަޖިސް ފެން އުފެދޭ ފެކްޓަރީ ސަރަޙައްދުގައި ސެޕްޓިކް ޓޭންކް ބެހެއްޓުމަން ހަމަޖެހިފައެވެ. ފެކްޓަރީއިން އުފެދޭ ކަމަ އާއި އެހެނިހެން ކުނީގެ ބާވަތްތައް އެކުލަވާ ހަމަޖެހިފައިވާ ހިތަދޫގެ ކުނިއެކަތާ ސަރަޙައްދަށެވެ.

9. މަޝްރޫއު ހިންގުމަށް ހަމަޖެހިފައިވާ ސަރަޙައްދުގެ ގިސްބަތަށް ސަރުކާ ދައްކާގޮތުން މި ސަރަޙައްދަކީ ރާއްޖޭގައި އާއްމުކޮށް ހުރި ބާވަތްތަކުގެ ގަސްގަހާގެހި ހުރިހާ ސަރަޙައްދެކެވެ. ނަމަވެސް، މި ސަރަޙައްދުގައި ދިވެހިރާއްޖޭ ހުރިހާ މިންވަރު

ދަށަކަށް ފުރަގަހުގެ ދަށުގައި. ދި ބަދަލު ވަކަނޑައެޅުމުގެ ކޮންސަލްޓަންސީ ސާރވިސަސް ޕްރައިވެޓް ލިމިޓެޑް ދަށުން ކުރިއަށް ގެންދާ ކަންތައްތަކެއް ކަމަށް ވާ ކަމަށް ބެލެވެ.

10. ދި ދަށުގައި ހިމަނާ ހުރި ކަންތައްތަކުގެ ތެރެއިން ކަނޑައެޅިފައި ވަނީ ކާނާ ތައްޔާރުކުރާ ތަނުގެ ކަންތައްތަކާ ގުޅިގެން ކަންތައްތަކެއް ދި ފައިދާގެ ތެރެއިން ކަނޑައެޅިފައި ވާ ކަމަށް ބެލެވެ. ދި ގަނޑުގައި ހުންނަ ކަންތައްތަކުގެ ތެރެއިން ކަނޑައެޅިފައި ވަނީ ގަނޑުގެ ކަނޑާ ދުރުގައި ހުންނަ ކަންތައްތަކާ ގުޅިގެން ކަންތައްތަކެއް ކަމަށް ވާ ކަމަށް ބެލެވެ. ދިހާ ބަލާ ކަންތައްތަކުގެ ތެރެއިން ކަނޑައެޅިފައި ވަނީ ކާނާ ތައްޔާރުކުރާ ތަނުގެ ކަންތައްތަކާ ގުޅިގެން ކަންތައްތަކެއް ކަމަށް ވާ ކަމަށް ބެލެވެ. ދި ކަންތައްތަކުގެ ތެރެއިން ކަނޑައެޅިފައި ވަނީ ކާނާ ތައްޔާރުކުރާ ތަނުގެ ކަންތައްތަކާ ގުޅިގެން ކަންތައްތަކެއް ކަމަށް ވާ ކަމަށް ބެލެވެ. ދި ކަންތައްތަކުގެ ތެރެއިން ކަނޑައެޅިފައި ވަނީ ކާނާ ތައްޔާރުކުރާ ތަނުގެ ކަންތައްތަކާ ގުޅިގެން ކަންތައްތަކެއް ކަމަށް ވާ ކަމަށް ބެލެވެ. ދި ކަންތައްތަކުގެ ތެރެއިން ކަނޑައެޅިފައި ވަނީ ކާނާ ތައްޔާރުކުރާ ތަނުގެ ކަންތައްތަކާ ގުޅިގެން ކަންތައްތަކެއް ކަމަށް ވާ ކަމަށް ބެލެވެ.

11. ދި ދަށުގައި ހިމަނާ ހުރި ކަންތައްތަކުގެ ތެރެއިން ކަނޑައެޅިފައި ވަނީ ކާނާ ތައްޔާރުކުރާ ތަނުގެ ކަންތައްތަކާ ގުޅިގެން ކަންތައްތަކެއް ކަމަށް ވާ ކަމަށް ބެލެވެ. ދިހާ ބަލާ ކަންތައްތަކުގެ ތެރެއިން ކަނޑައެޅިފައި ވަނީ ކާނާ ތައްޔާރުކުރާ ތަނުގެ ކަންތައްތަކާ ގުޅިގެން ކަންތައްތަކެއް ކަމަށް ވާ ކަމަށް ބެލެވެ. ދި ކަންތައްތަކުގެ ތެރެއިން ކަނޑައެޅިފައި ވަނީ ކާނާ ތައްޔާރުކުރާ ތަނުގެ ކަންތައްތަކާ ގުޅިގެން ކަންތައްތަކެއް ކަމަށް ވާ ކަމަށް ބެލެވެ. ދި ކަންތައްތަކުގެ ތެރެއިން ކަނޑައެޅިފައި ވަނީ ކާނާ ތައްޔާރުކުރާ ތަނުގެ ކަންތައްތަކާ ގުޅިގެން ކަންތައްތަކެއް ކަމަށް ވާ ކަމަށް ބެލެވެ. ދި ކަންތައްތަކުގެ ތެރެއިން ކަނޑައެޅިފައި ވަނީ ކާނާ ތައްޔާރުކުރާ ތަނުގެ ކަންތައްތަކާ ގުޅިގެން ކަންތައްތަކެއް ކަމަށް ވާ ކަމަށް ބެލެވެ.

12. ދި ދަށުގައި ހިމަނާ ހުރި ކަންތައްތަކުގެ ތެރެއިން ކަނޑައެޅިފައި ވަނީ ކާނާ ތައްޔާރުކުރާ ތަނުގެ ކަންތައްތަކާ ގުޅިގެން ކަންތައްތަކެއް ކަމަށް ވާ ކަމަށް ބެލެވެ. ދި ކަންތައްތަކުގެ ތެރެއިން ކަނޑައެޅިފައި ވަނީ ކާނާ ތައްޔާރުކުރާ ތަނުގެ ކަންތައްތަކާ ގުޅިގެން ކަންތައްތަކެއް ކަމަށް ވާ ކަމަށް ބެލެވެ. ދި ކަންތައްތަކުގެ ތެރެއިން ކަނޑައެޅިފައި ވަނީ ކާނާ ތައްޔާރުކުރާ ތަނުގެ ކަންތައްތަކާ ގުޅިގެން ކަންތައްތަކެއް ކަމަށް ވާ ކަމަށް ބެލެވެ. ދި ކަންތައްތަކުގެ ތެރެއިން ކަނޑައެޅިފައި ވަނީ ކާނާ ތައްޔާރުކުރާ ތަނުގެ ކަންތައްތަކާ ގުޅިގެން ކަންތައްތަކެއް ކަމަށް ވާ ކަމަށް ބެލެވެ. ދި ކަންތައްތަކުގެ ތެރެއިން ކަނޑައެޅިފައި ވަނީ ކާނާ ތައްޔާރުކުރާ ތަނުގެ ކަންތައްތަކާ ގުޅިގެން ކަންތައްތަކެއް ކަމަށް ވާ ކަމަށް ބެލެވެ.

13. ކަށަވަރު ގުޅުމެއް ނެތުމާ ބަދަލު ދިހާ ކަމުގައި ވާ ކަމަށް ދި ކަންތައްތަކުގެ ތެރެއިން ކަނޑައެޅިފައި ވަނީ ކާނާ ތައްޔާރުކުރާ ތަނުގެ ކަންތައްތަކާ ގުޅިގެން ކަންތައްތަކެއް ކަމަށް ވާ ކަމަށް ބެލެވެ. ދި ކަންތައްތަކުގެ ތެރެއިން ކަނޑައެޅިފައި ވަނީ ކާނާ ތައްޔާރުކުރާ ތަނުގެ ކަންތައްތަކާ ގުޅިގެން ކަންތައްތަކެއް ކަމަށް ވާ ކަމަށް ބެލެވެ. ދި ކަންތައްތަކުގެ ތެރެއިން ކަނޑައެޅިފައި ވަނީ ކާނާ ތައްޔާރުކުރާ ތަނުގެ ކަންތައްތަކާ ގުޅިގެން ކަންތައްތަކެއް ކަމަށް ވާ ކަމަށް ބެލެވެ. ދި ކަންތައްތަކުގެ ތެރެއިން ކަނޑައެޅިފައި ވަނީ ކާނާ ތައްޔާރުކުރާ ތަނުގެ ކަންތައްތަކާ ގުޅިގެން ކަންތައްތަކެއް ކަމަށް ވާ ކަމަށް ބެލެވެ.

2. Non-technical summary

1. The Environmental Impact Assessment (EIA) report carried out for proponent Yours Maldivian Addu Katsuobushi Pvt. Ltd. to develop and operate a katsuobushi plant on a leased plot of land from the RAF area of Hithadhoo Island, Addu City. The EIA is prepared as fulfilment of the requirement by the Ministry of Environment and Energy for granting permission for the Project. Environmental Impact Assessment (EIA) of development projects is a requirement by the Environmental Protection and Preservation Act (EPPA) (law 4/93) of the Government of the Republic of Maldives.

2. This report has been prepared in accordance with the Environmental Impact Assessment Regulations published by the Ministry of Environment and Energy in 2012 and covers environmental and socio-economic impacts arising from the proposed project. Major findings of this report are based on data and information gathered during the field inspection of the existing environment. In addition, expert judgement and published literature were used to predict the possible impacts from the project.

3. The development project is located in the western side of the southern section of Hithadhoo Island, Addu Atoll. The plot is separated from the western beach by about 65m of coastal vegetation. Terrestrial vegetation around the plot area is a mix of salt and salinity tolerant trees and shrubs. The population of the Island is mostly concentrated to the northern end of the island while the southern end is sparsely inhabited resulting in an abundant.

4. Tuna to be processed will be sourced from the local fishermen. While only skipjack tuna will be used to make katsuobushi, other species in the catch (yellowfin tuna and small amounts of bigeye tuna) will also be purchased and processed into other products and marketed to the locals. This is in order to incentivize the fishermen to sell their catch to the proponent and ensure a steady supply of raw materials.

5. Pole-and-line tuna fishery of the Maldives exploits the wider Indian Ocean stocks, the management of which falls on the Indian Ocean Tuna Commission (IOTC). Maldives is a full member of IOTC and takes a lead role in promoting management of the Indian Ocean tuna stocks. Most recent assessments for skipjack tuna (2014) indicate that the skipjack tuna stock is being exploited at safe levels. However, 2015 assessment of yellowfin tuna stocks showed that the stock has been overfished and is being overfished.

6. The development project involves construction of a 100 by 100 feet processing facility, its supporting infrastructure and a staff accommodation block for the employees of the facility. All construction will use general construction materials such as cement, imported river sand

and aggregate, deformed steel bars etc. Construction materials and crew will be transferred to, and waste removed from the facility via existing dirt roads.

7. Major waste stream from the factory would consist of organic waste (fish offal) and blood water from gutting and cleaning raw fish, domestic sewage diluted in flushed water and greywater from the staff accommodation block and ash from the smoking process.

8. Organic waste (consisting of viscera, cuttings, skin and bones) will be collected in leak proof containers and routinely removed from the facility before it becomes putrid. This will be disposed of in the sea by an external party during the first year and later used to make agricultural fertilizer. Blood water and water generated from cleaning the facility will be discharged onto the reef flat on the western side of the island. Septic tanks will be used for the treatment of domestic sewage and greywater from the accommodation block.

9. Assessment of the existing terrestrial environment in the vicinity of the site showed that the area consist of typical island vegetation except for a dominance of coconut palms (*Cocos nucifera*). Site of the project does not contain strong vegetation as it was cleared prior to leasing to the proponent. Small scale farming takes place in plots around the project site.

10. The island being located on the western atoll rim reef and the project site being located on the western side of the island, is in close proximity to the marine environment. The beach is exposed to strong swell waves originating in the Western Indian Ocean. Breaking of waves on the reef creates longshore currents which would allow almost instant mixing and dilution of effluent discharged. Benthic cover on the reef flat/lagoon showed a predominant abundance of seagrass and a lack of live corals and associated benthic fauna.

11. Minimal environmental impacts are predicted for the project. Key negative impacts include a transient deterioration of water quality at the effluent discharge site and likely deterioration of groundwater due to sewage from the accommodation block. Further, a localized reduction in air quality is expected due to gaseous (NOX) and particulate emissions from the smoking process.

12. The project is expected to have a number of positive impacts on the local economy and wellbeing of locals especially fishermen. Firstly, fishermen will be paid a competitive price for their catch in order to ensure a reliable supply of raw materials. The project will also open up employment opportunities for locals. Further, it will contribute to the local economy by outsourcing some aspects of the project such as waste disposal and sea transport of products to Male' and contribute to government's policy of value0addition of fishery catch.

13. Taking into account the limited scale of the project, it is concluded that the negative environmental impacts from the establishment and operation of the katsuobushi processing facility will be limited and reversible. Mitigation measures have been proposed to further reduce the negative effects from the project.

3. Introduction

3.1. Background and context

Pole-and-line tuna fishery is one of the key economic activities of Addu Atoll. With a modern fleet and enthusiastic fishermen, it is a key contributor to the country's pole-and-line caught tunas. Nominal catch statistics of 2013 (MoFA 2013), suggest fishermen from Addu Atoll contributed nearly 5000 tons of tuna to the national catch. This has mostly been disposed for canning and frozen export (mainly) to Thailand. Availability of alternative sources of catch disposal will increase the profitability of fishing operations by reducing the cost of visiting a cannery or tuna collector vessel.

Addu Atoll was declared a City in 2011, constituted by its natural islands as Districts. The council of Addu City envisions a greater involvement of private parties in the local economy by facilitating small to medium scale investments in the islands. As such, the so called Royal Air Force (RAF) area was designated as an industrial area for business to establish facilities for value addition of tuna, agricultural and other light industrial establishments. RAF area is on the southern end of Hithadhoo Island and is mostly uninhabited.

Yours Maldivian Addu Katsuobushi Pvt. Ltd (Registration Number: C-0438/2013) was established in 2013 with the aim to purchase pole-and-line caught skipjack tuna from the local fishermen and process as Katsuobushi for export to the Japanese market. It also aims to produce other value added products that can be marketed locally. For this purpose, the company is investing in a katsuobushi processing facility on a leased plot of land from the RAF area of Hithadhoo District, Addu City.

3.2. Project setting

The proposed project is set in the southern end of Hithadhoo Island, Addu atoll. The Island is located in a NW-SE direction on the protruding north western tip of the atoll on the western atoll rim reef (Figure 1). The population of the island is mostly concentrated to the northern section of the island except for the protected wetland area of Eidhigali kilkhi. The southern end, sparsely inhabited, is mostly home to agricultural farmland and other economic activities. The site for the katsuobushi facility is located on the southwestern side of the island (Figure 2).

Figure 1. Map of Addu Atoll

Figure 2. Project location (green polygon). Equatorial Convention Centre is located in the top of the figure.

The 40,000 square feet plot, previously leased to another party, was transferred to the proponent via the contract, 426-PD/2013/51, between the proponent and the Addu City council (Appendix 1), in September 2013 for a duration of 20 years. The area has been designated to be developed

by the City Council as an industrial zone that would be home for light industrial establishments (Appendix 2). Land plots with areas of 5,000, 20,000 and 40,000 square feet have been allocated and contracted to interested parties. Currently, small scale agricultural activities and a few other developments are underway in the area.

3.3. Key environmental features of the island

The island has two distinct wetland areas, *Eidhigali kilhi* (about 4.5 km north of the site proposed project site) and *Medheaari kilhi* (about 0.5 km north), in the north and south of the island respectively. *Eidhigali kilhi* and its associated *Koattey* area were declared protected on 7th December 2004. *Medheaari kilhi* is now the site of the Equatorial Convention Centre, built for the Seventeenth SAARC Summit of 2012 and has been significantly modified in the construction process. This ecosystem is situated roughly 0.32 km North East of the project site.

To the west of the proposed project site is the coastal vegetation line of the island. The coastal vegetation has remained largely intact along the length of the island except for some areas where development has encroached. The vegetation is roughly 65 m thick near the project site and will act as the first line of defense from severe environmental forces. Another environmental feature of the area is the seagrass bed on the reef flat which can be occasionally found on the western reef flat along the reef this reef system. The island has a fringing reef on the western side that protects the island from ocean induced elements. Figure 3 shows the project location and the key environmental features of the southern section of the island.

Figure 3. Map of the project site (green) and key environments of the area. Orange = wetland area, light green = coastal vegetation, blue = seagrass patches, red = coral reef areas.

3.4. Purpose of the EIA

The purpose of an Environmental Impact Assessment (EIA) is to identify the environmental and socio-economic impacts of a development project, propose mitigation measures of negative impacts and to develop monitoring plans for construction and operational phases of the project. It guides the proponent and relevant personnel on best practices during construction and operation of a facility.

This report was compiled to present the findings of the environmental impact assessment for development and operation of the proposed katsuobushi processing facility at Hithadhoo Island, Addu City. The decision for the EIA (Appendix 3) was based on the Initial Environmental Examination of the project. The development project has been approved by the Ministry of Fisheries and Agriculture (Appendix 4), Maldives Food and Drug Authority (Appendix 5) as well as the City Council of Addu City. This EIA is guided by the Terms of Reference in Apappendix pendix 6.

3.5. Study Area

The terrestrial and marine environment of the project vicinity was studied as part of this environmental assessment. Terrestrial study focused on the coastal vegetation near the project site while the marine component focused on the benthic environment and seawater quality

studies at the proposed effluent outfall location. In addition, physiochemical parameters were analyzed for groundwater obtained from the project site. For detailed location of the study areas, refer to the figure in the Methodology Section. Detailed location of the study areas are in Figure 4.

Figure 4. Locations of terrestrial (TS1-TS4) and benthic surveys (red polygon) as well ground water (plus sign) and seawater (cross) sampling sites. The project site is represented in green.

3.6. Methodology

The EIA regulation 2012 comprehensively describes the stages of the EIA process in the Maldives. The Regulation lists fish processing plants as projects that require an EIA. However, due to the small scale and the expected footprint of the project, it was subject to an Initial Environmental Examination (IEE) on which the requirement for EIA was based on. Scoping meeting for the EIA was held on 5th May 2015. Site specific marine and terrestrial data was gathered during the visit to the site. Other general information on the environment was gathered from various secondary sources including published literature.

3.6.1. Terrestrial surveys

Terrestrial vegetation was surveyed using DAFOR scale of abundance. The DAFOR Scale is a five point abundance scale where the surveyor assigns one of the following categories to the abundance of the plant species present; Dominant, Abundant, Frequent, Occasional and Rare.

Vegetation at fixed areas of interest around the site were observed and a category from the DAFOR scale assigned for the species present.

The DAFOR scale is a measure of abundance that can be easily employed to quantify the vegetation of a site of interest. Main advantage of this scale is that it can be repeatedly used with minimal technical expertise. The main disadvantage of this is that it is a very subjective system open to different interpretations and quantifiable only in a rudimentary way (Groom, Walker and McIntosh, 2011).

3.6.2. Marine surveys

While the proposed facility is located about 70m inland, the wastewater outfall pipe is proposed to be placed on the reef flat on west of the island. Therefore, a marine component was incorporated into the EIA.

Benthic substrate at the proposed effluent outfall location was assessed by randomly photographing the benthic cover of a known area (0.25x0.25m) and analyzing using CPCe (Coral Point Count with Excel Extensions). Percent cover was measured for the following categories;

- Hard coral
- Soft coral
- Rock
- Rubble
- Sand
- Algae
- Seagrass
- Others

Current at the location was studied using the drogue method where a neutrally buoyant object was allowed to drift with the current for a known distance and time. This method of measuring surface currents have several advantages such a requiring minimum equipment and manpower and flexibility to alter the study plan at any time. Limitations associated with this techniques should also be borne in mind.

Fish and invertebrate abundance was not assessed as the water was too shallow (> 80cm) and unfavorable during the survey. However, general observations were made on possible presence of fish and invertebrates.

Bathymetric data was obtained using a custom made tide staff and a GPS, which was made possible due to the shallow water depth at the time of study. The data were then plotted on a Google Earth map of the area.

To assess the water quality at the effluent outfall and groundwater intake areas, samples were obtained in clean PET bottles and stored under cool conditions. The samples were analyzed at the Water Quality Assurance Laboratory of Maldives Water and Sewerage Company (MWSC) lab within 24 hours of sampling.

4. Project description

4.1. Purpose of the project

The objective of the project is to build the necessary infrastructure that would enable the purchase of pole-and-line caught tuna and process as katsuobushi destined for the Japanese market. It will also produce smoked and dried fish and other products targeted at the domestic market. The project is funded by the proponent, Yours Maldivian Addu Katsuobushi Private Limited, registered in 2013.

As the products are not destined for the EU market, the project does not require adherence to EU Directives and requirements. However, the facility will be hygienically acceptable and will be inspected biannually by the Maldives Food and Drug Authority.

4.2. Rationale

One of the policies of Ministry of Fisheries and Agriculture (MoFA) to increase the role of the fisheries industry in the national economy is by allowing small and medium enterprises the opportunity to procure and process tuna from local fishermen. It is through this policy that MoFA licensed the proponent (Appendix 8) to purchase tuna to be processed as katsuobushi and other value added products.

As stated in Section 3.1, the Council of Addu City promotes contribution of small and medium sized business to the local economy by facilitating investments in fish processing, agricultural and light industrial activities. As such, the proponent was authorized to invest in a katsuobushi processing facility in the plot leased from the RAF area (designated for such activities). The project will introduce an alternative disposal option to the local fishermen and will create competition in the market whereby facilitating a higher income for the fishermen. It will also create employment for locals and introduce new food products into the market.

4.3. Duration of the project

The project is expected to commence during the month of September 2015, upon approval from the relevant government ministries and other stakeholder agencies. It is envisaged that the plant will be ready for operations within 18 weeks. The processing facility and the staff accommodation blocks are relatively small compared to other fish processing and packing factories. Further, the project takes place on an inhabited island with existing roads and infrastructure that the facility will draw from. Therefore, a mobilization and decommissioning phase will not exist per se. Equipment and materials will be transported to and from the project site as needed using light pickup trucks via existing roads. A timeline of activities is in Appendix 7.

4.4. Products

The proponent wishes to produce katsuobushi as the main product at the facility with an expected annual production of approximately 200 tons. Katsuobushi, smoked dried skipjack tuna, is an integral part of traditional Japanese cuisine and is consumed in flaked form in different foods. Non-skipjack species, purchased along with skipjack tuna, will be either sold as fresh fish or processed as smoked or dried fish, fish chips and other similar products for the domestic market. From the second year onwards, the proponent plans to utilize fish offal to produce agricultural fertilizer. Besides an added revenue, it will also serve to reduce the negative impacts of disposing the said materials in the environment.

4.5. Species processed

Katsuobushi will be processed from pole-and-line caught skipjack tuna, (*Katsuwonus pelamis*) purchased from fishermen of Addu atoll. Skipjack tuna is an epipelagic and oceanic fish which form large schools, sometimes with juvenile yellowfin tuna. It is the most commercially important species in the Maldives. The pole-and-line skipjack and yellowfin tuna fishery carries an ecolabel of the Marine Stewardship Council certifying that the fishery is being sustainably exploited.

Maldives pole-and-line fishery exploits the wider Indian Ocean stock of skipjack and yellowfin tuna, and to a lesser extent bigeye tuna. All three species are straddling and highly migratory species and so the stocks are managed at the ocean wide scale by the Indian Ocean Tuna Commission (IOTC). Maldives is a full member of the commission and takes a lead role in promoting management of the Indian Ocean tuna stocks. Most recent stock assessments for skipjack and yellowfin tuna were carried out in 2014 and 2015 respectively. The assessed status of skipjack tuna stock showed that the stock was in healthy conditions (IOTC–WPTT16 2014). However, the stock assessment for yellowfin tuna done in 2015 determined the yellowfin tuna stocks to be overfished and subject to overfishing (IOTC-WPTT 17 2015 IOTC-WPTT 17 2015).

Based on the sustainable nature of exploitation and the most recent stock assessment for the species, it can be said that exploitation of the species by the Maldives pole-and-line fishery will not be detrimental to the ecosystem and the stock of skipjack tuna.

4.6. Sourcing and transport of raw materials

The proponent will purchase mixed catch of skipjack tuna (SKJ), *Katsuwonus pelamis*, and yellowfin tuna (YFT), *Thunnus albacares* averaging about 3 ton/day, 5-6 days a week. The catch will also constitute minor amounts of bigeye tuna (*Thunnus obesus*). Although only SKJ is used to make katsuobushi, YFT along with SKJ will be purchased in order to incentivize the fishermen to sell to the facility. The YFT will either be used to make *valho mas* or be filleted, vacuum packed and retailed as frozen tuna.

Tuna will be purchased mainly from vessels landing at Maradhoo Port. Vessels will notify the facility prior to arrival at the port upon which a pickup truck will be used to transport to the facility in leak proof FRP boxes of 1 ton capacity.

4.7. Processing

Production of katsuobushi begins with the purchase of tuna from the local fishermen. Upon arrival at the facility, the tuna will be chilled to 5 degree Celsius to halt the spoilage, which would otherwise reduce the quality of the finished product. The tuna will then be gutted, cleaned and cooked in steel tanks with a cooking capacity of cook 250 kg (in about 100 litres of water) in each tank over stoves fueled by diesel. The cooking tanks will be emptied once a week and the byprodct *garudhiya* distributed among interested parties to be further cooked to make *rihaakuru.* The cooking process will be followed by two stages of smoking using oak wood specifically imported for the purpose. At the end of the second smoking process, the katsuobushi will be cleaned, sorted, packed and is ready to be shipped. Flow diagram for the different stages of the process is presented in Figure 5.

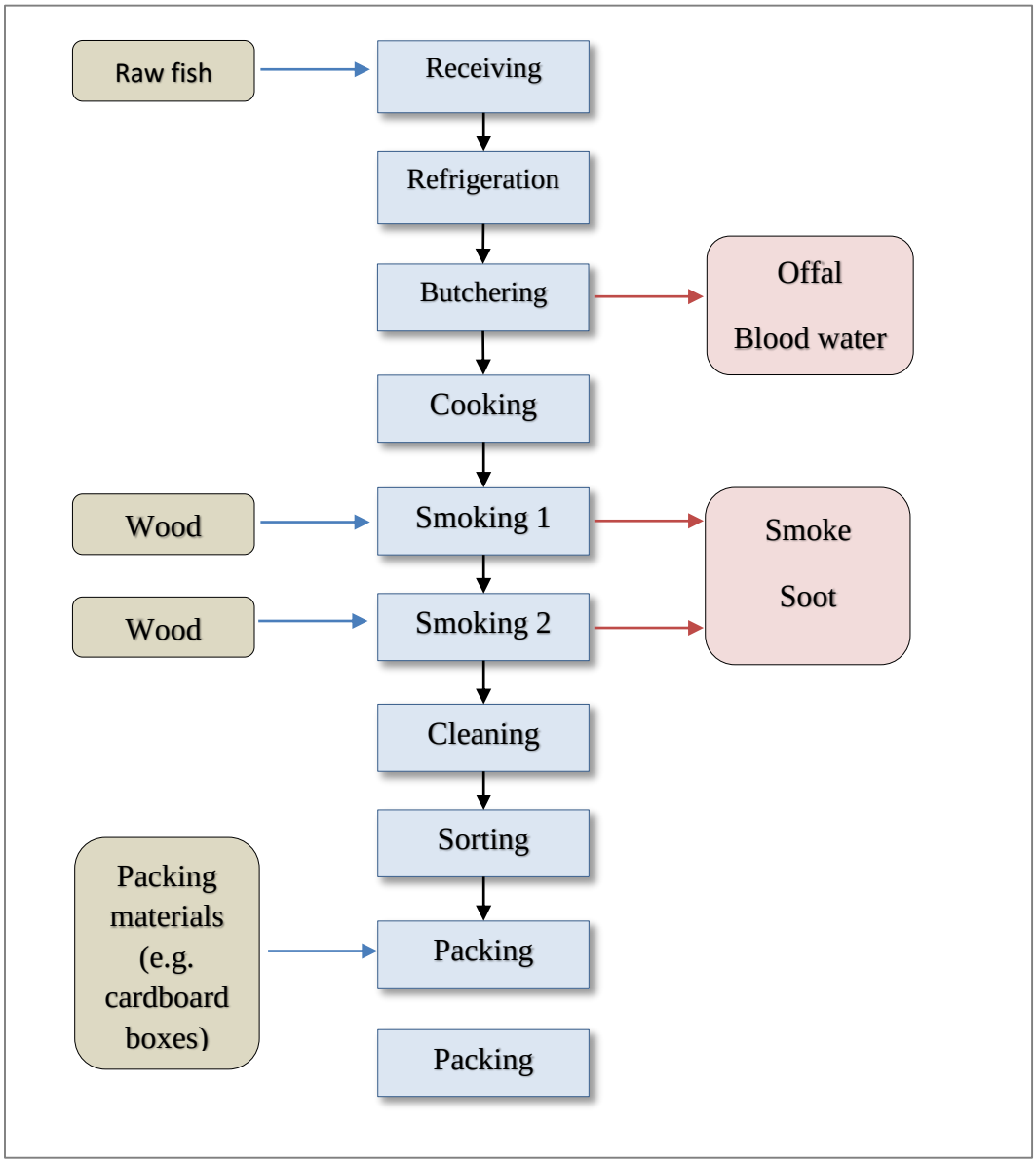


Figure 5. Flow diagram of the main processes in katsuobushi production showing the key inputs and outputs.

4.8. Packaging

Final products (katsuobushi) will be packed loose in specifically imported cardboard boxes and be stored in reefer containers at 5 degree Celsius. Once a shipment is ready, the reefer containers will be transported to the (island) jetty and to container transport vessels and shipped to Male' from where it will be shipped overseas through commercial cargo agents.

4.9. Infrastructure and facilities

4.9.1. Processing facility and accommodation block

The proposed facility consists of a single 100 x100 feet building that will house the required spaces needed for different stages of production (Appendix 9). These include 1) fish receiving area, 2) Refrigeration system, 3) gutting and cleaning area, 4) cooking area, 5) cleaning area, 6) B and C type smoking areas, 7) sorting, 8) packing and 9) storage areas. The facility will be constructed using cement and commercially available hollow cement blocks. Beams and columns for support will be of steel reinforced concrete.

An accommodation block for the staff (Appendix 10) will be located within the factory compound. The building will be a single story structure with 6 rooms, a kitchen and a mess room and will accommodate 20 staff. The accommodation block will be a regular cement mortar building using hollow cement blocks. Detailed site layout of the facility compound is in Appendix 11.

4.9.2. Refrigeration system

Fish spoilage occurs from the onset of death due to bacterial action and metabolic changes that occur within the fish. Fish host bacteria that contribute to deterioration of fish quality. Temperature plays a crucial role in spoilage of raw fish by promoting or preventing proliferation of these bacteria. A hot and humid climate such as in the Maldives can easily spoil fish much faster than temperate climates. Therefore, the facility will utilize a refrigeration system to cool the fish as soon as it arrives at the facility. The system will have a chilling capacity of 5 tons of water to 5 degree Celsius/day using R-134A as the refrigerant. The system will cool about 2.5 tons of fish per tank in 300 litres of water. The water used in the system will be renewed weekly, discharged via the effluent pipes into the lagoon. The water will be sourced from the public water supply grid of the island.

4.9.3. Fuel storage

Diesel will be used as a fuel to cook the tuna and will be consumed at a daily rate of roughly 30 litres/cooking tank (5 tanks in total). Diesel will be purchased in bulk from local suppliers and stored in tanks located within the facility compound. A storage tank of 800 litre capacity is to be constructed for this purpose. The tank will be a bunded, steel structure to prevent accidental spills or leaks from seeping into the ground.

4.10. Construction and transport of materials

General construction materials such as steel, timer, aggregate, river sand and cement etc., all imported and sourced from local suppliers will be the key construction materials for use in the construction phase of the project. All construction works will be outsourced to a local party.

Construction materials and waste to and from the project site will be transported using existing roads in pickup trucks, by the contracted party. Construction waste is to be disposed of at the public waste disposal site.

4.11. Water sources, intake and filtration mechanism

4.11.1. Freshwater supply

It was initially proposed to use seawater for refrigeration and gutting fish. However, use of seawater at the facility affects the quality of the final product and also reduces the lifetime of machinery and utensils due to corrosion and rust. Therefore, water requirement for these processes will be fulfilled from the public water supply of the island. It is estimated that water consumption at the facility will remain between 1.5 to 2 m^3/day.

Additional requirement of freshwater at the staff accommodation and for washing and cleaning purposes will be met using groundwater from wells placed within the facility compound. The freshwater supply will be augmented by rain water from the roof, collected by standard gutter system.

4.12. Effluent discharge mechanisms

Effluent produced at the facility will consist mainly of blood water from gutting and cleaning and used water from the refrigeration plant. These will be discharged via a purpose laid pipeline, using gravity flow, into the western side lagoon. The proposed effluent outfall location is the ocean ward side of the island and therefore has good mixing and flushing of the water column. While extension of the effluent outfall beyond the reef edge would be the preferred option, the scale (product throughput) of the project relative to the cost impede such heavy investments. However, should monitoring during operational phase reveal consistent deterioration of water quality in the lagoon, the developer is committed in extending the outfall outside the lagoon into the open ocean. Observations have shown relatively strong water movement occurs in the area and therefore dilution would occur to insignificant levels following release. Alternatively, it is recommended that the proponent consider connecting the effluent to the public sewerage network that is to be established in the near future.

4.13. Effluent outfall pipeline

PVC pipes of 4 inch diameter will be laid from the facility to the lagoon for effluent discharge (**Error! Reference source not found.**). The route for the pipeline has been chosen to make use of n existing path across the coastal vegetation and therefore does not require removal of any vegetation. A small excavator will be used for this purpose. Effluent outfall location will be roughly 40 m from shore and the entire pipeline from the facility will be about 140 m.

All internal plumbing within the facility and staff accommodation will use high pressure PVC pipes and general plumbing materials such as elbows, faucets, glue etc.

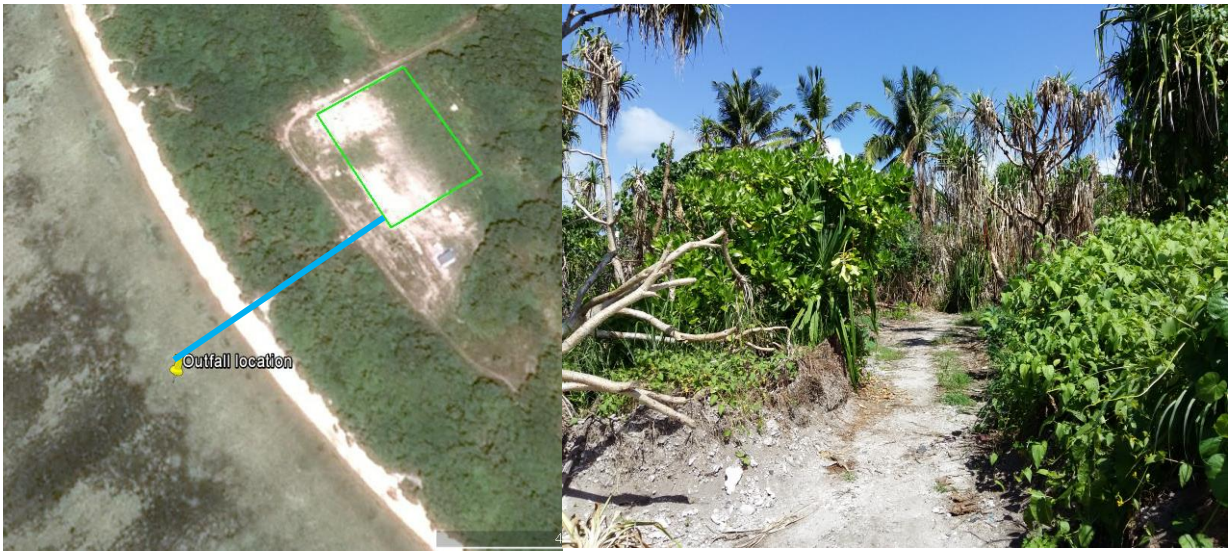


Figure 6. Proposed path for the effluent outfall pipeline (left) and the existing path through the coastal vegetation (right).

4.14. Electricity requirement and sources

The public electricity grid of Hithadhoo Island will supply the 50-80 KW of electricity required at the facility. Although the electricity grid does not include the area as of yet, the facility will be connected to the public grid by the time construction is completed.

4.15. Types of waste generated and disposal mechanisms

Being a food processing facility, the plant will employ stringent mechanisms to remove and dispose waste in a timely manner. This section presents the significant types of waste that will be generated from the facility and their disposal mechanisms.

Main types of waste produced from the facility will include:

- organic waste
- domestic waste
- Sewage and grey water
- Other waste from the facility

4.15.1. Organic waste

Organic waste will predominantly consist of gills and guts from gutting and cleaning stage of production. Heads of fish will be distributed among local *rihaakuru* makers and therefore will not be included in the waste. Fish offal will need to be routinely removed from the facility and

disposed in an appropriate manner. For the first year, the task of waste removal and disposal will be contracted to an independent party. It is proposed that the contracted party does so to the open sea/channel and avoid disposing the waste in the island lagoons and reefs. In subsequent years, the proponent plans to utilize the fish waste to produce agricultural fertilizer and market to the local population. It is expected that 100% utilization of raw materials and byproducts will be achieved during 2018.

4.15.2. Domestic waste

The staff accommodation building, which will accommodate 20 staff, will undoubtedly produce waste that will need to be removed and disposed of. Waste from the accommodation block will mainly constitute of general household waste and kitchen refuse. These will be regularly removed and disposed of at the public waste disposal site.

4.15.3. Sewage and greywater

The accommodation unit for the staff will produce domestic sewage and greywater that will need to be managed. The plumbing system for waterborne waste removal will be connected to septic tanks at the facility compound. Septic tanks are widely utilized in the households of the island as a means of sewage and greywater management due to an absence of a public sewerage system.

4.15.4. Other wastes from the facility

Apart from organic waste, facility will produce minor quantities of waste from different stages of production. Most important of these will be ash produced from the smoking process and leftover packaging materials. As the product will be packed loose in cardboard boxes that are specifically imported, the waste will be of insignificant quantity. Despite, minor quantities are expected due to packing material being damaged or defunct upon arrival or during packing. Such waste will be disposed of at the public waste disposal site.

5. Project inputs and outputs

5.1. Inputs during construction and operation phases

Table 1. Inputs during construction and operation phase.

	Input	Type/quantity	Source
Construction phase	Construction staff	Foreign and local	Employees of contractor
	Construction materials	Steel bars, river aggregate, river sand, cement, cement building blocks, electrical cables, electrical fixtures, pvc pipes, roofing materials, wall and wood paint, tiles, plywood etc.	Locally purchased when available or purchased from Male'.
	Machinery, equipment and vehicles	Cement mixer, scaffolding, pickup etc	To be supplied by the Contractor
	Machinery and equipment for the facility	RSW system, vacuum packing machines, stainless steel butchering tables	Imported and or purchased locally
	Fuel and lubricants for machinery	Diesel and petrol fuel, lubricant	Purchased locally
	Energy	Electricity	Portable genrator
	Water during construction	Freshwater	Ground
Operation phase	Raw fish	Skipjack and yellowfin tuna	Locally purchased from fishermen
	Packaging material	Cardboard boxes, cello tape etc.	Imported
	Wood	Oakwood (700 kg/month)	Imported
	Water	Desalinated water (1.5 -2 m^3/day) Groundwater (about 0.5 m^3/day)	Desalinated water from the public water supply grid. Groundwater pumped from a well within the facility compound.
	Fuel	Diesel (150 l/day)	Sourced locally
	Energy	Electricity (50-80 KW)	Public electricity grid

5.2. Outputs during construction and operation phases

Table 2. Outputs during construction and operation phase.

	Output	Expected volume	Disposal method
Construction phase	Construction waste	Medium	Local waste disposal site
	Dust	Insignificant	Dissipated into the atmosphere
	Lubricant	Minor quantities	Disposed of appropriately
Operation phase	Products (katsuobushi, smoked and dried fish etc.)	200 tons of katsuobushi /year + varying volumes of secondary products	Export and domestic market
	Garudhiya remaining from the cooking process	Less than 500 l/week	Distributed among local *rihaakuru* processors
	Organic waste	About 1.1 tons / day	Disposed of in the sea in the first year. Thereafter, will be utilized for fertilizer production
	Bloodwater	About 1.5 m^3/day	Discharged in the lagoon
	Water used in the refrigeration system	About 300 litres/week	Discharged in the lagoon
	Domestic waste	Small amounts	Local waste disposal site
	Domestic sewage and greywater	Moderate amounts	Septic tank system utilized
	Smoke	Varying quantities	Dissipated into the atmosphere
	Ash	40 kg/ week	Local waste disposal site
	Waste packaging materials	Less than 100 kg/month	Local waste disposal site

6. Legislative and policy considerations

6.1. Environmental Protection and Preservation Act (4/93)

The Environmental Protection and Preservation Act (Law 4/93) the key environmental legislature that is of relevance to the project. It states that the environment and its resources are a national heritage that needs to be protected and preserved for the benefit of future generations and accentuates the importance of the country's land and water resources, flora and fauna as well as the beaches, reefs, lagoons and other natural habitats for the sustainable development of the country.

The Act empowers the Ministry of Environment on all matters relating to the preservation and protection of the marine and terrestrial environments of the Maldives including formulation of policies, rules and regulations in areas that does not fall within the mandate of any other government authority. Clause 5 of the Act, authorizes the Environment Ministry to formulate guidelines on for EIAs determination of projects that need an environmental assessment.

6.2. Environment Impact Assessment Report Regulation 2012

The Environmental Impact Assessment Regulation 2012, stemming from the Environmental Protection and Preservation Act requires all development projects deemed to have an impact on the environment to conduct an Environmental Impact Assessment prior to commencement of the project. The Regulation further annexes fishery projects as requiring an EIA. The Regulation which became effective in 2012 describes the EIA process and steps in compiling an environmental impact assessment report for a developmental project.

6.3. Waste Management Regulation 2013 (2014/R-58)

The Waste Management Regulation which became effective in August 2013 provides guidelines on collecting, storing, transporting, and managing general and hazardous waste. The Regulation focuses on domestic household waste and waste generated from business establishments as well as hazardous waste. The objectives of the Regulation is to implement the national waste management strategy and to protect the environment through implementation of the Regulation. It identifies mangroves and wetlands, lagoons of islands, reefs, sandbanks, harbours, public spaces, parks, coastal vegetation and beaches as prohibited for waste disposal under any circumstance. Clause 26 of the regulation describes the responsibilities of parties that provide waste removal service to the public.

6.4. Regulation on liabilities for environmental damages from developmental activities

The regulation, stemming from the Environmental Protection and Preservation Act (4/93) aims to avert environmental degradation, extinction of species, and wastage of natural resources due to developmental projects. It outlines the procedures for assessment of environmental damages and fining procedures as well as on mitigating environmental effects of developmental projects.

6.5. The Fisheries Law of the Maldives

The fishery law, enacted in 1987 is the main fishery legislative component relating to the project. It defines "fisheries" removal or harvest of any living organism within the exclusive economic zone of the Maldives and empowers the Ministry of Fisheries and Agriculture in monitoring, research, collection of fishery data as well as development of all fishery activities within Maldives. Two key regulations relating to fisheries activities within the EEZ of Maldives that emanated from the Law is of importance to the project.

- Regulation of purchase and export of raw fish
- Regulation on fishing for sale to an exporter, value addition of fish for export and aquaculture licensing

6.6. Regulation of purchase and export of raw fish

Regulation on purchase and export of raw fish, stemming from the Fisheries Law of the Maldives, describes the process of obtaining permits to purchase fish from fishermen for export as fresh, frozen or processed products and the roles and responsibilities of such parties. It is within the boundaries of this regulation that the proponent was licensed to purchase raw fish.

6.7. Regulation on fishing for sale to an exporter, value addition of fish for export and aquaculture licensing

The Regulation on fishing for sale to an exporter, value addition of fish for export and aquaculture licensing, was made pursuant to the authority granted to the Ministry of Fisheries and Agriculture by Clause 3 of the Fisheries Law of the Maldives (5/87). Clause 4 of the Regulation is on licensing for processing of fish for export or sale to an exporter and lists the documents to be furnished in order to obtain a license. Clause 13 states that the exporter of the fishery products should validate and endorse a catch certificate as stipulated in the Regulation, at least 12 hours prior to export of the shipment.

6.8. Regulations on health and safety

General regulation on food establishment and services: This is a generic regulation that pertains to establishments for production, harvesting, transport, storage or sale of food items. It covers different aspects of food production including structure of the building, food hygiene and cleanliness of staff.

6.9. Maldives National Strategy for Sustainable Development (2009)

The Maldives National Strategy for Sustainable Development sets out the strategy on how Maldives will fulfill its commitment to meet the challenges of sustainable development. It sets out an approach to better policy-making based on the principle that sustainable development is to be integrated into policy-making at all levels. To achieve this, the NSDS requires that all government ministries and provincial level offices ensure that major policy decisions are based on proposals that have undergone rigorous Impact Assessment (IA) that assesses in a balanced way the social, human, natural and economic dimensions of sustainable development and take into account the external dimension of sustainable development and the costs of inaction.

6.10. Third National Environment Action Plan (2009 – 2013)

It has a 6 strategic results including, resilient islands, rich ecosystems, healthy communities, safe water, environmental stewardship and a carbon neutral nation and 30 goals to achieve these results. It further sets out the principles that should be adhered to in environment protection and management. Goal 24 of the Action Plan is on strengthening the Environmental Impact Assessment to ensure that all significant impacts associated with new developments are understood and accounted for.

7. Existing environmental conditions

7.1. Climate and meteorology

7.1.1. Monsoons

Maldives is located on the equator and hence enjoys a monsoonal climate. Northeast monsoon from January to March, is characterized by dry conditions while the Southwest monsoon, from April to December, brings wet conditions.

Hithadhoo Island is roughly 10km from Gan International Airport where meteorological data are gathered by the Maldives Meteorological Service. Therefore data and predictions from this station can safely be applied to the project site.

7.1.2. Temperature

Atmospheric temperature for the Maldives remains somewhat similar throughout the year. This is possibly the result of the moderation effect on the atmospheric temperature by the sea, which covers 99% of the country's area. However, daily temperatures can fluctuate from around 31^{o} C by day to 23^{o} C at night. Maldives observed its highest ever recorded temperature of 36.8 ^{o} C on 19 May 1991 while the lowest recorded was 17.2 ^{o} C on 11th April 1978. A high atmospheric temperature will undoubtedly promote bacterial spoilage of raw materials and products. Therefore, it is essential that this be taken into account during all stages of factory design and operation.

7.1.3. Rainfall

The monsoons determine the rainfall pattern in the Maldives with a higher rainfall being recorded during Southwest monsoonal months. This differentiated rainfall pattern is most significant in the north of the country. The southern atolls observe a higher rainfall which decreases towards the north (**Figure 1**Figure 7).

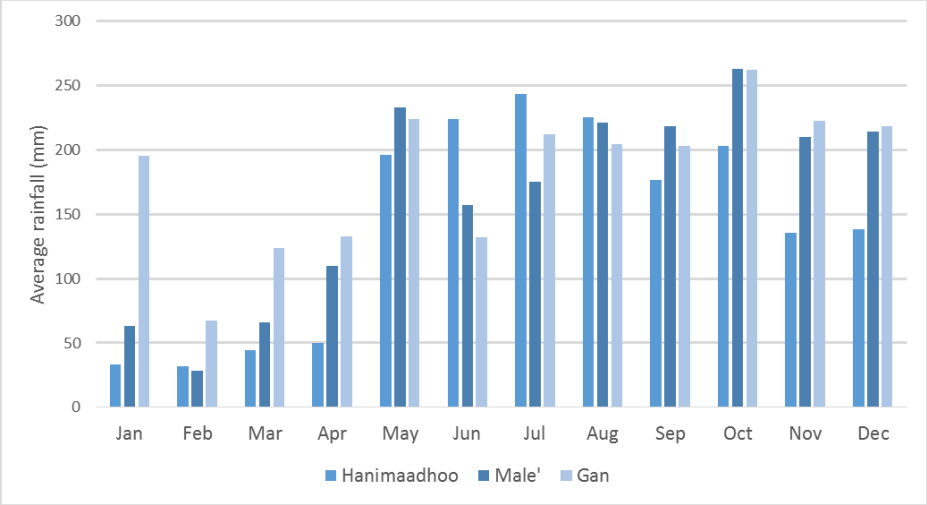


Figure 7. Monthly average rainfall (mm) from 3 stations, HDh. Hanimaadhoo, Hulhule and S. Gan.

7.1.4. Wind

Maldives experiences winds generated from an east to northeastern direction during Northeast monsoon and a westerly wind during Southwest monsoon. NE monsoon winds are generally calmer than SW monsoonal winds. An exception is the inter-monsoonal period of *Iruvai halha* during which winds can become quite strong resulting in rougher sea conditions. The predominant SW monsoon and its associated winds (Figure 8) will act to dissipate the smoke and odour generated from the facility into the island.

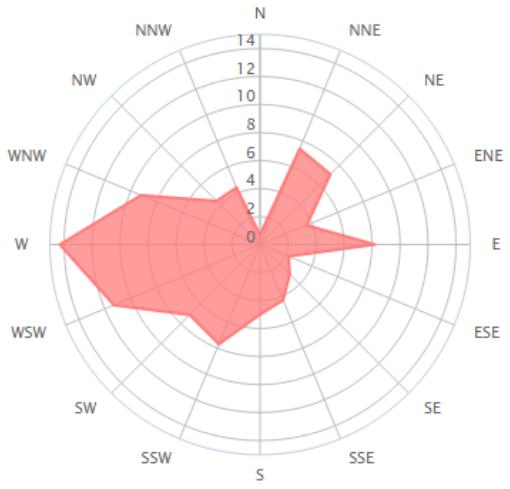


Figure 8. Annual wind direction in (%) for S. Gan.

7.1.5. Waves

Location of Hithadhoo Island on the atoll rim reef exposes the island's western coastline to the constant environmental forces emanating from the Western Indian Ocean. Two types of waves that are of importance here are the swell waves originating in the West Indian Ocean and local wind generated monsoonal waves of the South West monsoon.

Southern Indian Ocean is known to develop the most intense storms which are capable of generating swell waves throughout the year (UNDP 2008). Hence it is these waves that would have the dominant effect on the western coastline of Hithadhoo. Further, swell waves have been the cause of flooding in 4 known occasions in Hithadhoo Island (UNDP). The 215 m wide reef flat will act to dissipate the wave energy reaching the shore, and also create a longshore current.

7.1.6. Tides

Tides play an important role in determining the water flow within lagoons and reef flats. As the effluent outfall is located on the reef flat, tides and currents will act to dissipate the contents of the effluent and reduce the impact on the marine environment of the area. Tide predictions for S. Gan (Figure 9) can be applied for the project locale with relative accuracy due to the close proximity. Data obtained from the Maldives Meteorological Service for the month of November 2015 indicate that Gan area experienced a maximum tide of 49 cm (above MSL) and a minimum of -66 cm (below MSL).

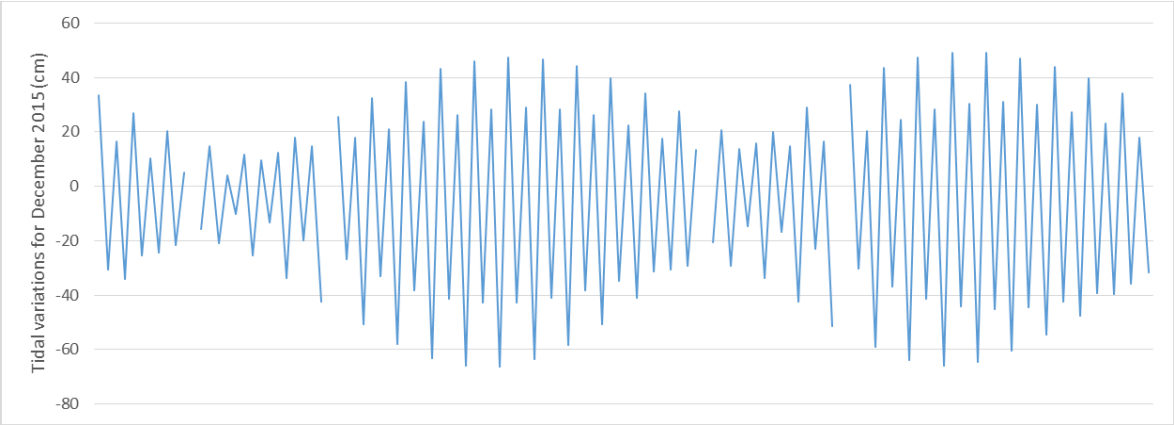


Figure 9. Tidal pattern for S. Gan, December 2015.

7.1.7. Natural hazards

There has been several major natural hazard events recorded for the Island of Hithadhoo. These include events of windstorms, flooding due to heavy rainfall, swell surges and tsunamis. Windstorms and flooding due to rainfall seems to be the most common and has caused damage to housing, personnel belongings and agricultural crops. Another hazard of importance is swell surge and its consequent flooding. There has been 3 recorded events of swell induced flooding affecting property and crops on Hithadhoo Island. The facility being located on the western side

of the island and close to the coast, exposes it to such events. However, presence of a high ridge system along the western coast of the island is known to have minimized the impact of swell surges compared to the neighboring Feydhoo Island. Therefore it can be assumed that the project facility will be relatively safe from sea induced hazards from originating from the western side of the island.

7.2. Terrestrial environment

Hithadhoo Island is inhabited mostly on the northern part of the island. The southern part is home to small scale agricultural plots and remains vastly unpopulated. The majority of the population being located in the northern part has resulted in terrestrial vegetation being considerably low in the north than the south. This geographic distribution is projected to change as more land is expected to be cleared for the growing number of agricultural and other small scale economic activities.

Vegetation around the project site is of mixed species consisting of trees and shrubs tolerant of salt laden winds, alkaline and nutrient poor soils and a hot and humid climate. The area lacks dominant growth of coconut palms (*Cocos nucifera*) which is atypical of many of the islands. Species of vegetation found common to the area were, magoo (*Scaevola taccada*), boakashikeyo (*Pandanus spp.*), aamanaka (*Ricinus communis*), hirun'dhu (*Thespesia populnea*) and uni (*Guettarda speciose*). DAFOR scale of abundance was applied to the vegetation in selected locations around the project site (Table 3). A 65 m band of coastal vegetation separates the site from the western beach of the island.

Table 3. Results of the vegetation survey

Vegetation site	Local name	Common name	Scientific name	Abundance
TS1	Maakashikeyo	Screw pine	*Pandanus odoratissimus*	Dominant
	Dhigga	Sea hibiscus	*Hibiscus tiliaceus*	Dominant
	Uni	Beach gardenia	*Guettarda speciosa*	Occasional
TS2	Dhigga	Sea hibiscus	*Hibiscus tiliaceus*	Dominant
	Maakashikeyo	Screw pine	*Pandanus odoratissimus*	Abundant
	Aamanaka	Castor bean	*Ricinus communis*	Occasional
TS3	Dhigga	Sea hibiscus	*Hibiscus tiliaceus*	Dominant
	Vina	Wild grass	-	Abundant
	Magoo	Sea lettuce	*Scaevola taccada*	Frequent
TS4	Magoo	Sea lettuce	*Scaevola taccada*	Abundant
	Funa	Alexandrian laurel	*Calophyllum inophyllum*	Frequent

7.3. Groundwater

Hithadhoo Island has a substantial layer of freshwater, the depth of which varies depending on the topography (UNDP 2008). Main use of groundwater from the area is by the farmers to water their crops and by other small establishments in the vicinity. Groundwater sample from the facility compound was analyzed at the MWSC laboratory. The water quality test results are in Table 4.

Table 4. Grounwater quality test results.

Parameter	Result
Physical appearance	Clear
Conductivity	23.1 µS/cm
Nitrate	0.8 mg/L
pH	7.71
Salinity	0.02 ppt
Biological Oxygen Demand	3 mg/L
Total Suspended Solids	<5 mmg/L

It should be noted that the area is also used for agriculture and use of fertilizers to increase crop yield is highly likely. Therefore, groundwater pollution from the agricultural practices should be taken into account in future environmental monitoring.

7.4. Marine environment

Hithadhoo Island is located on the northern end of the continuous reef system, which is surmounted by the islands Gan, Feydhoo, Maradhoo and Hithadhoo. As it is the atoll rim reef, the western coast of the islands are exposed to the elements from the western Indian Ocean. The western coastline also receives long range swell waves generated due to storm activities in the West Indian Ocean. The proposed site of the project is located about 90m inland and has a direct association with the marine environment via discharge of effluent and as a source of seawater.

The 1998 El Nino event and the consequent rise in sea surface temperatures caused widespread coral bleaching throughout the Maldives. Long term reef monitoring studies by the Marine Research Centre, showed gradual recovery in most sites. The reefs of Addu atoll have shown greater recovery compared to the rest of the reefs in the country (Zahir, et al., 2010). Anecdotal evidence gathered from fishermen of Addu atoll, as part of an island risk assessment for Hithadhoo indicated that the quality of the reefs in terms of coral cover and fish numbers declined over the past 50 years following construction of the causeways between Gan, Feydhoo and Maradhoo-Feydhoo. This condition does seem to be improving as the causeways were later replaced by bridges (UNDP, 2008).

7.5. Bathymetry at the effluent outfall site

Western side of Hithadhoo Island is consist of a relatively wide reef flat along the continuous reef system that constitutes the western rim of the atoll. The associated reef flat is relatively featureless reef flat with occasional patches of seagrass that has been prevalent at least since the 1960's (UNDP 2008). Bathymetry at the outfall location is in Figure 10.

7.6. Seawater quality

As the outfall location is the ocean ward side of the atoll, the water quality is expected to be good and free from anthropogenic sources of pollution. Water sample obtained from the effluent outfall location was tested at the Water Quality Assurance Laboratory of MWSC. The results are presented in Table 5. Results of MWSC for ground and seawater are in Appendix 12.

Table 5. Results of the seawater quality tests

Parameter	Result
Physical appearance	Clear
Conductivity	51100 µS/cm
Nitrate	3.9 mg/L
pH	8.28
Salinity	33.48 ppt
Total Suspended Solids	<5 mmg/L

As with groundwater, potential impact of agricultural runoff from excessive fertilizer use may contribute to nutrient pollution of the seawater in the area. However the likelihood of this is small due to the high coastal ridge system that would prevent surface runoff into the sea.

Figure 10. Bathymetry at the effluent outfall and seawater intake location (m).

7.6.1. Benthic flora and fauna

Benthic substrate at the reef flat was assessed by photographing a 0.25m^2 area of the reef flat and analyzing the images using Coral Point Count with Excel Extensions, for benthic cover categories, hard corals, soft corals, rock, rubble, sand, algae and seagrass. Mean percentage cover for each benthic category was then calculated. Ten images were analyzed for percent benthic cover (see Figure 11 for sample images).

Figure 11. Images from benthic cover.

Western reef flat of Hithadhoo Island has an extensive seagrass bed along the length of the island. The seagrass bed currently begins about 100 m from shore. Satellite images dating back to 2002 indicate that the seagrass bed has been progressing towards shore over the years. The study area has a predominant seagrass cover (45%) followed by sand, rubble and rock in order decreasing percent cover (Figure 12).

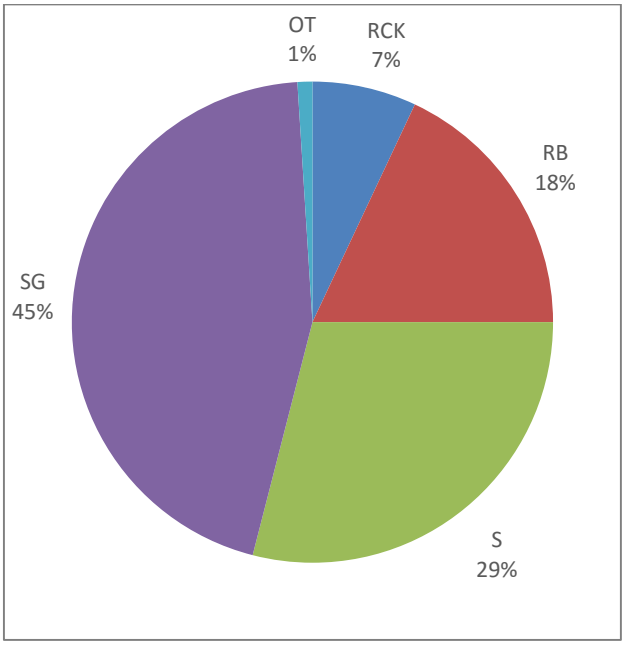


Figure 12. Percent benthic cover. RB: Rubble, RCK: Rock, S: Sand, SG: Seagrass, OT: Others

7.6.2. Currents at the effluent outfall location

Current measurements taken at the effluent outfall location indicated a longshore current at a speed of 025m/s (Figure 13**Error! Reference source not found.**). Stronger currents are expected during intense wave activity and tide changes and therefore facilitate flux.

Figure 13. Current direction at the effluent outfall location indicated by yellow lines.

7.6.3. Beach characteristics

The composition of coastal sediments and the geomorphology of coastal ridges along the western coastline suggest that the coast is in a very high energy zone (UNDP, 2007). The beach sediment consisted of fine/coarse sand and coral rubble ranging in sizes from cobble and pebble to small boulders (e.g. Figure 14). The size and abundance of rubble is consistent with the high energy location of the beach. This was in contrast to the fine beach sediment on the sheltered Eastern coastline.

Absence of young plants and presence of a solid mature coastal vegetation indicates that erosion the beach does not experience sever coastal modification. This is further corroborated when satellite images of the area taken in 2005, 2012, 2013, 2014 and 2015 were compared. However, seasonal and periodic cycles of erosion and accretion along the western beach of the island has been suggested (UNDP, 2007).

High coastal ridge, steep slopes and coarse beach material are characteristic of beaches exposed to high wave energy. The beach adjacent to the project site is exposed to long distance swell waves generated in the West Indian Ocean, resulting in the said features (Figure 14). Despite the

relatively high ridge in this (southern) section of the island's western coastline, it is still low compared to the northern parts causing it to be more vulnerable to swell wave induced flooding (UNDP, 2007).

Figure 14. Western side beach of Hithadhoo Island.

7.7. Other important ecosystems

Addu atoll is also home to several mangrove ecosystems, most notable being *Eidhigali kilhi*, on the north of Hithadhoo Island. A lesser known Medheaari kilhi lies about 0.32 km North East of the proposed project site and is the location of the Equatorial Convention Centre, built for the Seventeenth SAARC Summit held in 2011. The wetlands of Hithatdhoo are rich in biodiversity and act as natural drainage systems during times of heavy rainfall. Eidhigali kilhi and its koattey area were given protected status on December 2004. Medheaari kilhi has been significantly modified as part of the construction of the Convention Centre. Introduced exotic species of water lily, Family Nymphaeaceae, was found growing abundant in one section of the water body, covering the entire surface.

7.8. Socio-economic environment

Addu is the southernmost atoll of the Maldives archipelago. The atoll was recently designated as a city comprising of the four districts; Hithadhoo, Maradhoo, Feydhoo and Hulhumeedhoo. Hithadhoo, the district of the proposed development project is the seat of the local government and the hub of economic activities in the atoll. The City is of the highest population apart from Male'. The population size and the interconnectedness of the main islands of the atoll has given rise to a vibrant local economy. Recent development projects such as the proposed resort development at Ismehela Hera will tend to attract locals residing outside of the atoll for

employment back to Addu. Development of the International Airport at Gan will possibly see a higher tourist influx directly to the atoll, enabling a boom in local guesthouse tourism.

7.8.1. Population and gender

The 2014 census data indicate that the population of Addu City is close to 20,000 with an increase of 11% from 2006. Hithadhoo district has the second highest population in the country with almost 10,400 individuals. Annual population growth rate is 1.23 per-cent for the city. The City has a sex ratio of 90 males per 100 females (Ministry of Finance and Treasury 2014), indicating migration of males in search of job opportunities.

7.8.2. Employment

Fishing population of Addu Atoll is 270, based on the statistics of Ministry of Fisheries and Agriculture (MoFA 2013). The atoll is reported to have 28 active fishing vessels in in 2013 (MoFA 2013). Pole-and-line catch is landed to collector vessels that operate in the region and landing ports in nearby atolls. Some of the catch is also landed to the islands of the atoll and sold to small scale fish processors.

Other economic activities on the island and the atoll in general include; employment in the civil and public service, small businesses such as shops and café/restaurants, agriculture, value addition (smoke/dried fish) of fishery resources. The atoll has outlets of major businesses in the country including telecommunication companies (Dhiraagu and Ooredoo), commercial banks (Maldives Islamic Bank, Bank of Maldives and State Bank of India). Private distribution businesses such as Happy Market, Euro Store and Checkmark are also present in the atoll. A number of local guesthouses catering for the European and foreign markets has sprouted due to the recent change in the Government's policy. The atoll has resorts operating on the islands of Villingili and Herethera which employ a number of locals.

8. Impact prediction and analysis

8.1. Methodology

Environmental and socioeconomic impacts for the development project were predicted using an impact identification matrix. The impact prediction and analysis process incorporated qualitative expert judgement and opinion of the consultant. Environmental assessment reports for similar projects and published literature on topics of relevance to the project were also referred to in the process.

8.2. Predicted impacts

Few environmental impacts are predicted for the project. Key negative impacts identified include those on the marine and groundwater quality within the project vicinity. Localized temporary deterioration of air quality due to gaseous (NOX) and particulate output from the fish smoking process is also expected. The scale and location of the project, despite the impacts, do not pose an immediate threat to the environment.

Some positive aspects of the project include employment opportunities, increased financial wellbeing of the fishermen due to i) competitive prices paid and ii) from reduced operational costs of travelling to distant landing ports/collector vessels. In addition, land and sea transport of raw materials and products will employ existing local channels, whereby contributing further to the economy. Another key benefit of the project will be an increased foreign revenue from export of value added fishery products to Japan in lieu of what is currently earned from exporting frozen tuna to Thailand. Table 6 presents the identified impacts and the significance of those impacts.

Table 6. Impacts identification matrix for the construction and operational phase of the project.

Source of potential Impact	Impact area	Type of potential impact	Duration	Reversibility	Significance
Construction waste	Terrestrial environment at the waste disposal site	Contribution to waste production	Short term	Reversible	Insignificant: due to the small volume of waste that is expected to be produced.
Noise pollution	Localized to the project site				Insignificant: project located in an uninhabited area.
Fish offal	Marine environment at disposal site	Localized elevation of nutrient levels in the water column		Reversible	Moderately significant: disposal of fish offal in the marine environment could lead to localized eutrophication, depending on the oceanographic conditions at the site.
Bloodwater	Marine environment at outfall location	Localized elevation of nutrient levels in the water column	Short term	Reversible	Insignificant: effluent discharge pipe will be at a high energy location (exposed to the oceanic swell waves) resulting in adequate mixing of the water column resulting in dilution of the effluent within a short timeframe.
GHG emission during cooking and smoking processes	Air	Contribution to global warming	Long term	Irreversible	Insignificant as GHG input from the facility to the atmosphere is negligible
Particulate emissions	Air	Local air contamination	Long term	Irreversible	Moderately significant as the amount of gaseous and particulate emissions will be moderate and be partially or completely neutralized before they reach the ground or vegetation line.

Source of potential Impact	Impact area	Type of potential impact	Duration	Reversibility	Significance
Odour	Air	Local air pollution	Short term	Reversible	Insignificant as the facility is located in an unpopulated area. Therefore, disturbance to the public due to odour is avoided. Further, the close vicinity of the facility to the shore facilitates odour dispersal by the SW monsoonal winds during SW monsoon. During NE monsoon, the odour will be directed offshore.
Sewage and greywater	Groundwater	Contamination of freshwater lens	Long term	Non reversible	Moderately significant as only about 20 staff would inhabit the staff accommodation block. Proper use of septic tanks will minimize the impact on the ground water.
Sustainability of fishery	Marine fishery resources	Contribute to potential overexploitation of resource	Long term	Reversible	Insignificant: Maldives exploits part of the wider Indian Ocean tuna stocks. As these are highly migratory species, the IO stocks of these species are managed by the Regional Fisheries Management Organization, IOTC (Indian Ocean Tuna Commission). Current fishing effort for skipjack and yellowfin tuna were not hindering the stocks, based on the most recent stock assessments for both species.
Socio-economic aspects	Local and national economy	Enhancing the local economy and income	Short and long term		Moderately significant: the project will contribute to the local economy by outsourcing the construction and sourcing the materials from the local economy. During operation of the facility, it will contribute in terms of employment, alternative option for fishermen to sell their catch, fishery products for locals. It will also create competition within the market allowing fishermen a better income.

Source of potential Impact	Impact area	Type of potential impact	Duration	Reversibility	Significance
Food availability	General population	Increased variety of fishery products	Na	Na	Moderate: Local population will have access to a range of new hygienically prepared fishery products.
Foreign revenue	National economy	Increased national income	Na	Na	Increased foreign revenue from exporting value added fishery products to the Japanese market in lieu of exporting frozen tuna to Thailand.

9. Mitigating impacts

Key impacts identified for the development project and their mitigation measures are presented in this section. It should be noted that these impacts are important relative to the project scale and does not have significant adverse effects on the environment.

9.1. Mitigating impacts during the construction phase

9.1.1. Construction waste

The processing facility and its neighboring staff accommodation building will be cement mortar buildings. Concrete will be used for the foundation slabs, beams and columns. All the materials for construction will be sourced from local suppliers. This phase of the project will undoubtedly produce waste such as empty bags of cement and sand, used timber and plywood, empty paint cans etc. that will require proper disposal.

Irresponsible use of construction materials and disposal of the waste has the potential to adversely affect the groundwater, terrestrial and the marine environment. Therefore, preventive measures will need to be taken to minimize any adverse impacts.

- All materials will be transported in pickup trucks, securely packed in bags and stored away from environmental elements on site.
- Excessive use of oils and chemicals will be discouraged.
- All waste will be stored onsite until removed and disposed of at the island waste disposal sites.
- Fuel and oils will be stored in leak proof containers to prevent leakage to the ground.

9.1.2. Air emissions

Air emission will arise from the transport of materials and waste to and from the site and also from operation of construction machinery (mainly fossil fuel run cement mixer). As the project and the resulting air emissions is of a minimal scale, mitigation measure is not recommended.

9.1.3. Noise pollution

Noise pollution will arise only from the operation of the cement mixer, which would also be much localized. Hence the consultant does not foresee a noise pollution as a significant impact from the project.

9.2. Mitigating adverse impacts during operation phase

9.2.1. Solid waste disposal

Main waste from the facility will be viscera, skin and bones produced when fish are cleaned. These will need to be properly managed in order to preserve the integrity of the marine and

terrestrial environment. Following measures should be taken to prevent probable adverse impacts from the said waste.

- Fish offal shall be collected in leak proof containers and stored until removed from facility.
- All by-products from gutting and cleaning shall be removed from site in a timely manner before spoilage occurs.
- Where sea disposal of offal is employed, choose a location of strong current flow to facilitate effective dispersal. Such disposal should only be employed for the first year of operations or until a mechanism for the proposed alternative use (production of fertilizer) is established.
- Use fish of good quality or that has been stored in ice onboard to minimize having to discard spoilt fish. It will also reduce the amount of flesh lost during gutting and cleaning of raw fish.

9.2.2. Effluent discharge

The effluent from the facility, which will include blood water and used water from the refrigeration system will be discharged into the western side reef flat adjacent to the project site. The effluent will be rich in organic matter due to the presence of oils, proteins and other solids. The following mitigation measures are proposed to minimize the impacts on the marine environment.

- Sweep all solid material (scraps of flesh, guts etc.) from the work surface and floor instead of discharging with the effluent water.
- At the cleaning area, use screens and/traps in the drains to reduce the amount of solids entering the effluent stream.
- Locate the effluent discharge pipe well into the lagoon (about 60m from the low water mark) to facilitate mixing and dispersal of the effluent with the wave and current actions.
- Conduct cleaning raw fish during high tide so that the effluent is readily mixed and transported by the current at the outfall location.

9.2.3. Sewage and greywater discharge

Septic tanks are utilized in the households as a means of sewage and greywater management throughout the island due to an absence of a public sewerage system. Improper use of septic tanks or high density of septic tanks on the island may have led to fouling of groundwater lens in densely populated areas of the island. Therefore, following mitigation measures are proposed to minimize fouling of groundwater.

- Connect only the toilets and not the kitchen sink and laundry water as kitchen waste water will contain oils and grease which can block the pipes of the system. Further,

laundry wastewater will contain compounds that can be detrimental to the bacterial fauna in the tank.

- Conduct regular maintenance of the tank by removing undecomposed material (sludge) to avoid the tank filling up and releasing such material into the ground.
- Avoid flushing of non-biodegradable material such as cigarette butts and cotton swabs to avoid clogging of the tank.
- Avoid flushing of chemicals especially those containing bleach and caustic soda (e.g. toilet cleaning products) as these can harm the bacteria operating in the tank.

9.2.4. Smoking

Gaseous and particulate emissions are the key atmospheric emissions from the production process. Burning wood to smoke the cooked tuna will release, among others, gases such as CO_2, CO, NO_x. Carbondioxide gas has the potential to contribute to global warming, but the amount from the facility will have a negligible contribution. Soot, chiefly of carbon, produced by incomplete combustion of wood will be the main particulate emission from this process. It has the potential to cause health hazards to those who inhale it. Employees, especially those involved in the smoking process will be most exposed to particulate emissions. Following measures are recommended to negate the possible effects and ensure worker safety.

- Construct the smoking chamber (smoke stack) in a manner that smoke does not leak into the main facility building.
- Provide face masks to the employees to minimize inhalation of particles.
- Allow sufficient height of the smoke stack to ensure that the exhausts clear of the vegetation.

9.2.5. Odour emissions

Odour is an inevitable outcome of any fish processing facility. High ambient temperature such as in Maldives will accelerate the fouling process. Therefore it is important that raw materials are processed promptly or be refrigerated immediately upon arrival. Sources of odour from the facility are from cooking, from the smoking process and from the general facility as a result of handling raw fish. The proponent should strive to minimize odor emissions by minimizing processing of low quality raw materials and regular removal of waste before it becomes putrid. Further steps to minimize odour are;

- Chill raw materials as soon as they arrive at the facility to minimize deterioration.
- Remove all solid wastes in a timely manner to avoid fouling.
- Clean and wash all work surfaces where raw fish are handled at the end of each day/operation.
- Scrub and clean refrigeration tanks, cooking tanks at least once a week.
- Rinse raw material and waste storage bins after each use and scrub and clean at least once a week.

9.2.6. Cleaning and disinfecting

As the facility produces fishery products for human consumption, cleanliness in critical to ensure hygienic and safe products. Daily superficial cleaning and weekly thorough cleaning, preferably once a week, is recommended to ensure safety of the products and the employees. The following measures are recommended;

- Conduct dry pre-cleaning of work areas and equipment before wet cleaning.
- Conduct steam cleaning and avoid use of detergents and sterilizers.
- Ensure adequate ventilation of the facility during cleaning to reduce inhalation of aerosols.
- Ensure worker safety during steam cleaning by providing them with the right gear such as dry boots and protective clothing.
- Where needed, use environmentally safe cleaning agents in controlled amounts.

10. Alternatives

10.1. Alternative location

The current location for the project has significant advantages over others. The RAF area where the project is located has been designated for small and medium scale investments on fisheries and agriculture related activities. This will have the benefit of localizing such activities away from the population and reduce the possibility of conflicts with the public. Second, the project is located in an uninhabited area away from the population and therefore disturbance to the public due to smoke and odour will be evaded.

An alternative to the current location would be to establish the facility in another island within the Atoll. This may have negative consequences as it might bring the facility in close proximity to populated areas. Relocating the project to the greater Male' region will have the advantage of reduced cost of transport to Male' for export. However, the exorbitant prices of raw materials (i.e tuna), land rent and higher overhead costs will outweigh the seeming benefit of reduced transport costs and render the project economically unviable. It will also deprive the local fishermen from an alternative catch disposal option.

10.2. No project option

It is within the best interest of the environment that it be left intact. However, socio-economic development and betterment of livelihoods is not possible without developmental projects that can have some form of environmental impacts. This EIA study identified the key impacts and their magnitudes from developing a katsuobushi processing facility in the proposed location.

A "no project" alternative is not an option as the identified positive economic impacts outweigh the negative impacts. Specifically a no project alternative would deprive the local fishermen from an alternative disposal option, and lose an added price advantage for their catch. Further, the project proposes that the byproducts such as *garudhiya* be distributed among local *rihaakuru* processors who will consequently lose the opportunity. Outsourcing other materials and services (e.g. such as fuel, waste disposal and product transport to Male') and employment opportunities will also be lost in a "no project" scenario.

10.3. Alternative sources of fresh water

The facility will utilize desalinated water from the public network at a rate of about 1.5 to 2 tons/day. Additionally the staff accommodation will be supplied with groundwater for domestic use. It is presumed the facility's water consumption will not deteriorate the freshwater lens in the area. However, at a time that the primary water supply is interrupted, an alternative source of water will need to be considered. Rainwater collected from the roof and stored to supplement the freshwater needs is an inexpensive alternative. However, its supply can be limited and at times may require the proponent to transport water from the

islands. Installation of a desalination plant is another option and will ensure a constant supply but this will have a setup and maintenance costs involved.

10.4. Alternatives for effluent disposal

It is proposed that the effluent be discharged into the lagoon as it is the most viable option. It is assumed that the relatively small amount of effluent and the strong wave action and currents at the discharge locale will dilute the contents to negligible and environmentally safe levels. At a time of significantly increased effluent volume due to increased operations, it is proposed as an alternative that the effluent discharge pipe be extended beyond the reef edge. It is noted that this would incur additional financial and engineering costs that may be incompatible with the current scale of the project. Connecting the wastewater to the public sewage network that is to be established in the near future is a more efficient and cost effective alternative.

10.5. Alternatives for domestic sewage and greywater disposal

Use of septic tanks is the recommended method of sewage and greywater management for the project. Septic tanks are utilized throughout the island and the atoll at the household level. This method of sewage disposal is widely practiced in different parts of the world including some developed nations. However, possibility of groundwater pollution exists due to improper use of septic tanks. Therefore, connecting the sewage from the project to the public sewerage network, when available, is proposed as an alternative to septic tanks.

11. Environmental monitoring

Environmental monitoring shall be conducted to ensure construction and operation of the facility does not contribute unforeseen adverse impacts to the environment. Considering the nature of the operations, monitoring of terrestrial environment, groundwater within the facility and seawater quality and the marine ecosystem at the effluent outfall location is suggested. Results of the water quality assessments for this EIA will be used as a baseline in the future environmental monitoring processes.

11.1. Objectives of monitoring

The objectives of environmental monitoring for the project are:

- To ensure that any environmental impacts from the project fall within the scope of the predictions in the EIA report and gauge the reliability of the predictions.
- To identify any unforeseen environmental degradation in a timely manner and implement necessary mitigative measures.
- To avoid or reduce environmental costs of the project by implementing mitigatory measures as in a timely manner.

11.2. Monitoring plan and costs

Regular monitoring during construction and operation phases are important to assess the environmental impacts of the project. Table 7 presents the proposed monitoring plan for the project. Annual monitoring cost is expected to be US$ 1,000. Proponent's commitment to the environmental monitoring plan and costs is in the Proponent's Declaration of this report.

Table 7. Environmental monitoring plan for the proposed project.

Monitoring requirement	Parameter to be assessed	Frequency of monitoring
Terrestrial vegetation	Diversity and abundance	Once During construction phase. Every six months during the first year and once a year for 5 years.
Benthic community at the effluent outfall location	Percent cover	Once During construction phase. Every six months during the first year and once a year for 5 years.
Fish and invertebrates at the outfall location	Diversity and abundance	Once During construction phase. Every six months during the first year and once a year for 5 years.

Groundwater within the facility compound	Physical appearance, Conductivity, Nitrate, pH, Salinity, Biological Oxygen Demand, Total Suspended Solids	Once During construction phase. Every six months during the first year and once a year for 5 years.
Seawater at the outfall location	Physical appearance, Conductivity, Nitrate, pH, Salinity, Biological Oxygen Demand, Total Suspended Solids	Once During construction phase. Every six months during the first year and once a year for 5 years.
Air quality	Qualitative assessment based on interview process	Once During construction phase. Every six months during the first year and once a year for 5 years.

12. Stakeholder consultations

Stakeholder consultations present the opportunity to introduce the project to the key stakeholders and obtain their views and requirements on the project. Stakeholder consultations for this EAI included the scoping meeting and also separate discussions with representatives from identified stakeholders. A list of personnel consulted is presented in Table 8.

Table 8. Persons consulted as part of the EIA process.

Name	Designation	Authority
Satheesh Moosa	Senior Scientific Officer	Maldives Food and Drug Authority
Abdulla Thayyib	Deputy Mayor	Addu City Council
Athhar Haleem	Deputy Director	Fenaka Corporation Limited
Ahmed Shifaz	Senior Research Officer	Ministry of Fisheries and Agriculture

12.1. Scoping Meeting

The Scoping Meeting for the project was held on May 5, 2015, with the invitation of key stakeholders for the project including the Ministry of Fisheries and Agriculture, City Council of Addu City, Maldives Food and Drug Authority. The meeting did not see any significant concerns raised but generally had a positive view towards the project. Specifically, representative from the Maldives Food and Drug Authority highlighted the importance of hygiene and outlined the monitoring procedure for food establishments. EPA outlined the specific requirements for the EIA focusing on water sources and intake mechanisms. In addition to the scoping meeting, key stakeholders were consulted separately obtain their view and concerns towards the project.

12.2. Addu City Council

Deputy Mayor of Addu City highlighted that the RAF area was designated for small and medium scale agricultural and fishery value addition facilities. He further noted that the Council is working to facilitate the area with electricity and public water network as this is a designated small and medium scale industrial zone. Further, he noted that the RAF area currently has the best source of groundwater in Addu Atoll.

12.3. Maldives Food and Drug Authority

Senior Scientific Officer from the Maldives Food and Drug Authority highlighted the food hygiene measures enforced by the MFDA on food production facilities. It was also indicated that MFDA will issue a health certificate upon request of the proponent.

12.4. Fenaka Corporation Limited

Discussion with the Deputy Director of Fenaka Corporation Limited focused on provision of utility services to the project site and the District of Hithadhoo in general. As the utilities provider for the District and the City of Addu, Fenaka Corporation is working to provide desalinated water and sewerage to the households. Twenty-four hour electricity is available for the households and the project site is to be included in the future. It was also noted that a sewerage system with a sewage treatment facility is expected to be established in the future. The treatment facility and its effluent outfall is proposed to be located at the western side of the island near the existing powerhouse.

12.5. Ministry of Fisheries and Agriculture

The discussion focused on enforcement and adherence to rules and regulations of the Ministry of Fisheries and Agriculture. Importance of regular provision of data required from the facility was noted. Further, it was highlighted that the facility will be subject to inspection and monitoring by the Ministry.

13. Conclusion

Yours Maldives Addu Katsuobushi Pvt. Ltd. was established in2013 with the aim to purchase pole-and-line caught skipjack tuna from the local fishermen and process as Katsuobushi for export to the Japanese market. In addition to katsuobushi, the proponent plans to make products such as fresh and dried fish, fish chips to be sold domestically. For this purpose, the company invested in a processing facility on a leased plot of land from the south of Hithadhoo Island, Addu City.

Skipjack tuna, caught by local fishermen using pole-and-line will be the key raw material of katsuobushi production. The tuna fishery of Maldives exploits part of the wider Indian Ocean tuna stocks and is considered one of the most sustainable tuna fishery in the world. Further, the Indian Ocean stock of skipjack tuna stock was assessed in 2014 to be not overfished and not undergoing overfishing. Implementation of the project therefore, will not have negative implications on skipjack tuna stock. Yellowfin tuna stock which was assessed this year showed it to be overfished and overfishing is continuing. As yellowfin tuna is a minor component in the Maldives pole-and-line tuna fishery, the project will not have a significant impact on the stock of the species.

The development project involves construction of a 100 x 100 feet building to house the processing facility and a building to accommodate the employees of the facility. Construction of the facility and the adjacent staff accommodation block will be outsourced to a local contractor and all materials for construction will be sourced locally or brought in from Male'.

Different stages in the production of katsuobushi require water which will be sourced from the local public water supply network. Additional use of freshwater at the staff accommodation block and for cleaning and washing at the production facility will be met using groundwater. Use of seawater is avoided as it will affect the quality of the finished product and also reduce the life of machinery and equipment due to rust.

Effluent discharge on the reef flat will be the aspect of most concern of the project. However, the discharge of effluents is not expected to have significant environmental impacts due to the small scale of the operations and the geophysical nature and the conditions at the effluent outfall location. In addition to impacts from effluent, some degree of localized air pollution is expected to occur from the fish smoking process. However, the gaseous and particulate emissions will not affect the public as the facility is located away from the general population.

The project is expected to have a number of positive impacts that outweigh the negative aspects of operating the facility. One of the key being on the welfare of the fishermen as the proponent will purchase fish at a competitive price from the fishermen. The project will also present an alternative option of catch disposal for the local fishermen. The project will also contribute to the financial wellbeing of locals through employment. Outsourcing certain tasks such as waste disposal and transport of products by land and sea will further contribute to the economy. Another key benefit from the project will be the increased foreign revenue from

exporting value added fishery products to the Japanese market in in place of exporting frozen tuna to markets of Thailand.

14. References

CPCe. A Visual Basic program for the determination of coral and substrate coverage using random point count methodology. Computers and Geosciences, Vol. 32, No. 9, pp. 1259-1269, DOI:10.1016/j.cageo.2005.11.009.

Groom, Q., Walker, K., and McIntosh, K., (2011). BSBI Recording the British and Irish flora (2010-2020).

Irene Delgado and Graham Lloyd (2004) A Simple Low Cost Method for One Person Beach Profiling. Journal of Coastal Research: Volume 20, Issue 4: pp. 1246 – 1252.

IOTC-WPTT 17 2015. Report of the Seventeenth Session of the Working Party on Tropical Tunas. Montpellier, France, 23–28 October 2015. IOTC–2015–WPTT17–R[E]: 102 pp.

IOTC–WPTT16 2014. Report of the Sixteenth Session of the IOTC Working Party on Tropical Tunas. Bali, Indonesia, 15–19 November 2014. IOTC–2014–WPTT16– R[E]: 104 pp.

Kohler, K.E. and S.M. Gill, 2006. Coral Point Count with Excel extensions (CPCe): A Visual Basic program for the determination of coral and substrate coverage using random point count methodology. Computers and Geosciences, Vol. 32, No. 9, pp. 1259-1269.

UNDP. 2008. Detailed Island Risk Assessment in the Maldives. Volume III: Detailed Island Reports, S. Hithadhoo – Part 1.

Zahir, Hussein; Quinn, Norman and Cargilia, Nicky (2010). Assessment of Maldivian Coral Reefs in 2009 After Natural Disasters.

15. Appendices

Appendix 1: Land lease contract

[illegible]

426-PD/2013/51 [illegible]

[illegible]

[illegible] C-0438/2013

[illegible] 01 [illegible] 2012

[illegible] 31 [illegible] 2032

[illegible] 40000 [illegible]

1 – [illegible] 20 [illegible] 426-PD/2012/09 [illegible] 40000 [illegible]

[illegible] 426-PD/2012/09 [illegible]

25 [illegible] 2013 [illegible]

[illegible]

-MAK

1

(ހ) ތިން ދުވަހުގެ ފަހުން ހުއްދަ ދިނުމަށް ގަބޫލުކުރާ ކޮންމެ ފަރާތަކަށް ދަށުން ބުނެފައިވާ ގޮތަށް ދައްކަންޖެހޭ ފީ ގެ ދަށުން ދަށުން ތިން ދުވަހުގެ ފަހުން ދެވޭ ހުއްދަ ބާތިލުކުރުމުގެ ފީ ދައްކަންޖެހޭނެ ގޮތް ބަޔާންކުރުން.

(ށ) ހުއްދަ ބާތިލުކުރުމަށް 40000ރ. (ސާޅީސްހާސް) ގަޑުވެސް ދުވަހު ދައްކަންޖެހޭ ފަދަ ފީ ގަނެވުނު ގޮތަށް ބަދަލުދޫ ކައުންސިލަށް ދައްކަންޖެހޭނެ ގޮތް ބަޔާންކުރުން.

(ނ) ހުއްދަ ބާތިލުކުރުމަށް ދެވޭ ފީ 40000 ގަޑުވެސް ތިން ދުވަހުގެ ކުރިން ދައްކަންޖެހޭ ގޮތަށް ބަދަލުދޫ ކައުންސިލަށް ދަށުން ދެވޭ 20 ގަޑުގެ ތެރެއިން ދައްކަންޖެހޭ ގޮތް ބަޔާންކުރުން. ތަނަ ތިން ދުވަހުގެ ކުރިން ބާތިލުކުރާ ހުއްދަ ދެވުނު ފަރާތަކަށް ދައްކަންޖެހޭ ފީ ގެ ދަށުން ދައްކާ ފައިސާ ދެއްވުމަށް ބަދަލުދޫ ކައުންސިލުން ގަބޫލުކުރާ ގޮތް ބަޔާންކުރުން.

2- ތިން ދުވަހުގެ ކުރިން ހުއްދަ ބާތިލުކުރާ ފަރާތަކަށް "ކަންތައް ހަނދާންކުރުމަށް" ލިޔެގެން ކައުންސިލުގެ ލެޓަރ ހެޑްގައި ސޮއި ކޮށް ބާރުލާ ފަރާތަކަށް ލިޔެ ފޮނުވާ ގޮތް ބަޔާންކުރުން. ތަނަ "ކަންތައް ހަނދާންކުރުމަށް" ލިޔެގެން ކައުންސިލުގެ ލެޓަރ ހެޑްގައި ސޮއި ކުރުމަށް ކަނޑައަޅާ ފަރާތަކަށް (ތަނުގައި) ސޮއި ކުރުމަށް ބާރުލާ ގޮތް ބަޔާންކުރުން.

3- ހުއްދަ ދެވުނު 01ގަޑުގެ ތެރެއިން ރ. ތަނަ ބުނެފައިވާ ގޮތަށް ދައްކަންޖެހޭ ފީ ގެ 00/01ވަނައިވާ ގޮތަށް ދައްކަންޖެހޭ ގޮތް ބަޔާންކުރުން.
ދަތުރުކުރާ ފަރާތަކަށް ދެވޭ ފީ ގެ 00.15(ދިހަ) ވަނައިވާ ގޮތަށް ދައްކަންޖެހޭ ގޮތް ބަޔާންކުރުން.

4- (ހ) ހ. ހުއްދަ ދެވުނު 3 ގަނޑު ފުރުމުގެ ކުރިން ބާތިލުކުރާ ފަރާތަކަށް ދަށުން ބުނެފައިވާ ގޮތަށް ދައްކަންޖެހޭ ފީ ގެ 10 ގަނޑު ފުރުމަށް ކަނޑައަޅާ ގަނޑުގެ ތެރެއިން ދަތުރުކުރާ ފަރާތަކަށް ކަނޑައަޅާ ގަނޑުގެ ތެރެއިން ދައްކަންޖެހޭ ގޮތް ބަޔާންކުރުން.

(ށ) ކަންތައް ހަނދާންކުރުމަށް 1 (އެއް) ދަށުގެ ތެރެއިން ބާރު ދެވުނު ފަރާތަކަށް، ދެވުނު ފަރާތަށް ދަށުން ދައްކަންޖެހޭ ފީ ގެ ތެރެއިން 50% ދައްކަންޖެހޭ ގޮތް ބަޔާންކުރުން.

(ނ) ހ. ތިން ދުވަހުގެ (ށ) ގަ (ނ) ގައި ބުނެފައިވާ ގޮތަށް ދައްކަންޖެހޭ ފީ ގެ ތެރެއިން ދައްކާ ފައިސާ ދެއްވުމަށް ކަނޑައަޅާ ދުވަހުގެ ކުރިން ބާތިލުކުރާ ފަރާތަކަށް ދައްކަންޖެހޭ ގޮތް ބަޔާންކުރުން. -/25ރ (ފަންސަވީސް ރުފިޔާ) ގ ދ ދެއްވުމަށް ބަދަލުދޫ.

5- (ހ) ހުއްދަ ދެވުނު ދުވަހުގެ ތެރެއިން ، ދުވަހުގެ ތެރެއިން ދަތުރުކުރާ ދުވަހު ދުވަހުގެ ތެރެއިން ބަދަލުދޫ ކައުންސިލުން ގަބޫލުކުރާ ފަރާތަކަށް ދަތުރުކުރާ ދުވަހުގެ ކުރިން ދަތުރުކުރާ ދުވަހު ދުވަހުގެ ތެރެއިން ދަތުރުކުރާ ދުވަހުގެ ކުރިން ދަތުރުކުރާ ދުވަހު ދުވަހުގެ ތެރެއިން 06 ދަނޑުފުޅަށްވުރެ ، ބަދަލުދޫ ކައުންސިލުން ދެވުނު ހުއްދަ ، ހުއްދަ ދެވުނު ފަރާތަކަށް ދަތުރުކުރާ ދުވަހުގެ ކުރިން ، ދުވަހުގެ ތެރެއިން ދަތުރުކުރާ ދުވަހު ، ދުވަހުގެ ތެރެއިން ދަތުރުކުރާ ދުވަހުގެ ކުރިން ، ދުވަހުގެ ތެރެއިން ދަތުރުކުރާ ދުވަހު ، ދުވަހުގެ ތެރެއިން ދަތުރުކުރާ ދުވަހުގެ ކުރިން ، ދުވަހުގެ ތެރެއިން ދަތުރުކުރާ ދުވަހު ، ދުވަހުގެ ތެރެއިން 03 ދަނޑުފުޅަށްވުރެ ގަނޑުގެ ތެރެއިން ބަދަލުދޫ ކައުންސިލުން ބާތިލުކުރާ ގޮތް ބަޔާންކުރުން.

6- (ހ) [illegible]

(ށ) [illegible]

7- [illegible] 01 [illegible] 07 [illegible]

8- (ހ) [illegible] 1 [illegible] (ށ) [illegible] 04 [illegible]

(ށ) [illegible]

(ނ) [illegible] 05 [illegible]

(ރ) [illegible]

9- (ހ) [illegible] 01 [illegible] 06 [illegible]

(ށ) [illegible] 01 [illegible] 25 [illegible]

T-MAK

3

ހިންގުމަށް އިމާރާތުގައި ވަޔަރ ނުގަތުމުގެ ނަގަރާތްތަކެއް. 25 ދުވަހަށްފަހު ބިމުގައިވާ އެންމެހާ ތަކެތި ވާނީ
ބިންކުއްޔަށް ދޫކުރިފަރާތުގެ ތަކެތި ކަމުގައެވެ.

10- މިބިން އެއްވެސް ފަރާތަކަށް ވިކޭ ގޮތަށް ނުވަތަ ރަހުނުކޮށްގެން ވިޔަފާރި ހިންގުމަށް ސަރުކާރު ބަލަހައްޓަން ވާނެއެވެ.

11- ދަނޑުވެރިކަން ކުރުމަށް ކަސްޓަމަރުން ކުއްޔަށް ދޫކުރާ ބިމުގައި އިސްތިހާރުދީ ދިވެހިރާއްޖޭގެ ގާނޫނާ އެއްގޮތަށް ގެނެސްފައި ހުރި އެއްވެސް ތަކެތި ވަކި ސަރުކާރު ބަލަހައްޓަން ވާނެއެވެ.

12- މިއެގްރީމެންޓް ދުވަސްކުރުމަށް ހިތަދޫ ކައުންސިލް ބިންބޭނުން ކުރުމަށް ކުއްޔަށް ހިފާ ފަރާތުން މެނޭޖުކުރާ ދަނޑު ސަރަހައްދު ހުސްކުރުމަށް ކުއްޔަށް ހިފާ ފަރާތުން އަދާކުރަން ވާނެއެވެ.

13- ބިން ދޫކުރުމަށް ފަހުން ބިމުގައި ހިންގާ މަސައްކަތަށް އެމަސައްކަތާއި ހިންގާ ގޮތް ބަލައި ބޭނުންވާނީ ކުރާ ހިންގުމުގައި ތަފުސީލު އިމާރާތް އެއްބާރުލުން ދިނުމަށް އިދާރާއަށް ލިޔުމުން ވާނެއެވެ.

14- މިއެގްރީމެންޓުގައި ބަޔާންކޮށްފައިވާ މަސައްކަތް ދިރާސާކޮށް، އެކަމާބެހޭ ދާއިރާތަކުން ލިބިދޭ ހުއްދަތަކާ އެއްގޮތަށް ކުރުމަށް، އެފަދަ މަސައްކަތް ދާއިރާތަކުން ހުއްދަދޭނަމަ އެމަސައްކަތް ކުރުމަށް ފުރުޞަތު ހުޅުވާލެވޭނެއެވެ. ކުއްޔަށް ހިފާ ފަރާތުން މަސައްކަތް ފެށުމަށް ހުއްދަ ނެގުމަށް ލިބިގެންވެއެވެ.

25 ސެޕްޓެމްބަރ 2013

ކުއްޔަށްދޫކުރާފަރާތުން

ޢަބްދުﷲ ޝާހިރު
މޭޔަރ

ކުއްޔަށް ހިފާފަރާތުން

ޓޫނާ މޯލްޑިވްސް އައްޑޫކަޓްސުއޮބުޝި ޕްރައިވެޓް ލިމިޓެޑް
ޢަބްދުﷲ ޒާހިރު
މެނޭޖިންގ ޑިރެކްޓަރ
ވިނަރީ ސ.ހިތަދޫ

ޝާހިދު:

އިބްރާހިމް ވަޙީދު
އެސިސްޓަންޓް ޑިރެކްޓަރ

ޝާހިދު:

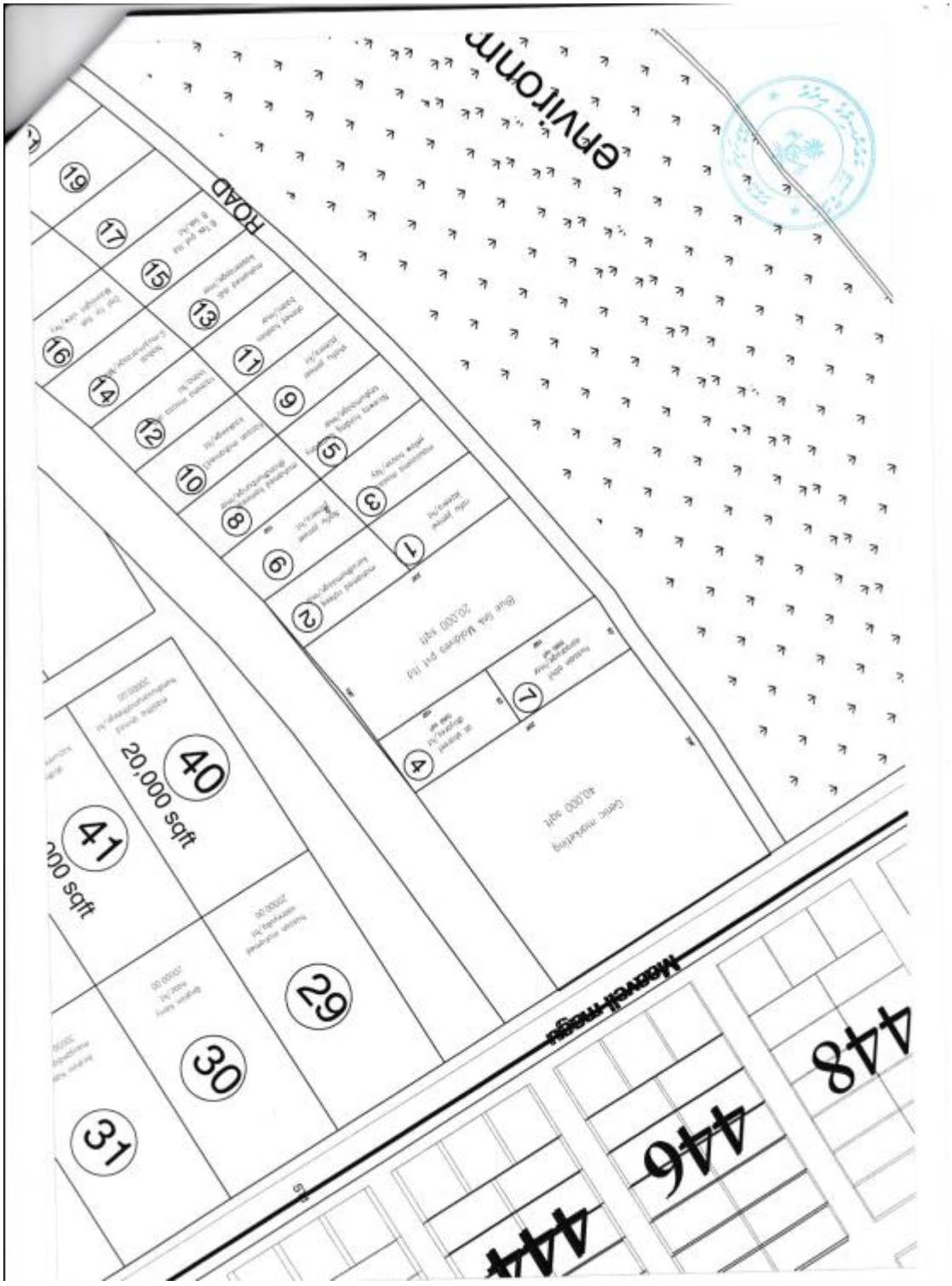
ޢަލީ މުޙައްމަދު
އޮލްސަންވިލާ/ސ.ހިތަދޫ
A132972

ޝާހިދު:

ޢަބްދުﷲ ރަޝީދު ޢަލީ
ނިކަގަސްދޮށުގެ/ސ.ހިތަދޫ

4

Appendix 2: Land use plan of the RAF area (Addu City)



Appendix 3: IEE Decision statement

203-ADMIN/PRIV/2015/125

ފުރަތަމަ ދިރާސާ ރިޕޯޓާބެހޭ ނިންމުން

މިއީ އައްޑޫ ސިޓީ ހިތަދޫގައި ކަޓްސުއޮބުޝި ޕްރޮސެސިންގ ފެސިލިޓީއެއް ގާއިމުކުރުމުގެ މަސައްކަތްކުރުމުގައި ގެނެވޭ ތިމާވެށްޓަށް ފުރަތަމަ ދިރާސާ ރިޕޯޓާބެހޭ ނިންމުން އެންވަޔަރަންމަންޓަލް ޕްރޮޓެކްޝަން އޭޖެންސީން އައްޑޫ ކަޓްސުއޮބުޝި ޕްރޮޖެކްޓްގެ ވިލަރެސް ދީފައި ނަންބަރު ވިއްޖެވެ.

■ މިމަޝްރޫޢުގެ ސަބަބުން ތިމާވެށްޓަށް ކުރާނެ ބޮޑު އަސަރެއް ކޮންޓްރޯލް ކުރެވޭނެ ފެންނާތީ. ވީމާ، ތިމާވެށްޓަށް އަސަރުކުރާނެ މިންވަރު ކުޑަކުރުމަށް ދީފައިވާ ލަފާތައް ހިފަހައްޓަންވާނެއެވެ.

☐ މިމަޝްރޫޢުގެ ސަބަބުން ތިމާވެށްޓަށް ކުރާނެ ބޮޑު އަސަރެއް ކޮންޓްރޯލް ނުކުރެވޭނެ ފެންނާތީ. ވީމާ، ތިމާވެށްޓަށް ގެއްލުންތެރި ޕްރޮޖެކްޓެއް ހިނގައިގެން ނުވާނެއެވެ.

އިދާރާ: އެންވަޔަރަންމަންޓަލް ޕްރޮޓެކްޝަން އޭޖެންސީ

ނަން: މުޙައްމަދު ޝަރީފް

މަޤާމު: ޑިރެކްޓަރ

ސޮއި:

ތާރީޚު: 4 މާރިޗު 2015

Appendix 4: Project approval from MoFA

Ministry of Fisheries and Agriculture

Male', Republic of Maldives

[illegible]

30-B/PRIV/2014/576 [illegible]

[illegible]

- [illegible]
- [illegible]
- [illegible] 15 [illegible] 2014

[illegible] 2.5 [illegible] 15 [illegible] 2014 [illegible]

- [illegible] 4 [illegible] 3 [illegible]
- [illegible]

[illegible]

13 [illegible] 1435

08 [illegible] 2014

1 | 1 [illegible]

Velaanaage, 7th Floor,

Ameeru Ahmed Magu, Male', 20096, Republic of Maldives

(+960) 332 2625 (+960) 332 6558 www.fishagri.gov.mv admin@fishagri.gov.mv fishagri

[illegible] 7 [illegible] 20096 [illegible]

Appendix 5: MFDA approval letter

بسم الله الرحمن الرحيم

ދިވެހިންނާ ދިވެހިރާއްޖެ – ފުރިހަމަ ދިވެހި، ދާއިމުވެ ސަލާމަތްތެރި
"Dhivehin" – Always Maldivian, Forever Independent

ވާތావරణ ආරක්ෂණ ඒජන්සිය
Environmental Protection Agency EPA

203-EIARES/PRIV/2015/654

Extended Terms of Reference for Environmental Impact Assessment for the proposed Katsuobushi Facility at Hithadhoo, Addu City

The following is the Extended Terms of Reference (ToR) for the EIA of the proposed Katsuobushi Facility at Hithadhoo, Addu City. 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 purpose of the project and, if applicable, the background information of the project/activity and the tasks already completed. Objectives of the development activities should be specific and if possible quantified. Define the arrangements required for the environmental assessment including how work carried out under this contract is linked to other activities that are carried out or that is being carried out within the project boundary. Identify the donors and the institutional arrangements relevant to this project.

2. **Study area** – Submit a minimumA3 size scaled plan with indications of all the proposed infrastructures. Specify the agreed boundaries of the study area for the environmental impact assessment highlighting the proposed development location and size of the proposed facility. The study area should include adjacent or remote areas, such as relevant developments and nearby environmentally sensitive sites (e.g. coral reef, sea grass, mangroves, 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.

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

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. In accordance with best international practice, the description should include all operations including use of port facilities by the boats, collection and transport of fish to the facility, onshore processing of the catches, arrangements for export of the product and quality control measures.

Type of species processed

- Identify species to be processed: Oily species pollute more than white fish (reef fish) therefore adjustments in design and mitigation measures will vary;
- Filleting, canning and packaging description;
- Weekly waste generation per unit weight of fish and how the offal is disposed, including blood water.

Environmental Protection Agency
Green Building, 3rd Floor, HandhuvareeHingun
Male', Rep. of Maldives, 20392
Tel: [+960] 333 5949 [+960] 333 5951 ގުޅުވުން:
Fax: [+960] 333 5953 ފެކްސް:

ވާތావරණ ආරක්ෂණ ඒජන්සිය
ހަންޑުވަރީ ހިންގުން، 3 ވަނަ ފަންގިފިލާ، ކޮޅުފޮތިގެ ކައިރި
ދާދި، ދިވެހިރާއްޖެ، 20392
Email: secretariat@epa.gov.mv ލިޔުންތަކ:
Website: www.epa.gov.mv ވެބްސައިޓ:

Facility design

- Description and justification of the location, size and design of the facility;
- Describe construction methods, materials, equipment required for construction and man power;
- Refrigeration design: capacity;
- Emergency plan during a power cut: waste generation will be intense due to refrigeration failure;
- Water supply needed including source, volume, pipeline structure and construction details and detailed water usages;
- Water pumping system;
- Waste water containing high nutrients (oils, proteins and suspended solids) treatment plan: sanitation process, treatment capacity, solid waste disposal mechanisms;
- Power supply plan: if inhabited island, define total power required from local power station (if possible); if in inhabited island and power requirements are too high for power station or if in uninhabited island, define power station facility design, construction details and operational features;
- Facility sanitation procedures: equipment and resources (water, products, power) required, periodicity;
- Access to facility activities including land clearance, jetty construction and road access Odour and noise control;
- Operational procedures for dispatching goods including type of transportation vessels;
- Infrastructure for staff including sewerage treatment plan;

Water intake pipeline

- Justification of location, distance from shore, depth of pipeline (include a map);
- Filter size;
- Construction operations, machinery required, man power.
- Propose an alternative source of water if the plant is to be expanded in the future.

Waste water (effluent) discharge pipeline

- Justify outfall site selection including the distance from the reef and depth of the pipe using oceanographic and ecological information. Currents and waves ought to quickly disperse the discharged water with minimum impacts on marine ecosystems and economic activities. Illustrate the extent of the sediment plume. The public and stakeholders should support the location of the outfall site;
- Describe equipment needed and construction methods for laying the offshore pipeline including handling transportation.

If power station required including fuel storage plan

- Location and size of generators and facility;
- Fuel transportation technique and volume required;
- Cooling water system including cooling pipe location (if any) and justification;
- Emergency supply;
- Low energy consumption ventures and awareness.

Packaging system

- Export and import plan: size of vessels entering port, volume of fish received per day, kilos of fish dispatched per day, destinations;
- Equipment required for packaging: card board boxes, plastic, wood, etc.;
- Number of employees;
- Packaging waste disposal mechanisms, e.g. faulty boxes;

Project management: Include communication of construction details, progress, target dates and duration of works, construction/operation/closure of labor camps, access to site, safety, equipment and material storage, water supply, waste management from construction operations (mainly dredged materials), power and fuel supply;

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, vegetation transects and manta tows sites for posterior data comparison. Information should be divided into the categories shown below:

Climate

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

Physical parameters required for water intake and effluent (waste) water outfall pipelines (use maps where appropriate)

- Tidal ranges and tidal currents;
- Wave climate and wave induced currents;
- Wind induced (seasonal) currents;
- Bathymetry (bottom morphology) (use maps);
- Characteristics of seabed sediments to assess direct habitat destruction and turbidity impacts during construction;
- Ground water quality assessment to assess possible contamination (see appendix for guidelines);
- Sea water quality measuring these parameters: temperature, pH, salinity, turbidity, sedimentation rate, phosphate, nitrate, ammonia, sulphate, BOD and COD.

Biological parameters: Land-water run-off could affect the marine environment:

- 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 island (see appendix for monitoring guidelines);

Socio-economic environment

- If in inhabited island, 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;
- Accessibility for commuting workers from neighbouring islands;
- Land use planning, natural resource use and zoning of activities at sea;
- Accessibility and (public) transport to other island;
- Services quality and accessibility if in inhabited island (water supply, waste/water disposal, energy supply, social services like health and education);
- Community needs, if in inhabited island;
- Sites with historical or cultural interest or sacred places (mosques, graveyard), if in inhabited island.

Absence of facilities in the country to carry out the water quality tests will not exempt the proponent from the obligation to provide necessary data. The report should outline the detailed methodology of data collection utilized to describe the existing environment.

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

- If it the project is focussed on an uninhabited island, the Law of Leased Islands ought to be consulted;
- Approval from the Ministry of Fisheries and Agriculture;
- Approval from the Housing and Environment Ministry.
- Land lease agreement

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

- Terrestrial impacts: including ground water quality and vegetation and fauna biodiversity structure and abundance from land clearance activities;
- Habitat destruction impacts from pipeline construction operations;
- At effluent (waste) water outfall site, assess impacts from increased nutrients (eutrophication) in the surrounding waters, assess seawater quality;
- Impacts on nearby MPAs or sensitive areas (natural breeding grounds and feeding grounds);
- Impacts on landscape integrity/scenery.

Impacts on the socio-economic environment, mostly if project is for inhabited islands

- Impacts of odours;
- Impacts on food prices and food availability;
- Impacts of intense organic materials on other resource users e.g. fisheries and tourism industry (nearby resorts and dive sites);
- Impacts on island employment, income and economy diversification;
- Impacts of increased demands on natural resources and services especially water supply, land availability, waste management, energy supply, harbour capacity;
- Impact equity (economic activities, employment, income);
- Social destabilization of the island community.

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

Task 5. Alternatives to proposed project – Describe alternatives including the *"no action option"* should be presented. Determine the best practical environmental options. Alternatives examined for the proposed project that would achieve the same objective including the "no action alternative". This should includeAlternative Island, water pumping technology, effluent (waste) water outfall pipelines and water intake pipeline locations taking into account environmental, social and economic factors. 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 with particular attention paid to sedimentation control and future changes in coastal processes. Mitigation measures to avoid or compensate habitat destruction. 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. An Environmental management plan for the proposed project, identifying responsible persons, their duties and commitments shall also be given. In cases where impacts are unavoidable arrangements to compensate for the environmental effect shall be given.

Task 7. Development of monitoring plan (see appendix)– Identify the critical issues requiring monitoring to ensure compliance to mitigation measures and present impact management and monitoring plan for ground water and sea water quality as well as for marine ecosystem due to increased nutrients in surrounding waters. 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. Monitoring of the following is required:

- Sea water quality especially at effluent outfall site, water intake pipeline and surrounding areas. Select a control site in another location around the island;
- Marine ecosystem monitoring especially at effluent outfall site, water intake pipeline and surrounding areas. Select a control site in another location around the island;
- Ground water assessment to monitor possible contamination.

* This TOR contains an outline of the parameters that have to be tested (see appendix). All projects are different, therefore additional or less data will be collected for recovery and impact assessments.

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 Addu city council, utility service providers, Maldives Food and Drug Authority, Ministry of Fisheries and Agriculture and the general public of Hithadhoo. The EIA report should include a list of people/groups consulted, their contact details and summary of the major outcomes.

Presentation- The environmental impact assessment report, to be presented in digital format, will be concise and focus on significant environmental issues. It will contain the findings, conclusions and recommended actions supported by summaries of the data collected and citations f or any references used in interpreting those data. The environmental assessment report will be organized according to, but not necessarily limited by, the outline given in the Environmental Impact Assessment Regulations, 2012 and the relevant amendments

Timeframe for submitting the EIA report – The developer must submit the completed EIA report within 3 months from the date of this Term of Reference.

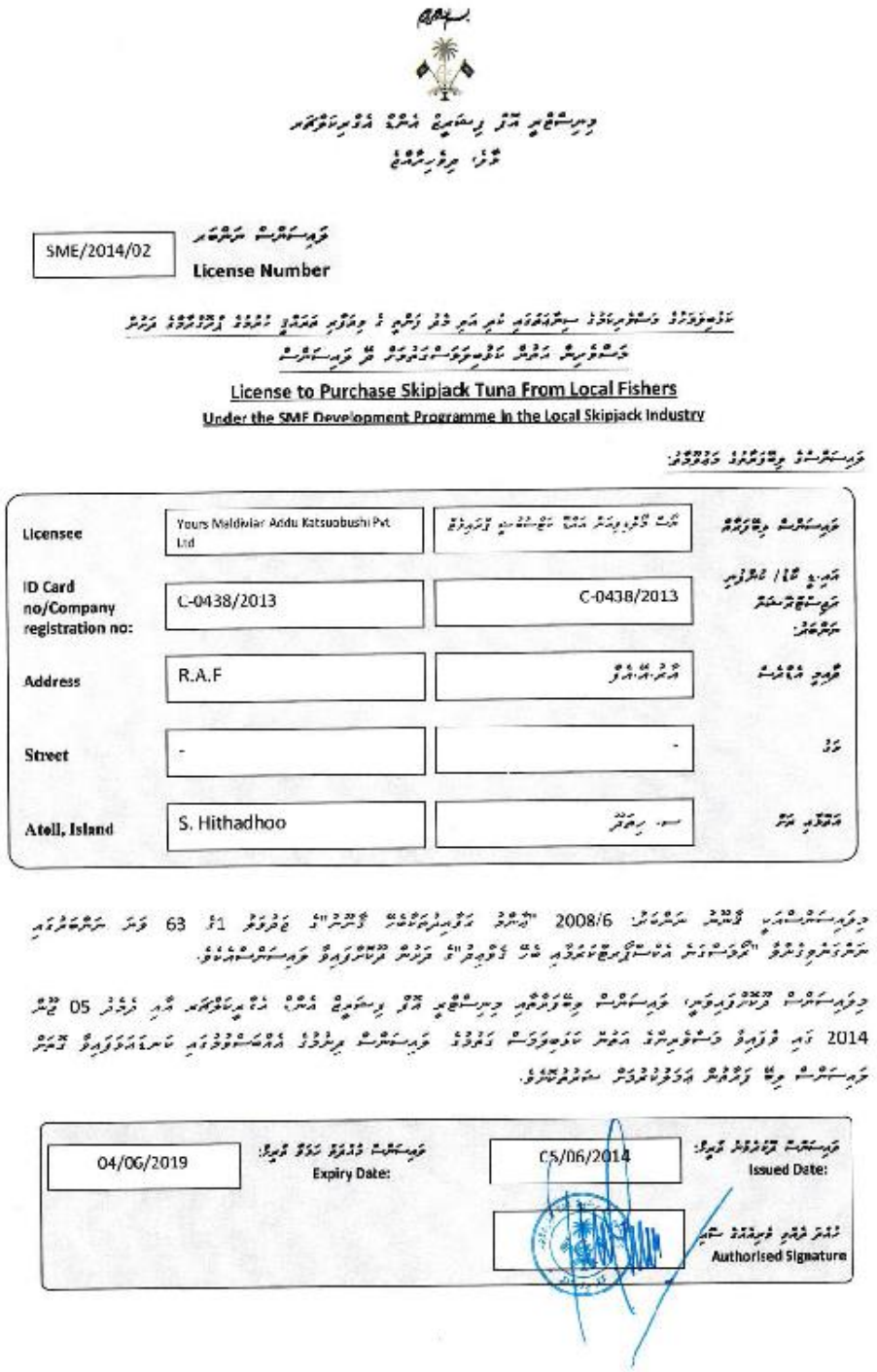
……

13th December 2015

Appendix 7: Timeline of activities

Activity	Weeks																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Site preparation																								
Mobilization																								
Construction of main production facility																								
Construction of staff accommodation block																								
Constructing the effluent pipeline																								
Other construction works (e.g. groundwater wells etc.)																								
Installing machinery and equipment																								
Waste removal and thorough cleaning the facility for operation																								
Facility inspection and obtaining necessary permissions																								
Commencement of operations																								

Appendix 8: Fish purchasing license



ދިވެހިރާއްޖެ ގައުމީ ތަރައްޤީ ބޯޑުގެ ގޮތުން

ފުރާ ތިރުވަނައްދޫ

SME/2014/02

ލައިސަންސް ނަންބަރ

License Number

ލޯކަލް ފިޝަރމަންސްގެ ކިޓ ކެޓ ސްކިޕްޖެކް ގަދަކުރުމުގެ ގޮތުގައި ދިވެހިރާއްޖެ ގައުމީ ތަރައްޤީ ބޯޑުގެ ފަރާތުން ދެވޭ ލައިސަންސް

License to Purchase Skipjack Tuna From Local Fishers

Under the SME Development Programme in the Local Skipjack Industry

ލައިސަންސް ދީފައިވާ ފަރާތުގެ ތަފްޞީލު:

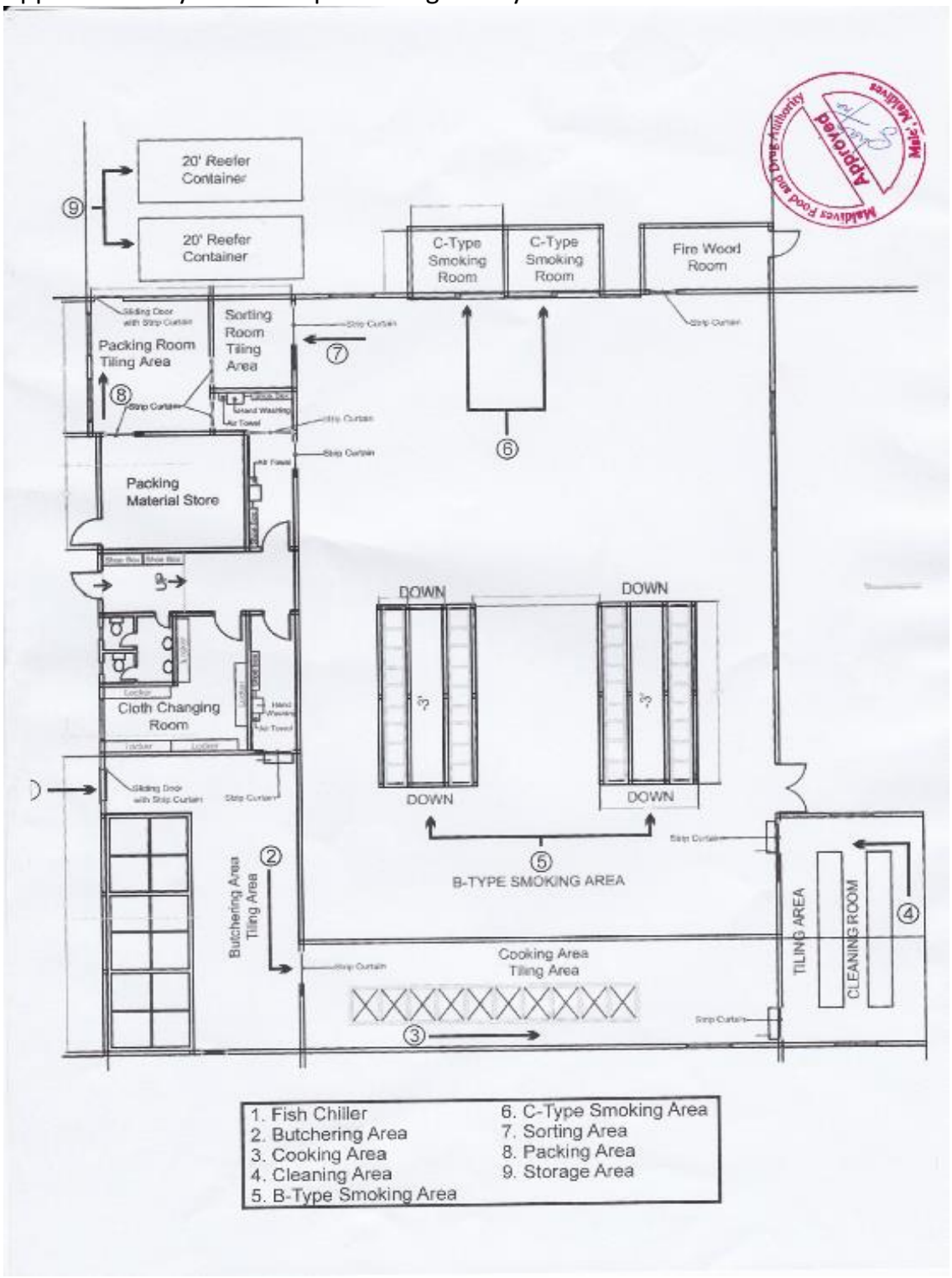
Licensee	Yours Maldivian Addu Katsuobushi Pvt Ltd	ތ.ކ.ކ ކުރިއަރާ ދަތުރުކުރާ ކުންފުނި	ލައިސަންސް ދީފައިވާ ފަރާތް
ID Card no/Company registration no:	C-0438/2013	C-0438/2013	ތާއީދު ކާޑު/ ކުންފުނި ރަޖިސްޓްރީ ނަންބަރ:
Address	R.A.F	ފ.ރ.ދ.ފ	ވަކިވި ތާށި
Street	-	-	ރޯޑ
Atoll, Island	S. Hithadhoo	ސ. ހިތަދޫ	ތަނޭ ތަން

ދިވެހިރާއްޖެ ގައުމީ ތަރައްޤީ ބޯޑުގެ 2008/6 ނަންބަރު "ގައުމީ ތަރައްޤީ ބޯޑު ބާރުދިނުމާ ގުޅޭ" ގަވާއިދުގެ 21 ވަނަ ގާނޫނުގެ ދަށުން "ދިވެހިރާއްޖެ ގައުމީ ތަރައްޤީ ބޯޑު" ގެ ފަރާތުން ލައިސަންސް ދީފައިވެއެވެ.

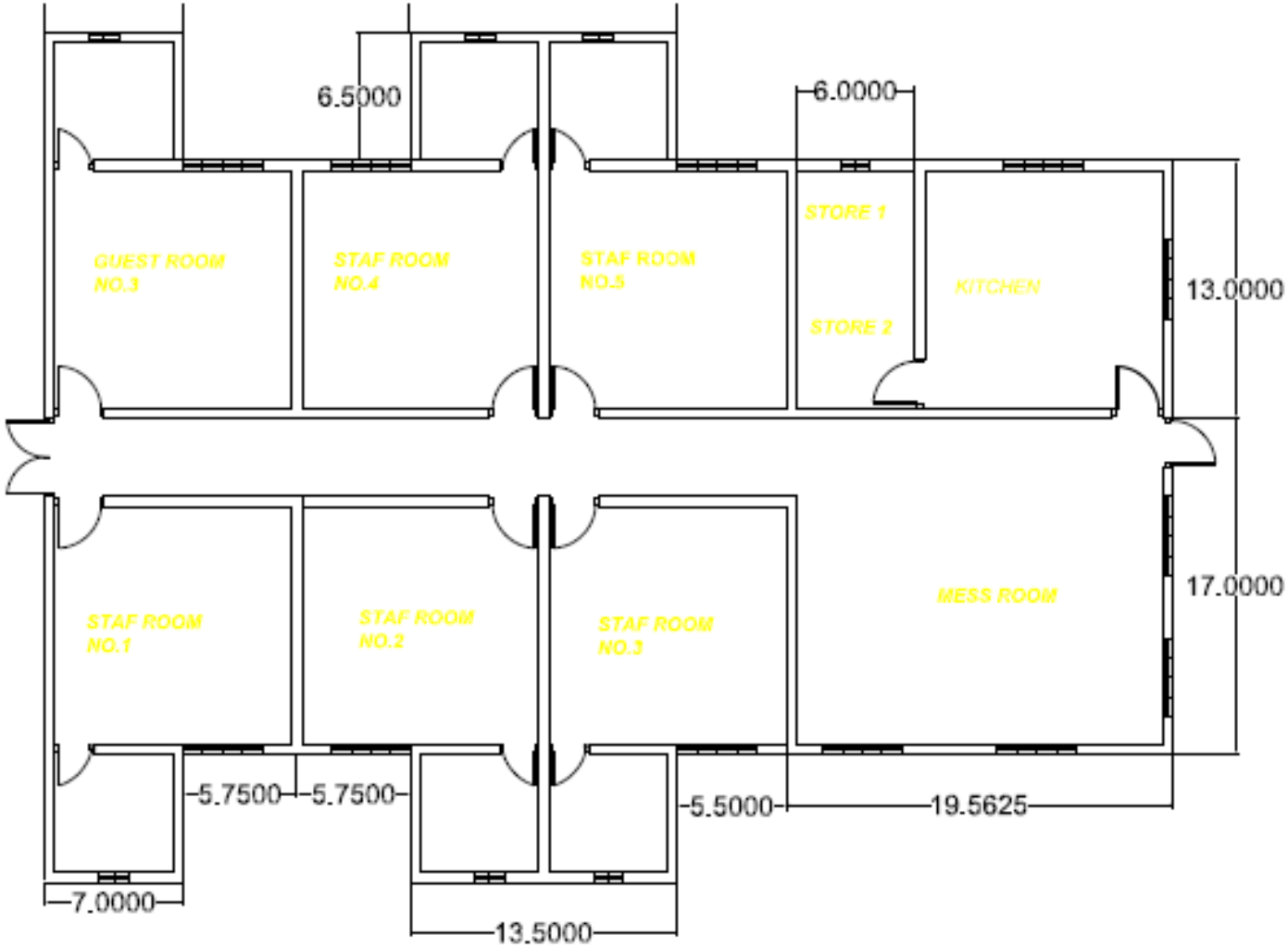
ދިވެހިރާއްޖެ ގައުމީ ތަރައްޤީ ބޯޑުގެ ވާދަކުރުމުގައި ދިވެހިރާއްޖެ ގައުމީ ތަރައްޤީ ބޯޑުގެ ގާނޫނު 2014/5 ގެ 05 ވަނަ ދުވަހު ކަނޑައެޅިފައިވާ ގޮތުގެ ދަށުން ކަނޑައެޅިފައިވާ ތަކެއްޗާ ގުޅޭ ލައިސަންސް ދީފައިވާ ފަރާތުން ހަދަންޖެހޭ ގޮތްތައް ހަމަޖެހުމަށް ލައިސަންސް ދީފައިވާ ފަރާތަށް ދަންނަވަމެވެ.

04/06/2019	ލައިސަންސް ހަމަވާ ދުވަސް Expiry Date:	05/06/2014	ލައިސަންސް ދެއްވި ތާރީޚް Issued Date:
			ބާރުދޭ ފަރާތުގެ ސޮއި Authorised Signature

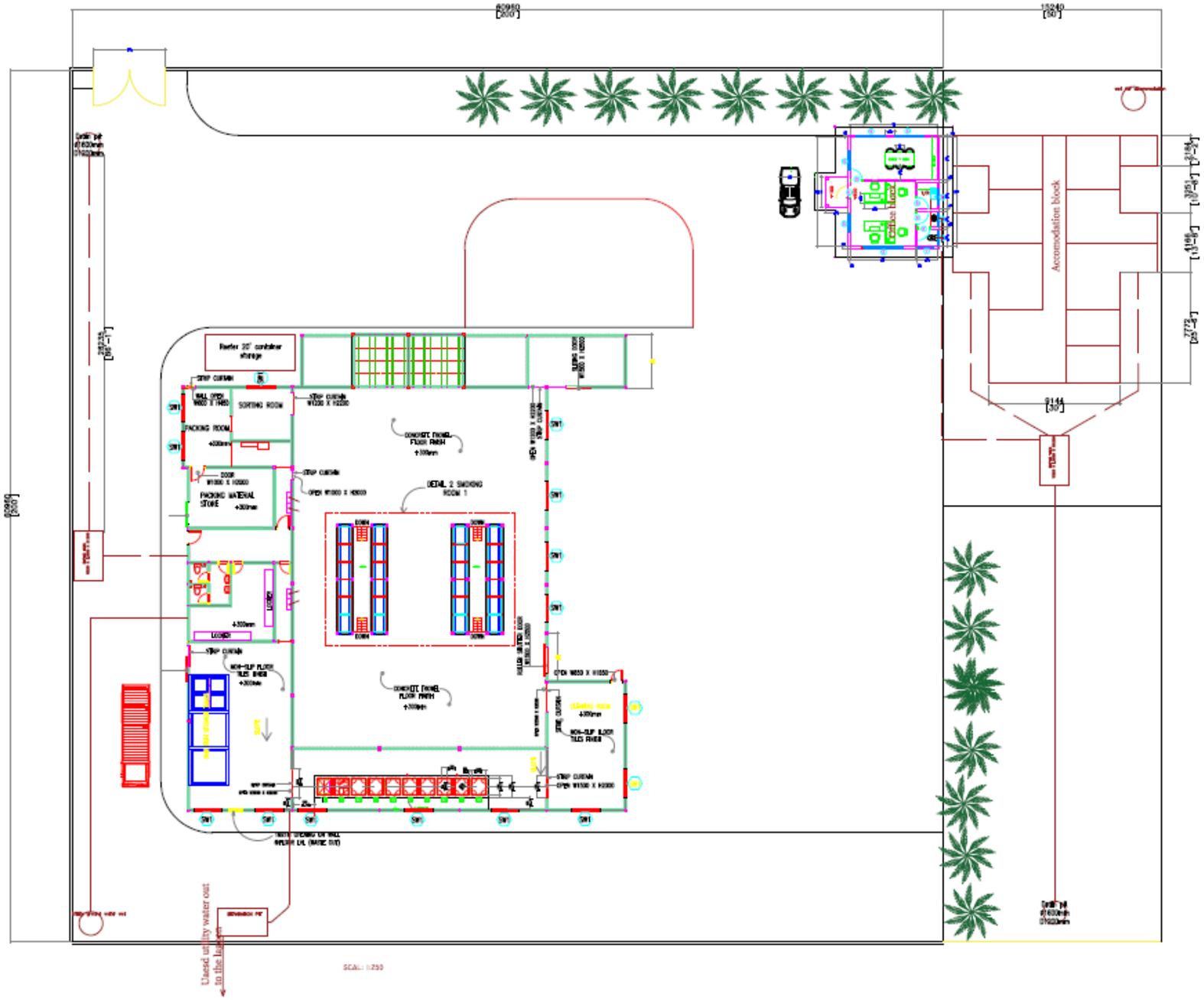
Appendix 9: Layout of the processing facility



Appendix 10: Layout of the staff accommodation block



Appendix 11: Layout of the project site



Appendix 12: Water quality test results

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

MWSC

WATER QUALITY TEST REPORT

Test Report No: 301312/2015/01

Customer Informations : ***Mr. Mohamed Ahusan***
Ma. Vili
Bulbul Goalhi
Male'
Rep.of Maldives

Date: 14/12/2015

Sample Description / Location~	S. Hithadhoo		TEST METHOD	UNIT
	RAF Area Sea	RAF Area GW		
Sample Type~	Sea Water	Ground Water		
Sampled Date~	6/12/2015			
Sample Received Date	7/12/2015			
Test Requisition Form No.	900162646			
Sample No.	820919	820920		
Date of Analysis	8/12/2015 - 13/12/2015			
PARAMETER	ANALYSIS RESULT			
Physical Appearance	Clear	Clear	Visual	-
Conductivity	51100	23.1	Electrometry	µS/cm
Nitrate	3.9	0.8	Method 8039 (Adapted from HACH DR5000 Spectrophotometer procedure Manual)	mg/L
pH	8.28	7.71	Method 4500-H+ B. (adapted from Standard methods for the examintation of water and waste water, 21st edition)	-
Salinity	33.48	0.02	Method 2520 B. (adapted from Standard methods for the examintation of water and waste water, 21st edition)	‰
Biological Oxygen Demand		3	HACH Method 8043	mg/L
Total Suspended Solids	<5 (LoQ 5mg/L)	<5 (LoQ 5mg/L)	Method 8006 (Adapted from HACH DR5000 Spectrophotometer procedure Manual)	mg/L

Keys:
mg/L: Milligram Per Liter, **‰:** Parts per thousand, **°C:** Degree Celcius, **µS/cm:** Micro Siemens per centimeter, **NTU:** Nephelometric Turbidity Unit
LOQ: Limit of Quantification

Checked by:	Approved by:
Nihaz Ali Zahir Laboratory Executive	Abdulla Rasheed Quality Officer

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

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

Appendix 13: Proof of receipt from City Council

Addu City Council,
Addu City
Republic of Maldives

Receipt of Document

I hereby acknowledge receipt of the following document to the Council of Addu City.

- Report "Environmental Impact Assessment (EIA) for Establishment of a Katsuobushi Processiing Facility in Hithadhoo, Addu City. December 2015"

Signature:

Name: Shan

Designation: Admin officer

Date: 22/12/15

Appendix 14: CV of contributors to the EIA

CURRICULUM VITAE

Mohamed Ahusan

Ma. Vili, Male' | (960) 767 0982 | mohamed.ahusan@gmail.com
Date of Birth: 29th April 1981 | Male

EDUCATION

B. Sc. In Marine Biology Universiti Malaysia Terengannu, Malaysia	2011
London GCE Advanced Level Science Education Centre, Maldives	2000

EMPLOYMENT HYSTORY

Senior Research Officer Marine Research Centre Ministry of Fisheries and Agriculture	2011 – to date
Assistant Research Officer Marine Research Centre Ministry of Fisheries, Agriculture and Marine Resources	2000 - 2008

WORK EXPERIENCES

Coordinated and actively participated in the Regional Tuna Tagging Project.	29 June – 02 July 2014
Active role in the Indian Ocean Tuna Tagging Project	
Managed the Maldives Tuna Pole-and-line Port sampling Project funded by the World Wide Fund for Nature (WWF)	
Managed the national Tuna Size sampling project at the Marine Research Centre, Ministry of Fisheries and Agriculture.	

MEETINGS, WORKSHOOPS AND SEMINARS ATTENDED

Fourth Session of the Indian Ocean Tuna Commission Working Party on Neritic Tunas Phuket, Thailand	29 June – 02 July 2014
Bay of Bengal Large Marine Ecosystem's Marine Protected Areas (MPA) Working Group meeting Penang, Malaysia	11 – 12 February 2014
Second Session of the Indian Ocean Tuna Commission Working Party on Neritic Tunas Penang, Malaysia	19 – 21 November 2012
Seventh Technical Advisory Committee Meeting of the Bay of Bengal Program – Intergovernmental Organization Colombo, Sri Lanka	27 – 28 August 2012
Indian Mackerel Fisheries Assessment Working Group - Bay of Bengal Large Marine Ecosystem Project Colombo, Sri Lanka	28 – 29 May 2012

Scientific Committee of the South West Indian Ocean Fisheries Commission Cape Town, South Africa	27 Feb – 1 Mar 2012
Indian Mackerel Fisheries Assessment Working Group - Bay of Bengal Large Marine Ecosystem Project Kochi, India	1 – 2 Dec 2011
First Session of the Indian Ocean Tuna Commission Working Party on Neritic Tunas Chennai, India	14 – 16 November 2011
Seventh Session of the Indian Ocean Tuna Commission Working Party Meeting on Ecosystem and Bycatch Paradise Island Resort, Maldives	24 – 27 October 2011
Thirteenth Session of the Indian Ocean Tuna Commission Working Party of Tropical Tunas Paradise Island Resort, Maldives	16 – 23 October 2011

TRANINGS AND OTHER SHORT COURSES

Fishing Capacity Assessment Training Bay of Bengal Large Marine Ecosystem Phuket, Thailand	12 -13 January 2015
1st Workshop on Connecting the IOTC Science and Management Processes Indian Ocean Tuna Commission / Bay of Bengal Large Marine Ecosystem Phuket, Thailand	25 – 27 June 2014
Weight of Evidence Workshop South West Indian Ocean Fishery Commission Mombasa, Kenya	24 - 24 March 2014
Climate Change University of Melbourne Online Course	2013
Environment Management Massey University Male', Maldives	August – December 2005
Group Training Course in Integrated Inshore Resources Management in Tropical Countries Japan International Cooperation Agency Yokohama, Japan	24 September – 7 November 2003
Training of Trainers Course in DFID (Department for International Development in Fisheries) FMSP (Fisheries Management Science Programme) Stock Assessment Software University of Nairobi Nairobi, Kenya	10 – 15 February 2003
GCRMN South Asia Training Workshop on Coral Reef Database data entry and management IOC-UNESCO/UNEP/IUCN, Global Coral Reef Monitoring Network (GCRMN) Male', Maldives	30 – 31 July 2001