ADDENDUM TO ENVIRONMENT IMPACT ASSESSMENT REPORT

Water Supply and sewerage System, Hulhumale Phase 2

Report Prepared by LAMER Group Pvt Ltd
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October 06 2020

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Proponents Declaration

Re: First Addendum to the Environmental Impact Assessment for the Proposed Water and Sewerage Project at Hulhumale' Phase 02

As the proponent of the proposed project WE guarantee that WE have read the report and to the best of our knowledge all non-technical information provided here are accurate and complete. Also, we hereby confirm our commitment to finance and implement all mitigation measures and the monitoring program as specified in the report.

Signature:

Name: BUSHRA HAMEED

Designation: GENERAL MANAGER, ENGINEERING

On behalf of: MALE' WATER & SEWERAGE COMPANY (MWSC)

Date: 6th October 2020

Consultants Declaration

I certify that to best of my knowledge that the statements made in this First Addendum to the EIA Report for the Proposed Water and Sewerage Project at Hulhumale' Phase 02, are true, complete and correct.

Name: Hussein Zahir

Consultant Registration Number: EIA P04/2007

Signature:

Company Name: Land and Marine Environmental Resource Group Pvt Ltd

Date: 6th October 2020

1 Non-technical Summary

1.1 Background

The non-technical summary outlines the findings of the First Addendum to the EIA report for the Proposed Water and Sewerage Project at Hulhumale' Phase 02. The Addendum is formulated to obtain environmental clearance for the changed location of the southern side outfall pipeline, by shifting it 114m north of initially proposed location, to avoid the Ooredoo submarine cable. Pipeline design and construction method remain the same as discussed in initial EIA report for the project and hence is not discussed in this Addendum.

1.2 Key impacts, mitigation measures and alternatives

Impacts and mitigation measures discussed in the initial EIA report are seen to be of relevance and sufficient for proposed relocation of outfall pipeline and hence are not discussed in this Addendum. Monitoring programme given in the initial EIA is also sufficient for proposed work and hence is not reiterated in this EIA report.

Alternatives considered in the EIA report also discuss alternative locations for outfall pipeline. The only additional alternative which has been considered in this Addendum is that of the no-project scenario. Selection of this would mean that need for the project which is to avoid the existing submarine fibre optic cable (Ooredoo Maldives) around 6m depth zone would not be met. Installation of the pipeline has the potential to damage the submarine cable during construction. Hence this is not considered a feasible option.

Hence, in consideration of proposed works, the Consultant concludes that the proposed project is feasible and can be carried out with full implementation of mitigation measures and monitoring programme given in the initial EIA report for the project.

1. ޚުލާޞާ

1.1 ތަޢާރުފު

މި ޚުލާޞާއިން ދައްކައިދެނީ މާލޭ ވޯޓަރ އެންޑް ސުވަރޭޖް ކޮމްޕެނީ ޕްރައިވެޓް ލިމިޓެޑްގެ ފަރާތުން ހުޅުމާލޭގެ ދެވަނަ ފިޔަވަޅުގައި އެޅުމަށް ހަމަޖެހިފައިވާ ފެނާއި ނަރުދަމާ ނިޒާމް އެޅުމުގެ ކުރިން ތައްޔާރުކޮށްފައިވާ ތިމާވެއްޓަށް އަސަރު ކުރާނެ މިންވަރު ބަޔާންކުރާ ރިޕޯޓުގެ ފުރަތަމަ އެޑެންޑަމްގެ ހޯދުންތަކުގެ ޚުލާޞާއެކެވެ. މިއެޑެންޑަމް ތައްޔާރުކޮށްފައިވަނީ އެމަޝްރޫޢުގެ ދަށުން އެޅޭ ނަރުދަމާ ނިޒާމްގެ ނަޖިސްބޭރުކުރާ އައުޓްފޯލް އެޅުމަށް ނިންމިފައިވާ ސަރަހައްދު ބަދަލުވުމުގެ ސަބަބުން އެކަމަށް ހުއްދަ ހޯދުމުގެ ގޮތުންނެވެ. މިގޮތުން މިހާރު ހުށަހަޅަނީ ކުރިން ހަމަޖެހިފައިވާ ސަރަހައްދަށްވުރެ 114މ. އުތުރު ސަރަހައްދަކަށް މިއައުޓްފޯލް ބަދަލުކުރުމަށެވެ. މިގޮތުން ސަރަހައްދު ބަދަލުކުރުމުގެ ސަބަބުން ހޮވިފައިވާ ގޮތްތަކާއި ޖެހިގެން ބަދަލު އައިސްފައި ނުވުމުގެ ސަބަބުން މިބައިތަކުގެ ތަފްސީލު މިރިޕޯޓުގައި ހިމެނިފައިއެއްނުވާނެއެވެ. މިމައުލޫމާތު މިމަޝްރޫޢަށް ތައްޔާރުކުރެވުނު އީ.އައި.އޭ. ރިޕޯޓުގައި ތަފްސީލުކުރެވިފައިވާނެއެވެ.

1.2 ތިމާވެއްޓަށް ކުރާނެ އަސަރު، އަދި މިއަސަރު ކުޑަކުރުމަށް އެޅިދާނެ ފިޔަވަޅުތަކާއި ބަދަލުގައި ކުރެވިދާނެ ކަންތައް

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2 Introduction

This First Addendum to the Environmental Impact Assessment (EIA) report for the proposed Water Supply and Sewerage System Hulhumale Phase 02, Male' Atoll is formulated to address the proposed location change of one of the sea outfall locations addressed in initial EIA for project (Sandcays Pvt Ltd, 2016). The initial EIA for the project was submitted on 23rd May 2016 and approved in August 2016 (Figure 1 shows proposed outfall locations given in the EIA report).

Under the project 4 outfalls were proposed to be constructed at two locations (each location with 2 pipelines run together). The outfalls were located at northern side and southern side of Hulhumale phase 2 eastern reef. Amongst the outfalls northern outfall lines were completed initially, while setting out works of southern outfall revealed that Ooredoo Maldives fiber optic submarine cable crosses the path of sea outfall line. Therefore, MWSC decided to move southern side sea outfall approximately 114m north of proposed location to avoid the submarine cable. Construction method and other related activities remains the same as described in the EIA report.

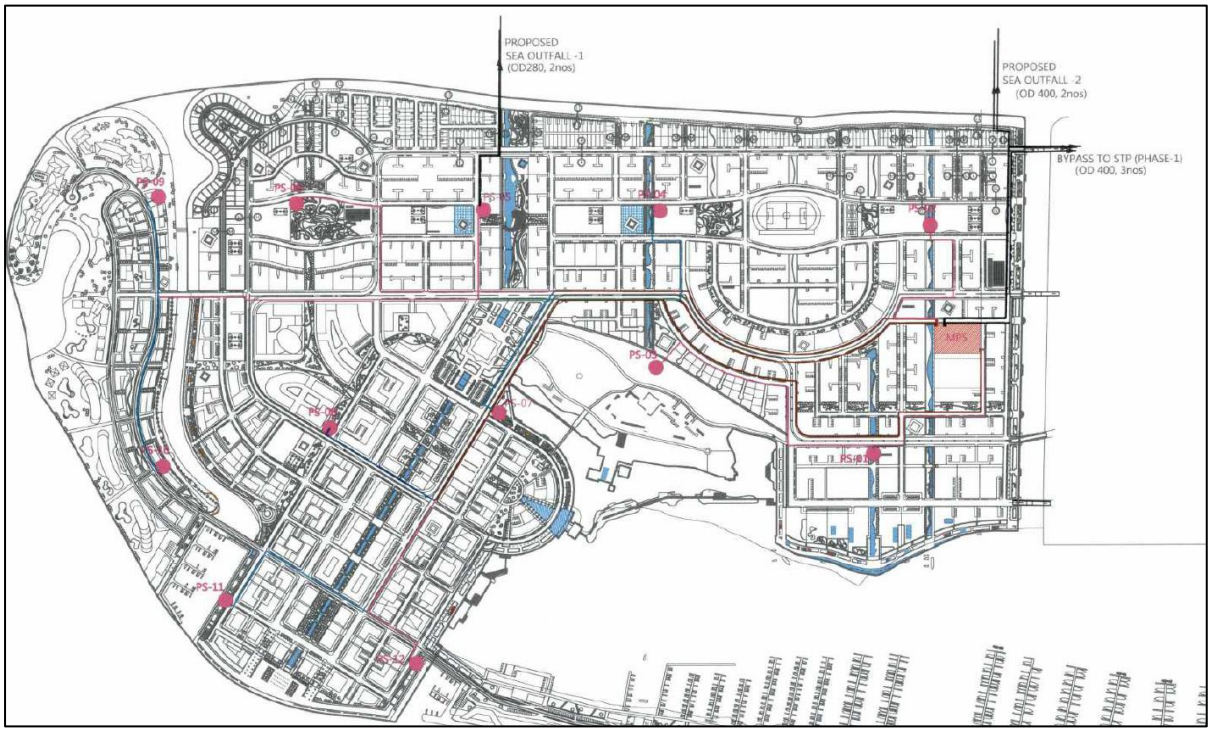


Figure 1. Location of proposed outfalls given in page 38 of EIA report (Figure 2-2 Water Supply Network, sourced from Sandcays Pvt Ltd., 2016)

2.1 Purpose of the report and need for the EIA

This document presents the findings of the First Addendum to EIA for the proposed Water Supply and Sewerage System Hulhumale Phase 02, Male' Atoll. Developers of such development projects are required to carry out EIA studies under the Environmental Act of Maldives. The developer is required to obtain approval of the Environmental Protection Agency, prior to the implementation of any development activities on the island.

Land and Marine Environmental Resource Group Pvt. Ltd. has been engaged by MWSC Plc to prepare the addendum to the EIA and to provide assistance in other environmental related activities. This report is prepared in accordance with Environmental Impact Assessment Regulation of the Environmental Protection Agency, the environmental policy and guidelines of the Government of Maldives.

3 Terms of Reference (ToR)

All development projects that have a socioeconomic environmental relevance and are listed in Appendix Raa (Appendix 4) of the EIA Regulations 2012 are required to submit an Environmental Impact Assessment report which forms the basis for project approval. As such, projects are required to follow a screening process identifying the environmental impacts associated with the project. Projects which are not listed in the above-mentioned Appendix has to follow a screening process, based on which EPA decides whether the project requires the submission of an Initial Environment Evaluation report or an Environmental Monitoring report. Based on the findings of this report, EPA as the regulator makes a decision on whether the specified project further requires the submission of an EIA based on the impacts associated with the project.

In accordance with the regulations of Ministry of Environment, an Addendum application was submitted to the Environmental Protection Agency and a Terms of Reference was finalized and approved by EPA on the 29th September 2020 (see Appendix 2).

4 Project Setting

Legislation and guidelines relevant to the project have been discussed in detail in Section 3 of the EIA report. The only additional legislation of relevance, which has not been prior discussed it the Water and Sewerage Act which was enacted on 5th August 2020. This is discussed in detail in Table 1 below. The legislation and guidelines which have been discussed in the initial EIA report are not reiterated in this Addendum. Hence, please refer to Chapter 3 of the initial EIA report for relevant legislation and how the project pertains to these legislations (Sandcays Pvt Ltd., 2016).

Table 1. Legislations pertaining to the project

Legislation	How project pertains to the legislation
Water and Sewerage Act 8/2020	The Act was recently enacted on 5th August 2020 with immediate effect. This act will precede any law or regulation that would coincide with this law. All related articles on water and sewerage stipulated in the General Regulations Act (6/2008) will be redundant with the enactment of this law. The act stipulates the establishment of safe and suitable potable water and appropriate sewerage systems for all the inhabited islands of the Maldives. The Act ensures the protection and conservation of the natural water resources available through guidelines and procedures stipulated within the act and other relevant guidelines that will be formulated under this act. The Act reiterates the need of EIA for all water and sewerage establishments. It states that the permit for construction of the systems can only be given after the formulation and approval of EIA (when Decision Statement is issued by EPA). Articles that concerns the proposed project at this stage are briefly explained below: • In article 18 (baa) it states that desalination intake should be below the freshwater lens of the island ensuring no impact to the ground water. • In article 26, the Act mandates the use of modern technology to seek the most environment friendly means of providing water and sewerage services

	• In article 27, it stipulates that renewable energy must be utilised in the production of water. The operation license should only be given if they fulfill this requirement. • Article 28 requires integrating treated rainwater into the desalination process and encourages to harvest the maximum possible amount of rainwater to be used in the system. • Article 31 stipulates that the potable water should meet FDA standards and the Utility Authority should also have minimum standards for water quality.

5 Project Description

5.1 Project Proponent

The proponent of the proposed project is Male' Water and Sewerage Company Pvt Ltd.

5.2 The Project

The EIA report prepared for Water Supply and Sewerage Systems Hulhumale Phase 02, proposed 4 sea outfalls for the sewerage network, constructed in pairs at two locations. From these two locations, the pipelines at the northern side of Hulhumale phase 02 is already constructed while setting out works for the southern side pipelines revealed that Ooredoo Maldives fibre optic submarine cable crosses path of the pipelines. Hence these two pipelines are proposed to be shifted approximately 114m north of proposed location (Figure 2).

The method of construction and design of the pipeline remains the same as provided in the EIA report (Sandcays Pvt Ltd 2016 Section 2.8.6) and hence will not be discussed in detail in this Addendum.

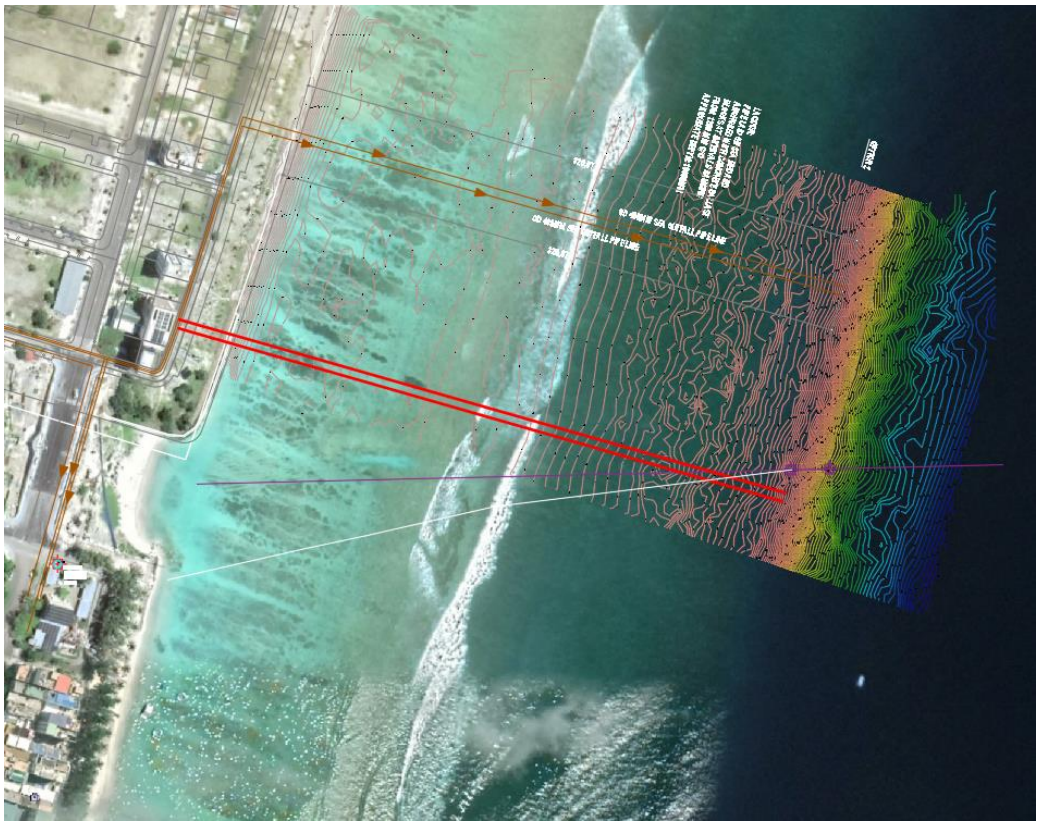


Figure 2. Location of outfall given in EIA report (red lines), proposed change to outfall location (brown lines), existing submarine cable (purple points are mapped point of cable at reef slope while the white line is traced from Google earth) (detailed scaled drawing is provide in Appendix 3)

5.3 Need for the Project

The main reason for the change in location for the 2 outfalls at the southern side is to avoid the existing submarine fibre optic cable (Ooredoo) around 6m depth zone. Since the pipeline will be anchored using concrete ballast anchor blocks (2ton) (Figure 3), there is possibility of damage to submarine cable during construction of the outfall pipeline. Hence MWSC Pvt Ltd decided to shift the location approximately 114m north of approved location thereby avoiding crossing the submarine fibre optic cable.

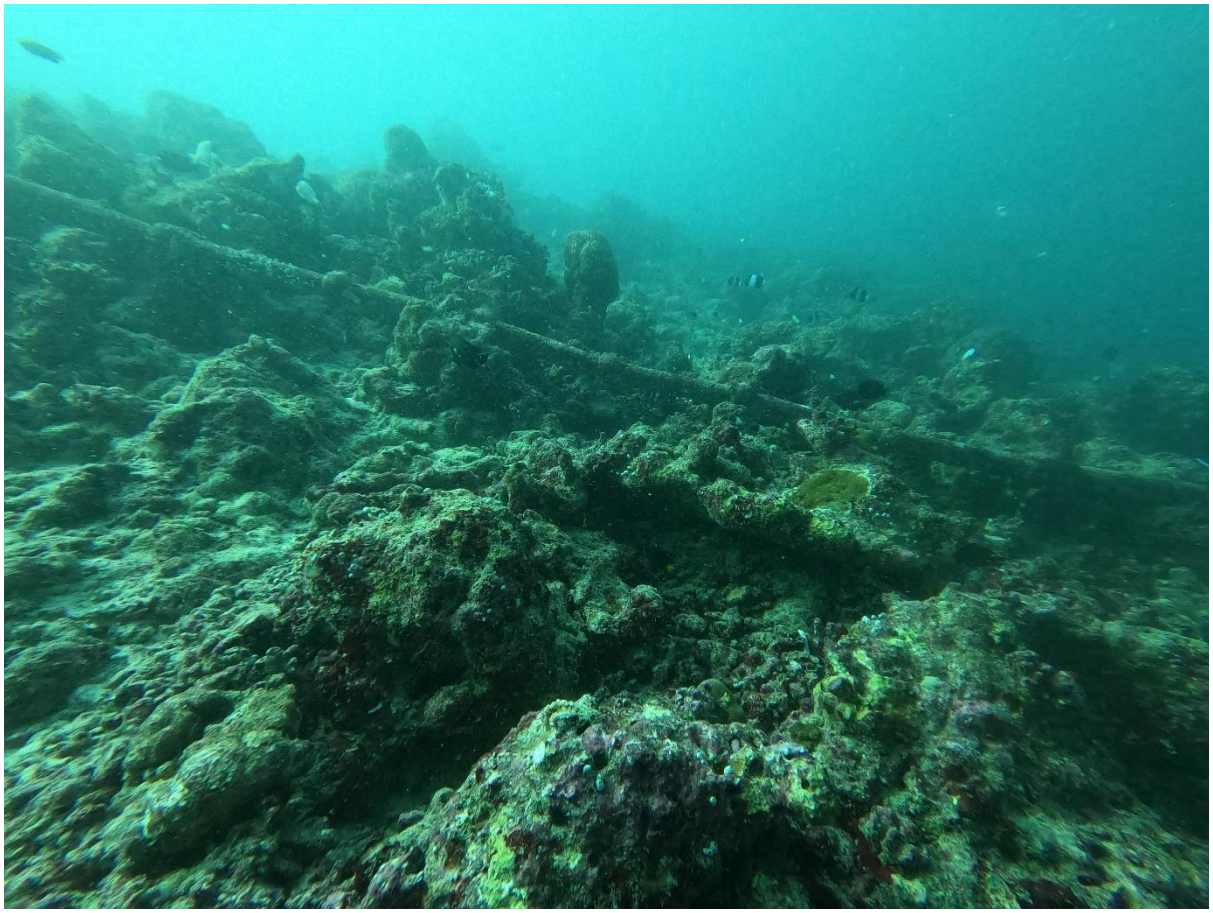


Figure 3. Submarine fibre optic cable at initial approved pipeline route (crossing the proposed pipeline route around 6m depth)

5.4 Construction phase and schedule for implementation

Revised construction schedule for the project is provided in Appendix 4. According to the revised schedule the pipeline construction works are expected to take 30 days from date of approval of this Addendum and attaining Decision Statement. At present, pipeline and anchor blocks are at site ready for work commencement.

5.5 Major Inputs and Outputs

5.5.1 Inputs (description of the project in terms of raw materials, processes, equipment and work force)

Input for the project remains the same provided in the EIA report (Sandcays Pvt Ltd 2016) and will not be reiterated in this Addendum.

5.5.1.1 Construction methods

Construction method of the pipeline remains the same provided in the EIA report (Sandcays Pvt Ltd 2016) and will not be reiterated in this Addendum.

5.5.2 Outputs (development concept and built environment)

5.5.2.1 Key structures

Outputs for the project remains the same provided in the EIA report (Sandcays Pvt Ltd 2016).

6 Methodology

Data collected from survey work carried out for the initial EIA report formulation is seen to suffice the need for assessment of existing environment for the current works. The TOR specifies to include monitoring report summaries in this Addendum, Consultant was informed by MWSC that monitoring was not undertaken hence this data is not available at the time of report preparation.

The TOR specifies Seawater quality testing from outfall location and alternative sites. Water samples were collected from the two sites R3 (proposed outfall area) and control (north eastern side of Hulhumale phase 02, north of existing outfalls) which is site R2 according to initial baseline survey (Table 2). In-situ tests were carried out to assess the Total Dissolved Solids (TDS) in the water samples, while rest of parameters were tested by sending water samples to MWSC Water Quality Assurance Laboratory.

Reef assessment was done using photo quadrats. Photo quadrats were taken by free diving, along a 50-meter transect line on the, within a 5-meter belt, along the reef flat at each site. 20 photo quadrats were randomly selected for each site and analysed using Coralnet (Beijbom et al., 2015). All the data on Coralnet were manually confirmed before any final processing. The mean percentage cover of different types of benthic substrate and the genera of hard coral at each site was obtained.

Assessment of the fish community was done at the same four sites where the reef benthic community assessment was conducted, along the same 50m by 5m transect. Fish abundance and density surveys were based on the visual fish census techniques described in English, Wilkinson and Baker (1997).

Table 2. Coordinates of baseline locations for seawater sampling

Survey location	Longitude	Longitude
R3	$4^0$13’20.46” N	$73^0$32’59.88” N
Control (R2)	$4^0$14’15.00” N	$73^0$33’19.17” N

Refer to Chapter 6 of the initial EIA report for Water and Sewerage System at Hulhumale’ Phase 02, for the hydrography and survey of marine environment (Sandcays Pvt Ltd., 2016).

7 Existing environment

As this is an Addendum to the initial EIA report, existing environment discussed here is only of components of the environment relevant to the proposed changes (revision of outfall location). These components have been discussed with reference to EIA report and associated survey results, as specified in the TOR. Climatology and other components not discussed here, have been discussed in detail in Chapter 4 of the EIA report for Water and Sewerage System at Hulhumale' Phase 02 (Sandcays Pvt Ltd., 2016) and readers are referred to the report for further details.

7.1 Hydrography/Hydrodynamics

7.1.1 Tide

Tides experienced in the Maldives are mixed semi-diurnal and diurnal with a strong diurnal inequality. A tide station at Hulhule' Meteorological Station has continuous records of tide for over the past 30 years. The maximum tidal range recorded at this tide station is 1.20m. The highest astronomical tide level is +0.64m (MSL) and the lowest astronomical tide level is -0.56m (MSL) (Table 3).

Table 3. Summary of tide level at Ibrahim Nasir International Airport, Male Atoll

Tide level	Water level referred to Mean Sea Level (MSL) (m)
Highest Astronomical Tide (HAT)	+0.64
Mean Higher High Water (MHHW)	+0.34
Mean Lower High Water (MLHW)	+0.14
Mean Sea Level (MSL)	0.0
Mean Higher Low Water (MHLW)	-0.16
Mean Lower Low Water (MLLW)	-0.36
Lowest Astronomical Tide (LAT)	-0.56

7.1.2 Wave climate and wave induced currents

Wind climate in the Maldives is dominated by the Indian Ocean monsoon climate, with the South West (SW) monsoon and North East (NE) monsoon. The Indian monsoon system is one of the major climate systems of the world, impacting large portions of both Africa and Asia (Overpeck et, al., 1996). The monsoon climate is driven by the atmospheric pressure differences that arise as a result of rapid warming or cooling of the Tibetan Plateau relative to the Indian Ocean. During the summer of northern hemisphere the Tibetan Plateau warms rapidly relative to the Indian Ocean which results in an atmospheric pressure gradient (Low pressure over Asia and high pressure over the Indian Ocean)

between the Asian landmass and the Indian ocean, which drives the prevailing wind from south to westerly directions. The period during which prevailing winds are from south to westerly direction is known as the SW monsoon. In the winter of northern hemisphere, the continent cools relative to the ocean. This reverses the pressure gradient (low pressure over the Indian Ocean high pressure over the Asian landmass) and the prevailing winds become northeasterly. The period during which prevailing winds are from northeasterly directions is known as NE monsoon. The transitions from NE to SW monsoon and vice versa are distinctly different from SW or NE monsoon. During these transition periods the wind becomes more variable.

The SW monsoon lasts between May and September while the NE monsoon lasts between December and February. The period between March and April is the transition period from the NE monsoon to SW monsoon known locally as the *Hulhangu Halha*, while the transition period from SW monsoon to NE monsoon is known as *Iruvai Halha*. *Iruvai halha* lasts from October to November. The SW monsoon is generally rough and wetter than the NE monsoon. Storms and gales are infrequent in this part of the world and cyclones do not reach as far south as the Maldivian archipelago (Ministry of Construction and Public Works, 1999).

Wind regime around Hulhumale' was analyzed using wind data collected from the Hulhule' meteorological station. Analysis of wind climate data was done using mean and maximum wind data from Hulhule' meteorological center. Mean wind data were available for a period of 34 years (from January1985 to March 2019) whereas maximum wind speed data were available for 11 years (from January 2008 to March 2019). In order to understand the dominant wind directions, wind rose diagrams were analyzed for the whole period as well as for each month using wind speed and direction.

Looking at the frequency plot data and wind rose plots, it was observed that the mean wind speed had gone as high as 36 kn towards the WNW direction. But the probability of occurrence was very low (only 0.02 % of the times). In general, the strongest winds occur from WSW, W and WNW directions. Winds from the south and SE as well as north were less prevalent and with comparatively low speeds. Majority of the times (about 12 to 19% of the times), winds occur at a speed of 4 to 14kn which is generally known as light to moderate breeze. Wind speeds above 18kn were a rare occurrence, occurring about 1.67 to 0.02% of the times (Figure 4).

With respect to maximum wind speeds, visual inspection of the wind rose plot coincides with that of the mean wind speeds. Approximately 1.46% of the times, wind speeds had gone as high as > 40kn at this region. The highest recorded maximum wind speed for the region was 54kn in the month of July during the data collection period. Winds higher that 24kn were frequent, occurring about 24% of the times. The most common maximum wind speed is between 12-16kn.

Wind rose plots for both maximum and mean wind speeds show that winds from the western quadrant are dominant (about 23% of the times) (Figure 4).

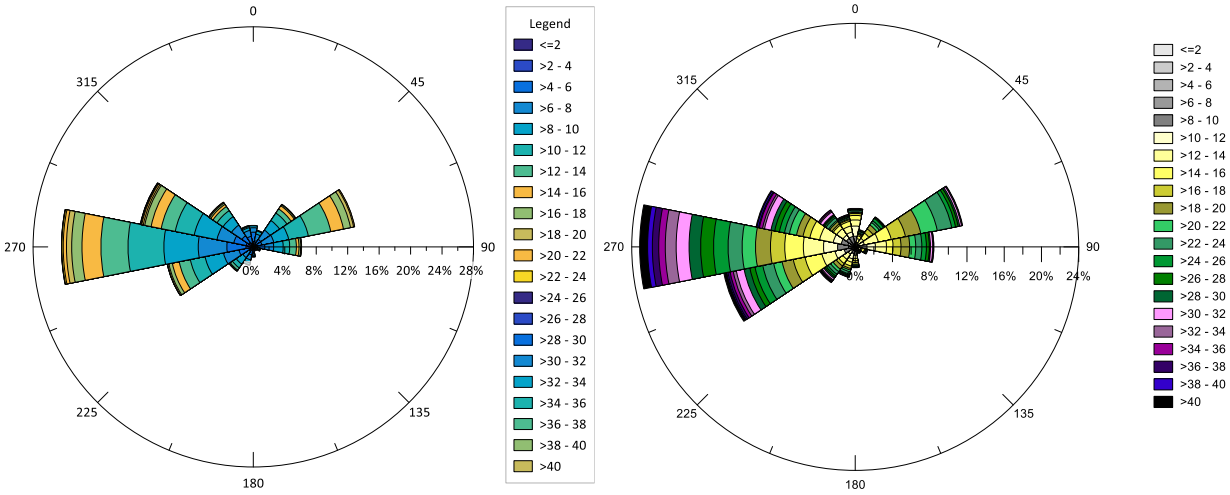


Figure 4. Wind rose plot for Hulhule' Meteorological station, based on mean daily wind data for the period of January 1998 to March 2019 (left) and maximum daily wind data (right) for the period of January 2008 to March 2019

Section 4.4.5 of the initial EIA report provides general description of waves, while section 4.5.2 provides results of in-situ current measurement at the reef (Figure 4-17, page 97 of EIA report). The in-situ current measurements done the proposed outfall location shows current movement is westwards to southwestwards (0.9m/s) and in the southwesterly direction (0.85m/s) at the control site area.

Figure 5 below shows assumed windwave induced currents based on wind data from Hulhule' Meteorological Centre. The surface currents are dictated by monsoonal wind waves and ocean waves (swell induced). Dominant swell wave direction is SE direction as shown in Figure 5 below, which is clearly seen in the Google Earth image. The outfall pipelines are approximately 114m north of initially proposed location hence current pattern is expected to be similar in both locations.

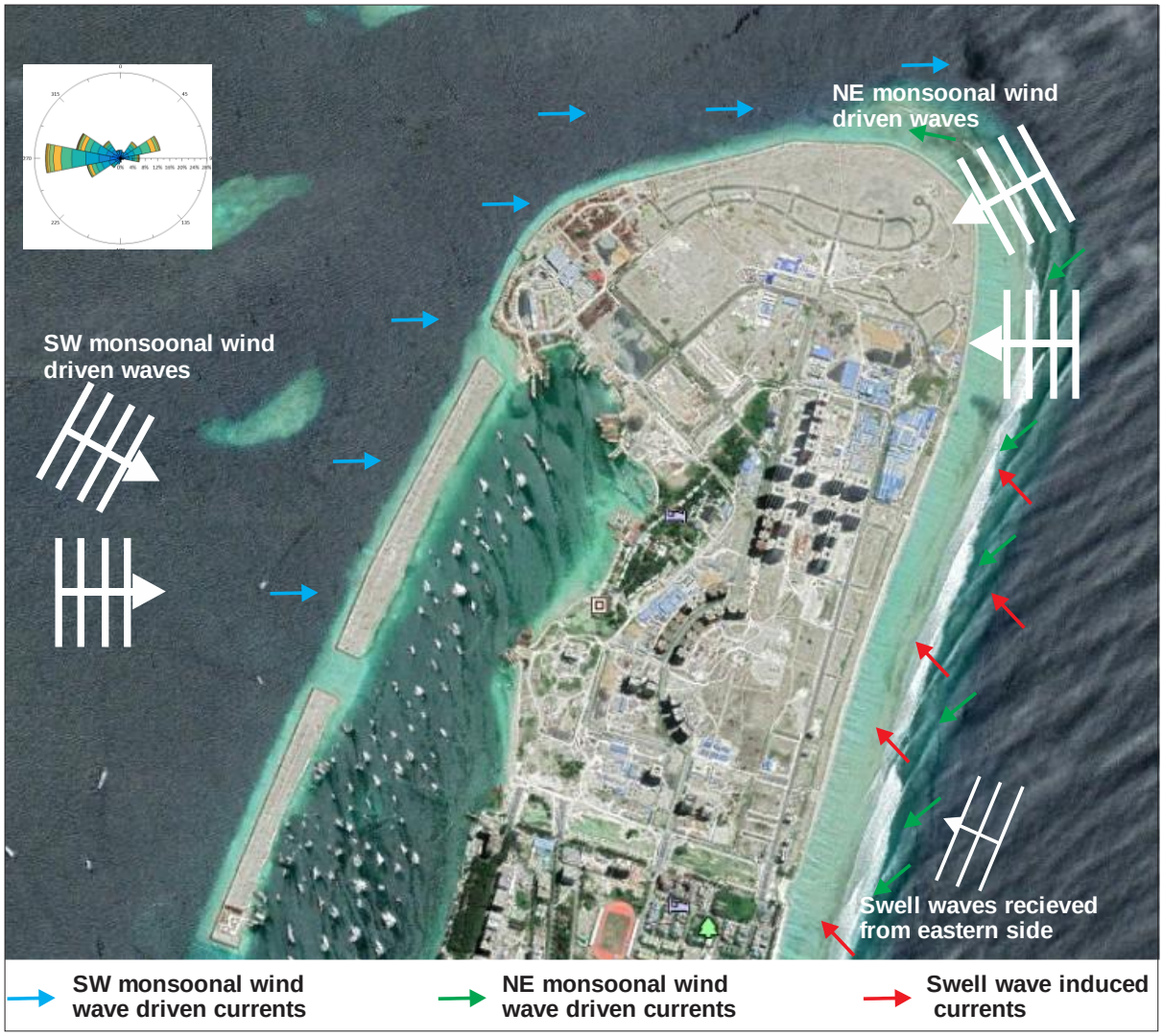


Figure 5. Schematic showing assumed windwave induced currents at the reef system

7.2 Marine surveys

Since the Addendum involves relocation of pipelines at one of the two locations, survey is done at proposed new location and control site.

7.2.1 Reef survey

The proposed new sea outfall location which is approximately 114m north of approved location under the EIA, is within the proximity of site R3 hence comparison is made with this site.

The survey site R3 was dominated by rock (88.18%) while hard coral cover was low just under 6%. The baseline survey of this site recorded live coral just around 7% (within the margin

of error) hence little change is observed since the baseline survey (Figure 6). The baseline line survey showed that 19% cover was dead corals perhaps due to the bleaching event of 2016.

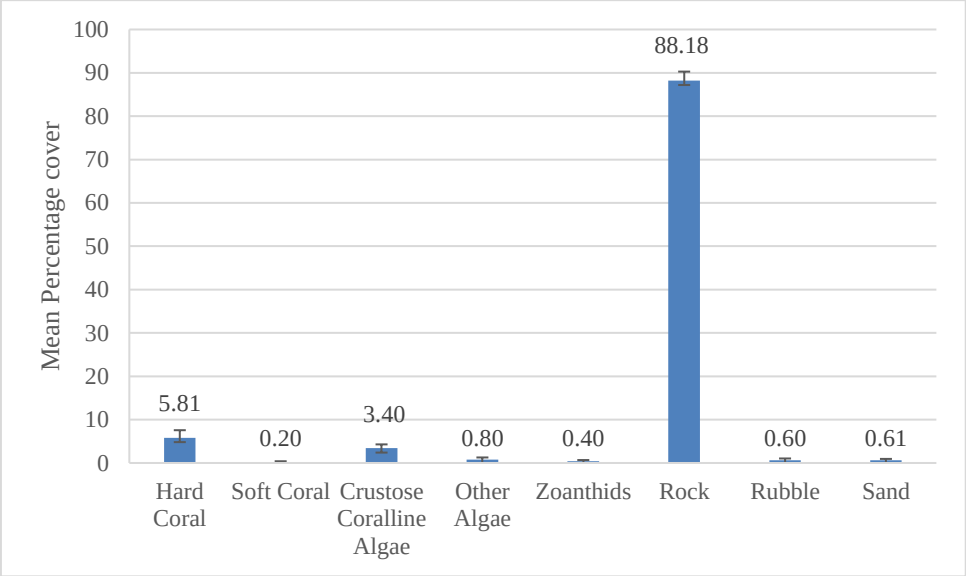


Figure 6. Mean percentage composition of benthic substrate at site R3

Figure 7. General reef condition at site R3

The control site used for current addendum is R2 as per baseline data given in EIA report, located at the north eastern corner area of Hulhumale' phase 02. Similar to site R3, control site was dominated by rock (88.8%) while hard coral cover was 4.6% (Figure 8). The baseline survey showed that rock cover was 33%, rubble 8% and dead coral with algae 32%. Live coral was just above 15%.

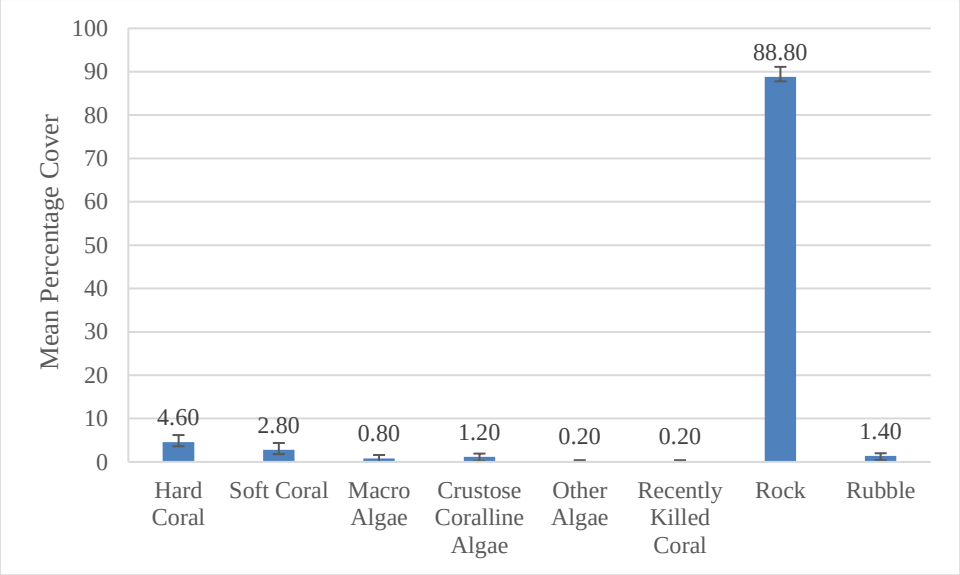


Figure 8. Mean percentage composition of benthic substrate at Control site (R2)

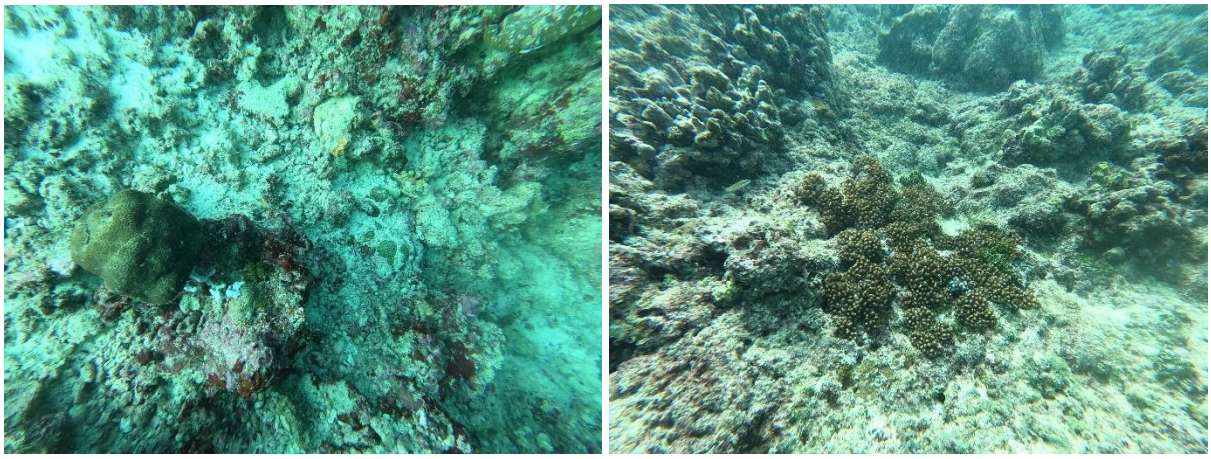


Figure 9. General reef condition at site Control site (R2)

Table 4. Mean Percentage cover of the different genera of coral observed at survey sites

Genus	R3		Control (R2)	
	Mean	SE	Mean	SE
Platygyra	0.0	0.0	0.4	0.4
Pocillopora	0.0	0.0	0.2	0.2
Favia	0.2	0.2	0.0	0.0
Favites	0.4	0.4	0.0	0.0
Pavona	0.6	0.4	0.0	0.0
Porites (branching)	0.2	0.2	0.0	0.0
Porites (massive)	4.2	1.4	4.0	1.5

7.2.2 **Fish community**

Reef fish surveys were also conducted at the two reef survey sites (during EIA report formulation) for quantitative assessments on the diversity and abundance of the fish community.

The baseline data showed poor fish count, but the resurvey of the sites showed a moderate abundance of fish (Table 5). This difference might be due to methodology used for fish census.

Table 5. Species composition and abundance of reef-associated fish observed during the fish survey

Family	Species	Common Name	Functional Group	Site	
				R3	Control (R2)
Herbivores					
Acanthuridae	*Acanthurus leucosternon*	Powder-blue Surgeonfish	Grazer	8	16
Acanthuridae	*Acanthurus lineatus*	Lined Surgeonfish	Grazer	9	21
Acanthuridae	*Acanthurus triostegus*	Convict Surgeonfish	Browser	5	3
Acanthuridae	*Ctenochaetus striatus*	Fine-lined Bristletooth	Browser	18	0
Acanthuridae	*Naso brevirostris*	Spotted Unicornfish	Grazer	4	16
Scaridae	*Cetoscarus bicolor*	Two-colour Parrotfish	Grazer	12	2
Scaridae	*Chlorurus sordidus*	Shabby Parrotfish	Browser	7	2
Carnivores					
Balistidae	*Odonus niger*	Blue Triggerfish	Browser	41	25
Caesionidae	*Caesio xanthonota*	Yellow-back Fusilier	Planktivore	0	105
Chaetodontidae	*Chaetodon auriga*	Threadfin Butterflyfish	Coralivore	4	1
Chaetodontidae	*Chaetodon triangulum*	Triangular Butterflyfish	Coralivore	1	6
Chaetodontidae	*Chaetodon trifasciatus*	Pinstriped Butterflyfish	Coralivore	4	11
Chaetodontidae	*Hemitaurichthys zoster*	Black Pyramid Butterflyfish	Planktivore	35	41
Cirrhitidae	*Paracirrhites forsteri*	Forster's Hawkfish	Predator	1	0
Labridae	*Halichoeres hortulanus*	Checkerboard Wrasse	Browser	2	3
Labridae	*Hemigymnus fasciatus*	Banded Thicklip Wrasse	Browser	1	0
Labridae	*Thalassoma hardwicke*	Six-bar Wrasse	Browser	1	3
Lutjanidae	*Lutjanus gibbus*	Humpback Snapper	Predator	17	23
Lutjanidae	*Lutjanus monostigma*	One-spot Snapper	Predator	3	6
Mullidae	*Parapeneus trifasciatus*	Double-bar Goatfish	Browser	2	1
Pomacanthidae	*Pomacanthus imperator*	Emperor Angelfish	Browser	7	1
Pomacanthidae	*Pygoplites diacanthus*	Regal Angelfish	Browser	3	0
Pomacentridae	*Amphiprion clarkii*	Clark's Anemonefish	Browser	7	3
Pomacentridae	*Chromis weberi*	Weber's Puller	Planktivore	24	30
Pomacentridae	*Dascyllus carneus*	Indian Humbug	Browser	2	0
Pomacentridae	*Pomacentrus indicus*	Indian Damselfish	Planktivore	3	10
Serranidae	*Aethaloperca rogaa*	Red-flushed Grouper	Predator	0	1
Serranidae	*Cephalopholis argus*	Peacock Rock Cod	Predator	3	0

7.2.3 **Seawater quality**

Seawater quality assessment was done at sites R3 and R2 (Control site). TDS was assessed by testing in-situ using Hanna HI9829 multiprobe. Table 6 below gives average of 5 readings. Remaining parameters were tested by sending samples to MSWC Water Quality Assurance laboratory. Test results report from MWSC is given in Appendix 5.

Table 6. Results of seawater sampling

Parameters	**R 3**	**R3 (baseline)**	**Control (R2)**	**R2 (baseline)**
Physical appearance	Clear with particles		Clear with particles	
Temperature (^{o}C)	23.7		23.2	
pH	8.18	8.02	8.24	8.31
Salinity ‰	33.68	35.01	34.01	35.65
TDS mg/l (done in-situ, n=5)	32153	34118	32190	34332
Turbidity NTU	0.407	0.13	0.388	0.2
Nitrite mg/l	4.2		4.9	
Nitrogen Ammonia mg/l	0.09		0.11	
Sulphate mg/l	2700		2850	
Phosphate mg/l	0.07		0.20	
Dissolved Oxygen (DO) mg/l	8.58	7.39	8.53	4.71
BOD mg/l	Test not available	6	Test not available	4
Total Coliform (CFU/100ml)	48	>2421	58	>2421
Feacal Coliform (CFU/100ml)	3	5	7	4

8 Stakeholder Consultation

Following stakeholders were consulted regarding the project, as per the TOR issued by EPA:

- Ooredoo Maldives
- Housing Development Corporation (HDC)

8.1 Housing Development Corporation (HDC)

Consultation with HDC was held on the 30th September 2020, 11:00 via telephone conversation. Assistant Project Manager Mohamed Rasheed (mobile number 7933344) participated in the meeting. According to personnel from HDC, MWSC already briefed HDC regarding the issue and alternative location was discussed. Personnel from HDC stated that since the pipeline is shifted by only 114m they do not have issues with the proposed work.

8.2 Ooredoo Maldives

Consultation with Ooredoo Maldives was held on the 1st October 2020, 09:00 via telephone conversation. Engineer Transmission and Planning, Afsheen Mohamed participated in the meeting. According to the personnel from Ooredoo, MWSC has already communicated with Ooredoo Maldives via HDC regarding the issue. Personnel from Ooredoo stated that it is highly improbable that cable will cross the path of pipeline. The EIA consultant informed that video survey was done at the proposed location and it was evident that pipeline alignment crosses the cable. EIA consultant also informed that the new location would guarantee that cable is avoided and video survey showed that cable does not cross the new pipeline alignment.

Personnel from Ooredoo informed that they do not have any additional comments for the project since new location does not impact the submarine cable.

9 Environmental Impacts

The proposed work involves relocation of location identified for outfall pipeline (second pipeline) for Hulhumale' phase 02. The new location is approximately 114m north of initially proposed site and as discussed in Chapter 7 of this Addendum, marine environment of both locations is very similar. The construction methodology and design remain the same as discussed in initial EIA report, and hence impacts identified for this work (on the marine environment and seawater quality during both construction and operational phase) are anticipated to be the same as that identified in the initial EIA report. No additional impacts are envisaged due to proposed works. Please refer to Chapter 6 of the EIA report for details of impacts.

10 Alternatives

Alternatives for the project discussed in Chapter 8 of the EIA report for the project are seen to be sufficient, even with change in location as per proposed work. Hence no new additional alternatives to the location are considered in this Addendum.

However, the no-project scenario is considered. Selection of this would mean that need for the project which is to avoid the existing submarine fibre optic cable (Ooredoo) around 6m depth zone would not be met. Installation of the pipeline has the potential to damage the submarine cable during construction. Hence this is not considered a feasible option.

11 Mitigation Plan and Monitoring

Mitigation measures for construction of outfall have been considered in Chapter 7 of the initial EIA report and these are considered to be sufficient for proposed works, which only involves a change in location of outfall by 114m. Hence, the Consultant does not feel that new mitigation measures are required for proposed works, and the work should be carried out with full implementation of the mitigation measures outlined in initial EIA report for the project.

Monitoring programme given in the initial EIA report also covers monitoring from the outfall locations and these are seen to be sufficient for the proposed work. Hence no additional monitoring is required and that given in the initial EIA report should be strictly followed.

12 Conclusion

The proposed project involves the relocation of one of the outfalls for the Hulhumale' phase 02 sewage network. The outfall is proposed to be shifted by 114m to the north of initially proposed location. Given the minor scope of the project, and existing environment of the new location, the impacts, mitigation measures and monitoring programme identified in the initial EIA for the project are relevant and sufficient for proposed work. Hence, no additional impacts have been identified in this Addendum.

Furthermore, no additional mitigation measures are required for the proposed work and the Consultant stresses that the proposed work be carried out with full implementation of the mitigation measures identified in the EIA report. Similarly, monitoring programme given in the initial EIA report is also seen to suffice the monitoring needs even with the changed location and thus Consultant stresses that this programme should be strictly followed, both during construction and operational stage.

The Consultant concludes that the proposed project is feasible and should be carried out with full implementation of the mitigation measures and monitoring programme identified in the initial EIA report for the project.

Acknowledgements

The consultant acknowledges the contribution provided by the team members in this report for the valuable contribution to the report and at the field. The consultant also acknowledges the assistance provided by MWSC Pvt Ltd during the report preparation work. The survey team of LaMer Group Pvt Ltd provided the bathymetry survey map.

CVs of team members are given below.

Curriculum Vitae

Position	Environmental Consultant
Name	Shahaama Abdul Sattar
Address	G. Helengeli, Lily Magu Male', Rep. of Maldives
Contact	Mobile: +9607904985 Email: shahaama.abdulsattar@lamer.com.mv shahaama.sattar@gmail.com
Date of Birth	30 September 1980
Nationality	Maldivian
Education	**Master of Science (MSc)** in Fisheries Biology and Fisheries Management, University of Bergen. Bergen, Norway, 2004 - 2006 **Bachelor of Science (BSc.),** The Flinders University of South Australia, Adelaide, South Australia, 1999 - 2001
Membership of Professional Associations	Small Island Research Group (SIRG) Maldives, Vice President
Countries of Work Experience	Maldives
Languages	**Dhivehi** Mother tongue **English** Fluent

Employment Record

From: 2008 - 2011
Employer: Marine Research Centre, Ministry of Fisheries and Agriculture, Male', Maldives.
Position: Fisheries Biologist

From: 2006 to 2008
Employer: Marine Research Centre, Ministry of Fisheries Agriculture and Marine Resources, Male', Maldives.
Position: Senior Research Officer

From: 2002 – 2004
Employer: Marine Research Centre, Ministry of Fisheries Agriculture and Marine Resources, Male', Maldives.
Position: Research Officer

Line of work at MRC included:
Assessment of the reef and grouper fisheries of Maldives, with surveys to monitor fisheries and fish species behavior. Compilation and analysis of data, for regular reviews and reporting and formation of management recommendations. Key role in the formulation of the Grouper Fisheries Management Plan / Grouper Fisheries and Export Regulation

Focal point for the IUCN funded project on identification of reef fish spawning aggregations in the Maldives through fishermen interviews (2007)

Secretariat and key organizer – Indian Ocean Cetacean Symposium 2009

Project Partner for Maldives for the Darwin Initiative Coral Reef Fish Project, Maldives

MRC Focal Point for the Atoll Ecosystem Conservation Programme, Ministry of Housing and Environment (2009 – 2011)

Participated in the Biodiversity Valuation survey of Baa Atoll Maldives carried out by AEC project and IUCN

From: May 2011 – Dec 2012
Employer: Darwin Reef Fish Project / Marine Research Centre (Maldives) and Marine Conservation Society (UK)
Position: Consultant, Darwin Reef Fish Project (4 year joint collaboration between MRC and MCS, UK)
Assess the various reef fisheries (grouper, aquarium and food fisheries) of the Maldives and aims to establish management plans for these fisheries. Provision of technical support and assistance to the project staff and MRC in implementing the project and formulation of the management plans.

From: July 2011 – Dec 2011
Employer: Bay of Bengal Large Marine Ecosystem Project
Position: BOBLME Sharks Working Group Coordinator
Coordinator for the Sharks WG of BOBLME project, and work with the focal points in the member countries, to assist in the formulation and implementation of their National Plans of Action for Sharks.

From: June 2011 to Present
Employer: Land and Marine Environmental Resource Group Pvt Ltd
Position: Environmental Consultant

Workshops/Seminars Participated

15-21 March 2003 - Training Workshop on the Implementation of Multilateral Agreements in the Conservation of Biodiversity with special focus on Marine Biodiversity. Kushiro, Japan

14-16 November 2006 – Sixth William R. and Lenore Mote International Symposium – Life history in Fisheries Ecology and Management. Sarasota, Florida

03-05 March 2008 – Olhugiri and Dhigalihaa Protected Areas Management Planning Workshop. Eydhafushi, Maldives

11 March 2008 – Applying the Ecosystem Approach to managing Atoll Ecosystems in the Maldives. Hulhule Island Hotel, Maldives

24-26 March 2008 – Regional Consultation on Preparation of Management Plans for Shark Fisheries. Beruwela, Sri Lanka

17-19 June 2008 – Workshop on Assessment and Management of the Offshore Resources of

South and Southeast Asia. Bangkok, Thailand
22-23 March 2009 – BOBP-IGO National Workshop on Monitoring, Control and Surveillance in Marine Fisheries. Male', Maldives

18 – 20 July 2009 – Indian Ocean Cetacean Symposium 2009. Paradise Island Resort and Spa, Maldives.

09-11 August 2009 – Second Regional Consultation on Preparation of Management Plans for Shark Fisheries. Kulhudhuffushi, Maldives

24-25 February 2010 – BOBLME Project – National Inception Workshop, Male', Maldives

2-3 June 2010 – BOBP-IGO Technical Advisory Committee – 5th Meeting, Male', Maldives

13-14 September 2010 – BOBLME Fisheries Assessment Working Group – 1st Meeting, Bangkok, Thailand

14-16 December 2010 – EWS-WWF 2nd Marine Conservation Forum for the Gulf Region In partnership with the Pew Environment Group – Local Actions for Global Challenges, Abu Dhabi, United Arab Emirates

18-19 January 2011 – Bay of Bengal Large Marine Ecosystem Project – Workshop on the Status of Marine Managed Areas in the Bay of Bengal, Penang, Malaysia

5-7 July 2011 –Bay of Bengal Large Marine Ecosystem Project – First meeting of the BOBLME Sharks Working Group, Male', Maldives

7-8 September 2011 – Workshop to formulate the Grouper Fisheries Management Plan, DRFP/MRC, Male', Maldives

15-17 September 2011 – SEAFDEC Special Meeting on Sharks Information Collection in Southeast Asia, Bangkok, Thailand

10 April 2014 - Stakeholder Consultation to present the National Plan of Action on the Conservation and Management of Sharks (NPOA-Sharks), Male', Maldives

Publications

Sattar, S. A., Najeeb, A., Islam, F., Afzal, M. S. and Wood, E. (2012) Management of the grouper fishery of the Maldives, *Proceedings of the 12th International Coral Reef Symposium, Cairns, Australia, 9-13 July 2012, Session 13E* (in press)

Ushan, M., Wood, E., Saleem, M. and Sattar, S. A (2012) Maldives Sharkwatch Report for 2009 - 2010, *Proceedings of the 12th International Coral Reef Symposium, Cairns, Australia, 9-13 July 2012, Session 13D* (in press)

Sattar, S. A., Andréfouët, S., Ahsan, M., Adam, M. S., Anderson, C. R. and Scott, L (2012) Status of the Coral Reef Fishery in an Atoll under tourism development: the case of Central Maldives, *Atoll Research Bulletin 590*: 163-186

Sattar, S. A., Amir, H. and Adam, M. S. (2012) Reef fish tagging programme – Baa Atoll Pilot project, *Atoll Research Bulletin 590*: 187-200

BOBLME (2011) Report of the BOBLME Sharks Working Group, 5-7 July 2011, Male' Maldives,

Prepared for the Bay of Bengal Large Marine Ecosystem Project by Sattar, S. A. and Anderson, R. C.
Saleem, M., Sattar, S. A. (2009) Study on post-tsunami restoration and conservation projects in Maldives, *Prepared for the International Union for Conservation of Nature*.

Tamelander, J., Sattar, S., Campbell, S., Hoon, V., Arthur, R., Patterson E. J.K., Satapoomin, U., Chandi, M., Rajasuriya, A. and Samoilys, M. (2009) Reef fish spawning aggregation in the Bay of Bengal: Awareness and Occurrence, *Proceedings of the 11th International Coral Reef Symposium, Ft. Lauderdale, Florida, 7-11 July 2008,* Session 22

Sattar, S. A., Jørgensen, C., Fiksen, Ø. (2008) Fisheries Induced Evolution of Energy and Sex Allocation. *Bulletin of Marine Science*, 83(1): 235-250

Sattar, S. A. (2008) Review of the Reef fishery of the Maldives, Marine Research Centre, Male', Maldives. 62 pp

Sattar, S. A. and M. S. Adam (2005) Review of the Grouper fishery of the Maldives with additional notes on the Faafu Atoll fishery. Marine Research Centre, Male', Maldives. 54 pp

Environmental Impact Assessments Reports and other studies

The following are a selected list of the projects I have been involved in as an environmental consultant at LaMer Group Pvt Ltd.

Name of assignment or project	EIA for development of domestic airport facility at Funadhoo, Shaviyani Atoll
Year	2018
Location	Funadhoo, Shaviyani Atoll, Maldives
Client	Regional Airports, Ministry of Tourism
Project features	Development of domestic airport facility at Funadhoo
Positions held	EIA team member
Responsibilities	Preparation of the EIA report
Name of assignment or project	EIA for agricultural development project at Hulhidhoo, Vaavu Atoll
Year	2017
Location	Hulhidhoo, Vaavu Atoll, Maldives
Client	Aarah Investments Pvt Ltd
Project features	Development of Hulhidhoo as a mix-use island with an agricultural (hydroponics) and tourism component
Positions held	EIA team member
Responsibilities	Preparation of the EIA report
Name of assignment or project	EIA for development of 100 bed hospital at Addu City
Year	2017
Location	Addu City, Maldives
Client	Ministry of Housing and Infrastructure
Project features	Redevelopment of Equatorial Convention Centre as a 100 bed tertiary level hospital
Positions held	EIA team member
Responsibilities	Preparation of the EIA report
Name of assignment or project	EIA for relocation of sewer outfalls at IGMH and Westpark area, Male' City
Year	2017
Location	Male', Maldives
Client	MWSC Pvt Ltd
Project features	Relocation of sewer outfalls at IGMH and Westpark area to industrial village area of Male'
Positions held	EIA team member

Responsibilities	Preparation of the EIA report
Name of assignment or project	EIA for resort development at Islands I and E of Emboodhoofalhu Finolhu Development project
Year	2017
Location	Emboodhoofalhu Finolhu, Maldives
Client	Dream Islands Development Project
Project features	Development of reclaimed islands I and E of Emboodhoofalhu Finolhu as tourist resorts
Positions held	EIA team member
Responsibilities	Preparation of the EIA report
Name of assignment or project	Environmental Impact Assessment Report for aquatic animal quarantine facility at Hulhumale'
Year	2016
Location	Hulhule, Maldives
Client	Ministry of Fisheries and Agriculture
Project features	Setting up an animal quarantine facility within plant quarantine service area in Hulhule
Positions held	EIA team member
Responsibilities	Preparation of the EIA report
Name of assignment or project	Environmental Impact Assessment report for relocation of Male' Submarine cable landing
Year	2016
Location	Male', Maldives
Client	Dhiraagu
Project features	EIA related to relocation of the submarine cable from existing location to a new location
Positions held	EIA team member
Responsibilities	Preparation of the EIA report
Name of assignment or project	Socioeconomic Situation analysis of selected fishing communities as part of formulation of Master Plan for Sustainable Fisheries (MASPLAN)
Year	2015
Location	ADh. Mahibadhoo, F. Bilehdhoo, GA. Villingili, HA. Ihavandhoo, L. Gan, L. Maamendhoo, Lh. Naifaru, S. Maradhoo, Maldives, Maldives
Client	Ministry of Fisheries and Agriculture
Project features	Socioeconomic survey of selected islands, to undertake a situational analysis of the island communities
Positions held	Fisheries Management Consultant
Responsibilities	Carryout socioeconomic surveys in forms of group discussions and household surveys. Data collection and analysis and report formulation (trip reports and overall situational analysis).
Name of assignment or project	Development of Training material for project staff on mainstreaming and increasing awareness on climate change adaptation and mitigation measures in tourism operation
Year	2015
Location	Male', Maldives
Client	Ministry of Tourism
Project features	Mainstreaming and increasing awareness on climate change adaptation and mitigation measures in tourism operation
Positions held	Team member
Responsibilities	Material development and presentation
Name of assignment or project	Development of water supply and a sewerage system at Fuvahmulah
Year	2015
Location	Fuvahmulah, Gnaviyani atoll. Maldives
Client	Ministry of Environment and Energy
Project features	Setting up a water supply and a sewerage facility
Positions held	EIA team member

Responsibilities	Preparation of the EIA report
Name of assignment or project	Environmental Impact Assessment for soft coastal protection works at GDh. Thinadhoo
Year	2014
Location	GDh. Thinadhoo, Maldives
Client	Ministry of Environment and Energy
Project features	Beach Nourishment and Coastal protection
Positions held	EIA team member
Responsibilities	Preparation of the EIA report
Name of assignment or project	Beach Nourishment and Coastal Protection works at a private land at Praslin, Seychelles
Year	2014
Location	Praslin, Seychelles
Client	Ahmed Didi
Project features	Beach Nourishment and Coastal protection at Praslin, Seychelles
Positions held	Environmental assessment team member
Responsibilities	Preparation of the report submitted to the client
Name of assignment or project	1500 Housing Unit construction Project Maldives
Year	2014
Location	Fuvahmulah, Gadhdhoo, Hoadedhdhoo, Hithadhoo, Holhudhoo, Madaveli, Thinadhoo, Maldives
Client	Ministry of Housing and Infrastructure
Project features	Construction of Housing Units at the specified Islands
Positions held	EIA team member
Responsibilities	Preparation of the EIA report
Name of assignment or project	EIA report for Coastal modification at Robinson Club Maldives
Year	2013
Location	Ga. Funamaudua, Maldives
Client	Robinson Club Maldives, Maldives
Project features	Coastal modification at the NW side of the island, construction of geo-bag revetment and harbor basin maintenance dredging works
Positions held	EIA team member
Responsibilities	Preparation of the EIA report
Name of assignment or project	EIA report for construction of gravity type waste water collection system at ADh Omadhoo
Year	2013
Location	ADh Omadhoo, Maldives
Client	ADh Omadhoo Island Council Office
Project features	Construction of gravity type waste water collection system and sea outfall pumping system
Positions held	EIA team member
Responsibilities	Preparation of the EIA report
Name of assignment or project	EIA report for upgrading of Maldive Gas Pvt Ltd Gas jetty
Year	2013
Location	Thilafushi, Maldives
Client	Maldive Gas Pvt Ltd
Project features	Reconstruction of existing gas jetty head and expansion of jetty head
Positions held	EIA team member
Responsibilities	Preparation of the EIA report
Name of assignment or project	EIA report for Resort development at GDh Havvodaa
Year	2013
Location	GDh Havvodaa, Maldives
Client	Crystal Plaza Pvt Ltd, Maldives
Project features	Construction of a resort hotel and all the related amenities
Positions held	EIA team member
Responsibilities	Preparation of the EIA report

Name of assignment or project	EIA report for Coastal protection, coastal modification, beach nourishment, coral nursery setup and entrance channel maintenance dredging work
Year	2013
Location	Gili Lankanfushi, Maldives
Client	Gili Lankanfushi, Maldives
Project features	Coastal protection, coastal modification, beach nourishment, coral nursery setup and entrance channel maintenance dredging work
Positions held	EIA team member
Responsibilities	Preparation of the EIA report
Name of assignment or project	EIA report for Harbor development project at Dh. Maaenboodhoo
Year	2013
Location	Dh. Maaenboodhoo, Maldives
Client	Ministry of Housing and Infrastructure
Project features	Development of harbor facility (dredging of harbor basin, construction of wharfs and breakwater)
Positions held	EIA team member
Responsibilities	Preparation of the EIA report
Name of assignment or project	EIA report for Flood mitigation and reclamation work at Faresmaathoda
Year	2013
Location	GDh. Faresmaathodaa, Maldives
Client	United Nations Office for Project Services (UNOPS)
Project features	Construction of breakwater and reclamation of land
Positions held	EIA team member
Responsibilities	Preparation of the EIA report
Name of assignment or project	EIA report for Development of Domestic Airport Facility
Year	2012
Location	Th. Thimarafushi, Maldives
Client	Maldives Airports Company Limited
Project features	Construction of runway apron
Positions held	EIA team member
Responsibilities	Preparation of the EIA report
Name of assignment or project	EIA report for Wharf reconstruction and upgrading of existing berthing facility and slipway
Year	2012
Location	Thilafushi, Maldives
Client	Fuel Supply Maldives Pvt Ltd, Maldives
Project features	Reconstruction of wharf and upgrading of existing berthing facility and slipway
Positions held	EIA team member
Responsibilities	Preparation of the EIA report
Name of assignment or project	EIA report for Resort development at B. Kanifinolhu
Year	2012
Location	B. Kanifushi, Maldives
Client	Coastline Hotels and Resorts Pvt Ltd, Maldives
Project features	Construction of a resort hotel and all the related amenities
Positions held	EIA team member
Responsibilities	Preparation of the EIA report
Name of assignment or project	EIA report for Borehole construction at Cyprea Mrine Food Fish Factory
Year	2012
Location	K. Himmafushi, Maldives
Client	Cyprea Marine Food Pvt Ltd, Maldives
Project features	Construction of a 8 inch borehole at factory premise
Positions held	EIA team member
Responsibilities	Preparation of the EIA report

Name of assignment or project	EIA report for resort development at K. Kudavilligili, Maldives
Year	2011
Location	K. Kudavilingili, Maldives
Client	Yacht Tours Pvt Ltd, Maldives
Project features	Construction of resort hotels and all the related amenities. In addition a large reclamation of the shoreline as additional land as part of the resort development is also part of the project
Positions held	EIA team member
Responsibilities	Preparation of the EIA report
Name of assignment or project	EIA report for development of city hotel, hospitality institute and resort development at Gasfinolhu and Bodufinolhu, L. Atoll
Year	2011
Location	L. Gan, Bodufinolhu and Gasfinolhu, Maldives
Client	Premier Equities Pvt Ltd, Maldives
Project features	Construction of a resort hotel and required amenities including a training hotel for hospitality industry
Positions held	EIA team member
Responsibilities	Preparation of the EIA report

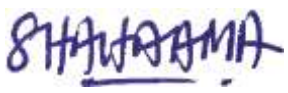
Referees

Dr. Mohamed Shiham Adam, PhD
Marine Research Centre
Ministry of Fisheries and Agriculture
Male', Republic of Maldives
Tel. No: +960 331 3681
Email: msadam@mrc.gov.mv

Dr. Charles Anderson
anderson@dhivehinet.net.mv
charles.anderson11@btinternet.com

Certification

I, the undersigned, certify that to the best of my knowledge and belief, this CV correctly describes my qualifications, my experience, and me. I understand that any willful misstatement described herein may lead to my disqualification or dismissal, if engaged.



Shahaama A. Sattar Date: October 2018

CURRICULUM VITAE

1. POSITION: Environment Analyst

2. NAME OF FIRM: LaMER Group Pvt.Ltd

3. NAME: Azim Musthag

4. DATE OF BIRTH: 13th December 1985

5. NATIONALITY: Maldivian

6. PERSONAL ADDRESS: M. Anthias, Fulooniya Magu, Malé, Maldives

7. EDUCATION

Bachelor of Marine Science (Majoring in Marine Ecology), Griffith University, Queensland, Australia.

DELF (Diplôme d'études en langue française) Level A1 and Level A2

8. MEMBERSHIP OF PROFESSIONAL SOCIETIES: Master Instructor with the Scuba Schools International (SSI).

9. OTHER TRAINING:

Fish Watch Training Workshop conducted by Darwin Reef Fish Project initiated by the Marine Research Centre of Maldives in collaboration with Marine Conservation Society (UK) in 2009.

IUCN Manta Ray Workshop in 2013.

National Coral Reef Monitoring Framework monitoring protocols training in 2014 conducted by IUCN Maldives.

10. COUNTRIES OF WORK EXPERIENCE: Maldives and Australia

11. LANGUAGE AND DEGREE OF PROFICIENCY:

English - Native or bilingual proficiency
Dhivehi - Native or bilingual proficiency
French - Limited working proficiency

12. EMPLOYMENT RECORD:

2005 - 2011	Dive Instructor, Maldivers Diving Centre, Malé.
2012 – 2014	Dive Instructor, Diveoceanus Dive Centre at Paradise Island Resort
2017 - 2017	Research Assistant Griffith University, Gold Coast, Australia.
2018 (Present)	Environmental Analyst Lamer Pvt Ltd

13. DETAILED TASKS ASSIGNED: **WORK UNDERTAKEN THAT BEST ILLUSTRATES CAPABILITY TO HANDLE TASKS:**

Project: Ecological surveys for the proposed, potential UNESCO biosphere reserves.
Year: 2018

Location: Maldives
Client: IUCN Maldives
Main project features: Surveying of 5 reefs and 3 islands.
Position: Consultant.
Activities performed:
Conducted ecological (marine and terrestrial) surveys at the proposed sites
Data compilation and analysis
Assisted in the final report development.

Project: Environmental Monitoring Report for resort development
Year: 2018
Location: Maldives
Client: Pearl Atoll Pvt Ltd
Main project features: Survey for the Environmental Monitoring Report
Position: Environmental Analyst
Activities performed:
Conducted the marine component of the survey. The seawater quality analysis, sedimentation analysis, reef benthic surveys, and fish surveys.

Project: Environmental Impact Assessment Report for resort development
Year: 2018
Location: Bodufushi, Raa Atoll.
Client: Alibey Maldives Pvt Ltd
Main project features: EIA Survey for an addendum
Position: Environmental Analyst
Activities performed:
Conducted the marine component of the survey. The seawater quality analysis, reef benthic surveys, and fish surveys.

Project: Environmental Impact Assessment for Coastal Protection and Entrance Clearance.
Year: 2018
Location: Bandos Island Resort, Kaafu Atoll.
Client: Bandos Island Resort.
Main project features: EIA Survey
Position: Environmental Analyst
Activities performed:
Conducted the marine component of the survey. The seawater quality analysis, reef benthic surveys, and fish surveys.

Project: Third Addendum to the Environmental Impact Assessment Report
Year: 2018
Location: Enboodhoo Finolhu Lagoon
Client: Dream Islands Development Pvt Ltd
Main project features: Reclamation of Islands for Resort Development at Enboodhoo Finolhu Falhu, South Malé Atoll
Position: Environmental Analyst
Activities performed:
Conducted the marine component of the survey. The seawater quality analysis, reef benthic surveys, and fish surveys.

14. Certification:

I, the undersigned, certify that to the best of my knowledge and belief, this CV correctly describes myself, my qualifications, and my experience. I understand that any wilful misstatement described herein may lead to my disqualification or dismissal, if engaged.

Date: 05th August 2018

[*Signature of staff member or authorized representative of the staff]* *Day/Month/Year*

Full name of staff member: Azim Musthag

References

Allison, W.R., 1996. Methods for surveying coral reef benthos. Prepared for IMS, Zanzibar, 18 pp.

Beijbom, O., Edmunds, P., Roelfsema, C., Smith, J., Kline, D., Neal, B., Dunlap, M., Moriarty, V., Fan, T., Tan, C., Chan, S., Treibitz, T., Gamst, A., Mitchell, B. and Kriegman, D. (2015). Towards Automated Annotation of Benthic Survey Images: Variability of Human Experts and Operational Modes of Automation. PLOS ONE, 10(7), p.e0130312.

Coleman, N., 2000. Marine Life of Maldives. Apollo Bay, Victoria: Atoll Editions

CDE Consulting Pvt Lte, 2019. Environment and Social Impact Assessment for proposed sewage treatment Plant in Hulhumale' Male' City, Maldives. Prepared for Ministry of National Planning and Infrastructure, Under Maldives urban Development and Resilience Project

Defant, A., 1961. Physical oceanography, Volume 2, Pergamon Press, New York.

English, S., Wilkinson, C. and Baker, V., 1997. Survey Manual for Tropical Marine Resources. Australian Institute of Marine Science, Townsville, Australia. 390pp.

Kuiter R. H., 1998. Photo guide to Fishes of the Maldives. Atoll Editions

Ministry of Construction and Public Works, 1999. Environmental/Technical Study for Dredging/Reclamation Works Under the Hulhumale Project, Maldives – Draft Final Stage 1 Report

Overpeck, J., Anderson, D., Trumbore, S., and Prell, W., 1996. The southwest Indian Monsoon over the last 18000 years; Climate Dynamics 12,pp213-225

Sandcays Pvt Ltd, 2016. Environmental Impact Assessment for the Proposed Water Supply and Sewerage System Hulhumalé Phase II, Malé City, Kaafu Atoll, Maldives. Prepared for Male' Water and Sewerage Company Pvt Ltd.

Appendices

Appendix 1 List of abbreviations

EIA – Environmental Impact Assessment
EPA – Environmental Protection Agency
HDC – Housing Development Corporation
IEE- Initial Environment Evaluation
MWSC – Male' Water and Sewerage Company
TOR – Terms of Reference

Appendix 2 Terms of Reference

No: 203-ECA/MWSC/2020/22

Terms of Reference for the First Addendum to the Environmental Impact Assessment for the Proposed Water and Sewerage Project at Hulhumale Phase 02

The following is the Terms of Reference (ToR) for undertaking the **First Addendum to the EIA for the Proposed Water and Sewerage Project at Hulhumale Phase 02.** The proponent of the project is **Male' Water and Sewerage Company Pvt Ltd.** The EIA consultants of this project is **Mr. Hussein Zahir (License No. EIAP04/2007).**

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 proposed project and, if applicable, the background of the project and the tasks already completed. Clearly identify the rationale and objectives of this addendum. Define the arrangements required for the environmental assessment including how work carried out under this addendum is linked with other component of the project, and how coordination between consultants, contractors and government institutions will be carried out. List the donors and the institutions the consultant will be coordinating with and the methodologies used.

2. **Study area** – Submit a minimum A3 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, size and important elements of the proposed project. The study area should include adjacent or remote areas, such as relevant developments and nearby environmentally sensitive sites (e.g. coral reef, sea grass, 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.

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

Task 1. Description of the proposed project – Provide a full description and justification of the relevant parts of the project, using maps at appropriate scales where necessary. The following should be:

A brief description of major component of the project

- A brief description of the project should be provided in reference to the initial EIA;
- Description of the components of the project subjected to this addendum and justifications;

- Describe equipment needed and construction methods associated with outfall relocations including handling transportation.

Task 2. Description of the existing environment – Assemble, evaluate and present the environmental baseline studies/data regarding the study area and timing of the project (e.g. monsoon season). Identify baseline data gaps, studies and the level of detail to be carried out by consultant. Consideration of likely monitoring requirement s 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.

Monitoring data from the last monitoring report needs to be provided in the report. Latest monitoring should be done during the last 06 months, if assessment needs to be undertaken from the marine sites in which baseline is collected and results presented. Reference shall be given to the data presented in the initial EIA report.

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

<u>Marine environment</u>

- Assessment of the marine environment;
- Description of characteristics of seabed subjected to outfall relocation area.

<u>Hydrography/hydrodynamics (localized maps)</u>

- Tidal ranges and tidal currents;
- Wave climate and wave induced currents;
- Wind induced (seasonal) currents;
- Marine water quality at the discharge location and alternative (control) location measuring these parameters: Temperature, pH, Salinity, E. Conductivity, TDS, Turbidity.

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. Show that the proponent has applied for all necessary permits. Specifically show how the proposed project meets the required legislative and regulatory requirements.

Task 4. Potential impacts (environmental and socio-cultural) of proposed project, include all stages - The addendum 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 project component on the following:

- Impacts of outfall relocation on marine habitat alteration;
- Increased turbidity and changes in sediment transport due to outfall relocation;
- Impacts on marine ecosystem from changes in the water quality at sea outfall site.

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

Task 5. Alternatives to proposed project- Describe alternatives including the *"no action option"* should be presented. Determine the best practical environmental options. Alternatives examined for the proposed project that would achieve the same objective including the "no action alternative". This should include alternative location. The report should highlight how the location was determined. All alternatives must be compared with locally accepted standards of similar nature. 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. Mitigation measures must also be identified for both construction and operation phase. Cost of the mitigation measures, equipment and resources required to implement those measures should be specified. The confirmation of commitment of the proponent/developer to implement the proposed mitigation measures shall also be included. In cases where impacts are unavoidable arrangements to compensate for the environmental effect shall be given.

Task 7. **Development of monitoring plan** - Identify the critical issues requiring monitoring to ensure compliance to mitigation measures and present impact management and monitoring plan for:

- Physical parameters such as marine water quality assessments and oceanographic studies at the sea outfall location;
- Biological parameters such as coral reef and benthic monitoring, fish community census at sea outfall pipe location to assess damages and recovery rates.

Environmental monitoring reports shall be submitted to the EPA. 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.

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 stakeholders, government authorities, NGOS, engineers/designers, development managers and staff. The EIA report should include a list of people/groups consulted and summary of major outcomes. The following parties should be consulted;

a) Housing Development Corporation Ltd;
b) Ooredoo Maldives Plc.

If the surveys are undertaken at a time where public health emergency is declared due to COVID 19, consultation with stakeholders can be undertaken via conference calls. Public consultations instead of community gatherings can be undertaken as one on one surveys in person, through telephone or through online surveys (evidence and records of this need to be presented). The EIA report needs to be submitted to the Male' city council and evidence of submission needs to be included in the report. EIA report needs to include a list of those who are consulted, moreover, the report needs annex minutes of any meetings held.

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

Timeframe for submitting the EIA report – The developer must submit the completed EIA report within 06 months from the date of this Term of Reference.

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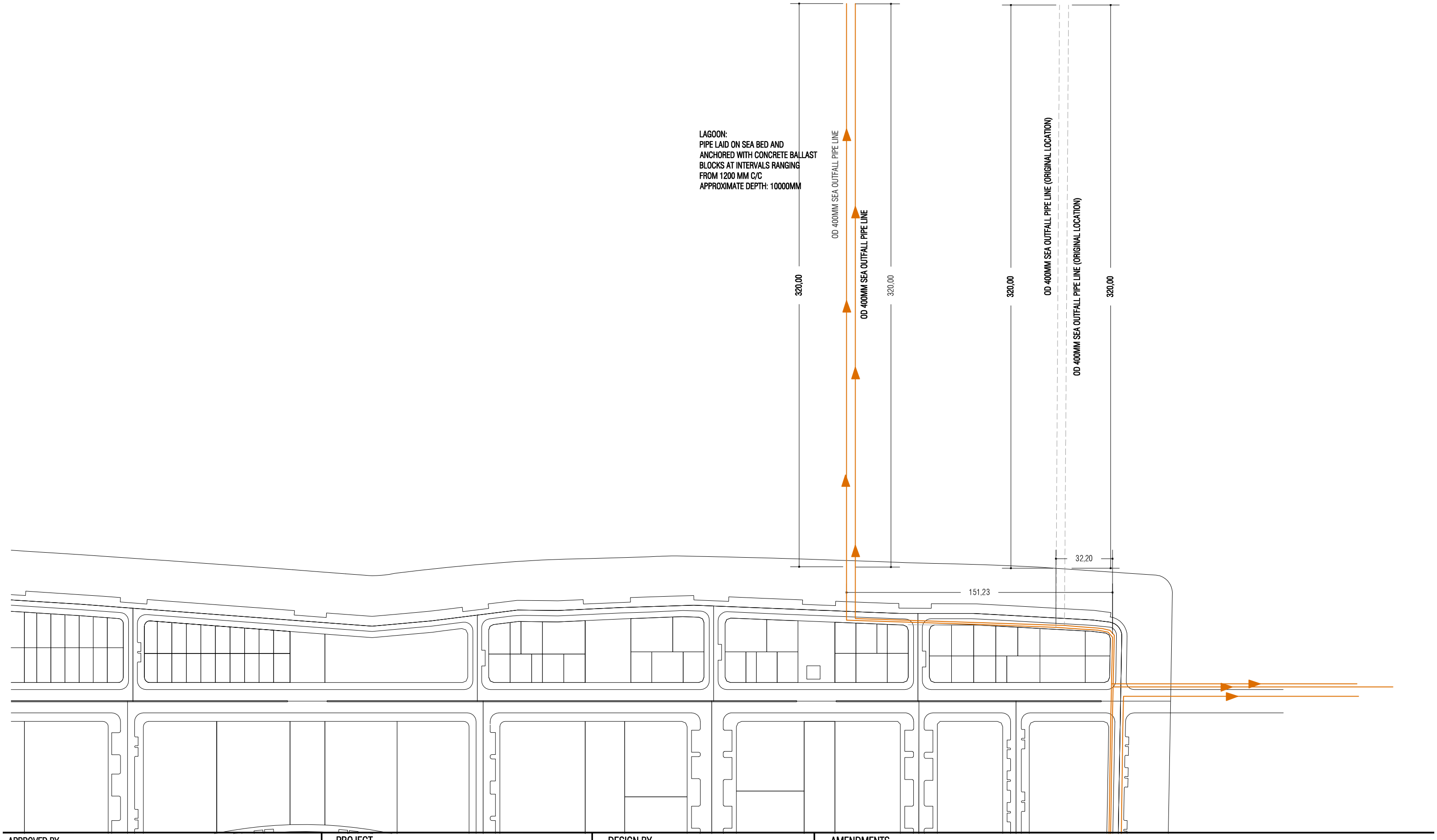
29th September 2020

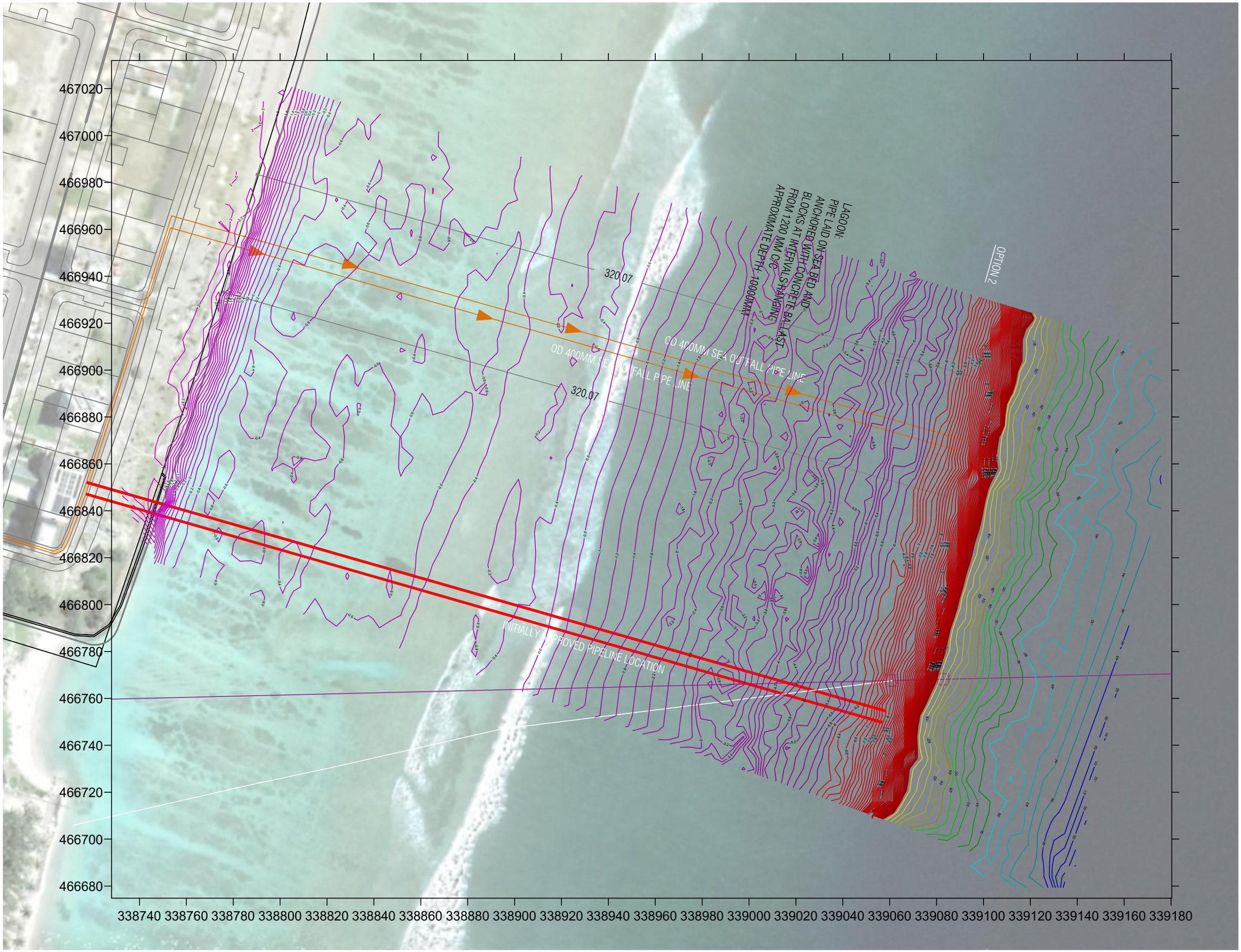
ENVIRONMENTAL PROTECTION AGENCY Male', Rep of Maldives

Appendix 3 Revised site plan



APPROVED BY	**PROJECT** K. HULHUMALE' (PHASE II) INSTALLATION OF SEA OUTFALL FOR THE YEAR 2019	**DESIGN BY** PAUL KURIAKOSE	**AMENDMENTS**
	TITLE SEA OUTFALL LAYOUT (ZONE 1)	**STRUCTURE BY** -	
	CLIENT DEPARTMENT BUSINESS DEVELOPMENT	**DRAWN BY** AISHATH NADHA GASIM	
	DESIGN CONTRACTOR INTERNAL PLANNING AND DESIGN DEPARTMENT	**SCALE** NTS **DWG NO.** 19-I36-HML-SO-S1-01	
	PAPER SIZE A3 **PAGE NO.** 01	**DATE** (R) 22.09.2020 [02]	

MWSC
MALE' WATER & SEWERAGE COMPANY PVT. LTD.
ﷲ ﷺ ﷺ ﷺ ﷺ ﷺ ﷺ ﷺ
AMEENEE MAGU, MACHCHANGOLHI MALE' 20-01 REPUBLIC OF MALDIVES
TEL: (+960) 3323209, FAX: (+960) 3324306, E-mail:mwsc@dhiraagu.net.mv



Outfall Bathymetry
Client: MWSC Plc

Date: September 2020
Architect :
Engineer :
Drawn by :
Services :
Interior :-

Rev no	Date
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--	----------
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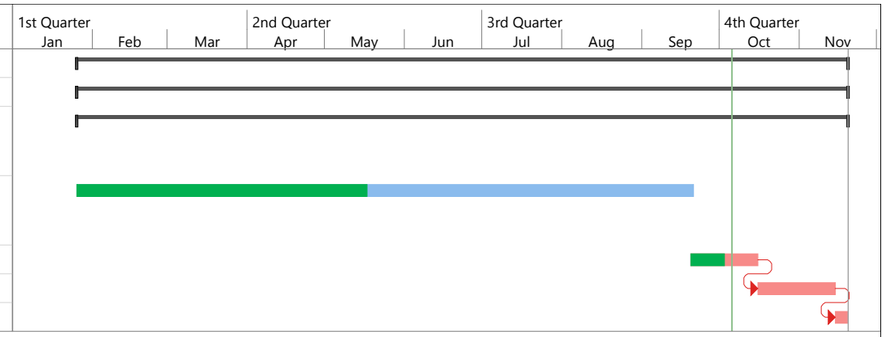
LAMER
t : +9603335049 f : +9603310776
e : info@lamer.com.mv
w : www.lamer.com.mv
4th floor, H. Azum, Ameeneemagu, Male'

Appendix 4 Work schedule for revised concept

ID	ID	Task Name	Duration	Start	Finish	% Complete	PROGRESS	Resource Names
1	**1**	**Hulhumale' Phase II Development Plan - Water & Sewer System**	**299 days**	**Sun 1/26/20**	**Thu 11/19/20**	**42%**		
2	**2**	**Construction of Sewer Outfall @Location 2**	**299 days**	**Sun 1/26/20**	**Thu 11/19/20**	**42%**		
3	**3**	**Construction of Sewer Outfall OD400 x 1**	**299 days**	**Sun 1/26/20**	**Thu 11/19/20**	**42%**	**267 Blocks cast; Work halt due to submarine cable in the outfall location**	**SASE**
4	4	Laying of Sea Outfall (Before location change)	239 days	Sun 1/26/20	Sun 9/20/20	47%	267 Blocks cast; Work halt due to submarine cable in the outfall location	
5	5	EIA Addendum and Approval	26 days	Sun 9/20/20	Thu 10/15/20	50%		
6	6	Laying of Sea Outfall Pipe	30 days	Fri 10/16/20	Sat 11/14/20	0%		
7	7	Comissioning and testing	5 days	Sun 11/15/20	Thu 11/19/20	0%		



Project: Tentative Schedule - Hmale phase II Sea Outfall 20201006

Task	Inactive Task	Manual Summary Rollup	External Milestone	Manual Progress	
Split	Inactive Milestone	Manual Summary	Deadline		
Milestone	Inactive Summary	Start-only	Critical		
Summary	Manual Task	Finish-only	Critical Split		
Project Summary	Duration-only	External Tasks	Progress		

Appendix 5 Water test results report from MWSC

بسم الله الرحمن الرحيم

MWSC
Reg. No. C-67/95

MALE' WATER & SEWERAGE COMPANY PVT. LTD.
ދގ ގަސް ހަމަ ސޮތަށް ކުރިއަށް ގެންދާ ކުންފުނި

04th October 2020

Our Ref. MWSC-A/5/2020/4133

Mr. Ismail Abid,
Managing Director,
Land and Marine Environment Resources,
H. Azum,
Ameenee Magu,
Male',
Republic of Maldives

Dear Sir,

Re: Unavailability of Testing Services at MWSC WQA Laboratory.

We regret to inform you that the following test is unavailable in our Laboratory at the time of your request (Application ID: 900190444) on 21st September 2020;

- Biological Oxygen Demand (BOD)

With increase in demand for such tests we are in the process of upgrading our laboratory such that the above tests are always available in our Laboratory.

Sincerely yours,
Male' Water & Sewerage Company Pvt. Ltd.

Mohamed Eyman
Manager, Quality

Ahmed Samiu
Assistant Manager, Sales

Fen Building, 5/F, Ameenee Magu, Machchangolhi, Male' 20375, Republic of Maldives
Tel: (+960)3323209 Fax: (+960)3324306 E-mail: mail@mwsc.com.mv Website: www.mwsc.com.mv

Male' Water & Sewerage Company Pvt Ltd
Water Quality Assurance Laboratory
Quality Assurance Building, 1st Floor, Male' Hingun, Vilimale', Male' City, Maldives
Tel: +9603323209, Fax: +9603324306, Email: wqa@mwsc.com.mv

090-LB-TEST

WATER QUALITY TEST REPORT

Report No: 500185102

Customer Information:
Land & Marine Environment Resources
H.Azum
Ameeneemagu
Male' MALE

Report date: **25/09/2020**
Test Requisition Form No: **900190444**
Sample(s) Recieved Date: **21/09/2020**
Date of Analysis: **21/09/2020 - 22/09/2020**

Sample Description ~	Hulhumale SW1	Hulhumale SW2	**TEST METHOD**	**UNIT**
Sample Type ~	Sea Water	Sea Water		
Sample No	83213809	83213810		
Sampled Date ~	19/09/2020 04:00	19/09/2020 04:00		
PARAMETER	**ANALYSIS RESULT**			
Physical Appearance	Clear with particles	Clear with particles		
pH *	8.18	8.24	Method 4500-H+ B. (adapted from Standard methods for the examination of water and waste water, 23rd edition)	-
Salinity	33.68	34.01	Method 2520 B. (adapted from Standard methods for the examination of water and waste water, 23rd edition)	‰
Temperature	23.7	23.2	Electrometry	°C
Turbidity *	0.407	0.388	HACH Nephelometric Method (adapted from HACH 2100N Turbidimeter User Manual)	NTU
Nitrate *	4.2	4.9	HACH Method 8171	mg/L
Nitrogen Ammonia	0.09	0.11	HACH Method 8038	mg/L
Sulphate *	2700	2850	HACH Method 8051	mg/L
Phosphate *	0.07	0.20	HACH Method 8048	mg/L
Dissolved Oxygen (DO)	8.58	8.53	In-house Test method (Adapted from HACH BOD LDO® Probe (Model LBOD10101) manual)	mg/L
Total Coliforms	48 (21/09/2020 15:25)	58 (21/09/2020 15:25)	HACH Method10029	CFU/100ml

Keys: ‰ : Parts Per Thousand, **°C** : Degree Celcius, **NTU** : Nephelometric Turbidity Unit, **mg/L** : Milligram Per Liter, **CFU/100ml** : Coliform Forming Unit

Checked by

Aminath Sofa
Laboratory Executive

Approved by

Mohamed Eyman
Manager, Quality

Notes: Sampling Authority: Sampling was not done by MWSC Laboratory

This test report is ONLY FOR THE SAMPLES TESTED.
~ Information provided by the customer
*Parameters accredited by EIAC under ISO/IEC 17025:2017

Male' Water & Sewerage Company Pvt Ltd
Water Quality Assurance Laboratory
Quality Assurance Building, 1st Floor, Male' Hingun, Vilimale', Male' City, Maldives
Tel: +9603323209, Fax: +9603324306, Email: wqa@mwsc.com.mv

090-LB-TEST

WATER QUALITY TEST REPORT

Report No: 500185102

Customer Information:
Land & Marine Environment Resources
H.Azum
Ameeneemagu
Male' MALE

Report date: **25/09/2020**
Test Requisition Form No: **900190444**
Sample(s) Recieved Date: **21/09/2020**
Date of Analysis: **21/09/2020 - 22/09/2020**

Sample Description ~	Hulhumale SW1	Hulhumale SW2	**TEST METHOD**	**UNIT**
Sample Type ~	Sea Water	Sea Water		
Sample No	83213809	83213810		
Sampled Date ~	19/09/2020 04:00	19/09/2020 04:00		
PARAMETER	**ANALYSIS RESULT**			
Physical Appearance	Clear with particles	Clear with particles		
Faecal Coliforms	3 (21/09/2020 15:25)	7 (21/09/2020 15:25)	HACH Method 8074	CFU/100ml

Keys: ‰ : Parts Per Thousand, **°C** : Degree Celcius, **NTU** : Nephelometric Turbidity Unit, **mg/L** : Milligram Per Liter, **CFU/100ml** : Coliform Forming Unit

Checked by

Aminath Sofa
Laboratory Executive

Approved by

Mohamed Eyman
Manager, Quality

Notes: Sampling Authority: Sampling was not done by MWSC Laboratory
This report shall not be reproduced except in full, without written approval of MWSC
This test report is ONLY FOR THE SAMPLES TESTED.
~ Information provided by the customer
*Parameters accredited by EIAC under ISO/IEC 17025:2017

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