# Environmental Impact Assessment

Document Stage: Updated
Number: 51077-003
August 2023

# Maldives: Greater Malé Waste-to-Energy Project – Waste to Energy Plant (Part G)

# Appendices

Prepared by the Ministry of Environment, Climate Change and Technology for the Ministry of Finance and the Asian Development Bank. This is an updated version of the draft originally posted in July 2020 available on https://www.adb.org/projects/documents/mld-51077-003-eia-2.

*Test not covered ISO 17025: 2017 by Sri Lanka Accreditation Board for conformity assessment.
**Reference range **as per Supply Water Quality Standard, Environment Protection Agency, Maldives**

**NOTE:**
APHA: American Public Health Association,
SLS: Sri Lanka Standard,
ND: Not Detected,
µS/cm: micro Siemens per centimeter
LOQ: Limit of Quantification,
mg/L: milligrams per liter,
NTU: Nephelometric Turbidity Units, ºC :Celcius,
MPN / 100mL- Most Probable Number per hundred milliliter,
APHA <1.8 MPN/100mL=Not Detected/100mL
ICP-MS- Inductively Coupled Plasma Mass Spectrometry

**COMMENT :The Testing Results revealed that Food hygiene of Tested Water Sample is satisfactory as per the Reference range **specified as per Supply Water Quality Standard, Environment Protection Agency EPA, Maldives.**

# TEST REPORT

**Report No: (7423)046-0110** Feb 24, 2023
**Code Name: AAWTE**



| | |
|---|---|
| **Customer:** | Alke Alkatas Joint Venture (Pvt) Ltd |
| **Address :** | H.H. Moomiyaage, 5A, Asaree Hingun. 20265 Male, Republic of Maldives |
| **Date of Sample Received**: | Feb 15, 2023 |
| **Date of Testing Started:** | Feb 15, 2023 |
| **Date of Testing Completed:** | Feb 22, 2023 |
| **Sample Description:** | **Sample Received as:**<br>A water sample contained in sealed plastic bottle<br><br>**Sample Identified by the Client as:**<br>Sample 02: Ground Water – GW02<br><br>Date of Sample Collection: 02.10.2023 |
| **Sample Drawn By BVCPS** | NO |

**Photo of the Submitted Samples**

# TEST REPORT

**Report No: (7423)046-0110** Feb 24, 2023
**Code Name: AAWTE**



## TEST RESULTS

### Sample 02

| No. | Parameters | Results | Reference range ** | LOQ | Unit | Test Method |
|---|---|---|---|---|---|---|
| 1 | Turbidity | 0.2 | Max. 1 | - | NTU | APHA 23rd ed: 2017 :2130 B |
| 2 | Nitrate (as $NO_3^-$)* | 0.6 | Max. 50 | - | mg/L | APHA 23rd ed: 2017: 4500 -$NO_3$– B |
| 3 | Iron (as Fe) | ND | Max. 0.3 | 0.001 | mg/L | APHA 23rd ed: 2017: 3125 B (ICP-MS) |
| 4 | Manganese (as Mn) * | ND | Max. 0.1 | 0.001 | mg/L | |
| 5 | Arsenic (as As) | ND | Max. 0.01 | 0.001 | mg/L | |
| 6 | Cadmium (as Cd) | ND | Max. 0.003 | 0.0001 | mg/L | |
| 7 | Lead (as Pb) | ND | Max. 0.01 | 0.001 | mg/L | |
| 8 | Mercury (as Hg) | ND | Max. 0.001 | 0.00050 | mg/L | |
| 9 | Total Suspended Solids (TSS) | ND | 5 - 750 | 1.0 | mg/L | APHA 23rd ed: 2017 : 2540D |
| 10 | Feacal Coliform | <1.8 | 0 | | MPN/100mL | APHA 23rd Edition 9221 E |
| 11 | Oil & Grease | 0.1 | - | - | mg/L | APHA 23rd ed: 2017: 5520B |
| 12 | pH at 25ºC | 6.7 | 6.5 – 8.5 | - | - | APHA 23rd ed: 2017: 4500H+B |
| 13 | Electrical Conductivity at 25ºC | 48.5 | Max. 1000 | - | mS/cm | APHA 23rd ed: 2017: 2510 B |
| 14 | Total Phosphates (as $PO_4^{3-}$) | 0.06 | Max. 5.0 | - | mg/L | APHA 23rd ed: 2017: 4500-PC |
| 15 | Chloride (as $Cl^-$) | 17872.5 | Max. 200 | - | mg/L | APHA 23rd ed: 2017: 4500-Cl- B |
| 16 | Polycyclic Aromatic Hydrocarbons (PAH)* | | | | | |
| i | Naphthalene* | ND | - | 1.0 | µg/L | CPSD-AN-00090 |
| ii | Benzo(a)anthracene* | ND | - | 1.0 | µg/L | |
| iii | Acenaphthylene* | ND | - | 1.0 | µg/L | |
| iv | Acenaphthene* | ND | - | 1.0 | µg/L | |
| v | Fluorene* | ND | - | 1.0 | µg/L | |
| vi | Phenanthrene* | ND | - | 1.0 | µg/L | |
| vii | Pyrene* | ND | - | 1.0 | µg/L | |
| viii | Chrysene* | ND | - | 1.0 | µg/L | |
| ix | Benzo(b)fluoranthene* | ND | - | 1.0 | µg/L | |
| x | Benzo(k)fluoranthene* | ND | - | 1.0 | µg/L | |
| xi | Dibenzo(a,h)anthracene* | ND | - | 1.0 | µg/L | |
| xii | Benzo(g,h,i)perylene* | ND | - | 1.0 | µg/L | |
| xiii | Benzo(j)fluoranthene* | ND | - | 1.0 | µg/L | |
| xiv | Benzo(a)pyrene* | ND | - | 1.0 | µg/L | |
| xv | Benzo(e)pyrene* | ND | - | 1.0 | µg/L | |
| xvi | Indeno(1,2,3-cd) pyrene* | ND | - | 1.0 | µg/L | |

*Test not covered ISO 17025: 2017 by Sri Lanka Accreditation Board for conformity assessment.
**Reference range **as per Supply Water Quality Standard, Environment Protection Agency, Maldives**

**NOTE:**
APHA: American Public Health Association,
SLS: Sri Lanka Standard,
ND: Not Detected,
µS/cm: micro Siemens per centimeter
LOQ: Limit of Quantification,
mg/L: milligrams per liter,
NTU: Nephelometric Turbidity Units, ºC :Celcius,
MPN / 100mL- Most Probable Number per hundred milliliter,
APHA <1.8 MPN/100mL=Not Detected/100mL
ICP-MS- Inductively Coupled Plasma Mass Spectrometry

**COMMENT :The Testing Results revealed that Food hygiene of Tested Water Sample is Not satisfactory as per the Reference range **specified as per Supply Water Quality Standard, Environment Protection Agency EPA, Maldives.**

# TEST REPORT

**Report No: (7423)046-0110** Feb 24, 2023
**Code Name: AAWTE**



| | |
|---|---|
| **Customer:** | Alke Alkatas Joint Venture (Pvt) Ltd |
| **Address :** | H.H. Moomiyaage, 5A, Asaree Hingun. 20265 Male, Republic of Maldives |
| **Date of Sample Received**: | Feb 15, 2023 |
| **Date of Testing Started:** | Feb 15, 2023 |
| **Date of Testing Completed:** | Feb 22, 2023 |
| **Sample Description:** | **Sample Received as:**<br>A water sample contained in sealed plastic bottle<br><br>**Sample Identified by the Client as:**<br>Sample 03: Ground Water – GW03<br><br>Date of Sample Collection: 02.10.2023 |
| **Sample Drawn By BVCPS** | NO |

**Photo of the Submitted Samples**

# TEST REPORT

**Report No: (7423)046-0110**
**Code Name: AAWTE**

Feb 24, 2023



## TEST RESULTS

### Sample 03

| No. | Parameters | Results | Reference range ** | LOQ | Unit | Test Method |
|---|---|---|---|---|---|---|
| 1 | Turbidity | 0.4 | Max. 1 | - | NTU | APHA 23rd ed: 2017 :2130 B |
| 2 | Nitrate (as $NO_3^-$)* | 0.5 | Max. 50 | - | mg/L | APHA 23rd ed: 2017: 4500 -$NO_3$– B |
| 3 | Iron (as Fe) | ND | Max. 0.3 | 0.001 | mg/L | APHA 23rd ed: 2017: 3125 B (ICP-MS) |
| 4 | Manganese (as Mn) * | ND | Max. 0.1 | 0.001 | mg/L | |
| 5 | Arsenic (as As) | ND | Max. 0.01 | 0.001 | mg/L | |
| 6 | Cadmium (as Cd) | ND | Max. 0.003 | 0.0001 | mg/L | |
| 7 | Lead (as Pb) | ND | Max. 0.01 | 0.001 | mg/L | |
| 8 | Mercury (as Hg) | ND | Max. 0.001 | 0.00050 | mg/L | |
| 9 | Total Suspended Solids (TSS) | 2 | 5 - 750 | - | mg/L | APHA 23rd ed: 2017 : 2540D |
| 10 | Feacal Coliform | <1.8 | 0 | | MPN/100mL | APHA 23rd Edition 9221 E |
| 11 | Oil & Grease | 0.1 | - | - | mg/L | APHA 23rd ed: 2017: 5520B |
| 12 | pH at 25ºC | 8.3 | 6.5 – 8.5 | - | - | APHA 23rd ed: 2017: 4500H+B |
| 13 | Electrical Conductivity at 25ºC | 13.5 | Max. 1000 | - | mS/cm | APHA 23rd ed: 2017: 2510 B |
| 14 | Total Phosphates (as $PO_4^{3-}$) | 0.05 | Max. 5.0 | - | mg/L | APHA 23rd ed: 2017: 4500-PC |
| 15 | Chloride (as $Cl^-$) | 3885.3 | Max. 200 | - | mg/L | APHA 23rd ed: 2017: 4500-Cl- B |
| 16 | Polycyclic Aromatic Hydrocarbons (PAH)* | | | | | |
| i | Naphthalene* | ND | - | 1.0 | µg/L | CPSD-AN-00090 |
| ii | Benzo(a)anthracene* | ND | - | 1.0 | µg/L | |
| iii | Acenaphthylene* | ND | - | 1.0 | µg/L | |
| iv | Acenaphthene* | ND | - | 1.0 | µg/L | |
| v | Fluorene* | ND | - | 1.0 | µg/L | |
| vi | Phenanthrene* | ND | - | 1.0 | µg/L | |
| vii | Pyrene* | ND | - | 1.0 | µg/L | |
| viii | Chrysene* | ND | - | 1.0 | µg/L | |
| ix | Benzo(b)fluoranthene* | ND | - | 1.0 | µg/L | |
| x | Benzo(k)fluoranthene* | ND | - | 1.0 | µg/L | |
| xi | Dibenzo(a,h)anthracene* | ND | - | 1.0 | µg/L | |
| xii | Benzo(g,h,i)perylene* | ND | - | 1.0 | µg/L | |
| xiii | Benzo(j)fluoranthene* | ND | - | 1.0 | µg/L | |
| xiv | Benzo(a)pyrene* | ND | - | 1.0 | µg/L | |
| xv | Benzo(e)pyrene* | ND | - | 1.0 | µg/L | |
| xvi | Indeno(1,2,3-cd) pyrene* | ND | - | 1.0 | µg/L | |

*Test not covered ISO 17025: 2017 by Sri Lanka Accreditation Board for conformity assessment.
**Reference range **as per Supply Water Quality Standard, Environment Protection Agency, Maldives**

**NOTE:**
APHA: American Public Health Association,
SLS: Sri Lanka Standard,
ND: Not Detected,
µS/cm: micro Siemens per centimeter
LOQ: Limit of Quantification,
mg/L: milligrams per liter,
NTU: Nephelometric Turbidity Units, ºC :Celcius,
MPN / 100mL- Most Probable Number per hundred milliliter,
APHA <1.8 MPN/100mL=Not Detected/100mL
ICP-MS- Inductively Coupled Plasma Mass Spectrometry

**COMMENT :The Testing Results revealed that Food hygiene of Tested Water Sample is Not satisfactory as per the Reference range **specified as per Supply Water Quality Standard, Environment Protection Agency EPA, Maldives.**

# TEST REPORT

**Report No: (7423)046-0110** Feb 24, 2023
**Code Name: AAWTE**



| | |
|---|---|
| **Customer:** | Alke Alkatas Joint Venture (Pvt) Ltd |
| **Address :** | H.H. Moomiyaage, 5A, Asaree Hingun. 20265 Male, Republic of Maldives |
| **Date of Sample Received**: | Feb 15, 2023 |
| **Date of Testing Started:** | Feb 15, 2023 |
| **Date of Testing Completed:** | Feb 22, 2023 |
| **Sample Description:** | **Sample Received as:**<br>A water sample contained in sealed plastic bottle<br><br>**Sample Identified by the Client as:**<br>Sample 04: Ground Water – GW04<br><br>Date of Sample Collection: 02.10.2023 |
| **Sample Drawn By BVCPS** | NO |

**Photo of the Submitted Samples**

# TEST REPORT

**Report No: (7423)046-0110**
**Code Name: AAWTE**

Feb 24, 2023



## TEST RESULTS

### Sample 04

| No. | Parameters | Results | Reference range ** | LOQ | Unit | Test Method |
|---|---|---|---|---|---|---|
| 1 | Turbidity | 0.4 | Max. 1 | - | NTU | APHA 23rd ed: 2017 :2130 B |
| 2 | Nitrate (as $NO_3^-$)* | 0.5 | Max. 50 | - | mg/L | APHA 23rd ed: 2017: 4500 -$NO_3$– B |
| 3 | Iron (as Fe) | ND | Max. 0.3 | 0.001 | mg/L | APHA 23rd ed: 2017: 3125 B (ICP-MS) |
| 4 | Manganese (as Mn) * | ND | Max. 0.1 | 0.001 | mg/L | |
| 5 | Arsenic (as As) | ND | Max. 0.01 | 0.001 | mg/L | |
| 6 | Cadmium (as Cd) | ND | Max. 0.003 | 0.0001 | mg/L | |
| 7 | Lead (as Pb) | ND | Max. 0.01 | 0.001 | mg/L | |
| 8 | Mercury (as Hg) | ND | Max. 0.001 | 0.00050 | mg/L | |
| 9 | Total Suspended Solids (TSS) | 2 | 5 - 750 | - | mg/L | APHA 23rd ed: 2017 : 2540D |
| 10 | Feacal Coliform | <1.8 | 0 | | MPN/100mL | APHA 23rd Edition 9221 E |
| 11 | Oil & Grease | 0.1 | - | - | mg/L | APHA 23rd ed: 2017: 5520B |
| 12 | pH at 25ºC | 7.6 | 6.5 – 8.5 | - | - | APHA 23rd ed: 2017: 4500H+B |
| 13 | Electrical Conductivity at 25ºC | 18 | Max. 1000 | - | mS/cm | APHA 23rd ed: 2017: 2510 B |
| 14 | Total Phosphates (as $PO_4^{3-}$) | 0.05 | Max. 5.0 | 0.05 | mg/L | APHA 23rd ed: 2017: 4500-PC |
| 15 | Chloride (as $Cl^-$) | 6605 | Max. 200 | - | mg/L | APHA 23rd ed: 2017: 4500-Cl- B |
| 16 | Polycyclic Aromatic Hydrocarbons (PAH)* | | | | | |
| i | Naphthalene* | ND | - | 1.0 | µg/L | CPSD-AN-00090 |
| ii | Benzo(a)anthracene* | ND | - | 1.0 | µg/L | |
| iii | Acenaphthylene* | ND | - | 1.0 | µg/L | |
| iv | Acenaphthene* | ND | - | 1.0 | µg/L | |
| v | Fluorene* | ND | - | 1.0 | µg/L | |
| vi | Phenanthrene* | ND | - | 1.0 | µg/L | |
| vii | Pyrene* | ND | - | 1.0 | µg/L | |
| viii | Chrysene* | ND | - | 1.0 | µg/L | |
| ix | Benzo(b)fluoranthene* | ND | - | 1.0 | µg/L | |
| x | Benzo(k)fluoranthene* | ND | - | 1.0 | µg/L | |
| xi | Dibenzo(a,h)anthracene* | ND | - | 1.0 | µg/L | |
| xii | Benzo(g,h,i)perylene* | ND | - | 1.0 | µg/L | |
| xiii | Benzo(j)fluoranthene* | ND | - | 1.0 | µg/L | |
| xiv | Benzo(a)pyrene* | ND | - | 1.0 | µg/L | |
| xv | Benzo(e)pyrene* | ND | - | 1.0 | µg/L | |
| xvi | Indeno(1,2,3-cd) pyrene* | ND | - | 1.0 | µg/L | |

*Test not covered ISO 17025: 2017 by Sri Lanka Accreditation Board for conformity assessment.
**Reference range **as per Supply Water Quality Standard, Environment Protection Agency, Maldives**

**NOTE:**
APHA: American Public Health Association,
SLS: Sri Lanka Standard,
ND: Not Detected,
µS/cm: micro Siemens per centimeter
LOQ: Limit of Quantification,
mg/L: milligrams per liter,
NTU: Nephelometric Turbidity Units, ºC :Celcius,
MPN / 100mL- Most Probable Number per hundred milliliter,
APHA <1.8 MPN/100mL=Not Detected/100mL
ICP-MS- Inductively Coupled Plasma Mass Spectrometry

**COMMENT :The Testing Results revealed that Food hygiene of Tested Water Sample is Not satisfactory as per the Reference range **specified as per Supply Water Quality Standard, Environment Protection Agency EPA, Maldives.**

# TEST REPORT

**Report No: (7423)046-0110** Feb 24, 2023
**Code Name: AAWTE**



| | |
|---|---|
| **Customer:** | Alke Alkatas Joint Venture (Pvt) Ltd |
| **Address :** | H.H. Moomiyaage, 5A, Asaree Hingun. 20265 Male, Republic of Maldives |
| **Date of Sample Received**: | Feb 15, 2023 |
| **Date of Testing Started:** | Feb 15, 2023 |
| **Date of Testing Completed:** | Feb 22, 2023 |
| **Sample Description:** | **Sample Received as:**<br>A water sample contained in sealed plastic bottle<br><br>**Sample Identified by the Client as:**<br>Sample 05: Ground Water – GW05<br><br>Date of Sample Collection: 02.10.2023 |
| **Sample Drawn By BVCPS** | NO |

**Photo of the Submitted Samples**

# TEST REPORT

**Report No: (7423)046-0110**
**Code Name: AAWTE**

Feb 24, 2023



## TEST RESULTS

### Sample 05

| No. | Parameters | Results | Reference range ** | LOQ | Unit | Test Method |
|---|---|---|---|---|---|---|
| 1 | Turbidity | 5870 | Max. 1 | - | NTU | APHA 23rd ed: 2017 :2130 B |
| 2 | Nitrate (as $NO_3^-$)* | 0.6 | Max. 50 | - | mg/L | APHA 23rd ed: 2017: 4500 -$NO_3$– B |
| 3 | Iron (as Fe) | ND | Max. 0.3 | 0.001 | mg/L | APHA 23rd ed: 2017: 3125 B (ICP-MS) |
| 4 | Manganese (as Mn) * | ND | Max. 0.1 | 0.001 | mg/L | |
| 5 | Arsenic (as As) | ND | Max. 0.01 | 0.001 | mg/L | |
| 6 | Cadmium (as Cd) | ND | Max. 0.003 | 0.0001 | mg/L | |
| 7 | Lead (as Pb) | ND | Max. 0.01 | 0.001 | mg/L | |
| 8 | Mercury (as Hg) | ND | Max. 0.001 | 0.00050 | mg/L | |
| 9 | Total Suspended Solids (TSS) | 680 | 5 - 750 | - | mg/L | APHA 23rd ed: 2017 : 2540D |
| 10 | Feacal Coliform | <1.8 | 0 | | MPN/100mL | APHA 23rd Edition 9221 E |
| 11 | Oil & Grease | 0.9 | - | - | mg/L | APHA 23rd ed: 2017: 5520B |
| 12 | pH at 25ºC | 7.5 | 6.5 – 8.5 | - | - | APHA 23rd ed: 2017: 4500H+B |
| 13 | Electrical Conductivity at 25ºC | 15.5 | Max. 1000 | - | mS/cm | APHA 23rd ed: 2017: 2510 B |
| 14 | Total Phosphates (as $PO_4^{3-}$) | 0.05 | Max. 5.0 | - | mg/L | APHA 23rd ed: 2017: 4500-PC |
| 15 | Chloride (as $Cl^-$) | 5439.4 | Max. 200 | - | mg/L | APHA 23rd ed: 2017: 4500-Cl- B |
| 16 | Polycyclic Aromatic Hydrocarbons (PAH)* | | | | | |
| i | Naphthalene* | ND | - | 1.0 | µg/L | CPSD-AN-00090 |
| ii | Benzo(a)anthracene* | ND | - | 1.0 | µg/L | |
| iii | Acenaphthylene* | ND | - | 1.0 | µg/L | |
| iv | Acenaphthene* | ND | - | 1.0 | µg/L | |
| v | Fluorene* | ND | - | 1.0 | µg/L | |
| vi | Phenanthrene* | ND | - | 1.0 | µg/L | |
| vii | Pyrene* | ND | - | 1.0 | µg/L | |
| viii | Chrysene* | ND | - | 1.0 | µg/L | |
| ix | Benzo(b)fluoranthene* | ND | - | 1.0 | µg/L | |
| x | Benzo(k)fluoranthene* | ND | - | 1.0 | µg/L | |
| xi | Dibenzo(a,h)anthracene* | ND | - | 1.0 | µg/L | |
| xii | Benzo(g,h,i)perylene* | ND | - | 1.0 | µg/L | |
| xiii | Benzo(j)fluoranthene* | ND | - | 1.0 | µg/L | |
| xiv | Benzo(a)pyrene* | ND | - | 1.0 | µg/L | |
| xv | Benzo(e)pyrene* | ND | - | 1.0 | µg/L | |
| xvi | Indeno(1,2,3-cd) pyrene* | ND | - | 1.0 | µg/L | |

*Test not covered ISO 17025: 2017 by Sri Lanka Accreditation Board for conformity assessment.
**Reference range **as per Supply Water Quality Standard, Environment Protection Agency, Maldives**

**NOTE:**
APHA: American Public Health Association,
SLS: Sri Lanka Standard,
ND: Not Detected,
µS/cm: micro Siemens per centimeter
LOQ: Limit of Quantification,
mg/L: milligrams per liter,
NTU: Nephelometric Turbidity Units, ºC :Celcius,
MPN / 100mL- Most Probable Number per hundred milliliter,
APHA <1.8 MPN/100mL=Not Detected/100mL
ICP-MS- Inductively Coupled Plasma Mass Spectrometry

**COMMENT :The Testing Results revealed that Food hygiene of Tested Water Sample is Not satisfactory as per the Reference range **specified as per Supply Water Quality Standard, Environment Protection Agency EPA, Maldives.**

# TEST REPORT

**Report No: (7423)046-0110** Feb 24, 2023
**Code Name: AAWTE**



| | |
|---|---|
| **Customer:** | Alke Alkatas Joint Venture (Pvt) Ltd |
| **Address :** | H.H. Moomiyaage, 5A, Asaree Hingun. 20265 Male, Republic of Maldives |
| **Date of Sample Received**: | Feb 15, 2023 |
| **Date of Testing Started:** | Feb 15, 2023 |
| **Date of Testing Completed:** | Feb 22, 2023 |
| **Sample Description:** | **Sample Received as:**<br>A water sample contained in sealed plastic bottle<br><br>**Sample Identified by the Client as:**<br>Sample 06: Ground Water – GW06<br><br>Date of Sample Collection: 02.10.2023 |
| **Sample Drawn By BVCPS** | NO |

**Photo of the Submitted Samples**

# TEST REPORT



## TEST RESULTS

### Sample 06

| No. | Parameters | Results | Reference range ** | LOQ | Unit | Test Method |
|---|---|---|---|---|---|---|
| 1 | Turbidity | 0.3 | Max. 1 | - | NTU | APHA 23rd ed: 2017 :2130 B |
| 2 | Nitrate (as $NO_3^-$)* | 0.1 | Max. 50 | - | mg/L | APHA 23rd ed: 2017: 4500 -$NO_3$– B |
| 3 | Iron (as Fe) | ND | Max. 0.3 | 0.001 | mg/L | APHA 23rd ed: 2017: 3125 B (ICP-MS) |
| 4 | Manganese (as Mn) * | ND | Max. 0.1 | 0.001 | mg/L | |
| 5 | Arsenic (as As) | ND | Max. 0.01 | 0.001 | mg/L | |
| 6 | Cadmium (as Cd) | ND | Max. 0.003 | 0.0001 | mg/L | |
| 7 | Lead (as Pb) | ND | Max. 0.01 | 0.001 | mg/L | |
| 8 | Mercury (as Hg) | ND | Max. 0.001 | 0.00050 | mg/L | |
| 9 | Total Suspended Solids (TSS) | ND | 5 - 750 | 1.0 | mg/L | APHA 23rd ed: 2017 : 2540D |
| 10 | Feacal Coliform | <1.8 | 0 | | MPN/100mL | APHA 23rd Edition 9221 E |
| 11 | Oil & Grease | 0.1 | - | - | mg/L | APHA 23rd ed: 2017: 5520B |
| 12 | pH at 25ºC | 6.8 | 6.5 – 8.5 | - | - | APHA 23rd ed: 2017: 4500H+B |
| 13 | Electrical Conductivity at 25ºC | 1291 | Max. 1000 | - | µS/cm | APHA 23rd ed: 2017: 2510 B |
| 14 | Total Phosphates (as $PO_4^{3-}$) | ND | Max. 5.0 | 0.05 | mg/L | APHA 23rd ed: 2017: 4500-PC |
| 15 | Chloride (as $Cl^-$) | 83.5 | Max. 200 | - | mg/L | APHA 23rd ed: 2017: 4500-Cl- B |
| 16 | Polycyclic Aromatic Hydrocarbons (PAH)* | | | | | |
| i | Naphthalene* | ND | - | 1.0 | µg/L | CPSD-AN-00090 |
| ii | Benzo(a)anthracene* | ND | - | 1.0 | µg/L | |
| iii | Acenaphthylene* | ND | - | 1.0 | µg/L | |
| iv | Acenaphthene* | ND | - | 1.0 | µg/L | |
| v | Fluorene* | ND | - | 1.0 | µg/L | |
| vi | Phenanthrene* | ND | - | 1.0 | µg/L | |
| vii | Pyrene* | ND | - | 1.0 | µg/L | |
| viii | Chrysene* | ND | - | 1.0 | µg/L | |
| ix | Benzo(b)fluoranthene* | ND | - | 1.0 | µg/L | |
| x | Benzo(k)fluoranthene* | ND | - | 1.0 | µg/L | |
| xi | Dibenzo(a,h)anthracene* | ND | - | 1.0 | µg/L | |
| xii | Benzo(g,h,i)perylene* | ND | - | 1.0 | µg/L | |
| xiii | Benzo(j)fluoranthene* | ND | - | 1.0 | µg/L | |
| xiv | Benzo(a)pyrene* | ND | - | 1.0 | µg/L | |
| xv | Benzo(e)pyrene* | ND | - | 1.0 | µg/L | |
| xvi | Indeno(1,2,3-cd) pyrene* | ND | - | 1.0 | µg/L | |

*Test not covered ISO 17025: 2017 by Sri Lanka Accreditation Board for conformity assessment.
**Reference range **as per Supply Water Quality Standard, Environment Protection Agency, Maldives**

**NOTE:**
APHA: American Public Health Association,
SLS: Sri Lanka Standard,
ND: Not Detected,
µS/cm: micro Siemens per centimeter
LOQ: Limit of Quantification,
mg/L: milligrams per liter,
NTU: Nephelometric Turbidity Units, ºC :Celcius,
MPN / 100mL- Most Probable Number per hundred milliliter,
APHA <1.8 MPN/100mL=Not Detected/100mL
ICP-MS- Inductively Coupled Plasma Mass Spectrometry

**COMMENT :The Testing Results revealed that Food hygiene of Tested Water Sample is Not satisfactory as per the Reference range **specified as per Supply Water Quality Standard, Environment Protection Agency EPA, Maldives.**

# TEST REPORT

**Report No: (7423)046-0110** Feb 24, 2023
**Code Name: AAWTE**



| | |
|---|---|
| **Customer:** | Alke Alkatas Joint Venture (Pvt) Ltd |
| **Address :** | H.H. Moomiyaage, 5A, Asaree Hingun. 20265 Male, Republic of Maldives |
| **Date of Sample Received**: | Feb 15, 2023 |
| **Date of Testing Started:** | Feb 15, 2023 |
| **Date of Testing Completed:** | Feb 22, 2023 |
| **Sample Description:** | **Sample Received as:**<br>A water sample contained in sealed plastic bottle<br><br>**Sample Identified by the Client as:**<br>Sample 07: Ground Water – GW07<br><br>Date of Sample Collection: 02.10.2023 |
| **Sample Drawn By BVCPS** | NO |

**Photo of the Submitted Samples**

# TEST REPORT

**Report No: (7423)046-0110**
**Code Name: AAWTE**

Feb 24, 2023



## TEST RESULTS

### Sample 07

| No. | Parameters | Results | Reference range ** | LOQ | Unit | Test Method |
|---|---|---|---|---|---|---|
| 1 | Turbidity | 0.2 | Max. 1 | - | NTU | APHA 23rd ed: 2017 :2130 B |
| 2 | Nitrate (as $NO_3^-$)* | ND | Max. 50 | 0.05 | mg/L | APHA 23rd ed: 2017: 4500 -$NO_3$– B |
| 3 | Iron (as Fe) | ND | Max. 0.3 | 0.001 | mg/L | APHA 23rd ed: 2017: 3125 B (ICP-MS) |
| 4 | Manganese (as Mn) * | ND | Max. 0.1 | 0.001 | mg/L | |
| 5 | Arsenic (as As) | ND | Max. 0.01 | 0.001 | mg/L | |
| 6 | Cadmium (as Cd) | ND | Max. 0.003 | 0.0001 | mg/L | |
| 7 | Lead (as Pb) | ND | Max. 0.01 | 0.001 | mg/L | |
| 8 | Mercury (as Hg) | ND | Max. 0.001 | 0.00050 | mg/L | |
| 9 | Total Suspended Solids (TSS) | ND | 5 - 750 | 1.0 | mg/L | APHA 23rd ed: 2017 : 2540D |
| 10 | Feacal Coliform | <1.8 | 0 | | MPN/100mL | APHA 23rd Edition 9221 E |
| 11 | Oil & Grease | 0.1 | - | - | mg/L | APHA 23rd ed: 2017: 5520B |
| 12 | pH at 25ºC | 6.8 | 6.5 – 8.5 | - | - | APHA 23rd ed: 2017: 4500H+B |
| 13 | Electrical Conductivity at 25ºC | 595 | Max. 1000 | - | µS/cm | APHA 23rd ed: 2017: 2510 B |
| 14 | Total Phosphates (as $PO_4^{3-}$) | ND | Max. 5.0 | 0.05 | mg/L | APHA 23rd ed: 2017: 4500-PC |
| 15 | Chloride (as $Cl^-$) | 79.6 | Max. 200 | - | mg/L | APHA 23rd ed: 2017: 4500-Cl- B |
| 16 | Polycyclic Aromatic Hydrocarbons (PAH)* | | | | | |
| i | Naphthalene* | ND | - | 1.0 | µg/L | CPSD-AN-00090 |
| ii | Benzo(a)anthracene* | ND | - | 1.0 | µg/L | |
| iii | Acenaphthylene* | ND | - | 1.0 | µg/L | |
| iv | Acenaphthene* | ND | - | 1.0 | µg/L | |
| v | Fluorene* | ND | - | 1.0 | µg/L | |
| vi | Phenanthrene* | ND | - | 1.0 | µg/L | |
| vii | Pyrene* | ND | - | 1.0 | µg/L | |
| viii | Chrysene* | ND | - | 1.0 | µg/L | |
| ix | Benzo(b)fluoranthene* | ND | - | 1.0 | µg/L | |
| x | Benzo(k)fluoranthene* | ND | - | 1.0 | µg/L | |
| xi | Dibenzo(a,h)anthracene* | ND | - | 1.0 | µg/L | |
| xii | Benzo(g,h,i)perylene* | ND | - | 1.0 | µg/L | |
| xiii | Benzo(j)fluoranthene* | ND | - | 1.0 | µg/L | |
| xiv | Benzo(a)pyrene* | ND | - | 1.0 | µg/L | |
| xv | Benzo(e)pyrene* | ND | - | 1.0 | µg/L | |
| xvi | Indeno(1,2,3-cd) pyrene* | ND | - | 1.0 | µg/L | |

*Test not covered ISO 17025: 2017 by Sri Lanka Accreditation Board for conformity assessment.
**Reference range **as per Supply Water Quality Standard, Environment Protection Agency, Maldives**

**NOTE:**
APHA: American Public Health Association,
SLS: Sri Lanka Standard,
ND: Not Detected,
µS/cm: micro Siemens per centimeter
LOQ: Limit of Quantification,
mg/L: milligrams per liter,
NTU: Nephelometric Turbidity Units, ºC :Celcius,
MPN / 100mL- Most Probable Number per hundred milliliter,
APHA <1.8 MPN/100mL=Not Detected/100mL
ICP-MS- Inductively Coupled Plasma Mass Spectrometry

**COMMENT :The Testing Results revealed that Food hygiene of Tested Water Sample is satisfactory as per the Reference range **specified as per Supply Water Quality Standard, Environment Protection Agency EPA, Maldives.**

# TEST REPORT

**Report No: (7423)046-0110** Feb 24, 2023
**Code Name: AAWTE**



| | |
|---|---|
| **Customer:** | Alke Alkatas Joint Venture (Pvt) Ltd |
| **Address :** | H.H. Moomiyaage, 5A, Asaree Hingun. 20265 Male, Republic of Maldives |
| **Date of Sample Received**: | Feb 15, 2023 |
| **Date of Testing Started:** | Feb 15, 2023 |
| **Date of Testing Completed:** | Feb 22, 2023 |
| **Sample Description:** | **Sample Received as:**<br>A water sample contained in sealed plastic bottle<br><br>**Sample Identified by the Client as:**<br>Sample 08: Ground Water – GW08<br><br>Date of Sample Collection: 02.10.2023 |
| **Sample Drawn By BVCPS** | NO |

**Photo of the Submitted Samples**

# TEST REPORT



## TEST RESULTS

### Sample 08

| No. | Parameters | Results | Reference range ** | LOQ | Unit | Test Method |
|---|---|---|---|---|---|---|
| 1 | Turbidity | 0.2 | Max. 1 | - | NTU | APHA 23rd ed: 2017 :2130 B |
| 2 | Nitrate (as $NO_3^-$)* | ND | Max. 50 | 0.05 | mg/L | APHA 23rd ed: 2017: 4500 -$NO_3$– B |
| 3 | Iron (as Fe) | ND | Max. 0.3 | 0.001 | mg/L | APHA 23rd ed: 2017: 3125 B (ICP-MS) |
| 4 | Manganese (as Mn) * | ND | Max. 0.1 | 0.001 | mg/L | |
| 5 | Arsenic (as As) | ND | Max. 0.01 | 0.001 | mg/L | |
| 6 | Cadmium (as Cd) | ND | Max. 0.003 | 0.0001 | mg/L | |
| 7 | Lead (as Pb) | ND | Max. 0.01 | 0.001 | mg/L | |
| 8 | Mercury (as Hg) | ND | Max. 0.001 | 0.00050 | mg/L | |
| 9 | Total Suspended Solids (TSS) | ND | 5 - 750 | 1.0 | mg/L | APHA 23rd ed: 2017 : 2540D |
| 10 | Feacal Coliform | <1.8 | 0 | | MPN/100mL | APHA 23rd Edition 9221 E |
| 11 | Oil & Grease | ND | - | - | mg/L | APHA 23rd ed: 2017: 5520B |
| 12 | pH at 25ºC | 6.8 | 6.5 – 8.5 | - | - | APHA 23rd ed: 2017: 4500H+B |
| 13 | Electrical Conductivity at 25ºC | 580 | Max. 1000 | - | µS/cm | APHA 23rd ed: 2017: 2510 B |
| 14 | Total Phosphates (as $PO_4^{3-}$) | ND | Max. 5.0 | 0.05 | mg/L | APHA 23rd ed: 2017: 4500-PC |
| 15 | Chloride (as $Cl^-$) | 77.8 | Max. 200 | - | mg/L | APHA 23rd ed: 2017: 4500-Cl- B |
| 16 | Polycyclic Aromatic Hydrocarbons (PAH)* | | | | | |
| i | Naphthalene* | ND | - | 1.0 | µg/L | CPSD-AN-00090 |
| ii | Benzo(a)anthracene* | ND | - | 1.0 | µg/L | |
| iii | Acenaphthylene* | ND | - | 1.0 | µg/L | |
| iv | Acenaphthene* | ND | - | 1.0 | µg/L | |
| v | Fluorene* | ND | - | 1.0 | µg/L | |
| vi | Phenanthrene* | ND | - | 1.0 | µg/L | |
| vii | Pyrene* | ND | - | 1.0 | µg/L | |
| viii | Chrysene* | ND | - | 1.0 | µg/L | |
| ix | Benzo(b)fluoranthene* | ND | - | 1.0 | µg/L | |
| x | Benzo(k)fluoranthene* | ND | - | 1.0 | µg/L | |
| xi | Dibenzo(a,h)anthracene* | ND | - | 1.0 | µg/L | |
| xii | Benzo(g,h,i)perylene* | ND | - | 1.0 | µg/L | |
| xiii | Benzo(j)fluoranthene* | ND | - | 1.0 | µg/L | |
| xiv | Benzo(a)pyrene* | ND | - | 1.0 | µg/L | |
| xv | Benzo(e)pyrene* | ND | - | 1.0 | µg/L | |
| xvi | Indeno(1,2,3-cd) pyrene* | ND | - | 1.0 | µg/L | |

# TEST REPORT

**Report No: (7423)046-0110** Feb 24, 2023
**Code Name: AAWTE**



*Test not covered ISO 17025: 2017 by Sri Lanka Accreditation Board for conformity assessment.
**Reference range **as per Supply Water Quality Standard, Environment Protection Agency, Maldives**

**NOTE:**
APHA: American Public Health Association,
SLS: Sri Lanka Standard,
ND: Not Detected,
µS/cm: micro Siemens per centimeter
LOQ: Limit of Quantification,
mg/L: milligrams per liter,
NTU: Nephelometric Turbidity Units, ºC :Celcius,
MPN / 100mL- Most Probable Number per hundred milliliter,
APHA <1.8 MPN/100mL=Not Detected/100mL
ICP-MS- Inductively Coupled Plasma Mass Spectrometry

**COMMENT :The Testing Results revealed that Food hygiene of Tested Water Sample is satisfactory as per the Reference range **specified as per Supply Water Quality Standard, Environment Protection Agency EPA, Maldives.**

**Contact information for this report (Technical and General Inquiries and Feedback)**

| | | |
|---|---|---|
| **GENERAL INQUIRIES:** | | |
| MOHOMED NAWZER | TEL: +94 764 412 907 | E-MAIL: mohomed.nawzer@bureauveritas.com |
| **TECHNICAL INQUIRIES:** | | |
| RUWANI AMARASINGHE | TEL: +94 768 229 457 | E-MAIL: ruwani.amarasinghe@bureauveritas.com |
| **FEED BACK:** | | |
| KUMUDINI RATHNAYAKE – ASST. QA MANAGER | TEL: +94 768 229 455 | E-MAIL: kumudinie.rathnayake@bureauveritas.com |

REVIEWED BY: HIMASHA JAYAWARDENA

BUREAU VERITAS CONSUMER PRODUCTS SERVICES LANKA (PVT) LTD.
AUTHORIZED SIGNATORY

APPROVED BY: RUWANI AMARASINGHE
ASSISTANT MANAGER –
FOOD & MICROBIOLOGY LABORATORY

**END OF THE REPORT**

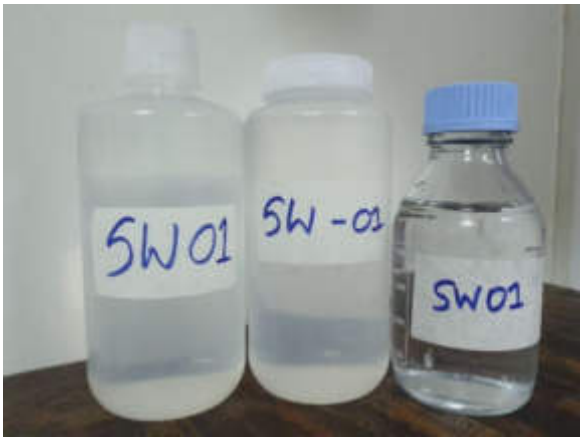
# TEST REPORT

**Report No: (7423)046-0113** Feb 24, 2023
**Code Name: AAWTE**



| | |
|---|---|
| **Customer:** | Alke Alkatas Joint Venture (Pvt) Ltd |
| **Address :** | H.H. Moomiyaage, 5A, Asaree Hingun. 20265 Male, Republic of Maldives |
| **Date of Sample Received:** | Feb 15, 2023 |
| **Date of Testing Started:** | Feb 15, 2023 |
| **Date of Testing Completed:** | Feb 22, 2023 |
| **Sample Description:** | **Sample Received as:**<br>A water sample contained in sealed plastic bottle<br><br>**Sample Identified by the Client as:**<br>Sample 01: Sea Water – SW01<br><br>Date of Sample Collection: 02.10.2023 |
| **Sample Drawn By BVCPS** | NO |

**Photo of the Submitted Samples**




**Bureau Veritas Consumer Products Services Lanka (Pvt) Ltd.**

No. 570, Galle Road, Katubedda, Moratuwa, Sri Lanka
Tel: (9411) 2350111-115 (dedicated lines), Fax: (9411) 112622198 & 199
Email: bvcps.lanka@lk.bureauveritas.com

# TEST REPORT

**Report No: (7423)046-0113** Feb 24, 2023
**Code Name: AAWTE**



## TEST RESULTS

### Sample 01

| No. | Parameters | Results | Reference range ** | LOQ | Unit | Test Method |
|---|---|---|---|---|---|---|
| 1 | Total Nitrogen (as N)* | 11.6 | Max.70 | - | mg/L | APHA 23rd ed: 2017 - 4500-Norg B |
| 2 | Nitrite (as $NO_2^-$)* | 0.3 | Max.2 | - | mg/L | APHA 23rd ed: 2017: 4500 -$NO_2$– B |
| 3 | Arsenic (as As) | ND | Max.0.1 | 0.001 | mg/L | CPSD-AN-00581: 2019 V15 |
| 4 | Cadmium (as Cd) | ND | Max.0.05 | 0.0001 | mg/L | |
| 5 | Lead (as Pb) | ND | Max.0.5 | 0.001 | mg/L | |
| 6 | Total Chromium (as Cr) | ND | Max.0.5 | 0.001 | mg/L | |
| 7 | Mercury (as Hg) | ND | Max.0.02 | 0.00050 | mg/L | |
| 8 | Nickel (as Ni) | ND | Max.1 | 0.001 | mg/L | |
| 9 | Zinc (as Zn) | ND | Max.2 | 0.001 | mg/L | |
| 10 | Copper (as Cu) | ND | Max.0.5 | 0.001 | mg/L | |
| 11 | Chemical Oxygen Demand (COD) | 40 | Max.200 | - | mg/L | APHA 23rd ed: 2017 : 5220D |
| 12 | Biological Oxygen Demand (BOD5) @ 20ºC | 6 | Max.20 | - | mg/L | APHA 23rd ed: 2017 : 5210D |
| 13 | Hexavalent Chromium (as $Cr^{6+}$)* | ND | Max.0.1 | 0.05 | mg/L | CPSD-AN-00582-MTHD |
| 14 | Electrical Conductivity at 25ºC | 54.5 | Max. 2500 | - | mS/cm | APHA 23rd ed: 2017: 2510 B |
| 15 | Total Phosphates (as $PO_4^{3-}$) | 0.05 | Max.3 | - | mg/L | APHA 23rd ed: 2017: 4500-PC |
| 16. | Sulfide | ND | Max.1 | 0.01 | mg/L | APHA 23rd ed: 2017: 4500-$S^{2-}$ F |

*Test not covered ISO 17025: 2017 by Sri Lanka Accreditation Board for conformity assessment.

**Reference range **as per Supply Water Quality Standard, Environment Protection Agency, Maldives**

**NOTE:**
APHA: American Public Health Association,
SLS: Sri Lanka Standard,
ND: Not Detected,
µS/cm: micro Siemens per centimeter
LOQ: Limit of Quantification,
mg/L: milligrams per liter,
NTU: Nephelometric Turbidity Units, ºC :Celcius,

**COMMENT :The Testing Results revealed that Food hygiene of Tested Water Sample is satisfactory as per the Reference range **specified as per Supply Water Quality Standard, Environment Protection Agency EPA, Maldives.**

# TEST REPORT

**Report No: (7423)046-0113** Feb 24, 2023
**Code Name: AAWTE**



| | |
|---|---|
| **Customer:** | Alke Alkatas Joint Venture (Pvt) Ltd |
| **Address :** | H.H. Moomiyaage, 5A, Asaree Hingun. 20265 Male, Republic of Maldives |
| **Date of Sample Received**: | Feb 15, 2023 |
| **Date of Testing Started:** | Feb 15, 2023 |
| **Date of Testing Completed:** | Feb 22, 2023 |
| **Sample Description:** | **Sample Received as:**<br>A water sample contained in sealed plastic bottle<br><br>**Sample Identified by the Client as:**<br>Sample 02: Sea Water – SW02<br><br>Date of Sample Collection: 02.10.2023 |
| **Sample Drawn By BVCPS** | NO |

**Photo of the Submitted Samples**

# TEST REPORT

**Report No: (7423)046-0113** Feb 24, 2023
**Code Name: AAWTE**



## TEST RESULTS

**Sample 02**

| No. | Parameters | Results | Reference range ** | LOQ | Unit | Test Method |
|---|---|---|---|---|---|---|
| 1 | Total Nitrogen (as N)* | 9.8 | Max.70 | - | mg/L | APHA 23rd ed: 2017 - 4500-Norg B |
| 2 | Nitrite (as $NO_2^-$)* | 0.3 | Max.2 | - | mg/L | APHA 23rd ed: 2017: 4500 -$NO_2$– B |
| 3 | Arsenic (as As) | ND | Max.0.1 | 0.001 | mg/L | CPSD-AN-00581: 2019 V15 |
| 4 | Cadmium (as Cd) | ND | Max.0.05 | 0.0001 | mg/L | |
| 5 | Lead (as Pb) | ND | Max.0.5 | 0.001 | mg/L | |
| 6 | Total Chromium (as Cr) | ND | Max.0.5 | 0.001 | mg/L | |
| 7 | Mercury (as Hg) | ND | Max.0.02 | 0.00050 | mg/L | |
| 8 | Nickel (as Ni) | ND | Max.1 | 0.001 | mg/L | |
| 9 | Zinc (as Zn) | ND | Max.2 | 0.001 | mg/L | |
| 10 | Copper (as Cu) | ND | Max.0.5 | 0.001 | mg/L | |
| 11 | Chemical Oxygen Demand (COD) | 38 | Max.200 | - | mg/L | APHA 23rd ed: 2017 : 5220D |
| | Biological Oxygen Demand (BOD5) @ 20ºC | 6 | Max.20 | - | mg/L | APHA 23rd ed: 2017 : 5210D |
| 13 | Hexavalent Chromium (as $Cr^{6+}$)* | ND | Max.0.1 | 0.05 | mg/L | CPSD-AN-00582-MTHD |
| 14 | Electrical Conductivity at 25ºC | 54 | Max. 2500 | - | mS/cm | APHA 23rd ed: 2017: 2510 B |
| 15 | Total Phosphates (as $PO_4^{3-}$) | 0.05 | Max.3 | - | mg/L | APHA 23rd ed: 2017: 4500-PC |
| 16. | Sulfide | ND | Max.1 | 0.01 | mg/L | APHA 23rd ed: 2017: 4500-$S^{2-}$ F |

*Test not covered ISO 17025: 2017 by Sri Lanka Accreditation Board for conformity assessment.

**Reference range **as per Supply Water Quality Standard, Environment Protection Agency, Maldives**

**NOTE:**
APHA: American Public Health Association,
SLS: Sri Lanka Standard,
ND: Not Detected,
µS/cm: micro Siemens per centimeter
LOQ: Limit of Quantification,
mg/L: milligrams per liter,
NTU: Nephelometric Turbidity Units, ºC :Celcius,

**COMMENT :The Testing Results revealed that Food hygiene of Tested Water Sample is satisfactory as per the Reference range **specified as per Supply Water Quality Standard, Environment Protection Agency EPA, Maldives.**

# TEST REPORT

**Report No: (7423)046-0113** Feb 24, 2023
**Code Name: AAWTE**



| | |
|---|---|
| **Customer:** | Alke Alkatas Joint Venture (Pvt) Ltd |
| **Address :** | H.H. Moomiyaage, 5A, Asaree Hingun. 20265 Male, Republic of Maldives |
| **Date of Sample Received**: | Feb 15, 2023 |
| **Date of Testing Started:** | Feb 15, 2023 |
| **Date of Testing Completed:** | Feb 22, 2023 |
| **Sample Description:** | **Sample Received as:**<br>A water sample contained in sealed plastic bottle<br><br>**Sample Identified by the Client as:**<br>Sample 03: Sea Water – SW03<br><br>Date of Sample Collection: 02.10.2023 |
| **Sample Drawn By BVCPS** | NO |

**Photo of the Submitted Samples**

# TEST REPORT

**Report No: (7423)046-0113** Feb 24, 2023
**Code Name: AAWTE**



## TEST RESULTS

### Sample 03

| No. | Parameters | Results | Reference range ** | LOQ | Unit | Test Method |
|---|---|---|---|---|---|---|
| 1 | Total Nitrogen (as N)* | ND | Max.70 | 0.5 | mg/L | APHA 23rd ed: 2017 - 4500-Norg B |
| 2 | Nitrite (as $NO_2^-$)* | 0.1 | Max.2 | - | mg/L | APHA 23rd ed: 2017: 4500 -$NO_2$– B |
| 3 | Arsenic (as As) | ND | Max.0.1 | 0.001 | mg/L | CPSD-AN-00581: 2019 V15 |
| 4 | Cadmium (as Cd) | ND | Max.0.05 | 0.0001 | mg/L | |
| 5 | Lead (as Pb) | ND | Max.0.5 | 0.001 | mg/L | |
| 6 | Total Chromium (as Cr) | ND | Max.0.5 | 0.001 | mg/L | |
| 7 | Mercury (as Hg) | ND | Max.0.02 | 0.00050 | mg/L | |
| 8 | Nickel (as Ni) | ND | Max.1 | 0.001 | mg/L | |
| 9 | Zinc (as Zn) | ND | Max.2 | 0.001 | mg/L | |
| 10 | Copper (as Cu) | ND | Max.0.5 | 0.001 | mg/L | |
| 11 | Chemical Oxygen Demand (COD) | 3 | Max.200 | - | mg/L | APHA 23rd ed: 2017 : 5220D |
| 12 | Biological Oxygen Demand (BOD5) @ 20ºC | ND | Max.20 | 1 | mg/L | APHA 23rd ed: 2017 : 5210D |
| 13 | Hexavalent Chromium (as $Cr^{6+}$)* | ND | Max.0.1 | 0.05 | mg/L | CPSD-AN-00582-MTHD |
| 14 | Electrical Conductivity at 25ºC | 57.2 | Max. 2500 | - | µS/cm | APHA 23rd ed: 2017: 2510 B |
| 15 | Total Phosphates (as $PO_4^{3-}$) | ND | Max.3 | 0.05 | mg/L | APHA 23rd ed: 2017: 4500-PC |
| 16. | Sulfide | ND | Max.1 | 0.01 | mg/L | APHA 23rd ed: 2017: 4500-$S^{2-}$ F |

*Test not covered ISO 17025: 2017 by Sri Lanka Accreditation Board for conformity assessment.

**Reference range **as per Supply Water Quality Standard, Environment Protection Agency, Maldives**

**NOTE:**
APHA: American Public Health Association,
SLS: Sri Lanka Standard,
ND: Not Detected,
µS/cm: micro Siemens per centimeter
LOQ: Limit of Quantification,
mg/L: milligrams per liter,
NTU: Nephelometric Turbidity Units, ºC :Celcius,

**COMMENT :The Testing Results revealed that Food hygiene of Tested Water Sample is satisfactory as per the Reference range **specified as per Supply Water Quality Standard, Environment Protection Agency EPA, Maldives.**

# TEST REPORT

**Report No: (7423)046-0113** Feb 24, 2023
**Code Name: AAWTE**



| | |
|---|---|
| **Customer:** | Alke Alkatas Joint Venture (Pvt) Ltd |
| **Address :** | H.H. Moomiyaage, 5A, Asaree Hingun. 20265 Male, Republic of Maldives |
| **Date of Sample Received**: | Feb 15, 2023 |
| **Date of Testing Started:** | Feb 15, 2023 |
| **Date of Testing Completed:** | Feb 22, 2023 |
| **Sample Description:** | **Sample Received as:**<br>A water sample contained in sealed plastic bottle<br><br>**Sample Identified by the Client as:**<br>Sample 04: Sea Water – SW04<br><br>Date of Sample Collection: 02.10.2023 |
| **Sample Drawn By BVCPS** | NO |

**Photo of the Submitted Samples**

# TEST REPORT

**Report No: (7423)046-0113** Feb 24, 2023
**Code Name: AAWTE**



## TEST RESULTS

**Sample 04**

| No. | Parameters | Results | Reference range ** | LOQ | Unit | Test Method |
|---|---|---|---|---|---|---|
| 1 | Total Nitrogen (as N)* | 11.6 | Max.70 | - | mg/L | APHA 23rd ed: 2017 - 4500-Norg B |
| 2 | Nitrite (as $NO_2^-$)* | 0.3 | Max.2 | - | mg/L | APHA 23rd ed: 2017: 4500 -$NO_2$– B |
| 3 | Arsenic (as As) | ND | Max.0.1 | 0.001 | mg/L | CPSD-AN-00581: 2019 V15 |
| 4 | Cadmium (as Cd) | ND | Max.0.05 | 0.0001 | mg/L | |
| 5 | Lead (as Pb) | ND | Max.0.5 | 0.001 | mg/L | |
| 6 | Total Chromium (as Cr) | ND | Max.0.5 | 0.001 | mg/L | |
| 7 | Mercury (as Hg) | ND | Max.0.02 | 0.00050 | mg/L | |
| 8 | Nickel (as Ni) | ND | Max.1 | 0.001 | mg/L | |
| 9 | Zinc (as Zn) | ND | Max.2 | 0.001 | mg/L | |
| 10 | Copper (as Cu) | ND | Max.0.5 | 0.001 | mg/L | |
| 11 | Chemical Oxygen Demand (COD) | 36 | Max.200 | - | mg/L | APHA 23rd ed: 2017 : 5220D |
| 12 | Biological Oxygen Demand (BOD5) @ 20ºC | 6 | Max.20 | - | mg/L | APHA 23rd ed: 2017 : 5210D |
| 13 | Hexavalent Chromium (as $Cr^{6+}$)* | ND | Max.0.1 | 0.05 | mg/L | CPSD-AN-00582-MTHD |
| 14 | Electrical Conductivity at 25ºC | 48.6 | Max. 2500 | - | mS/cm | APHA 23rd ed: 2017: 2510 B |
| 15 | Total Phosphates (as $PO_4^{3-}$) | 0.05 | Max.3 | - | mg/L | APHA 23rd ed: 2017: 4500-PC |
| 16. | Sulfide | ND | Max.1 | 0.01 | mg/L | APHA 23rd ed: 2017: 4500-$S^{2-}$ F |

*Test not covered ISO 17025: 2017 by Sri Lanka Accreditation Board for conformity assessment.

**Reference range **as per Supply Water Quality Standard, Environment Protection Agency, Maldives**

**NOTE:**
APHA: American Public Health Association,
SLS: Sri Lanka Standard,
ND: Not Detected,
µS/cm: micro Siemens per centimeter
LOQ: Limit of Quantification,
mg/L: milligrams per liter,
NTU: Nephelometric Turbidity Units, ºC :Celcius,

**COMMENT :The Testing Results revealed that Food hygiene of Tested Water Sample is satisfactory as per the Reference range **specified as per Supply Water Quality Standard, Environment Protection Agency EPA, Maldives.**

# TEST REPORT

**Report No: (7423)046-0113** Feb 24, 2023
**Code Name: AAWTE**



| | |
|---|---|
| **Customer:** | Alke Alkatas Joint Venture (Pvt) Ltd |
| **Address :** | H.H. Moomiyaage, 5A, Asaree Hingun. 20265 Male, Republic of Maldives |
| **Date of Sample Received**: | Feb 15, 2023 |
| **Date of Testing Started:** | Feb 15, 2023 |
| **Date of Testing Completed:** | Feb 22, 2023 |
| **Sample Description:** | **Sample Received as:**<br>A water sample contained in sealed plastic bottle<br><br>**Sample Identified by the Client as:**<br>Sample 05: Sea Water – SW05<br><br>Date of Sample Collection: 02.10.2023 |
| **Sample Drawn By BVCPS** | NO |

**Photo of the Submitted Samples**

# TEST REPORT



## TEST RESULTS

### Sample 05

| No. | Parameters | Results | Reference range ** | LOQ | Unit | Test Method |
|---|---|---|---|---|---|---|
| 1 | Total Nitrogen (as N)* | 10.4 | Max.70 | - | mg/L | APHA 23rd ed: 2017 - 4500-Norg B |
| 2 | Nitrite (as $NO_2^-$)* | 0.4 | Max.2 | - | mg/L | APHA 23rd ed: 2017: 4500 -$NO_2$– B |
| 3 | Arsenic (as As) | ND | Max.0.1 | 0.001 | mg/L | CPSD-AN-00581: 2019 V15 |
| 4 | Cadmium (as Cd) | ND | Max.0.05 | 0.0001 | mg/L | |
| 5 | Lead (as Pb) | ND | Max.0.5 | 0.001 | mg/L | |
| 6 | Total Chromium (as Cr) | ND | Max.0.5 | 0.001 | mg/L | |
| 7 | Mercury (as Hg) | ND | Max.0.02 | 0.00050 | mg/L | |
| 8 | Nickel (as Ni) | ND | Max.1 | 0.001 | mg/L | |
| 9 | Zinc (as Zn) | ND | Max.2 | 0.001 | mg/L | |
| 10 | Copper (as Cu) | ND | Max.0.5 | 0.001 | mg/L | |
| 11 | Chemical Oxygen Demand (COD) | 39 | Max.200 | - | mg/L | APHA 23rd ed: 2017 : 5220D |
| 12 | Biological Oxygen Demand (BOD5) @ 20ºC | 6 | Max.20 | - | mg/L | APHA 23rd ed: 2017 : 5210D |
| 13 | Hexavalent Chromium (as $Cr^{6+}$)* | ND | Max.0.1 | 0.05 | mg/L | CPSD-AN-00582-MTHD |
| 14 | Electrical Conductivity at 25ºC | 47.8 | Max. 2500 | - | mS/cm | APHA 23rd ed: 2017: 2510 B |
| 15 | Total Phosphates (as $PO_4^{3-}$) | 0.05 | Max.3 | - | mg/L | APHA 23rd ed: 2017: 4500-PC |
| 16. | Sulfide | ND | Max.1 | 0.01 | mg/L | APHA 23rd ed: 2017: 4500-$S^{2-}$ F |

*Test not covered ISO 17025: 2017 by Sri Lanka Accreditation Board for conformity assessment.

**Reference range **as per Supply Water Quality Standard, Environment Protection Agency, Maldives**

**NOTE:**
APHA: American Public Health Association,
SLS: Sri Lanka Standard,
ND: Not Detected,
µS/cm: micro Siemens per centimeter
LOQ: Limit of Quantification,
mg/L: milligrams per liter,
NTU: Nephelometric Turbidity Units, ºC :Celcius,

**COMMENT :The Testing Results revealed that Food hygiene of Tested Water Sample is satisfactory as per the Reference range **specified as per Supply Water Quality Standard, Environment Protection Agency EPA, Maldives.**

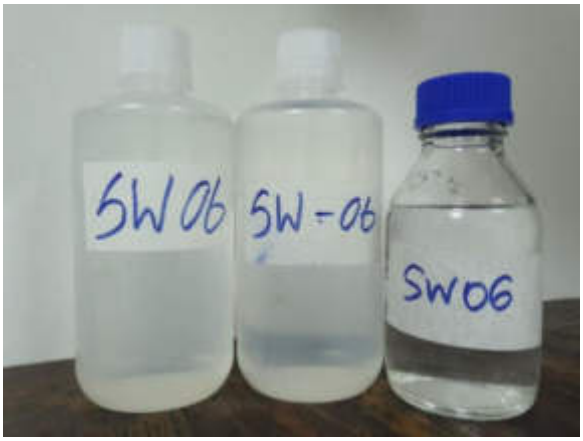
# TEST REPORT

**Report No: (7423)046-0113** Feb 24, 2023
**Code Name: AAWTE**



| | |
|---|---|
| **Customer:** | Alke Alkatas Joint Venture (Pvt) Ltd |
| **Address :** | H.H. Moomiyaage, 5A, Asaree Hingun. 20265 Male, Republic of Maldives |
| **Date of Sample Received**: | Feb 15, 2023 |
| **Date of Testing Started:** | Feb 15, 2023 |
| **Date of Testing Completed:** | Feb 22, 2023 |
| **Sample Description:** | **Sample Received as:**<br>A water sample contained in sealed plastic bottle<br><br>**Sample Identified by the Client as:**<br>Sample 06: Sea Water – SW06<br><br>Date of Sample Collection: 02.10.2023 |
| **Sample Drawn By BVCPS** | NO |

**Photo of the Submitted Samples**



# TEST REPORT

**Report No: (7423)046-0113** Feb 24, 2023
**Code Name: AAWTE**



## TEST RESULTS

### Sample 06

| No. | Parameters | Results | Reference range ** | LOQ | Unit | Test Method |
|---|---|---|---|---|---|---|
| 1 | Total Nitrogen (as N)* | 11.8 | Max.70 | - | mg/L | APHA 23rd ed: 2017 - 4500-Norg B |
| 2 | Nitrite (as $NO_2^-$)* | 0.3 | Max.2 | - | mg/L | APHA 23rd ed: 2017: 4500 -$NO_2$– B |
| 3 | Arsenic (as As) | ND | Max.0.1 | 0.001 | mg/L | CPSD-AN-00581: 2019 V15 |
| 4 | Cadmium (as Cd) | ND | Max.0.05 | 0.0001 | mg/L | |
| 5 | Lead (as Pb) | ND | Max.0.5 | 0.001 | mg/L | |
| 6 | Total Chromium (as Cr) | ND | Max.0.5 | 0.001 | mg/L | |
| 7 | Mercury (as Hg) | ND | Max.0.02 | 0.00050 | mg/L | |
| 8 | Nickel (as Ni) | ND | Max.1 | 0.001 | mg/L | |
| 9 | Zinc (as Zn) | ND | Max.2 | 0.001 | mg/L | |
| 10 | Copper (as Cu) | ND | Max.0.5 | 0.001 | mg/L | |
| 11 | Chemical Oxygen Demand (COD) | 38 | Max.200 | - | mg/L | APHA 23rd ed: 2017 : 5220D |
| 12 | Biological Oxygen Demand (BOD5) @ 20ºC | 6 | Max.20 | - | mg/L | APHA 23rd ed: 2017 : 5210D |
| 13 | Hexavalent Chromium (as $Cr^{6+}$)* | ND | Max.0.1 | 0.05 | mg/L | CPSD-AN-00582-MTHD |
| 14 | Electrical Conductivity at 25ºC | 48 | Max. 2500 | - | mS/cm | APHA 23rd ed: 2017: 2510 B |
| 15 | Total Phosphates (as $PO_4^{3-}$) | 0.05 | Max.3 | - | mg/L | APHA 23rd ed: 2017: 4500-PC |
| 16. | Sulfide | ND | Max.1 | 0.01 | mg/L | APHA 23rd ed: 2017: 4500-$S^{2-}$ F |

*Test not covered ISO 17025: 2017 by Sri Lanka Accreditation Board for conformity assessment.

**Reference range **as per Supply Water Quality Standard, Environment Protection Agency, Maldives**

**NOTE:**
APHA: American Public Health Association,
SLS: Sri Lanka Standard,
ND: Not Detected,
µS/cm: micro Siemens per centimeter
LOQ: Limit of Quantification,
mg/L: milligrams per liter,
NTU: Nephelometric Turbidity Units, ºC :Celcius,

**COMMENT :The Testing Results revealed that Food hygiene of Tested Water Sample is satisfactory as per the Reference range **specified as per Supply Water Quality Standard, Environment Protection Agency EPA, Maldives.**

# TEST REPORT

**Report No: (7423)046-0113** Feb 24, 2023
**Code Name: AAWTE**



| | |
|---|---|
| **Customer:** | Alke Alkatas Joint Venture (Pvt) Ltd |
| **Address :** | H.H. Moomiyaage, 5A, Asaree Hingun. 20265 Male, Republic of Maldives |
| **Date of Sample Received**: | Feb 15, 2023 |
| **Date of Testing Started:** | Feb 15, 2023 |
| **Date of Testing Completed:** | Feb 22, 2023 |
| **Sample Description:** | **Sample Received as:**<br>A water sample contained in sealed plastic bottle<br><br>**Sample Identified by the Client as:**<br>Sample 07: Sea Water – SW07<br><br>Date of Sample Collection: 02.10.2023 |
| **Sample Drawn By BVCPS** | NO |

**Photo of the Submitted Samples**

# TEST REPORT

**Report No: (7423)046-0113** Feb 24, 2023
**Code Name: AAWTE**



## TEST RESULTS

### Sample 07

| No. | Parameters | Results | Reference range ** | LOQ | Unit | Test Method |
|---|---|---|---|---|---|---|
| 1 | Total Nitrogen (as N)* | 10.9 | Max.70 | - | mg/L | APHA 23rd ed: 2017 - 4500-Norg B |
| 2 | Nitrite (as $NO_2^-$)* | 0.4 | Max.2 | - | mg/L | APHA 23rd ed: 2017: 4500 -$NO_2$– B |
| 3 | Arsenic (as As) | ND | Max.0.1 | 0.001 | mg/L | CPSD-AN-00581: 2019 V15 |
| 4 | Cadmium (as Cd) | ND | Max.0.05 | 0.0001 | mg/L | |
| 5 | Lead (as Pb) | ND | Max.0.5 | 0.001 | mg/L | |
| 6 | Total Chromium (as Cr) | ND | Max.0.5 | 0.001 | mg/L | |
| 7 | Mercury (as Hg) | ND | Max.0.02 | 0.00050 | mg/L | |
| 8 | Nickel (as Ni) | ND | Max.1 | 0.001 | mg/L | |
| 9 | Zinc (as Zn) | ND | Max.2 | 0.001 | mg/L | |
| 10 | Copper (as Cu) | ND | Max.0.5 | 0.001 | mg/L | |
| 11 | Chemical Oxygen Demand (COD) | 41 | Max.200 | - | mg/L | APHA 23rd ed: 2017 : 5220D |
| 12 | Biological Oxygen Demand (BOD5) @ 20ºC | 6 | Max.20 | - | mg/L | APHA 23rd ed: 2017 : 5210D |
| 13 | Hexavalent Chromium (as $Cr^{6+}$)* | ND | Max.0.1 | 0.05 | mg/L | CPSD-AN-00582-MTHD |
| 14 | Electrical Conductivity at 25ºC | 56 | Max. 2500 | - | mS/cm | APHA 23rd ed: 2017: 2510 B |
| 15 | Total Phosphates (as $PO_4^{3-}$) | 0.05 | Max.3 | - | mg/L | APHA 23rd ed: 2017: 4500-PC |
| 16. | Sulfide | ND | Max.1 | 0.01 | mg/L | APHA 23rd ed: 2017: 4500-$S^{2-}$ F |

*Test not covered ISO 17025: 2017 by Sri Lanka Accreditation Board for conformity assessment.

**Reference range **as per Supply Water Quality Standard, Environment Protection Agency, Maldives**

**NOTE:**
APHA: American Public Health Association,
SLS: Sri Lanka Standard,
ND: Not Detected,
µS/cm: micro Siemens per centimeter
LOQ: Limit of Quantification,
mg/L: milligrams per liter,
NTU: Nephelometric Turbidity Units, ºC :Celcius,

**COMMENT :The Testing Results revealed that Food hygiene of Tested Water Sample is satisfactory as per the Reference range **specified as per Supply Water Quality Standard, Environment Protection Agency EPA, Maldives.**

# TEST REPORT



**Contact information for this report (Technical and General Inquiries and Feedback)**

| | | |
|---|---|---|
| **GENERAL INQUIRIES:** | | |
| MOHOMED NAWZER | TEL: +94 764 412 907 | E-MAIL: mohomed.nawzer@bureauveritas.com |
| **TECHNICAL INQUIRIES:** | | |
| RUWANI AMARASINGHE | TEL: +94 768 229 457 | E-MAIL: ruwani.amarasinghe@bureauveritas.com |
| **FEED BACK:** | | |
| KUMUDINI RATHNAYAKE – ASST. QA MANAGER | TEL: +94 768 229 455 | E-MAIL: kumudinie.rathnayake@bureauveritas.com |

REVIEWED BY: DILINI JAYASINGHE

BUREAU VERITAS CONSUMER PRODUCTS SERVICES LANKA (PVT) LTD.
AUTHORIZED SIGNATORY

APPROVED BY: RUWANI AMARASINGHE

ASSISTANT MANAGER –
FOOD & MICROBIOLOGY LABORATORY

**END OF THE REPORT**

MDV-AAK-CEMPX-XX-RP-XXX-0002-000

# Environmental Monitoring Report - January 2023

REPUBLIC OF MALDIVES

MINISTRY of ENVIRONMENT, CLIMATE CHANGE and TECHNOLOGY

DBO CONTRACTOR:

urbaser

RAMBOLL

| | | |
|---|---|---|
| EMPLOYER REPRESANTATIVE | FICHTNER | Review & Approval: |

EPC CONTRACTOR:

alke ALKATAŞ

ALKE-ALKATAŞ JV

| | | | | |
|---|---|---|---|---|
| Project Title: | Design, Build and Operate of a Waste to Energy Facility at Thilafushi<br>Contract No: (AGR)438-WPMC/PRIV/2021/71 | | | |
| Document Name: | **ENVIRONMENTAL MONTHLY REPORT**<br>**JANUARY 2023** | | | |
| Status: | Project Management Deliverables | | | |
| Design: | Company: | Name: | Date: | Document No: |
| Prepared by: | AAJV | Binh, T.H | 29.01.2023 | |
| Checked by: | AAJV | CIVAN KALAFAT | 30.1.2023 | MDV-AAK-CEMPX-XX-RP- XXX-0002-000 |
| | URB/RAM | JMA/RLEE | | |
| Released by: | | | | |

# CONTENT

## 1. ENVIRONMENTAL REPORTING

This report provides an overview of the monthly environmental monitoring program conducted at the waste-to-energy construction project site on Thilafushi Island. The focus of the monitoring program is to assess the impact of the construction activities on the surrounding environment, particularly with regards to air, noise and water quality. The monitoring program is carried out in accordance with relevant environmental regulations and guidelines to ensure the protection of the environment and the health and well-being of the local community. The results of the monitoring program are used to identify any potential environmental impacts and to implement appropriate corrective actions to minimize or mitigate these impacts.

This report provides detailed information on the monitoring results, including data on key environmental parameters, such as air and water quality parameters, and noise levels. The report also includes a summary of any significant findings and any corrective actions that have been taken.

We hope that this report will provide a useful source of information for stakeholders, including local residents, regulatory authorities, and other interested parties.

### 1.1 Activities on site

The environmental monitoring program was conducted at the waste-to-energy construction site during the reporting period. The monitoring activities focused on air, noise, and water quality and were performed by a combination of employed staff and subcontractors.

No environmental incidents or near misses were reported during the monitoring period, and all equipment was in good working condition and properly maintained. The monitoring data were collected and analyzed using established procedures, and the results provide a comprehensive assessment of the site's environmental conditions. The monitoring program is an important aspect of our commitment to protecting the environment and ensuring the health and well-being of the surrounding community.

**Table 1: Activities at Site**

| Activity on site | Units | 2022 | | | | | | 2023 |
|---|---|---|---|---|---|---|---|---|
| | | Jul | Aug | Sep | Oct | Nov | Dec | Jan |
| Staff - employed | Nos | 44 | 48 | 52 | 48 | 46 | 46 | 46 |
| Staff - subcontractors | Nos | 08 | 08 | 08 | 06 | 10 | 10 | 0 |
| Excavator | Nos | 01 | 01 | 01 | 00 | 00 | 01 | 01 |
| Jcb | Nos | 01 | 01 | 01 | 01 | 01 | 01 | 01 |
| Car Mix | Nos | 01 | 01 | 01 | 01 | 01 | 00 | 00 |
| Diesel generators | Nos | 03 | 03 | 03 | 03 | 03 | 03 | 03 |
| Small mobile generators | Nos | 02 | 02 | 02 | 02 | 01 | 02 | 02 |
| Lightweight Equipment (i.e tower lights, vibrators etc.) | Nos | 01 each | 01 each | 01 each | 01 each | 01 each | 4 each | 6 each |
| Pick up | Nos | 02 | 02 | 02 | 02 | 02 | 00 | 00 |
| Forklift | Nos | 02 | 02 | 02 | 02 | 02 | 02 | 02 |
| Environmental Incidents/Near Miss: | No of incidents | NIL | NIL | NIL | NIL | NIL | NIL | NIL |

## 1.2 Construction Material

A wide range of construction materials are supplied to the waste-to-energy construction site to support the ongoing construction activities. These materials include stone of all types, sand of all types, concrete, steel, macadam, cement, pipe, wood, plastic, glass, electric wire, machine oil, gasoline, soils from weathered excavation, filling earth, and disposal waste.

The materials are stored and managed on-site in accordance with established procedures and regulations, to minimize the risk of any potential environmental impacts. The storage and handling of the materials is closely monitored, and appropriate measures are taken to prevent any spillage or leakage that could impact the surrounding environment.

It is important to note that all materials supplied to the site are sourced from reputable suppliers and are subject to rigorous quality control procedures to ensure that they meet the required standards for use in construction. These materials are also closely monitored to ensure that they are used in an environmentally responsible manner, and any waste materials generated during the construction activities are properly managed and disposed of in accordance with established procedures.

**Table 2: Construction Materials**

| Construction materials | Unit | Quantity |
|---|---|---|
| Stone of all types | $m^3$ | 1000 |
| Sand of all types | $m^3$ | 570000 |
| Concrete | $m^3$ | 30000 |
| Steel | ton | 3600 |
| Macadam | $m^2$ | |
| Cement | ton | 12000 |
| Pipe | pieces | |
| Wood | $m^3$ | 300 |
| Plastic | Tone | - |
| Glass | $m^2$ | - |
| Electric wire | m length | - |
| Machine oil | Litter | 1000 |
| Fuel (gasoline) | Litter | 3000 |
| Soils weathered excavation | $m^3$ | 30000 |
| Filling earth | $m^3$ | 30000 |
| Disposal waste | $m^3$ | ? |

# 2. WASTE MANAGEMENT

The domestic and construction waste generated from the daily activities at the waste-to-energy construction site will be managed according to the Waste Management Procedure and Plan document, which is currently being reviewed.

As per the agreement between AAJV and WAMCO of Maldives dated January 29, 2023, the company will be responsible for the collection and classification of waste at the Thilafushi WTE project site in the Maldives, as outlined in Appendix 1. The location of disposal sites and sewage lines can be found in Appendices 2 and 3, respectively.

## 3. DOCUMENTATION

To ensure the responsible and sustainable management of the waste-to-energy construction project in the Maldives, a comprehensive suite of environmental management documents have been developed and approved in line with the requirements set forth by the Asian Development Bank (ADB). These documents are key to ensuring that the project is managed in an environmentally responsible manner and that its impacts on the surrounding environment are minimized.

The environmental management documents include:

- The Waste Management System Plan outlines the procedures for managing and disposing of waste generated at the construction site.
- The Stakeholder Engagement Plan details the measures that will be taken to engage with and involve local stakeholders in the project.
- The Environmental Social Management Plan (ESMP) sets out the strategies and procedures for mitigating and managing the social and environmental impacts of the project.
- The Environmental Social Action Plan (ESAP) outlines the specific actions that will be taken to address any identified social and environmental issues.
- The Spill Control & Containment Plan outlines the measures that will be taken to prevent and respond to spills of hazardous materials at the construction site.
- The Chemicals & Hazardous Material Management Plan sets out the procedures for managing and disposing of chemicals and hazardous materials used at the construction site.
- The Public Health, Safety, and Security Plan, outlines the measures that will be taken to ensure the health, safety, and security of workers and the public.
- The Traffic Management Plan sets out the procedures for managing traffic and ensuring the safety of workers and the public during project construction.
- The Security Management Plan outlines the measures that will be taken to secure the construction site and protect workers and the public.
- The Standard Operating Procedures for GRM, outline the procedures for managing the day-to-day operations of the construction site.
- The Emergency Response Plan outlines the procedures for responding to and managing emergencies at the construction site.
- The ERP and Site Procedure Manual provides a comprehensive guide to the procedures and processes used at the construction site.
- The HIRA outlines the hazards and risks associated with the construction of the project and the measures that will be taken to manage them.
- The Marine and Beach Area Plan sets out the procedures for protecting and preserving the marine and beach areas in the vicinity of the construction site.

These environmental management documents form the foundation of the environmental management system for the waste-to-energy construction project and will be used to ensure that the project is managed in a responsible and sustainable manner, minimizing its impact on the environment and the surrounding community.

The following documents have been prepared, submitted reviewed and finalized:

**Table 3: Status of Documents**

| No. | Document name | Accepted date | Rejected date | Date of Re-submitted | Deadline of re-submission |
|---|---|---|---|---|---|
| 1 | Marine and Beach Area Plan- MDV-AAK-HSEXX-XX-PL-MGT-0014-000 | 7-Feb-23 | | | |
| 2 | Public Health Safety and Security Plan-MDV-AAK-HSEXX-XX-PL-MGT-0017-001 | | 7-Feb-23 | 10-Feb-2023 | |
| 3 | Traffic Management Plan- MDV-AAK-HSEXX-XX-PL-MGT-0016-000 | | 7-Feb-23 | 11-Feb-2023 | |
| 4 | ERP and Site Procedure Manual= MDV-AAK-HSEXX-XX-PL-MGT-0015-001 | | 7-Feb-23 | 10-Feb-2023 | |
| 5 | Chemical and Hazardous Material Management plan- MDV-AAK-HSEXX-XX-PL-MGT-0012-000 | 7-Feb-23 | | | 14-Feb-2023 |
| 6 | Stakeholder Engagement Plan- MDV-AAK-HSEXX-XX-PL-MGT-0011-000 | 7-Feb-23 | | | 14-Feb-2023 |
| 7 | Security Management Plan-MDV-AAK-HSEXX-XX-PL-MGT-0013-000 | 7-Feb-23 | | | |
| 8 | Spill Control and Containment Plan-MDV-AAK-HSEXX-XX-PL-MGT-0010-000 | | 3-Feb-23 | 11-Feb-2023 | |
| 9 | Waste management procedure and plan-MDV-AAK-HSEXX-XX-PL-MGT-0009-000 | 30-Jan-23 | | 11-Feb-2023 | |
| 10 | Environmental Social Action Plan (ESAP)= MDV-AAK-CEMPX-XX-PL-MGT-0008-000 | 30-Jan-23 | | | |
| 11 | Hazard identification risk assessment-MDV-AAK-CEMPX-XX-PL-MGT-0007-000 | 4-Feb23 | | | |
| 12 | SOP for Grievances Redness Mechanism-MDV-AAK-CEMPX-XX-PL-MGT-0006-001 | | 22-Jan-23 | 11-Feb-2023 | |
| 13 | Environmental Social Management Plan (ESMP)-MDV-AAK-CEMPX-XX-PL-MGT-0005-001 | | 15-Jan-23 | 10-Feb-2023 | |
| 14 | Obligations register - environment impact & aspect register= MDV-AAK-CEMPX-XX-PL-MGT-0004-000 | | | | |
| 15 | Environmental Management & Impact Mitigation Plan- MDV-AAK-CEMPX-XX-PL-MGT-0009-000 | | | 10-Feb-2023 (new uploaded) | |
| 16 | Emergency Response Plan for environment | | | | 14-Feb-2023 (new uploaded) |

## 4. TRAINING COURSES ON ENVIRONMENTAL SAFEGUARDS

The following internal training courses and training material documents related to environmental protection and safety have been developed for the project

The training course on Driving Safety Awareness focuses on educating participants on the importance of safe driving practices in the construction site of the Thilafushi WTE project in the Maldives. The course covers a range of topics, including identifying unsafe driving decisions, appropriate responses to unexpected driving circumstances, and methods to avoid risk and accidents. The aim is to provide participants with a thorough understanding of the steps they can take to ensure the safe operation of vehicles on the construction site. Additionally, the course covers vehicle maintenance and upkeep to ensure that vehicles are in good condition and ready to operate safely.

The Spillage Response course is designed to create awareness among workers and staff on the construction site about the Maldives Government and EPA regulations, Environmental Impact Assessment (EIA), and Construction Environmental Management Plan (CEMP) related to spillage response and the impact of hazardous chemicals and materials on their health. The course covers the responsibilities and strategies for preventing spills, assessing the hazards presented by spills, reporting spills when necessary, and cleaning up spills when appropriate. This training aims to ensure that participants are well-informed about the measures they can take to prevent and respond to spills in a safe and effective manner.

The Awareness of Noise and Record course aims to provide participants with an appreciation of the nature of noise hazards in the workplace and their impact on human health and well-being. The course covers the understanding of conducting noise assessments in the workplace and general environment to determine the need for compliance with relevant standards. Participants will learn about the consequences of excessive noise exposure and the need for control measures, including personal protective equipment. The course also covers the measurement (including dosimetry) of noise in relation to current standards and the means of controlling noise levels in the workplace.
The AAJV environmental management responses to the training.

Three training courses have been done in January 2023, are as follows

**Table 2. Training courses program in January 2023**

| | Training program | Location | Day | Time | Participant | Status |
|---|---|---|---|---|---|---|
| 1 | Spill Response, Clean-Up, and Emergency Response | At Thilafushi office | Jan 7, 2023 | 9.00-10.0 AM | All worker and staffs, officers | Done |
| 2 | Awareness training for noise/records | At Thilafushi office | Jan 10, 2023 | 9.00-10.0 AM | All worker and staffs, officers | Done |
| 3 | Driving safety in construction areas training course | At Thilafushi office | Jan 12, 2023 | 9.00-10.0 AM | All Drivers in site | Done |

### 4.1 Training Plan for the Next Reporting Period

To ensure that new employees are equipped with the necessary knowledge and skills to work safely and responsibly, several training courses will be held in March 2023. These courses, including Spill Response, Clean-Up, Emergency Response, and Awareness of Noise/Records, will take place at the Thilafushi construction site of the Thilafushi WTE project in the Maldives.

The Spill Response training will aim to raise awareness among workers and staff about the regulations of the Maldives Government & EPA, EIA, and CEMP related to spill response, as well as the impacts of hazardous chemicals and materials on their health. This course will also provide information on the responsibilities and strategies for preventing spills, assessing hazards presented by spills, reporting spills when necessary, and cleaning up spills when appropriate.

The Clean-Up training will focus on the proper procedures for cleaning up spills and managing hazardous materials. Participants will learn how to properly contain spills, dispose of contaminated materials, and minimize the environmental impact of spills.

The Emergency Response training will cover procedures for responding to emergencies on the construction site, including fires, spills, and other hazardous events. Participants will learn how to quickly and effectively respond to emergency situations to minimize harm to people and the environment.

The Awareness for Noise/Records training aims to provide participants with an understanding of the nature of noise hazards in the workplace and their effects on people. The course will also cover conducting noise assessments in the workplace and the general environment, determining compliance requirements, and controlling noise exposure, including the use of personal protective equipment.

Overall, the training sessions are an essential part of the project's environmental management, ensuring that new employees and workers are well-equipped to work safely and responsibly at the construction site. The Awareness for Noise/Records training will take place on March 16, 2023, while Spill Response, Clean-Up, and Emergency Response training will be conducted on March 17, 2023.

# 5. ENVIRONMENTAL ACTIVITIES SUMMARY

## 5.1 Monitoring in the Pre-Construction Phase

To ensure that the environmental impact of the waste-to-energy (WtE) facility at Thilafushi, Maldives is well-monitored, a monitoring schedule has been proposed and followed. As per the schedule, the first round of environmental monitoring was carried out in January 2023. This report is part of the pre-construction and construction stage monitoring, which is a contractual requirement outlined in the Environmental Impact Assessment report for the project. The purpose of the monitoring is to assess the environmental impact of the WtE facility on its surroundings.

The environmental monitoring conducted in January focused on two main aspects: ambient air quality, noise levels. The ambient air monitoring was conducted from January 28th to January 30th, 2023, at various approved locations, using AirQoon Sensor equipment. Similarly, the noise level monitoring was conducted on January 26th and January 27th, 2023, at five locations, using a T-958 Professional Sound Level Meter device. The results of these environmental monitoring activities will help ensure that the WtE facility operates within the acceptable environmental standards and regulations set by the Maldives Government and the Environmental Protection Agency (EPA).

## 5.2 Weather Conditions in Measuring Day

When conducting noise level and ambient air quality monitoring, several key considerations need to be taken into account to ensure accurate and reliable results.

For noise level monitoring, it is essential to consider the time of day when monitoring is conducted, as noise levels can vary significantly depending on the level of activity in the surrounding area. The type of environment being monitored, such as a busy construction site or a residential area, should also be considered, as this can impact the type of equipment used for monitoring and the locations of the monitoring points. The type of equipment used for noise level monitoring is also critical, as different types of meters can produce different results. In this case, the T-958 Professional Sound Level Meter was used, which is a reliable and accurate tool for monitoring noise levels.

When conducting ambient air quality monitoring, it is also important to consider the time of day and the weather conditions on the day of monitoring. Changes in wind speed, humidity, and other weather conditions can affect air quality, and the locations of the monitoring points should also be considered, as different locations can produce different results due to factors such as local traffic patterns and the presence of nearby industrial sources. In this case, the monitoring was conducted over a period of three days, with the AirQoon Sensor being used to monitor air quality at eight approved locations.

By taking these key considerations into account, the results of the noise level and ambient air quality monitoring conducted in January 2023 can be relied upon to provide an accurate and meaningful representation of the environmental conditions in the area surrounding the project.

**Table 4: Weather Conditions During the Monitoring Days**

| Date | Time | Atmospheric temperature in °F | Atmospheric pressure in Hg | Wind speed mph | Wind direction | Air Humid % |
|---|---|---|---|---|---|---|
| 26 Jan 2023 | Night | +79° | 29.8 | 9.4 | North East | 84 |
| | Morning | +81° | 29.8 | 10.5 | East | 77 |
| | Day | +84° | 29.8 | 11.4 | East | 74 |
| | Evening | +82° | 29.8 | 11.2 | East | 69 |
| 27 Jan 2023 | Night | +81 | 29.8 | 12.3 | East | 77 |
| | Morning | +81 | 29.8 | 11.4 | North East | 84 |
| | Day | +86 | 29.8 | 11.4 | North East | 72 |
| | Evening | +82 | 29.8 | 11.6 | North East | 75 |
| 28 Jan 2023 | Night | +82 | 29.8 | 11.6 | North East | 78 |
| | Morning | +82 | 29.8 | 10.7 | North East | 80 |
| | Day | +86 | 29.8 | 12.1 | North East | 75 |
| | Evening | +82 | 29.8 | 13 | North East | 74 |
| 29 Jan 2023 | Night | +81 | 29.8 | 9.6 | North East | 74 |
| | Morning | +84 | 29.8 | 7.6 | North | 85 |
| | Day | +84 | 29.7 | 11.4 | North East | 83 |
| | Evening | +81 | 29.8 | 8.3 | East | 78 |
| 30 Jan 2023 | Night | +81 | 29.8 | 8.1 | North East | 70 |
| | Morning | +86 | 29.9 | 8.7 | North East | 77 |
| | Day | +84 | 29.9 | 9.2 | North | 71 |
| | Evening | +81 | 29.9 | 7.8 | North East | 77 |

## 5.3 The Summary Weather Conditions of the Maldives Over the Year

The Maldives are a group of tropical islands located in the Indian Ocean to the southwest of India. Known for their hot and humid climate, the Maldives experience two monsoons throughout the year that influence their weather conditions. The southwest monsoon, from April to September, is stronger in the northern islands and is accompanied by rough sea conditions, high humidity, and frequent cloudiness. The northeast monsoon, from October to December, brings showers and thunderstorms, especially in the southern atolls.

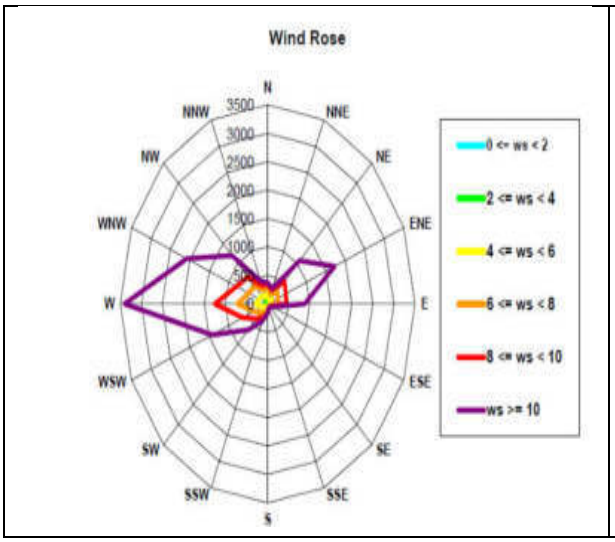
Between the monsoons, the driest period occurs from January to April, particularly in the northern atolls. The temperatures are consistent year-round, with a relative humidity of 80%. During the period of March to May, there is a slight increase in temperature, especially in the northern atolls, with maximum temperatures reaching 32-33 °C (90-91 °F) and minimum temperatures of 26-27 °C (79-81 °F).

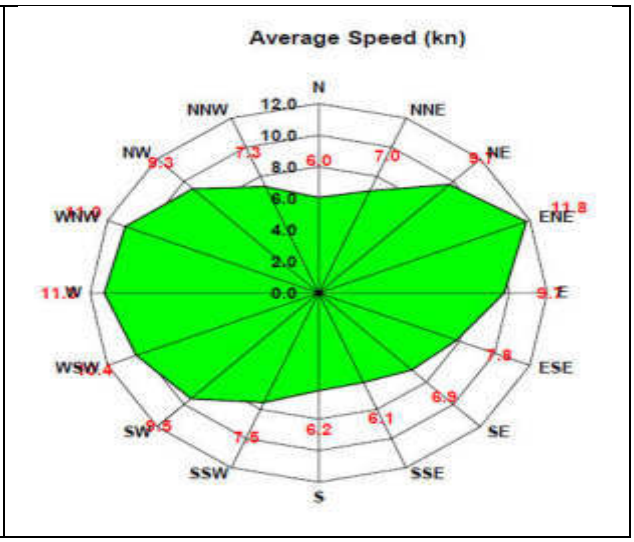
In tropical areas like the Maldives, rainfall typically occurs in short, intense downpours or thunderstorms. The southern atolls experience slightly more rainfall, with an annual average of 2,200-2,300 millimeters (87-91 inches), while the north experiences an average of 1,700-1,800 millimeters (67-71 inches) per year due to a relatively dry season from January to mid-April. This dry season is more pronounced in the northernmost atolls.

- **Wind**: The prevailing wind over the Maldives follows the typical Asian monsoonal characteristics, with seasonal reversals of wind direction by more than 120° between January and July. Throughout the year, westerly winds are predominant in the country, varying between west-southwest and west-northwest.

The southwest monsoon, which lasts from May to October, brings winds predominantly between SW and NW. From May to June, winds are mainly from WSW to WNW, and from July to October, winds between W and NW predominate. On the other hand, the northeast monsoon, which lasts from December to February, brings winds predominantly from NE to E. Winds are variable in March and April.

November is a transitional month, with winds primarily from the west, becoming variable and occasionally exceeding 30 knots from the NE sector. However, yearly wind speeds during the northeast and southwest monsoons are observed to be between 9-13 knots.



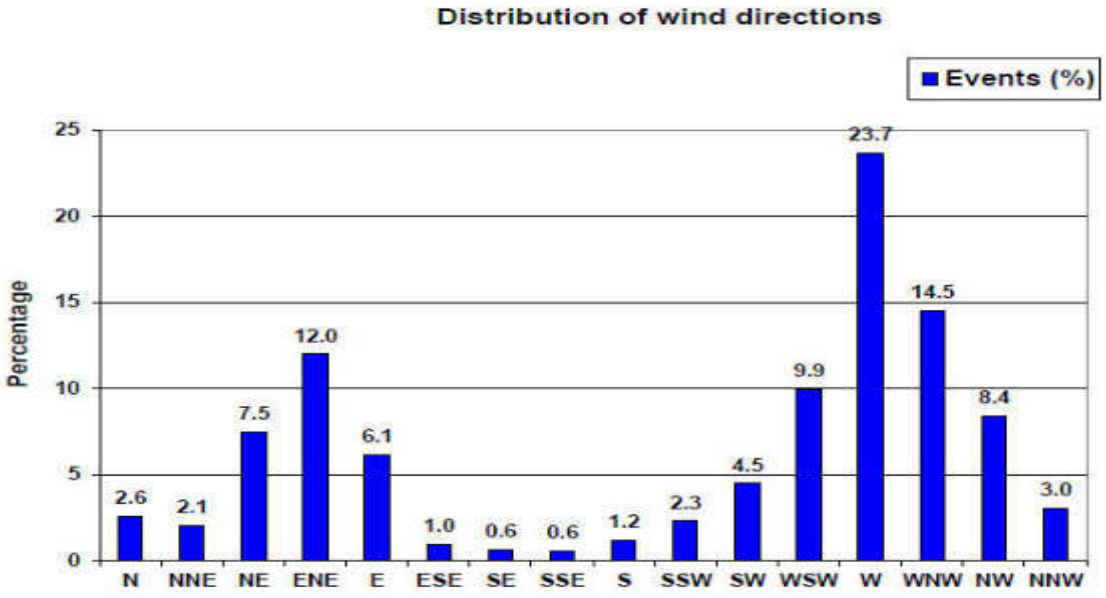



Figure 1: Spatial distribution of wind speed and directions (Source: MEE)

With respect to maximum wind speeds, visual inspection of the wind rose plot coincides with that of the mean wind speeds. Approximately 3% of the time, wind speeds had gone as high as > 40 knots in this region. The highest recorded maximum wind speed for the region during the data collection period was 62 knots. The most common maximum wind speed is between 10-20 knots. Wind rose plots for both maximum and mean wind speeds show that winds from the West are dominant (21.3% of the time).

## 6. Key Monitoring Findings from the Reporting Period

### 6.1 Ambient/Air Monitoring Results

The pre-construction environmental monitoring of ambient air quality was conducted in January 2023 at seven different locations, six of which were located at Thilafushi, and one at Villingili. During the monitoring period, which took place from January 28th to January 30th, 2023, various air quality parameters were monitored using air quality monitoring stations equipped with sensor technology. The parameters that were monitored included PM10, PM2.5, SO2, NO2, and O3. In order to measure the Total Suspended Particles (TSPs), dust sampling devices that conform to international HSE-MDHS 14/3 were used. As recommended in the Environmental Impact Assessment (EIA) report, air quality was measured for 24 hours at each station to ensure a thorough evaluation of the air quality in the area. The locations for air quality monitoring were selected based on the findings of the EIA, and ASR 2, ASR 3, and ASR 5 were recommended for monitoring in the EIA report.


**Table 5: Sampling Locations Pre-construction Ambient Air Quality Monitoring**

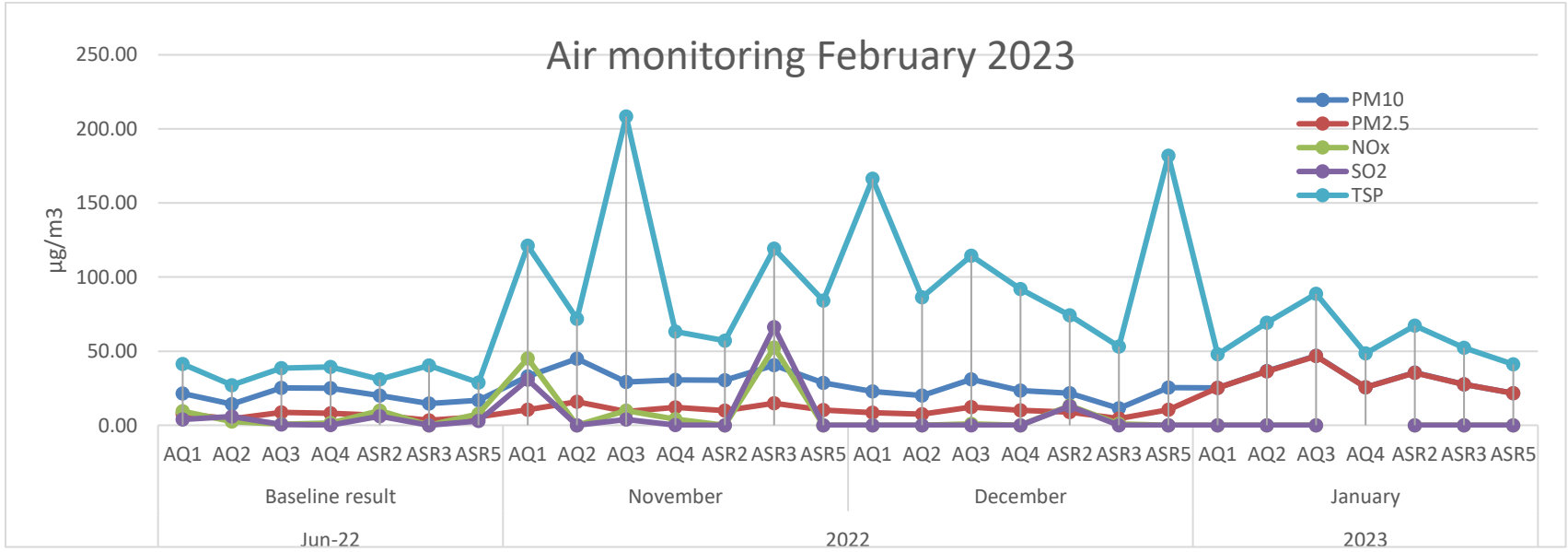
The approved Environmental Impact Assessment (EIA) document has identified and described the air quality monitoring locations. There are five designated air monitoring stations. These locations are further presented in the table below.

**Table 6: Brief Description of Air Quality Monitoring Stations**

| | |
|---|---|
| AQ1 | Represents a dense industrial area. The distance from the project area to the stations is 650m, and the location is located directly to the working area of Ship and vessel repair and maintenance |
| AQ2 | Represents dense industrial area. The distance from the project area to the stations is 1000m and the location is located directly to the working area of Ship and vessel repair and maintenance |
| AQ3 | Represents dense industrial area, the distance from the project area to the stations is 500m, and the location is located directly to the working area of Ship and vessel repair and maintenance |
| AQ4 | Represents dense housing and population area, the distance from the project area to the stations is 4500m |
| ARS2 | Represents a dense industrial area, the distance from the project area to the stations is 700m, the location is located directly to the working area of Ship and vessel repair and maintenance |
| ARS3 | Represents dense industrial area, the distance from the project area to the stations is 500m the location is located directly to the working area of Ship, vehicle and vessel repair and maintenance |
| ARS5 | Represents dense industrial area, , the distance from the project area to the stations is 1000m, the location is located directly to the working area of Ship, vehicle and vessel repair and maintenance |

**Table 7: Air Quality Monitoring Result in January 2023**

| 2022 | | | | | | | | | | | | | | 2023 | | | | | | | Standard value (WHO) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| November | | | | | | | December | | | | | | | January | | | | | | | |
| AQ1 | AQ2 | AQ3 | AQ4 | ASR2 | ASR3 | ASR5 | AQ1 | AQ2 | AQ3 | AQ4 | ASR2 | ASR3 | ASR5 | AQ1 | AQ2 | AQ3 | AQ4 | ASR2 | ASR3 | ASR5 | |
| 33.06 | 44.87 | 29.23 | 30.67 | 30.45 | 40.55 | 28.59 | 22.87 | 20.00 | 31.06 | 23.47 | 21.55 | 11.41 | 25.47 | **25.28** | **36.6** | **46.84** | 25.59 | **35.54** | **27.61** | 21.68 | 50 µg/m$^3$ |
| 10.52 | 15.85 | 9.25 | 12.06 | 9.83 | 14.84 | 10.19 | 8.41 | 7.55 | 12.28 | 10.10 | 8.95 | 4.44 | 10.42 | **25.13** | **36.45** | **46.64** | 25.56 | **35.46** | **27.57** | 21.66 | 25 µg/m$^3$ |
| 45.18 | 0 | 9.85 | 4.03 | 0 | 52.53 | 0 | 0 | 0 | 0.86 | 0 | 13.35 | 0.86 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 200 µg/m3 |
| 30.78 | 0 | 3.81 | 0.08 | 0 | 66.25 | 0 | 0 | 0 | 0 | 0 | 12.83 | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 20 µg/m3 |
| 121.14 | 71.75 | 208.34 | 63.2 | 57.08 | 119.13 | 84.21 | 166.41 | 86.40 | 114.36 | 91.96 | 74.10 | 53.16 | 181.96 | **47.82** | **69.28** | **88.65** | 48.49 | **67.31** | 52.31 | 41.08 | - |



According the result from table 5 and the graphic, the ambient air quality results obtained from the preconstruction monitoring in January 2023 the background air quality values mostly comply with air quality standards.

Deviations from the baseline could be explained through a combination of the following factors, that are not necessarily related to the project activities.

- **Industrial and commercial activities**: Industries and businesses that emit pollutants such as chemicals, fumes, and dust can contribute to poor air quality.
- **Transportation**: The emission of pollutants from vehicles such as cars, trucks, and buses can also contribute to poor air quality.
- **Weather conditions**: Weather conditions like temperature inversions, which trap pollutants close to the ground, can contribute to poor air quality.
- **Population growth**: As populations grow in the island, the emission of pollutants from factories and human activities increases, leading to poor air quality.

Industrial and commercial activities, transportation, and population growth are more likely to be dependent on the monitoring location as they are directly influenced by human activities and the level of development of a particular area. Weather conditions and natural sources can affect air quality in a specific location, but their impact may not be as directly linked to the monitoring location as the other three factors.

For this reason, it is also important to look at differences between the monitoring locations, to ascertain whether the deviations are because of the monitoring regime, affected by the project activities and/or factors outside of the project area. Comparing air quality monitoring data over time provides several key benefits:

- **Identifying Trends**: Monitoring air quality over a period of time can reveal trends and patterns that may not be noticeable in isolated data points. This information can help to identify sources of pollution and prioritize mitigation efforts.
- **Evaluating the Effectiveness of Mitigation Efforts**: Comparing air quality data over time can show the impact of mitigation efforts, such as reducing emissions from industrial sources or implementing a clean-air policy.
- **Identifying Seasonal Variations**: Some air pollutants such as toxic gas, dust, high particles (Pm10, PM2.5) concentration, etc., can vary seasonally, and comparing air quality data over time can reveal these patterns and help to understand the impact of weather on air quality.
- **Compliance Monitoring**: Comparing air quality data over time can help determine if a location is meeting air quality standards and regulations.
- **Supporting Research**: Comparing air quality data over time can support scientific research and provide important information for understanding the long-term effects of air pollution on human health and the environment.

Overall, comparing air quality monitoring data over time is an important tool for understanding and addressing air pollution and ensuring that communities have safe and healthy air to breathe.

Single data points from air quality monitoring are just snapshots of air quality conditions at a specific moment in time. They can provide information about the current state of air quality, but it is not possible to determine the

cause of any changes in air quality based on just one data point. To determine the cause and effect of changes in air quality, it is necessary to examine the data over a longer period of time and look for patterns and trends. Factors such as weather conditions, seasonal changes, and human activities can all have an impact on air quality, and it is important to consider these factors and their interactions when analyzing air quality data over time. Additionally, it is also important to examine other data sources such as emissions data, meteorological data, and land use data to gain a more comprehensive understanding of the factors affecting air quality. By analyzing data over time and considering multiple data sources, it is possible to identify the causes and effects of changes in air quality and develop strategies for improving air quality.

## 6.2 Noise Monitoring Findings

The purpose of conducting repeated ambient noise level measurements at five locations in the pre-construction phase of the Thilafushi Waste to Energy facility is to assess the noise impact of the facility on its surrounding environment. These measurements are performed using a handheld sound level meter, specifically the ET-958 Professional Sound Level Meter, to ensure accurate and consistent results. The methodology for conducting these noise level measurements is still under review, but the intention is to establish a comprehensive and consistent approach for all future noise monitoring efforts at the facility.

The measurements for this reporting period were conducted over a 24-hour period on the 26th and 27th of January 2023, to capture both daytime and nighttime noise levels. This was done to account for any differences in noise levels that may occur due to changes in human activities and other sources of noise during different times of the day. The results of these measurements were recorded and analyzed to determine the baseline noise levels in the surrounding environment and assess the waste-to-energy facility's potential impact on the community.

**Table 8: Locations Selected for Ambient Noise Level Measurements**

| Station name | Geographic Coordinates | Reason for selection |
|---|---|---|
| NQ1 | 4°10’26.4 N, 73°28’59.9 E | Included in the original EIA |
| NQ2 | 4°10’56.6 N, 73°26’53.3 E | Included in the original EIA |
| NQ3 | 4°10’58.3 N, 73°26’09.6 E | Included in the original EIA |
| NQ4 | 4°10’57.3 N,73°25’59.4 E | Included in the original EIA |
| NQ5 | 4°10’57.3 N, 73°26’14.4 E | Included in the original EIA |

**Table 9: Brief Description of Noise Monitoring Locations**

| | |
|---|---|
| NQ1 | The station was selected as it represents a major industrial location of the island and is also located close to the harbor. The location lies north of the proposed facility on the opposite side of the lagoon. |
| NQ2 | The station was selected as it represents a major industrial location of the island. The location lies east of the proposed facility on the opposite side of the lagoon. The location has various industrial activities in its proximity |
| NQ3 | This station was selected as it is located near the boundary of the proposed WTE facility. |
| NQ4 | This station was selected as it is located west of proposed WTE facility. The area has less development and less activity during the day time. |
| NQ5 | This station was selected as it is located at the proposed WTE facility. |


**Figure 2: Ambient Noise Level Sampling Locations**

.

Table 8. Noise monitoring result in January 2023

| Parameter | Month/years | | | | | | | | | | | | | | | | | | | | Standard value (WHO)-dBA | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2019 | | | | | 2022 | | | | | | | | | | 2023 | | | | | | |
| | Baseline result | | | | | November | | | | | December | | | | | January | | | | | Day time | Night time |
| | NQ1 | NQ2 | NQ3 | NQ4 | NQ5 | NQ1 | NQ2 | NQ3 | NQ4 | NQ5 | NQ1 | NQ2 | NQ3 | NQ4 | NQ5 | NQ1 | NQ2 | NQ3 | NQ4 | NQ5 | | |
| Day time | 65.1 | 64.2 | 53.66 | 53.4 | 54.6 | 59 | 43.59 | 39.22 | 46.89 | 40.75 | 57.6 | 54.3 | 56.7 | 44.3 | 38.2 | 61.9 | 55.2 | 52.4 | 53.8 | 51.4 | 70 | |
| Night time | 58.7 | 51.8 | 50.14 | 48.38 | 49 | 36.87 | 23.24 | 20.17 | 24.28 | 31.52 | 50.9 | 51.78 | 54.43 | 53.16 | 50.04 | 55.6 | 50.5 | 54 | 56.1 | 44.3 | | |

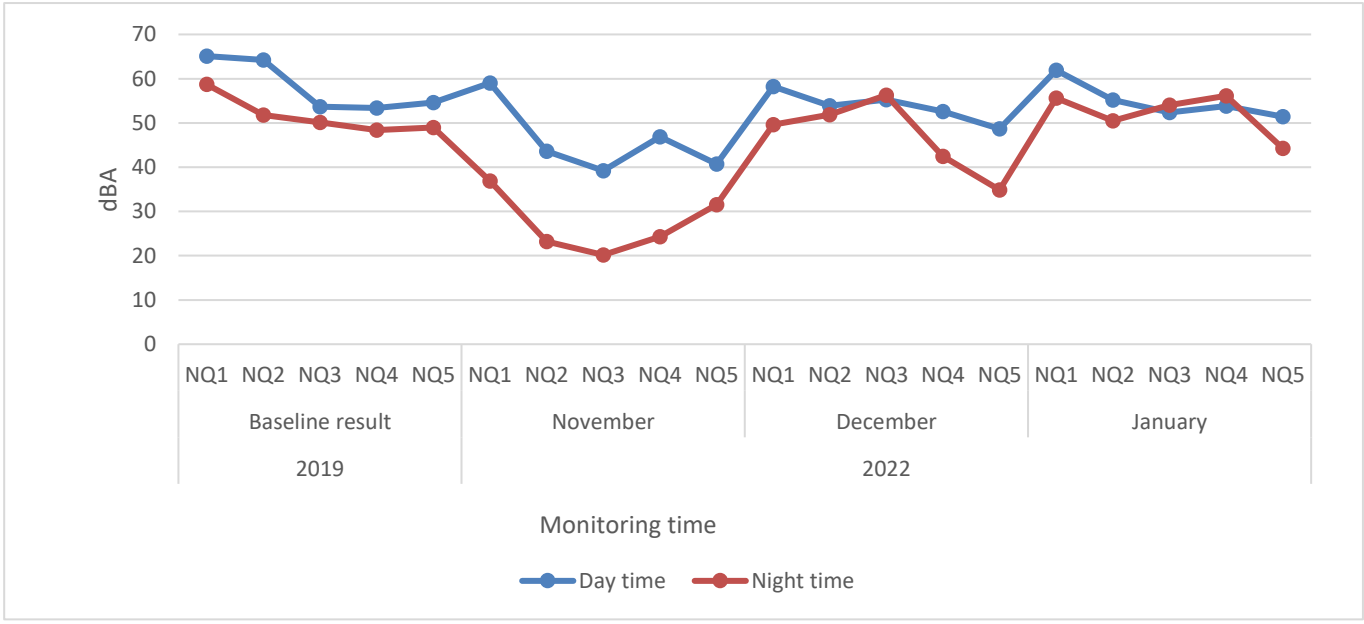



Figure 3: Noise monitoring diagram January 2023

To comprehensively understand the ambient noise levels in the vicinity of the Thilafushi Waste to Energy facility, 7-8 readings were taken every hour for 30-50 seconds at each monitoring station. These readings were then averaged to determine the average ambient noise level, which was recorded in dB(A). The results were summarized in Table 8 and depicted in Figure 3, providing a comprehensive overview of the ambient noise levels in the area. This data enabled further analysis and evaluation of the facility's potential impact on the surrounding environment.
It is important to note that the monitoring was carried out during two different time periods:

- Dayy time (07.00 AM - 22.00 PM)
- Night time (22.00 PM - 07.00 AM, possibly the next day).

It is worth mentioning that there are currently no specific national standards for ambient noise levels in outdoor industrial areas in the Maldives. However, the measurements taken in Thilafushi island and the subproject area were compared to noise level standards specified by the World Health Organization (WHO) and the Asian Development Bank (ADB) for outdoor industrial and commercial areas. The results showed that all of the monitored locations had ambient noise levels below the threshold levels set by the WHO standards, indicating that the ambient noise levels in the area are considered safe according to WHO's criteria for outdoor industrial and commercial areas.

It is important to consider that several factors can lead to differences in noise levels between a baseline measurement and a subsequent measurement. Some of the most likely explanations for noise levels being beyond acceptable standards or differing from a baseline measurement include... (the rest of the paragraph is missing).

There could be several factors that can lead to differences in noise levels between a baseline measurement and a subsequent measurement. Some of the key most likely explanations for noise levels being beyond acceptable standards or differing from a baseline measurement include:

- Increase in traffic volume or industrial activities: An increase in the volume of vehicles or industrial activities in the area can result in an increase in noise levels.
- The difference in weather conditions: Weather conditions such as wind speed and direction can affect noise levels by carrying sounds further or reducing their impact.
- The difference in time of day: Noise levels can vary depending on the time of day. For example, noise levels may be higher during the day when there is more activity compared to nighttime.
- The difference in location of the source of noise: If the source of noise has moved, it can result in different noise levels at a particular location.
- Change in measurement equipment or methodology: If the measurement equipment or methodology has changed, it can result in different noise level readings compared to a baseline measurement.
- New construction or demolition activities: new construction or demolition activities can result in an increase in noise levels.

These are some reasons why noise levels are higher at nighttime compared to daytime. Some of the reasons could be:

- Increased human activity: People tend to be more active during nighttime, and construction work could increase noise levels.

- Traffic: There could be an increase in the number of vehicles in the area at nighttime, leading to increased noise levels.
- Industrial activities: Some industries may operate 24/7, increasing noise levels during nighttime.
- Echoes and reflections: At nighttime, there are often fewer people and objects to absorb sound, so noise can travel farther and be amplified by echoes and reflections.

It is important to consider these factors when interpreting changes in noise levels over time

## 7. Picture demonstrate to physical environment monitoring in Pre-construction phase

1. Ambient Air monitoring

Ambient Air monitoring at AQ 2

Ambient Air monitoring at AQ 3

Ambient Air monitoring at AQ 4

Ambient Air monitoring at AQ 1

## Appendix 1. Waste collection agreement

# Waste Disposal Form

Request Date: 29 / 01 / 2023

DETAILS OF PARTY REQUESTING FOR SERVICE

Alke Alkatas Joint Venture Pvt. Ltd.
Name of Individual / Company / Resort / Island/Department

H.H. maamiyage 5A Asare Hingun K. male - 20265
Address

burak.ozdemir@aawu.com
Email Address — Telephone Number and Fax Number

DETAILS OF VESSEL/ VEHICLE

Pick up — Name of Vessel/ Vehicle
AC1 AT1612 — Registry Number

Mehadi — Name of Captain/ Driver
National ID Card Number

Length of the Vessel / Vehicle
1.5 Ton — Tonnage

Name of Company
9114593 — Telephone Number and Fax Number

Location of WAMCO

- ☐ Industrial Village/Male
- ☑ K. Thilafushi
- ☐ Hulhumale
- ☐ Villimale
- ☐ R. Vandhoo
- ☐ Fuvahmulah
- ☐ S.Hithadhoo
- ☐ S.Hulhumeedhoo
- ☐ HDh. Kulhudhuffushi

PARTICULARS OF WASTE (SEGREGATED)

- ☐ Green Waste
- ☑ Plastic
- ☑ Wood
- ☐ Glass
- ☑ Paper/Cardboard
- ☐ *ELV
- ☐ Electronic Waste
- ☐ C&D
- ☐ Other

*ELV: End of Life *C&D: Construction and Demolition waste

Note 1: The following waste types are not accepted at the facility
a) Hospital Clinical Waste
b) Liquid or semi liquid sewage and septic waste

Note 2: Please send the original along with a copy of the same with the boat captain or driver.

AUTHORIZED PERSONNEL OF REQUESTING PARTY

FNOL REILLY — Name
9311779. — Telephone Number and Fax Number
MANAGING DIRECTOR. — Designation
C02782022 — Signature and Stamp

Payment basis: ☐ Cash ☐ Credit
*Any alterations on the form will not be accepted

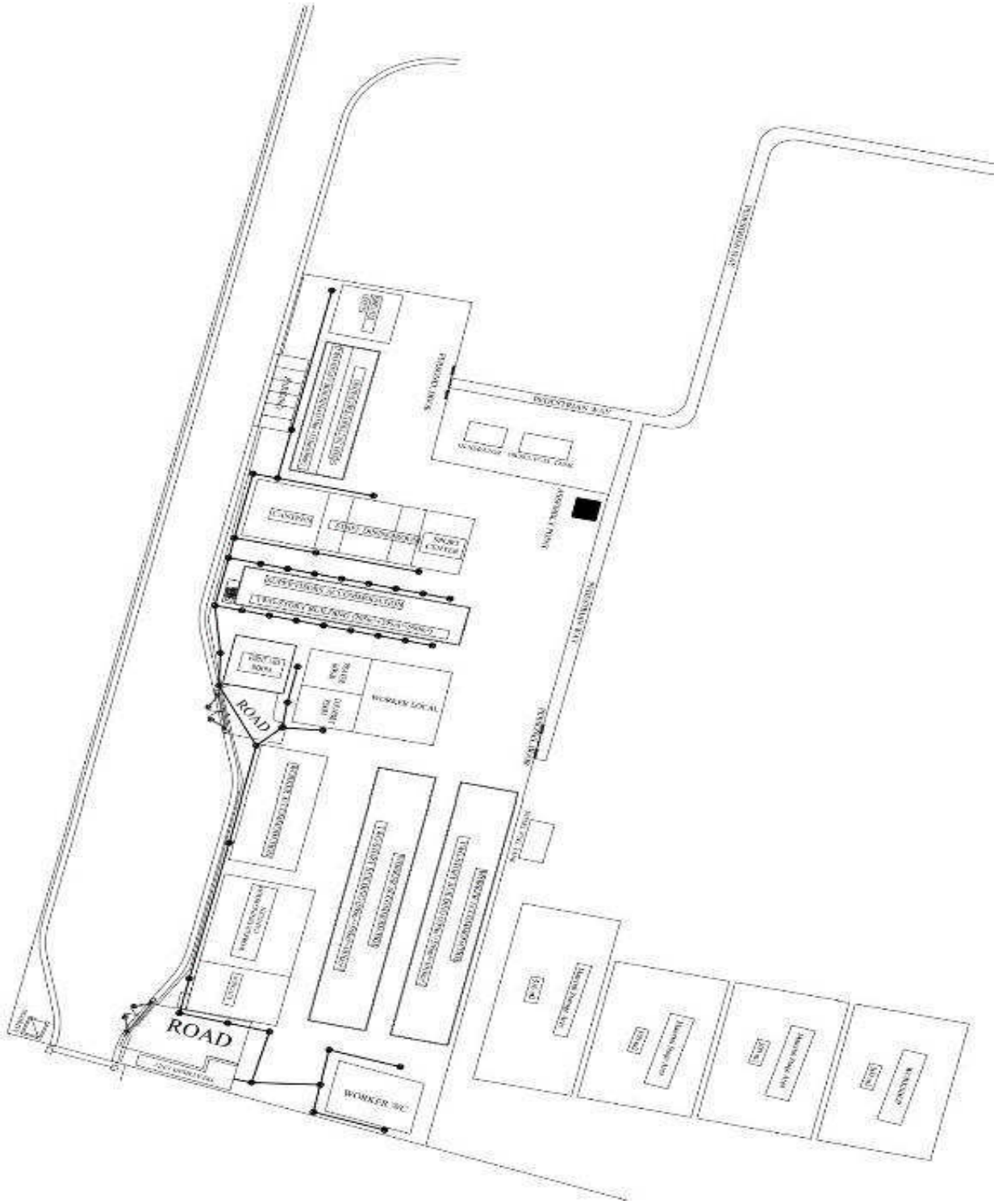
----------To be filled by official of Waste Management Corporation----------

Name — Date Received — Time Received

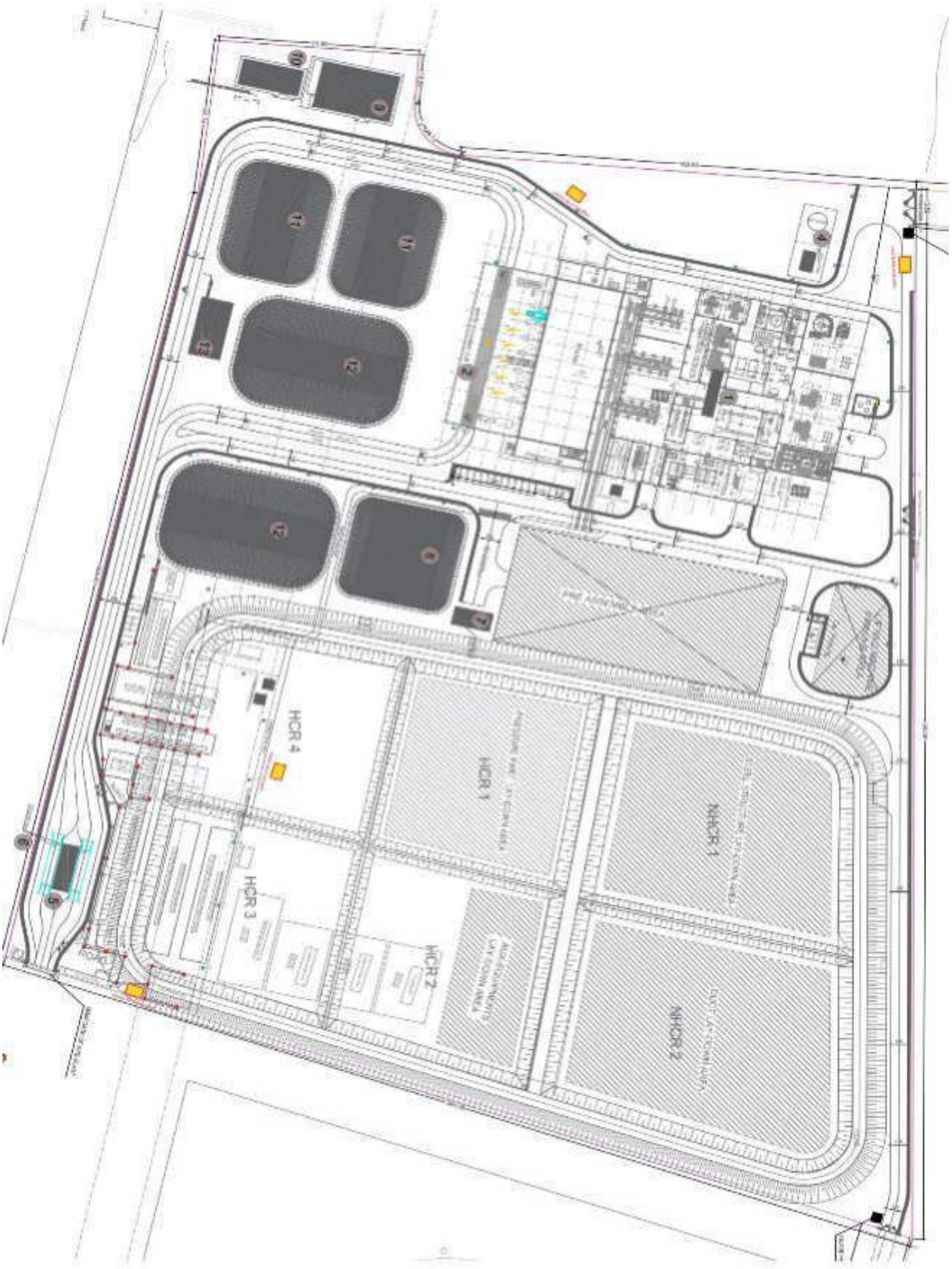
Sales Receipt / Estimate Number — Signature and Stamp

*Waste manifest form with guideline must be attached with this form.

## Appendix 2. Sewage layout plan



## Appendix 3. Disposal areas layout plan (WASTE STORAGE ARES IN YELLOW RECTANGULAR)



# GOVERNMENT of MALDIVES

WtE Energy Facility Project

# BACKGROUND AIR QUALITY MEASUREMENT REPORT

Thilafushi Island/MALDIVES

**MALDIVES 2023**

**AIRS Air Quality Management Services Ltd**
Mustafa Kemal Mah. Via Green Is Mrk. B-36
Cankaya Ankara TURKEY
Tel: +90 312 221 02 45 Fax: +90 312 221 02 45
**www.airsaqms.com**

**Test Report**

| | |
|---|---|
| **Customer Name/Address** | Alke Alkatas Joint Venture Pvt Ltd<br>H.H.Moomiyaage 5A Asaree Hingun K.Male 20265 MALDIVES |
| **Order No.** | EN-M/2207/417_01 |
| **Name and identity of test item** | Immission (Air Quality) |
| **Remarks** | - |
| **Date of Test** | 28.01.2023-01.02.2023 |
| **Number of Pages of the Report** | 27 Pages |
| ***Test Method*** | Air Quality Sensors |
| ***Test results*** | The test results are given in the measurement result tables. |
| ***Enviromental conditions*** | Environmental conditions during the measurement are given in the measurement result tables. |
| ***Comments*** | - |

The test and/or measurement results, the uncertainties (if applicable) with confidence probability and test methods are given on the following pages which are part of this report.

| Reporter and Approval |
|---|
| Ismail Ulusoy<br>Environmental Engineer<br>  |

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## LIST OF FIGURES

## 1. INTRODUCTION

This report has been prepared with the aim of determining the air quality in the sensitive receptors located in the impact area of the The Greater Malé Waste to Energy Project. Air quality results were determined for $PM_{10}$, $PM_{2.5}$, $NO_2$, $SO_2$ and TSP parameters.

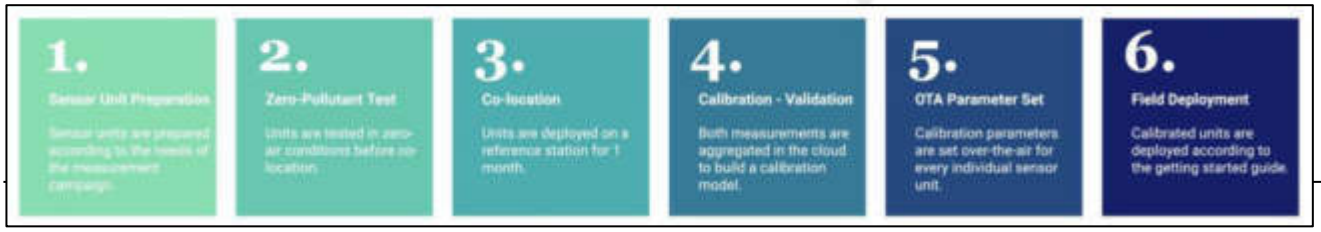
## 2. MEASUREMENT METHODS

$PM_{10}$, $PM_{2.5}$, TSP, $SO_2$, and $NO_2$ parameters were monitored by using air quality monitoring stations based on sensor technology. The US EPA refers to the term 'air sensor' as a class of non-regulatory technology that is low-cost, portable, capable of measuring several pollutants simultaneously, and often easier to operate than regulatory stations. For example, monitoring air pollution with reference measurement methods (regulatory stations) requires skilled operators to maintain and calibrate measuring instruments. On the other hand, air sensors describe the hardware and software set that can be operated without human intervention and enable unskilled users to monitor air pollution without additional technical knowledge.

Sensor specifications which are used for measurement study are shown below.

| Parameter | | Unit | Value |
|---|---|---|---|
| SO2 | Sensitivity | nA/ppm at 2ppm $SO_2$ | 275 to 520 |
| | Range | ppm limit of performance warranty | 100 |
| | Linearity | error at 100ppm SO2, linear at zero and 10ppm SO2 | 0 to -2 |
| NO2 | Sensitivity | nA/ppm at 2ppm $NO_2$ | -200 to -650 |
| | Range | ppm $NO_2$ limit of performance warranty | 20 |
| | Linearity | ppb error at full scale, linear at zero and 20ppm | |
| Particles ($PM_{10}$, $PM_{2.5}$ and TSP) | Mass concentration precision | % | 5 |
| | Mass concentration range | $\mu g/m^3$ | 0 to 1000 |
| Temperature | Typ. temperature accuracy | $^0C$ | 0.45 |
| | Operating temperature range | $^0C$ | -10 to 50 |
| | Response time ($\tau$63%) | s | <60 |
| Humidity | Typ. relative humidity accuracy | %RH | 4.5 |
| | Operating relative humidity range | %RH | 0 to 100 |
| | Response time ($\tau$63%) | s | 20 |
| All | Temperature Range | $^0C$ | -30 to 50 |
| | Humidity Range | % RH | 5 to 99 |

The accuracy of these low-cost sensors is as critical as measuring the air quality. With the smart calibration process, low-cost sensors are corrected and accurate compared to reference stations. The Smart Calibration Algorithm consists of the below operational steps shown figure below.



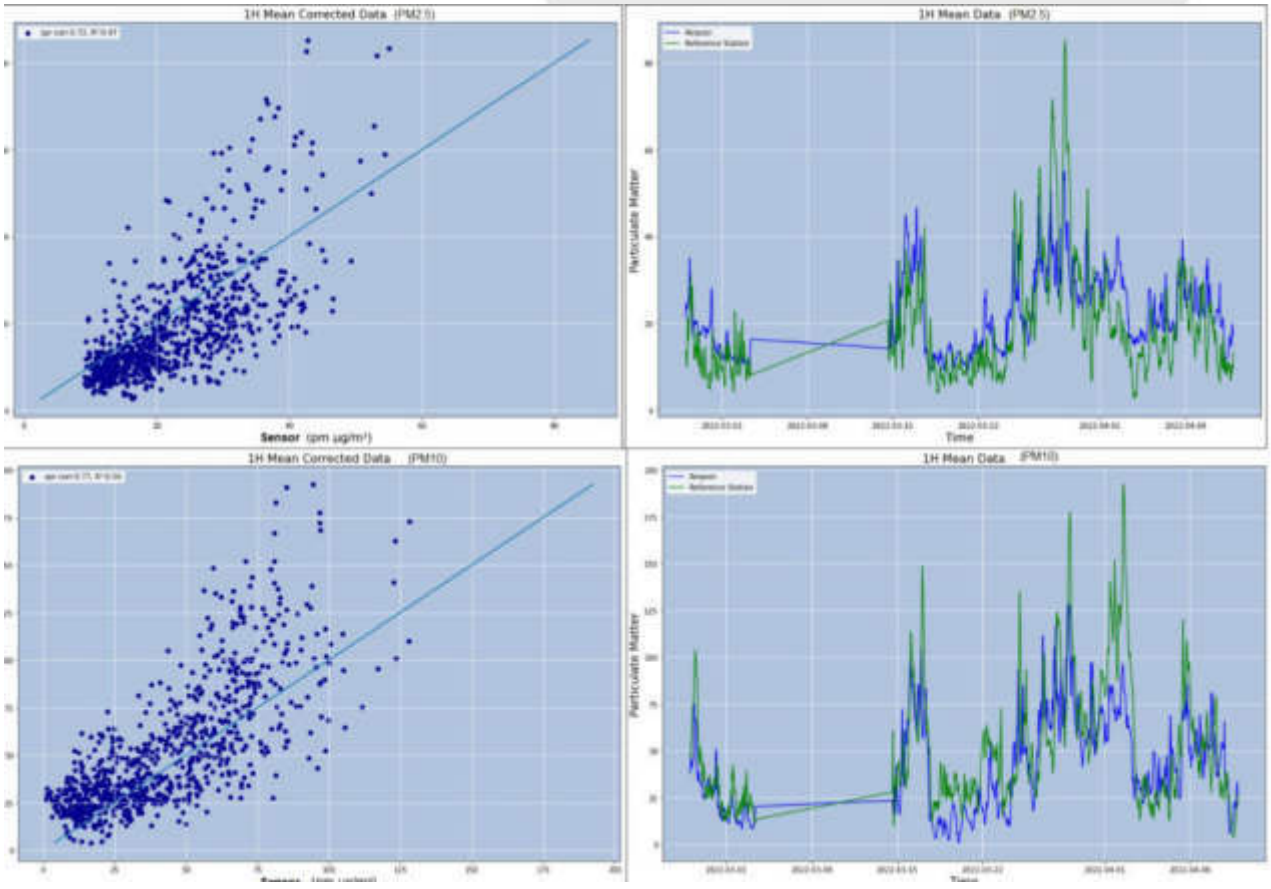
Sensor Units were calibrated using reference stations for a period before the deployment. The calibration process for particle matter and gas pollutants measurement is explained below.

**Table 1 Calibration Process for Pollutants**

| Description | Methodology | |
|---|---|---|
| | $NO_2$-$SO_2$-$O_3$ | $PM_{10}$-$PM_{2.5}$-TSP |
| Installation | Near Reference Station (3/4 meters) | Near Reference Station (3/4 meters) |
| Pre-Test | Quality Check in zero air conditions | Quality Check in zero air conditions |
| Co-Located Period | 4-5 weeks | 8 weeks |
| Sampling Period | 30 seconds. Hourly mean is used because the reference station measurements are hourly. | 60 seconds. Hourly mean is used because the reference station measurements are hourly. |
| Validation | Cross-validation is used. Also, some ranges of measurement are eliminated, where the reference station is not available. | Cross-validation is used. Also, some ranges of measurement are eliminated, where the reference station is not available. |
| Calibration Procedure | is obtained via $R^2$ and spearman correlation | is obtained via $R^2$ and spearman correlation |

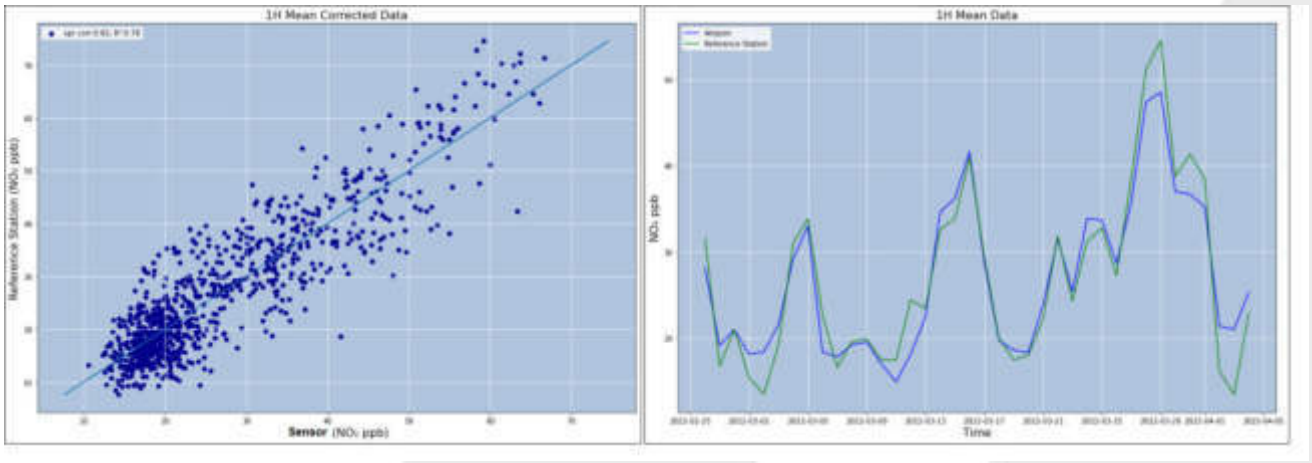
## Calibration Result for PM

The corrected measurement results after the Smart Calibration Process are shown in the figures below. The correlation between Sensor Unit's $PM_{2.5}$ measurements between Reference Station's $PM_{2.5}$ measurements for hourly and daily mean of data is 0.73, and the correlation between Sensor Unit's $PM_{10}$ measurements between Reference Station's $PM_{10}$ measurements for hourly and daily mean of data is 0.77.



**Calibration Result for Gases**

The corrected measurement results after the Smart Calibration Process are shown in the figures below. The correlation between Sensor Unit's $NO_2$ measurements between Reference Station's $NO_2$ measurements for hourly and daily mean of data is respectively 0.823, 0.898

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## 2.1. FIELD APPLICATION

This section describes how the measurements, the general methodology of which is given above, are applied in the field.

**Preliminary Preparations**

Preliminary preparations for air quality measuring stations with sensors include factory calibrations and field calibrations. Factory calibrations are provided by the sensor manufacturer. Stations capable of making reference measurements were used for field calibrations, as described above. For this purpose, a 1-month comparison measurement was carried out at a reference station in the Turkish air quality monitoring network and the calibration factors were applied.

**During Measurements**

Air quality measurements were made with two sets of devices.

AQ2 and ASR2 measurements were conducted on the first day,

AQ1 and AQ3 measurements were conducted on the second day,

ASR3 and ASR5 measurements were conducted on the third day and

AQ4 measurement were conducted on the fourth day.

The locations of the sampling points are determined in the macro scale ESIA report. A site visit was made and a location was determined at the micro scale where the devices would be placed.

Measurements were made at a height of 1.5 to 4 meters from the ground, depending on the suitability of the sampling point.

24-hour measurements were made at each point. Parameters measured with sensor devices consist of the averages of instantaneous measurements taken at 10-minute intervals.

**After Measurements**

The values after the measurements were taken by reading directly on the air quality measuring devices with sensors.

## 3. MEASUREMENT LOCATION

For the Preconstruction baseline environmental assessment of the ambient air quality was conducted at seven locations: 6 locations at Thilafushi (AQ1, AQ2, and AQ3 in the EIA and the ASR 2, ASR3 and ASR5 recommended for monitoring in the EIA Report) and one location at Villingili (AQ4).

**Table 2 Sampling Point Coordinates and Sampling dates**

| No | Location | Description | Distance to Source (meters) |
|---|---|---|---|
| **1** | AQ1 | Represents dense industrial area | 650 |
| **2** | AQ2 | Represents dense industrial area | 1000 |
| **3** | AQ3 | Represents dense industrial area | 500 |
| **4** | ASR2 | Represents dense industrial area | 700 |
| **5** | ASR3 | Represents dense industrial area | 500 |
| **6** | ASR5 | Represents dense industrial area | 1000 |
| **7** | AQ4 | Represents dense housing and population area | 4500 |


**Figure 1** Sampling Points on satellite Map

## 4. LEGAL FRAMEWORK

Within the scope of the project, particle matter ($PM_{10}$-$PM_{2.5}$), $NO_2$, $SO_2$ AND TSP emissions were monitored. It is known that Maldives does not have a national air quality policy. Therefore, international standards were used for the evaluation. WHO defines limit values in "Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide" document. European Union directives also have limit values for air pollution prevention (EU Council Directive 2008/50/EC relating to health based standards and objectives for a number of pollutants in ambient air). Germany has an air pollution control regulation titled "Technical Instructions on Air Quality Control" (Technische Anleitung zur Reinhaltung der Luft) and commonly referred to as the TA Luft and determines the limit values to protect the general public and the neighborhood against harmful effects of air pollution on the environment. Comparison of these limit values and chosen parameters and values for the modeling study according to these standards are shown in Table 3.

**Table 3.** Limit Values Stipulated in the International Legislation

| Pollutant | Averaging Period | TA Luft | EU | WHO Ambient Air Quality Guideline Value | Project Standards |
|---|---|---|---|---|---|
| Particular Matter <10 µm ($PM_{10}$) | 24 hours | 50 µg/m$^3$ | 50 µg/m$^3$ | 45 µg/m$^3$ | 45 µg/m$^3$ |
| | 1-year | 40 µg/m$^3$ | 40 µg/m$^3$ | 15 µg/m$^3$ | 15 µg/m$^3$ |
| Particular Matter <2.5 µm ($PM_{2.5}$) | 24 hours | - | - | 15 (not to be exceeded more than 3-4 times a year) | 15 |
| | 1-year | - | 20 | 5 | 5 |
| Nitrogen Dioxide ($NO_x$) | 1-hour | 200 µg/m$^3$ | 200 µg/m$^3$ | - | 200 µg/m$^3$ |
| | 24 hours | - | - | 25 µg/m$^3$ | 25 µg/m$^3$ |
| | 1-year | 40 µg/m$^3$ | 40 µg/m$^3$ | 10 µg/m$^3$ | 10 µg/m$^3$ |
| Sulphur Dioxide ($SO_2$) | 1-hour | 350 µg/m$^3$ | 350 µg/m$^3$ | - | 350 µg/m$^3$ |
| | 24 hours | 125 µg/m$^3$ | 125 µg/m$^3$ | 40 µg/m$^3$ | 40 µg/m$^3$ |
| | 1-year | 50 µg/m$^3$ | - | - | 50 µg/m$^3$ |
| TSP* | - | - | - | - | - |

***There is no limit value for TSP.**

## 5. RESULTS

**Table 4 Measurement Results for Location 1**

| Location | Sampling Date | Air Quality Results ( µg/m³ ) | | | | | Ambient Conditions | |
|---|---|---|---|---|---|---|---|---|
| | | $PM_{10}$ | $PM_{2.5}$ | $NO_2$ | $SO_2$ | TSP | Humidity (%) | Temperature ($^0$C) |
| AQ1 | 2023-1-28 17:00:00 | 46.34 | 45.79 | 0.00 | 0.00 | 87.48 | 78.49 | 26.85 |
| | 2023-1-28 18:00:00 | 38.13 | 37.78 | 0.00 | 0.00 | 72.04 | 81.55 | 27.28 |
| | 2023-1-28 19:00:00 | 33.93 | 33.56 | 0.00 | 0.00 | 64.07 | 84.54 | 26.80 |
| | 2023-1-28 20:00:00 | 31.42 | 31.23 | 0.00 | 0.00 | 59.42 | 84.43 | 26.77 |
| | 2023-1-28 21:00:00 | 28.10 | 27.92 | 0.00 | 0.00 | 53.14 | 84.54 | 26.69 |
| | 2023-1-28 22:00:00 | 26.16 | 26.01 | 0.00 | 0.00 | 49.49 | 84.09 | 26.59 |
| | 2023-1-28 23:00:00 | 23.53 | 23.51 | 0.00 | 0.00 | 44.59 | 85.78 | 26.52 |
| | 2023-1-29 00:00:00 | 20.51 | 20.51 | 0.00 | 0.00 | 38.87 | 85.70 | 26.42 |
| | 2023-1-29 01:00:00 | 21.01 | 20.96 | 0.00 | 0.00 | 39.79 | 87.15 | 26.25 |
| | 2023-1-29 02:00:00 | 22.03 | 21.89 | 0.00 | 0.00 | 41.67 | 86.43 | 26.14 |
| | 2023-1-29 03:00:00 | 23.33 | 23.28 | 0.00 | 0.00 | 44.19 | 87.59 | 26.07 |
| | 2023-1-29 04:00:00 | 25.00 | 24.95 | 0.00 | 0.00 | 47.36 | 87.99 | 25.94 |
| | 2023-1-29 05:00:00 | 26.07 | 25.96 | 0.00 | 0.00 | 49.33 | 87.41 | 26.02 |
| | 2023-1-29 06:00:00 | 27.42 | 27.38 | 0.00 | 0.00 | 51.94 | 86.64 | 26.06 |
| | 2023-1-29 07:00:00 | 22.43 | 22.30 | 0.00 | 0.00 | 42.43 | 87.24 | 26.13 |
| | 2023-1-29 08:00:00 | 13.02 | 12.61 | 0.00 | 0.00 | 24.41 | 92.43 | 24.03 |
| | 2023-1-29 09:00:00 | 15.81 | 15.75 | 0.00 | 0.00 | 29.92 | 85.81 | 26.24 |
| | 2023-1-29 10:00:00 | 17.83 | 17.82 | 0.00 | 0.00 | 33.79 | 78.51 | 28.91 |
| | 2023-1-29 11:00:00 | 18.30 | 18.24 | 0.00 | 0.00 | 34.65 | 72.17 | 30.35 |
| | 2023-1-29 12:00:00 | 27.76 | 27.69 | 0.00 | 0.00 | 52.57 | 70.05 | 31.53 |
| | 2023-1-29 13:00:00 | 25.60 | 25.60 | 0.00 | 0.00 | 48.52 | 63.15 | 33.56 |
| | 2023-1-29 14:00:00 | 19.64 | 19.31 | 0.00 | 0.00 | 37.01 | 79.65 | 28.36 |
| | 2023-1-29 15:00:00 | 24.09 | 24.00 | 0.00 | 0.00 | 45.59 | 95.80 | 180.07 |
| | 2023-1-29 16:00:00 | 29.30 | 29.15 | 0.00 | 0.00 | 55.44 | 93.40 | 24.17 |
| Hourly Limit Values | TA Luft | - | - | 200 | 350 | - | - | - |
| | EU | - | - | 200 | 350 | - | - | - |
| | WHO Ambient Air Quality Guideline Value | - | - | - | - | - | - | - |
| 24 h Average | | **25.28** | **25.13** | **0.00** | **0.00** | **47.82** | **83.77** | **33.49** |
| Daily Limit Values | TA Luft | 50 | - | - | 125 | - | - | - |
| | EU | 50 | - | - | 125 | - | - | - |
| | WHO Ambient Air Quality Guideline Value | 45 | 15 | 25 | 40 | - | - | - |


**Figure 2** Measurement Graphs for Location AQ1

**Table 5 Measurement Results for Location 2**

| Location | Sampling Date | Results ( µg/m³ ) | | | | | Ambient Conditions | |
|---|---|---|---|---|---|---|---|---|
| | | $PM_{10}$ | $PM_{2.5}$ | $NO_2$ | $SO_2$ | TSP (24 Hours Average) | Humidity (%) | Temperature ($^0C$) |
| AQ2 | 2023-1-28 17:00:00 | 28.10 | 27.95 | 0.00 | 0.00 | 53.15 | 84.76 | 25.96 |
| | 2023-1-28 18:00:00 | 29.02 | 28.84 | 0.00 | 0.00 | 54.89 | 80.82 | 26.24 |
| | 2023-1-28 19:00:00 | 30.28 | 30.12 | 0.00 | 0.00 | 57.29 | 83.45 | 26.04 |
| | 2023-1-28 20:00:00 | 31.89 | 31.69 | 0.00 | 0.00 | 60.31 | 85.78 | 26.16 |
| | 2023-1-28 21:00:00 | 31.38 | 31.27 | 0.00 | 0.00 | 59.42 | 87.67 | 26.21 |
| | 2023-1-28 22:00:00 | 33.95 | 33.75 | 0.00 | 0.00 | 64.23 | 89.65 | 26.03 |
| | 2023-1-28 23:00:00 | 41.44 | 41.29 | 0.00 | 0.00 | 78.45 | 90.56 | 25.87 |
| | 2023-1-29 00:00:00 | 35.04 | 34.83 | 0.00 | 0.00 | 66.27 | 90.23 | 25.71 |
| | 2023-1-29 01:00:00 | 32.91 | 32.72 | 0.00 | 0.00 | 62.25 | 85.68 | 25.77 |
| | 2023-1-29 02:00:00 | 35.87 | 35.62 | 0.00 | 0.00 | 67.83 | 84.95 | 25.83 |
| | 2023-1-29 03:00:00 | 40.43 | 40.11 | 0.00 | 0.00 | 76.41 | 83.20 | 25.96 |
| | 2023-1-29 04:00:00 | 43.88 | 43.61 | 0.00 | 0.00 | 82.99 | 83.15 | 26.03 |
| | 2023-1-29 05:00:00 | 43.50 | 43.26 | 0.00 | 0.00 | 82.30 | 84.04 | 25.92 |
| | 2023-1-29 06:00:00 | 42.37 | 42.14 | 0.00 | 0.00 | 80.16 | 82.67 | 25.94 |
| | 2023-1-29 07:00:00 | 41.02 | 40.85 | 0.00 | 0.00 | 77.64 | 82.22 | 26.50 |
| | 2023-1-29 08:00:00 | 39.82 | 39.64 | 0.00 | 0.00 | 75.35 | 73.77 | 28.65 |
| | 2023-1-29 09:00:00 | 39.41 | 39.27 | 0.00 | 0.00 | 74.60 | 68.54 | 29.92 |
| | 2023-1-29 10:00:00 | 37.64 | 37.56 | 0.00 | 0.00 | 71.29 | 63.74 | 31.29 |
| | 2023-1-29 11:00:00 | 40.54 | 40.52 | 0.00 | 0.00 | 76.82 | 62.37 | 32.29 |
| | 2023-1-29 12:00:00 | 40.77 | 40.71 | 0.00 | 0.00 | 77.23 | 59.54 | 33.62 |
| | 2023-1-29 13:00:00 | 36.51 | 36.51 | 0.00 | 0.00 | 69.20 | 52.62 | 35.08 |
| | 2023-1-29 14:00:00 | 33.80 | 33.77 | 0.00 | 0.00 | 64.04 | 51.45 | 36.16 |
| | 2023-1-29 15:00:00 | 34.53 | 34.53 | 0.00 | 0.00 | 65.44 | 54.38 | 35.12 |
| | 2023-1-29 16:00:00 | 34.32 | 34.32 | 0.00 | 0.00 | 65.04 | 56.05 | 35.04 |
| **Hourly Limit Values** | **TA Luft** | - | - | 200 | 350 | - | - | - |
| | **EU** | - | - | 200 | 350 | - | - | - |
| | **WHO Ambient Air Quality Guideline Value** | - | - | - | - | - | - | - |
| **Average** | | **36.60** | **36.45** | **0.00** | **0.00** | **69.28** | **75.89** | **28.64** |
| **Daily Limit Values** | **TA Luft** | 50 | - | - | 125 | - | - | - |
| | **EU** | 50 | - | - | 125 | - | - | - |
| | **WHO Ambient Air Quality Guideline Value** | 45 | 15 | 25 | 40 | - | - | - |


**Figure 3** Measurement Graphs for Location AQ2

**Table 6 Measurement Results for Location 3**

| Location | Sampling Date | Results ( µg/m³ ) | | | | | Ambient Conditions | |
|---|---|---|---|---|---|---|---|---|
| | | $PM_{10}$ | $PM_{2.5}$ | $NO_2$ | $SO_2$ | TSP (24 Hours Average) | Humidity (%) | Temperature ($^0$C) |
| AQ3 | 2023-1-29 17:00:00 | 39.68 | 39.61 | 0.00 | 0.00 | 75.16 | 62.70 | 32.56 |
| | 2023-1-29 18:00:00 | 42.05 | 41.71 | 0.00 | 0.00 | 79.49 | 73.66 | 29.14 |
| | 2023-1-29 19:00:00 | 45.11 | 44.83 | 0.00 | 0.00 | 85.32 | 78.54 | 27.83 |
| | 2023-1-29 20:00:00 | 45.73 | 45.57 | 0.00 | 0.00 | 86.57 | 79.97 | 27.47 |
| | 2023-1-29 21:00:00 | 47.18 | 46.79 | 0.00 | 0.00 | 89.17 | 79.93 | 27.24 |
| | 2023-1-29 22:00:00 | 47.93 | 47.70 | 0.00 | 0.00 | 90.70 | 80.67 | 27.01 |
| | 2023-1-29 23:00:00 | 49.18 | 48.91 | 0.00 | 0.00 | 93.05 | 82.84 | 26.64 |
| | 2023-1-30 00:00:00 | 49.60 | 49.25 | 0.00 | 0.00 | 93.78 | 82.71 | 26.45 |
| | 2023-1-30 01:00:00 | 49.56 | 49.24 | 0.00 | 0.00 | 93.74 | 81.85 | 26.27 |
| | 2023-1-30 02:00:00 | 51.37 | 51.01 | 0.00 | 0.00 | 97.13 | 83.83 | 25.95 |
| | 2023-1-30 03:00:00 | 53.10 | 52.74 | 0.00 | 0.00 | 100.41 | 86.27 | 25.74 |
| | 2023-1-30 04:00:00 | 54.29 | 53.94 | 0.00 | 0.00 | 102.68 | 85.82 | 25.65 |
| | 2023-1-30 05:00:00 | 55.56 | 55.23 | 0.00 | 0.00 | 105.12 | 85.65 | 25.66 |
| | 2023-1-30 06:00:00 | 55.69 | 55.38 | 0.00 | 0.00 | 105.36 | 86.50 | 25.61 |
| | 2023-1-30 07:00:00 | 52.24 | 52.02 | 0.00 | 0.00 | 98.88 | 84.18 | 26.38 |
| | 2023-1-30 08:00:00 | 43.59 | 43.56 | 0.00 | 0.00 | 82.61 | 68.79 | 30.52 |
| | 2023-1-30 09:00:00 | 39.81 | 39.80 | 0.00 | 0.00 | 75.45 | 58.37 | 33.89 |
| | 2023-1-30 10:00:00 | 41.22 | 41.22 | 0.00 | 0.00 | 78.12 | 57.31 | 34.74 |
| | 2023-1-30 11:00:00 | 49.37 | 49.35 | 0.00 | 0.00 | 93.55 | 58.78 | 34.27 |
| | 2023-1-30 12:00:00 | 40.13 | 40.12 | 0.00 | 0.00 | 76.04 | 59.48 | 34.14 |
| | 2023-1-30 13:00:00 | 41.78 | 41.76 | 0.00 | 0.00 | 79.17 | 59.84 | 34.07 |
| | 2023-1-30 14:00:00 | 42.93 | 42.86 | 0.00 | 0.00 | 81.33 | 60.48 | 33.66 |
| | 2023-1-30 15:00:00 | 42.78 | 42.71 | 0.00 | 0.00 | 81.04 | 61.28 | 33.29 |
| | 2023-1-30 16:00:00 | 44.22 | 44.09 | 0.00 | 0.00 | 83.74 | 64.04 | 32.57 |
| Hourly Limit Values | TA Luft | - | - | 200 | 350 | - | - | - |
| | EU | - | - | 200 | 350 | - | - | - |
| | WHO Ambient Air Quality Guideline Value | - | - | - | - | - | - | - |
| **Average** | | **46.84** | **46.64** | **0.00** | **0.00** | **88.65** | **73.48** | **29.45** |
| Daily Limit Values | TA Luft | 50 | - | - | - | - | - | - |
| | EU | 50 | - | - | - | - | - | - |
| | WHO Ambient Air Quality Guideline Value | 45 | 15 | 25 | - | - | - | - |


**Figure 4** Measurement Graphs for Location AQ3

**Table 7 Measurement Results for Location 4**

| Location | Sampling Date | Results ( µg/m³ ) | | | | | Ambient Conditions | |
|---|---|---|---|---|---|---|---|---|
| | | $PM_{10}$ | $PM_{2.5}$ | $NO_2$ | $SO_2$ | TSP (24 Hours Average) | Humidity (%) | Temperature ($^0$C) |
| ASR2 | 2023-1-29 17:00:00 | 46.78 | 46.63 | 0.00 | 0.00 | 88.56 | 72.89 | 29.89 |
| | 2023-1-29 18:00:00 | 48.10 | 47.89 | 0.00 | 0.00 | 91.04 | 79.32 | 27.96 |
| | 2023-1-29 19:00:00 | 45.05 | 44.91 | 0.00 | 0.00 | 85.29 | 82.28 | 26.98 |
| | 2023-1-29 20:00:00 | 43.66 | 43.56 | 0.00 | 0.00 | 82.69 | 84.06 | 26.74 |
| | 2023-1-29 21:00:00 | 41.20 | 41.03 | 0.00 | 0.00 | 77.99 | 85.36 | 26.67 |
| | 2023-1-29 22:00:00 | 41.07 | 40.93 | 0.00 | 0.00 | 77.75 | 84.87 | 26.63 |
| | 2023-1-29 23:00:00 | 40.88 | 40.77 | 0.00 | 0.00 | 77.42 | 85.18 | 26.36 |
| | 2023-1-30 00:00:00 | 40.13 | 40.01 | 0.00 | 0.00 | 75.97 | 87.07 | 26.22 |
| | 2023-1-30 01:00:00 | 39.51 | 39.41 | 0.00 | 0.00 | 74.81 | 87.42 | 26.11 |
| | 2023-1-30 02:00:00 | 40.78 | 40.67 | 0.00 | 0.00 | 77.22 | 86.29 | 26.03 |
| | 2023-1-30 03:00:00 | 36.10 | 35.91 | 0.00 | 0.00 | 68.30 | 87.29 | 25.93 |
| | 2023-1-30 04:00:00 | 34.66 | 34.58 | 0.00 | 0.00 | 65.64 | 85.64 | 25.88 |
| | 2023-1-30 05:00:00 | 33.88 | 33.80 | 0.00 | 0.00 | 64.16 | 87.32 | 25.82 |
| | 2023-1-30 06:00:00 | 33.45 | 33.33 | 0.00 | 0.00 | 63.32 | 87.86 | 25.82 |
| | 2023-1-30 07:00:00 | 29.67 | 29.61 | 0.00 | 0.00 | 56.19 | 83.64 | 26.84 |
| | 2023-1-30 08:00:00 | 30.82 | 30.82 | 0.00 | 0.00 | 58.41 | 75.53 | 29.29 |
| | 2023-1-30 09:00:00 | 30.97 | 30.93 | 0.00 | 0.00 | 58.68 | 70.54 | 30.63 |
| | 2023-1-30 10:00:00 | 30.14 | 30.12 | 0.00 | 0.00 | 57.12 | 73.19 | 29.95 |
| | 2023-1-30 11:00:00 | 27.83 | 27.83 | 0.00 | 0.00 | 52.75 | 71.50 | 30.49 |
| | 2023-1-30 12:00:00 | 26.43 | 26.43 | 0.00 | 0.00 | 50.10 | 63.91 | 32.97 |
| | 2023-1-30 13:00:00 | 27.02 | 26.98 | 0.00 | 0.00 | 51.19 | 63.17 | 32.93 |
| | 2023-1-30 14:00:00 | 27.83 | 27.80 | 0.00 | 0.00 | 52.73 | 64.02 | 32.46 |
| | 2023-1-30 15:00:00 | 27.60 | 27.53 | 0.00 | 0.00 | 52.27 | 65.31 | 32.19 |
| | 2023-1-30 16:00:00 | 29.51 | 29.48 | 0.00 | 0.00 | 55.91 | 64.33 | 32.17 |
| **Hourly Limit Values** | **TA Luft** | - | - | 200 | 350 | - | - | - |
| | **EU** | - | - | 200 | 350 | - | - | - |
| | **WHO Ambient Air Quality Guideline Value** | - | - | - | - | - | - | - |
| **Average** | | **35.54** | **35.46** | **0.00** | **0.00** | **67.31** | **78.25** | **28.46** |
| **Daily Limit Values** | **TA Luft** | 50 | - | - | 125 | - | - | - |
| | **EU** | 50 | - | - | 125 | - | - | - |
| | **WHO Ambient Air Quality Guideline Value** | 45 | 15 | 25 | 40 | - | - | - |


**Figure 5** Measurement Graphs for Location ASR2

**Table 8 Measurement Results for Location 5**

| Location | Sampling Date | Results ( µg/m³ ) | | | | | Ambient Conditions | |
|---|---|---|---|---|---|---|---|---|
| | | $PM_{10}$ | $PM_{2.5}$ | $NO_2$ | $SO_2$ | TSP (24 Hours Average) | Humidity (%) | Temperature ($^0C$) |
| ASR3 | 2023-1-30 17:00:00 | 29.35 | 29.28 | 0.00 | 0.00 | 55.59 | 71.76 | 29.60 |
| | 2023-1-30 18:00:00 | 35.08 | 35.01 | 0.00 | 0.00 | 66.45 | 77.43 | 27.94 |
| | 2023-1-30 19:00:00 | 30.15 | 30.08 | 0.00 | 0.00 | 57.12 | 82.67 | 27.05 |
| | 2023-1-30 20:00:00 | 29.01 | 28.90 | 0.00 | 0.00 | 54.91 | 84.21 | 26.77 |
| | 2023-1-30 21:00:00 | 31.22 | 31.11 | 0.00 | 0.00 | 59.09 | 85.77 | 26.63 |
| | 2023-1-30 22:00:00 | 30.68 | 30.65 | 0.00 | 0.00 | 58.14 | 86.53 | 26.57 |
| | 2023-1-30 23:00:00 | 29.50 | 29.46 | 0.00 | 0.00 | 55.89 | 85.75 | 26.64 |
| | 2023-1-31 00:00:00 | 29.27 | 29.22 | 0.00 | 0.00 | 55.44 | 86.13 | 26.42 |
| | 2023-1-31 01:00:00 | 29.70 | 29.63 | 0.00 | 0.00 | 56.25 | 85.76 | 26.24 |
| | 2023-1-31 02:00:00 | 30.32 | 30.26 | 0.00 | 0.00 | 57.43 | 87.11 | 25.99 |
| | 2023-1-31 03:00:00 | 30.33 | 30.28 | 0.00 | 0.00 | 57.46 | 86.44 | 25.91 |
| | 2023-1-31 04:00:00 | 30.84 | 30.82 | 0.00 | 0.00 | 58.44 | 86.31 | 25.76 |
| | 2023-1-31 05:00:00 | 30.28 | 30.22 | 0.00 | 0.00 | 57.34 | 86.60 | 25.66 |
| | 2023-1-31 06:00:00 | 29.31 | 29.28 | 0.00 | 0.00 | 55.53 | 85.26 | 25.78 |
| | 2023-1-31 07:00:00 | 25.52 | 25.48 | 0.00 | 0.00 | 48.33 | 81.50 | 26.91 |
| | 2023-1-31 08:00:00 | 22.99 | 22.99 | 0.00 | 0.00 | 43.58 | 64.84 | 31.68 |
| | 2023-1-31 09:00:00 | 23.31 | 23.31 | 0.00 | 0.00 | 44.18 | 59.75 | 33.21 |
| | 2023-1-31 10:00:00 | 23.85 | 23.85 | 0.00 | 0.00 | 45.20 | 57.37 | 34.12 |
| | 2023-1-31 11:00:00 | 23.70 | 23.70 | 0.00 | 0.00 | 44.92 | 59.77 | 33.11 |
| | 2023-1-31 12:00:00 | 21.64 | 21.61 | 0.00 | 0.00 | 41.00 | 60.23 | 33.28 |
| | 2023-1-31 13:00:00 | 21.97 | 21.97 | 0.00 | 0.00 | 41.63 | 61.28 | 32.62 |
| | 2023-1-31 14:00:00 | 23.03 | 23.03 | 0.00 | 0.00 | 43.66 | 59.82 | 32.80 |
| | 2023-1-31 15:00:00 | 26.38 | 26.33 | 0.00 | 0.00 | 49.97 | 61.66 | 32.11 |
| | 2023-1-31 16:00:00 | 25.28 | 25.28 | 0.00 | 0.00 | 47.90 | 62.71 | 31.63 |
| **Hourly Limit Values** | **TA Luft** | - | - | 200 | 200 | - | - | - |
| | **EU** | - | - | 200 | 350 | - | - | - |
| | **WHO Ambient Air Quality Guideline Value** | - | - | - | - | - | - | - |
| **Average** | | **27.61** | **27.57** | **0.00** | **0.00** | **52.31** | **75.28** | **28.93** |
| **Daily Limit Values** | **TA Luft** | 50 | - | - | 125 | - | - | - |
| | **EU** | 50 | - | - | 125 | - | - | - |
| | **WHO Ambient Air Quality Guideline Value** | 45 | 15 | 25 | 40 | - | - | - |


**Figure 6** Measurement Graphs for Location ASR3

**Table 9 Measurement Results for Location 6**

| Location | Sampling Date | Results ( µg/m³ ) | | | | | Ambient Conditions | |
|---|---|---|---|---|---|---|---|---|
| | | $PM_{10}$ | $PM_{2.5}$ | $NO_2$ | $SO_2$ | TSP (24 Hours Average) | Humidity (%) | Temperature ($^0$C) |
| ASR5 | 2023-1-30 17:00:00 | 24.06 | 24.00 | 0.00 | 0.00 | 45.56 | 65.99 | 30.76 |
| | 2023-1-30 18:00:00 | 26.15 | 26.14 | 0.00 | 0.00 | 49.56 | 72.18 | 28.66 |
| | 2023-1-30 19:00:00 | 25.73 | 25.65 | 0.00 | 0.00 | 48.72 | 77.84 | 27.22 |
| | 2023-1-30 20:00:00 | 26.17 | 26.17 | 0.00 | 0.00 | 49.59 | 78.29 | 26.95 |
| | 2023-1-30 21:00:00 | 25.52 | 25.50 | 0.00 | 0.00 | 48.35 | 79.04 | 26.75 |
| | 2023-1-30 22:00:00 | 25.91 | 25.84 | 0.00 | 0.00 | 49.06 | 79.42 | 26.68 |
| | 2023-1-30 23:00:00 | 25.11 | 25.07 | 0.00 | 0.00 | 47.57 | 81.09 | 26.43 |
| | 2023-1-31 00:00:00 | 26.27 | 26.23 | 0.00 | 0.00 | 49.76 | 84.13 | 26.01 |
| | 2023-1-31 01:00:00 | 25.32 | 25.29 | 0.00 | 0.00 | 47.97 | 81.65 | 25.98 |
| | 2023-1-31 02:00:00 | 25.16 | 25.16 | 0.00 | 0.00 | 47.68 | 83.51 | 25.74 |
| | 2023-1-31 03:00:00 | 24.20 | 24.19 | 0.00 | 0.00 | 45.86 | 83.03 | 25.69 |
| | 2023-1-31 04:00:00 | 23.68 | 23.64 | 0.00 | 0.00 | 44.85 | 83.20 | 25.54 |
| | 2023-1-31 05:00:00 | 23.41 | 23.37 | 0.00 | 0.00 | 44.34 | 83.44 | 25.45 |
| | 2023-1-31 06:00:00 | 22.97 | 22.95 | 0.00 | 0.00 | 43.52 | 82.71 | 25.48 |
| | 2023-1-31 07:00:00 | 20.71 | 20.71 | 0.00 | 0.00 | 39.25 | 81.12 | 26.22 |
| | 2023-1-31 08:00:00 | 19.19 | 19.17 | 0.00 | 0.00 | 36.36 | 65.60 | 30.44 |
| | 2023-1-31 09:00:00 | 17.91 | 17.91 | 0.00 | 0.00 | 33.94 | 62.33 | 31.41 |
| | 2023-1-31 10:00:00 | 18.33 | 18.33 | 0.00 | 0.00 | 34.73 | 62.08 | 31.37 |
| | 2023-1-31 11:00:00 | 17.42 | 17.40 | 0.00 | 0.00 | 33.00 | 66.53 | 29.69 |
| | 2023-1-31 12:00:00 | 16.48 | 16.47 | 0.00 | 0.00 | 31.22 | 67.69 | 29.70 |
| | 2023-1-31 13:00:00 | 15.48 | 15.43 | 0.00 | 0.00 | 29.30 | 65.68 | 30.02 |
| | 2023-1-31 14:00:00 | 14.00 | 14.00 | 0.00 | 0.00 | 26.54 | 65.26 | 30.49 |
| | 2023-1-31 15:00:00 | 14.29 | 14.29 | 0.00 | 0.00 | 27.09 | 61.67 | 31.32 |
| | 2023-1-31 16:00:00 | 16.88 | 16.88 | 0.00 | 0.00 | 31.98 | 62.29 | 31.17 |
| **Hourly Limit Values** | **TA Luft** | - | - | 200 | 350 | - | - | - |
| | **EU** | - | - | 200 | 350 | - | - | - |
| | **WHO Ambient Air Quality Guideline Value** | - | - | - | - | - | - | - |
| **Average** | | **21.68** | **21.66** | **0.00** | **0.00** | **41.08** | **73.99** | **28.13** |
| **Daily Limit Values** | **TA Luft** | 50 | - | - | 125 | - | - | - |
| | **EU** | 50 | - | - | 125 | - | - | - |
| | **WHO Ambient Air Quality Guideline Value** | 45 | 15 | 25 | 40 | - | - | - |


**Figure 7** Measurement Graphs for Location ASR2

**Table 10 Measurement Results for Location 7**

| Location | Sampling Date | Results ( µg/m³ ) | | | | | Ambient Conditions | |
|---|---|---|---|---|---|---|---|---|
| | | $PM_{10}$ | $PM_{2.5}$ | $NO_2$ | $SO_2$ | TSP (24 Hours Average) | Humidity (%) | Temperature ($^0$C) |
| AQ4 | 2023-1-31 17:00:00 | 17.49 | 17.49 | 0.00 | 0.00 | 33.15 | 67.04 | 29.97 |
| | 2023-1-31 18:00:00 | 19.68 | 19.68 | 0.00 | 0.00 | 37.30 | 70.97 | 28.24 |
| | 2023-1-31 19:00:00 | 18.94 | 18.93 | 0.00 | 0.00 | 35.90 | 76.63 | 26.93 |
| | 2023-1-31 20:00:00 | 19.37 | 19.35 | 0.00 | 0.00 | 36.70 | 78.46 | 26.70 |
| | 2023-1-31 21:00:00 | 20.38 | 20.36 | 0.00 | 0.00 | 38.61 | 80.02 | 26.50 |
| | 2023-1-31 22:00:00 | 21.44 | 21.43 | 0.00 | 0.00 | 40.63 | 81.66 | 26.24 |
| | 2023-1-31 23:00:00 | 21.77 | 21.71 | 0.00 | 0.00 | 41.23 | 82.11 | 26.16 |
| | 2023-2-1 00:00:00 | 22.39 | 22.37 | 0.00 | 0.00 | 42.42 | 82.13 | 26.18 |
| | 2023-2-1 01:00:00 | 22.43 | 22.40 | 0.00 | 0.00 | 42.48 | 81.55 | 26.22 |
| | 2023-2-1 02:00:00 | 23.86 | 23.79 | 0.00 | 0.00 | 45.17 | 83.05 | 26.02 |
| | 2023-2-1 03:00:00 | 27.28 | 27.20 | 0.00 | 0.00 | 51.65 | 81.68 | 26.17 |
| | 2023-2-1 04:00:00 | 28.84 | 28.81 | 0.00 | 0.00 | 54.65 | 80.48 | 26.24 |
| | 2023-2-1 05:00:00 | 29.21 | 29.12 | 0.00 | 0.00 | 55.31 | 80.93 | 26.06 |
| | 2023-2-1 06:00:00 | 29.34 | 29.17 | 0.00 | 0.00 | 55.50 | 81.53 | 25.99 |
| | 2023-2-1 07:00:00 | 27.36 | 27.34 | 0.00 | 0.00 | 51.84 | 77.20 | 26.91 |
| | 2023-2-1 08:00:00 | 26.73 | 26.73 | 0.00 | 0.00 | 50.67 | 62.22 | 31.80 |
| | 2023-2-1 09:00:00 | 29.60 | 29.59 | 0.00 | 0.00 | 56.09 | 59.27 | 32.91 |
| | 2023-2-1 10:00:00 | 29.48 | 29.48 | 0.00 | 0.00 | 55.88 | 60.55 | 32.70 |
| | 2023-2-1 11:00:00 | 29.23 | 29.22 | 0.00 | 0.00 | 55.40 | 60.01 | 33.10 |
| | 2023-2-1 12:00:00 | 27.62 | 27.62 | 0.00 | 0.00 | 52.34 | 57.37 | 33.99 |
| | 2023-2-1 13:00:00 | 29.58 | 29.57 | 0.00 | 0.00 | 56.05 | 57.95 | 33.94 |
| | 2023-2-1 14:00:00 | 30.59 | 30.59 | 0.00 | 0.00 | 57.98 | 61.79 | 32.45 |
| | 2023-2-1 15:00:00 | 29.63 | 29.60 | 0.00 | 0.00 | 56.15 | 62.34 | 32.14 |
| | 2023-2-1 16:00:00 | 31.98 | 31.92 | 0.00 | 0.00 | 60.57 | 59.63 | 33.10 |
| **Hourly Limit Values** | **TA Luft** | - | - | 200 | 350 | | - | - |
| | **EU** | - | - | 200 | 350 | | - | - |
| | **WHO Ambient Air Quality Guideline Value** | - | - | - | - | | - | - |
| **Average** | | **25.59** | **25.56** | **0.00** | **0.00** | **48.49** | **71.94** | **29.03** |
| **Daily Limit Values** | **TA Luft** | 50 | - | - | 125 | | - | - |
| | **EU** | 50 | - | - | 125 | | - | - |
| | **WHO Ambient Air Quality Guideline Value** | 45 | 15 | 25 | 40 | | - | - |


**Figure 8** Measurement Graphs for Location AQ4

## 6. ASSESSMENT

The air quality measurement study was carried out with the aim of determining the air pollutants on ambient air quality. Results were assessed according to the TA LUFT, EU Council Directive 2008/50/EC and WHO limit values and this report was prepared. According to air quality measurement studies, background air quality values are comply with air quality standards.

Environmental monitoring Report Pre-Construction–Stage WtE Facility at Thilafushi

# Noise Level Measurments (January 2023)

Prepared by: Mahmood Riyaz

GeotechMaldives

2nd February 2023

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# 1. INTRODUCTION

This is the ambient noise level monitoring report prepared as part of the pre-construction environmental monitoring of the waste to energy (WtE) facility at Thilafushi, Maldives. This report presents methodologies and results of the noise level measurements conducted to fulfill the requirements of the EIA and the Project Environmental Management Plan that is being developed to meet the anticipated environment impacts, health and safety, as well as to ensure the sustainability of the Project.

# 2. NOISE LEVEL

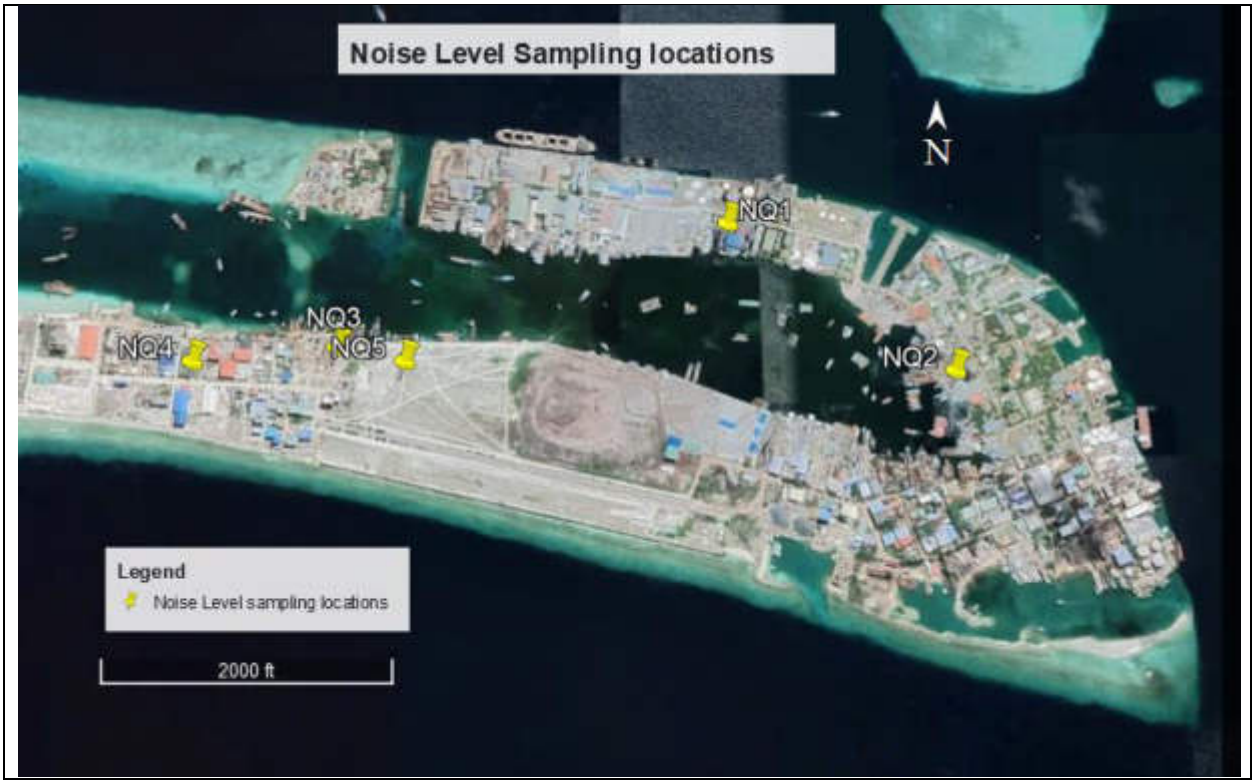
As part of the pre-construction monitoring of Thilafushi Waste to Energy facility, ambient noise levels measurements were repeated at the same five locations used in the EIA report. Ambient noise level measurement was done using a handheld sound level meter (ET-958 Professional Sound Level Meter) Measurements were conducted in all location on 27-29 December 2022 during the day time and night time for 24 hours. Measurements are recorded in NQ1, and NQ2 NQ3, NQ4 and NQ5 from 26th January 2022 10:00 to 27th January 2022 10:00 continuously for 24 four hours. Table 1 summarizes the explanation on the selection of baseline monitoring stations given in the EIA report. **Figure 1** is the map that shows the sampling locations. Graph showing the noise levels in five locations is in **Figure 2**

At each station hourly 7-8 readings are recorded for a duration of 30-50seconds at each location. Average of ambient noise level in dB(A) was recorded and the average noise of each location is calculated Table 2. Ambient noise levels recorded with the EIA levels presented in the EIA report is given in **Table 2**

**Table 1: Locations selected for Ambient Noise Level Measurements**

| Station name | Geographic Coordinates | Reason for selection |
|---|---|---|
| NQ1 | 4°10’26.4 N, 73°28’59.9 E | Included in the original EIA |
| NQ2 | 4°10’56.6 N, 73°26’53.3 E | Included in the original EIA |
| NQ3 | 4°10’58.3 N, 73°26’09.6 E | Included in the original EIA |
| NQ4 | 4°10’57.3 N,73°25’59.4 E | Included in the original EIA |
| NQ5 | 4°10’57.3 N, 73°26’14.4 E | Included in the original EIA |

**Figure 1: Ambient noise level sampling locations**



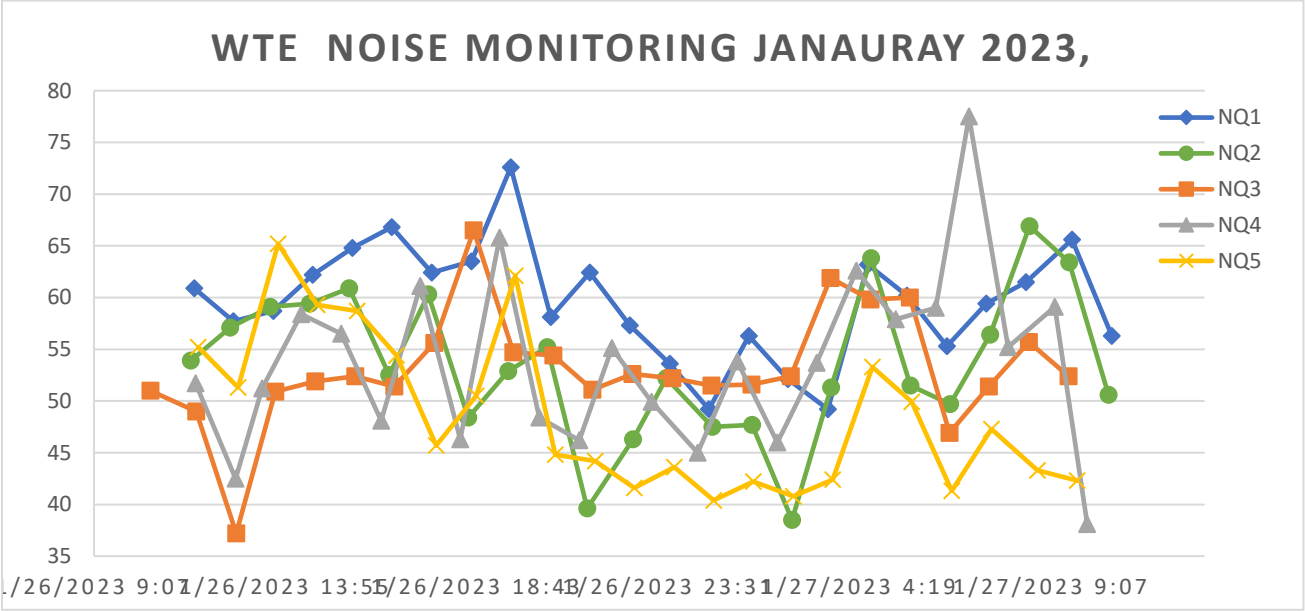

## 2.1 Results

**Table 2: Noise measurement records in (dB), 26-27 January 2023 Thilafushi**

| NQ1 | | NQ | | NQ3 | | NQ4 | | NQ5 | |
|---|---|---|---|---|---|---|---|---|---|
| Date and time) | dB(A | dB(A) | Date/time | dB(A) | Date/time | dB(A) | Date/time | dB(A) | Date/time |
| 1/27/2023 10:38 | 56.3 | 50.6 | 1/27/2023 10:33 | 51 | 1/26/2023 10:32 | 38.1 | 1/27/2023 10:01 | 56.1 | 1/26/2023 10:45 |
| 1/26/2023 11:38 | 60.9 | 53.9 | 1/26/2023 11:33 | 49 | 1/26/2023 11:41 | 51.7 | 1/26/2023 11:40 | 55.2 | 1/26/2023 11:44 |
| 1/26/2023 12:37 | 57.7 | 57.1 | 1/26/2023 12:32 | 37.2 | 1/26/2023 12:41 | 42.5 | 1/26/2023 12:40 | 51.3 | 1/26/2023 12:44 |
| 1/26/2023 13:37 | 58.7 | 59.1 | 1/26/2023 13:32 | 50.9 | 1/26/2023 13:40 | 51.2 | 1/26/2023 13:20 | 65.2 | 1/26/2023 13:44 |
| 1/26/2023 14:36 | 62.2 | 59.4 | 1/26/2023 14:32 | 51.9 | 1/26/2023 14:40 | 58.4 | 1/26/2023 14:19 | 59.3 | 1/26/2023 14:43 |
| 1/26/2023 15:36 | 64.8 | 60.9 | 1/26/2023 15:31 | 52.4 | 1/26/2023 15:40 | 56.5 | 1/26/2023 15:19 | 58.7 | 1/26/2023 15:43 |
| 1/26/2023 16:35 | 66.8 | 52.5 | 1/26/2023 16:31 | 51.4 | 1/26/2023 16:39 | 48.1 | 1/26/2023 16:19 | 54.4 | 1/26/2023 16:42 |
| 1/26/2023 17:35 | 62.4 | 60.3 | 1/26/2023 17:30 | 55.6 | 1/26/2023 17:39 | 61.1 | 1/26/2023 17:18 | 45.7 | 1/26/2023 17:42 |
| 1/26/2023 18:35 | 63.5 | 48.4 | 1/26/2023 18:30 | 66.5 | 1/26/2023 18:38 | 46.3 | 1/26/2023 18:18 | 50.5 | 1/26/2023 18:42 |
| 1/26/2023 19:34 | 72.6 | 52.9 | 1/26/2023 19:30 | 54.7 | 1/26/2023 19:38 | 65.8 | 1/26/2023 19:17 | 62.1 | 1/26/2023 19:41 |
| 1/26/2023 20:34 | 58.1 | 55.2 | 1/26/2023 20:29 | 54.4 | 1/26/2023 20:38 | 48.4 | 1/26/2023 20:17 | 44.8 | 1/26/2023 20:41 |
| 1/26/2023 21:33 | 62.4 | 39.6 | 1/26/2023 21:29 | 51.1 | 1/26/2023 21:37 | 46.2 | 1/26/2023 21:17 | 44.2 | 1/26/2023 21:41 |
| 1/26/2023 22:33 | 57.3 | 46.3 | 1/26/2023 22:38 | 52.6 | 1/26/2023 22:37 | 55.1 | 1/26/2023 22:06 | 41.6 | 1/26/2023 22:40 |
| 1/26/2023 23:33 | 53.6 | 52.2 | 1/26/2023 23:28 | 52.2 | 1/26/2023 23:37 | 49.9 | 1/26/2023 23:06 | 43.6 | 1/26/2023 23:40 |
| 1/27/2023 0:32 | 49.2 | 47.5 | 1/27/2023 0:37 | 51.5 | 1/27/2023 0:36 | 45 | 1/27/2023 0:15 | 40.4 | 1/27/2023 0:39 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1/27/2023 1:32 | 56.3 | 47.7 | 1/27/2023 1:37 | 51.6 | 1/27/2023 1:36 | 53.8 | 1/27/2023 1:15 | 42.2 | 1/27/2023 1:39 |
| 1/27/2023 2:31 | 52.1 | 38.5 | 1/27/2023 2:37 | 52.4 | 1/27/2023 2:35 | 46 | 1/27/2023 2:15 | 40.8 | 1/27/2023 2:39 |
| 1/27/2023 3:31 | 49.2 | 51.3 | 1/27/2023 3:36 | 61.9 | 1/27/2023 3:35 | 53.7 | 1/27/2023 3:14 | 42.4 | 1/27/2023 3:38 |
| 1/27/2023 4:31 | 63.2 | 63.8 | 1/27/2023 4:36 | 59.8 | 1/27/2023 4:35 | 62.6 | 1/27/2023 4:14 | 53.3 | 1/27/2023 4:38 |
| 1/27/2023 5:30 | 60.2 | 51.5 | 1/27/2023 5:35 | 60 | 1/27/2023 5:34 | 57.9 | 1/27/2023 5:13 | 49.9 | 1/27/2023 5:37 |
| 1/27/2023 6:30 | 55.3 | 49.7 | 1/27/2023 6:35 | 46.9 | 1/27/2023 6:34 | 59 | 1/27/2023 6:13 | 41.3 | 1/27/2023 6:37 |
| 1/27/2023 7:29 | 59.4 | 56.4 | 1/27/2023 7:35 | 51.4 | 1/27/2023 7:33 | 77.5 | 1/27/2023 7:03 | 47.3 | 1/27/2023 7:37 |
| 1/27/2023 8:29 | 61.5 | 66.9 | 1/27/2023 8:34 | 55.7 | 1/27/2023 8:33 | 55.2 | 1/27/2023 8:02 | 43.3 | 1/27/2023 8:46 |
| 1/27/2023 9:38 | 65.6 | 63.4 | 1/27/2023 9:34 | 52.4 | 1/27/2023 9:33 | 59.1 | 1/27/2023 9:12 | 42.3 | 1/27/2023 9:46 |
| Average dB(A) | **59.5** | **53.7** | | **53.0** | | **54.7** | | **48.9** | |
| Daytime | **61.9** | **55.2** | | **52.4** | | **53.8** | | **51.4** | |
| Night time | **55.6** | **50.5** | | **54.0** | | **56.1** | | **44.3** | |
| WHO guideline for ambient noise level | 70 | | | | | | | | |

**Figure 2. Graph showing the Ambient noise level recorded**




There are no designated national standards for ambient noise level in outdoor industrial area in the Maldives. Compared to WHO and ADB specified noise level standards for outdoors industrial and commercial area the noise level in Thilafushi island and the subproject area is below the noise level standards. The results show that in all the stations ambient noise level are below threshold levels specified by the WHO standards.

# Annex 1. Noise level Hourly recorded

**Noise Monitoring data 26-27 January 2023**

StartTime:2023-01-26 10:15:28
EndTime:2023-01-27 12:05:28
Wind E 5-15mph
Temperature 28.4°C
Humidity 29%
Sunshine

| NQ1 | | NQ2 | | NQ3 | | NQ4 | | NQ5 | |
|---|---|---|---|---|---|---|---|---|---|
| NQ1 | Date and time) | NQ2 | Date/time | NQ3 | Date/time | Nq4 | Date/time | NQ4 | Date/time |
| 60.9 | 1/26/2023 11:38 | 53.9 | 1/26/2023 11:33 | 51 | 1/26/2023 10:32 | 51.7 | 1/26/2023 11:40 | 56.1 | 1/26/2023 10:45 |
| 57.7 | 1/26/2023 12:37 | 57.1 | 1/26/2023 12:32 | 49 | 1/26/2023 11:41 | 42.5 | 1/26/2023 12:40 | 55.2 | 1/26/2023 11:44 |
| 58.7 | 1/26/2023 13:37 | 59.1 | 1/26/2023 13:32 | 37.2 | 1/26/2023 12:41 | 51.2 | 1/26/2023 13:20 | 51.3 | 1/26/2023 12:44 |
| 62.2 | 1/26/2023 14:36 | 59.4 | 1/26/2023 14:32 | 50.9 | 1/26/2023 13:40 | 58.4 | 1/26/2023 14:19 | 65.2 | 1/26/2023 13:44 |
| 64.8 | 1/26/2023 15:36 | 60.9 | 1/26/2023 15:31 | 51.9 | 1/26/2023 14:40 | 56.5 | 1/26/2023 15:19 | 59.3 | 1/26/2023 14:43 |
| 66.8 | 1/26/2023 16:35 | 52.5 | 1/26/2023 16:31 | 52.4 | 1/26/2023 15:40 | 48.1 | 1/26/2023 16:19 | 58.7 | 1/26/2023 15:43 |
| 62.4 | 1/26/2023 17:35 | 60.3 | 1/26/2023 17:30 | 51.4 | 1/26/2023 16:39 | 61.1 | 1/26/2023 17:18 | 54.4 | 1/26/2023 16:42 |
| 63.5 | 1/26/2023 18:35 | 48.4 | 1/26/2023 18:30 | 55.6 | 1/26/2023 17:39 | 46.3 | 1/26/2023 18:18 | 45.7 | 1/26/2023 17:42 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 72.6 | 1/26/2023 19:34 | 52.9 | 1/26/2023 19:30 | 66.5 | 1/26/2023 18:38 | 65.8 | 1/26/2023 19:17 | 50.5 | 1/26/2023 18:42 |
| 58.1 | 1/26/2023 20:34 | 55.2 | 1/26/2023 20:29 | 54.7 | 1/26/2023 19:38 | 48.4 | 1/26/2023 20:17 | 62.1 | 1/26/2023 19:41 |
| 62.4 | 1/26/2023 21:33 | 39.6 | 1/26/2023 21:29 | 54.4 | 1/26/2023 20:38 | 46.2 | 1/26/2023 21:17 | 44.8 | 1/26/2023 20:41 |
| 57.3 | 1/26/2023 22:33 | 46.3 | 1/26/2023 22:38 | 51.1 | 1/26/2023 21:37 | 55.1 | 1/26/2023 22:06 | 44.2 | 1/26/2023 21:41 |
| 53.6 | 1/26/2023 23:33 | 52.2 | 1/26/2023 23:28 | 52.6 | 1/26/2023 22:37 | 49.9 | 1/26/2023 23:06 | 41.6 | 1/26/2023 22:40 |
| 49.2 | 1/27/2023 0:32 | 47.5 | 1/27/2023 0:37 | 52.2 | 1/26/2023 23:37 | 45 | 1/27/2023 0:15 | 43.6 | 1/26/2023 23:40 |
| 56.3 | 1/27/2023 1:32 | 47.7 | 1/27/2023 1:37 | 51.5 | 1/27/2023 0:36 | 53.8 | 1/27/2023 1:15 | 40.4 | 1/27/2023 0:39 |
| 52.1 | 1/27/2023 2:31 | 38.5 | 1/27/2023 2:37 | 51.6 | 1/27/2023 1:36 | 46 | 1/27/2023 2:15 | 42.2 | 1/27/2023 1:39 |
| 49.2 | 1/27/2023 3:31 | 51.3 | 1/27/2023 3:36 | 52.4 | 1/27/2023 2:35 | 53.7 | 1/27/2023 3:14 | 40.8 | 1/27/2023 2:39 |
| 63.2 | 1/27/2023 4:31 | 63.8 | 1/27/2023 4:36 | 61.9 | 1/27/2023 3:35 | 62.6 | 1/27/2023 4:14 | 42.4 | 1/27/2023 3:38 |
| 60.2 | 1/27/2023 5:30 | 51.5 | 1/27/2023 5:35 | 59.8 | 1/27/2023 4:35 | 57.9 | 1/27/2023 5:13 | 53.3 | 1/27/2023 4:38 |
| 55.3 | 1/27/2023 6:30 | 49.7 | 1/27/2023 6:35 | 60 | 1/27/2023 5:34 | 59 | 1/27/2023 6:13 | 49.9 | 1/27/2023 5:37 |
| 59.4 | 1/27/2023 7:29 | 56.4 | 1/27/2023 7:35 | 46.9 | 1/27/2023 6:34 | 77.5 | 1/27/2023 7:03 | 41.3 | 1/27/2023 6:37 |
| 61.5 | 1/27/2023 8:29 | 66.9 | 1/27/2023 8:34 | 51.4 | 1/27/2023 7:33 | 55.2 | 1/27/2023 8:02 | 47.3 | 1/27/2023 7:37 |
| 65.6 | 1/27/2023 9:38 | 63.4 | 1/27/2023 9:34 | 55.7 | 1/27/2023 8:33 | 59.1 | 1/27/2023 9:12 | 43.3 | 1/27/2023 8:46 |
| 56.3 | 1/27/2023 10:38 | 50.6 | 1/27/2023 10:33 | 52.4 | 1/27/2023 9:33 | 38.1 | 1/27/2023 10:01 | 42.3 | 1/27/2023 9:46 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Average dB(A) | **59.5** | | **53.7** | | **53** | | **54.7** | | **48.9** | |
| Daytime | **61.9** | | **55.2** | | **52.4** | | **53.8** | | **51.4** | |
| Night time | **55.6** | | **50.5** | | **54** | | **56.1** | | **44.3** | |
| WHO guideline for ambient noise level | 70 | | | | | | | | | |

MDV-AAK-CEMPX-XX-RP-XXX-0002-000

# Environmental Monitoring Report - December 2022

REPUBLIC OF MALDIVES

MINISTRY of ENVIRONMENT, CLIMATE CHANGE and TECHNOLOGY

DBO CONTRACTOR:

urbaser

RAMBOLL

EMPLOYER REPRESENTATIVE

FICHTNER

Review & Approval:

EPC CONTRACTOR:

alke ALKATAŞ

ALKE-ALKATAŞ JV

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| Project Title: | Design, Build and Operate of a Waste to Energy Facility at Thilafushi<br><br>Contract No: (AGR)438-WPMC/PRIV/2021/71 |
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| | URB/RAM | | | |
| Released by: | | | | |

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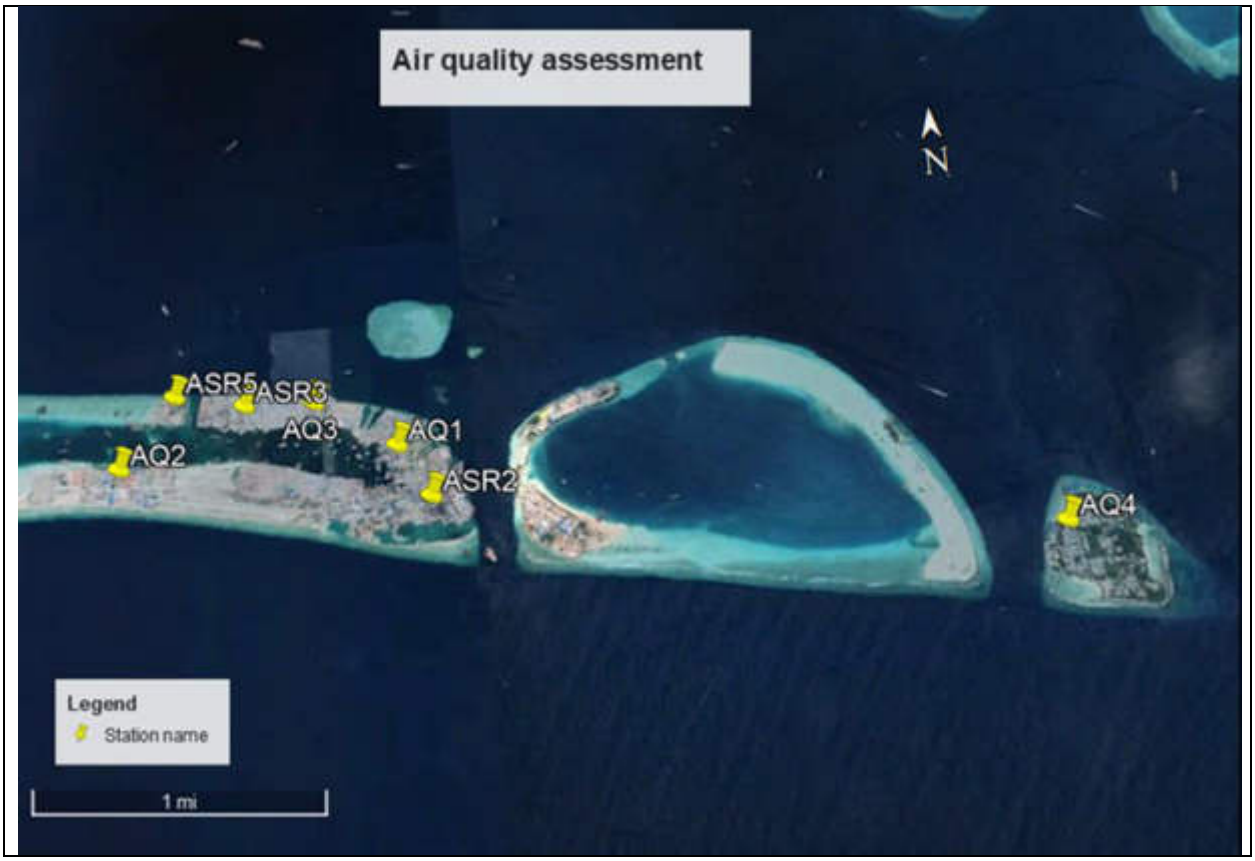
## 1. INTRODUCTION

This is the environmental monitoring report of Ambient air quality, noise level and marine ecology result conducted in December 2022 prepared as part of the pre-construction & construction stage monitoring of the waste to energy (WtE) facility at Thilafushi, Maldives. Environmental monitoring is a contractual requirement of the DBO in the Environmental Impact Assessment report prepared for the project. This report presents results of the environmental monitoring of Ambient noise level and marine ecology assessments conducted in December 2022 as part the requirements of the EIA monitoring and the Project Environmental Management Plan that is being developed to meet the anticipated environment impacts, health and safety, as well as to ensure the sustainability of the Project.

## 2. AMBIENT AIR QUALITY ASSESSMENT

Preconstruction environmental monitoring of the ambient air quality was conducted in December 2022 from 21-23$^{rd}$ at seven locations: 6 locations at Thilafushi (AQ1, AQ2, and AQ3 in the EIA and the ASR 2, ASR3 and ASR5 recommended for monitoring in the EIA Report) and one location at Villingili (AQ4) **Figure 1**. PM10, PM2.5, SO2, NO2 and O3 parameters were monitored by using air quality monitoring stations based on sensor technology. TSP's were measured by dust sampling devices conforming to the international HSE-MDHS 14/3. As recommended in the EIA report air quality were measured 24 hours at each station.

**Figure 1: Sampling Locations Pre-construction Ambient Air Quality monitoring stations**




## 2.1 Results

**Table 1: summary of pre-construction sir quality monitoring results for December 2022**

| Reading Description | Parameters / Results[b] | | | | |
|---|---|---|---|---|---|
| | PM10 | PM2.5 | SO2 | NO2 | TSP 24 hour average |
| | µg/m3 | µg/m3 | µg/m3 | µg/m3 | |
| | **Thilafushi Downwind (AQ-1) (21st December 2022)** | | | | |
| Minimum | 9.36 | 3.86 | 00 | 00 | 166.41 |
| Maximum | 32.8 | 51 | 00 | 00 | |
| Mean | **22.87** | **8.41** | 0.00 | 0.00 | |
| | **Thilafushi Crosswind (AQ-2) (22nd December 2022)** | | | | |
| Minimum | 13.9 | 5.27 | 00 | 00 | 86.4 |
| Maximum | 24.8 | 10.6 | 00 | | |
| Mean | **20.00** | **7.55** | 0.00 | 0.00 | |
| | **Thilafushi Downwind (AQ-3) (22nd December 2022)** | | | | |
| Minimum | 21.25 | 6.64 | 0.00 | 0.00 | 114.36 |
| Maximum | 53.35 | 22.83 | .00 | 20.71 | |

| Reading Description | Parameters / Results[b] | | | | |
|---|---|---|---|---|---|
| | PM10 | PM2.5 | SO2 | NO2 | TSP 24 hour average |
| | µg/m3 | µg/m3 | µg/m3 | µg/m3 | |
| Mean | **31.06** | **12.28** | **0.00** | **0.86** | |
| | **Vilingili Island (AQ-4) (23rd December 2022)** | | | | |
| Minimum | 18.19 | 8.33 | 0.00 | 0.00 | 91.96 |
| Maximum | 32.21 | 13.60 | 0.00 | 0.00 | |
| Mean | 23.47 | 10.10 | **0.00** | **0.00** | |
| | **Thilafushi (ASR2) (21st December 2022)** | | | | |
| Minimum | 10.57 | 2.51 | 00 | 2.46 | 74.1 |
| Maximum | 35.16 | 14.78 | 27.25 | 35.74 | |
| Mean | **21.55** | **8.95** | **12.83** | **13.35** | |
| | **Thilafushi (ASR3) (23rd December 2022)** | | | | |
| Minimum | 2.89 | 1.42 | 0.00 | 0.00 | 53.16 |
| Maximum | 31.10 | 14.86 | 0.00 | 20.71 | |
| Mean | **11.41** | **4.44** | **0.00** | **0.86** | |
| | **Thilafushi (ASR5) (23 December 2022)** | | | | |
| Minimum | 19.05 | 8.82 | 0.00 | 0.00 | 181.96 |
| Maximum | 36.58 | 12.99 | 0.00 | 0.00 | |
| Mean | **25.47** | **10.42** | **0.00** | **0.00** | |
| **WHO Standard (µg/m3)** | **50.0[a]** | **25.0[a]** | **20.0[a]** | **200.0[b]** **40.0[c]** | |

a Based on 24-hour averaging period; b Based on 1-hour averaging period; c Based on 1-year averaging period

Ambient air quality results obtained from the preconstruction monitoring in December 2022 the background air quality values comply with air quality standards.

## 3. AMBIENT NOISE LEVEL MEASUREMENTS

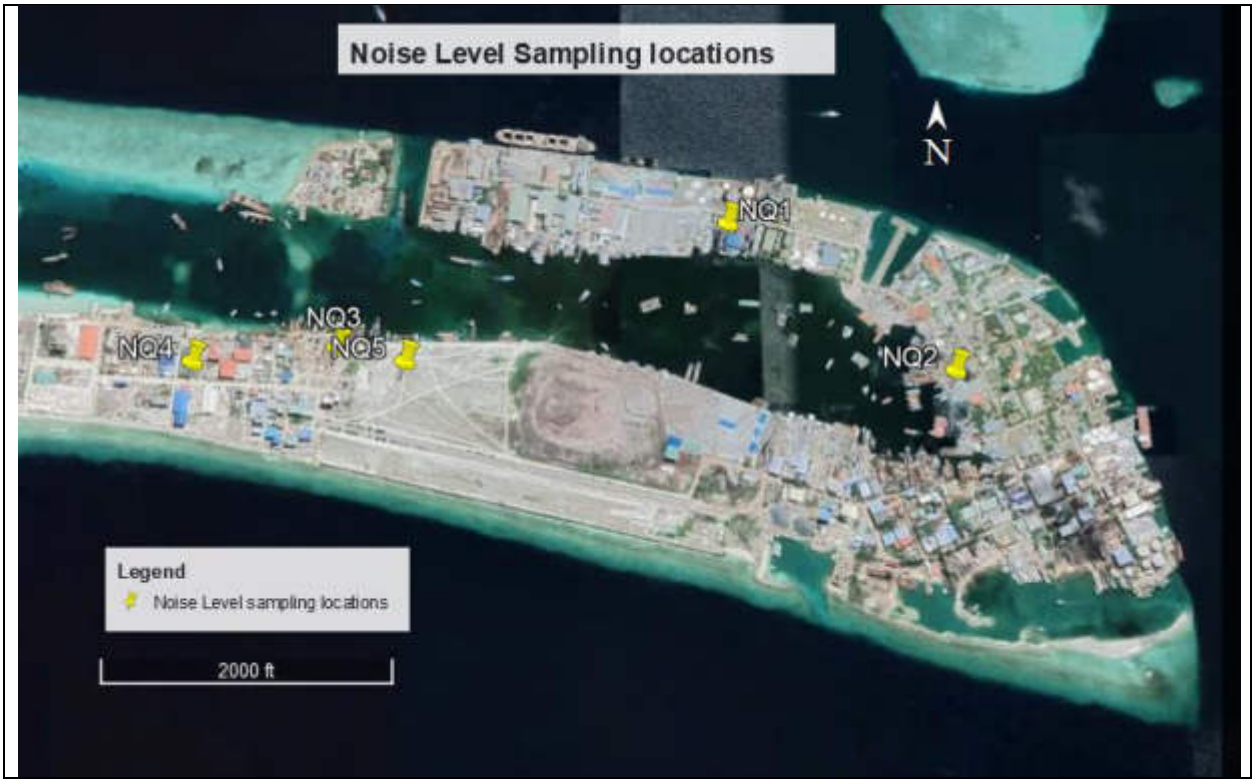
As part of the pre-construction monitoring of Thilafushi Waste to Energy facility, ambient noise levels measurements were repeated at the same five locations used in the EIA report. Ambient noise level measurement was done using a handheld sound level meter (ET-958 Professional Sound Level Meter) Measurements were conducted in all location on 27-29 December 2022 during the day time and night time for 24 hours. Measurements are recorded in NQ1, and NQ2 on from 27th December 20:00 to 28th December 2022 20:00. In stations NQ3, NQ4 and NQ5 from 28th December 2022 10:00 to 29th December 2022 10:00 continuously for 24 four hours. Table 2 summarizes the explanation on the selection of baseline monitoring stations given in the EIA report. **Figure 2** is the map that shows the sampling locations.

At each station hourly 7-8 readings are recorded for a duration of 30-50seconds at each location. Average of ambient noise level in dB(A) was recorded and the average noise of each location is calculated Table 3. Ambient noise levels recorded with the EIA levels presented in the EIA report is given in **Table 3**

**Table 2: Locations selected for Ambient Noise Level Measurements**

| Station name | Geographic Coordinates | Reason for selection |
|---|---|---|
| NQ1 | 4°10'26.4 N, 73°28'59.9 E | Included in the original EIA |
| NQ2 | 4°10'56.6 N, 73°26'53.3 E | Included in the original EIA |
| NQ3 | 4°10'58.3 N, 73°26'09.6 E | Included in the original EIA |
| NQ4 | 4°10'57.3 N,73°25'59.4 E | Included in the original EIA |
| NQ5 | 4°10'57.3 N, 73°26'14.4 E | Included in the original EIA |

**Figure 2: Ambient noise level sampling locations**

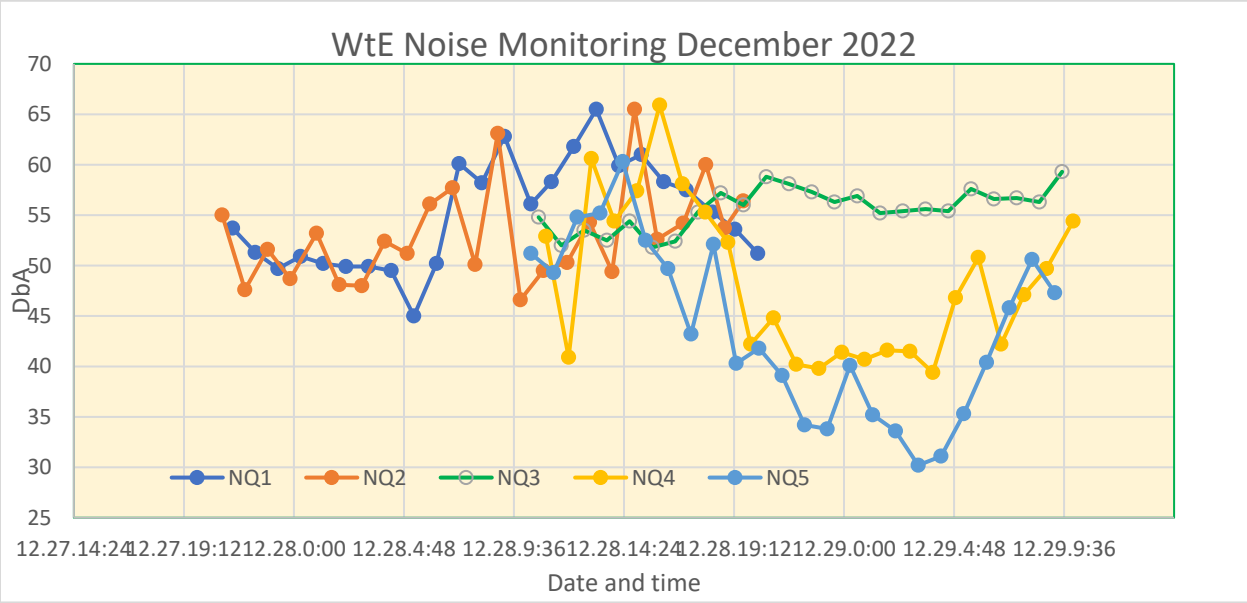


## 3.1 RESULTS

**Table 3: Noise measurement records in (dB), 27-29 December 2022 for Thilafushi**

| NQ1 | | NQ | | NQ3 | | NQ4 | | NQ5 | |
|---|---|---|---|---|---|---|---|---|---|
| Date and time | dB(A | Date/time | dB(A | Date/time | dB(A | Date/time | dB(A | Date/time | dB(A |
| 12/27/21:19 | 53.7 | 12/27/20:52 | 55 | 12/28/10:40 | 54.8 | 12/28/10:59 | 52.9 | 12/28/10:20 | 51.2 |
| 12/27/22:18 | 51.3 | 12/27/21:51 | 47.6 | 12/28/11:40 | 52 | 12/28/11:59 | 40.9 | 12/28/11:20 | 49.3 |
| 12/27/23:18 | 49.7 | 12/27/22:50 | 51.6 | 12/28/12:39 | 53.5 | 12/28/12:58 | 60.6 | 12/28/12:21 | 54.8 |
| 12/28/0:17 | 50.9 | 12/27/23:50 | 48.7 | 12/28/13:39 | 52.5 | 12/28/13:58 | 54.4 | 12/28/13:21 | 55.2 |
| 12/28/1:16 | 50.2 | 12/28/0:59 | 53.2 | 12/28/14:38 | 54.4 | 12/28/14:57 | 57.4 | 12/28/14:20 | 60.3 |
| 12/28/2:16 | 49.9 | 12/28/1:58 | 48.1 | 12/28/15:38 | 51.8 | 12/28/15:57 | 65.9 | 12/28/15:20 | 52.5 |
| 12/28/3:15 | 49.9 | 12/28/2:57 | 48 | 12/28/16:38 | 52.4 | 12/28/16:57 | 58.1 | 12/28/16:19 | 49.7 |
| 12/28/4:14 | 49.5 | 12/28/3:57 | 52.4 | 12/28/17:37 | 55.3 | 12/28/17:56 | 55.3 | 12/28/17:19 | 43.2 |
| 12/28/5:13 | 45 | 12/28/4:56 | 51.2 | 12/28/18:37 | 57.2 | 12/28/18:56 | 52.3 | 12/28/18:18 | 52.1 |
| 12/28/6:13 | 50.2 | 12/28/5:55 | 56.1 | 12/28/19:36 | 56 | 12/28/19:55 | 42.2 | 12/28/19:17 | 40.3 |
| 12/28/7:12 | 60.1 | 12/28/6:55 | 57.7 | 12/28/20:36 | 58.8 | 12/28/20:55 | 44.8 | 12/28/20:17 | 41.8 |
| 12/28/8:11 | 58.2 | 12/28/7:54 | 50.1 | 12/28/21:35 | 58.1 | 12/28/21:54 | 40.2 | 12/28/21:17 | 39.1 |
| 12/28/9:11 | 62.8 | 12/28/8:53 | 63.1 | 12/28/22:35 | 57.3 | 12/28/22:54 | 39.8 | 12/28/22:16 | 34.2 |
| 12/28/10:20 | 56.1 | 12/28/9:52 | 46.6 | 12/28/23:35 | 56.3 | 12/28/23:54 | 41.4 | 12/28/23:16 | 33.8 |
| 12/28/11:13 | 58.3 | 12/28/10:52 | 49.5 | 12/29/0:34 | 56.9 | 12/29/0:53 | 40.7 | 12/29/0:15 | 40.1 |
| 12/28/12:12 | 61.8 | 12/28/11:55 | 50.3 | 12/29/1:34 | 55.2 | 12/29/1:53 | 41.6 | 12/29/1:15 | 35.2 |
| 12/28/13:11 | 65.5 | 12/28/12:54 | 54.3 | 12/29/2:33 | 55.4 | 12/29/2:52 | 41.5 | 12/29/2:14 | 33.6 |
| 12/28/14:10 | 59.9 | 12/28/13:52 | 49.4 | 12/29/3:33 | 55.6 | 12/29/3:52 | 39.4 | 12/29/3:14 | 30.2 |
| 12/28/15:09 | 61 | 12/28/14:51 | 65.5 | 12/29/4:33 | 55.4 | 12/29/4:52 | 46.8 | 12/29/4:14 | 31.1 |
| 12/28/16:08 | 58.3 | 12/28/15:50 | 52.6 | 12/29/5:32 | 57.6 | 12/29/5:51 | 50.8 | 12/29/5:13 | 35.3 |
| 12/28/17:07 | 57.5 | 12/28/16:59 | 54.2 | 12/29/6:32 | 56.6 | 12/29/6:51 | 42.2 | 12/29/6:13 | 40.4 |
| 12/28/18:15 | 55.3 | 12/28/17:58 | 60 | 12/29/7:31 | 56.7 | 12/29/7:50 | 47.1 | 12/29/7:12 | 45.8 |
| 12/28/19:14 | 53.6 | 12/28/18:47 | 53.7 | 12/29/8:31 | 56.3 | 12/29/8:50 | 49.7 | 12/29/8:12 | 50.6 |
| 12/28/20:14 | 51.2 | 12/28/19:36 | 56.4 | 12/29/9:31 | 59.3 | 12/29/9:59 | 54.4 | 12/29/9:11 | 47.3 |
| Average dB(A) | 54.9 | | 53.1 | | 55.6 | | 48.3 | | 43.6 |
| WHO guideline for ambient noise level | 70 | | | | | | | | |

**Figure 3. Graph showing the Ambient noise level recorded**




There are no designated national standards for ambient noise level in outdoor industrial area in the Maldives. Compared to WHO and ADB specified noise level standards for outdoors industrial and commercial area the noise level in Thilafushi island and the subproject area is below the noise level standards. The results show that in all the stations ambient noise level are below threshold levels specified by the WHO standards.

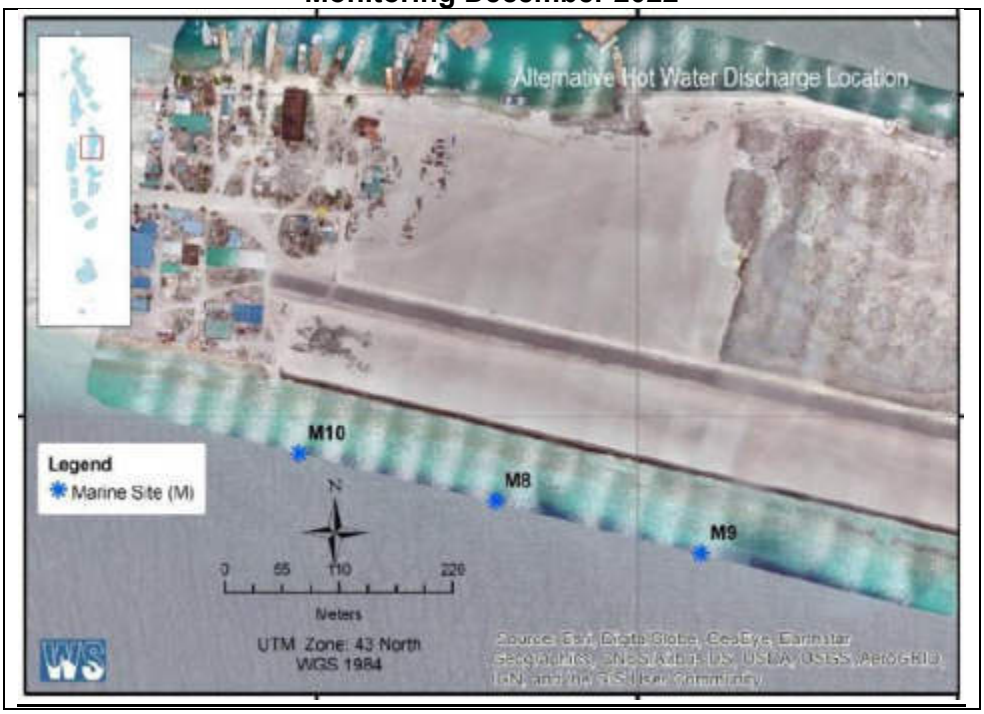
## 4. MARINE ECOLOGICAL SURVEY

For the pre-construction site environmental monitoring reef benthic survey was conducted on 24th December 2022 in locations M10, M9 and M8 **Figure 4**. The purpose of the marine survey was to continue monitoring changes to the conditions established in the Environmental Impact Assessment (EIA) during August and September 2018. A re-evaluation of the baseline was established in June 2022, and the following report is based on the survey conducted on December 24, 2022.

A standard approach, established by the Maldives EIA community and approved by the Environmental Protection Agency (EPA), was employed to study benthic cover and fish populations. The survey employed GPS locations, transects surveys conducted at two depths: 5m and 10m at each station (M8, M9 and M10 – as detailed in an earlier report). The methods followed were those outlined by Hodgson et.al (2006) in Reef Check Instruction Manual: A Guide to Reef Check Coral Reef Monitoring.

Three transects of 20 m length were laid, one after the other along the reef, ensuring the transect falls to the specific depth. A quadrat of size 0.5 x 0.5 m was laid sequentially on the transect, and photo images were taken with the quadrat in the center. This way, every transect would have at least 10 images, resulting in around 60 images from each depth.

**Figure 4: Underwater Marine Survey Locations M8,M9 and M10 for pre-construction Monitoring December 2022**




## 4.1 DATA ANALYSIS

The data collected in June 2022 was analyzed using CoralNet (an online resource for benthic images analysis - https://coralnet.ucsd.edu/), which utilizes artificial intelligence for automatic classification. However, for the December 2022 survey, analysis was conducted using CPCe (Coral Point Count of Excel Extension)1. Like CoralNet, CPCe involves randomly placing points over the quadrat space on the image, but in this case, the points are identified by humans. Twenty-five points were randomly placed on the entire photo image. The points were then classified under the following categories, as listed in Table 4

**Table 4: Substrate categories and the codes.**

| Category | Code |
|---|---|
| ROCK (R) | RCK |
| CORAL (C) | HC |
| SAND AND SILT (S) | SND |
| CORALLINACEAE (CO) | CON |
| MACRO ALAGE (MA) | ALG |
| CORAL RUBBLE (CR) | RUB |

[1] Kohler, K.E., Gill, S.M., 2006. Coral Point Count with Excel Extension (CPCe): A Visual Basic program for the determination of coral and substrate coverage using random point count methodology. Computers and Geosciences 32, 1259–1269.

| | |
|---|---|
| SPONGE (SP) | ENSP |
| TUNICATE (TU) | TUN |
| ZOANTHARIAN (ZO) | ZON |
| SOFT CORAL (SC) | SC |
| TURF ALAGE (TUR) | TRF |
| BLEACHED CORAL (BLC) | BCO |
| UNKOWN (UN) | UNC |
| SEAGRASS (SG) | SGR |
| INVERTEBRATES (INV) | INV |

### 4.2 Results

The following presents findings and observations from under marine ecological surveys conducted at the monitoring location at Thilafushi reef.

**Status of Site M8:** The site is the location that will be used for discharge of waste water from the brine outfall as described in the EIA. The survey conducted in June 2022 reported hard coral cover within 26-28%. In December the mean hard coral cover for both depths was around 25-26% which is more or less the same. Rocks cover 48% of the substrate in at 5m depth and 25% at 10m depth. Sand cover was more (37%) at 10m while at 5m it was 15% (see Figure 1). Coraline algae cover was around 5% which is like what was obtained earlier. Most of the live coral was massive and sub-massive corals.

Fish diversity was highest for one species of Balistidae, Odonus niger and fusilier (Pterocaesio tile) and. The Chromid, Chromis dimidiata, was observed as abundant, which means >40 individual on average at each 20 m transect.. Photographs of the transact quadrats are shown in Figure 5 and Figure 6.Benthic composition of M8 at both 5 and 10m depth is inFigure **7**.

**Figure 5: Photos Taken from Site 8 (M8) (24th December 2022) at 5m depth**

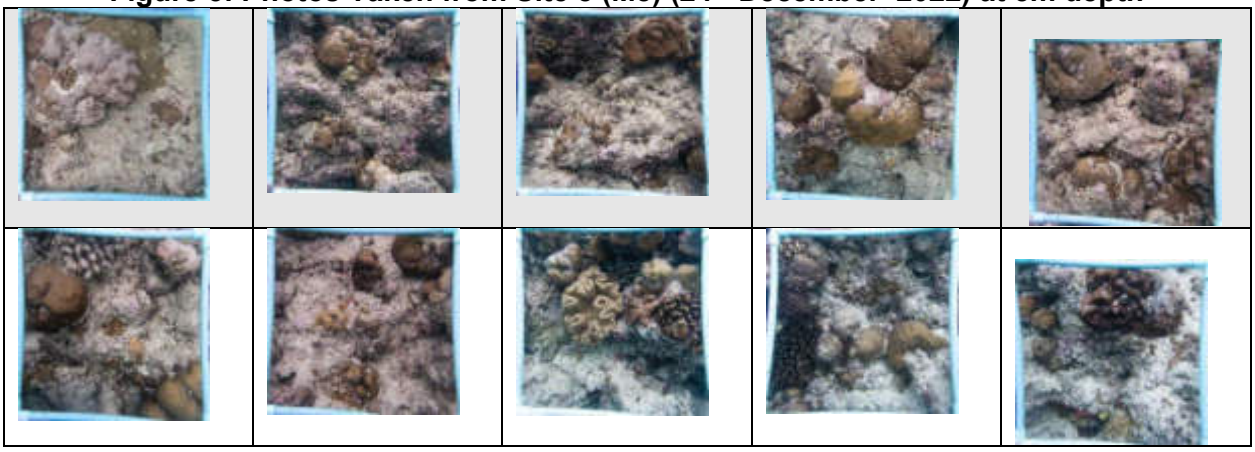


**Figure 6: Photos Taken from Site 8 (M8) (24th December 2022) at 10m depth**

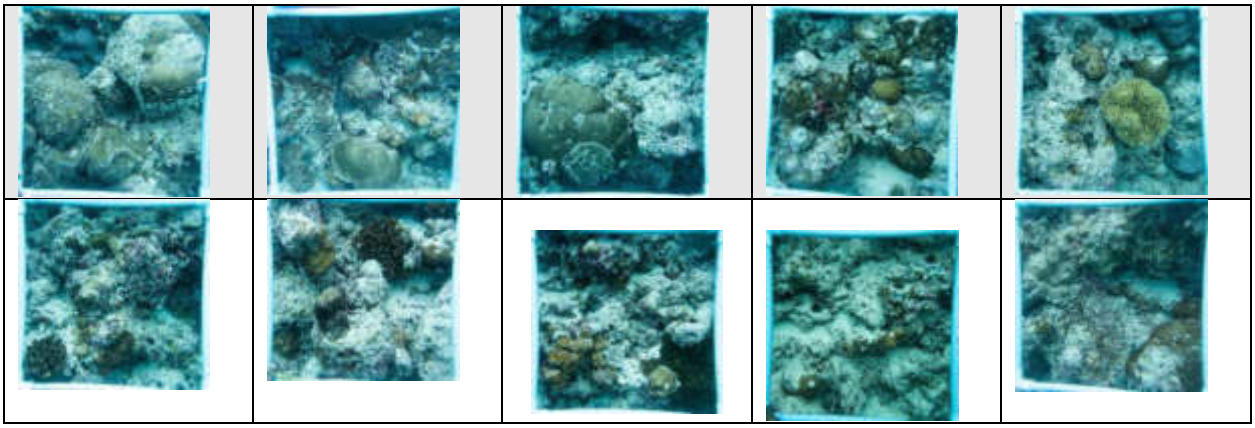
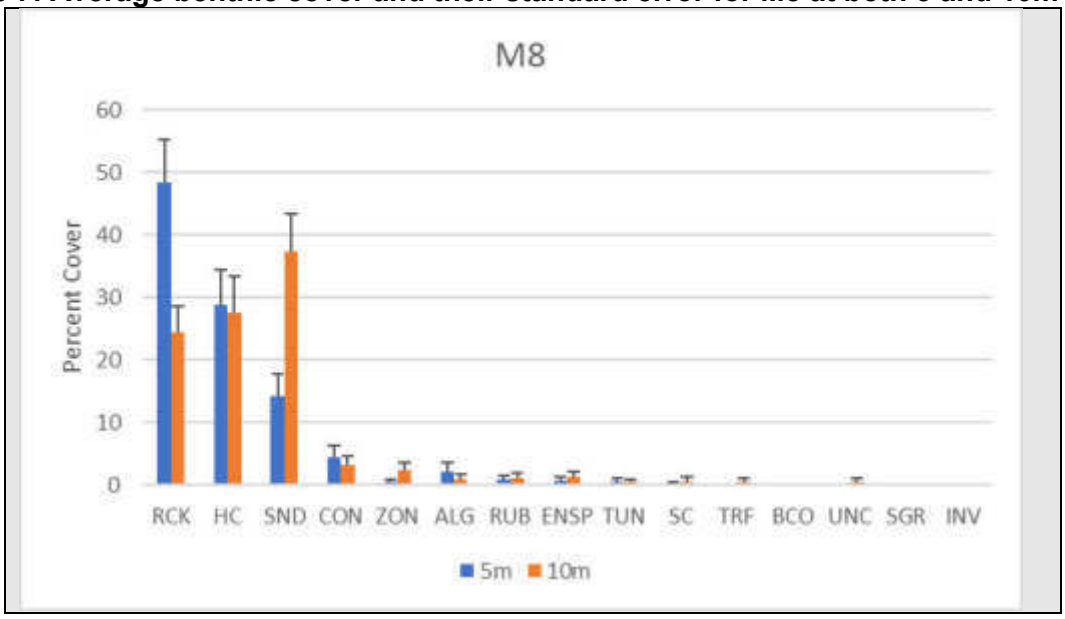


**Figure 7: Average benthic cover and their standard error for M8 at both 5 and 10m depth**




**Status of Site M9:** This location was identified as an alternative for brine discharge and wastewater outfall. This is close to the WtE site at the southern reef of Thilafushi Island. Substrate cover was qualitatively similar to the results obtained for the survey conducted in June. Like Site 8, the highest substrate cover was rock, some 50-60% of the 0.5 x 05 m quadrat, followed by live coral. Live coral cover was also qualitatively like M8. Sand cover was around 5-15%, much lower at 5m. Rubble cover also was low.

With regards to fish Chormis dimidiata was abundant, occurring > 40 individuals along 20 meters transect. Also, the Pomecentrid philippinus and Pterocaesio tile were common at site. Photographs of the transact quadrats are shown in Figure 8 and Figure 9.Benthic composition of M8 at both 5 and 10m depth is in Figure 10.

**Figure 8: Photos Taken from Site 9 (M9) (24th December 2022) at 5m depth**

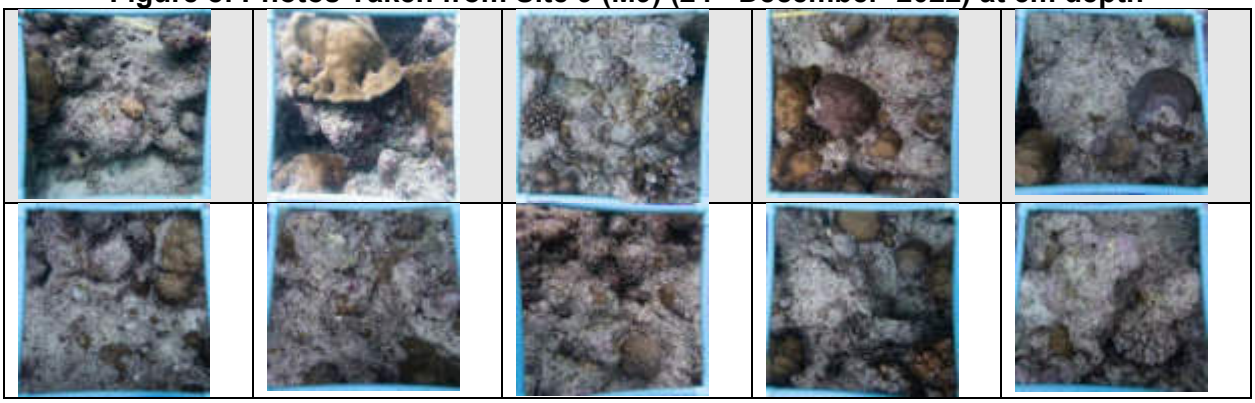


**Figure 9: Photos Taken from Site 9 (M9) (24th December 2022) at 10m depth**

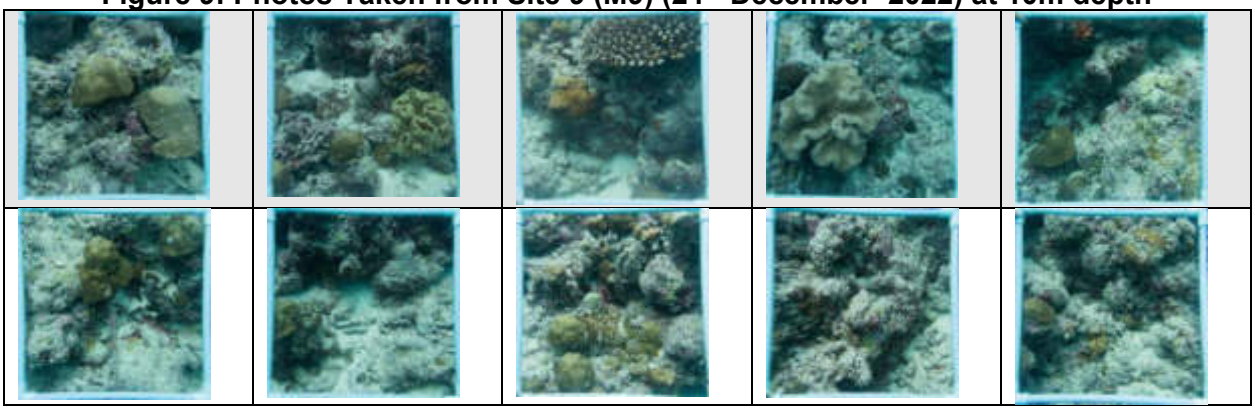
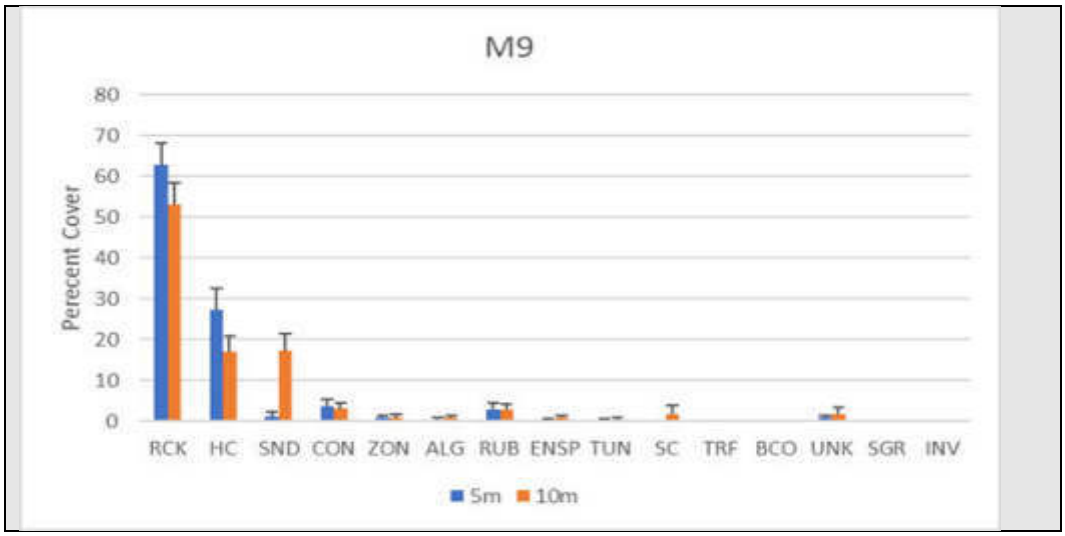


**Figure 10: Average benthic cover and their standard error for M9 at both 5 and 10m depth**



**Status of Site M10:** This location has been identified in the EIA report as a potential alternative for the discharge of brine water and waste water. The location is very close to the WtE facility and it is on the southern reef of Thilafushi Island. Site M10 had largest cover for rock, hard coral and sand (around 40-40%) although rock was significantly lower at 10m depth, while sand cover was lower about 15% at 5m and slightly over 30% at 10m depth. Corallinaceae cover is slightly higher at 10m than 5m depth 8% and 3 % respectively. Mirco Algae and rubble cover on the substrates are higher at 5m than 10m at 5 dept micro algae cover does not exceeds 5% of substrate while rubble content is over 5% at 5m depth at 10 m depth both Micro Algae and rubble content is below 3%.

With regard to fish *Chormis dimidiata* was the only abundant fish found in the area. Common occurrence of any species was not recoded at this location. Photographs of the transact quadrats are shown in Figure 5 and Figure 6.Benthic composition of M8 at both 5 and 10m depth is in the graph in

Figure **13** .

**Figure 11: Photos Taken from Site 10 (M10) (24th December 2022) at 5m depth**

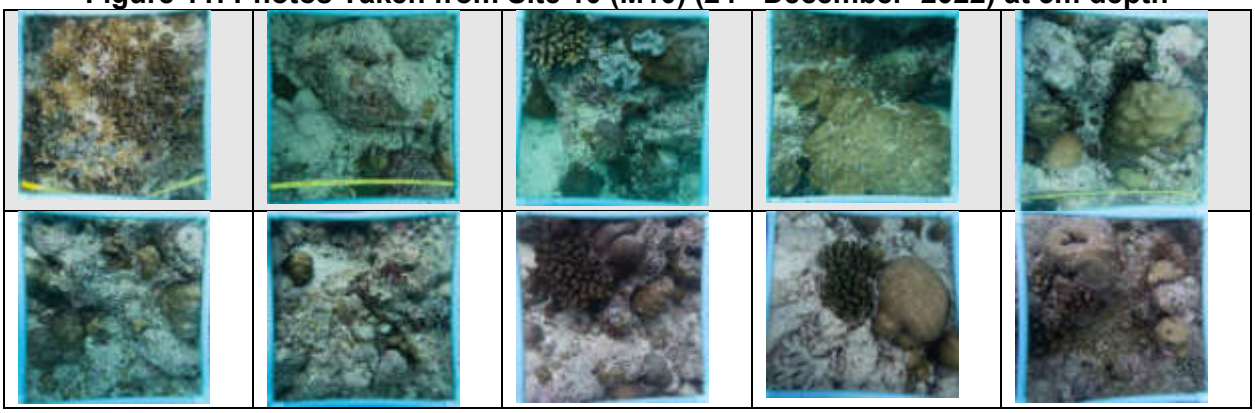


**Figure 12: Photos Taken from Site 10 (M10) (24th December 2022) at 10m depth**

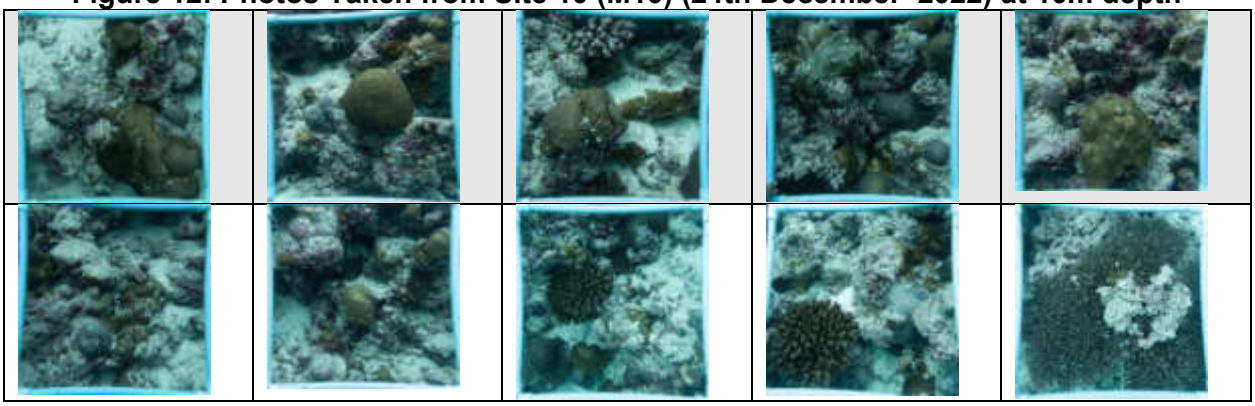
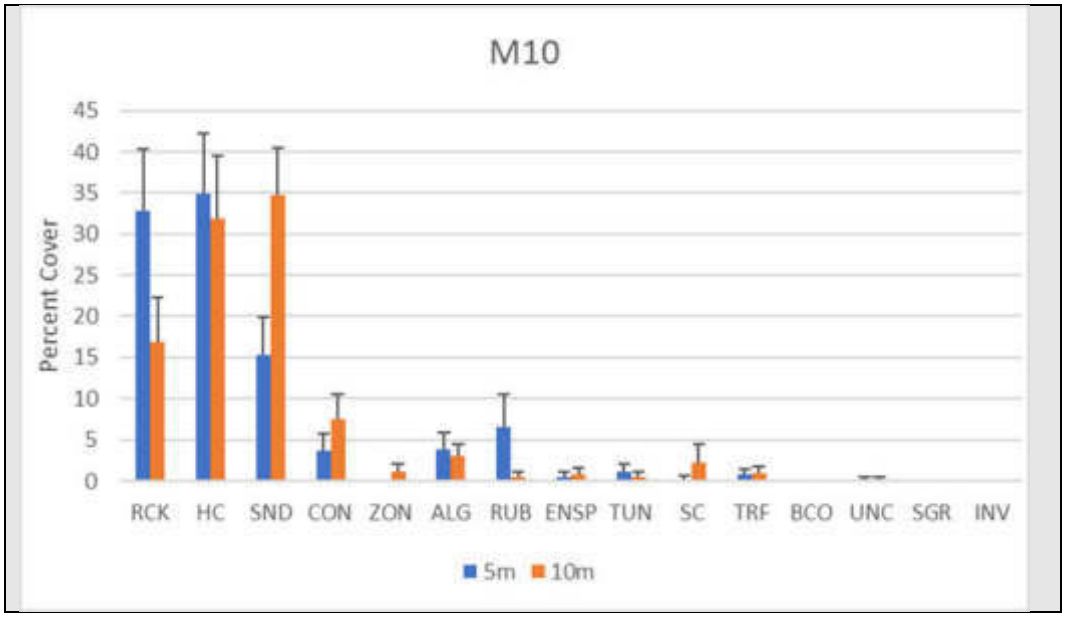


**Figure 13: Average benthic cover and their standard error for M9 at both 5 and 10m depth**




## 4.3 Fish surveys

To ensure that the fish were not disturbed while data on substrate was being collected, a visual assessment of the fish was performed after the transect was laid. As previously mentioned, at each transect and at each depth (5m and 10m), three transects of 20m length were observed. The counts were estimated in the field and the average count of each depth was taken as the mean abundance. The mean abundance was then categorized into three arbitrary scales: "Rare" (no fish to 20 fish), "Common" (20-40 fish), and "Abundant" (counts over 40 fish).

Summaries of the data collected at each site (combining both depths) are provided in **Table 5**. The majority of the fish observed were considered rare. However, there were instances of Pomacentrids (2 species) and Balistidae (Odonus niger) being common at M8 and M9, and Pomacentrid, Chormis didmidiata being abundant at M9 and M10. In M8, only Anthias (Pseudanthias evanis) was considered abundant.

When examining the data at the family level and by depth (5m and 10m) for all three sites, it appears that Pomacentrid (C didmidiata) was more common in deeper waters, while Acanthuridae was more common in shallower waters. However, it is important to note that fish composition can vary greatly due to a variety of factors such as time of day, currents and other environmental conditions. Therefore, it is difficult to make generalizations about the fish composition based on this data.

**Figure 14** shows frequency of occurrence of fish families at two depths. There appears to no difference in occurrence of fish families at depth, although there are some indication occurrences are more frequent at 10m (M10) Magnified view of the list is provided in the Appendix.

**Table 5: Summary of fish census for three site ordered as Rare, Common and Abundant for three site.**

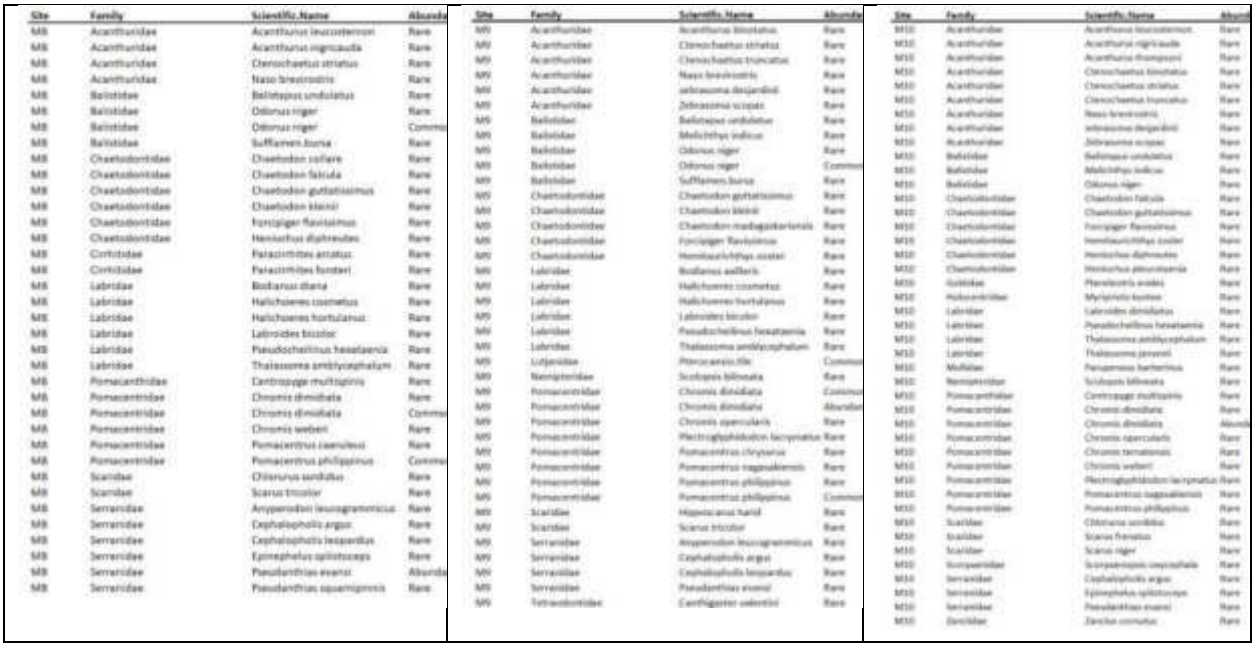
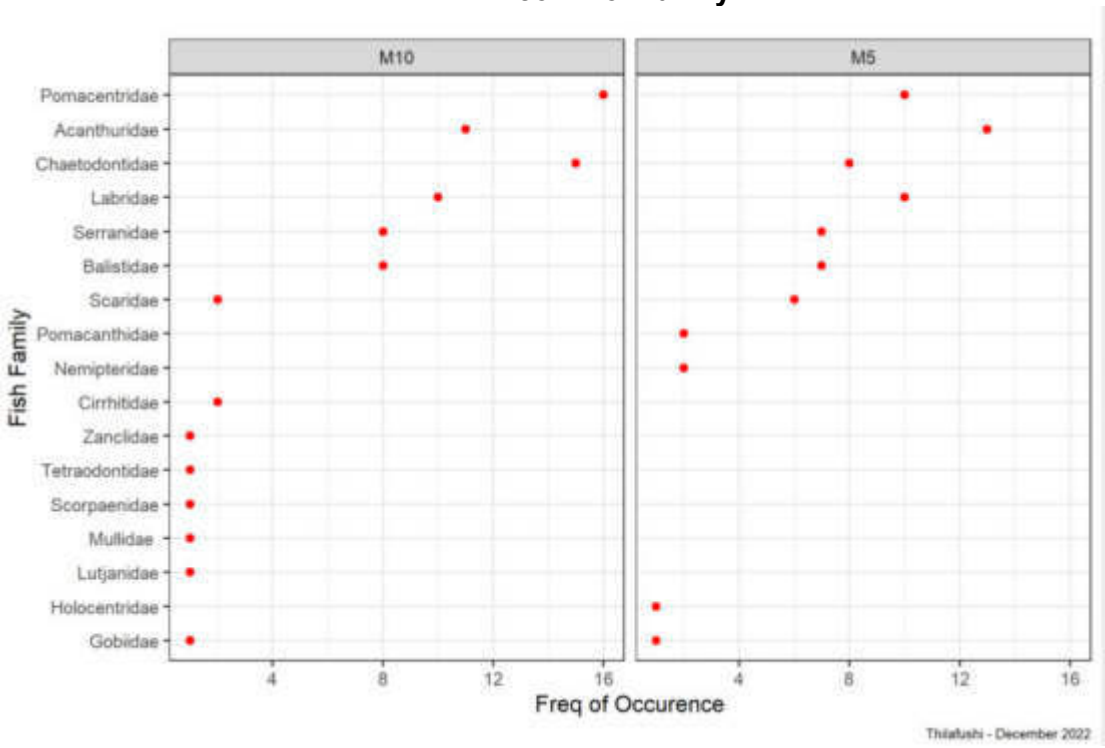


**Figure 14: Fish Families ordered with frequency of occurrence. Pomacentridae is most common family**

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# ANNEX 1 AMBIENT AIR QUALITY REPORT

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# GOVERNMENT of MALDIVES

WtE Energy Facility Project

## BACKGROUND AIR QUALITY MEASUREMENT REPORT

Thilafushi Island/MALDIVES

**MALDIVES 2022**

**AIRS Air Quality Management Services Ltd**
Mustafa Kemal Mah. Via Green Is Mrk. B-36
Cankaya Ankara TURKEY
Tel: +90 312 221 02 45 Fax: +90 312 221 02 45
**www.airsaqms.com**

**Test Report**

| | |
|---|---|
| **Customer Name/Address** | Alke Alkatas Joint Venture Pvt Ltd<br>H.H.Moomiyaage 5A Asaree Hingun K.Male 20265 MALDIVES |
| **Order No.** | EN-M/2207/417_01 |
| **Name and identity of test item** | Immission (Air Quality) |
| **Remarks** | - |
| **Date of Test** | 21.12.2022-23.12.2022 |
| **Number of Pages of the Report** | 27 Pages |
| ***Test Method*** | Air Quality Sensors<br>HSE-MDHS 14/3 |
| ***Test results*** | The test results are given in the measurement result tables. |
| ***Environmental conditions*** | Environmental conditions during the measurement are given in the measurement result tables. |
| ***Comments*** | - |

The test and/or measurement results, the uncertainties (if applicable) with confidence probability and test methods are given on the following pages which are part of this report.

Repeater and Approval
Ismail Ulusoy
Environmental Engineer

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## 1. INTRODUCTION

This report has been prepared with the aim of determining the air quality in the sensitive receptors located in the impact area of the The Greater Malé Waste to Energy Project. Air quality results were determined for $PM_{10}$, $PM_{2.5}$, $NO_2$, $SO_2$, TSP and $O_3$ parameters.

## 2. MEASUREMENT METHODS

$PM_{10}$, $PM_{2.5}$, $SO_2$, and $NO_2$ parameters were monitored by using air quality monitoring stations based on sensor technology. TSP's were measured by dust sampling devices conforming to the international HSE-MDHS 14/3. Ideally as recommended in the EIA report air quality should be measured 24 hours at each station, all measurements were made at each point within this framework 24 hours a day.

The US EPA refers to the term 'air sensor' as a class of non-regulatory technology that is low-cost, portable, capable of measuring several pollutants simultaneously, and often easier to operate than regulatory stations. For example, monitoring air pollution with reference measurement methods (regulatory stations) requires skilled operators to maintain and calibrate measuring instruments. On the other hand, air sensors describe the hardware and software set that can be operated without human intervention and enable unskilled users to monitor air pollution without additional technical knowledge.

Sensor specifications which are used for measurement study are shown below.

| Sensor Name | Sensor Type | Accuracy $r^2$-score* | Range |
|---|---|---|---|
| PM2.5 | Laser scattering | >0.9 | 0 to 1000 µg/m³ |
| PM10 | Laser scattering | >0.9 | 0 to 1000 µg/m³ |
| $NO_2$ | Electro chemical | >0.82 | 0 to 5000 ppb |
| $SO_2$ | Electro chemical | >0.82 | 0 to 5000 ppb |
| Temperature | CMOS IC | 0.9 | -20°C to 60°C |
| Humidity | CMOS IC | 0.9 | 5% to 95% |

The accuracy of these low-cost sensors is as critical as measuring the air quality. With the smart calibration process, low-cost sensors are corrected and accurate compared to reference stations. The Smart Calibration Algorithm consists of the below operational steps shown figure below.


Sensor Units were calibrated using reference stations for a period before the deployment. The calibration process for particle matter and gas pollutants measurement is explained below.

**Table 1 Calibration Process for Pollutants**

| Description | Methodology | |
|---|---|---|
| | $NO_2$-$SO_2$-$O_3$ | $PM_{10}$-$PM_{2.5}$ |
| Installation | Near Reference Station (3/4 meters) | Near Reference Station (3/4 meters) |
| Pre-Test | Quality Check in zero air conditions | Quality Check in zero air conditions |
| Co-Located Period | 4-5 weeks | 8 weeks |
| Sampling Period | 30 seconds. Hourly mean is used because the reference station measurements are hourly. | 60 seconds. Hourly mean is used because the reference station measurements are hourly. |
| Validation | Cross-validation is used. Also, some ranges of measurement are eliminated, where the reference station is not available. | Cross-validation is used. Also, some ranges of measurement are eliminated, where the reference station is not available. |
| Calibration Procedure | is obtained via $R^2$ and spearman correlation | is obtained via $R^2$ and spearman correlation |

**Calibration Result for PM**

The corrected measurement results after the Smart Calibration Process are shown in the figures below. The correlation between Sensor Unit's $PM_{2.5}$ measurements between Reference Station's $PM_{2.5}$ measurements for hourly and daily mean of data is 0.73, and the correlation between Sensor Unit's $PM_{10}$ measurements between Reference Station's $PM_{10}$ measurements for hourly and daily mean of data is 0.77.

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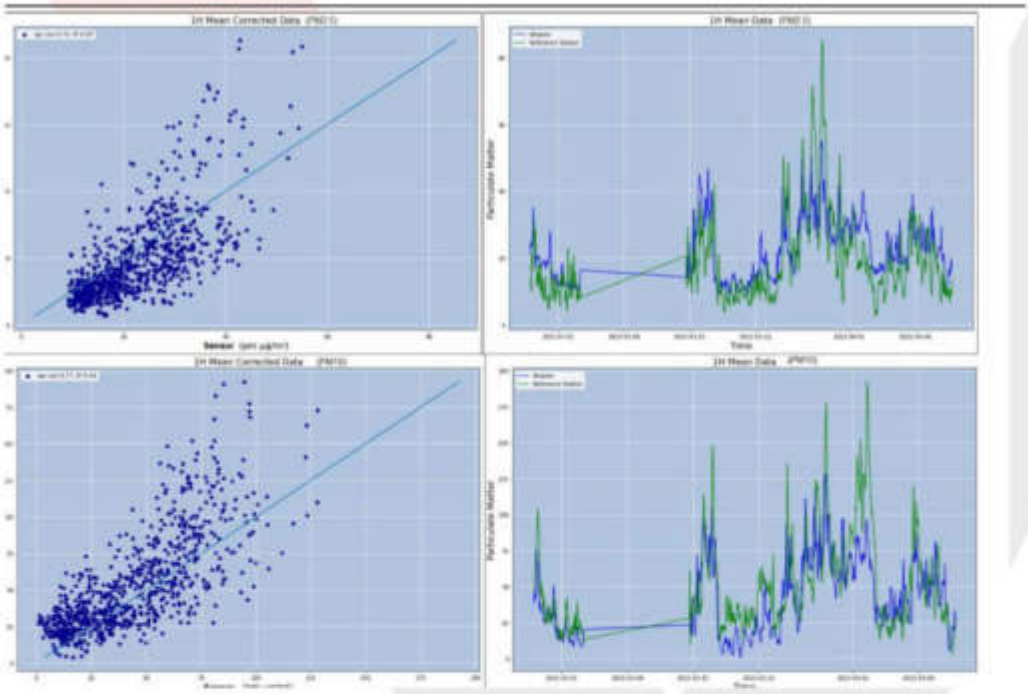
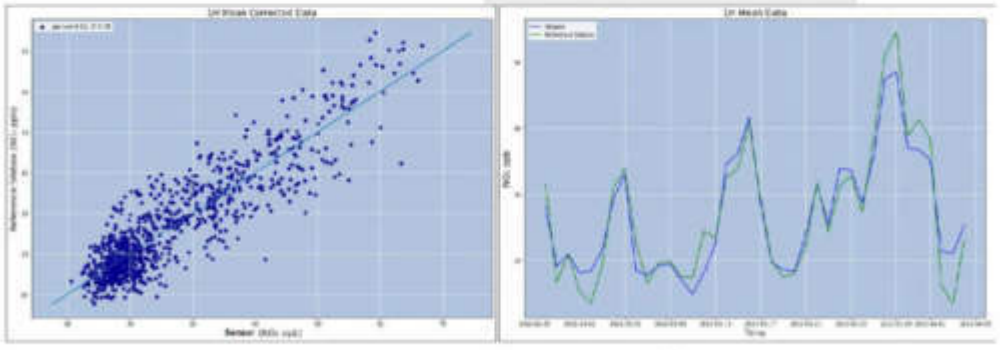


**Calibration Result for Gases**

The corrected measurement results after the Smart Calibration Process are shown in the figures below. The correlation between Sensor Unit's $NO_2$ measurements between Reference Station's $NO_2$ measurements for hourly and daily mean of data is respectively 0.823, 0.898



## 2.1. FIELD APPLICATION

This section describes how the measurements, the general methodology of which is given above, are applied in the field.

**Preliminary Preparations**

Preliminary preparations for air quality measuring stations with sensors include factory calibrations and field calibrations. Factory calibrations are provided by the sensor manufacturer. Stations capable of making reference measurements were used for field calibrations, as described above. For this purpose, a 1-month comparison measurement was carried out at a reference station in the Turkish air quality monitoring network and the calibration factors were applied.

For TSP measurements, filter conditioning was carried out in the laboratory. For this purpose, cassettes and filters were conditioned for 24 hours in a room conditioned at 25 degrees Celsius and 50% humidity and were tared.

**During Measurements**

Air quality measurements were made with four sets of devices. AQ1, AQ2, AQ3 and ASR2 measurements were made with these devices on the first day, and ASR 3, ASR5 and AQ4 points were measured on the second day.

The locations of the sampling points are determined in the macro scale ESIA report. A site visit was made and a location was determined at the micro scale where the devices would be placed.

Measurements were made at a height of 1.5 to 4 meters from the ground, depending on the suitability of the sampling point.

24-hour measurements were made at each point. Parameters measured with sensor devices consist of the averages of instantaneous measurements taken at 10-minute intervals. For TSP measurements, 24-hour uninterrupted sampling was carried out.

**After Measurements**

The values after the measurements were taken by reading directly on the air quality measuring devices with sensors.

In TSP measurements, the filters were brought to the laboratory, conditioned for 24 hours at 25 degrees Celsius and 50% humidity for 24 hours and weighed. The 24-hour dust amount was found by subtracting the last weighing result from the first weighing result.

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## 3. MEASUREMENT LOCATION

For the Preconstruction baseline environmental assessment of the ambient air quality was conducted at seven locations: 6 locations at Thilafushi (AQ1, AQ2, and AQ3 in the EIA and the ASR 2, ASR3 and ASR5 recommended for monitoring in the EIA Report) and one location at Villingili (AQ4).

**Table 2 Sampling Point Coordinates and Sampling dates**

| No | Location | Description | Distance to Source (meters) |
|---|---|---|---|
| 1 | AQ1 | Represents dense industrial area | 650 |
| 2 | AQ2 | Represents dense industrial area | 1000 |
| 3 | AQ3 | Represents dense industrial area | 500 |
| 4 | ASR2 | Represents dense industrial area | 700 |
| 5 | ASR3 | Represents dense industrial area | 500 |
| 6 | ASR5 | Represents dense industrial area | 1000 |
| 7 | AQ4 | Represents dense housing and population area | 4500 |


Figure 1 Sampling Points on satellite Map

## 4. LEGAL FRAMEWORK

Within the scope of the project, particle matter ($PM_{10}$-$PM_{2.5}$), $NO_2$, $SO_2$ AND TSP emissions were measured. It is known that Maldives does not have a national air quality policy. Therefore, international standards were used for the evaluation. WHO defines limit values in "Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide" document. European Union directives also have limit values for air pollution prevention (EU Council Directive 2008/50/EC relating to health based standards and objectives for a number of pollutants in ambient air). Germany has an air pollution control regulation titled "Technical Instructions on Air Quality Control" (Technische Anleitung zur Reinhaltung der Luft) and commonly referred to as the TA Luft and determines the limit values to protect the general public and the neighborhood against harmful effects of air pollution on the environment. Comparison of these limit values and chosen parameters and values for the modeling study according to these standards are shown in Table 3.

**Table 3.** Limit Values Stipulated in the International Legislation

| Pollutant | Averaging Period | TA Luft | EU | WHO Ambient Air Quality Guideline Value | Project Standards |
|---|---|---|---|---|---|
| Particular Matter <10 µm ($PM_{10}$) | 24 hours | 50 µg/m³ | 50 µg/m³ | 45 µg/m³ | 45 µg/m³ |
| | 1-year | 40 µg/m³ | 40 µg/m³ | 15 µg/m³ | 15 µg/m³ |
| Particular Matter <2.5 µm ($PM_{2.5}$) | 24 hours | - | - | 15 (not to be exceeded more than 3-4 times a year) | 15 |
| | 1-year | - | 20 | 5 | 5 |
| Nitrogen Dioxide ($NO_x$) | 1-hour | 200 µg/m³ | 200 µg/m³ | - | 200 µg/m³ |
| | 24 hours | - | - | 25 µg/m³ | 25 µg/m³ |
| | 1-year | 40 µg/m³ | 40 µg/m³ | 10 µg/m³ | 10 µg/m³ |
| Sulphur Dioxide ($SO_2$) | 1-hour | 350 µg/m³ | 350 µg/m³ | - | 350 µg/m³ |
| | 24 hours | 125 µg/m³ | 125 µg/m³ | 40 µg/m³ | 40 µg/m³ |
| | 1-year | 50 µg/m³ | - | - | 50 µg/m³ |
| TSP* | - | - | - | - | - |

***There is no limit value for TSP.**

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## 5. RESULTS

**Table 4 Measurement Results for Location 1**

| Location | Sampling Date | Air Quality Results ($\mu g/m^3$) | | | | | Ambient Conditions | |
|---|---|---|---|---|---|---|---|---|
| | | $PM_{10}$ | $PM_{2.5}$ | $NO_2$ | $SO_2$ | TSP (24 Hours Average) | Humidity (%) | Temperature (°C) |
| AQ1 | 2022-12-21 13:00:00 | 16.1 | 2.77 | 0.00 | 0.00 | 166.41 | 76.82 | 31.10 |
| | 2022-12-21 14:00:00 | 23.9 | 7.71 | 0.00 | 0.00 | | 82.19 | 29.40 |
| | 2022-12-21 15:00:00 | 19.2 | 3.86 | 0.00 | 0.00 | | 77.60 | 31.46 |
| | 2022-12-21 16:00:00 | 32.8 | 8.1 | 0.00 | 0.00 | | 69.71 | 33.08 |
| | 2022-12-21 17:00:00 | 30.5 | 8.93 | 0.00 | 0.00 | | 71.84 | 30.93 |
| | 2022-12-21 18:00:00 | 24.6 | 9.22 | 0.00 | 0.00 | | 82.14 | 27.72 |
| | 2022-12-21 19:00:00 | 17.4 | 6.59 | 0.00 | 0.00 | | 86.71 | 27.30 |
| | 2022-12-21 20:00:00 | 17.1 | 7.59 | 0.00 | 0.00 | | 90.13 | 26.12 |
| | 2022-12-21 21:00:00 | 14.4 | 7.19 | 0.00 | 0.00 | | 93.97 | 25.65 |
| | 2022-12-21 22:00:00 | 13 | 6.2 | 0.00 | 0.00 | | 93.62 | 25.99 |
| | 2022-12-21 23:00:00 | 14.1 | 6.76 | 0.00 | 0.00 | | 93.66 | 26.04 |
| | 2022-12-22 00:00:00 | 11.3 | 5.7 | 0.00 | 0.00 | | 95.56 | 26.02 |
| | 2022-12-22 01:00:00 | 9.36 | 4.69 | 0.00 | 0.00 | | 95.57 | 26.08 |
| | 2022-12-22 02:00:00 | 11.6 | 5.62 | 0.00 | 0.00 | | 94.60 | 26.14 |
| | 2022-12-22 03:00:00 | 12.5 | 5.98 | 0.00 | 0.00 | | 94.47 | 26.25 |
| | 2022-12-22 04:00:00 | 13.1 | 6.23 | 0.00 | 0.00 | | 94.34 | 26.27 |
| | 2022-12-22 05:00:00 | 12.5 | 5.79 | 0.00 | 0.00 | | 94.33 | 26.52 |
| | 2022-12-22 06:00:00 | 13 | 5.83 | 0.00 | 0.00 | | 94.41 | 26.85 |
| | 2022-12-22 07:00:00 | 14.6 | 5.71 | 0.00 | 0.00 | | 92.30 | 27.75 |
| | 2022-12-22 08:00:00 | 23.1 | 7.96 | 0.00 | 0.00 | | 86.36 | 29.14 |
| | 2022-12-22 09:00:00 | 129 | 51 | 0.00 | 0.00 | | 82.93 | 29.70 |
| | 2022-12-22 10:00:00 | 22.6 | 6.57 | 0.00 | 0.00 | | 81.17 | 30.11 |
| | 2022-12-22 11:00:00 | 31.3 | 9.7 | 0.00 | 0.00 | | 78.51 | 30.72 |
| | 2022-12-22 12:00:00 | 21.8 | 6.14 | 0.00 | 0.00 | | 79.35 | 30.03 |
| Hourly Limit Values | TA Luft | - | - | 200 | 350 | - | - | - |
| | EU | - | - | 200 | 350 | - | - | - |
| | WHO Ambient Air Quality Guideline Value | - | - | - | - | - | - | - |
| 24 h Average | | **22.87** | **8.41** | **0.00** | **0.00** | **166.41** | **66.32** | **29.68** |
| Daily Limit Values | TA Luft | 50 | - | - | 125 | - | - | - |
| | EU | 50 | - | - | 125 | - | - | - |
| | WHO Ambient Air Quality Guideline Value | 45 | 15 | 25 | 40 | - | - | - |

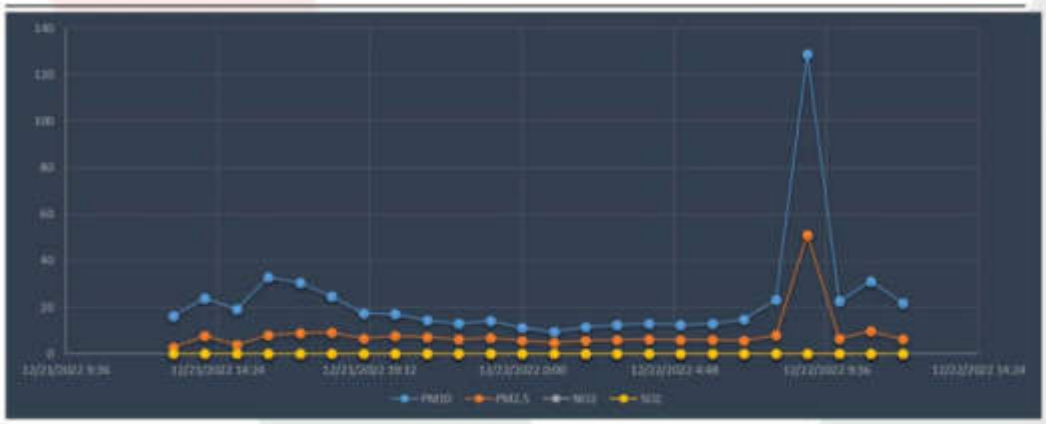

**Figure 2** Measurement Graphs for Location AQ1

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**Table 5 Measurement Results for Location 2**

| Location | Sampling Date | Results ($\mu g/m^3$) | | | | | Ambient Conditions | |
|---|---|---|---|---|---|---|---|---|
| | | $PM_{10}$ | $PM_{2.5}$ | $NO_2$ | $SO_2$ | TSP (24 Hours Average) | Humidity (%) | Temperature (°C) |
| AQ2 | 2022-12-21 13:00:00 | 18.8 | 5.79 | 0.00 | 0.00 | 86.40 | 78.05 | 28.56 |
| | 2022-12-21 14:00:00 | 16.8 | 5.27 | 0.00 | 0.00 | | 80.56 | 28.17 |
| | 2022-12-21 15:00:00 | 20 | 5.9 | 0.00 | 0.00 | | 76.51 | 29.08 |
| | 2022-12-21 16:00:00 | 24.8 | 7.74 | 0.00 | 0.00 | | 73.45 | 29.26 |
| | 2022-12-21 17:00:00 | 30 | 10.6 | 0.00 | 0.00 | | 76.85 | 28.53 |
| | 2022-12-21 18:00:00 | 24.5 | 9.31 | 0.00 | 0.00 | | 82.83 | 27.58 |
| | 2022-12-21 19:00:00 | 20.1 | 7.53 | 0.00 | 0.00 | | 84.75 | 27.47 |
| | 2022-12-21 20:00:00 | 22.3 | 9.77 | 0.00 | 0.00 | | 87.53 | 26.10 |
| | 2022-12-21 21:00:00 | 15.1 | 7.15 | 0.00 | 0.00 | | 90.92 | 25.36 |
| | 2022-12-21 22:00:00 | 18 | 8.24 | 0.00 | 0.00 | | 90.09 | 25.76 |
| | 2022-12-21 23:00:00 | 15.7 | 7 | 0.00 | 0.00 | | 90.29 | 26.00 |
| | 2022-12-22 00:00:00 | 13.9 | 6.28 | 0.00 | 0.00 | | 91.04 | 25.98 |
| | 2022-12-22 01:00:00 | 18.8 | 5.79 | 0.00 | 0.00 | | 71.66 | 24.08 |
| | 2022-12-22 02:00:00 | 16.8 | 5.27 | 0.00 | 0.00 | | 74.73 | 23.63 |
| | 2022-12-22 03:00:00 | 20 | 5.9 | 0.00 | 0.00 | | 61.83 | 23.58 |
| | 2022-12-22 04:00:00 | 24.8 | 7.74 | 0.00 | 0.00 | | 61.15 | 23.75 |
| | 2022-12-22 05:00:00 | 30 | 10.6 | 0.00 | 0.00 | | 60.42 | 23.85 |
| | 2022-12-22 06:00:00 | 24.5 | 9.31 | 0.00 | 0.00 | | 60.06 | 23.77 |
| | 2022-12-22 07:00:00 | 20.1 | 7.53 | 0.00 | 0.00 | | 59.71 | 23.69 |
| | 2022-12-22 08:00:00 | 22.3 | 9.77 | 0.00 | 0.00 | | 59.56 | 23.73 |
| | 2022-12-22 09:00:00 | 15.1 | 7.15 | 0.00 | 0.00 | | 88.23 | 26.65 |
| | 2022-12-22 10:00:00 | 18 | 8.24 | 0.00 | 0.00 | | 85.43 | 27.20 |
| | 2022-12-22 11:00:00 | 15.7 | 7 | 0.00 | 0.00 | | 85.82 | 27.93 |
| | 2022-12-22 12:00:00 | 13.9 | 6.28 | 0.00 | 0.00 | | 80.43 | 28.04 |
| Hourly Limit Values | TA Luft | - | - | 200 | 350 | - | - | - |
| | EU | - | - | 200 | 350 | - | - | - |
| | WHO Ambient Air Quality Guideline Value | - | - | - | - | - | - | - |
| **Average** | | **20.00** | **7.55** | **0.00** | **0.00** | **86.40** | **58.24** | **28.97** |
| Daily Limit Values | TA Luft | 50 | - | - | 125 | - | - | - |
| | EU | 50 | - | - | 125 | - | - | - |
| | WHO Ambient Air Quality Guideline Value | 45 | 15 | 25 | 40 | - | - | - |

**Figure 3** Measurement Graphs for Location AQ2

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**Table 6 Measurement Results for Location 3**

| Location | Sampling Date | Results ($\mu g/m^3$) | | | | | Ambient Conditions | |
|---|---|---|---|---|---|---|---|---|
| | | $PM_{10}$ | $PM_{2.5}$ | $NO_2$ | $SO_2$ | TSP (24 Hours Average) | Humidity (%) | Temperature (°C) |
| AQ3 | 2022-12-21 13:00:00 | 21.25 | 6.64 | 0.00 | 0.00 | 114.36 | 69.40 | 28.50 |
| | 2022-12-21 14:00:00 | 23.23 | 7.59 | 0.00 | 0.00 | | 65.53 | 28.30 |
| | 2022-12-21 15:00:00 | 22.54 | 7.23 | 0.00 | 0.00 | | 63.50 | 28.42 |
| | 2022-12-21 16:00:00 | 22.82 | 7.72 | 0.00 | 0.00 | | 67.74 | 27.82 |
| | 2022-12-21 17:00:00 | 21.93 | 6.94 | 0.00 | 0.00 | | 64.78 | 28.46 |
| | 2022-12-21 18:00:00 | 30.68 | 10.17 | 0.00 | 0.00 | | 60.23 | 29.14 |
| | 2022-12-21 19:00:00 | 28.59 | 9.79 | 0.00 | 0.00 | | 63.15 | 28.38 |
| | 2022-12-21 20:00:00 | 30.40 | 11.59 | 0.00 | 0.00 | | 70.90 | 26.94 |
| | 2022-12-21 21:00:00 | 32.77 | 12.67 | 0.00 | 0.00 | | 71.63 | 26.91 |
| | 2022-12-21 22:00:00 | 33.38 | 14.21 | 0.00 | 0.00 | | 75.57 | 25.19 |
| | 2022-12-21 23:00:00 | 33.86 | 14.54 | 0.00 | 0.00 | | 77.61 | 25.24 |
| | 2022-12-22 00:00:00 | 35.31 | 14.91 | 0.00 | 0.00 | | 75.99 | 25.49 |
| | 2022-12-22 01:00:00 | 44.36 | 18.91 | 0.00 | 0.00 | | 76.68 | 25.59 |
| | 2022-12-22 02:00:00 | 27.93 | 11.60 | 0.00 | 0.00 | | 77.04 | 25.63 |
| | 2022-12-22 03:00:00 | 28.91 | 11.99 | 0.00 | 0.00 | | 77.14 | 25.73 |
| | 2022-12-22 04:00:00 | 31.15 | 12.80 | 0.00 | 0.00 | | 75.76 | 25.89 |
| | 2022-12-22 05:00:00 | 53.35 | 22.83 | 20.71 | 0.00 | | 55.60 | 23.48 |
| | 2022-12-22 06:00:00 | 44.72 | 18.67 | 0.00 | 0.00 | | 69.04 | 25.32 |
| | 2022-12-22 07:00:00 | 31.41 | 12.20 | 0.00 | 0.00 | | 73.60 | 26.86 |
| | 2022-12-22 08:00:00 | 44.96 | 19.64 | 0.00 | 0.00 | | 79.93 | 25.57 |
| | 2022-12-22 09:00:00 | 30.89 | 14.08 | 0.00 | 0.00 | | 83.97 | 24.85 |
| | 2022-12-22 10:00:00 | 23.25 | 9.76 | 0.00 | 0.00 | | 80.55 | 25.61 |
| | 2022-12-22 11:00:00 | 22.22 | 8.40 | 0.00 | 0.00 | | 76.55 | 26.67 |
| | 2022-12-22 12:00:00 | 25.46 | 9.89 | 0.00 | 0.00 | | 76.60 | 26.60 |
| Hourly Limit Values | TA Luft | - | - | 200 | 350 | - | - | - |
| | EU | - | - | 200 | 350 | - | - | - |
| | WHO Ambient Air Quality Guideline Value | - | - | - | - | - | - | - |
| Average | | **31.06** | **12.28** | **0.86** | **0.00** | **114.36** | **69.88** | **29.48** |
| Daily Limit Values | TA Luft | 50 | - | - | - | - | - | - |
| | EU | 50 | - | - | - | - | - | - |
| | WHO Ambient Air Quality Guideline Value | 45 | 15 | 25 | - | - | - | - |

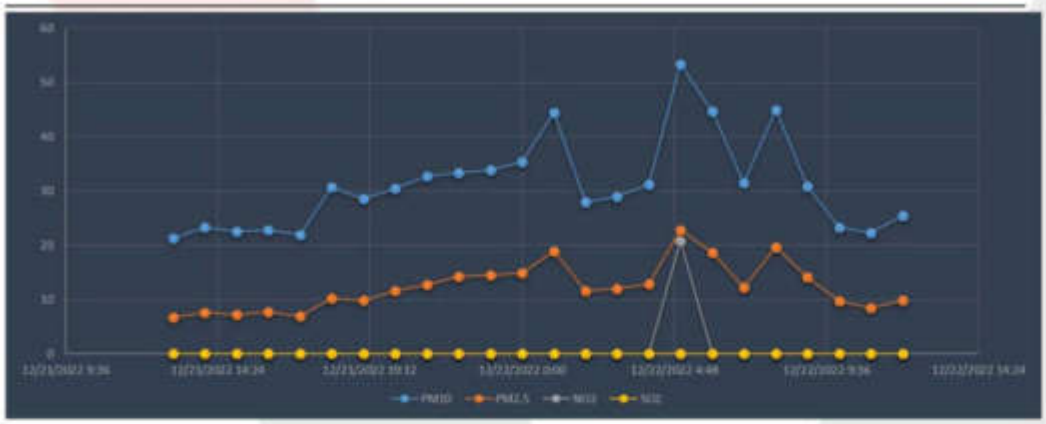

**Figure 4** Measurement Graphs for Location AQ3

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**Table 7 Measurement Results for Location 4**

| Location | Sampling Date | Results ($\mu g/m^3$) | | | | | Ambient Conditions | |
|---|---|---|---|---|---|---|---|---|
| | | $PM_{10}$ | $PM_{2.5}$ | $NO_2$ | $SO_2$ | TSP (24 Hours Average) | Humidity (%) | Temperature (°C) |
| ASR2 | 2022-12-21 16:00:00 | 10.57 | 2.51 | 0.00 | 5.63 | 74.10 | 81.66 | 28.18 |
| | 2022-12-21 17:00:00 | 35.16 | 14.78 | 0.00 | 8.77 | | 66.36 | 28.73 |
| | 2022-12-21 18:00:00 | 20.07 | 5.30 | 27.25 | 2.46 | | 73.38 | 29.84 |
| | 2022-12-21 19:00:00 | 19.22 | 5.69 | 17.41 | 7.59 | | 76.76 | 28.86 |
| | 2022-12-21 20:00:00 | 15.20 | 5.15 | 19.66 | 9.00 | | 82.66 | 27.41 |
| | 2022-12-21 21:00:00 | 20.75 | 8.10 | 7.48 | 9.41 | | 86.01 | 27.26 |
| | 2022-12-21 22:00:00 | 21.41 | 9.29 | 0.00 | 9.48 | | 86.24 | 27.10 |
| | 2022-12-21 23:00:00 | 20.61 | 9.13 | 7.98 | 7.63 | | 87.71 | 26.84 |
| | 2022-12-22 00:00:00 | 18.51 | 8.36 | 5.29 | 8.85 | | 87.45 | 26.62 |
| | 2022-12-22 01:00:00 | 19.02 | 8.67 | 17.32 | 8.75 | | 88.12 | 26.74 |
| | 2022-12-22 02:00:00 | 18.23 | 8.40 | 16.31 | 8.89 | | 89.51 | 26.40 |
| | 2022-12-22 03:00:00 | 18.79 | 8.69 | 13.23 | 8.97 | | 89.88 | 26.21 |
| | 2022-12-22 04:00:00 | 18.27 | 8.38 | 14.54 | 9.40 | | 88.06 | 25.74 |
| | 2022-12-22 05:00:00 | 19.22 | 8.60 | 19.08 | 11.53 | | 86.34 | 25.18 |
| | 2022-12-22 06:00:00 | 20.26 | 8.85 | 13.10 | 7.62 | | 81.19 | 25.10 |
| | 2022-12-22 07:00:00 | 21.83 | 9.42 | 16.66 | 3.41 | | 78.45 | 24.66 |
| | 2022-12-22 08:00:00 | 21.98 | 9.46 | 14.12 | 13.36 | | 78.12 | 25.37 |
| | 2022-12-22 09:00:00 | 29.99 | 12.87 | 14.96 | 21.23 | | 77.49 | 26.16 |
| | 2022-12-22 10:00:00 | 27.45 | 11.78 | 18.42 | 17.55 | | 80.12 | 26.69 |
| | 2022-12-22 11:00:00 | 25.86 | 11.06 | 14.79 | 16.40 | | 79.25 | 27.00 |
| | 2022-12-22 12:00:00 | 25.76 | 11.02 | 19.45 | 29.14 | | 74.12 | 27.69 |
| | 2022-12-22 13:00:00 | 23.28 | 9.96 | 8.83 | 22.13 | | 76.75 | 28.15 |
| | 2022-12-22 14:00:00 | 23.09 | 9.84 | 20.82 | 35.74 | | 71.18 | 28.39 |
| | 2022-12-22 15:00:00 | 22.61 | 9.52 | 13.61 | 24.88 | | 69.54 | 28.06 |
| Hourly Limit Values | TA Luft | - | - | 200 | 350 | - | - | - |
| | EU | - | - | 200 | 350 | - | - | - |
| | WHO Ambient Air Quality Guideline Value | - | - | - | - | - | - | - |
| Average | | **21.55** | **8.95** | **13.35** | **12.83** | **74.10** | **71.93** | **29.37** |
| Daily Limit Values | TA Luft | 50 | - | - | 125 | - | - | - |
| | EU | 50 | - | - | 125 | - | - | - |
| | WHO Ambient Air Quality Guideline Value | 45 | 15 | 25 | 40 | - | - | - |

airs
Air Quality Management Services

**Figure 5** Measurement Graphs for Location ASR2

airs Air Quality Management Services

**Table 8 Measurement Results for Location 5**

| Location | Sampling Date | Results ($\mu g/m^3$) | | | | | Ambient Conditions | |
|---|---|---|---|---|---|---|---|---|
| | | $PM_{10}$ | $PM_{2.5}$ | $NO_2$ | $SO_2$ | TSP (24 Hours Average) | Humidity (%) | Temperature (°C) |
| ASR3 | 2022-12-22 17:00:00 | 31.10 | 14.86 | 0.00 | 0.00 | 53.16 | 82.29 | 23.92 |
| | 2022-12-22 18:00:00 | 14.91 | 5.50 | 0.00 | 0.00 | | 89.61 | 27.72 |
| | 2022-12-22 19:00:00 | 13.19 | 5.85 | 0.00 | 0.00 | | 93.50 | 26.76 |
| | 2022-12-22 20:00:00 | 9.00 | 5.03 | 0.00 | 0.00 | | 97.96 | 25.98 |
| | 2022-12-22 21:00:00 | 6.58 | 3.33 | 0.00 | 0.00 | | 96.78 | 26.40 |
| | 2022-12-22 22:00:00 | 6.75 | 2.38 | 0.00 | 0.00 | | 93.89 | 27.35 |
| | 2022-12-22 23:00:00 | 5.78 | 1.99 | 0.00 | 0.00 | | 94.53 | 27.40 |
| | 2022-12-23 00:00:00 | 4.27 | 1.42 | 0.00 | 0.00 | | 95.37 | 27.31 |
| | 2022-12-23 01:00:00 | 7.03 | 2.37 | 0.00 | 0.00 | | 93.30 | 27.47 |
| | 2022-12-23 02:00:00 | 5.48 | 1.49 | 0.00 | 0.00 | | 92.14 | 27.41 |
| | 2022-12-23 03:00:00 | 9.53 | 3.52 | 0.00 | 0.00 | | 92.44 | 27.37 |
| | 2022-12-23 04:00:00 | 9.14 | 3.41 | 0.00 | 0.00 | | 92.80 | 27.31 |
| | 2022-12-23 05:00:00 | 11.10 | 4.49 | 0.00 | 0.00 | | 93.62 | 27.32 |
| | 2022-12-23 06:00:00 | 12.54 | 6.05 | 0.00 | 0.00 | | 94.99 | 26.29 |
| | 2022-12-23 07:00:00 | 10.66 | 6.38 | 0.00 | 0.00 | | 99.20 | 25.64 |
| | 2022-12-23 08:00:00 | 2.89 | 2.25 | 0.00 | 0.00 | | 98.94 | 25.69 |
| | 2022-12-23 09:00:00 | 4.26 | 2.46 | 20.71 | 0.00 | | 98.73 | 26.54 |
| | 2022-12-23 10:00:00 | 8.52 | 2.56 | 0.00 | 0.00 | | 92.46 | 28.11 |
| | 2022-12-23 11:00:00 | 13.63 | 3.99 | 0.00 | 0.00 | | 89.12 | 29.01 |
| | 2022-12-23 12:00:00 | 13.27 | 3.29 | 0.00 | 0.00 | | 87.89 | 29.58 |
| | 2022-12-23 13:00:00 | 20.68 | 5.51 | 0.00 | 0.00 | | 83.49 | 30.54 |
| | 2022-12-23 14:00:00 | 15.68 | 6.21 | 0.00 | 0.00 | | 90.19 | 27.33 |
| | 2022-12-23 15:00:00 | 16.77 | 5.44 | 0.00 | 0.00 | | 88.52 | 28.92 |
| | 2022-12-23 16:00:00 | 21.12 | 6.89 | 0.00 | 0.00 | | 86.31 | 29.36 |
| Hourly Limit Values | TA Luft | - | - | 200 | 200 | - | - | - |
| | EU | - | - | 200 | 350 | - | - | - |
| | WHO Ambient Air Quality Guideline Value | - | - | - | - | - | - | - |
| **Average** | | **11.41** | **4.44** | **0.86** | **0.00** | **53.16** | **71.93** | **29.37** |
| Daily Limit Values | TA Luft | 50 | - | - | 125 | - | - | - |
| | EU | 50 | - | - | 125 | - | - | - |
| | WHO Ambient Air Quality Guideline Value | 45 | 15 | 25 | 40 | - | - | - |

**Figure 6** Measurement Graphs for Location ASR3

airs Air Quality Management Services

**Table 9 Measurement Results for Location 6**

| Location | Sampling Date | Results ($\mu g/m^3$) | | | | | Ambient Conditions | |
|---|---|---|---|---|---|---|---|---|
| | | $PM_{10}$ | $PM_{2.5}$ | $NO_2$ | $SO_2$ | TSP (24 Hours Average) | Humidity (%) | Temperature (°C) |
| ASR5 | 2022-12-22 17:00:00 | 24.59 | 9.32 | 0.00 | 0.00 | 181.96 | 75.59 | 26.81 |
| | 2022-12-22 18:00:00 | 23.59 | 8.82 | 0.00 | 0.00 | | 73.95 | 26.79 |
| | 2022-12-22 19:00:00 | 25.33 | 9.64 | 0.00 | 0.00 | | 73.65 | 26.68 |
| | 2022-12-22 20:00:00 | 28.01 | 10.81 | 0.00 | 0.00 | | 74.82 | 26.79 |
| | 2022-12-22 21:00:00 | 28.51 | 11.36 | 0.00 | 0.00 | | 76.74 | 26.44 |
| | 2022-12-22 22:00:00 | 30.19 | 11.91 | 0.00 | 0.00 | | 76.09 | 26.69 |
| | 2022-12-22 23:00:00 | 26.70 | 10.63 | 0.00 | 0.00 | | 75.79 | 26.22 |
| | 2022-12-23 00:00:00 | 27.48 | 10.96 | 0.00 | 0.00 | | 75.53 | 26.20 |
| | 2022-12-23 01:00:00 | 27.81 | 12.93 | 0.00 | 0.00 | | 84.07 | 24.31 |
| | 2022-12-23 02:00:00 | 23.51 | 9.89 | 0.00 | 0.00 | | 81.92 | 25.79 |
| | 2022-12-23 03:00:00 | 34.15 | 12.99 | 0.00 | 0.00 | | 72.94 | 27.45 |
| | 2022-12-23 04:00:00 | 34.33 | 12.17 | 0.00 | 0.00 | | 70.52 | 28.61 |
| | 2022-12-23 05:00:00 | 34.67 | 11.52 | 0.00 | 0.00 | | 66.15 | 29.61 |
| | 2022-12-23 06:00:00 | 36.58 | 11.30 | 0.00 | 0.00 | | 84.98 | 27.14 |
| | 2022-12-23 07:00:00 | 21.18 | 9.59 | 0.00 | 0.00 | | 84.62 | 27.85 |
| | 2022-12-23 08:00:00 | 23.25 | 10.59 | 0.00 | 0.00 | | 83.57 | 28.29 |
| | 2022-12-23 09:00:00 | 20.75 | 9.68 | 0.00 | 0.00 | | 78.81 | 29.12 |
| | 2022-12-23 10:00:00 | 19.05 | 9.07 | 0.00 | 0.00 | | 83.47 | 27.74 |
| | 2022-12-23 11:00:00 | 19.12 | 9.16 | 0.00 | 0.00 | | 79.85 | 28.66 |
| | 2022-12-23 12:00:00 | 19.48 | 9.35 | 0.00 | 0.00 | | 77.93 | 28.71 |
| | 2022-12-23 13:00:00 | 19.64 | 9.36 | 0.00 | 0.00 | | 81.98 | 26.05 |
| | 2022-12-23 14:00:00 | 20.03 | 9.38 | 0.00 | 0.00 | | 77.99 | 28.23 |
| | 2022-12-23 15:00:00 | 21.16 | 9.70 | 0.00 | 0.00 | | 83.44 | 28.30 |
| | 2022-12-23 16:00:00 | 22.06 | 10.01 | 0.00 | 0.00 | | 87.36 | 27.42 |
| Hourly Limit Values | TA Luft | - | - | 200 | 350 | - | - | - |
| | EU | - | - | 200 | 350 | - | - | - |
| | WHO Ambient Air Quality Guideline Value | - | - | - | - | - | - | - |
| **Average** | | **25.47** | **10.42** | **0.00** | **0.00** | **181.96** | **80.59** | **28.63** |
| Daily Limit Values | TA Luft | 50 | - | - | 125 | - | - | - |
| | EU | 50 | - | - | 125 | - | - | - |
| | WHO Ambient Air Quality Guideline Value | 45 | 15 | 25 | 40 | - | - | - |

**Figure 7** Measurement Graphs for Location ASR2

airs Air Quality Management Services

**Table 10 Measurement Results for Location 7**

| Location | Sampling Date | Results ($\mu g/m^3$) | | | | | Ambient Conditions | |
|---|---|---|---|---|---|---|---|---|
| | | $PM_{10}$ | $PM_{2.5}$ | $NO_2$ | $SO_2$ | TSP (24 Hours Average) | Humidity (%) | Temperature (°C) |
| AQ4 | 2022-12-22 17:00:00 | 32.21 | 13.60 | 0.00 | 0.00 | 91.96 | 71.70 | 28.26 |
| | 2022-12-22 18:00:00 | 29.98 | 12.57 | 0.00 | 0.00 | | 72.83 | 28.23 |
| | 2022-12-22 19:00:00 | 27.57 | 11.55 | 0.00 | 0.00 | | 73.15 | 28.10 |
| | 2022-12-22 20:00:00 | 24.23 | 10.12 | 0.00 | 0.00 | | 75.16 | 27.75 |
| | 2022-12-22 21:00:00 | 24.33 | 10.15 | 0.00 | 0.00 | | 78.99 | 26.79 |
| | 2022-12-22 22:00:00 | 24.40 | 10.30 | 0.00 | 0.00 | | 80.33 | 26.43 |
| | 2022-12-22 23:00:00 | 21.65 | 9.34 | 0.00 | 0.00 | | 81.53 | 25.97 |
| | 2022-12-23 00:00:00 | 21.45 | 9.45 | 0.00 | 0.00 | | 82.60 | 26.03 |
| | 2022-12-23 01:00:00 | 19.28 | 8.68 | 0.00 | 0.00 | | 82.45 | 26.03 |
| | 2022-12-23 02:00:00 | 19.74 | 8.99 | 0.00 | 0.00 | | 76.51 | 25.56 |
| | 2022-12-23 03:00:00 | 18.93 | 8.73 | 0.00 | 0.00 | | 77.65 | 25.50 |
| | 2022-12-23 04:00:00 | 18.19 | 8.46 | 0.00 | 0.00 | | 73.81 | 25.54 |
| | 2022-12-23 05:00:00 | 19.63 | 8.96 | 0.00 | 0.00 | | 76.16 | 24.87 |
| | 2022-12-23 06:00:00 | 18.69 | 8.33 | 0.00 | 0.00 | | 69.27 | 24.22 |
| | 2022-12-23 07:00:00 | 19.78 | 8.55 | 0.00 | 0.00 | | 73.75 | 25.18 |
| | 2022-12-23 08:00:00 | 21.33 | 9.12 | 0.00 | 0.00 | | 73.55 | 26.39 |
| | 2022-12-23 09:00:00 | 21.63 | 9.20 | 0.00 | 0.00 | | 75.13 | 26.17 |
| | 2022-12-23 10:00:00 | 29.53 | 12.58 | 0.00 | 0.00 | | 84.55 | 27.32 |
| | 2022-12-23 11:00:00 | 28.31 | 12.04 | 0.00 | 0.00 | | 81.92 | 27.70 |
| | 2022-12-23 12:00:00 | 25.13 | 10.66 | 0.00 | 0.00 | | 85.06 | 27.13 |
| | 2022-12-23 13:00:00 | 25.24 | 10.69 | 0.00 | 0.00 | | 80.56 | 27.68 |
| | 2022-12-23 14:00:00 | 24.55 | 10.41 | 0.00 | 0.00 | | 72.48 | 28.82 |
| | 2022-12-23 15:00:00 | 23.94 | 10.09 | 0.00 | 0.00 | | 72.52 | 28.45 |
| | 2022-12-23 16:00:00 | 23.48 | 9.77 | 0.00 | 0.00 | | 71.14 | 28.59 |
| Hourly Limit Values | TA Luft | - | - | 200 | 350 | | - | - |
| | EU | - | - | 200 | 350 | | - | - |
| | WHO Ambient Air Quality Guideline Value | - | - | - | - | | - | - |
| Average | | 23.47 | 10.10 | 0.00 | 0.00 | 91.96 | 81.17 | 27.66 |
| Daily Limit Values | TA Luft | 50 | - | - | 125 | | - | - |
| | EU | 50 | - | - | 125 | | - | - |
| | WHO Ambient Air Quality Guideline Value | 45 | 15 | 25 | 40 | | - | - |

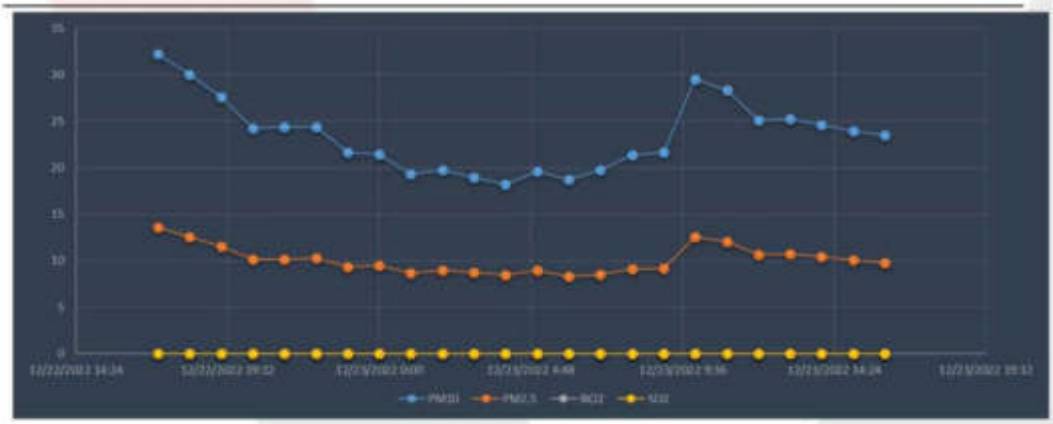

**Figure 8** Measurement Graphs for Location AQ4

## 6. ASSESSMENT

The air quality measurement study was carried out with the aim of determining the air pollutants on ambient air quality. Results were assessed according to the TA LUFT, EU Council Directive 2008/50/EC and WHO limit values and this report was prepared. According to air quality measurement studies, background air quality values are comply with air quality standards.

## ANNEX 2: NOISE LEVEL HOURLY RECORDS

| | Station 1 | | ST 2 | | ST3 | | ST4 | | ST 5 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | DbA | Date time | DbA | Date/time | DbA | Date time | DbA | Date time | DbA | Date Time |
| | 53.7 | 12/27/21:19 | 55 | 12/27/20:52 | 54.8 | 12/28/10:40 | 52.9 | 12/28/10:59 | 51.2 | 12/28/10:20 |
| | 51.3 | 12/27/22:18 | 47.6 | 12/27/21:51 | 52 | 12/28/11:40 | 40.9 | 12/28/11:59 | 49.3 | 12/28/11:20 |
| | 49.7 | 12/27/23:18 | 51.6 | 12/27/22:50 | 53.5 | 12/28/12:39 | 60.6 | 12/28/12:58 | 54.8 | 12/28/12:21 |
| | 50.9 | 12/28/0:17 | 48.7 | 12/27/23:50 | 52.5 | 12/28/13:39 | 54.4 | 12/28/13:58 | 55.2 | 12/28/13:21 |
| | 50.2 | 12/28/1:16 | 53.2 | 12/28/0:59 | 54.4 | 12/28/14:38 | 57.4 | 12/28/14:57 | 60.3 | 12/28/14:20 |
| | 49.9 | 12/28/2:16 | 48.1 | 12/28/1:58 | 51.8 | 12/28/15:38 | 65.9 | 12/28/15:57 | 52.5 | 12/28/15:20 |
| | 49.9 | 12/28/3:15 | 48 | 12/28/2:57 | 52.4 | 12/28/16:38 | 58.1 | 12/28/16:57 | 49.7 | 12/28/16:19 |
| | 49.5 | 12/28/4:14 | 52.4 | 12/28/3:57 | 55.3 | 12/28/17:37 | 55.3 | 12/28/17:56 | 43.2 | 12/28/17:19 |
| | 45 | 12/28/5:13 | 51.2 | 12/28/4:56 | 57.2 | 12/28/18:37 | 52.3 | 12/28/18:56 | 52.1 | 12/28/18:18 |
| | 50.2 | 12/28/6:13 | 56.1 | 12/28/5:55 | 56 | 12/28/19:36 | 42.2 | 12/28/19:55 | 40.3 | 12/28/19:17 |
| | 60.1 | 12/28/7:12 | 57.7 | 12/28/6:55 | 58.8 | 12/28/20:36 | 44.8 | 12/28/20:55 | 41.8 | 12/28/20:17 |
| | 58.2 | 12/28/8:11 | 50.1 | 12/28/7:54 | 58.1 | 12/28/21:35 | 40.2 | 12/28/21:54 | 39.1 | 12/28/21:17 |
| | 62.8 | 12/28/9:11 | 63.1 | 12/28/8:53 | 57.3 | 12/28/22:35 | 39.8 | 12/28/22:54 | 34.2 | 12/28/22:16 |
| | 56.1 | 12/28/10:20 | 46.6 | 12/28/9:52 | 56.3 | 12/28/23:35 | 41.4 | 12/28/23:54 | 33.8 | 12/28/23:16 |
| | 58.3 | 12/28/11:13 | 49.5 | 12/28/10:52 | 56.9 | 12/29/0:34 | 40.7 | 12/29/0:53 | 40.1 | 12/29/0:15 |
| | 61.8 | 12/28/12:12 | 50.3 | 12/28/11:55 | 55.2 | 12/29/1:34 | 41.6 | 12/29/1:53 | 35.2 | 12/29/1:15 |
| | 65.5 | 12/28/13:11 | 54.3 | 12/28/12:54 | 55.4 | 12/29/2:33 | 41.5 | 12/29/2:52 | 33.6 | 12/29/2:14 |
| | 59.9 | 12/28/14:10 | 49.4 | 12/28/13:52 | 55.6 | 12/29/3:33 | 39.4 | 12/29/3:52 | 30.2 | 12/29/3:14 |
| | 61 | 12/28/15:09 | 65.5 | 12/28/14:51 | 55.4 | 12/29/4:33 | 46.8 | 12/29/4:52 | 31.1 | 12/29/4:14 |
| | 58.3 | 12/28/16:08 | 52.6 | 12/28/15:50 | 57.6 | 12/29/5:32 | 50.8 | 12/29/5:51 | 35.3 | 12/29/5:13 |
| | 57.5 | 12/28/17:07 | 54.2 | 12/28/16:59 | 56.6 | 12/29/6:32 | 42.2 | 12/29/6:51 | 40.4 | 12/29/6:13 |
| | 55.3 | 12/28/18:15 | 60 | 12/28/17:58 | 56.7 | 12/29/7:31 | 47.1 | 12/29/7:50 | 45.8 | 12/29/7:12 |
| | 53.6 | 12/28/19:14 | 53.7 | 12/28/18:47 | 56.3 | 12/29/8:31 | 49.7 | 12/29/8:50 | 50.6 | 12/29/8:12 |
| | 51.2 | 12/28/20:14 | 56.4 | 12/28/19:36 | 59.3 | 12/29/9:31 | 54.4 | 12/29/9:59 | 47.3 | 12/29/9:11 |
| | | | | | | | | | | |
| Max | 65.5 | | 65.5 | | 59.3 | | 65.9 | | 60.3 | |
| Min | 45 | | 46.6 | | 51.8 | | 39.4 | | 30.2 | |
| Avr | 54.996 | | 53.138 | | 55.642 | | 48.350 | | 43.629 | |

## ANNEX 3. MARINE ECOLOGY SURVEY; FISH CENSUS DATA

Fish Census data M8

| Site | Family | Scientific.Name | Abundance |
|---|---|---|---|
| M8 | Acanthuridae | Acanthurus leucosternon | Rare |
| M8 | Acanthuridae | Acanthurus nigricauda | Rare |
| M8 | Acanthuridae | Ctenochaetus striatus | Rare |
| M8 | Acanthuridae | Naso brevirostris | Rare |
| M8 | Balistidae | Balistapus undulatus | Rare |
| M8 | Balistidae | Odonus niger | Rare |
| M8 | Balistidae | Odonus niger | Common |
| M8 | Balistidae | Sufflamen.bursa | Rare |
| M8 | Chaetodontidae | Chaetodon collare | Rare |
| M8 | Chaetodontidae | Chaetodon falcula | Rare |
| M8 | Chaetodontidae | Chaetodon guttatissimus | Rare |
| M8 | Chaetodontidae | Chaetodon kleinii | Rare |
| M8 | Chaetodontidae | Forcipiger flavissimus | Rare |
| M8 | Chaetodontidae | Heniochus diphreutes | Rare |
| M8 | Cirrhitidae | Paracirrhites arcatus | Rare |
| M8 | Cirrhitidae | Paracirrhites forsteri | Rare |
| M8 | Labridae | Bodianus diana | Rare |
| M8 | Labridae | Halichoeres cosmetus | Rare |
| M8 | Labridae | Halichoeres hortulanus | Rare |
| M8 | Labridae | Labroides bicolor | Rare |
| M8 | Labridae | Pseudocheilinus hexataenia | Rare |
| M8 | Labridae | Thalassoma amblycephalum | Rare |
| M8 | Pomacanthidae | Centropyge multispinis | Rare |
| M8 | Pomacentridae | Chromis dimidiata | Rare |
| M8 | Pomacentridae | Chromis dimidiata | Common |
| M8 | Pomacentridae | Chromis weberi | Rare |
| M8 | Pomacentridae | Pomacentrus caeruleus | Rare |
| M8 | Pomacentridae | Pomacentrus philippinus | Common |
| M8 | Scaridae | Chlorurus sordidus | Rare |
| M8 | Scaridae | Scarus tricolor | Rare |
| M8 | Serranidae | Anyperodon leucogrammicus | Rare |
| M8 | Serranidae | Cephalopholis argus | Rare |
| M8 | Serranidae | Cephalopholis leopardus | Rare |
| M8 | Serranidae | Epinephelus spilotoceps | Rare |
| M8 | Serranidae | Pseudanthias evansi | Abundant |
| M8 | Serranidae | Pseudanthias squamipinnis | Rare |

Fish Census data M9

| Site | Family | Scientific.Name | Abundance |
|---|---|---|---|
| M9 | Acanthuridae | Acanthurus binotatus | Rare |
| M9 | Acanthuridae | Ctenochaetus striatus | Rare |
| M9 | Acanthuridae | Ctenochaetus truncatus | Rare |
| M9 | Acanthuridae | Naso brevirostris | Rare |
| M9 | Acanthuridae | zebrasoma desjardinii | Rare |
| M9 | Acanthuridae | Zebrasoma scopas | Rare |
| M9 | Balistidae | Balistapus undulatus | Rare |
| M9 | Balistidae | Melichthys indicus | Rare |
| M9 | Balistidae | Odonus niger | Rare |
| M9 | Balistidae | Odonus niger | Common |
| M9 | Balistidae | Sufflamen.bursa | Rare |
| M9 | Chaetodontidae | Chaetodon guttatissimus | Rare |
| M9 | Chaetodontidae | Chaetodon kleinii | Rare |
| M9 | Chaetodontidae | Chaetodon madagaskariensis | Rare |
| M9 | Chaetodontidae | Forcipiger flavissimus | Rare |
| M9 | Chaetodontidae | Hemitaurichthys zoster | Rare |
| M9 | Labridae | Bodianus axillaris | Rare |
| M9 | Labridae | Halichoeres cosmetus | Rare |
| M9 | Labridae | Halichoeres hortulanus | Rare |
| M9 | Labridae | Labroides bicolor | Rare |
| M9 | Labridae | Pseudocheilinus hexataenia | Rare |
| M9 | Labridae | Thalassoma amblycephalum | Rare |
| M9 | Lutjanidae | Pterocaesio.tile | Common |
| M9 | Nemipteridae | Scolopsis bilineata | Rare |
| M9 | Pomacentridae | Chromis dimidiata | Common |
| M9 | Pomacentridae | Chromis dimidiata | Abundant |
| M9 | Pomacentridae | Chromis opercularis | Rare |
| M9 | Pomacentridae | Plectroglyphidodon lacrymatus | Rare |
| M9 | Pomacentridae | Pomacentrus chrysurus | Rare |
| M9 | Pomacentridae | Pomacentrus nagasakiensis | Rare |
| M9 | Pomacentridae | Pomacentrus philippinus | Rare |
| M9 | Pomacentridae | Pomacentrus philippinus | Common |
| M9 | Scaridae | Hipposcarus harid | Rare |
| M9 | Scaridae | Scarus tricolor | Rare |