

# **Technical Specification for Khawr Hajar – Eastern Shore**

# 1. SITE DESCRIPTION

## 1.1 Location

|  |   |
|--|---|
| Governorate/ Region                    | Ash Sharqiyah   |
| Wilayat                                | Sur   |
| Distance from the Centre of Wilayat    | 30 km   |
| Nearest Locality                       | Sur   |
| Fame of the Site/ Distinctive Features | The northern and southern parts of the reserve consist of limestone rock and the khawrs have sabkha along their south and west shores. Khawr Hajar serves as a harbour for fishermen using smaller boats and dhows. No gill nets are allowed in the khawrs. |
| Facilities in the Site                 | None  |
| Features of Surrounding Areas          | Ras Al-Had area is designated as Turtle Reserve.  |

## 1.2 Natural Conditions

|                     |   |
|---------------------|---|
| Climate Zone        | Sharqiyah Zone  |
| General Terrain     | Flat plain  |
| Geological Features | Clarke (1986) proposed this area as a scenic reserve, including the turtle nesting beaches and the two large tidal inlets, Khawr Quq and Khawr Hajar, which form an enclosed body of water; a narrow strip of land separates the two parts. There are both sandy and rocky shores.  |
| Soil                | Seashores on Khawr Hajar divided into 2 areas by small rock outcrop. South part of Khawr Hajar lies on the beach with wide and very gentle slope and extended to rocky coast to the south. This area is covered with deep and coarse sands with anaerobic condition. Soil colours are bright yellowish to brownish in surface and dull yellowish grey in subsurface. The soils near rock outcrop at southern coastal areas are relatively shallow. Soils within 50m from southern rocky coast are very shallow (less than 50cm). The salinity of ground water is ranging from 4.4 to 6.3%. The salinities at southern beach near rock outcrops show relatively high values.<br>Details are shown in attached table “ <b>Attachment 4: Soil Profile in Khawr Hajar</b> ” and “ <b>Attachment 9: Soil Profile of Samples in Khawr Hajar</b> ” |
| Water               | There were no significant constraints on the water quality. Water was clear. The value of salinity and DO was 3.9‰ and 8.25 mg/l, respectively.<br>Details are shown in attached table “ <b>Attachment 5: Surface Water Quality in Khawr Hajar</b> ”.   |
| Fauna               | Small fish (blennies) were also observed.<br>7 species of crustaceans were recorded. Where the tide level reaches rocks they are covered by oysters ( <i>Saccostrea cucullata</i> ). At the east end of the khawr the sand is fine grained with some silt and clay. Near the water line with shallow water and wet sand, two species of crab were collected ( <i>Macrophthalmus depressus</i> and <i>Metapograpsus messor</i> ) and two species of shrimp ( <i>alpheus</i> sp and callianassid). Small fish (blennies) were also observed. Further up the beach in wet sand, snails were abundant ( <i>Cerithidea cingulata</i> , <i>Nassarius coronatus</i> , <i>N. arcularia plicatus</i> and <i>N. albescens gemmuliferus</i> ) as well as hermit  |

|                                    |  |
|------------------------------------|--|
|                                    | <p>crabs (<i>Diogenes</i> sp). Buried in the sediment three species of molluscs (<i>Dosinia alta</i>, <i>Umbonium vestiarium</i> and <i>Tellina valtonis</i>) and annelids were found. At the top of the beach, fiddler crabs (<i>Uca annulipes</i>) and the ghost crab (<i>Ocypode jousseaumei</i>) occurred.</p> <p>12 species of birds were recorded. Many (4-500) gulls and terns roosted on sandbanks in the middle of Khawr Hajar. During the winter, waders were numerous (60) along the waterline and 15 herons were observed.</p> <p>7 species of molluscs were recorded. Buried in the sediment three species of molluscs (<i>Dosinia alta</i>, <i>Umbonium vestiarium</i> and <i>Tellina valtonis</i>) and a species of annelid were found.</p> |
| Flora                              | <p>Most of Khawr Hajar is surrounded by a rocky shoreline without vegetation but some sandy areas support large clumps of halophytic plants with a total plant cover of about 10%. The dominant species was <i>Zygophyllum qatarense</i>, a bright green shrublet with jointed, oblong, succulent leaves. Trees approaching the coastal area were dominated by <i>Prosopis cineraria</i>. No mangroves occur in Khawr Hajar but they do occur in Khawr Jaramah.</p>  |
| Impacts from the Surrounding Areas | <p>Resort development would affect environmental condition in the future.</p>  |

### 1.3 Socio-economic Situation

|   |   |
|---|---|
| Population of the Wilayat (2001)          | 65 thousand   |
| Population of the Nearest Locality (1993) | 1.9 thousand  |
| Main Economic Activities                  | Fishery   |
| Infrastructure                            | Palace of Abu Dhabi Princess is located here.   |
| Main Usage                                | Fishing, tourism  |
| Community Interference with the Area      | Beach Hotel is under construction. Recreational use is seasonal. A number of overnight campers visit drastically during summer. Ras Al Had is a town with an important fishing boat harbour, with a variety of recreational activities including turtle-watching. |
| Cultural Significance                     | None  |

### 1.4 Legal Setup and Development Plans

|  |   |
|--|---|
| Land Ownership and Land Use Designation                | Turtle Reserve ( <b>Figure 4 Turtle Reserve</b> )   |
| Development Plans in the Site and the Surrounding Area | Resort development area   |
| Existing Conservation Proposal                         | Clarke (1986) proposed this area as a scenic reserve, including the turtle nesting beaches and the two large tidal inlets, Khawr Quq and Khawr Hajar, which form an enclosed body of water; a narrow strip of land separates the two parts. |

## 2. PROGRAMME AND PROJECT

### 2.1 Prerequisite

|                                  |   |
|----------------------------------|---|
| Legal Setup for Land Use Control | Set a distinct boundary of Turtle Reserve (see 4.2 Required Action for Conservation and Management)   |
| Facility Development Control     | No permanent structure in Turtle Reserve, except hide for bird watching, sign and information boards, and boardwalk or pedestrian bridge. Footpath should be designated but not paved. No permanent commercial buildings such as restaurants, hotels, shops and mechanised amusement facilities in the park development area. Basic activities in this park are relaxation and picnicking. Partial lighting for safety only. Utilities lines (water and electricity should be at a minimum) and setback at 150 m from the edge of Mangrove. |

### 2.2 Description of Programmes

|   |   |
|---|---|
| Facility Development Programme          | (1) Visitor service and information facilities development.   |
| Restoration and Afforestation Programme | (2) Mangrove planting project   |
| Monitoring Programme                    | (3) Mangrove monitoring project (4) Soil and water monitoring project (5) Fauna and flora monitoring project (6) Pollution monitoring project (7) Monitoring project on legal setup and development plans   |
| Public Awareness Programme              | It will include an educational programme for school children and conservation campaign for residents of the Wilayat. Required materials and facilities are (8) Pamphlets and posters distributed to the residents, (9) Information boards describing significance of the natural environment. |

### 2.3 Implementation Mechanism

| Projects  | Responsible Agencies | Implementing Body/ Agencies             | Related Agencies |
|---|----------------------|---|------------------|
| (1) Visitor service and information facilities development. | MRMEWR               | Wilayat Sur                             | MCI              |
| (2) Mangrove planting project                               | MRMEWR               | Wilayat Sur                             |                  |
| (3) Mangrove Monitoring Project                             | MRMEWR               | Wilayat Sur                             |                  |
| (4) Soil and Water Monitoring Project                       | MRMEWR               | Wilayat Sur                             |                  |
| (5) Fauna and Flora Monitoring Project                      | MRMEWR               | MRMEWR/<br>Omani Institute<br>for Birds |                  |
| (6) Pollution Monitoring Project                            | MRMEWR               | Wilayat Sur/<br>MRMEWR                  |                  |
| (7) Monitoring Project on Legal Setup and Development Plans | MRMEWR               | Wilayat Sur                             |                  |
| (8) Pamphlets and posters distributed to the residents      | MRMEWR               | MRMEWR                                  | MOE              |
| (9) Information boards                                      | MRMEWR               | MRMEWR                                  | MOE              |

## 2.4 Implementation Schedule

| Project No. | 1 st | 2 nd | 3 rd | 4 th | 5 th | 6th | 7th | 8th | 9 th | 10 th |
|-------------|------|------|------|------|------|-----|-----|-----|------|-------|
| (1)         |      |      |      |      |      |     |     |     |      |       |
| (2)         |      |      |      |      |      |     |     |     |      |       |
| (3)         |      |      |      |      |      |     |     |     |      |       |
| (4)         |      |      |      |      |      |     |     |     |      |       |
| (5)         |      |      |      |      |      |     |     |     |      |       |
| (6)         |      |      |      |      |      |     |     |     |      |       |
| (7)         |      |      |      |      |      |     |     |     |      |       |
| (8)         |      |      |      |      |      |     |     |     |      |       |
| (9)         |      |      |      |      |      |     |     |     |      |       |

## 3. IMPLEMENTATION PLAN

### 3.1 Restoration and Afforestation

#### 3.1.1 Existing Mangrove Area

|                                 |  |
|---------------------------------|--|
| Location and Area               | No mangrove trees ( <b>Figure 2 Location Map</b> ) |
| Conditions of Existing Mangrove | No mangrove  |

#### 3.1.2 Plantation Area

|                       |  |
|-----------------------|--|
| Tidal Condition       | Normal   |
| Wave and Wind         | South wind in summer, north wind in winter, 20% wave frequency in summer, 40% in winter  |
| Flood                 | Every 5-10 years   |
| Water Salinity and pH | Salinity; <u>3.9 %</u> , pH; <u>8.4</u> (“ <b>Attachment 5: Surface Water Quality in Khawr Hajar</b> ”)  |
| Soil Conditions       | Sandy soil at whole khawr, shallow soils near rocky surface areas. Surveyed data is in the “ <b>Attachment 4: Soil Profile in Khawr Hajar</b> ” of this technical specification.   |
| Potential Area        | Along eastern seashore. See “ <b>Figure 3 Planting Map</b> ”. Southern shore in mapping area of Khawr Hajar has higher potentiality for new mangrove plantation than northern shore. Soils are deep and coarse sand except the area near southern-end shallow shore. Northern shore in mapping area of Khawr Hajar has potential area but there are some constraints because of narrow beach and relatively steep slope. |

**Table 3.1 Location and Areas of Potential Planting Area(s)**

|        | Designated Area | Area (ha) |
|--------|-----------------|-----------|
| Area-1 | (1) in Figure 3 | 10.9      |
| Area-2 | (2) in Figure 3 | 1.0       |

### 3.1.3 Planting Schedule

|  |  |
|--|--|
| Total Planting Area                        | 11.9 ha  |
| Planting Season and Timing                 | January ~ February   |
| Seed/ Seedlings Supply Source and Location | Seed from existing mangrove area at Khawr Jaramah<br>Seeding from temporary nursery in Khawr Quq   |
| Planting Method                            | Start from the south edge of south-east shore. Extend to northward. Detailed technical guidelines should refer to the “ <b>Technical Guideline for Afforestation</b> ” attached with this technical specification. |

**Table 3.2 Planting Schedule**

| Year            | 1 st | 2 nd | 3 rd | 4 th | 5 th | 6th | 7th | 8th | 9 th | 10 th | Total |
|-----------------|------|------|------|------|------|-----|-----|-----|------|-------|-------|
| Planting area-1 |      |      |      |      |      |     |     |     |      |       |       |
| Planting area-2 |      |      |      |      |      |     |     |     |      |       |       |

**Table 3.3 Seeds/ Seedling Supply Schedule**

| Year                                   | 1st | 2nd | 3rd | 4th | 5th | 6th | 7th | 8th | 9th | 10th | Total |
|--|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|-------|
| Season/ time                           |     |     |     |     |     |     |     |     |     |      |       |
| Planting area (ha)                     |     | 1.4 | 1.4 | 1.3 | 1.3 | 1.3 | 1.3 | 1.2 | 1.2 | 1.2  | 11.9  |
| Number of seeds/ seedlings (thousands) |     | 14  | 14  | 13  | 13  | 13  | 13  | 12  | 12  | 12   | 119   |

### 3.1.4 Conservation Area

|                  |                     |
|------------------|---------------------|
| Area of Land Use | Turtle Reserve Area |
|------------------|---------------------|

### 3.1.5 Required Action for Conservation and Management

|  |   |
|--|---|
| Inspection   | Daily observation by park management body, 2 to 4 times of inspection by MRMEWR (Mangrove Information Centre)   |
| Cleaning   | Management Body   |
| Replantation of Seedlings Growing Bad, Dead or Washed Away         | MRMEWR (Mangrove Information Centre) for 5 years after plantation.  |
| Service for Associated Facilities                                  | Regularly by Management Body  |
| Patrol and Enforcement   | Daily ordinary patrol by a police office of Wilayat is required, and the management body regularly inspects facilities conditions and littering and waste disposal to the ground and water in Turtle Reserve areas.   |
| Restoration and Rehabilitation Work                                | The mangrove plantation work in the planting area described in the previous section is necessary.   |
| Facilities Required for the Conservation and Management Activities | Directional signs along the highway and entrance to the access road(s), guide signs, and information boards can be seen in the Turtle Reserve area to explain the significance of the reserve and major flora and fauna. Plant Nursery not only for this site but also for mangrove planting site in the vicinity is required. Footpath and boardwalk for observation of wildlife as well as mangrove are also necessary. |

## 3.2 Monitoring

### 3.2.1 Mangrove

|                   |   |
|-------------------|---|
| Monitoring Method | Select and label trees for monitoring. Monitor mangrove by using the attached “ <b>Attachment 1: Field Monitoring Sheet for Mangrove</b> ”. |
| Frequency         | Planting mangrove:<br>First 4 years: annual monitoring<br>After 4 years: every 2 years  |
| Monitoring Target | Planting mangrove:<br>Select 20 trees at random and label.  |
| Baseline Data     | No Baseline data.   |

### 3.2.2 Soil and Water

|                   |  |
|-------------------|--|
| Monitoring Method | Monitor soil and water in and around mangrove plantation by using attached table “ <b>Attachment 3: Field Monitoring Sheet for Soil and Water (Khawr Hajar)</b> ”. |
| Frequency         | Soil: (New plantation area) Before plantation and<br>Every two year after plantation<br>Water; Every year<br>(Outflow water at low tide should be measured.)       |
| Monitoring Target |  |
| Baseline Data     | See attached table “ <b>Attachment 4: Soil Profile in Khawr Hajar</b> ” and “ <b>Attachment 5: Surface Water Quality in Khawr Hajar</b> ”.                         |

### 3.2.3 Fauna and Flora

|                   |   |
|-------------------|---|
| Monitoring Method | Monitor fauna and flora by using the attached “ <b>Attachment 6: Field Monitoring Sheet for Fauna and Flora and Pollution</b> ”. For the observation of birds, an institute that is studying birds in Oman can be the best institute to take a part of the monitoring work by sub-contract basis. |
| Frequency         | At least twice a year   |
| Monitoring Target | <b>Attachment 6</b>   |
| Baseline Data     | The result of field reconnaissance of fauna and flora is shown in “ <b>Attachment 7: Result of Field Reconnaissance of Fauna and Flora and Pollution in Khawr Hajar</b> ”.  |

### 3.2.4 Pollution (garbage and waste)

|                   |   |
|-------------------|---|
| Monitoring Method | Monitor pollution by using the attached “ <b>Attachment 6: Field Monitoring Sheet for Fauna and Flora and Pollution</b> ”. Water Quality and Soil Sample Tests should be carried out by MRMEWR. |
| Frequency         | At least twice a year   |
| Monitoring Target | <b>Attachment 6</b>   |
| Baseline Data     | See “ <b>Attachment 7: Result of Field Reconnaissance of Fauna and Flora and Pollution in Khawr Hajar</b> ”.  |

### 3.2.5 Change on Legal Setup and Development Plans

|                   |  |
|-------------------|--|
| Frequency         | At least once a year   |
| Monitoring Target | Land Ownership, Land Use Designation, Development Plans in the Site and Surrounding Area |

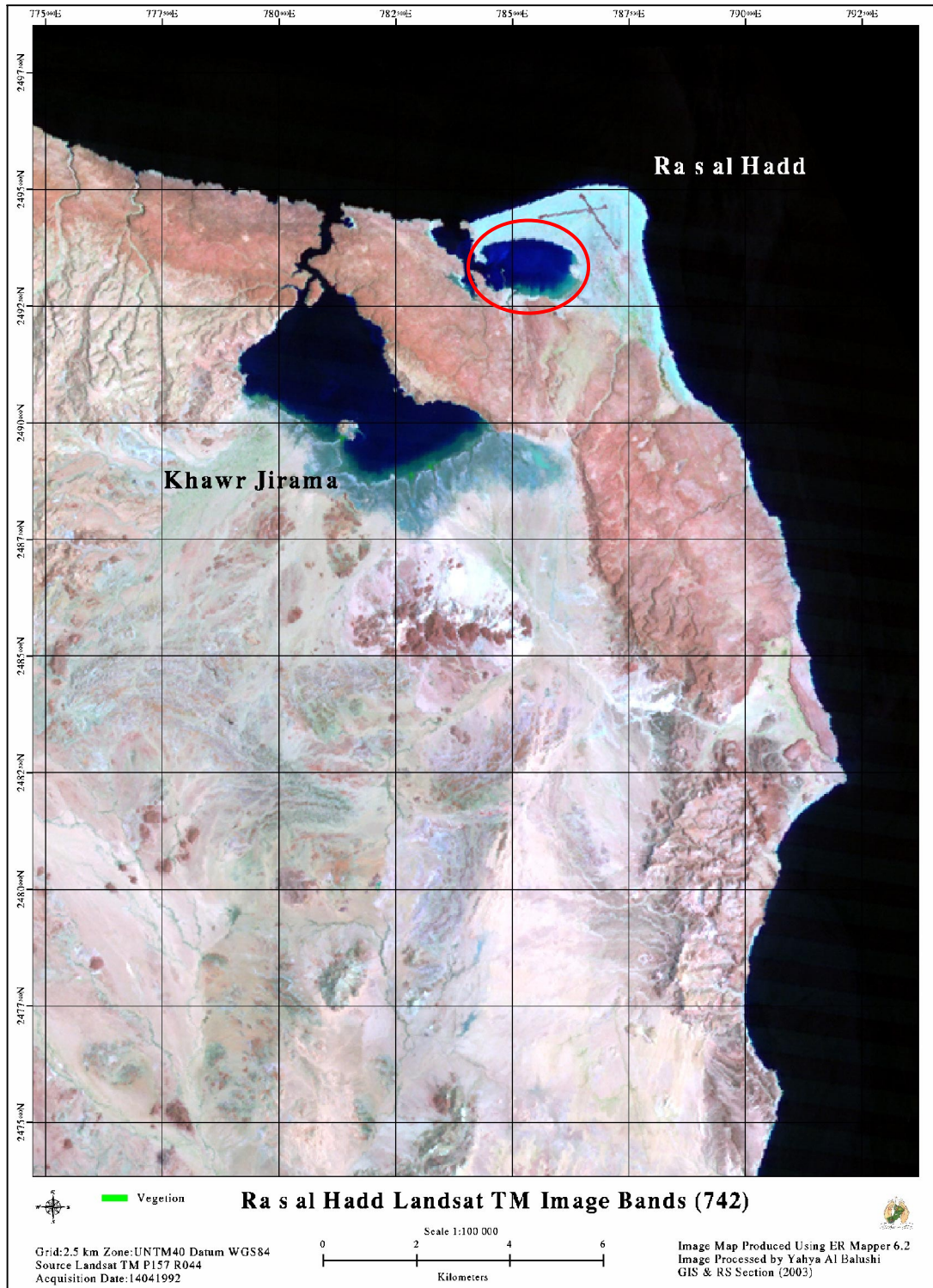
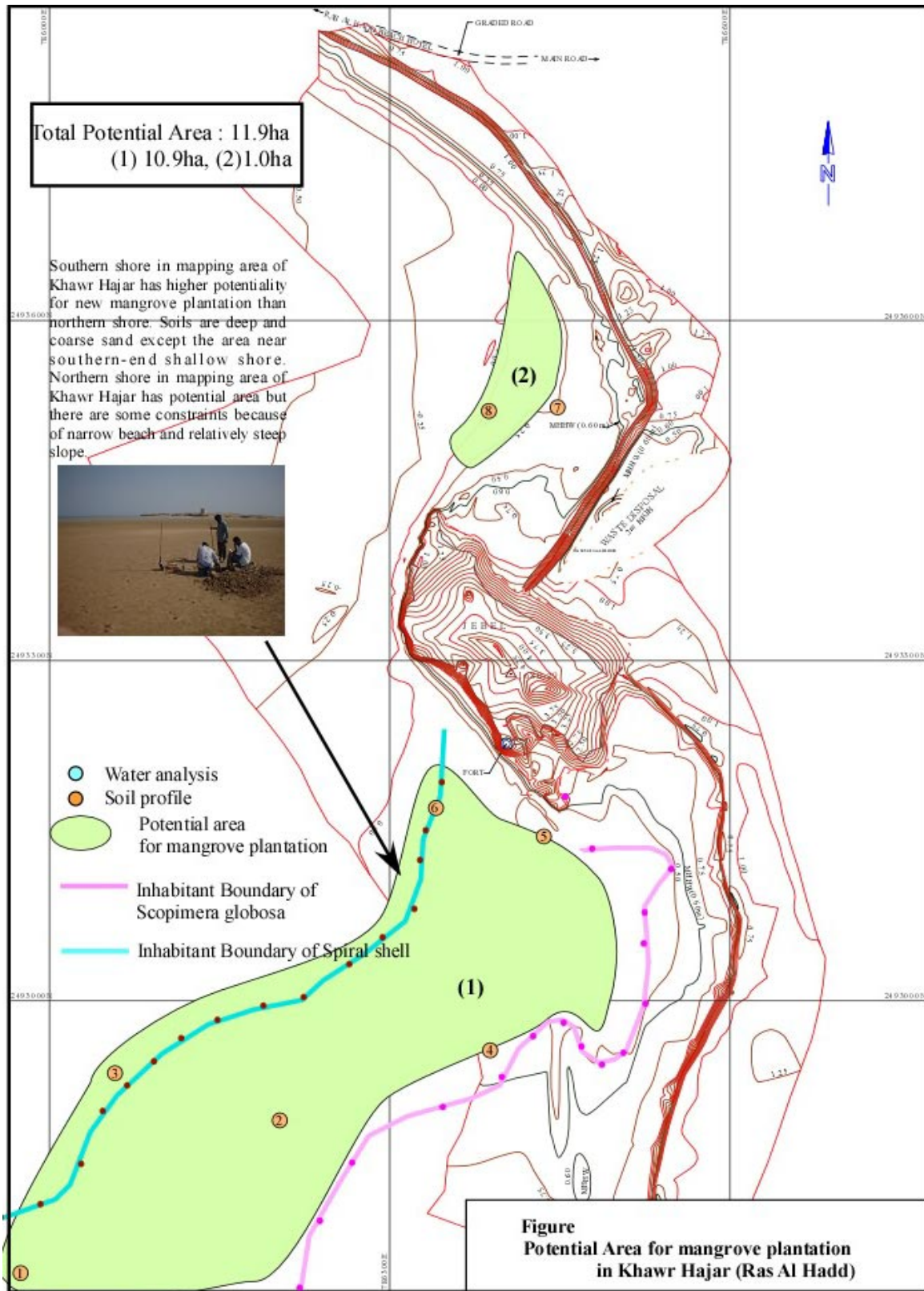


Figure 1 Key Map





Figure 2 Location Map



**Figure 3 Planting Map**

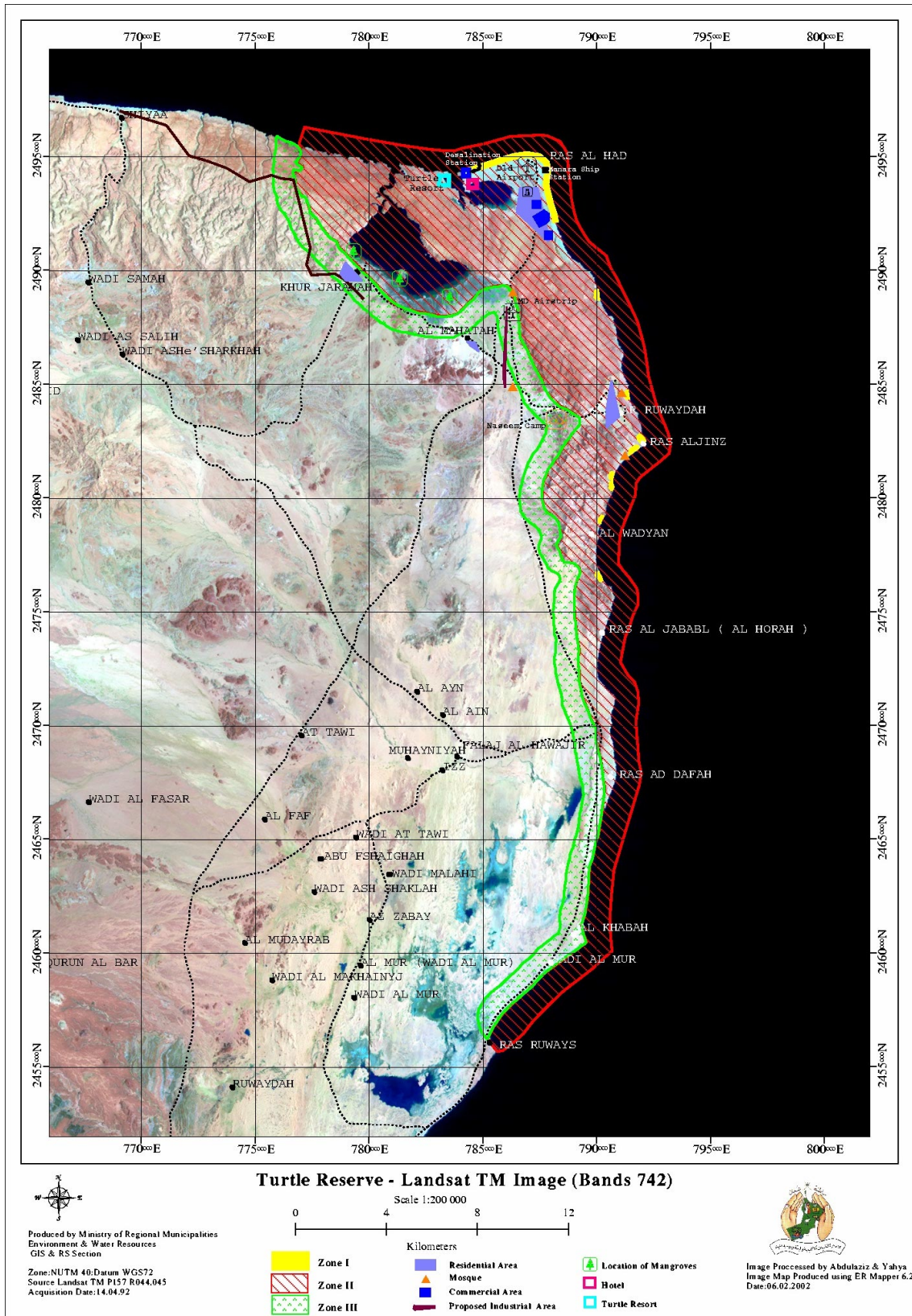


Figure 4 Turtle Reserve

**Attachment 1: Field Monitoring Sheet for Mangrove (Khawr Hajar)**

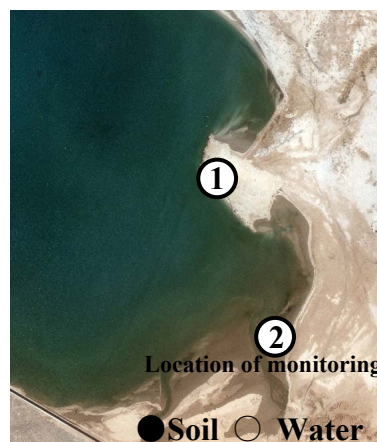
| <b>Mangrove Observation Records</b>  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |  |  |   |   |  |  |  |
|--|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|----|--|--|---|---|--|--|--|
| <p>1) Identification No. _____</p> <p>2) Location by GPS (WGS 84, UTM)<br/>                     Easting: _____<br/>                     Northing: _____</p> <p>3) Photograph No. _____</p> <p>4) Observation of tree size and shape<br/>                     a) Tree Height (cm) <input style="width: 60px; height: 20px;" type="text"/><br/>                     b) Trunk diameter near bottom (cm) <input style="width: 60px; height: 20px;" type="text"/><br/>                     c) Live branches at the position about 1.3m off the centre of tree bottom (painted)<br/>                     Branch/ limb diameter measured in cm</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%; text-align: center;">1</td> <td style="width: 25%; text-align: center;">2</td> <td style="width: 25%; text-align: center;">3</td> <td style="width: 25%; text-align: center;">4</td> </tr> <tr> <td style="text-align: center;"><input style="width: 60px; height: 20px;" type="text"/></td> <td style="text-align: center;"><input style="width: 60px; height: 20px;" type="text"/></td> <td style="text-align: center;"><input style="width: 60px; height: 20px;" type="text"/></td> <td style="text-align: center;"><input style="width: 60px; height: 20px;" type="text"/></td> </tr> <tr> <td style="text-align: center;">5</td> <td style="text-align: center;">6</td> <td style="text-align: center;">7</td> <td style="text-align: center;">8</td> </tr> <tr> <td style="text-align: center;"><input style="width: 60px; height: 20px;" type="text"/></td> <td style="text-align: center;"><input style="width: 60px; height: 20px;" type="text"/></td> <td style="text-align: center;"><input style="width: 60px; height: 20px;" type="text"/></td> <td style="text-align: center;"><input style="width: 60px; height: 20px;" type="text"/></td> </tr> <tr> <td style="text-align: center;">9</td> <td style="text-align: center;">10</td> <td></td> <td></td> </tr> <tr> <td style="text-align: center;"><input style="width: 60px; height: 20px;" type="text"/></td> <td style="text-align: center;"><input style="width: 60px; height: 20px;" type="text"/></td> <td></td> <td></td> </tr> </table> <p>5) Observation of tree history, health and environment<br/>                     a) History<br/>                     Tree shape: _____<br/>                     Sign of cut in the past: _____</p> <p>b) Health<br/>                     Nodes with leaves: _____<br/>                     Inter-node length: _____<br/>                     Leaf length: _____<br/>                     Leaf colour: _____<br/>                     Looks / die back: _____</p> <p>c) Environment<br/>                     Soil depth / texture: _____<br/>                     Surface water Salinity: _____<br/>                     Ground level: _____<br/>                     Position: _____</p> | 1   | 2   | 3   | 4 | <input style="width: 60px; height: 20px;" type="text"/> | <input style="width: 60px; height: 20px;" type="text"/> | <input style="width: 60px; height: 20px;" type="text"/> | <input style="width: 60px; height: 20px;" type="text"/> | 5 | 6 | 7 | 8 | <input style="width: 60px; height: 20px;" type="text"/> | <input style="width: 60px; height: 20px;" type="text"/> | <input style="width: 60px; height: 20px;" type="text"/> | <input style="width: 60px; height: 20px;" type="text"/> | 9 | 10 |  |  | <input style="width: 60px; height: 20px;" type="text"/> | <input style="width: 60px; height: 20px;" type="text"/> |  |  | <div style="border: 1px solid black; padding: 5px; min-height: 150px;"> <p><b>Memo:</b><br/>                             (specific information or data significant for the tree will be written here)</p> </div> |
| 1  | 2   | 3   | 4   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |  |  |   |   |  |  |  |
| <input style="width: 60px; height: 20px;" type="text"/>  | <input style="width: 60px; height: 20px;" type="text"/> | <input style="width: 60px; height: 20px;" type="text"/> | <input style="width: 60px; height: 20px;" type="text"/> |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |  |  |   |   |  |  |  |
| 5  | 6   | 7   | 8   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |  |  |   |   |  |  |  |
| <input style="width: 60px; height: 20px;" type="text"/>  | <input style="width: 60px; height: 20px;" type="text"/> | <input style="width: 60px; height: 20px;" type="text"/> | <input style="width: 60px; height: 20px;" type="text"/> |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |  |  |   |   |  |  |  |
| 9  | 10  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |  |  |   |   |  |  |  |
| <input style="width: 60px; height: 20px;" type="text"/>  | <input style="width: 60px; height: 20px;" type="text"/> |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |  |  |   |   |  |  |  |
| <div style="border: 1px solid black; padding: 5px; min-height: 60px;"> <p><b>Note:</b></p> </div>  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |  |  |   |   |  |  |  |

**Attachment 3: Field Monitoring Sheet for Soil & Water (Khawr Hajar)**

|              |                        |
|--------------|------------------------|
| Location     |                        |
| Date / time: | ___ / ___, 200__ : ___ |
| Recorder     |                        |
|              |                        |

**General Condition in plantation area:**

(garbage, rubbish, leaf, alga, crab, shell, etc)



**(1) Soil Condition**

|                        |              | New planted area<br>( ) | New planted area<br>( ) |
|------------------------|--------------|-------------------------|-------------------------|
| Coordinate             | Easting      |                         |                         |
|                        | Northing     |                         |                         |
| Surface condition      |              |                         |                         |
| Soil Texture           | 0-10cm       |                         |                         |
|                        | 30-40cm      |                         |                         |
|                        | 50-60cm      |                         |                         |
| Soil Colour            | 0-10cm       |                         |                         |
|                        | 30-40cm      |                         |                         |
|                        | 50-60cm      |                         |                         |
| Root development       |              |                         |                         |
| Depth of surface humus |              |                         |                         |
| Free water             | GWL* (cm)    |                         |                         |
|                        | pH           |                         |                         |
|                        | Salinity (%) |                         |                         |

Soil colour by Munsell notation, GPS\*:by UTM of WGS84 GWL: Ground water level

**(2) Surface Water Quality**

(Observation time: : )

|                    |          | Sea water ① | Khawr mouth ② |
|--------------------|----------|-------------|---------------|
| Coordinate         | Easting  | 786300      | 786450        |
|                    | Northing | 2493300     | 2492950       |
| Surface waste      |          |             |               |
| pH                 |          |             |               |
| Salinity (%)       |          |             |               |
| Temperature (C)    |          |             |               |
| DO (mg/l)          |          |             |               |
| Turbidity / Colour |          |             |               |

**Attachment 4: Soil Profile in Khawr Hajar**

| Profile No. | Location                                      | Coordinate (UTM) |          | Ground Water |     | Texture      |                  |                       | Soil Colour        |                                    | Hardness                     |              |              |
|-------------|---|------------------|----------|--------------|-----|--------------|------------------|-----------------------|--------------------|------------------------------------|------------------------------|--------------|--------------|
|             |   | Easting          | Northing | Depth (cm)   | pH  | Salinity (%) | Surface (0-30cm) | Sub-surface (30-60cm) | Deep layer (>90cm) | Surface (0-30cm)                   | Sub-surface (30-60cm)        | Surface      | Sub-surface  |
| 1           | Northern part of beach (Southern beach)       | 785970           | 2492777  | 53           | 7.9 | 5.7          | Sand             | Sand                  | Sand               | Dull yellowish orange              | Dull yellow                  | Friable      | Friable      |
| 2           | Central upper beach (Southern beach)          | 786184           | 2492877  | 47           | 7.6 | 6            | Sand             | Sand                  | Sand               | Dull yellowish brown - dull yellow | Dull yellow                  | Friable      | Friable      |
| 3           | Central lower beach (Southern beach)          | 786387           | 2492973  | 80           | 7.8 | 6.3          | Sand             | Sand                  | Sand               | Brown - Olive brown                | Olive brown                  | Friable      | Friable      |
| 4           | Upper southern part of beach (Southern beach) | 786049           | 2492924  | 29           | 8   | 4.4          | Sand             | Sand                  | Sand               | Greyish olive - grey               | -                            | -            | -            |
| 5           | Upper beach near tower (Southern beach)       | 786422           | 2493170  | 36           | 7.8 | 4.4          | Sand             | Sand                  | Sand               | Dull yellow                        | Dull yellow - greyish yellow | Very friable | -            |
| 6           | Lower beach near tower (Southern beach)       | 786336           | 2493167  | -            | -   | -            | Sand             | Sand                  | Sand               | Greyish olive - grey               | -                            | -            | -            |
| 7           | Upper beach (Northern beach)                  | 786446           | 2493526  | 45           | 7.9 | 4.3          | Sand             | Sand                  | Sand               | Yellowish brown                    | Yellowish brown - light      | Loose        | Very friable |
| 8           | Lower beach (Northern beach)                  | 786393           | 2493515  | 17           | 7.5 | 5.1          | Sand             | Sand                  | Sand               | Dark greyish yellow -              | Greyish yellow               | -            | -            |

Data of hardness in parenthesis by hand observation

**Attachment 5: Surface Water Quality in Khawr Hajar**

| No. | Location             | Coordinate (UTM) |          | Colour/ Visibility | pH  | Salinity (%) | Temperature (C) | DO (mg/l) | COD (mg/l) | NO3 (mgNO <sup>3</sup> /l) |
|-----|----------------------|------------------|----------|--------------------|-----|--------------|-----------------|-----------|------------|----------------------------|
|     |                      | Easting          | Northing |                    |     |              |                 |           |            |                            |
| 1   | Mouth of Khawr Hajar | -                | -        | Clear              | 8.4 | 3.9          | 28.3            | 8.25      | -          | -                          |

Observation Date: 16-17 May, 2003

**Attachment 6: Field Monitoring Sheet for Fauna and Flora and Pollution (Khawr Hajar)**

|                             |             |
|-----------------------------|-------------|
| <b>Location</b> Khawr Hajar | <b>Date</b> |
| <b>Time</b>                 | <b>Tide</b> |
| <b>Recorder</b>             |             |

|   |         |
|---|---------|
| <b>Bird counts:</b> species:  | number: |
| Expected winter birds: gulls and terns roost on sandbanks in the middle of khawr. Waders (oystercatcher, curlew, plovers) and herons feed along the waterline. Osprey<br>Expected summer birdes: gulls and terns, waders (e.g. whimbrel, plovers), herons |         |

|                   |   |
|-------------------|---|
| <b>Pollution:</b> |   |
| Evidence of:      | solid waste (garbage), liquid waste, oil. |
| Water quality:    | clear/muddy/green/salinity                |
| Fishing:          | nets                                      |

|                                |
|--------------------------------|
| <b>Domestic/feral animals:</b> |
|--------------------------------|

|                    |
|--------------------|
| <b>Vegetation:</b> |
| Sandy edges:       |
| Rocky edges:       |

|                  |
|------------------|
| <b>Animals:</b>  |
| Intertidal zone: |

|                        |
|------------------------|
| <b>Other comments:</b> |
|------------------------|

**Attachment 7: Result of Field Reconnaissance of Fauna and Flora and Pollution in Khawr Hajar**

**Field Monitoring Sheet for Fauna and Flora and Pollution Sample (1)**

|                 |             |             |            |
|-----------------|-------------|-------------|------------|
| <b>Location</b> | Khawr Hajar | <b>Date</b> | 29/12/2002 |
| <b>Time</b>     | 09.00       | <b>Tide</b> | Low tide   |
| <b>Recorder</b> | N.V. Clarke |             |            |

**Bird counts:** species: 12 number: 575  
 Many (4-500) gulls and terns roosted on sandbanks in the middle of Khawr Hajar. Waders were numerous (60) along the waterline and 15 herons were observed.  
 Conspicuous species: oystercatcher, curlew, plovers

**Pollution:**  
 Evidence of: solid waste (garbage), liquid waste, oil none  
 Water quality: clear/muddy/green/salinity clear  
 Fishing: nets none

**Domestic/feral animals:** goats

**Vegetation:**  
 Most of Khawr Hajar is surrounded by a rocky shoreline without vegetation but some sandy areas support large clumps of halophytic plants with a total plant cover of about 10%. The dominant species was *Zygophyllum qatarense*, a bright green shrublet with jointed, oblong, succulent leaves.

The sediment at the east end of the khawr is deep enough to try planting mangroves.

**Animals:**  
 Where the tide level reaches the rocks are covered by oysters (*Saccostrea cucullata*). The area sampled was the bay at the east end of the khawr separated by a small tower. The sand is fine grained with some silt and clay.

Near the water line with shallow water and wet sand, two species of crab were collected (*Macrophthalmus depressus* and *Metapograpsus messor*) and two species of shrimp (*alpheus* sp and callianassid). Small fish (blennies) were also observed. Further up the beach in wet sand, abundant snails (*Cerithidea cingulata* – 200/m<sup>2</sup> and *Nassarius coronatus*, *N. arcularia plicatus* and *N. albescens gemmuliferus*) and hermit crabs (*Diogenes* sp) were seen on the surface. Buried in the sediment three species of molluscs (*Dosinia alta*, *Umbonium vestiarium* and *Tellina valtonis*) and a species of annelid were found. At the top of the beach, small holes (50/m<sup>2</sup>) of the fiddler crab (*Uca annulipes*) were found as well as large red annelid worms (Capitellidae - 100/m<sup>2</sup>). Larger holes of the ghost crab (*Ocypode jousseaumei*) were found in the upper part of the sandflats. A beetle larva (Tiger beetle) was found buried in the sediment.

**Other comments:**  
 Large lagoon with coral at the entrance, tourism development occurring.



**Field Monitoring Sheet for Fauna and Flora and Pollution Sample (2)**

|                 |             |             |          |
|-----------------|-------------|-------------|----------|
| <b>Location</b> | Khawr Hajar | <b>Date</b> | 26/07/03 |
| <b>Time</b>     | 15.00       | <b>Tide</b> | Mid tide |
| <b>Recorder</b> | N.V. Clarke |             |          |

**Bird counts:** species: 7 number: 150  
 Many (100) gulls and terns roosted on sandbanks in the middle of khawr Hajar. Waders were numerous (whimbrel, plovers) at the waterline, 3 herons were observed.

**Pollution:**

|                |   |       |
|----------------|---|-------|
| Evidence of:   | solid waste (garbage), liquid waste, oil. | none  |
| Water quality: | clear/muddy/green/salinity                | clear |
| Fishing: nets  |   | none  |

**Domestic/feral animals:** goats

**Vegetation:**

Most of khawr Hajar is surrounded by a rocky shoreline without vegetation but some sandy areas support large clumps of halophytic plants with a total plant cover of about 10%. The dominant species was *Zygophyllum qatarense*, a bright green shrublet with jointed, oblong, succulent leaves.

Some algal mats occurred on the south side of the khawr.

**Animals:**

Where the tide level reaches the rocks are covered by oysters (*Saccostrea cucullata*).

At the bays on the east side, larger holes of the ghost crab (*Ocypode jousseaumei*) were found in the upper part of the sandflats. Smaller holes belonged to the fiddler crab (*Uca annulipes*).

2 species of crab were collected from mid tide levels (*Macrophthalmus depressus* and *Metapograpsus messor*) and two species of shrimp (*alpheus* sp and callianassid). In wet sand, there were abundant snails (*Cerithidea cingulata*, *Nassarius coronatus*, *N. arcularia plicatus* and *N. albescens gemmuliferus*) and hermit crabs (*Diogenes* sp) on the surface.

Buried in the sediment three species of molluscs (*Dosinia alta*, *Umbonium vestiarium* and *Tellina valtonis*) and a species of annelid were found.

**Other comments:**

Large lagoon with coral at the entrance, tourism development occurring nearby.

**Attachment 8: Site Photos (Khawr Hajar)**

**General Condition**



Beach front of the area



Upper beach of the area

**Soil Condition**



Central lower beach, Southern beach (Profile No. 3)



Upper beach near tower, Southern beach (Profile No. 5)

**Attachment 9: Soil Profile of Samples in Khawr Hajar (Ras Al Had)**

(Profile No. Had/Hjr- 3)

|                      |                                      |   |      |
|----------------------|--------------------------------------|---|------|
| Location             | Central lower beach (Southern beach) |   |      |
| Coordinate (UTM)     | Eastng: 786387                       | Northng: 2492973  |      |
| Physiologic position | Lower marine terrace                 | Topography  | Flat |
| Soil Classification  | Typic Psammaquents                   |   |      |
| Parent material      | Marine deposit                       | Depth of free water   | 80cm |
| Vegetation/ mangrove | No vegetation                        |   |      |
|                      | Description of soil profile          |   |      |
| C                    | 0-18cm                               | Brown (10YR 4/6), friable, coarse sand with massive structure; few shell fragments; gradual smooth boundary       |      |
| C                    | 18-62cm                              | Olive brown (2.5Y 4/4), friable, coarse sand with massive structure; few shell fragments; gradual smooth boundary |      |
| C                    | 62-80cm                              | Dull yellow (2.5Y 6/3), coarse sand with massive structure; common shell fragments                                |      |
| C                    | 80-100cm                             | Coarse sand (by soil auger)   |      |

\*1: Descriptions of structure and boundary are estimated from limited observation of core sample.

\*2: Texture was classified at field by visual and touching observation

(Profile No. Had/Hjr- 5)

|                      |   |  |      |
|----------------------|---|--|------|
| Location             | Upper beach near tower (Southern beach) |  |      |
| Coordinate (UTM)     | Eastng: 786422                          | Northng: 2493170   |      |
| Physiologic position | Middle marine terrace                   | Topography   | Flat |
| Soil Classification  | Typic Psammaquents                      |  |      |
| Parent material      | Marine deposit                          | Depth of free water  | 35cm |
| Vegetation/ mangrove | No vegetation                           |  |      |
|                      | Description of soil profile             |  |      |
| C                    | 0-20cm                                  | Dull yellow (2.5Y 6/4), very friable, coarse sand with massive structure; few shell fragments; gradual smooth boundary |      |
| C                    | 20-54cm                                 | Dull yellow (2.5Y 6/3), coarse sand with massive structure; common shell fragments; gradual smooth boundary            |      |
| C                    | 54-74cm                                 | Greyish yellow (2.5Y 6/2), coarse sand with massive structure; common bright brown (7.5YR 5/6) mottles                 |      |
| C                    | 74-100cm                                | Coarse sand (by soil auger)  |      |

\*1: Descriptions of structure and boundary are estimated from limited observation of core sample.

\*2: Texture was classified at field by visual and touching observation

# **Technical Specification for Wadi Muraysis**

# 1. SITE DESCRIPTION

## 1.1 Location

|  |   |
|--|---|
| Governorate/ Region                    | Ash Sharqiyah   |
| Wilayat                                | Masirah   |
| Distance from the Centre of Wilayat    | 30 km   |
| Nearest Locality                       | Wadi Muraysis   |
| Fame of the Site/ Distinctive Features | Fishing   |
| Facilities in the Site                 | None  |
| Features of Surrounding Areas          | This site is located in the central western coast in the Masirah Island. The wide shallow beach at Umm Muraysis is exposed to strong monsoon winds in the summer. |

## 1.2 Natural Conditions

|                     |  |
|---------------------|--|
| Climate Zone        | Wusta Zone   |
| General Terrain     | Flat plain   |
| Geological Features | The wide shallow beach at Umm Muraysis is composed of hard fine sand with some silt. It appeared well oxygenated below the surface without any dark colouration.   |
| Soil                | <p>The area is located in the tidal zone with very gentle slope. Soils on this area are basically deep coarse sand. Surface soils up to 30cm are soft but compact sand soil layers with shell fragments lie underneath. In the tidal area, the sediments with soil (fine sand + silt) and decomposed seaweeds lie on the surface. The soils on channels are silty. Shallow soil with beach rock is found in front of the small rock hill near the centre.</p> <p>The salinities of groundwater at the depth of 10cm in the central area of inter tidal zone ranged from 7 to 8%. The salinity of groundwater at the depth of 20-30cm on the upper tidal zone was more than 10%.</p> <p>Details are shown in attached table “<b>Attachment 4: Soil Profile in Wadi Muraysis (Masirah Island)</b>” and “<b>Attachment 9: Soil Profile of Samples in Wadi Muraysis (Masirah Island)</b>”.</p> |
| Water               | <p>The values of salinity, pH, DO of seawater were 4.1%, 8.3 and DO 6.9 mg/l, respectively. But salinity on tidal zone in this area showed high a value (5.0%).</p> <p>Details are shown in attached table “<b>Attachment 5: Surface Water Quality in Wadi Muraysis (Masirah Island)</b>”.</p>   |
| Fauna               | At the top of the beach fiddler crabs and ghost crabs were found ( <i>Uca inversa</i> , <i>Ocyropode saratan</i> ). Lower down the beach bivalves were common including <i>Lanternula erythraensis</i> and <i>Dosinia alta</i> . Two species of burrowing crabs occurred at this mid tide level ( <i>Macrophthalmus depressus</i> , <i>Scopimera crabricauda</i> ). The small mud snail, <i>Cerithidea cingulata</i> , was abundant on the wet sand surface further down the beach. The other common snail on the surface was the fast moving <i>Nassarius persicus</i> , while the small hermit crab ( <i>Diogenes</i> ) was also common. Along the low water line waders were common including the crab plover, sand plovers and curlew.   |

|                                    |   |
|------------------------------------|---|
| Flora                              | The beach at Muraysis is surrounded by terrestrial vegetation. No halophytes were recorded. |
| Impacts from the Surrounding Areas | Strong wind and wave in Summer  |

### 1.3 Socio-economic Situation

|   |               |
|---|---------------|
| Population of the Wilayat (2001)          | 10 thousand   |
| Population of the Nearest Locality (1993) | 10 thousand   |
| Main Economic Activities                  | Fishery       |
| Infrastructure                            | Fishing jetty |
| Main Usage                                | Bare land     |
| Community Interference with the Area      | Almost none   |
| Cultural Significance                     | None          |

### 1.4 Legal Setup and Development Plans

|  |      |
|--|------|
| Land Ownership and Land Use Designation                | None |
| Development Plans in the Site and the Surrounding Area | None |
| Existing Conservation Proposal                         | None |

## 2. PROGRAMME AND PROJECT

### 2.1 Prerequisite

|                                  |   |
|----------------------------------|---|
| Legal Setup for Land Use Control | Designate Nature Reserve. Set a distinct boundary of NR (see 4.2 Required Action for Conservation and Management).  |
| Facility Development Control     | No permanent structure in NR, except hide for bird watching, sign and information boards, and boardwalk or pedestrian bridge. Footpath should be designated but not paved. No permanent commercial buildings such as restaurants, hotels, shops and mechanised amusement facilities in the park development area. Basic activities in this park are relaxation and picnicking. Partial lighting for safety only. Utilities lines (water and electricity should be at a minimum) and setback at 150 m from the edge of Mangrove. |

### 2.2 Description of Programmes

|   |   |
|---|---|
| Facility Development Programme          | None  |
| Restoration and Afforestation Programme | (1) Mangrove planting project   |
| Monitoring Programme                    | (2) Mangrove monitoring project (3) Soil and water monitoring project (4) Fauna and flora monitoring project (5) Pollution monitoring project (6) Monitoring project on legal setup and development plans |

|                            |  |
|----------------------------|--|
| Public Awareness Programme | It will include an educational programme for school children and conservation campaign for residents of the Wilayat. Required materials and facilities are (7) Pamphlets and posters distributed to the residents, 8) Information boards describing significance of the natural environment. |
|----------------------------|--|

### 2.3 Implementation Mechanism

| Projects  | Responsible Agencies | Implementing Body/ Agencies             | Related Agencies |
|---|----------------------|---|------------------|
| (1) Mangrove planting project                               | MRMEWR               | Wilayat Masirah                         |                  |
| (2) Mangrove Monitoring Project                             | MRMEWR               | Wilayat Masirah                         |                  |
| (3) Soil and Water Monitoring Project                       | MRMEWR               | Wilayat Masirah                         |                  |
| (4) Fauna and Flora Monitoring Project                      | MRMEWR               | MRMEWR/<br>Omani Institute<br>for Birds |                  |
| (5) Pollution Monitoring Project                            | MRMEWR               | Wilayat Masirah/<br>MRMEWR              |                  |
| (6) Monitoring Project on Legal Setup and Development Plans | MRMEWR               | Wilayat Masirah                         |                  |
| (7) Pamphlets and posters distributed to the residents      | MRMEWR               | MRMEWR                                  | MOE              |
| (8) Information boards                                      | MRMEWR               | MRMEWR                                  | MOE              |

### 2.4 Implementation Schedule

| Project No. | 1 st | 2 nd | 3 rd | 4 th | 5 th | 6th | 7th | 8th | 9 th | 10 th |
|-------------|------|------|------|------|------|-----|-----|-----|------|-------|
| (1)         |      |      |      |      |      |     |     |     |      |       |
| (2)         |      |      |      |      |      |     |     |     |      |       |
| (3)         |      |      |      |      |      |     |     |     |      |       |
| (4)         |      |      |      |      |      |     |     |     |      |       |
| (5)         |      |      |      |      |      |     |     |     |      |       |
| (6)         |      |      |      |      |      |     |     |     |      |       |
| (7)         |      |      |      |      |      |     |     |     |      |       |
| (8)         |      |      |      |      |      |     |     |     |      |       |

## 3. IMPLEMENTATION PLAN

### 3.1 Restoration and Afforestation

#### 3.1.1 Existing Mangrove Area

|                                 |  |
|---------------------------------|--|
| Location and Area               | There are no mangrove trees in this site. <b>(Figure 2 Location Map)</b> |
| Conditions of Existing Mangrove | N/A  |

### 3.1.2 Plantation Area

|                       |   |
|-----------------------|---|
| Tidal Condition       | Normal  |
| Wave and Wind         | Strong in summer  |
| Flood                 | Every 5 to 10 years   |
| Water Salinity and pH | ("Attachment 5: Surface Water Quality in Wadi Muraysis")  |
| Soil Conditions       | Surveyed data is in the "Attachment 4: Soil Profile in Wadi Muraysis" of this technical specification.  |
| Potential Area        | See <b>Figure 3 Planting Area</b> . Soils are deep and coarse sands but compact at lower layer. The areas of upper tidal zone are not suitable due to high salinity in ground water. Lower beach along long tidal zone may be possible for transplantation. The countermeasure against floating alga and/or seaweed may be necessary. Boundary is not clearly identified. |

**Table 3.1 Location and Areas of Potential Planting Area(s)**

|        | Designated Area | Area (ha) |
|--------|-----------------|-----------|
| Area-1 | (1) in Figure 3 | 1.0       |

### 3.1.3 Planting Schedule

|  |  |
|--|--|
| Total Planting Area                        | 1.0 ha   |
| Planting Season and Timing                 | January ~ February   |
| Seed/ Seedlings Supply Source and Location | Seed from existing mangrove at Mahawt Island<br>Seedling from temporary nursery at Mahawt Island   |
| Planting Method                            | Start from the area near rock hill. Extend to southward. Detailed technical guidelines should refer to the "Technical Guideline for Afforestation" attached with this technical specification. |

**Table 3.2 Planting Schedule**

| Year            | 1 st | 2 nd | 3 rd | 4 th | 5 th | 6th | 7th | 8th | 9 th | 10 th | Total |
|-----------------|------|------|------|------|------|-----|-----|-----|------|-------|-------|
| Planting area-1 |      |      |      |      |      |     |     |     |      |       | 1.0   |

**Table 3.3 Seeds/ Seedling Supply Schedule**

| Year                                   | 1st | 2nd     | 3rd     | 4th     | 5th     | 6th | 7th | 8th | 9th | 10th | Total |
|--|-----|---------|---------|---------|---------|-----|-----|-----|-----|------|-------|
| Season/ time                           |     | Jan/Feb | Jan/Feb | Jan/Feb | Jan/Feb |     |     |     |     |      |       |
| Planting area (ha)                     |     | 0.25    | 0.25    | 0.25    | 0.25    |     |     |     |     |      | 1.0   |
| Number of seeds/ seedlings (thousands) |     | 2.5     | 2.5     | 2.5     | 2.5     |     |     |     |     |      | 10    |

### 3.1.4 Conservation Area

|                  |      |
|------------------|------|
| Area of Land Use | None |
|------------------|------|



### 3.1.5 Required Action for Conservation and Management

|  |  |
|--|--|
| Inspection   | Daily observation by the management body, 2 to 4 times of inspection by MRMEWR (Mangrove Information Centre)   |
| Cleaning   | Management Body  |
| Replantation of Seedlings Growing Bad, Dead or Washed Away         | MRMEWR (Mangrove Information Centre) for 5 years after plantation.   |
| Service for Associated Facilities                                  | Regularly by Management Body   |
| Patrol and Enforcement   | Daily ordinary patrol by a police office of Wilayah is required, and the management body regularly inspects facilities conditions and littering and waste disposal to the ground and water in NR areas.                                |
| Restoration and Rehabilitation Work                                | The mangrove plantation work in the planting area described in the previous section is necessary.  |
| Facilities Required for the Conservation and Management Activities | Directional signs along the highway and entrance to the access road(s), guide signs in the reserve, and information boards in the NR area can be seen in the area to explain the significance of the reserve and major flora and fauna |

## 3.2 Monitoring

### 3.2.1 Mangrove

|                   |   |
|-------------------|---|
| Monitoring Method | Select and label trees for monitoring. Monitor mangrove by using the attached “ <b>Attachment 1: Field Monitoring Sheet for Mangrove</b> ”. |
| Frequency         | Planting mangrove:<br>First 4 years: annual monitoring<br>After 4 years: every 2 years  |
| Monitoring Target | Planting mangrove:<br>Select 20 trees at random and label.  |
| Baseline Data     | No Baseline data.   |

### 3.2.2 Soil and Water

|                   |   |
|-------------------|---|
| Monitoring Method | Monitor soil and water in and around mangrove vegetation by using attached table “ <b>Attachment 3: Field Monitoring Sheet for Soil and Water (Wadi Muraysis in Masirah Island)</b> ”.                          |
| Frequency         | Soil: (New plantation area) Before plantation and<br>Every two years after the plantation<br>Water; Before (Apr) and after (Nov) monsoon season (Every year)<br>(Outflow water at low tide should be measured.) |
| Monitoring Target |   |
| Baseline Data     | See attached table “ <b>Attachment 4: Soil Profile in Wadi Muraysis</b> ” and “ <b>Attachment 5: Surface Water Quality in Wadi Muraysis</b> ”.  |

### 3.2.3 Fauna and Flora

|                   |   |
|-------------------|---|
| Monitoring Method | Monitor fauna and flora by using the attached “ <b>Attachment 6: Field Monitoring Sheet for Fauna and Flora and Pollution</b> ”. For the observation of birds, an institute that is studying birds in Oman can be the best institute to take a part of the monitoring work by sub-contract basis. |
| Frequency         | At least twice a year   |
| Monitoring Target | <b>Attachment 6</b>   |
| Baseline Data     | The result of field reconnaissance of flora and fauna is shown in “ <b>Attachment 7: Result of Field Reconnaissance of Fauna and Flora and Pollution in Wadi Muraysis</b> ”.  |

### 3.2.4 Pollution (garbage and waste)

|                   |   |
|-------------------|---|
| Monitoring Method | Monitor pollution by using the attached “ <b>Attachment 6: Field Monitoring Sheet for Fauna and Flora and Pollution</b> ”. Water Quality and Soil Sample Tests should be carried out by MRMEWR. |
| Frequency         | At least twice a year   |
| Monitoring Target | <b>Attachment 6</b>   |
| Baseline Data     | See “ <b>Attachment 7: Result of Field Reconnaissance of Fauna and Flora and Pollution in Wadi Muraysis</b> ”.  |

### 3.2.5 Change on Legal Setup and Development Plans

|                   |  |
|-------------------|--|
| Frequency         | At least once a year   |
| Monitoring Target | Land Ownership, Land Use Designation, Development Plans in the Site and Surrounding Area |

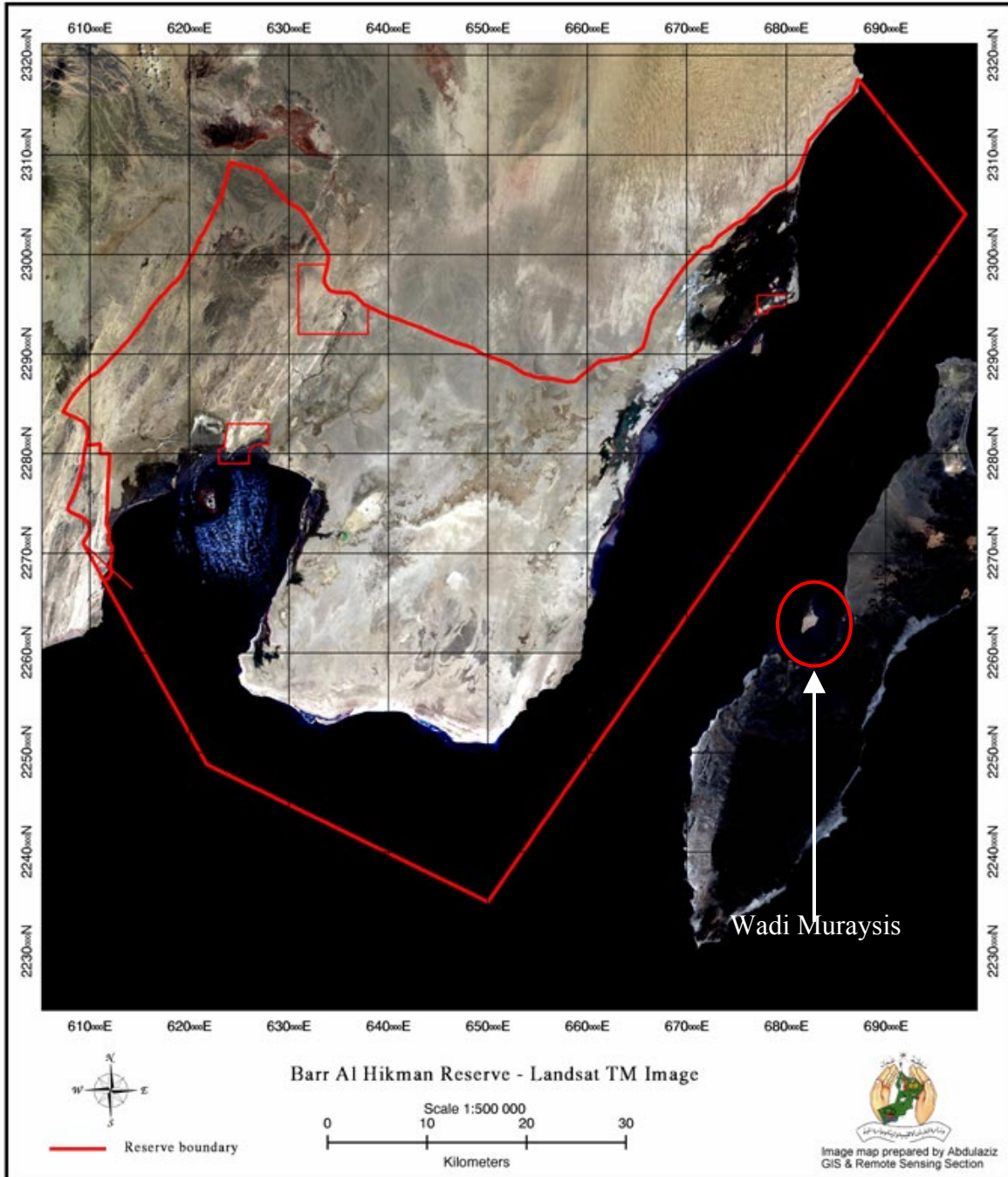
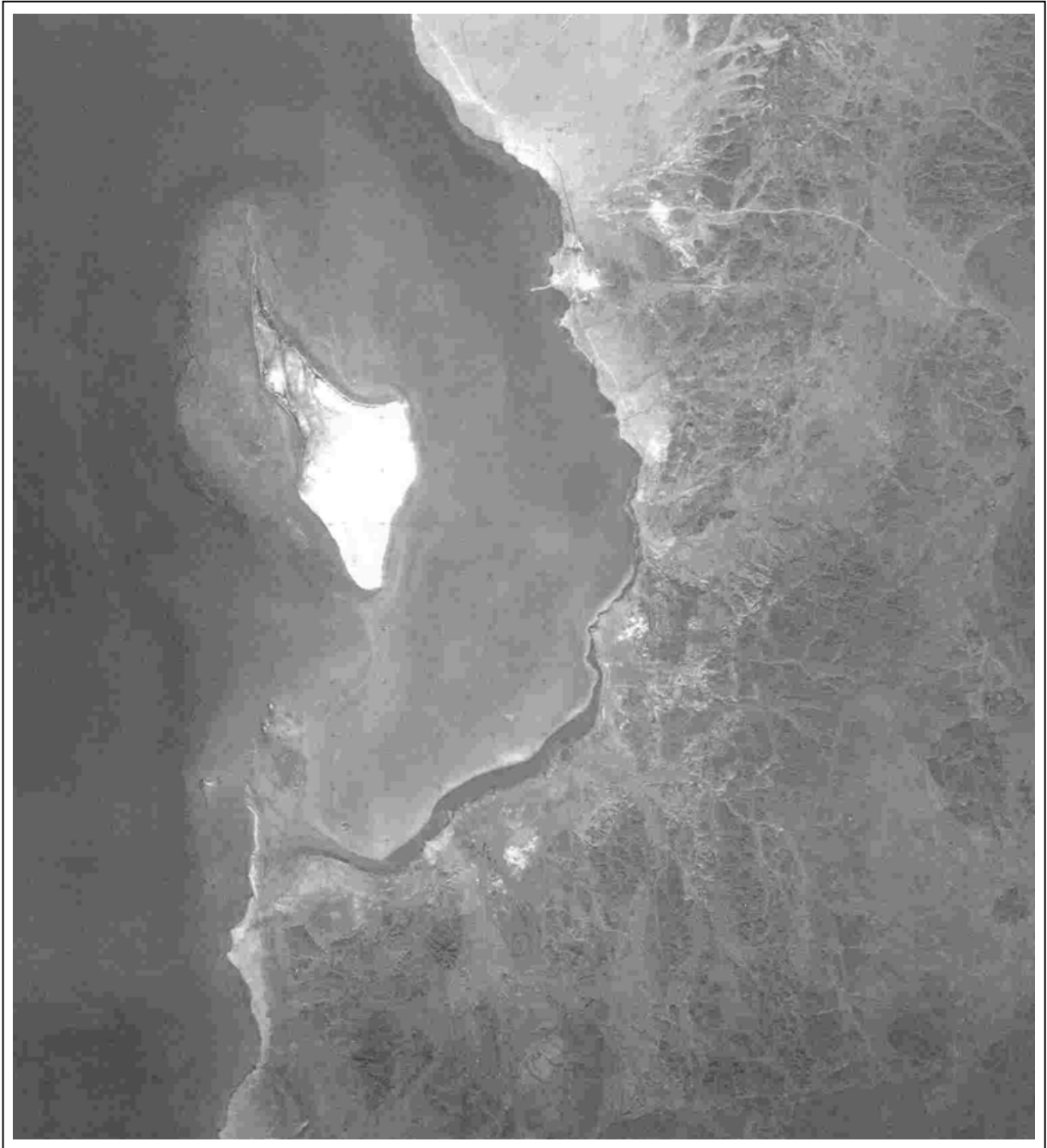


Figure 1 Key Map



**Figure 2 Location Map**

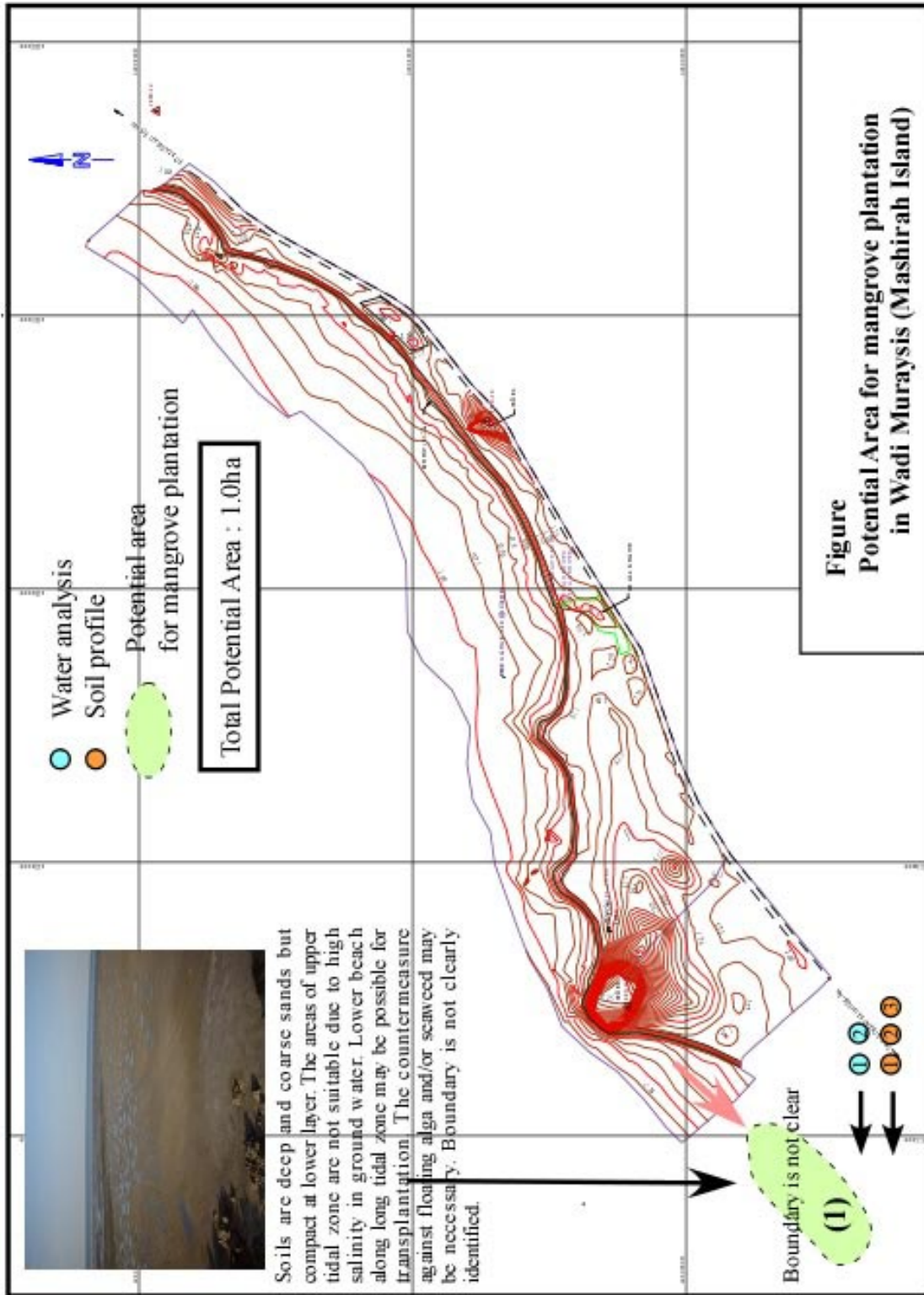


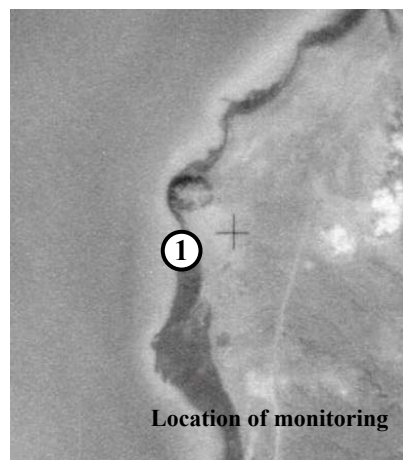
Figure 3 Planting Map

**Attachment 1: Field Monitoring Sheet for Mangrove (Wadi Muraysis)**

| <b>Mangrove Observation Records</b>  |    |   |   |   |   |   |   |   |   |    |  |  |  |
|--|----|---|---|---|---|---|---|---|---|----|--|--|--|
| <p>1) Identification No. _____</p> <p>2) Location by GPS (WGS 84, UTM)<br/>                     Easting: _____<br/>                     Northing: _____</p> <p>3) Photograph No. _____</p> <p>4) Observation of tree size and shape<br/>                     a) Tree Height (cm) <input style="width: 100px; height: 20px;" type="text"/><br/>                     b) Trunk diameter near bottom (cm) <input style="width: 100px; height: 20px;" type="text"/><br/>                     c) Live branches at the position about 1.3m off the centre of tree bottom (painted)<br/>                         Branch/ limb diameter measured in cm</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%; text-align: center;">1</td> <td style="width: 25%; text-align: center;">2</td> <td style="width: 25%; text-align: center;">3</td> <td style="width: 25%; text-align: center;">4</td> </tr> <tr> <td style="text-align: center;">5</td> <td style="text-align: center;">6</td> <td style="text-align: center;">7</td> <td style="text-align: center;">8</td> </tr> <tr> <td style="text-align: center;">9</td> <td style="text-align: center;">10</td> <td></td> <td></td> </tr> </table> | 1  | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |  |  | <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p><b>Memo:</b><br/>                     (specific information or data significant for the tree will be written here)</p> </div> |
| 1  | 2  | 3 | 4 |   |   |   |   |   |   |    |  |  |  |
| 5  | 6  | 7 | 8 |   |   |   |   |   |   |    |  |  |  |
| 9  | 10 |   |   |   |   |   |   |   |   |    |  |  |  |
| <p>5) Observation of tree history, health and environment</p> <p>a) History<br/>                     Tree shape: _____<br/>                     Sign of cut in the past: _____</p> <p>b) Health<br/>                     Nodes with leaves: _____<br/>                     Inter-node length: _____<br/>                     Leaf length: _____<br/>                     Leaf colour: _____<br/>                     Looks / die back: _____</p> <p>c) Environment<br/>                     Soil depth / texture: _____<br/>                     Surface water Salinity: _____<br/>                     Ground level: _____<br/>                     Position: _____</p>   |    |   |   |   |   |   |   |   |   |    |  |  |  |
| <div style="border: 1px solid black; padding: 5px; min-height: 60px;"> <p>Note:</p> </div>   |    |   |   |   |   |   |   |   |   |    |  |  |  |

**Attachment 3: Field Monitoring Sheet for Soil & Water (Wadi Muraysis)**

|              |          |
|--------------|----------|
| Location     |          |
| Date / time: | / ,200 : |
| Recorder     |          |
|              |          |



**General Condition in plantation area:**

(garbage, rubbish, leaf, alga, crab, shell, etc)

**(1) Soil Condition**

● Soil ○ Water

|                        |              | New planted area<br>( ) | New planted area<br>( ) |
|------------------------|--------------|-------------------------|-------------------------|
| Coordinate             | Easting      |                         |                         |
|                        | Northing     |                         |                         |
| Surface condition      |              |                         |                         |
| Soil Texture           | 0-10cm       |                         |                         |
|                        | 30-40cm      |                         |                         |
|                        | 50-60cm      |                         |                         |
| Soil Colour            | 0-10cm       |                         |                         |
|                        | 30-40cm      |                         |                         |
|                        | 50-60cm      |                         |                         |
| Root development       |              |                         |                         |
| Depth of surface humus |              |                         |                         |
| Free water             | GWL* (cm)    |                         |                         |
|                        | pH           |                         |                         |
|                        | Salinity (%) |                         |                         |

Soil colour by Munsell notation, GPS\*:by UTM of WGS84 GWL: Ground water level

**(2) Surface Water Quality**

(Observation time: : )

|                    |          | Sea water ① |  |
|--------------------|----------|-------------|--|
| Coordinate         | Easting  | -           |  |
|                    | Northing | -           |  |
| Surface waste      |          |             |  |
| pH                 |          |             |  |
| Salinity (%)       |          |             |  |
| Temperature (C)    |          |             |  |
| DO (mg/l)          |          |             |  |
| Turbidity / Colour |          |             |  |

**Attachment 4: Soil Profile in Wadi Muraysis**

| Profile No. | Location                     | Coordinate (UTM) |          | Ground Water |     | Texture      |                  |                       | Soil Colour        |               | Hardness              |           |             |
|-------------|------------------------------|------------------|----------|--------------|-----|--------------|------------------|-----------------------|--------------------|---------------|-----------------------|-----------|-------------|
|             |                              | Easting          | Northing | Depth (cm)   | pH  | Salinity (%) | Surface (0-30cm) | Sub-surface (30-60cm) | Deep layer (>90cm) | Surface       | Sub-surface (30-60cm) | Surface   | Sub-surface |
| SI-2        | West beach, lower tidal zone | 681810           | 2259171  | 70           | 7.5 | 7.6          | Sand             | Sand                  | Sand               | Olive black   | Grey                  | (Friable) | (friable)   |
| SI-3        | West beach, upper tidal zone | 681674           | 2259141  | 40           | 7.3 | >10          | Sand             | Sand                  | Sand               | Greyish olive | Greyish olive         | (Friable) | (friable)   |

Data of hardness in parenthesis by hand observation

**Attachment 5: Surface Water Quality in Wadi Muraysis**

| No. | Location                    | Coordinate (UTM) |          | Colour/ Visibility | pH  | Salinity (%) | Temperature (C) | DO (mg/l) | COD (mg/l) | NO3 (mgNO3/l) |
|-----|-----------------------------|------------------|----------|--------------------|-----|--------------|-----------------|-----------|------------|---------------|
|     |                             | Easting          | Northing |                    |     |              |                 |           |            |               |
| 1   | Beach                       | 682158           | 2259309  | Clear              | 8.4 | 4.1          | 25.3            | 6.90      | 2±         | -             |
| 2   | Surface water on tidal zone | 682095           | 2259130  | Clear              | 7.9 | 5.0          | -               | -         | -          | -             |

Observation Date: 18-21 January, 2003



**Attachment 6: Field Monitoring Sheet for Fauna and Flora and Pollution (Wadi Muraysis)**

|                  |                |              |  |
|------------------|----------------|--------------|--|
| <b>Location:</b> | Muraysis, Wadi | <b>Date:</b> |  |
| <b>Time:</b>     |                | <b>Tide:</b> |  |
| <b>Recorder:</b> | N V Clarke     |              |  |

|   |         |        |
|---|---------|--------|
| <b>Bird Counts:</b>   | species | number |
| <p>Expected winter birds: abundant waders – curlew, crab plovers sandpipers, etc</p> <p>Expected summer birds: terns, gulls, herons</p> |         |        |

|  |                   |
|--|-------------------|
| <b>Pollution:</b>                                    |                   |
| Evidence of solid waste (garbage), liquid waste, oil |                   |
| Water quality:                                       | clear/muddy/green |
| Fishing:   | nets              |

|  |
|--|
| <b>Vegetation:</b>   |
| Evidence of:                      grazing, cutting, flowering, seeds |

|                |
|----------------|
| <b>Animals</b> |
|----------------|

|                                |                              |
|--------------------------------|------------------------------|
| <b>Domestic/feral animals:</b> | none seen but village nearby |
|--------------------------------|------------------------------|

|                        |
|------------------------|
| <b>Other Comments:</b> |
|                        |

## **Attachment 7: Result of Field Reconnaissance of Fauna and Flora and Pollution in Wadi Muraysis**

### **Field Monitoring Sheet for Fauna and Flora and Pollution Sample (1)**

**Location:** Muraysis                                      **Date:** 23/12/02  
**Time:** 16.30-18.00                                      **Tide:** low 1.1 ?m  
**Recorder:** N V Clarke

#### **Bird Counts:**

35 waders (curlew, crab plovers, sandpipers, sand plovers), 2 Gulls, 1 reef heron  
Expected winter birds: abundant waders – curlew, crab plovers sandpipers, etc  
Expected summer birds: terns, gulls, herons

#### **Pollution:**

The wide shallow beach at Umm Muraysis is composed of hard fine sand with some silt. It appeared well oxygenated below the surface without any dark colouration.

|  |       |
|--|-------|
| Evidence of solid waste (garbage), liquid waste, oil | none  |
| Water quality: clear/muddy/green                     | clear |
| Fishing: nets  | none  |

#### **Vegetation:**

The beach at Muraysis is surrounded by terrestrial vegetation.  
No halophytes were recorded.

#### **Animals**

At the top of the beach holes of the large fiddler crab were found (*Uca inversa*). Lower down the beach bivalves were common including *Lanternula erythraensis* and *Dosinia alta*. The small mud snail, *Cerithidea cingulata*, was abundant on the wet sand surface further down the beach reaching densities of 300/m<sup>2</sup>. The other common snail on the surface was the fast moving *Nassarius persicus*, while the hermit crab (*Diogenes*) was also common.

**Domestic/feral animals:** none seen but village nearby

#### **Other Comments:**

Muraysis (Shagpah) Island nearby is an important conservation area. There are mangroves, salt tolerant bushes, thousands of breeding seabirds in the summer and thousands of roosting waders and seabirds in the winter. Jensen and Salm (IUCN 1992) estimated numbers of breeding birds as follows:

|   |             |
|---|-------------|
| Western Reef Heron ( <i>Egretta gularis</i> ) | 20-30 nests |
| Crested Tern ( <i>Sterna bergii</i> )         | 100's nests |
| White-cheeked Tern ( <i>Sterna repressa</i> ) | 1000 nests  |
| Roseate Tern ( <i>Sterna dougallii</i> )      | few nests   |
| Bridled Tern ( <i>Sterna anaethetus</i> )     | 15000 nests |
| Sooty Gull ( <i>Larus hemprichii</i> )        | 5000 nests  |
| Crab Plover ( <i>Dromas ardeola</i> )         | 85+ nests   |

**Field Monitoring Sheet for Fauna and Flora and Pollution Sample (2)**

**Location:** Muraysis, Wadi **Date:** 07/07/03  
**Time:** 12.00 **Tide:** low  
**Recorder:** N V Clarke

**Bird Counts:**

25 caspian terns,  
Expected winter birds: abundant waders – curlew, crab plovers sandpipers, etc  
Expected summer birds: terns, gulls, herons

**Pollution:**

Evidence of solid waste (garbage), liquid waste, oil none  
Water colour: clear/muddy/green none  
Fishing: nets none

**Vegetation:**

None on beach area

**Animals**

2 species of crabs common in silty sand areas (mid-tide level)  
(*Macrophthalmus depressus*, *Uca inversa*)  
2 species of bivalve common in sediment (mid-tide level)  
(*Laternula erythraensis*, *Dosinia alta*)

**Domestic/feral animals:** none seen but village nearby

**Other Comments:**

Potential planting site for mangroves, but wind blows strongly offshore during the Summer. Protection from the wind is needed for seedlings.

**Attachment 8: Site Photos (Wadi Muraysis)**

**General Condition**



Upper beach of the area (near border to halophyte)



Lower beach of the area

**Mangrove Vegetation**



Transplanted seedling

**Soil Condition**



Wadi Muraysis, west beach, lower tidal zone (Profile No. SI-2)



Wadi Muraysis, west beach, upper tidal zone (Profile No. SI-3)

**Attachment 9: Soil Profile of Samples in Wadi Muraysis**

(Profile No. Sl-2)

|                                 |  |  |              |
|---------------------------------|--|--|--------------|
| Location                        | Wadi Muraysis, west beach, front tidal zone  |  |              |
| Coordinate (UTM)                | Easting: 681810                              | Northing: 2259171  | Gentle slope |
| Physiologic position            | Lower terrace                                | Topography   | Gentle slope |
| Soil Classification             | Typic Psammaquents                           |  |              |
| Parent material                 | Marine deposit                               | Depth of free water  | 70cm         |
| Vegetation/ mangrove            | No vegetation, middle position on tidal zone |  |              |
| Description of soil profile *2) |  |  |              |
| C                               | 0-3cm  | Olive black (7.5Y 3.5/2) sand with single grain structure and non-sticky consistency; seaweed decomposition on surface; abrupt smooth boundary                           |              |
| C                               | 3-24cm                                       | Olive black (7.5Y 3.5/2) sand with single grain structure and non-sticky consistency; common Olive black (5G2.5/1) mottle; common shell fragment; diffused wave boundary |              |
| C                               | 24-35cm                                      | Grey (5Y 5/1) sand with single grain structure and non-sticky consistency; many shell fragments  |              |

\*1: Descriptions of structure and boundary are estimated from limited observation of core sample.

\*2: Texture was classified at field by visual and touching observation

(Profile No. Sl-3)

|                                 |   |  |              |
|---------------------------------|---|--|--------------|
| Location                        | Wadi Muraysis, west beach, inner tidal zone |  |              |
| Coordinate (UTM)                | Easting: 681674                             | Northing: 2259141  | Gentle slope |
| Physiologic position            | Lower terrace                               | Topography   | Gentle slope |
| Soil Classification             | Typic Psammaquents                          |  |              |
| Parent material                 | Marine deposit                              | Depth of free water  | 40cm         |
| Vegetation/ mangrove            | No vegetation, upper position on tidal zone |  |              |
| Description of soil profile *2) |   |  |              |
| C                               | 0-9m  | Greyish olive (5Y 4/2) sand with single grain structure and non-sticky consistency; common shell fragment; diffused, smooth boundary |              |
| C                               | 9-33m                                       | Greyish olive (5Y 4/2) sand with single grain structure and non-sticky consistency; common shell fragment; diffused smooth boundary  |              |
| C                               | 33-42cm                                     | Olive black (5Y 3.5/2) sand with single grain structure and non-sticky consistency; many shell fragments                             |              |

\*1: Descriptions of structure and boundary are estimated from limited observation of core sample.

\*2: Texture was classified at field by visual and touching observation

# **Technical Specification for Filim – Eastern Beach**

# 1. SITE DESCRIPTION

## 1.1 Location

|  |  |
|--|--|
| Governorate/ Region                    | Wusta  |
| Wilayat                                | Muhut  |
| Distance from the Centre of Wilayat    | The centre of Wilayat is Muhut located 20 km north of the site.  |
| Nearest Locality                       | Falam  |
| Fame of the Site/ Distinctive Features | Fishing village  |
| Facilities in the Site                 | Temporary fishing houses   |
| Features of Surrounding Areas          | This site is located in the south of Falam locality, approximately 1 km south of the National Highway. |

## 1.2 Natural Conditions

|                     |  |
|---------------------|--|
| Climate Zone        | Wusta Zone   |
| General Terrain     | Flat plain   |
| Geological Features | The tidal flat forms a large shallow area.   |
| Soil                | <p>Filim area on the eastern beach covers a wide area along the tidal coast and is located on the delta of salt marsh called “sabkha”. There are beach rocks on the western limit. These beach rocks underlie the beach sand, which is more than 1m deep at about 30 m from bare rock. Most seashore areas are covered by fine sand soils. These soils are deep. But there is a compact layer with a great many shell fragments 20-30 cm below the surface. There are two main water channels. One intrudes from the western beach near the rock hill to the northeast. Another one intrudes from the east side to the northwest. The soils on these water channels and upper tidal zone change to finer soil texture (sandy loam to silty loam). On the higher flat areas, salt accumulations are observed and soil colour changes to white.</p> <p>Details are shown in attached table “<b>Attachment 4: Soil Profile in Filim-Eastern Beach</b>” and “<b>Attachment 9: Soil Profile of Samples in Filim-Eastern Beach</b>”.</p> |
| Water               | <p>The values of salinity, pH, DO and COD of seawater were 4.6%, 8.5, 5.9 mg/l and approx. 2 mg/l, respectively. However, water salinity on the seashore showed 6 to 7% and salinities of ground waters were ranging from 7 to 10%. High salinity of groundwater indicates that the salty water come from sabkha.</p> <p>Details are shown in attached table “<b>Attachment 5: Surface Water Quality in Filim-Eastern Beach</b>”.</p>  |
| Fauna               | <p>The small mud snails, <i>Cerithidea cingulata</i>, were abundant on the surface; the other common snail was the fast moving <i>Nassarius arcularia plicatus</i>. The most abundant animals in the mud were annelid worms. Two species of bivalves were common in the sediment (<i>Tellina arsinoensis</i>, <i>Dosinia alta</i>) where surface water run-off occurred. Small crabs (including <i>Serenella leachii</i> and <i>Macrophthalmus depressus</i>) were found in the mud. The crab <i>Eurycarcinus orientalis</i> was recorded among the larger mangrove trees and <i>Metaplex indica</i> occurred in the soft mud at low tide. Occasional swimming crabs (<i>Portunus pelagicus</i>) and the venus bivalve (<i>Amiantis umbonella</i>) were found in channels.</p>   |

|                                    |  |
|------------------------------------|--|
|                                    | <p>Hermit crabs (<i>Diogenes sp</i>) were common moving along the water edge as the tide came in.</p> <p>Hundreds of thousands of migrant waders visit this area from August to May, attracted to the rich feeding areas on the mudflats. Flamingos also occur in large numbers.</p> <p>Mangroves are regenerating in the area. The mudskipper fish (previously only recorded on Mahawt) has already colonised the larger trees in the rocky inlet next to the desalination plant (July 2003).</p> <p>Proposed area is widely spreading on the eastern beach of Filim and it is locating on the downstream of salt marsh called “sabkha”. This area is facing with beach rocks in western limit. These beach rocks get down into the beach sand and the sand covers more than 1m at about 30 m from bared rock. Most of seashore areas are covered by fine sand soils. These soils are deep and soft. But there is a compact layer with crushing shells under 20-30 cm beneath. The soils on the channels and upper seashore come to finer in soil texture. The salt accumulation where surface soil colour changes to white is observed on the high flat areas on seashore.</p> <p>The quality of seawater is 4.6% salinity, pH 8.5, DO 5.9 mg/l and COD approx. 2 mg/l. However, the surface water on the seashore shows 6 to 7% and ground water is ranging from 7 to 10% in salinity. This high salinity indicates that the salts come from upper sabkha.</p> <p>According to the observation of field survey, there are no serious constraints for transplantation of <i>Avecinnia marina</i> in the viewpoint of soil texture except the areas of channel and upper limit of tidal area. However, the high water salinity of surface water and groundwater on intertidal zone will have an effect for the transplantation and growth of <i>Avecinnia marina</i>.</p> |
| Flora                              | <p>The beach at Filim is surrounded by sabka, saline, sandy soils with very little vegetation. The succulent shrub in this area, <i>Suaeda moschata</i>, is endemic to Oman, and replaces <i>Suaeda vermiculata</i>. In the intertidal zone, scattered low bushes of <i>Avicennia marina</i> about 10 m apart are found across the mudflats. In shallow water below low tide two species of seagrass are common (<i>Halophile ovalis</i>, <i>Halodule uninervis</i>).</p>  |
| Impacts from the Surrounding Areas | Wastewater from temporary fishing houses   |

### 1.3 Socio-economic Situation

|   |  |
|---|--|
| Population of the Wilayat (2001)          | 10 thousand                                  |
| Population of the Nearest Locality (1993) | 0.3 thousand                                 |
| Main Economic Activities                  | Fishery and agriculture                      |
| Infrastructure                            | Desalination factory                         |
| Main Usage                                | Used for temporary housing area by fishermen |
| Community Interference with the Area      | Almost none                                  |
| Cultural Significance                     | None   |



## 1.4 Legal Setup and Development Plans

|  |   |
|--|---|
| Land Ownership and Land Use Designation                | Candidate Nature Reserve (NR)                                   |
| Development Plans in the Site and the Surrounding Area | Bridge or Causeway (Filim – Mahawt Island) construction project |
| Existing Conservation Proposal                         | Candidate Nature Reserve (NR)                                   |

## 2. PROGRAMME AND PROJECT

### 2.1 Prerequisite

|                                  |   |
|----------------------------------|---|
| Legal Setup for Land Use Control | Set a distinct boundary of NR (see 4.2 Required Action for Conservation and Management)   |
| Facility Development Control     | No permanent structure in NR, except hide for bird watching, sign and information boards, and boardwalk or pedestrian bridge. Footpath should be designated but not paved. No permanent commercial buildings such as restaurants, hotels, shops and mechanised amusement facilities in the park development area. Basic activities in this park are relaxation and picnicking. Partial lighting for safety only. Utilities lines (water and electricity should be at a minimum) and setback at 150 m from the edge of mangrove. |

### 2.2 Description of Programmes

|   |   |
|---|---|
| Facility Development Programme          | (1) Visitor service and information facilities development.   |
| Restoration and Afforestation Programme | (2) Mangrove planting project   |
| Monitoring Programme                    | (3) Mangrove monitoring project (4) Soil and water monitoring (5) Fauna and flora monitoring project (6) Pollution monitoring project (7) Monitoring project on legal setup and development plans   |
| Public Awareness Programme              | It will include an educational programme for school children and conservation campaign for residents of the Wilayat. Required materials and facilities are (8) Pamphlets and posters distributed to the residents, (9) Information boards describing significance of the natural environment. |

### 2.3 Implementation Mechanism

| Projects  | Responsible Agencies | Implementing Body/ Agencies             | Related Agencies |
|---|----------------------|---|------------------|
| (1) Visitor service and information facilities development. | MRMEWR               | Wilayat Muhut                           | MCI              |
| (2) Mangrove planting project                               | MRMEWR               | Wilayat Muhut                           |                  |
| (3) Mangrove Monitoring Project                             | MRMEWR               | Wilayat Muhut                           |                  |
| (4) Soil and Water Monitoring Project                       | MRMEWR               | Wilayat Muhut                           |                  |
| (5) Fauna and Flora Monitoring Project                      | MRMEWR               | MRMEWR/<br>Omani Institute<br>for Birds |                  |
| (6) Pollution Monitoring Project                            | MRMEWR               | Wilayat Muhut/<br>MRMEWR                |                  |
| (7) Monitoring Project on Legal Setup and Development Plans | MRMEWR               | MRMEWR                                  |                  |
| (8) Pamphlets and posters distributed to the residents      | MRMEWR               | MRMEWR                                  | MOE              |
| (9) Information boards                                      | MRMEWR               | MRMEWR                                  | MOE              |

### 2.4 Implementation Schedule

| Project No. | 1 st | 2 nd | 3 rd | 4 th | 5 th | 6th | 7th | 8th | 9 th | 10 th |
|-------------|------|------|------|------|------|-----|-----|-----|------|-------|
| (1)         |      |      |      |      |      |     |     |     |      |       |
| (2)         |      |      |      |      |      |     |     |     |      |       |
| (3)         |      |      |      |      |      |     |     |     |      |       |
| (4)         |      |      |      |      |      |     |     |     |      |       |
| (5)         |      |      |      |      |      |     |     |     |      |       |
| (6)         |      |      |      |      |      |     |     |     |      |       |
| (7)         |      |      |      |      |      |     |     |     |      |       |
| (8)         |      |      |      |      |      |     |     |     |      |       |
| (9)         |      |      |      |      |      |     |     |     |      |       |

## 3. IMPLEMENTATION PLAN

### 3.1 Restoration and Afforestation

#### 3.1.1 Existing Mangrove Area

|                                 |  |
|---------------------------------|--|
| Location and Area               | Wide and very gentle flat tidal area at Filim eastern beach covered by mangrove area is <b>10 ha</b> approximately. <b>(Figure 2 Location Map)</b>   |
| Conditions of Existing Mangrove | Dwarf trees are scattering on wide seashore. Mangroves on upper seashore are almost dead. Heights of trees are low, less than 1.5m. According to the information from residents, growing of mangroves is very slow. No seed production was observed. Grazing by camel is observed. |

### 3.1.2 Plantation Area

|                       |   |
|-----------------------|---|
| Tidal Condition       | Normal  |
| Wave and Wind         | Strong in summer  |
| Flood                 | Every 5 to 10 years   |
| Water Salinity and pH | (“Attachment 5: Surface Water Quality in Filim – Eastern Beach”)  |
| Soil Conditions       | Surveyed data is in the “Attachment 4: Soil Profile in Filim – Eastern Beach” of this technical specification.  |
| Potential Area        | Lower shore along tidal zone. See “Figure 3 Planting Map“. Similar condition with Wadi Muraysis of Masirah Island. There are no serious constraints for transplantation in the viewpoint of soil texture except the areas of channel and upper shore of tidal area. However, the high salinity of surface water and groundwater on tidal zone may have an effect for the transplantation and growth of trees. Lower beach along tidal zone may be possible for transplantation. Boundary is not clearly identified. |

**Table 3.1 Location and Areas of Potential Planting Area(s)**

|        | Designated Area | Area (ha) |
|--------|-----------------|-----------|
| Area-1 |                 | 1.0       |

### 3.1.3 Planting Schedule

|  |   |
|--|---|
| Total Planting Area                        | 1.0 ha  |
| Planting Season and Timing                 | January ~ February  |
| Seed/ Seedlings Supply Source and Location | Seed from existing mangrove at Mahawt Island<br>Seedling from temporary nursery at Mahawt Island  |
| Planting Method                            | Start from eastern shore of potential area. Extend westward (to port side). Select grid spacing area (50m x 50m) and plant in a random order. Detailed technical guidelines should refer to the “Technical Guideline for Afforestation” attached with this technical specification. |

**Table 3.2 Planting Schedule**

| Year            | 1 st | 2 nd | 3 rd | 4 th | 5 th | 6th | 7th | 8th | 9 th | 10 th | Total |
|-----------------|------|------|------|------|------|-----|-----|-----|------|-------|-------|
| Planting area-1 |      |      |      |      |      |     |     |     |      |       | 1.0   |

**Table 3.3 Seeds/ Seedling Supply Schedule**

| Year                                   | 1st | 2nd  | 3rd  | 4th  | 5th  | 6th | 7th | 8th | 9 th | 10 th | Total |
|--|-----|------|------|------|------|-----|-----|-----|------|-------|-------|
| Season/ time                           |     |      |      |      |      |     |     |     |      |       |       |
| Planting area (ha)                     |     | 0.25 | 0.25 | 0.25 | 0.25 |     |     |     |      |       | 1.0   |
| Number of seeds/ seedlings (thousands) |     | 2.5  | 2.5  | 2.5  | 2.5  |     |     |     |      |       | 10    |

### 3.1.4 Conservation Area

|                  |      |
|------------------|------|
| Area of Land Use | None |
|------------------|------|

### 3.1.5 Required Action for Conservation and Management

|  |   |
|--|---|
| Laws and Regulations Related to the Conservation Activities        | Designate NR  |
| Inspection   | Daily observation by the management body, 2 to 4 times of inspection by MRMEWR (Mangrove Information Centre)  |
| Cleaning   | Management Body   |
| Replantation of Seedlings Growing Bad, Dead or Washed Away         | MRMEWR (Mangrove Information Centre) for 5 years after plantation.  |
| Service for Associated Facilities                                  | Regularly by Management Body  |
| Patrol and Enforcement   | Daily ordinary patrol by a police office of Wilayah is required, and the management body regularly inspects facilities conditions and littering and waste disposal to the ground and water in NR areas.                                 |
| Restoration and Rehabilitation Work                                | The mangrove plantation work in the planting area described in the previous section is necessary.   |
| Facilities Required for the Conservation and Management Activities | Directional signs along the highway and entrance to the access road(s), guide signs in the reserve, and information boards in the NR area can be seen in the area to explain the significance of the reserve and major flora and fauna. |

## 3.2 Monitoring

### 3.2.1 Mangrove

|                   |   |
|-------------------|---|
| Monitoring Method | Select and label trees for monitoring. Monitor mangrove by using the attached “ <b>Attachment 1: Field Monitoring Sheet for Mangrove</b> ”. |
| Frequency         | Planting mangrove:<br>First 4 years: annual monitoring<br>After 4 years: every 2 years  |
| Monitoring Target | Planting mangrove:<br>Select 20 trees at random and label.  |
| Baseline Data     | No baseline data.   |

### 3.2.2 Soil and Water

|                   |   |
|-------------------|---|
| Monitoring Method | Monitor soil and water in and around mangrove vegetation by using attached table “ <b>Attachment 3: Field Monitoring Sheet for Soil and Water (Filim-Eastern Beach)</b> ”.                                      |
| Frequency         | Soil: (New plantation area) Before plantation and<br>Every two years after the plantation<br>Water; Before (Apr) and after (Nov) monsoon season (Every year)<br>(Outflow water at low tide should be measured.) |
| Monitoring Target |   |
| Baseline Data     | See attached table “ <b>Attachment 4: Soil Profile in Filim - Eastern Beach</b> ” and “ <b>Attachment 5: Surface Water Quality in Filim – Eastern Beach</b> ”.  |

### 3.2.3 Fauna and Flora

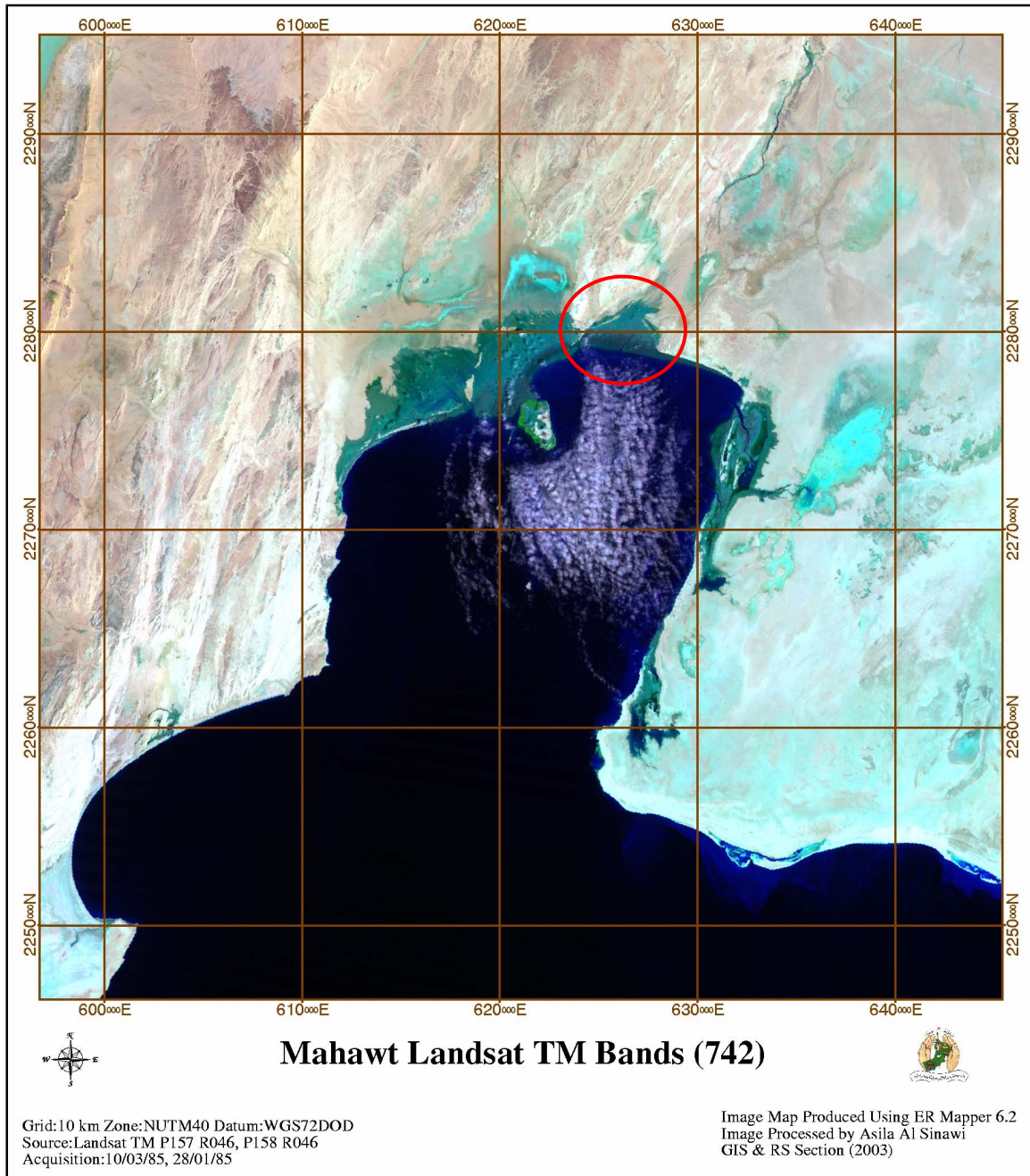
|                   |   |
|-------------------|---|
| Monitoring Method | Monitor fauna and flora by using the attached “ <b>Attachment 6: Field Monitoring Sheet for Fauna and Flora and Pollution</b> ”. For the observation of birds, an institute that is studying birds in Oman can be the best institute to take a part of the monitoring work by sub-contract basis. |
| Frequency         | At least twice a year   |
| Monitoring Target |   |
| Baseline Data     | The result of field reconnaissance of fauna and flora is shown in “ <b>Attachment 7: Result of Field Reconnaissance of Fauna and Flora and Pollution in Filim – Eastern Beach</b> ”.  |

### 3.2.4 Pollution (garbage and waste)

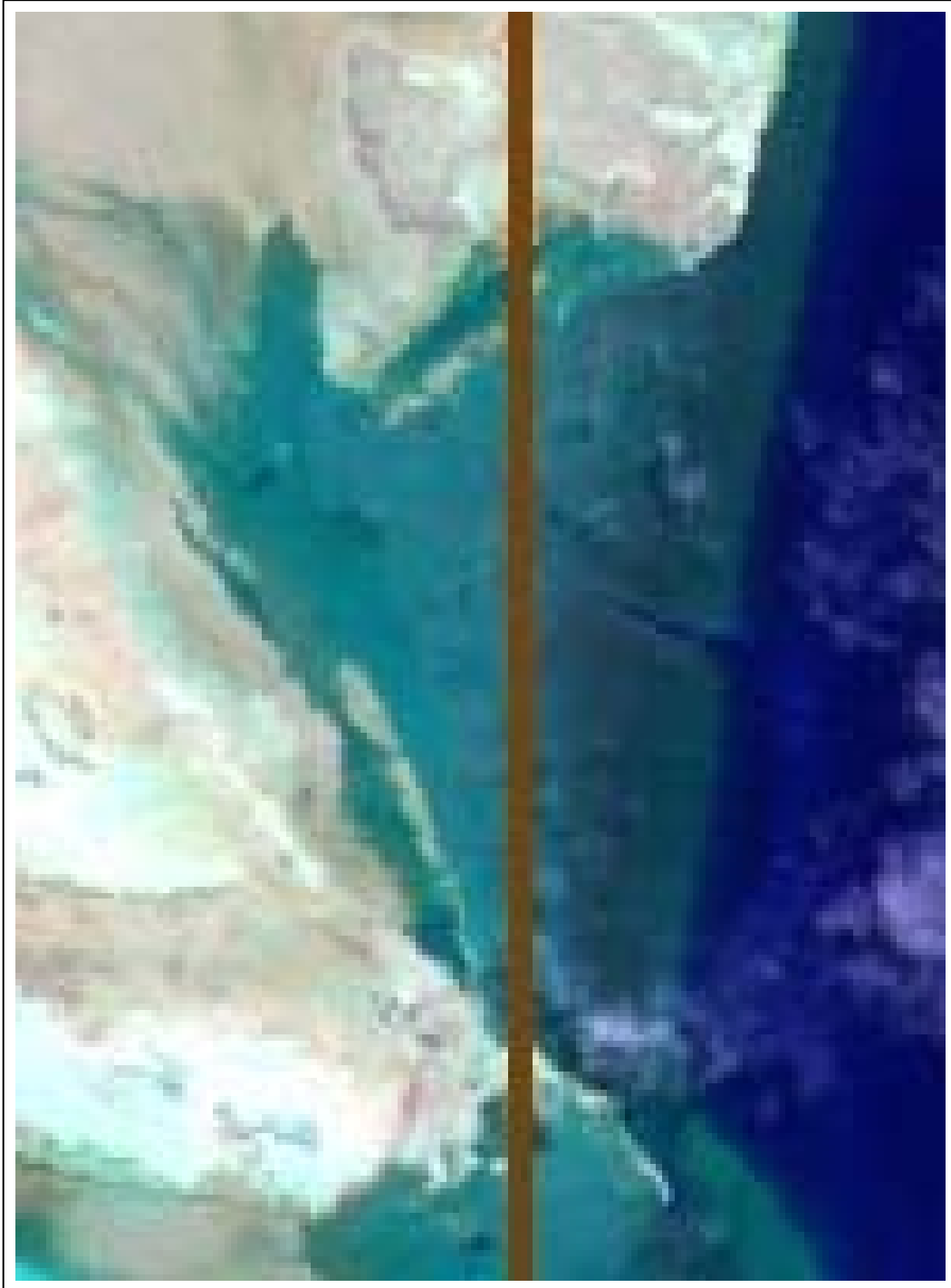
|                   |   |
|-------------------|---|
| Monitoring Method | Monitor pollution by using the attached “ <b>Attachment 6: Field Monitoring Sheet for Fauna and Flora and Pollution</b> ”. Water Quality and Soil Sample Tests should be carried out by MRMEWR. |
| Frequency         | At least twice a year   |
| Monitoring Target | <b>Attachment 6</b>   |
| Baseline Data     | See “ <b>Attachment 7: Result of Field Reconnaissance of Fauna and Flora and Pollution in Filim – Eastern Beach</b> ”.  |

### 3.2.5 Change on Legal Setup and Development Plans

|                   |  |
|-------------------|--|
| Frequency         | At least once a year   |
| Monitoring Target | Land Ownership, Land Use Designation, Development Plans in the Site and Surrounding Area |



**Figure 1 Key Map**



**Figure 2 Location Map**

**Attachment 1: Field Monitoring Sheet for Mangrove (Filim - Eastern Beach)**

| <b>Mangrove Observation Records</b>  |    |   |   |   |   |   |   |   |   |    |  |  |  |
|--|----|---|---|---|---|---|---|---|---|----|--|--|--|
| <p>1) Identification No. _____</p> <p>2) Location by GPS (WGS 84, UTM)<br/>                     Easting: _____<br/>                     Northing: _____</p> <p>3) Photograph No. _____</p> <p>4) Observation of tree size and shape<br/>                     a) Tree Height (cm) _____<br/>                     b) Trunk diameter near bottom (cm) _____<br/>                     c) Live branches at the position about 1.3m off the centre of tree bottom (painted)<br/>                     Branch/ limb diameter measured in cm</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%; text-align: center;">1</td> <td style="width: 25%; text-align: center;">2</td> <td style="width: 25%; text-align: center;">3</td> <td style="width: 25%; text-align: center;">4</td> </tr> <tr> <td style="text-align: center;">5</td> <td style="text-align: center;">6</td> <td style="text-align: center;">7</td> <td style="text-align: center;">8</td> </tr> <tr> <td style="text-align: center;">9</td> <td style="text-align: center;">10</td> <td></td> <td></td> </tr> </table> | 1  | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |  |  | <div style="border: 1px solid black; padding: 5px; min-height: 150px;"> <p><b>Memo:</b><br/>                     (specific information or data significant for the tree will be written here)</p> </div> |
| 1  | 2  | 3 | 4 |   |   |   |   |   |   |    |  |  |  |
| 5  | 6  | 7 | 8 |   |   |   |   |   |   |    |  |  |  |
| 9  | 10 |   |   |   |   |   |   |   |   |    |  |  |  |
| <p>5) Observation of tree history, health and environment</p> <p>a) History<br/>                     Tree shape: _____<br/>                     Sign of cut in the past: _____</p> <p>b) Health<br/>                     Nodes with leaves: _____<br/>                     Inter-node length: _____<br/>                     Leaf length: _____<br/>                     Leaf colour: _____<br/>                     Looks / die back: _____</p> <p>c) Environment<br/>                     Soil depth / texture: _____<br/>                     Surface water Salinity: _____<br/>                     Ground level: _____<br/>                     Position: _____</p>   |    |   |   |   |   |   |   |   |   |    |  |  |  |
| <div style="border: 1px solid black; padding: 5px; min-height: 80px;"> <p>Note:</p> </div>   |    |   |   |   |   |   |   |   |   |    |  |  |  |

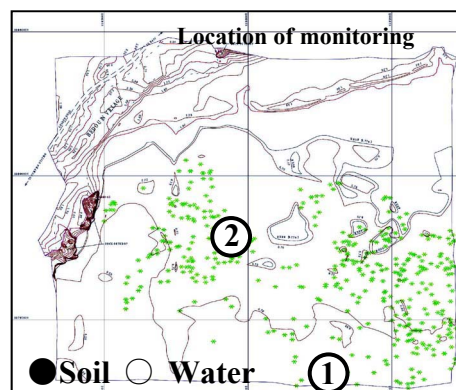


**Attachment 2: List of Observed Points in Filim- Eastern Beach**

| Khawr | Tree Number | Monitoring Trees | Date of Observation | Coordinate (UTM) |          | Photo Number | Height (cm) | Trunk near bottom | Diameter (cm)  |    |    |    |   |   |   |   |   |    | Remarks |  |
|-------|-------------|------------------|---------------------|------------------|----------|--------------|-------------|-------------------|--|----|----|----|---|---|---|---|---|----|---------|--|
|       |             |                  |                     | Easting          | Northing |              |             |                   | Live branches at the position about 1.3m off the centre of tree bottom (DBH: Diameter Breast Height) |    |    |    |   |   |   |   |   |    |         |  |
|       |             |                  |                     |                  |          |              |             |                   | 1  | 2  | 3  | 4  | 5 | 6 | 7 | 8 | 9 | 10 |         |  |
| Film  | Fi-OT1      |                  | 21 Dec '02          | 626354           | 2279716  |              | 609         | 90                | 21   | 22 | 25 | 21 |   |   |   |   |   |    |         |  |

**Attachment 3: Field Monitoring Sheet for Soil & Water (Filim–Eastern Beach)**

|              |                         |
|--------------|-------------------------|
| Location     |                         |
| Date / time: | ___ / ___ ,200___ : ___ |
| Recorder     |                         |
|              |                         |



**General Condition in plantation area:**

(garbage, rubbish, leaf, alga, crab, shell, etc)

**(1) Soil Condition**

|                        |              | New planted area<br>( ) | New planted area<br>( ) |
|------------------------|--------------|-------------------------|-------------------------|
| Coordinate             | Easting      |                         |                         |
|                        | Northing     |                         |                         |
| Surface condition      |              |                         |                         |
| Soil Texture           | 0-10cm       |                         |                         |
|                        | 30-40cm      |                         |                         |
|                        | 50-60cm      |                         |                         |
| Soil Colour            | 0-10cm       |                         |                         |
|                        | 30-40cm      |                         |                         |
|                        | 50-60cm      |                         |                         |
| Root development       |              |                         |                         |
| Depth of surface humus |              |                         |                         |
| Free water             | GWL* (cm)    |                         |                         |
|                        | pH           |                         |                         |
|                        | Salinity (%) |                         |                         |

Soil colour by Munsell notation, GPS\*:by UTM of WGS84 GWL: Ground water level

**(2) Surface Water Quality**

(Observation time: : )

|                    |          | Sea water① | Upper shore② |  |
|--------------------|----------|------------|--------------|--|
| Coordinate         | Easting  | 624500     | 624500       |  |
|                    | Northing | 2279600    | 2279800      |  |
| Surface waste      |          |            |              |  |
| pH                 |          |            |              |  |
| Salinity (%)       |          |            |              |  |
| Temperature (C)    |          |            |              |  |
| DO (mg/l)          |          |            |              |  |
| Turbidity / Colour |          |            |              |  |

**Attachment 4: Soil Profile in Filim – Eastern Beach**

| Profile No. | Location                                      | Coordinate (UTM) |          | Ground Water |     | Texture      |                  |                       | Soil Colour        |                  | Hardness              |           |             |
|-------------|---|------------------|----------|--------------|-----|--------------|------------------|-----------------------|--------------------|------------------|-----------------------|-----------|-------------|
|             |   | Easting          | Northing | Depth (cm)   | pH  | Salinity (%) | Surface (0-30cm) | Sub-surface (30-60cm) | Deep layer (>90cm) | Surface (0-30cm) | Sub-surface (30-60cm) | Surface   | Sub-surface |
| Fl-1        | Near sea water, around non-healthy vegetation | 624930           | 2279694  | 52           | 7.1 | 9.0          | Sand             | Sand                  | Sand               | Grey             | Grey                  | Friable   | Friable     |
| Fl-2        | West side, relatively high land on tidal zone | 624281           | 2279787  | -            | -   | -            | Sand             | Sandy                 | Sand               | Grey             | Grey                  | Friable   | Friable     |
| Fl-3        | Beside waterway on tidal zone                 | 624407           | 2279893  | -            | -   | -            | Sandy            | Loamy                 | Loamy              | -                | -                     | (Friable) | (friable)   |
| Fl-5        | East side, relatively high land on tidal zone | 624615           | 2279864  | 66           | 7.1 | 7.3          | Sand             | Sand                  | Sandy              | Yellowish Grey   | Dark greyish yellow   | -         | -           |
| Fl-6        | East side, inner tidal zone                   | 625912           | 2279781  | 57           | -   | 9.6          | Sand             | Sand                  | Sandy              | Yellowish Grey   | Greyish olive         | Firm      | Friable     |

Data of hardness in parenthesis by hand observation

**Attachment 5: Surface Water Quality in Filim – Eastern Beach**

| No. | Location                    | Coordinate (UTM) |          | Colour/Visibility | pH  | Salinity (%) | Temperature (C) | DO (mg/l) | COD (mg/l) | NO3 (mgNO3/l) |
|-----|-----------------------------|------------------|----------|-------------------|-----|--------------|-----------------|-----------|------------|---------------|
|     |                             | Easting          | Northing |                   |     |              |                 |           |            |               |
| 1   | Beach front of factory      | -                | -        | Clear             | 8.5 | 4.5          | 14.9            | 5.90      | 2±         | -             |
| 2   | Surface water on tidal zone | 626126           | 2279780  | Clear             | 8.0 | 8.9          | -               | -         | -          | -             |

Observation Date: 18-21 January, 2003

**Attachment 6: Field Monitoring Sheet for Fauna and Flora and Pollution (Filim - Eastern Beach)**

|  |              |
|--|--------------|
| <b>Location:</b> Filim – Eastern Beach | <b>Date:</b> |
| <b>Time:</b>                           | <b>Tide:</b> |
| <b>Recorder:</b>                       |              |

|   |          |        |
|---|----------|--------|
| <b>Bird counts:</b>   | species: | number |
| Expected winter birds: flamingo, abundant waders – sandpipers, oystercatcher, bar-tailed godwits, curlew, herons, gulls |          |        |
| Expected summer birds: reef heron, gulls, terns, flamingos, whimbrel, crab plovers                                      |          |        |

|                   |                     |
|-------------------|---------------------|
| <b>Pollution:</b> |                     |
| Evidence of:      | solid/liquid waste: |
| Water quality:    | clear/muddy/green   |
| Fishing:          | nets                |

|  |
|--|
| <b>Vegetation:</b>                             |
| Evidence of: grazing, cutting, flowering, seed |

|                 |
|-----------------|
| <b>Animals:</b> |
| mudflats        |

|                                |
|--------------------------------|
| <b>Domestic/feral animals:</b> |
|--------------------------------|

|                        |
|------------------------|
| <b>Other Comments:</b> |
|------------------------|

**Attachment 7: Result of Field Reconnaissance of Fauna and Flora and Pollution in Filim – Eastern Beach**

**Field Monitoring Sheet for Fauna and Flora and Pollution Sample (1)**

**Location:** Filim East  
**Time:** 16.00-18.00  
**Recorder:** N V Clarke

**Date:** 21/12/02  
**Tide:** low, 1.1 m at 16.00

**Bird counts:**

Gulls – common, Herons – common, Waders – abundant (hundreds), flamingos - common

Expected winter birds: flamingo, abundant waders – sandpipers, oystercatcher, bar-tailed godwits, curlew, herons

**Pollution:**

|                |                    |  |
|----------------|--------------------|--|
| Evidence of:   | solid/liquid waste | possible sewage contamination at village |
| Water quality: | clear/muddy/green  | clear                                    |
| Fishing:       | nets               | some discarded netting                   |

**Vegetation:**

The beach is surrounded by saline, sandy soils with little vegetation. The succulent shrub, *Suaeda moschata*, is endemic to Oman, and replaces *Suaeda vermiculata* here.

In the intertidal zone, scattered low bushes of *Avicennia marina* about 10 m apart are found across the mudflats. A few larger trees are found along deeper channels (e.g. behind desalination plant). Mangroves are protected from camels by soft mud and regeneration is occurring.

In shallow water, sea grass is common (*Halophile ovalis*, *Halodule uninervis*).

**Animals:**

Small mud snails, *Cerithidea cingulata*, were abundant on the surface varying from about 50 - 200/m<sup>2</sup>. The other common snail on the surface was the fast moving *Nassarius arcularia plicatus* at densities of about 50/m<sup>2</sup>. Annelid worms were abundant in the mud (several hundred/m<sup>2</sup>). Two species of bivalves were common in the sediment (*Tellina arsinoensis*, *Dosinia alta*), where surface water run-off occurred. Small crabs (including *Serenella leachii* and *Macrophthalmus depressus*) were found in the mud. The crab *Eurycarcinus orientalis* was recorded among the larger mangrove trees and *Metaplex indica* occurred in the soft mud at low tide. Swimming crabs (*Portunus pelagicus*) and the bivalve (*Marcia opima*) occurred in channels. Hermit crabs (*Diogenes sp*) followed the water line as the tide came in.

**Domestic/feral animals:** goats, camels, cats

**Other Comments:**

Opportunities for mangrove planting in the bay to speed up regeneration. Seeds should come from Mahawt Island.

The mudflats support abundant small invertebrate animals, which provide food for massive numbers of wading birds and flamingos over the winter period. The large numbers of birds have potential for eco-tourism.

**Field Monitoring Sheet for Fauna and Flora and Pollution Sample (2)**

**Location:** Filim East                              **Date:** 07/07/2003  
**Time:** 16.00-18.00                              **Tide:** high  
**Recorder:** N V Clarke

**Bird counts:**     flamingos – common, waders, common  
Expected winter birds: flamingo, abundant waders – sandpipers, oystercatcher, bar-tailed godwits, curlew, herons  
Expected summer birds: reef heron, gulls, terns, flamingos, whimbrel, crab plovers

**Pollution:**  
Evidence of:     solid/liquid waste                      possible sewage contamination at village  
Water quality:   clear/muddy/green                      clear  
Fishing:           nets    none

**Vegetation:**  
Sabka saline soils, very little vegetation.  
Small, well-spaced mangrove bushes. A few larger trees found along deeper channels

**Animals:**  
mudflats with abundant invertebrates.  
Mudskipper fish seen at larger mangrove trees near desalination plant.  
Mud crabs common.

**Domestic/feral animals:** goats, camels, cats

**Other Comments:**  
Observed at high tide.  
Mangroves regenerating, could become the largest mangrove forest in Oman.  
Potentially an enormous area for mangrove planting, seeds from Mahawt Island.

**Attachment 8: Site Photos (Filim-Eastern Beach)**

**General Condition**



Dwarf mangroves near water channel



Scattered dwarf mangroves on beach

**Mangrove Vegetation**



Tallest mangrove



Typical mangrove form at site

**Soil Condition**



Filim, near sea water, non-healthy vegetation around (Profile No.FI-1)



Filim, relatively upper land in tidal zone (Profile No.FI-5)

**Attachment 9: Soil Profile of Samples in Filim-Eastern Beach**

(Profile No. FI-1)

|                                 |   |  |      |
|---------------------------------|---|--|------|
| Location                        | Filim, near sea water, around non-healthy vegetation            |  |      |
| Coordinate (UTM)                | Easting: 624930   | Northing: 2279694  |      |
| Physiologic position            | Lower terrace   | Topography   | Flat |
| Soil Classification             | Typic Psammaquents  |  |      |
| Parent material                 | Marine deposit  | Depth of free water  | 52cm |
| Vegetation/mangrove             | Middle position on tidal zone, scattered, non-healthy mangroves |  |      |
| Description of soil profile *2) |   |  |      |
| C                               | 0-23cm  | Grey (7.5Y 4/1) sand with single massive and non-sticky consistency; smooth boundary                                     |      |
| C                               | 23-53cm   | Grey (7.5Y 4/1) sand with massive structure and non-sticky consistency; greyish olive (7.5Y 5/2) mottle; smooth boundary |      |
| C                               | 53-63cm   | Grey (7.5Y 4/1) sand with single grain structure and non-sticky consistency; common shell fragment                       |      |

\*1: Descriptions of structure and boundary are estimated from limited observation of core sample.

\*2: Texture was classified at field by visual and touching observation

(Profile No. FI-5)

|                                 |  |   |      |
|---------------------------------|--|---|------|
| Location                        | Filim, east, relatively upper land on tidal zone                                       |   |      |
| Coordinate (UTM)                | Easting: 624615  | Northing: 2279864   |      |
| Physiologic position            | Lower terrace  | Topography  | Flat |
| Soil Classification             | Typic Psammaquents   |   |      |
| Parent material                 | Marine deposit   | Depth of free water   | 66cm |
| Vegetation/mangrove             | No vegetation, topographically top area on tidal zone<br>Observation of core sample *1 |   |      |
| Description of soil profile *2) |  |   |      |
| C                               | 0-28cm   | Grey (7.5Y 4/1) sand with single grain structure and non-sticky consistency; grey (7.5Y 5/1.5) mottle; few shell fragments diffused boundary                          |      |
| C                               | 28-53m   | Greyish olive (7.5Y 5/2), soft sand with single grain structure and non-sticky consistency; grey (7.5Y 5/1.5) mottle; few to common shell fragment, diffused boundary |      |
| C                               | 53-74m   | Greyish olive (7.5Y 5/2) sand with single grain structure and non-sticky consistency; common shell fragment, gradual boundary   |      |
| C                               | 74-93cm  | Greyish olive (7.5Y 5.5/2), sandy loam and slightly sticky consistency; many shell fragment   |      |

\*1: Descriptions of structure and boundary are estimated from limited observation of core sample.

\*2: Texture was classified at field by visual and touching observation



# **Technical Specification for Mahawt Island**

# 1. SITE DESCRIPTION

## 1.1 Location

|  |   |
|--|---|
| Governorate/ Region                    | Wusta   |
| Wilayat                                | Mahawt  |
| Distance from the Centre of Wilayat    | 50 km   |
| Nearest Locality                       | Jazirat Muhut   |
| Fame of the Site/ Distinctive Features | Mahawt Island is surrounded by shallow water with rich sediments and seagrass beds that provide important nursery areas for shrimp and fish. The mangroves on the island form the best developed mangrove forest in Oman. |
| Facilities in the Site                 | None  |
| Features of Surrounding Areas          | Mahawt Island, 4 km south from Filim village. It is designated as a Nature Reserve area.  |

## 1.2 Natural Conditions

|                     |   |
|---------------------|---|
| Climate Zone        | Wusta Zone  |
| General Terrain     | Flat plain  |
| Geological Features | The island is located in a large tidal flat.  |
| Soil                | The areas of seashore in southeast and northeast of Mahawt Island are covered by deep sand soil. The soils under dense mangrove vegetation are clayey and silty soils with humic substances on the surface but sand soils are found in subsurface. Surface humic substances have accumulated with development of mangrove forest. These surface soils are deep in north and are relatively shallow (50-80cm) in west and south areas of the island. The shallow soils with rocks under soil covers are recognized on the southern area of the island. The depth of soil in these areas is approximately 30cm. The soils occurred on the back swamp (inside of island) are very sticky and clayey.<br>Details are shown in attached table “ <b>Attachment 4: Soil Profile in Mahawt Island</b> ” and “ <b>Attachment 9: Soil Profile Samples in Mahawt Island</b> ”. |
| Water               | The values of salinity, pH, DO and COD at seashore were 3.9%, 8.2, 6.7 mg/l and less than 2 mg/l, respectively. The values of salinity and pH of channel water in the northern part of forest are 5.3% and 8.2, respectively. There were no significant constraints for water quality.<br>Details are shown in attached table “ <b>Attachment 5: Surface Water Quality in Mahawt Island</b> ”.  |
| Fauna               | On the landward side of the mangroves an outer zone of wet sand with clay has large regular mounds formed by fiddler crabs ( <i>Uca inversa</i> ). Other burrowing crab species occurred nearer smaller mangrove bushes ( <i>Leptochryseus kuwaitense</i> , <i>Macrophthalmus depressus</i> , <i>Serenella (Paracleistostoma) leachii</i> ).<br>Towards the sea the bushes gradually change to tall trees and the canopy closes. Crab holes are numerous with at least 4 other crab species present. Small mud snails ( <i>Cerithidea cingulata</i> ) occurred on the surface, while in pools, shrimp and small gobies were found. The mudskipper ( <i>Periopthalmus koelreuteri</i> - only found on Mahawt in Oman) occurred throughout the mangroves and the soft pulmonate   |

|                                    |   |
|------------------------------------|---|
|                                    | <p>gastropod, <i>Onchidium peronii</i>, was found on larger branches. Among the large trees, large grapsoid crab species (<i>Neosarmatium meinerti</i> <i>Metapograpsus messor</i>,) were found climbing among the branches. Molluscs included <i>Cerithidea cingulata</i>, <i>Nassarius arcularia plicatus</i>, <i>Cerithium scabridum</i>, and <i>Tellina arsinoensis</i>.</p> <p>The small bird, the white-eye, is considered to be an endemic subspecies found only on Mahawt. A pair of White-collared Kingfishers and Clamorous Reed Warblers was calling in the summer (July 2003). Winter birds included: 40 Gulls, over 100 herons (Grey, Western Reef, and Great White Egret) and 30 waders (Redshank and other small species).</p> <p>Occupied Red Fox holes occur on the northwest sandbanks of Mahawt as well as on the small island of A'raq. Feral cats are numerous on Mahawt.</p>  |
| Flora                              | <p>The Island is fringed by mangrove forest about 400-500m wide on the north, west and south sides. The southwest side is exposed to wave action especially during the monsoon season. This makes it difficult for seedling establishment and younger trees grow on the inner landward side. On the northeast side where exposure is reduced, young trees are found on the seaward side. Generally, the mangroves are healthy and there is no need for planting.</p> <p>In the middle of the island a sandy sabkha exists without any vegetation. On the east side there is a sandy beach. Fishermen's huts occupy the middle section of the beach but at each end vegetation consisted of the halophytic shrub <i>Suaeda moschata</i>, which is endemic to this region of Oman. Along the landward edges of the mangroves there are several species of halophytes (<i>Suaeda monoica</i>, <i>Halopeplis perfoliata</i>, <i>Arthrocnemum macrostachyum</i> and <i>Halocnemum strobilaceum</i>).</p> |
| Impacts from the Surrounding Areas | Wastewater from the island  |

### 1.3 Socio-economic Situation

|   |   |
|---|---|
| Population of the Wilayat (2001)          | 10 thousand   |
| Population of the Nearest Locality (1993) | 10 thousand   |
| Main Economic Activities                  | Fishery   |
| Infrastructure                            | Water tower supplied from desalination factory in Filim |
| Main Usage                                | Used for temporary residential area for fishermen       |
| Community Interference with the Area      | Fishermen live in temporary housing semi-permanently.   |
| Cultural Significance                     | None  |

### 1.4 Legal Setup and Development Plans

|  |  |
|--|--|
| Land Ownership and Land Use Designation                | Candidate Bar al Hikman and Ghubart al Hashish Nature Reserve (NR)   |
| Development Plans in the Site and the Surrounding Area | Bridge or causeway construction (Filim ~ Mahawt Island) project  |
| Existing Conservation Proposal                         | Bar al Hikman and Ghubart al Hashish are proposed as protected areas to ensure management of the valuable fishery resources and outstanding wildlife. Mahawt Island lies within the boundaries of this proposal. |

|  |   |
|--|---|
|  | Declaration is expected in 2003, with management under the authority of the Ministry of Regional Municipalities and Environment. The management plan will be agreed on after the declaration although management studies have been carried out (Weidleplan 1991). |
|--|---|

## 2. PROGRAMME AND PROJECT

### 2.1 Prerequisite

|                                  |   |
|----------------------------------|---|
| Legal Setup for Land Use Control | Set a distinct boundary of NR and RDA (see 4.2 Required Action for Conservation and Management)   |
| Facility Development Control     | No permanent structure in NR, except hide for bird watching, sign and information boards, and boardwalk or pedestrian bridge. Footpath should be designated but not paved. No permanent commercial buildings such as restaurants, hotels, shops and mechanised amusement facilities in the park development area. Basic activities in this park are relaxation and picnicking. Partial lighting for safety only. Utilities lines (water and electricity should be at a minimum) and setback at 150 m from the edge of mangrove. |

### 2.2 Description of Programmes

|   |   |
|---|---|
| Facility Development Programme          | (1) Visitor service and information facilities development. (2) Temporary nursery construction project (for Wadi Muraysis, Film) (3) Eco-tourism development project  |
| Restoration and Afforestation Programme | (4) Mangrove maintenance project  |
| Monitoring Programme                    | (5) Mangrove monitoring project (6) Soil and water monitoring project (7) Fauna and flora monitoring project (8) Pollution monitoring project (9) Monitoring project on legal setup and development plans   |
| Public Awareness Programme              | It will include an educational programme for school children and conservation campaign for residents of the Wilayat. Required materials and facilities are (10) Pamphlets and posters distributed to the residents, (11) Information boards describing significance of the natural environment. |

### 2.3 Implementation Mechanism

| Projects  | Responsible Agencies | Implementing Body/ Agencies             | Related Agencies |
|---|----------------------|---|------------------|
| (1) Visitor service and information facilities development. | MRMEWR               | Wilayat Muhut                           | MCI              |
| (2) Temporary nursery construction project                  | MRMEWR               | Wilayat Muhut                           |                  |
| (3) Eco-tourism development project                         | MRMEWR               | Wilayat Muhut                           |                  |
| (4) Mangrove maintenance project                            | MRMEWR               | Wilayat Muhut                           |                  |
| (5) Mangrove Monitoring Project                             | MRMEWR               | Wilayat Muhut                           |                  |
| (6) Soil and Water Monitoring Project                       | MRMEWR               | Wilayat Muhut                           |                  |
| (7) Fauna and Flora Monitoring Project                      | MRMEWR               | MRMEWR/<br>Omani Institute<br>for Birds |                  |
| (8) Pollution Monitoring Project                            | MRMEWR               | Wilayat Muhut                           |                  |

|   |        |               |     |
|---|--------|---------------|-----|
| (9) Monitoring Project on Legal Setup and Development Plans | MRMEWR | Wilayat Muhut |     |
| (10) Pamphlets and posters distributed to the residents     | MRMEWR | MRMEWR        | MOE |
| (11) Information boards                                     | MRMEWR | MRMEWR        | MOE |

## 2.4 Implementation Schedule

| Project No. | 1 st | 2 nd | 3 rd | 4 th | 5 th | 6th | 7th | 8th | 9 th | 10 th |
|-------------|------|------|------|------|------|-----|-----|-----|------|-------|
| (1)         |      |      |      |      |      |     |     |     |      |       |
| (2)         |      |      |      |      |      |     |     |     |      |       |
| (3)         |      |      |      |      |      |     |     |     |      |       |
| (4)         |      |      |      |      |      |     |     |     |      |       |
| (5)         |      |      |      |      |      |     |     |     |      |       |
| (6)         |      |      |      |      |      |     |     |     |      |       |
| (7)         |      |      |      |      |      |     |     |     |      |       |
| (8)         |      |      |      |      |      |     |     |     |      |       |
| (9)         |      |      |      |      |      |     |     |     |      |       |
| (10)        |      |      |      |      |      |     |     |     |      |       |
| (11)        |      |      |      |      |      |     |     |     |      |       |

## 3. IMPLEMENTATION PLAN

### 3.1 Restoration and Afforestation

#### 3.1.1 Existing Mangrove Area

|                                 |  |
|---------------------------------|--|
| Location and Area               | Whole beach surrounding Mahawt Island in bay of Ghabbat Hashish covered by mangrove. Total area of mangrove vegetation is <b>162 ha</b> approximately. ( <b>Figure 2 Location Map</b> )  |
| Conditions of Existing Mangrove | Biggest mangrove forest in Oman. Dense and large mangrove forest on small island. Almost all of beaches are covered by mangrove trees except eastern rocky seashore. Trees at beach side are healthy and have big stems. Trees at inland are also healthy but small (2-4m heights). Trees reach more than 9m heights. Standing dead trees were observed in places. Many seeds are observed after flowering season. There is no extension area anymore except for a small area on the northern beach side. Many cut off big trees lay on the land. Some branches are used for animal feeding. |

#### 3.1.2 Plantation Area

|                       |  |
|-----------------------|--|
| Tidal Condition       | Normal   |
| Wave and Wind         | Strong in summer   |
| Flood                 | N/A  |
| Water Salinity and PH | (“ <b>Attachment 5: Surface Water Quality in Mahawt Island</b> ”)  |
| Soil Conditions       | Sandy soil with aerobic condition at seaside, silty and muddy surface soil with anaerobic condition at inner course of site. Surveyed data is in the “ <b>Attachment 4: Soil Profile in Mahawt Island</b> ” of this technical specification. |
| Potential Area        | N/A  |

**Table 3.1 Location and Areas of Potential Planting Area(s)**

|        | Designated Area | Area (ha) |
|--------|-----------------|-----------|
| Area-1 | No plantation   |           |

### 3.1.3 Conservation Area

| Area of Land Use | Candidate Nature Reserve (NR) |
|------------------|-------------------------------|
|                  |                               |

### 3.1.4 Required Action for Conservation and Management

| Laws and Regulations Related to the Conservation Activities        | Designated Nature Reserve  |
|--|--|
| Inspection   | N/A  |
| Cleaning   | N/A  |
| Replantation of Seedlings Growing Bad, Dead or Washed Away         | N/A  |
| Service for Associated Facilities                                  | N/A  |
| Patrol and Enforcement   | Daily ordinary patrol by a police office of Wilayat is required, and the management body regularly inspects facilities conditions and littering and waste disposal to the ground and water in NR areas.  |
| Restoration and Rehabilitation Work                                | The maintenance work of mangrove is necessary.   |
| Facilities Required for the Conservation and Management Activities | Directional signs along the highway and entrance to the access road(s), guide signs in the reserve, and information boards in the NR area can be seen in the area to explain the significance of the reserve and major flora and fauna. Footpath and boardwalk for observation of wildlife as well as mangrove are also necessary. The construction of tourist huts is required. <b>(Figure 4 Proposed Tourism Development Plan)</b> |

## 3.2 Monitoring

### 3.2.1 Mangrove

| Monitoring Method | Label trees for monitoring. Monitor mangrove by using the attached <b>“Attachment 1: Field Monitoring Sheet for Mangrove”</b> .   |
|-------------------|---|
| Frequency         | Existing mangrove:<br>Every 2 years   |
| Monitoring Target | Existing mangrove:<br>1) Mh-OT1: Coordinate Easting 611614 /Northing 2276114<br>2) Mh-OT3: Coordinate Easting 621514 /Northing 2276146<br>3) Mh-OT19: Coordinate Easting 611614 /Northing 2276114 |
| Baseline Data     | Baseline data and monitoring trees are listed in <b>“Attachment 2: List of the Observed Points in Mahawt Island”</b> .  |

### 3.2.2 Soil and Water

|                   |  |
|-------------------|--|
| Monitoring Method | Monitor soil and water in and around mangrove vegetation by using attached table “ <b>Attachment 3: Field Monitoring Sheet for Soil and Water (Mahawt Island)</b> ”. |
| Frequency         | Soil: (Existing mangrove area) Every 2 Years<br>Water; Before (Apr) and after (Nov) monsoon season (Every year) (Outflow water at low tide should be measured.)      |
| Monitoring Target | <b>Attachment 3</b>  |
| Baseline Data     | See attached table “ <b>Attachment 4: Soil Profile in Mahawt Island</b> ” and “ <b>Attachment 5: Surface Water Quality in Mahawt Island</b> ”.                       |

### 3.2.3 Fauna and Flora

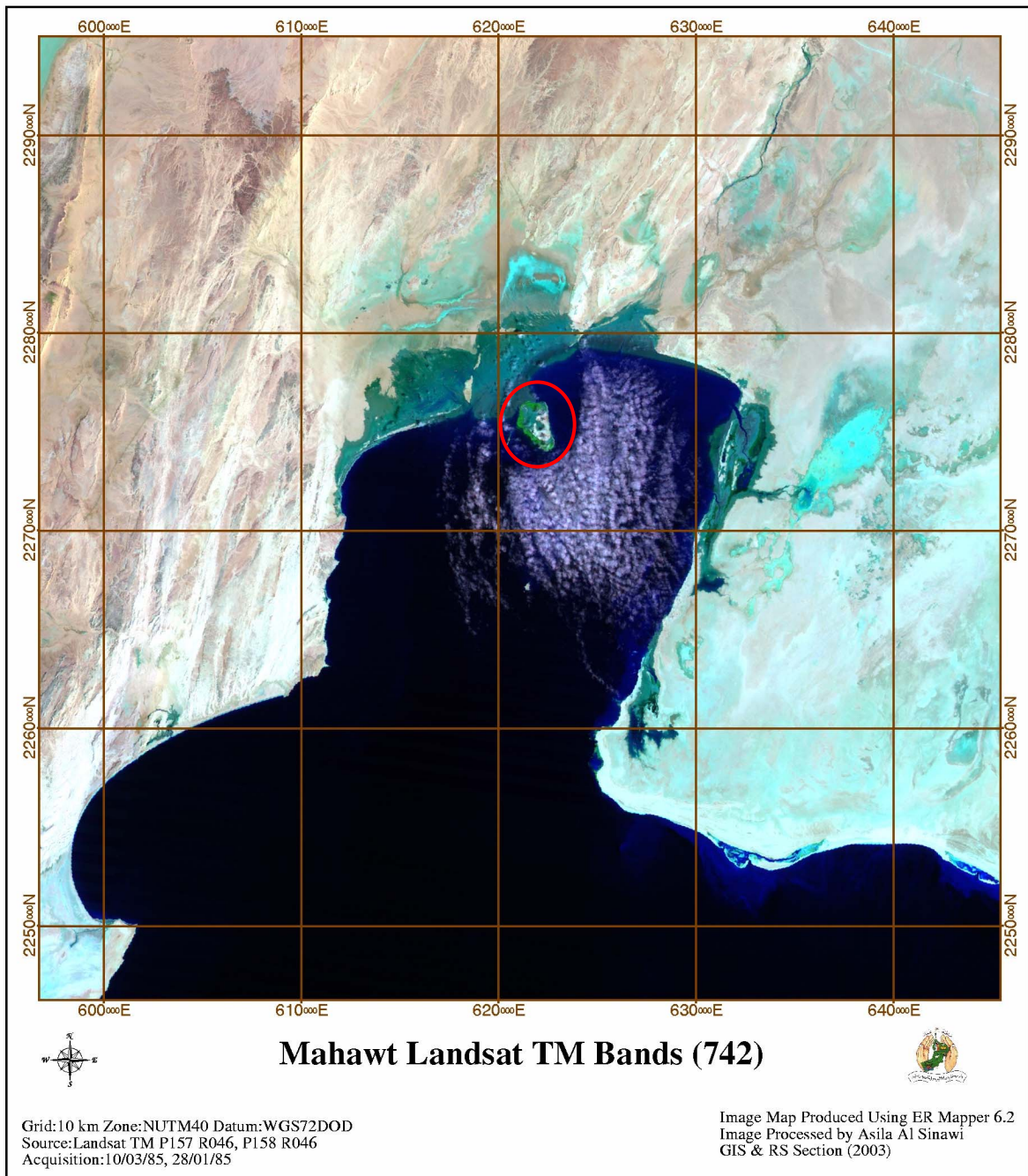
|                   |   |
|-------------------|---|
| Monitoring Method | Monitor fauna and flora by using the attached “ <b>Attachment 6: Field Monitoring Sheet for Fauna and Flora and Pollution</b> ”. For the observation of birds, an institute that is studying birds in Oman can be the best institute to take a part of the monitoring work by sub-contract basis. |
| Frequency         | At least twice a year   |
| Monitoring Target | <b>Attachment 6</b>   |
| Baseline Data     | The result of field reconnaissance of fauna and flora is shown in “ <b>Attachment 7: Result of Field Reconnaissance of Fauna and Flora and Pollution in Mahawt Island</b> ”.  |

### 3.2.4 Pollution (garbage and waste)

|                   |   |
|-------------------|---|
| Monitoring Method | Monitor pollution by using the attached “ <b>Attachment 6: Field Monitoring Sheet for Fauna and Flora and Pollution</b> ”. Water Quality and Soil Sample Tests should be carried out by MRMEWR. |
| Frequency         | At least twice a year   |
| Monitoring Target | <b>Attachment 6</b>   |
| Baseline Data     | See “ <b>Attachment 7: Result of Field Reconnaissance of Fauna and Flora and Pollution in Mahawt Island</b> ”.  |

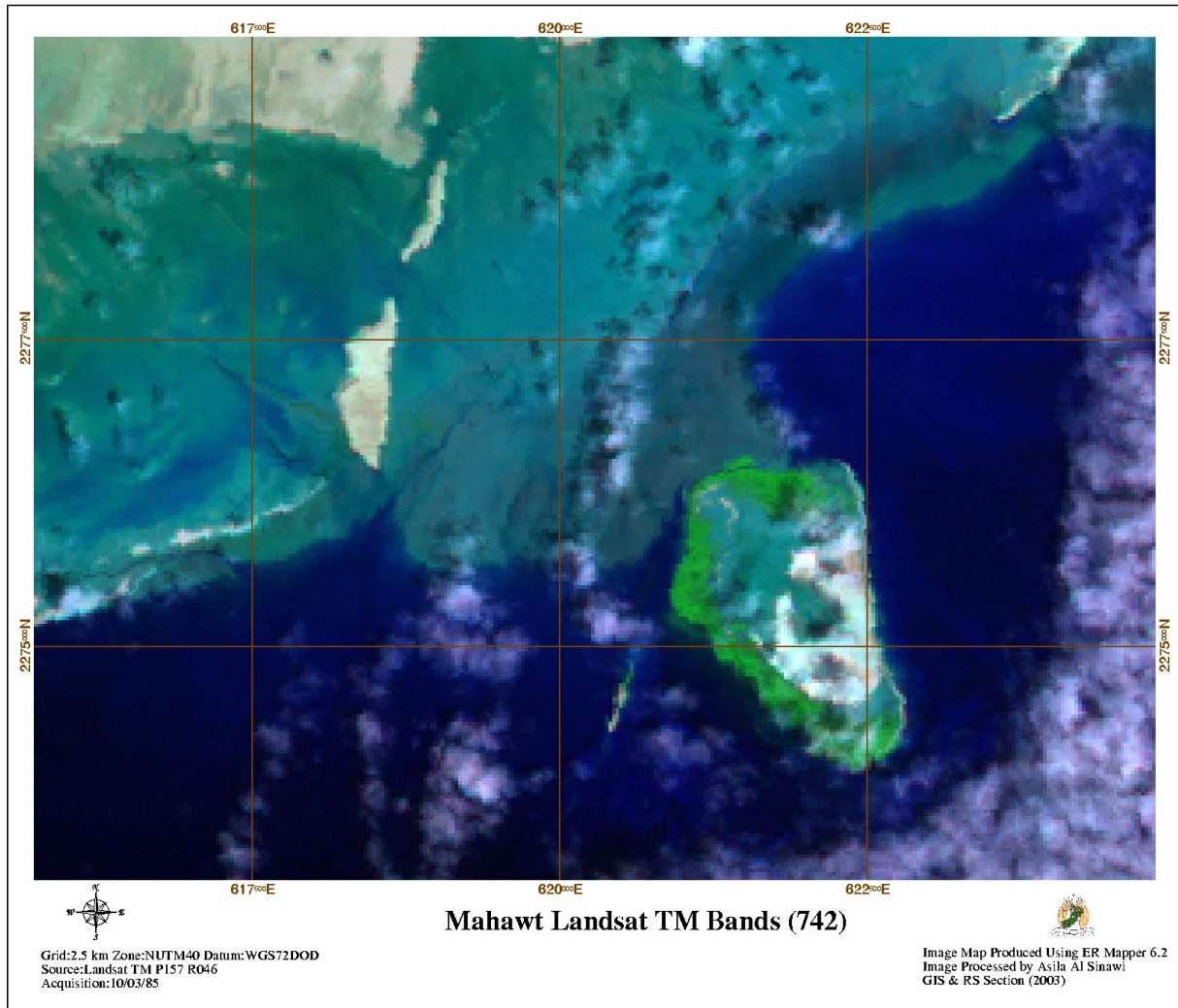
### 3.2.5 Change on Legal Setup and Development Plans

|                   |  |
|-------------------|--|
| Frequency         | At least once a year   |
| Monitoring Target | Land Ownership, Land Use Designation, Development Plans in the Site and Surrounding Area |



**Figure 1 Key Map**





**Figure 2 Location Map**

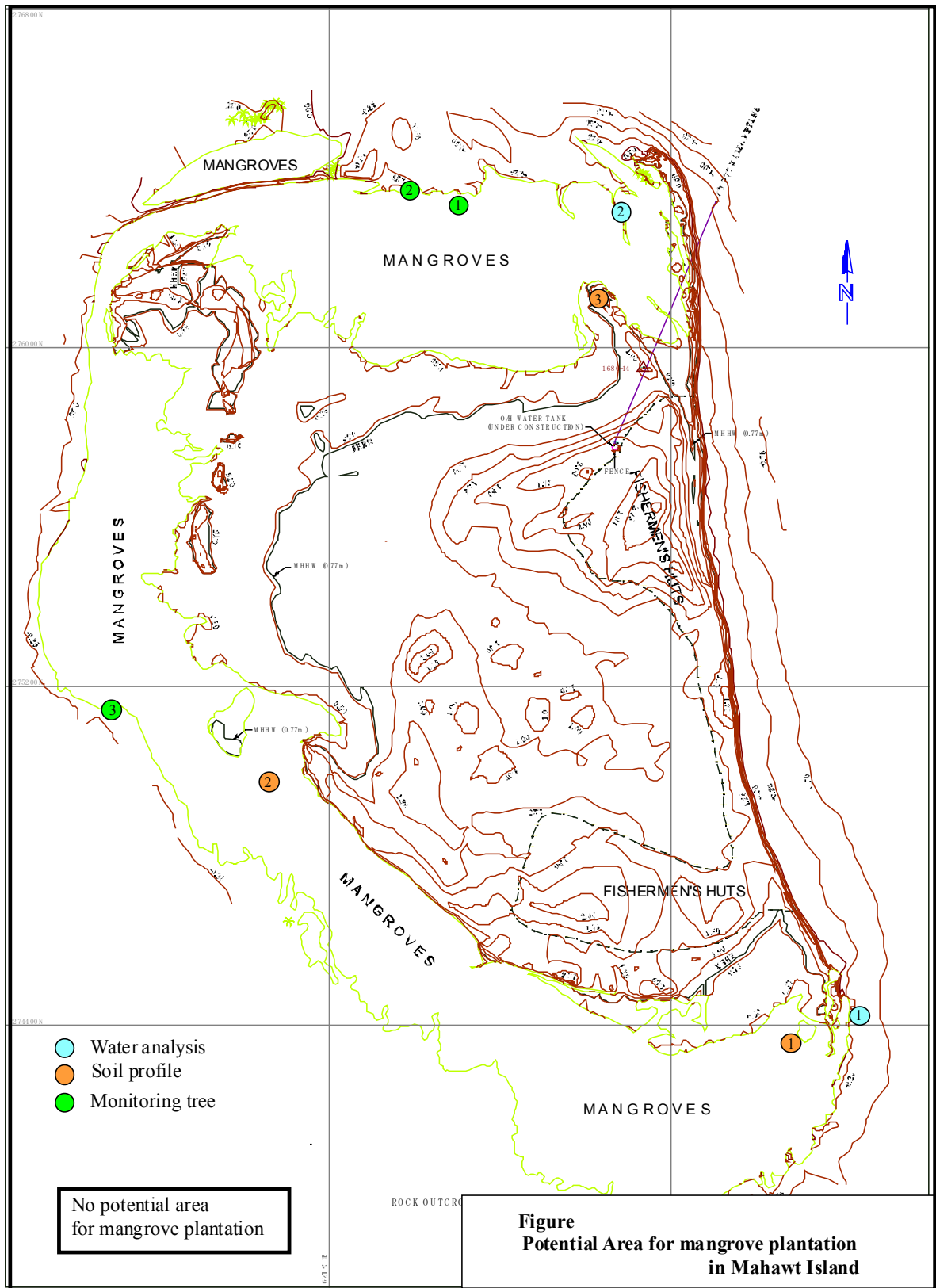


Figure 3 Planting Map

**Attachment 1: Field Monitoring Sheet for Mangrove (Mahawt Island)**

| <b>Mangrove Observation Records</b>   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |  |  |   |   |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|----|--|--|---|---|--|--|--|
| <p>1) Identification No. _____</p> <p>2) Location by GPS (WGS 84, UTM)<br/>                     Easting: _____<br/>                     Northing: _____</p> <p>3) Photograph No. _____</p> <p>4) Observation of tree size and shape<br/>                     a) Tree Height (cm) <input style="width: 80px; height: 20px;" type="text"/><br/>                     b) Trunk diameter near bottom (cm) <input style="width: 80px; height: 20px;" type="text"/><br/>                     c) Live branches at the position about 1.3m off the centre of tree bottom (painted)<br/>                     Branch/ limb diameter measured in cm</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%; text-align: center;">1</td> <td style="width: 25%; text-align: center;">2</td> <td style="width: 25%; text-align: center;">3</td> <td style="width: 25%; text-align: center;">4</td> </tr> <tr> <td style="text-align: center;"><input style="width: 80px; height: 20px;" type="text"/></td> <td style="text-align: center;"><input style="width: 80px; height: 20px;" type="text"/></td> <td style="text-align: center;"><input style="width: 80px; height: 20px;" type="text"/></td> <td style="text-align: center;"><input style="width: 80px; height: 20px;" type="text"/></td> </tr> <tr> <td style="text-align: center;">5</td> <td style="text-align: center;">6</td> <td style="text-align: center;">7</td> <td style="text-align: center;">8</td> </tr> <tr> <td style="text-align: center;"><input style="width: 80px; height: 20px;" type="text"/></td> <td style="text-align: center;"><input style="width: 80px; height: 20px;" type="text"/></td> <td style="text-align: center;"><input style="width: 80px; height: 20px;" type="text"/></td> <td style="text-align: center;"><input style="width: 80px; height: 20px;" type="text"/></td> </tr> <tr> <td style="text-align: center;">9</td> <td style="text-align: center;">10</td> <td></td> <td></td> </tr> <tr> <td style="text-align: center;"><input style="width: 80px; height: 20px;" type="text"/></td> <td style="text-align: center;"><input style="width: 80px; height: 20px;" type="text"/></td> <td></td> <td></td> </tr> </table> | 1   | 2   | 3   | 4 | <input style="width: 80px; height: 20px;" type="text"/> | <input style="width: 80px; height: 20px;" type="text"/> | <input style="width: 80px; height: 20px;" type="text"/> | <input style="width: 80px; height: 20px;" type="text"/> | 5 | 6 | 7 | 8 | <input style="width: 80px; height: 20px;" type="text"/> | <input style="width: 80px; height: 20px;" type="text"/> | <input style="width: 80px; height: 20px;" type="text"/> | <input style="width: 80px; height: 20px;" type="text"/> | 9 | 10 |  |  | <input style="width: 80px; height: 20px;" type="text"/> | <input style="width: 80px; height: 20px;" type="text"/> |  |  | <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p><b>Memo:</b><br/>                     (specific information or data significant for the tree will be written here)</p> </div> |
| 1   | 2   | 3   | 4   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |  |  |   |   |  |  |  |
| <input style="width: 80px; height: 20px;" type="text"/>   | <input style="width: 80px; height: 20px;" type="text"/> | <input style="width: 80px; height: 20px;" type="text"/> | <input style="width: 80px; height: 20px;" type="text"/> |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |  |  |   |   |  |  |  |
| 5   | 6   | 7   | 8   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |  |  |   |   |  |  |  |
| <input style="width: 80px; height: 20px;" type="text"/>   | <input style="width: 80px; height: 20px;" type="text"/> | <input style="width: 80px; height: 20px;" type="text"/> | <input style="width: 80px; height: 20px;" type="text"/> |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |  |  |   |   |  |  |  |
| 9   | 10  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |  |  |   |   |  |  |  |
| <input style="width: 80px; height: 20px;" type="text"/>   | <input style="width: 80px; height: 20px;" type="text"/> |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |  |  |   |   |  |  |  |
| <p>5) Observation of tree history, health and environment</p> <p>a) History<br/>                     Tree shape: _____<br/>                     Sign of cut in the past: _____</p> <p>b) Health<br/>                     Nodes with leaves: _____<br/>                     Inter-node length: _____<br/>                     Leaf length: _____<br/>                     Leaf colour: _____<br/>                     Looks / die back: _____</p> <p>c) Environment<br/>                     Soil depth / texture: _____<br/>                     Surface water Salinity: _____<br/>                     Ground level: _____<br/>                     Position: _____</p>  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |  |  |   |   |  |  |  |
| <div style="border: 1px solid black; padding: 5px; min-height: 60px;"> <p>Note:</p> </div>  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |  |  |   |   |  |  |  |

**Attachment 2: List of the Observed Points in Mahawt Island**

| Khawr  | Tree Number | Monitoring Trees | Date of Observation | Coordinate (UTM) |          | Photo Number     | Height (cm) | Trunk near bottom | Diameter (cm)  |    |    |    |   |   |   |   |   |    | Remarks |
|--------|-------------|------------------|---------------------|------------------|----------|------------------|-------------|-------------------|--|----|----|----|---|---|---|---|---|----|---------|
|        |             |                  |                     | Easting          | Northing |                  |             |                   | Live branches at the position about 1.3m off the centre of tree bottom (DBH: Diameter Breast Height) |    |    |    |   |   |   |   |   |    |         |
|        |             |                  |                     |                  |          |                  |             |                   | 1  | 2  | 3  | 4  | 5 | 6 | 7 | 8 | 9 | 10 |         |
| Mahawt | Mh-OT1      |                  | 22 Dec '02          |                  |          |                  | 778         |                   | 32   | 69 | 21 |    |   |   |   |   |   |    |         |
| Mahawt | Mh-OT2      | 1                | 22 Dec '02          | 621886           | 2276318  | mahawtree1a & 1b | 974         |                   | 54   | 10 |    |    |   |   |   |   |   |    |         |
| Mahawt | Mh-OT3      | 2                | 22 Dec '02          | 621786           | 2276350  | mahawtree2a & 2b | 926         |                   | 32   | 54 | 29 | 35 |   |   |   |   |   |    |         |
| Mahawt | Mh-OT4      | 3                | 22 Dec '02          | 621178           | 2275096  | mahawtree3a & 3b | 912         |                   | 46   | 38 | 14 | 13 |   |   |   |   |   |    |         |
| Mahawt | Mh-OT5      |                  | 22 Dec '02          | 622262           | 2274047  |                  | 909         |                   | 54   | 22 |    |    |   |   |   |   |   |    |         |
| Mahawt | Mh-OT6      |                  | 22 Dec '02          | 621902           | 2275964  |                  | 224         |                   |  |    |    |    |   |   |   |   |   |    |         |
| Mahawt | Mh-OT7      |                  | 22 Dec '02          | 621908           | 2275983  |                  | 233         |                   |  |    |    |    |   |   |   |   |   |    |         |
| Mahawt | Mh-OT8      |                  | 22 Dec '02          | 621908           | 2276009  |                  | 329         |                   |  |    |    |    |   |   |   |   |   |    |         |
| Mahawt | Mh-OT9      |                  | 22 Dec '02          | 621907           | 2276024  |                  | 302         |                   |  |    |    |    |   |   |   |   |   |    |         |
| Mahawt | Mh-OT10     |                  | 22 Dec '02          | 621908           | 2276039  |                  | 314         |                   |  |    |    |    |   |   |   |   |   |    |         |
| Mahawt | Mh-OT11     |                  | 22 Dec '02          | 621908           | 2276071  |                  | 354         |                   |  |    |    |    |   |   |   |   |   |    |         |
| Mahawt | Mh-OT12     |                  | 22 Dec '02          | 621907           | 2276092  |                  | 440         |                   |  |    |    |    |   |   |   |   |   |    |         |
| Mahawt | Mh-OT13     |                  | 22 Dec '02          | 621906           | 2276116  |                  | 424         |                   |  |    |    |    |   |   |   |   |   |    |         |
| Mahawt | Mh-OT14     |                  | 22 Dec '02          | 621907           | 2276150  |                  | 570         |                   |  |    |    |    |   |   |   |   |   |    |         |
| Mahawt | Mh-OT15     |                  | 22 Dec '02          | 621907           | 2276179  |                  | 613         |                   |  |    |    |    |   |   |   |   |   |    |         |
| Mahawt | Mh-OT16     |                  | 22 Dec '02          | 621899           | 2276193  |                  | 600         |                   |  |    |    |    |   |   |   |   |   |    |         |
| Mahawt | Mh-OT17     |                  | 22 Dec '02          | 621891           | 2276214  |                  | 731         |                   |  |    |    |    |   |   |   |   |   |    |         |
| Mahawt | Mh-OT18     |                  | 22 Dec '02          | 621906           | 2276247  |                  | 804         |                   |  |    |    |    |   |   |   |   |   |    |         |
| Mahawt | Mh-OT19     |                  | 22 Dec '02          |                  |          |                  | 907         |                   | 47   | 55 | 11 |    |   |   |   |   |   |    |         |

**Attachment 3: Field Monitoring Sheet for Soil & Water (Mahawt Island)**

|              |                        |
|--------------|------------------------|
| Location     |                        |
| Date / time: | ___ / ___, 200__ : ___ |
| Recorder     |                        |
|              |                        |



**General Condition in plantation area:**

(garbage, rubbish, leaf, alga, crab, shell, etc)

**(1) Soil Condition**

● Soil ○ Water

|                        |              | Exist. mangrove ①<br>on young mangrove bush | Exist. mangrove ②<br>deep forest |
|------------------------|--------------|---|----------------------------------|
| Coordinate             | Easting      | 622200                                      | 621600                           |
|                        | Northing     | 2276450                                     | 2274800                          |
| Surface condition      |              |   |                                  |
| Soil Texture           | 0-10cm       |   |                                  |
|                        | 30-40cm      |   |                                  |
|                        | 50-60cm      |   |                                  |
| Soil Colour            | 0-10cm       |   |                                  |
|                        | 30-40cm      |   |                                  |
|                        | 50-60cm      |   |                                  |
| Root development       |              |   |                                  |
| Depth of surface humus |              |   |                                  |
| Free water             | GWL* (cm)    |   |                                  |
|                        | pH           |   |                                  |
|                        | Salinity (%) |   |                                  |

Soil colour by Munsell notation, GPS\*:by UTM of WGS84 GWL: Ground water level

**(2) Surface Water Quality**

(Observation time: \_\_\_\_\_ : \_\_\_\_\_ )

|                    |          | Sea water ③ |  |
|--------------------|----------|-------------|--|
| Coordinate         | Easting  | 622800      |  |
|                    | Northing | 2274210     |  |
| Surface waste      |          |             |  |
| pH                 |          |             |  |
| Salinity (%)       |          |             |  |
| Temperature (C)    |          |             |  |
| DO (mg/l)          |          |             |  |
| Turbidity / Colour |          |             |  |

**Attachment 4: Soil Profile in Mahawt Island**

| Profile No. | Location   | Coordinate (UTM) |          | Ground Water  |    | Texture      |                  |                       | Soil Colour        |                             | Hardness              |                |                |
|-------------|--|------------------|----------|---------------|----|--------------|------------------|-----------------------|--------------------|-----------------------------|-----------------------|----------------|----------------|
|             |  | Easting          | Northing | Depth (cm)    | pH | Salinity (%) | Surface (0-30cm) | Sub-surface (30-60cm) | Deep layer (>90cm) | Surface (0-30cm)            | Sub-surface (30-60cm) | Surface        | Sub-surface    |
| Mo-1        | Swamp on south east beach under vegetation             | 622719           | 2274285  | Surface water |    |              | Loamy            | Sandy                 | Sand               | Yellow Grey                 | Grey                  | (Loose)        | (Very friable) |
| Mo-2        | Gentle tidal zone in north east shore under vegetation | 622064           | 2276043  | Surface water |    |              | Clay             | Clay                  | Clay               | Olive black - greyish olive | Grey                  | (Very friable) | (friable)      |
| Mo-3        | Gentle upper beach in south shore under vegetation     | 621579           | 2274839  | -             | -  | -            | Sandy            | Sandy                 | Sand               | Olive black - Grey          | Brownish grey - grey  | (friable)      | (friable)      |

Data of hardness in parenthesis by hand observation

**Attachment 5: Surface Water Quality in Mahawt Island**

| No. | Location                      | Coordinate (UTM) |          | Colour/ Visibility | pH  | Salinity (%) | Temperature (C) | DO (mg/l) | COD (mg/l) | NO3 (mgNO3/l) |
|-----|-------------------------------|------------------|----------|--------------------|-----|--------------|-----------------|-----------|------------|---------------|
|     |                               | Easting          | Northing |                    |     |              |                 |           |            |               |
| 1   | Southeast beach               | 622742           | 2274208  | Clear              | 8.3 | 3.9          | 14.9            | 6.70      | 0-2        | -             |
| 2   | Water channel in north forest | 622219           | 2276017  | +                  | 8.2 | 5.3          | -               | -         | -          | -             |

Observation Date: 18-21 January, 2003

**Attachment 6: Field Monitoring Sheet for Fauna and Flora and Pollution  
(Mahawt Island)**

|                                |              |
|--------------------------------|--------------|
| <b>Location:</b> Mahawt Island | <b>Date:</b> |
| <b>Time:</b>                   | <b>Tide:</b> |
| <b>Recorder:</b>               |              |

|   |         |        |
|---|---------|--------|
| <b>Bird counts:</b>   | species | number |
| Expected winter birds: Gulls, Terns, Herons, Waders, Waterfowl,<br>Expected summer birds: Clamorous Reed Warbler, Reef Heron, White-collared Kingfisher,<br>Characteristic species: Oriental Whiteeye – <i>Zosterops palpebrosa</i> |         |        |

|                   |  |
|-------------------|--|
| <b>Pollution:</b> |  |
| Evidence of:      | solid waste (garbage), liquid waste, oil |
| Water quality:    | clear/muddy/green                        |
| Fishing:          | nets                                     |

|  |  |
|--|--|
| <b>Vegetation:</b>                             |  |
| Evidence of grazing, cutting, flowering, seeds |  |
| Mangrove condition                             |  |
| Other plants                                   |  |

|   |  |
|---|--|
| <b>Animals:</b>   |  |
| Diverse crab fauna, fiddler crabs, mud crabs, marsh crabs   |  |
| Characteristic species: large grey/purple marsh crab on mangrove trees– <i>Epineosesarma versicolour</i> ,<br>Mudskipper fish on mud and trees- <i>Periophthalmus koelreuteri</i> |  |

|                                |
|--------------------------------|
| <b>Domestic/feral animals:</b> |
|--------------------------------|

|                        |
|------------------------|
| <b>Other comments:</b> |
|------------------------|

**Attachment 7: Result of Field Reconnaissance of Fauna and Flora and Pollution in Mahawt Island**

**Field Monitoring Sheet for Fauna and Flora and Pollution Sample (1)**

**Location:** Mahawt Island **Date:** 22-3/12/02  
**Time:** 16.00-18.00/07.00-09.30 **Tide:** low? 1.1 m at 16.00  
**Recorder:** N V Clarke

**Bird counts:**

| <b>Gulls</b> | <b>Terns</b> | <b>Herons</b> | <b>Waders</b> | <b>Waterfowl</b> |
|--------------|--------------|---------------|---------------|------------------|
| 40 off beach | none         | abundant      | common        | none             |

osprey, western reef heron, grey heron, great white egret, little green heron  
 Endemic Oriental white-eye observed in large trees.

**Pollution:**

|                |                                |   |
|----------------|--------------------------------|---|
| Evidence of:   | solid waste, liquid waste, oil | area of solid waste in middle of island                             |
| Water quality: | clear/muddy/green              | clear   |
| Fishing:       | nets                           | some discarded nets clinging to trees<br>Children hunting for crabs |

**Vegetation:**

Mangroves in excellent condition, young trees regenerating

Evidence of cutting of small mangrove branches for goats

Five species of succulent plants along outer edge of island, (*Atriplex farinosa*, *Suaeda moschata*, *Suaeda monoica*, *Arthrocnemum macrostachyum*, *Halopeplis perfoliata*).

**Animals:**

Landward fringe of mangroves: Large *Uca inversa* crabs.

Among trees: Large marsh crabs (*Neopisesarma versicolour*, *Parasesarma plicatum*) and numerous small grapsoid crabs,

In mud: Numerous crabs: *Serenella leachii*, *Macrophthalmus depressus*, *M. Grandidieri*, *Leptochryseus kuwaitense*

Molluscs included the gastropods: *Cerithidea cingulata*, *Cerithium scabridum*, *Planaxis sulcata*, *Nassarius spp*, and the soft-bodied gastropod (*Onchidium*),

Bivalves included: *Marcia opima*, *Tellina arsinoides* and the small oyster, *Alectryonela plicatula*.

Other species of note: mudskipper fish, active holes of the red fox

**Domestic/feral animals:** goats and abundant cats

**Other comments:**

Extremely diverse mangrove fauna with several unusual species. To protect native island fauna, introduced feral cats should be eliminated.





**Attachment 8: Site Photos (Mahawt Island)**

**General Condition**



Mangroves front of sea side



Mangroves along water channel

**Mangrove Vegetation**



Deep mangrove forest



New seedlings

**Soil Condition**



Back swamp on southeast beach under vegetation (Profile No. Mo-1)



Gentle upper beach in south shore under vegetation (Profile No. Mo-3)

**Attachment 9: Soil Profile of Samples in Mahawt Island**

(Profile No. Mo-1)

|                                 |  |   |                |
|---------------------------------|--|---|----------------|
| Location                        | Mahawt, swamp on south east beach under vegetation |   |                |
| Coordinate (UTM)                | Easting: 622719                                    | Northing: 2274285   |                |
| Physiologic position            | Swamp  | Topography  | Undulating     |
| Soil Classification             | Typic Fluvaquents                                  |   |                |
| Parent material                 | Marine deposit                                     | Depth of free water   | Not determined |
| Vegetation/ mangrove            | Young mangrove vegetation, South east of island    |   |                |
| Description of soil profile *2) |  |   |                |
| A                               | 0-4cm  | Greyish olive (5Y 4/2), sandy loam with sticky consistency; very small roots; clear, smooth boundary  |                |
| C                               | 4-37cm   | Grey (5Y 4/1), silty loam with sticky consistency; many brownish black (10YR 2/2) mottles; common medium and small roots and many very small roots; gradual wavy boundary |                |
| C                               | 37-54cm  | Grey (5Y 4/1), loamy sand with non-sticky consistency; few black (5Y 2/1) mottle; few small and common very small roots; gradual smooth boundary                          |                |
| C                               | 54-83cm  | Greyish olive (5Y 4/2), very soft sand to loamy sand and slightly sticky consistency; many shell fragments, few small roots   |                |

\*1: Descriptions of structure and boundary are estimated from limited observation of core sample.

\*2: Texture was classified at field by visual and touching observation

(Profile No. Mo-3)

|                                 |  |  |                |
|---------------------------------|--|--|----------------|
| Location                        | Mahawt, gentle intertidal zone in south shore under vegetation |  |                |
| Coordinate (UTM)                | Easting: 621579  | Northing: 2274839  |                |
| Physiologic position            | Lower terrace  | Topography   | Undulating     |
| Soil Classification             | Humaqueptic (Mollic) Psammaquents                              |  |                |
| Parent material                 | Marine deposit   | Depth of free water  | Not determined |
| Vegetation/ mangrove            | Deep and large mangrove vegetation, Beside channel in forest   |  |                |
| Description of soil profile *2) |  |  |                |
| A                               | 0-8cm  | Olive black (7.5Y 3.5/1), sandy loam with sticky consistency; many very small roots; gradual boundary  |                |
| A                               | 8-29cm   | Grey (10Y 4/1) loamy sand with sticky consistency; brownish black (10YR 3/2) mottle; many small and very small roots; accumulated layer of organic matter; diffused boundary |                |
| C                               | 29-48cm  | Brownish black (10YR 3.5/1), loamy sand with non-sticky consistency; many small and very small roots; clear boundary   |                |
| C                               | 48-63cm  | Grey (7.5Y 4/1) sand with non-sticky consistency; few very small roots   |                |

\*1: Descriptions of structure and boundary are estimated from limited observation of core sample.

\*2: Texture was classified at field by visual and touching observation