

Technical Specification for AI Demer Beach

1. SITE DESCRIPTION

1.1 Location

Governorate/ Region	Dofar
Wilayat	Mirbat
Distance from the Centre of Wilayat	This site is located 5 km west of Mirbat town.
Fame of the Site/ Distinctive Features	N/A
Facilities in the Site	N/A
Features of Surrounding Areas	This site is sand dune. No mangrove tree exists.

1.2 Natural Conditions

Climate Zone	Dhofar Zone
General Terrain	Relatively flat plain
Soil	Proposed area locates at the beach sand area on the way to Mirbat from Taqah This area was proposed for afforestation to prevent sand shifting and for wind protection. During monsoon season in summer, the sand in this area has been blown by strong wind from beach. The area is covered by coarse sand more than 1m deep. The salinity (soil: water=1.1) of these sand soils shows low values ranging from 475 to 730 μ S/cm in surface soil and less than 200 μ S/cm in subsurface soil. The area beside the road has compact gravel soils, which were brought for road foundation.
Water	No data
Fauna	No data
Flora	This is an excellent example of relatively unspoilt sand dune supporting vegetation dominated at the seafront by dune grass, <i>Halopyrum mucronatum</i> . Other plants included <i>Urochondra setulosa</i> , <i>Cyperus conglomeratus</i> , <i>Ipomoea pes-caprae</i> , <i>Polycarpae spicata</i> , <i>Aizoon canariense</i> , <i>Indigophora sp</i> and <i>Sporobolus spicatus</i> .
Impacts from the Surrounding Areas	None

1.3 Socio-economic Situation

Population of the Wilayat (2001)	14 thousand
Main Economic Activities	Agriculture and livestock farming
Infrastructure	N/A
Main Usage	Used for public open space for communities
Community Interference with the Area	N/A
Cultural Significance	N/A

1.4 Legal Setup and Development Plans

Land Ownership and Land Use Designation	Open space
Development Plans in the Site and the Surrounding Area	N/A
Existing Conservation Proposal	N/A

2. PROGRAMME AND PROJECT

2.1 Prerequisite

Legal Setup for Land Use Control	N/A
Facility Development Control	No permanent structure in the site

2.2 Description of Programmes

Facility Development Programme	N/A
Restoration and Afforestation Programme	N/A
Monitoring Programme	(1) Shifting sand monitoring project
Public Awareness Programme	N/A

2.3 Implementation Mechanism

Projects	Responsible Agencies	Implementing Body/ Agencies	Related Agencies
(1) Shifting sand monitoring project	MRMEWR Dhofar	Wilayat Mirbat	

2.4 Implementation Schedule

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

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 (Figure 2 Location Map). No mangrove plantation work is proposed.
Conditions of Existing Mangrove	N/A

3.1.2 Conservation Area

Area of Land Use	None
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3.1.3 Required Action for Conservation and Management

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	N/A
Facilities Required for the Conservation and Management Activities	N/A

3.2 Monitoring

3.2.1 Shifting Sand

Monitoring Method	Installation of pole for measurement of shifting sand. Monitor shifting sand by using pole. “Attachment 1: Field Monitoring Sheet for Shifting Sand” .
Frequency	Every year
Monitoring Target	Shifting sand
Baseline Data	No data

3.2.2 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

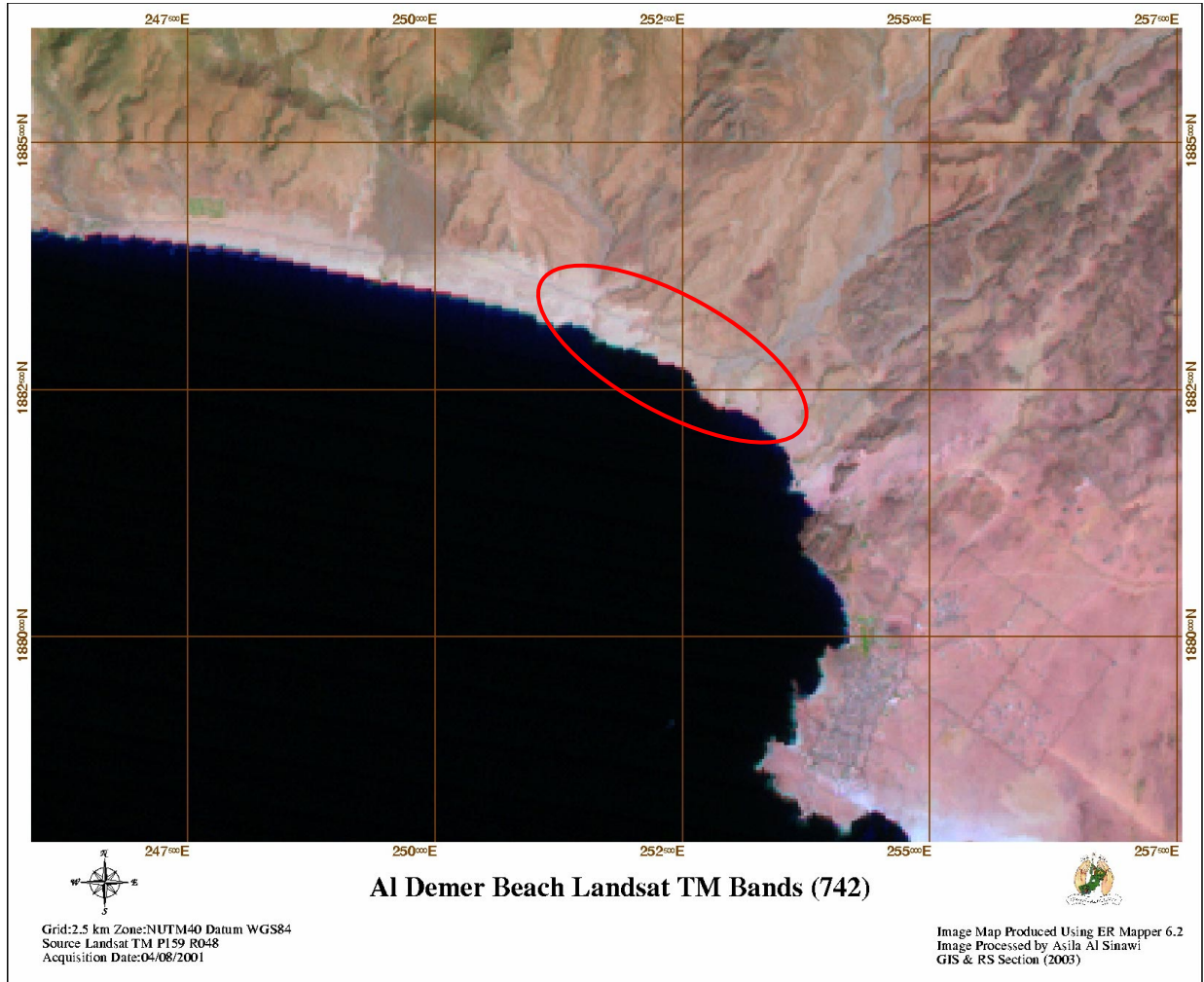


Figure 1 Key Map

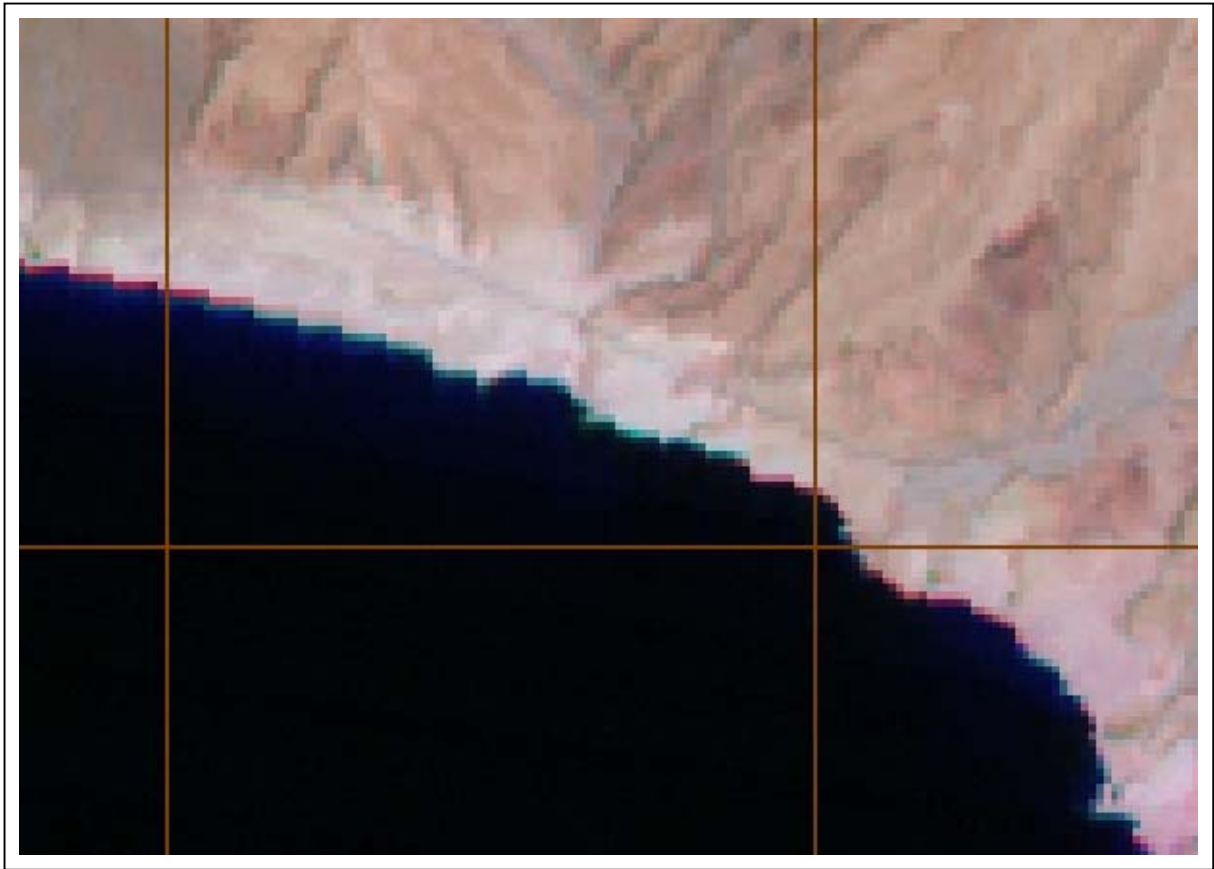


Figure 2 Location Map

Attachment 8: Site Photos (Al Demer Beach)

General Condition



View of site (1)



View of site (2)

Sand Shifting



Shifting sand on road



Sandy wind at site

Technical Specification for Khawr Rowri

1. SITE DESCRIPTION

1.1 Location

Governorate/ Region	Dhofar
Wilayat	Taqah
Distance from the Centre of Wilayat	Wilayat centre is Taqah located 3.2 km east of the site. This khawr is located 36 km east of Salalah
Nearest Locality	20 km
Fame of the Site/ Distinctive Features	Khawr Rowri is famous for ruins of the city of Samharam, a very important archaeological site on the banks of the water. This khawr is the largest and most diverse freshwater system in the Salalah area and it forms an important wildlife area as well as a tourism and recreation resource.
Facilities in the Site	None
Features of Surrounding Areas	None

1.2 Natural Conditions

Climate Zone	Dhofar Zone
General Terrain	Steep and rocky
Geological Features	No data
Soil	<p>Khawr Rowri is the largest khawr in Salalah area and one of the most famous tourist sites. The khawr is located on the east of Taqah town. The khawr is surrounded by calcareous rock outcrops. There are two water channels to the khawr. Main channel is stretching to the mountains leading to “Darbat Falls”, which has occasional water flow during floods. Another one is a branch channel extending to the east. The khawr is cut off by sandbar from sea. Many parts of shoreline are bound by rock outcrops. In general, the soils on the shores are shallow. Soils on the shores are basically loamy to silty through layers. Where reeds are growing soils are silty with humic substances in the surface and sand and/or rocks in subsurface. The terrace soils on the west shore near the ruins are shallow with 40-50cm depths and have salt accumulation on surface. Sand bars stretch south-north to both banks near the mouth of main khawr.</p> <p>Details are shown in attached table “Attachment 4: Soil Profile in Khawr Rowri” and “Attachment 9: Soil Profile of Samples in Khawr Rowri”.</p>
Water	<p>The salinities of surface water in the khawrs in the Salalah showed low values compared to other areas. It appears that water from the mountains has flowed into khawrs. In consequence, salinity levels were kept at low levels. The salinity of water in this khawr was also low ranging from 1.1 to 1.3%. The values of DO were more than 5 mg/l. But COD was about 5-10 mg/l.</p> <p>Details are shown in attached table “Attachment 5: Surface Water Quality in Khawr Rowri”.</p>
Fauna	<p>A few holes of ghost crabs (<i>Ocypode</i>) were seen. Fish were abundant. Unfortunately, an exotic species of fish (<i>Oreochromis niloticus</i>) has found its way into the khawr. It was introduced into Wadi Darbat to control mosquitoes, although the small native pup fish (<i>Aphanius dispar</i>) should be just as effective. The <i>Oreochromis</i> prefers the fresher</p>

	<p>water at the north end and will probably be impossible to eradicate from this nature reserve and may well spread to other khawrs and water bodies.</p> <p>Winter Birds included: 80 flamingos, 140 ducks (mallard, teal, shoveller, wigeon, garganey, pochard, pintail, tufted), 50 waders, 28 herons, black-necked grebe, cormorant, marsh harrier and eagle. Summer birds included grey heron, reef heron, and moorhen.</p>
Flora	<p>Submerged rooted plants in the water were common (e.g. <i>potamogeton pectinatus</i>), while the edge of the water was lined mostly by the sedges and reeds. The northern arm has fresher water where reedmace is dominant. Where the reeds and sedges are near the land they are heavily grazed. Grass (<i>Paspalum</i>) grows in the water next to the sedges. The drier bank vegetation was dominated by a grass (<i>Sporobolus virginicus</i>) nearest to the water and by <i>Cressa cretica</i>, and <i>Aeluropus lagopoides</i> on raised areas.</p> <p>Compared with studies in 1993 (TS-PCDEGD), the khawr has similar vegetation zones but a muddy gap has developed between the vegetation in the water and the bank and the extent of <i>Sporobolus virginicus</i> is reduced. This may be the combined effect of recent floods (May 2002) and heavy grazing. Many camel camps are present nearby in the summer.</p> <p>The planting of mangroves is not recommended at Khawr Rowri, as it represents a unique lagoon system.</p>
Impacts from the Surrounding Areas	Tourism development will affect the environment.

1.3 Socio-economic Situation

Population of the Wilayat (2001)	19 thousand
Population of the Nearest Locality (1993)	6.9 thousand
Main Economic Activities	Fishery, livestock farming and tourism
Infrastructure	Unpaved road has been developed for provision of the access to the historical heritage and water front in the khawr.
Main Usage	The site is in the protected area. Khawr Rowri is expected to be a nature conservation, archaeological conservation and eco-tourism area to attract tourists to the site.
Community Interference with the Area	N/A
Cultural Significance	World heritage site

1.4 Legal Setup and Development Plans

Land Ownership and Land Use Designation	<p>The khawr was designated as World Heritage Site in 2000. It was also designated as a Nature Reserve by Royal Decree 49/97 dated 28/6/97 with the Ministry of Regional Municipalities and Environment as the managing authority and the Directorate General of Nature Conservation as the implementing agency. The management plan provides for sustainable use of the natural resources and the protection of the very important archaeological site at Samharam. Provision will be made for visitor facilities to give out information on the historical site. The vegetation will be protected as representative of the natural flora of the gravel plain.</p>
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Development Plans in the Site and the Surrounding Area	Hotel development at sea shore just out side of the khawr.
Existing Conservation Proposal	A proposal of management plan exists. It recommends fencing the site, information centre development, limited type of visitor facilities development and conservation and restoration of fauna and flora.

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.
Restoration and Afforestation Programme	None
Monitoring Programme	(2) Soil and water monitoring project (3) Fauna and flora monitoring project (4) Pollution monitoring project (5) 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 (6) 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 Mirbat	MCI
(2) Soil and Water Monitoring Project	MRMEWR	Wilayat Mirbat	
(3) Fauna and Flora Monitoring Project	MRMEWR	MRMEWR/ Omani Institute for Birds	
(4) Pollution Monitoring Project	MRMEWR	Wilayat Mirbat	
(5) Monitoring Project on Legal Setup and Development Plans	MRMEWR	Wilayat Mirbat	
(6) Information boards	MRMEWR	MRMEWR	MOE

2.4 Implementation Schedule

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

3. IMPLEMENTATION PLAN

3.1 Restoration and Afforestation

3.1.1 Existing Mangrove Area

Location and Area	There is no mangrove vegetation in this khawr. No Plantation Plan is proposed. (Figure 2 Location Map)
Conditions of Existing Mangrove	N/A

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; ____, pH; ____ (“Attachment 5: Surface Water Quality in Khawr Rowri”)
Soil Conditions	Surveyed data is in the “Attachment 4: Soil Profile in Khawr Rowri” of this technical specification.
Potential Area	Sand bars along khawr near beach. Sand bars along khawr near beach are possible for transplantation. Soils of these areas are deep and coarse sands but the area is very small.

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	Nature Reserve (NR) Area
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3.1.4 Required Action for Conservation and Management

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	Biodiversity of flora and fauna
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.

3.2 Monitoring

3.2.1 Soil and Water

Monitoring Method	Monitor soil and water in and around mangrove vegetation by using attached table “ Attachment 3: Field Monitoring Sheet for Soil and Water (Khawr Rowri) ”
Frequency	Soil: No need monitoring work Water; Before (Apr) and after (Nov) monsoon season (Every year) (Outflow water at low tide should be measured.)
Monitoring Target	Attachment 3
Baseline Data	See attached table “ Attachment 4: Soil Profile in Khawr Rowri ” and “ Attachment 5: Surface Water Quality in Khawr Rowri ”

3.2.2 Fauna and Flora

Monitoring Method	Monitor fauna and flora by using the attached “ Attachment 6: Field Monitoring Sheet for Fauna and Flora and Pollution. ” 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	Attachment 6
Baseline Data	The result of field reconnaissance of fauna and flora is shown in “ Attachment 7: Result of Field Reconnaissance of Flora and Fauna and Pollution in Khawr Rowri ”

3.2.3 Pollution (garbage and waste)

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

3.2.4 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

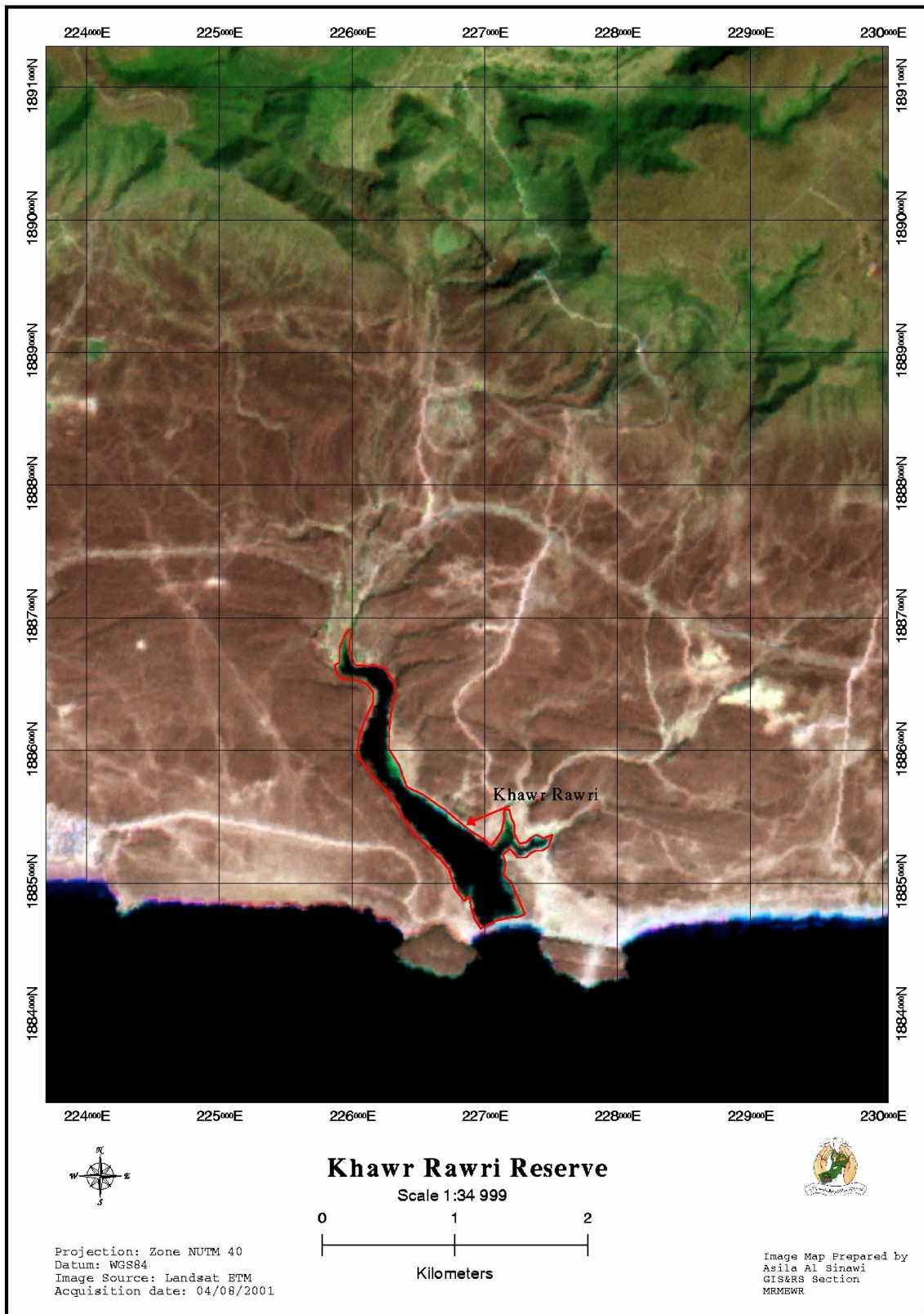


Figure 1 Key Map

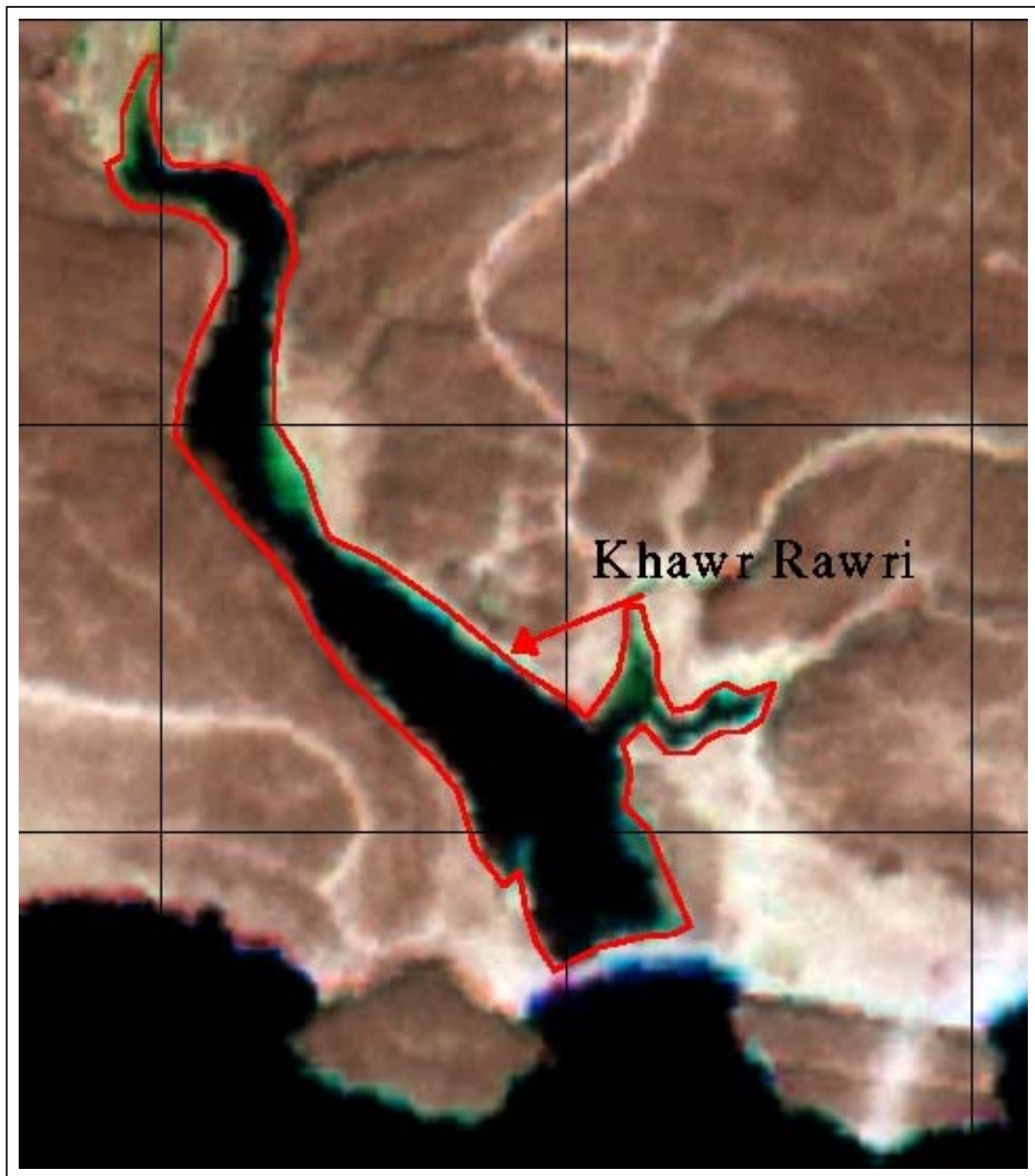


Figure 2 Location Map

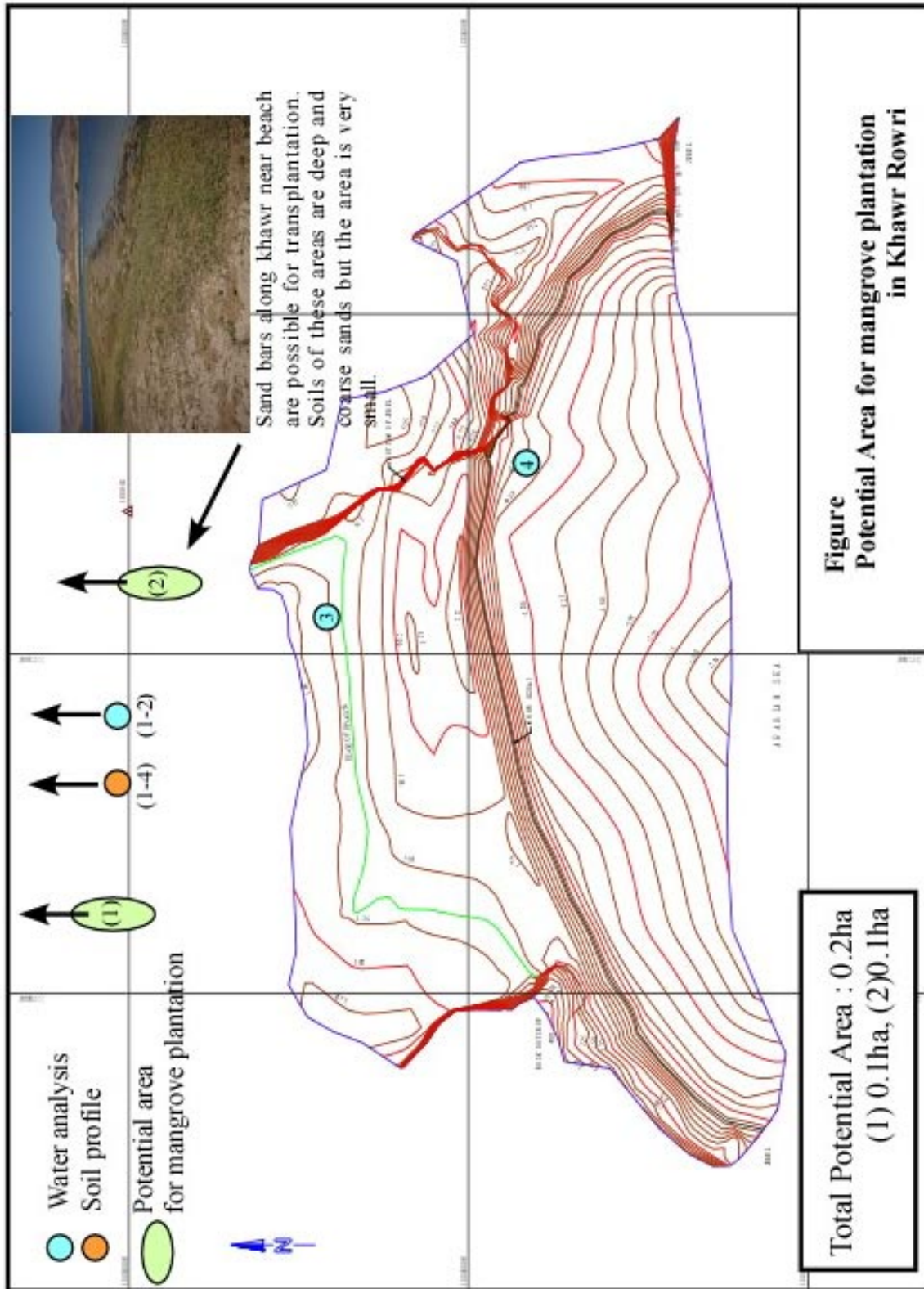
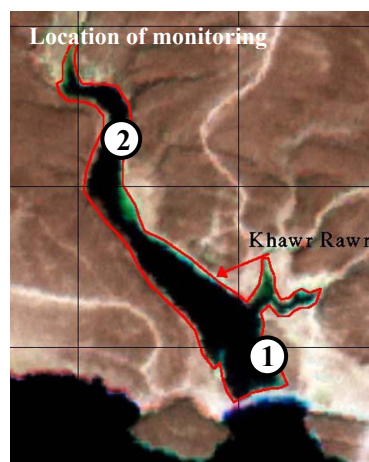


Figure 3 Planting Map

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

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



General Condition in plantation area:

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

(1) Soil Condition (No monitoring work)

● Soil ○ Water

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: _____ : _____)

		Khawr mouth①	Upstream khawr②
Coordinate	Easting	227200	226290
	Northing	1884870	1886400
Surface waste			
pH			
Salinity (%)			
Temperature (C)			
DO (mg/l)			
Turbidity / Colour			

Attachment 4: Soil Profile in Khawr Rowri

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
Ro-1	West shore of ruin	226292	1886102	Core sample			Loamy	Loamy - rock	Rock	Brownish black	Brownish black	Firm to friable	Friable
Ro-2	Terrace near ruin, 5m away from share	226641	1885681	No water			Sandy - loamy	Loamy loam	Loamy sand	Dull yellowish brown	Greyish yellow	Very firm	Firm
Ro-3	Beside of central swamp	227164	1885481	52	-	-	Loamy sand	Loamy	-	Dark olive brown	Black	Very firm to firm	Firm
Ro-4	Terrace near end of branch water channel	227480	1885443	No water			Sandy - loamy	Sandy	-	Greyish olive - olive brown	Greyish olive - olive yellow	Very firm to firm	Firm

Data of hardness in parenthesis by hand observation

Attachment 5: Surface Water Quality in Khawr Rowri

No.	Location	Coordinate (UTM)		Colour/ Visibility	pH	Salinity (%)	Temperature (C)	DO (mg/l)	COD (mg/l)	NO3 (mgNO3/l)
		Easting	Northing							
1	Upstream of main water channel	226290	1886389	+	8.1	1.2		8.20	5-10	-
2	Inmost upstream of main water channel	227492	1885386	+	8.0	1.1	22.1	5.60	5±	-
3	East beach of main water channel	227201	1884872	±	8.2	1.3	21.7	8.60	5-10	-
4	Sea water	227335	1884781	Clear	8.2	3.8	-	-	-	-
5	Inmost upstream of main water channel	227492	1885386	+	8.9	0.7	36.7	9.10	10±	1<
6	Khawr mouth	227201	1884872	±	8.5	0.8	36.6	7.90	-	-

Observation Date: 12-14 January 2003 for sample No.1-2, 31 May 2003 for sample No.3-6

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

Location	Khawr Rowri	Date
Time		Tide
Recorder		

Bird counts: (species or group and number)

Expected Winter Birds: greater flamingo, ducks (mallard, teal, shoveller, wigeon, garganey, pochard, pintail, tufted), waders (curlew, redshank, greenshank, sandpipers, plovers), herons (grey, purple, reef, striated, little egret, great white egret), glossy ibis, spoonbill, black-necked grebe, cormorant, marsh harrier and eagle.

Expected Summer Birds: grey heron, reef heron, striated heron, greater flamingo, moorhen, little grebe,

Pollution:
Evidence of: solid waste (garbage), liquid waste, oil
Water quality: clear/muddy/green/salinity
Fishing: nets

Domestic/feral animals:

Vegetation:
Reedbeds

Submerged

Water edge

Animals:
Invertebrates

Fish

Other Comments:

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

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

Location Khawr Rowri
Date 08/01/2003
Time 08.00
Tide non-tidal
Recorder N.V. Clarke

Bird counts: species: 20 number: 400
 Birds included: 80 flamingos, 140 ducks (mallard, teal, shoveller, wigeon, garganey, pochard, pintail, tufted), 50 waders (Curlew, redshank, greenshank, sandpipers, plovers), 28 herons, black-necked grebe, cormorant, marsh harrier and eagle.

Pollution:

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

Domestic/feral animals: Heavy grazing pressure from camels and goats.

Vegetation:

Submerged rooted plants were common, mainly beds of *Potamogeton pectinatus*. The edge of the water was lined mostly by the sedge *Schoenoplectus litoralis* with beds of *Typha angustata* and *Phragmites australis*. Where the reeds and sedges are near the land they are heavily grazed. The grass *Paspalum vaginatum* grows in the water next to the sedges. A muddy area often separated the water from the bank and sometimes had *Juncellus laevigatus* and *Bacopa monnieri* growing on it. The bank edge had *Sporobolus virginicus* but previous wide areas around the eastern side channel appeared to have been reduced to mud. Grasses had also disappeared from behind the sandbar near the mouth, although a small clump of *Schoenoplectus* remained in the water since 1993.

The drier bank vegetation was dominated by *Cressa cretica*, with *Aeluropus lagopoides* in lower depressions.

Compared with studies in 1993, the khawr has similar vegetation zones but a muddy gap has developed between the vegetation in the water and the bank and the extent of *Sporobolus virginicus* is reduced.

Invertebrates: A few holes of ghost crabs (*Ocypode*) were seen. Fish were abundant.

Other Comments:

Freshwater flows from the landward side and salinity varied from 0.4% in the middle to 1.4% at the mouth.

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

Location Khawr Rowri
Date 14/07/03
Time 14.00
Tide non-tidal
Recorder N.V. Clarke

Bird counts: species: 3 number: 30
 Birds included: 17 reef herons, 5 grey heron, 8 moorhen (breeding).

Pollution:

Evidence of: solid waste (garbage), liquid waste, oil. none
 Water quality: clear/muddy/green/salinity clear
 Fishing: nets 2 gill nets

Domestic/feral animals: Heavy grazing pressure from camels (camps established on the jerbeeb plain during the khareef) and goats.

Vegetation:

Submerged rooted plants of *Potamogeton pectinatus*. The edge of the water was lined mostly by the sedge *Schoenoplectus litoralis* with beds of *Typha angustata* (especially at north fresher end) and *Phragmites australis*. Where the reeds and sedges are near the land they are heavily grazed. The grass *Paspalum vaginatum* grows in the water next to the sedges. A muddy area often separated the water from the bank and sometimes had *Juncellus laevigatus* and *Bacopa monnieri* growing on it. The bank edge had *Sporobolus virginicus* but previous wide areas around the eastern side channel appeared to have been reduced to mud.

The drier bank vegetation was dominated by *Cressa cretica*, with *Aeluropus lagopoides* in lower depressions. *Limonium axillare* seems to have disappeared from large areas of the gravel and rocky plain.

Alien trees (about 12 *Prosopis juliflora*) were appearing at southern end.

Invertebrates: Ghost crabs (*Ocypode*) were seen. Fish were abundant.

Other comments:

Large *Typha* beds at the north end. An introduced species of fish (*Oreochromis niloticus*), now common in the fresher water at the north end of this nature reserve. Said to have been put into Wadi Darbat for mosquito control (although *Aphanius dispar*) already present in this unique environment.

Collection and distribution of animal manure within reserve boundaries (north east).

Action needed to remove about 12 *Prosopis juliflora* trees by hand to avoid damage to nature reserve by machine.

Attachment 8: Site Photos (Khawr Rowri)

General Condition



Upstream of khawr



Mouth of khawr

Soil Condition



West shore of ruins (Profile No. Ro-1)



Terrace near end of branch water channel (Profile No. Ro-4)



Attachment 9: Soil Profile of Samples in Khawr Rowri

(Profile No. Ro-1)

Location	(K. Rowri) west shore of ruins		
Coordinate (UTM)	Eastings: 226292	Northings: 1886102	
Physiologic position	Lower terrace	Topography	Slope
Soil Classification	Lithic Fluvaquents		
Parent material	Alluvial deposit	Depth of free water	Not determined
Vegetation/ mangrove	Rees on the share Observation of core sample *1		
Description of soil profile *2)			
A	0-4cm	Dark brown (10YR 3/3), silty loam with slightly sticky consistency; many black (10RY 1.7/1) mottle; gradual boundary	
A	4-18cm	Olive black (7.5Y 3/2) loam with slightly sticky consistency; common black (7.5Y 2/1) mottle; common very small roots; diffused boundary	
C	18-49cm	Brownish black (2.5Y 3/2) loam with slightly sticky consistency; few dark greyish yellow (2.5Y 4/2) mottle; many very small roots	
C	49-cm	Stone/rock	

*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. Ro-4)

Location	(K. Rowri) terrace near end of branch water channel		
Coordinate (UTM)	Eastings: 227480	Northings: 1885443	
Physiologic position	Upper terrace	Topography	Gentle slope
Soil Classification	Salic Torrifluvents		
Parent material	Alluvial deposit	Depth of free water	Not determined
Vegetation/ mangrove	Sparse halophyte grasses Salt accumulation of surface		
Description of soil profile *2)			
A	0-6cm	Olive brown (2.5Y 4/3) compact loamy sand with sub-angular blocky structure and non-sticky consistency; clear smooth boundary	
C	6-14cm	Olive brown (2.5Y 4/4) sand with single grain structure and non-sticky consistency; gradual smooth boundary	
C	14-31cm	Greyish olive (5Y 5/3), silty loam with sub-angular blocky structure and slightly sticky consistency; gradual smooth boundary	
C	31-44cm	Olive yellow (5Y 6/4) sand to loamy sand and slightly sticky consistency; clear, smooth boundary	
C	44-62cm	Greyish olive (5Y 6/2), very soft silt with sub-angular blocky and sticky consistency	

*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 Qurm Taqah

1. SITE DESCRIPTION

1.1 Location

Governorate/ Region	Dhofar
Wilayat	Taqah
Distance from the Centre of Wilayat	Qurm Taqah is just west of Khawr Taqah.
Nearest Locality	Taqah
Fame of the Site/ Distinctive Features	None
Facilities in the Site	None
Features of Surrounding Areas	Located near Taqah town

1.2 Natural Conditions

Climate Zone	Dhofar Zone
General Terrain	Flat plain
Geological Features	None
Soil	<p>Khawr Qurm Taqah is a small-scale site lying on flat alluvial plain; it is cut off by sandbar from sea. The upper areas of this khawr are covered by mangrove. Soils in this khawr are deep. The soils under mangrove vegetation are silty with humic on surface, but sandy in subsurface. The soils at shores near khawr mouth are deep and sandy, where covered by young seedlings of mangrove.</p> <p>Details are shown in attached table “Attachment 4: Soil Profile in Qurm Taqah” and “Attachment 9: Soil Profile of Samples in Qurm Taqah”.</p>
Water	<p>Salinities of water in khawr were 1.1‰ at mouth and 1.9‰ at inner khawr. DO at upper khawr showed about 5 mg/l. The value of COD showed relatively high (10-20 mg/l). Green alga was found in the water of khawr.</p> <p>Details are shown in attached table “Attachment 5: Surface Water Quality in Qurm Taqah”.</p>
Fauna	<p>The freshwater/brackish water fish, <i>Aphanius dispar</i>, was abundant but marine species were not seen.</p> <p>Burrowing shrimp holes (<i>Callichirus</i> sp) were seen but only a few holes of mud crabs (<i>Macrophthalmus</i>) and ghost crabs (Ocypode) were observed. Damsel, dragonflies and mosquito larvae (<i>Anopheles coustani</i>) were seen. Annelid worms (Capitellidae) occurred in wet margins.</p> <p>Birds recorded included: 1 moorhen, 30 redshank, 16 small waders, 1 common snipe, 9 teal, 1 little green heron, (night heron previously recorded). Weaverbird nests were hanging from mangrove branches.</p>
Flora	<p>A submerged, rooted aquatic plant, <i>Ruppia maritima</i>, formed beds in shallow water. Two small clumps of the sedge, <i>Schoenoplectus litoralis</i>, occurred in shallow water on the east side. The mangroves show evidence of heavy grazing by camel and cattle and many of the young seedlings are at risk. At the back of the mangroves on the landward side, the reed, <i>Phragmites australis</i>, occurs, often growing in pools. If growing on the bank it shows evidence of grazing with bitten stems and branching side shoots bearing small spiky leaves. A</p>

	<p>climbing asclepiad (<i>Pentatropis nivalis</i>) grew on the bank and among the reeds. In wet mud at the back of the mangroves, <i>Juncellus laevigatus</i> and <i>Bacopa monnieri</i> were found. The grass, <i>Sporobolus virginicus</i>, forms a zone on the landward edge of the water. At the mouth of the khawr behind the sandbar an extensive area of <i>S. virginicus</i> grass indicates that the sea has not broken the sandbar recently. On raised edges of side channels and behind the mangroves dense growth of <i>Juncus rigidus</i> occurred. The vegetation of the drier sandy banks comprised the normal plant association for this zone (<i>Suaeda vermiculata</i>, <i>Cyperus conglomeratus</i>, <i>Urochondra setulosa</i>, <i>Aeluropus lagopoides</i>, <i>Sporobolus spicatus</i>, <i>Cressa cretica</i>, <i>Heliotropium fartakense</i>).</p>
Impacts from the Surrounding Areas	<p>Compared with studies in 1993, the khawr had less marine species (e.g. <i>Uca</i> not seen) suggesting that connection to the sea was very short. The main issue at Qurm Taqah remains that of overgrazing by livestock. While some grazing of adult trees is sustainable, the protection of young trees and seedlings is needed to encourage regeneration and increase the number of trees. The owners of livestock should accept the need to fence off parts of the khawr to allow young trees to survive and grow.</p>

1.3 Socio-economic Situation

Population of the Wilayat (2001)	19 thousand
Population of the Nearest Locality (1993)	6.9 thousand
Main Economic Activities	Fishery, Livestock farming of camels, Agriculture with large cultivation of date palms
Infrastructure	Taqah Town has a fishing port. Proclaimed as a nature reserve with great scenic, historical and wildlife values.
Main Usage	
Community Interference with the Area	Place for recreation (picnic areas but causing car tracks and litter). Heavy grazing by camels and additional livestock are brought from the mountains during the monsoon time.
Cultural Significance	None

1.4 Legal Setup and Development Plans

Land Ownership and Land Use Designation	<p>The Khawr was designated as a Nature Reserve by Royal Decree 49/97 dated 28/6/97 with the Ministry of Regional Municipalities and Environment as the managing authority. Khawr Taqah was proclaimed as a reserve for the protection of its natural resources and its scenic value. The management plan provides for the protection of these entities as well as the sustainable utilization through consumptive use of the plants as well as the non-consumptive use in the form of recreation for visitors, with development aiming at the minimum disturbance.</p> <p>The management proposals/activities presented here are consistent with the approved management plan.</p>
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	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 of 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 Taqah	MCI
(2) Mangrove planting project	MRMEWR	Wilayat Taqah	
(3) Mangrove Monitoring Project	MRMEWR	Wilayat Taqah	
(4) Soil and Water Monitoring Project	MRMEWR	Wilayat Taqah	
(5) Fauna and Flora Monitoring Project	MRMEWR	MRMEWR/ Omani Institute for Birds	
(6) Pollution Monitoring Project	MRMEWR	Wilayat Taqah/ MRMEWR	
(7) Monitoring Project on Legal Setup and Development Plans	MRMEWR	Wilayat Taqah	
(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	Shores on upper khawr are covered by mangroves. Total area of mangrove vegetation is 1.6 ha approximately. (Figure 2 Location Map)
Conditions of Existing Mangrove	Small mangrove vegetation. Mangroves are lushly surviving on inner khawr. Tallest tree is more than 11m in height. Lower branches of tall trees are severely grazed by camels. Seeds are observed after flowering season. New natural seedlings are developing on southern narrow shore but there have been grazing by camels on most seedlings.

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; 1.9 % , pH; 7.9 ~ 8.0 (Attachment 5: Surface Water Quality in Qurm Taqah)
Soil Conditions	Silty surface soil along the khawr. Surveyed data is in the Attachment 4: Soil Profile in Qurm Taqah of this technical specification.
Potential Area	The areas near khawr mouth and southern narrow shore. See Figure 3 Planting Map . The areas near the mouth and southern narrow shore of khawr have some potentiality for mangrove plantation but the area is very limited. New seedlings are developing but most of them are grazed by camels.

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

	Designated Area	Area (ha)
Area-1	(1) in Figure 3	0.15
Area-2	(2) in Figure 3	0.05

3.1.3 Planting Schedule

Total Planting Area	0.2 ha
Planting Season and Timing	January ~ February
Seed/ Seedlings Supply Source and Location	Seed from Qurum Taqah Seeding from Nursery at Khawr Kabir
Planting Method	Start from narrow shore on southeast side. Move to the area of the khawr mouth. 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											0.1
Planting area-2											0.1

Table 3.3 Seeds/ Seedling Supply Schedule

Year	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	Total
Season/ time	Jan/Feb										
Planting area (ha)	0.2										0.2
Number of seeds/ seedlings (thousands)	2										2

3.1.4 Conservation Area

Area of Land Use	Park Development Area
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3.1.5 Required Action for Conservation and Management

Inspection	Daily observation by 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 the area.
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 area to explain the significance of the area and major flora and fauna. Footpath and boardwalk for observation of wildlife as well as mangrove are also necessary.

3.2 Monitoring

3.2.1 Mangrove

Monitoring Method	Existing mangrove: Select and label trees for monitoring. Monitor mangrove by using the attached “ Attachment 1: Field Monitoring Sheet for Mangrove ”. Planting mangrove: First 4 years: tree height, canopy X:Y After 4 years: follow monitoring sheet
Frequency	Existing mangrove: Every 2 years Planting mangrove: First 4 years: annual monitoring After 4 years: every 2 years
Monitoring Target	Existing mangrove: 1) QT-OT1: Coordinate Easting 219446 /Northing 1885317 Planting mangrove: Select 20 trees at random and monitor them.
Baseline Data	Baseline data and monitoring trees are listed in “ Attachment 2: List of the Observed Points in Qurm Taqah ”.

3.2.2 Soil and Water

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

3.2.3 Fauna and Flora

Monitoring Method	Monitor fauna and flora by using the attached “ Attachment 6: Field Monitoring Sheet for Fauna and Flora and Pollution ”. 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	Attachment 6
Baseline Data	The result of field reconnaissance of fauna and flora is shown in “ Attachment 7: Result of Field Reconnaissance of Fauna and Flora and Pollution in Qurm Taqah ”.

3.2.4 Pollution (garbage and waste)

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

3.2.5 Change on Legal Setup and Development Plans

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

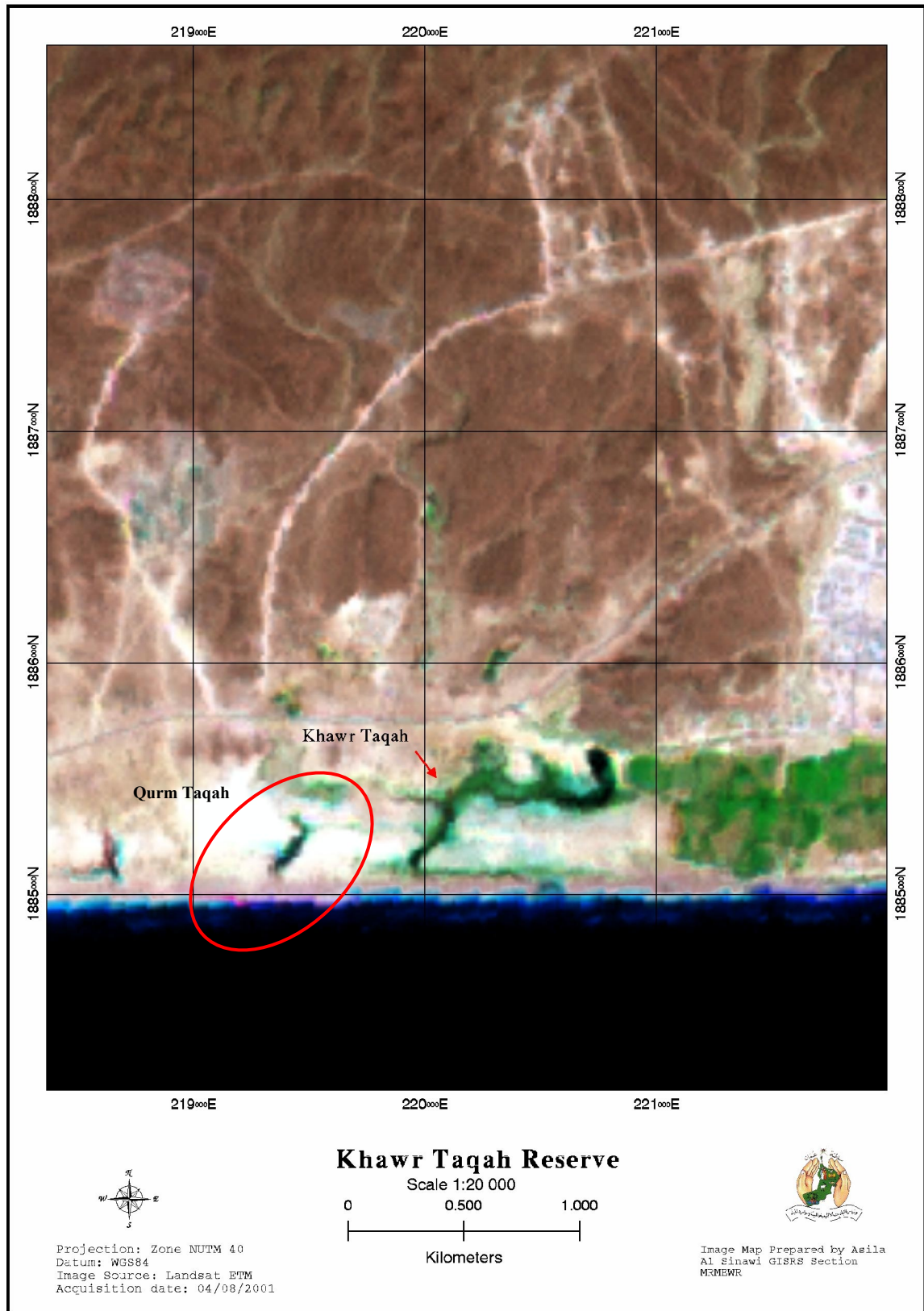


Figure 1 Key Map

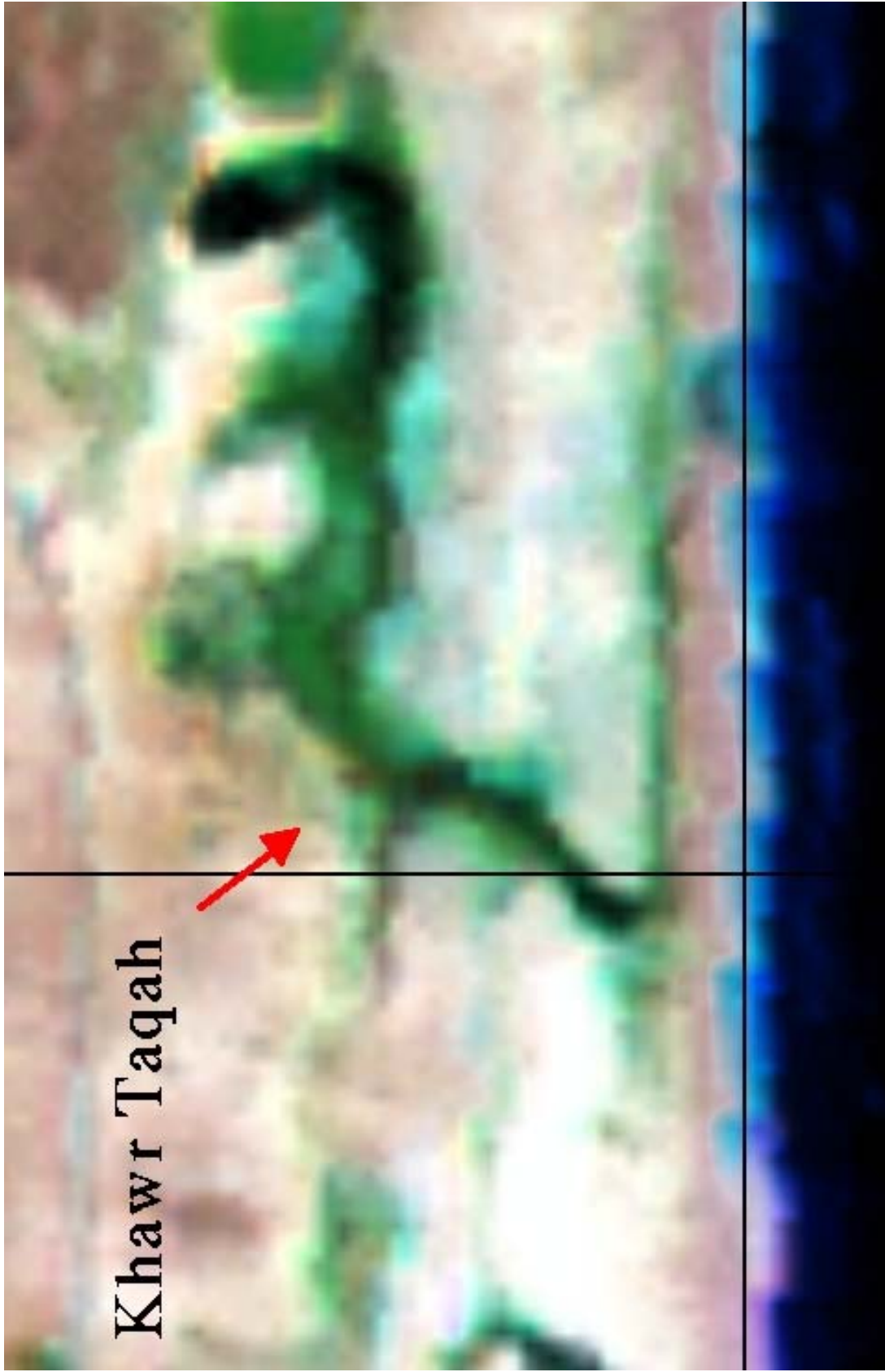


Figure 2 Location Map

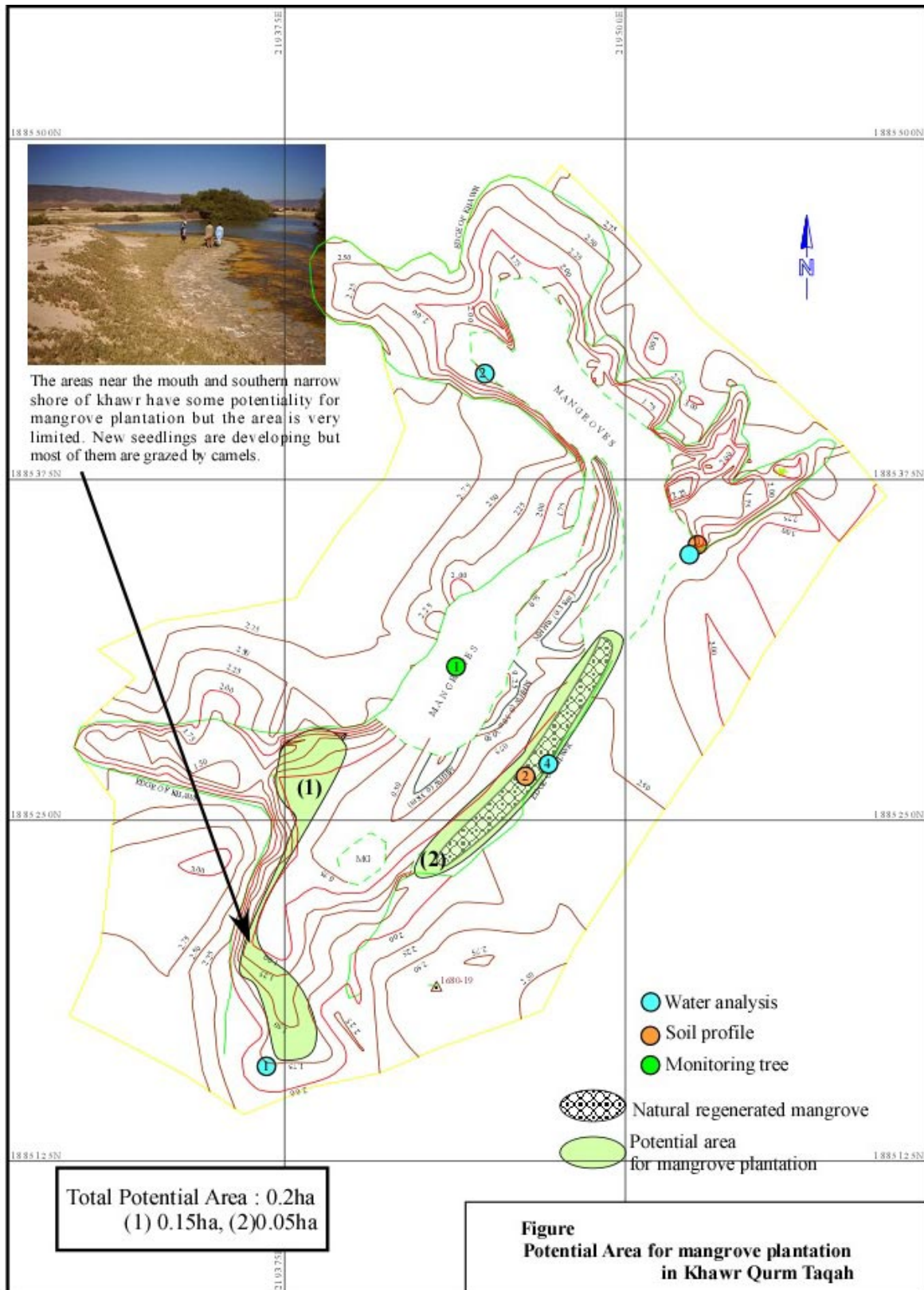


Figure 3 Planting Map

Attachment 1: Field Monitoring Sheet for Mangrove (Qurm Taqah)

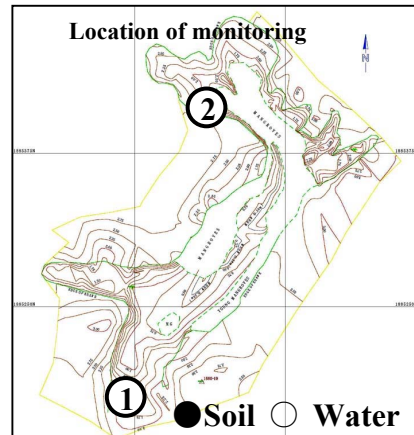
Mangrove Observation Records													
<p>1) Identification No. _____</p> <p>2) Location by GPS (WGS 84, UTM) Easting: _____ Northing: _____</p> <p>3) Photograph No. _____</p> <p>4) Observation of tree size and shape a) Tree Height (cm) _____ b) Trunk diameter near bottom (cm) _____ c) Live branches at the position about 1.3m off the centre of tree bottom (painted) 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>Memo: (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 Tree shape: _____ Sign of cut in the past: _____</p> <p>b) Health Nodes with leaves: _____ Inter-node length: _____ Leaf length: _____ Leaf colour: _____ Looks / die back: _____</p> <p>c) Environment Soil depth / texture: _____ Surface water Salinity: _____ Ground level: _____ Position: _____</p>													
<div style="border: 1px solid black; padding: 5px; min-height: 80px;"> <p>Note:</p> </div>													

Attachment 2: List of the Observed Points in Qurm Taqah

Khawr	Tree Number	Monitoring Trees	Date of Observation	Coordinate (UTM)		Photo Number	Height (cm)	Diameter (cm)										Remarks
				Easting	Northing			Trunk near bitom	Lived branches at the position about 13.0m from the center of tree bottom (DBH: Diameter Breast Height)									
								1	2	3	4	5	6	7	8	9	10	
Taqah	QT-OT1	1	22 Dec '02	219446	1885317	taqah tree 1a & 1b	1144	19	18	19	16	11						
Taqah	QT-OT2		22 Dec '02	219422	1885300		966	47	14	23	9	6	12	28				

Attachment 3: Field Monitoring Sheet for Soil & Water (Qurm Taqah)

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



General Condition in plantation area:

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

(1) Soil Condition

		New planted area ()	New planted area ()	
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: :)

		Khawr mouth ①	Inner Khawr ②	
Coordinate	Easting	219375	219450	
	Northing	1885250	1885420	
Surface waste				
pH				
Salinity (%)				
Temperature (C)				
DO (mg/l)				
Turbidity / Colour				

Attachment 4: Soil Profile in Qurum Taqah

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
TQ-1	South east share under vegetation	219501	1885342	Core sample			Clay loam	Sand	Sand	Greyish brown - dark brown	Grey	Loose	Very friable
TQ-2	Narrow share at beach side	219470	1885280	Core sample, under surface water			Sand	Sand	Sand	Dark greyish yellow - yellowish grey	Dark greyish yellow	(Very friable)	(Very friable)

Data of hardness in parenthesis by hand observation

Attachment 5: Surface Water Quality in Qurum Taqah

No.	Location	Coordinate (UTM)		Colour/ Visibility	pH	Salinity (%)	Temperature (C)	DO (mg/l)	COD (mg/l)	NO3 (mgNO3/l)
		Easting	Northing							
1	Khawr mouth	219391	1885223	+	7.6	1.8	24.3	12.20	10-20	-
2	Inmost upstream of khawr	219447	1885418	+	7.2	1.1	22.4	4.90	10±	0±
3	Khawr mouth	219371	1885198	+	8.0	1.9	34.0	4.80	-	-
4	Mid-stream of khawr	219481	1885357	±	7.9	1.9	36.0	3.60	-	-

Observation Date: 12-14 January 2003 for sample No.1-2, 31 May 2003 for sample No.3-4

**Attachment 6: Field Monitoring Sheet for Fauna and Flora and Pollution
(Qurm Taqah)**

Location	Qurm Taqah	Tide
Date		Time
Recorder		

Bird counts:	species:	number:
<p>Winter birds expected: moorhen, waders (redshank, common snipe), teal, little green heron, reef heron, grey heron Summer birds expected: night heron, grey heron, redshank, and moorhen</p>		

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

Domestic/feral animals:

Vegetation:
mangroves
submerged
water edge
landward side of mangroves

Invertebrates:

Fish:

Other Comments:

Attachment 7: Result of Field Reconnaissance of Fauna and Flora and Pollution in Qurm Taqah

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

Location	Qurm Taqah	Time	14.00
Date	07/01/2003	Tide	non-tidal
Recorder	N.V. Clarke		

Bird counts: species: 8 number: 58
 Birds recorded included: 1 moorhen, 30 redshank, 16 small waders, 1 common snipe, 9 teal, 1 little green heron, (night heron previously recorded). Weaverbird nests were hanging from mangrove branches.

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

Domestic/feral animals: heavy grazing from camel and goats

Vegetation:
 A submerged, rooted aquatic plant, *Ruppia maritima*, formed beds in shallow water. Two small clumps of the sedge, *Schoenoplectus litoralis*, occurred in shallow water on the east side. The mangroves show evidence of heavy grazing by camel and cattle and many of the young seedlings are at risk. At the back of the mangroves on the landward side, the reed, *Phragmites australis*, occurs, often growing in pools. If growing on the bank it shows evidence of grazing with bitten stems and branching side shoots bearing small spiky leaves. A climbing asclepiad (*Pentstemon nivalis*) grew on the bank and among the reeds. In wet mud at the back of the mangroves, *Juncellus laevigatus* and *Bacopa monnieri* were found. The grass, *Sporobolus virginicus*, forms a zone on the landward edge of the water. At the mouth of the khawr behind the sandbar an extensive area of *S. virginicus* grass indicates that the sea has not broken the sandbar recently. On raised edges of side channels and behind the mangroves dense growth of *Juncus rigidus* occurred.

The vegetation of the drier sandy banks comprised the normal plant association for this zone (*Suaeda vermiculata*, *Cyperus conglomeratus*, *Urochondra setulosa*, *Aeluropus lagopoides*, *Sporobolus spicatus*, *Cressa cretica*, *Heliotropium fartakense*).

Invertebrates:
 Burrowing shrimp holes (*Callichirus* sp) were seen but only a few holes of mud crabs (*Macrophthalmus*) and ghost crabs (Ocypode) were observed. Damsel, dragonflies and mosquito larvae (*Anopheles coustani*) were seen. Lumbricid annelid worms occurred in wet margins. The freshwater/brackish water fish, *Aphanius dispar*, was abundant but marine species were not seen.

Other Comments: Qurm Taqah is just west of Khawr Taqah. A sandbar separates the water from the sea but some small fluctuation in water level may be related to tidal changes. The salinity was about 1.8% and the recent floods (May 2002) have caused an input of freshwater. Previous records in 1993 gave salinities between 1.6-3.1%.

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

Location Qurm Taqah
Date 15/07/03
Time 10.00
Tide non-tidal (but sea spilling over sandbar bringing fish).
Recorder N.V. Clarke

Bird counts: species: 7 number: 11 (+150 gulls & terns on beach)

Birds recorded included: 3 redshank, 2 night heron, 5 grey heron, 1 moorhen

Pollution:

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

Domestic/feral animals: heavy grazing from camels, which are in the area in large numbers (80 animals seen) at this time of year.

Vegetation:

The mangroves show evidence of heavy grazing by camel and cattle and many of the young seedlings are at risk. Two small clumps of the sedge, *Schoenoplectus litoralis*, occurred in shallow water on the east side, in poor condition. At the back of the mangroves on the landward side, the reed, *Phragmites australis*, occurs, often growing in pools. If growing on the bank it shows evidence of grazing. In wet mud at the back of the mangroves, *Juncellus laevigatus* and *Bacopa monnieri* were found in poor condition. The grass, *Sporobolus virginicus*, forms a zone on the landward edge of the water. On raised edges of side channels and behind the mangroves the rush *Juncus rigidus* occurred.

Invertebrates: Burrowing shrimp holes (*Callichirus* sp) were seen but only a few holes of mud crabs (*Macrophthalmus*) and ghost crabs (Ocypode) were observed. Damsel, dragonflies and mosquito larvae (*Anopheles coustani*) were seen. Lumbricid annelid worms occurred in wet margins.

Fish: Several fish (*Ophiocara porocephala*, *Anguilla* sp) were showing signs of poor water quality (high temperature and low oxygen). Seawater at high tide was spilling over the sandbar creating a channel along which fish (*Therapon jarbua*) were entering the khawr.

Other Comments:

Dead *Prosopis juliflora* trees at the edge of the khawr have protected some of the vegetation underneath which is in good condition. It would be possible to use cut *Prosopis* bushes (without seeds or pods) to protect selected areas around mangrove khawrs. This could be done at Jnawf and Rzat mangroves.

Attachment 8: Site Photos (Qurm Taqah)

General Condition



Mangroves at upstream of khawr



Mangroves at sea side

Mangrove Vegetation



Measurement of tallest tree



Grazing by camel

Soil Condition



Southeast shore under vegetation (Profile No. TQ-1)



Narrow shore at beach side (Profile No. TQ-2)



Attachment 9: Soil Profile of Samples in Qurm Taqah

(Profile No. TQ-1)

Location	(Qurm Taqah) south east shore under vegetation		
Coordinate (UTM)	Easting: 219501	Northing: 1885342	Slope
Physiologic position	Lower terrace	Topography	Slope
Soil Classification	Typic Fluvaquents		
Parent material	Marine deposit	Depth of free water	Not determined
Vegetation/ mangrove	Under tall mangrove Observation of core sample *1		
Description of soil profile *2)			
A	0-17cm	Greyish brown (5YR 4/2), soft, silty, clay loam with sticky consistency; many small and very small roots; gradual boundary	
A	17-27cm	Dark brown (10YR 3/3), soft, silty, clay loam with sticky consistency; many small and very small roots; gradual boundary	
C	27-38cm	Greyish brown (10YR 4/2), silty loam with slightly sticky consistency; very small roots; clear boundary	
C	38-70cm	Grey (5Y 5.5/1) sand with single grain structure and slightly sticky consistency; common 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. TQ-2)

Location	(Qurm Taqah) narrow shore at beach side		
Coordinate (UTM)	Easting: 219470	Northing: 1885280	Slope
Physiologic position	Lower terrace	Topography	Slope
Soil Classification	Typic Psammaquents		
Parent material	Marine deposit	Depth of free water	Not determined
Vegetation/ mangrove	Sparse young mangroves, Observation of core sample *1		
Description of soil profile *2)			
C	0-4cm	Yellowish brown (2.5Y 5/3) sand with single grain structure and non-sticky consistency; clear boundary	
C	4-10cm	Dark greyish yellow (2.5Y 5/2) sand with single grain structure and non-sticky consistency; common brownish black (2.5Y 3/2) mottle; few shell fragment; gradual boundary	
C	10-30cm	Yellowish grey (2.5Y 4.5/1) sand with single grain structure and non-sticky consistency; few shell fragment; diffused boundary	
C	30-50cm	Dark greyish yellow (2.5Y 5/2) sand with single grain structure and non-sticky consistency; few shell fragment; diffused boundary	
C	50-61cm	Dark greyish yellow (2.5Y 4.5/2) sand with single grain structure and non-sticky consistency	

*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 Khawr Dahariz

1. SITE DESCRIPTION

1.1 Location

Governorate/ Region	Dhofar
Wylayat	Salalah
Distance from the Centre of Wylayat	Khawr Dahariz is located on the eastern outskirts of Salalah city.
Nearest Locality	Salalah
Fame of the Site/ Distinctive Features	This khawr is one of the popular bird watching sites because of easy access from the city centre.
Facilities in the Site	None
Features of Surrounding Areas	None

1.2 Natural Conditions

Climate Zone	Dhofar Zone
General Terrain	Flat plain
Geological Features	This khawr is typical coastal lagoon in Dhofar region with extensive reed beds at the upper end. The mouth of the khawr is closed by a narrow sand bar. The sand bar sometimes washed away by the flood after the heavy rain, but reforms by coastal sand sedimentation.
Soil	<p>Khawr Dahariz lies on flat alluvial plain and locates on the eastern area in Salalah. The khawr is gently bent to the west. The swamp on east shore, which is a deposited area, is wider than the west shore, which is an eroded area.</p> <p>The khawr is cut off by sandbar from sea. The soils on the sandbar and its surrounding area up to approximately 100m to north from sandbar are deep coarse sand. The soils on the west shore are deep clayey with organic matter and humic substances. On the other hand, the soils on east shore are relatively shallow and silty with humic substances in the surface, and sandy in subsurface. The soils on the west shore are mixed with eroded sandy soils supplied from upper terrace. Small and medium gravels cover the surface in the upper khawr.</p> <p>Details are shown in attached table “Attachment 4: Soil Profile in Khawr Dahariz” and “Attachment 9: Soil Profile Samples in Khawr Dahariz”.</p>
Water	<p>Salinities of water in the Khawr were ranging from 1.0 to 1.5%. The values of DO were more than 5mg/l except upper khawr (2.9mg/l on May 2003).</p> <p>Details are shown in attached table “Attachment 5: Surface Water Quality in Khawr Dahariz”</p>
Fauna	<p>A few large holes that could belong to <i>Cardisoma</i> crabs were seen. Other smaller holes probably belonged to juvenile ghost crabs (<i>Ocypode</i>). No evidence of <i>Uca</i> fiddler crabs (recorded in 1993) or <i>Callichirus</i> shrimps was seen. Caridean shrimps (<i>Palaemon</i> sp) were observed.</p> <p>Sieving sand revealed a very small bivalve (cf <i>Musculista senhousia</i>) and small <i>Hydrobia</i> snails. Damselfly and dragonfly were common. The freshwater and saltwater tolerant fish, <i>Aphanius dispar</i>, was abundant. Fishing can continue on a small scale and should be monitored.</p>

	<p>Winter Birds included: 8 coot, 2 moorhen, 3 common snipe, 7 teal, 4 shoveller, 3 mallard, 16 small waders, 5 herons (grey, purple, western reef, little egret) and 32 gulls on the beach. Summer birds included about 30 moorhen with juveniles, 7 grey herons, 17 waders (mostly whimbrel and Kentish Plover), and terns and gulls on the beach.</p> <p>About 20 camels were seen close to the khawr.</p>
Flora	<p>Submerged plants were not seen, although filamentous green algae were present (<i>Chaetomorpha</i> sp and <i>Enteromorpha</i> sp). The edge of the water was lined by reeds (<i>Phragmites australis</i>) except at the seaward end. In the water behind the reeds, a zone of the grass, <i>Paspalum vaginatum</i>, occurred. An open gap of wet mud about 2m wide then separated the water from the bank edge. On the eastern side the grass, <i>Sporobolus virginicus</i>, dominated the bank edge, while on the western side, the woody succulent <i>Arthrocnemum macrostachyum</i> was abundant. Occasional clumps of the rush, <i>Juncus rigidus</i>, occurred behind the reeds in the same places as in 1993. At the mouth of the khawr behind the sandbar fresh sand has been deposited over the grass zone recorded in 1993. Only wet bare sand occurred here with occasional plants of <i>Eclipta alba</i>. The drier sand bank vegetation consisted of <i>Suaeda vermiculata</i>, <i>Urochondra setulosa</i>, <i>Cyperus conglomerates</i>, <i>Sporobolus spicatus</i>, <i>Cressa cretica</i>, <i>Limonium axillare</i>, <i>Ipomoea pes-caprae</i> and <i>Heliotropium fartakense</i>. On dry shelly sand <i>Suaeda aegyptiaca</i> and <i>Aizoon canariensis</i> occurred. At the landward end, the tree, <i>Prosopis juliflora</i>, now occurs along both sides. Compared with studies in 1993, the khawr is similar but a muddy gap has developed between the vegetation in the water and the bank probably due to trampling and grazing. The succulent bush, <i>Arthrocnemum</i>, has increased its distribution and the tree, <i>Prosopis juliflora</i>, has also spread.</p> <p>This site is not recommended for mangrove planting as it represents a unique coastal environment.</p>
Impacts from the Surrounding Areas	None

1.3 Socio-economic Situation

Population of the Wylayat (2001)	162 thousand
Population of the Nearest Locality (1993)	N/A
Main Economic Activities	Commercial and residential area
Infrastructure	All utility and infrastructure available. Highway passing near the site.
Main Usage	Use for recreational activities of peoples in the Salalah City as well as tourists who is interested in bird watching.
Community Interference with the Area	Development of housing and commercial facilities.
Cultural Significance	N/A

1.4 Legal Setup and Development Plans

Land Ownership and Land Use Designation	The Khawr was designated as a Nature Reserve by Royal Decree Royal Decree 49/97 dated 28/6/97 with the Ministry of Regional Municipalities and Environment as the managing authority. It is an important bird site and the resources should be used sustainably. The management proposals/activities presented here are consistent with the approved management plan.
Development Plans in the Site and the Surrounding Area	Housing development
Existing Conservation Proposal	Declared as nature reserve in 1997

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 board walking or pedestrian bridge. Footpath should be designated but not paved. No permanent commercial buildings such as restaurants hotels shops and mechanized 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 minimum) and setback 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	N/A
Monitoring Programme	(2) Soil and water monitoring project (3) Fauna and flora monitoring project (4) Pollution monitoring project (5) 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 (6) Pamphlets and posters distributed to the residents, (7) 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	Wylayat Salalah	MCI
(2) Soil and Water Monitoring Project	MRMEWR	Wylayat Salalah	
(3) Fauna and Flora Monitoring Project	MRMEWR	MRMEWR/ Omani Institute for Birds	
(4) Pollution Monitoring Project	MRMEWR	Wylayat Salalah/ MRMEWR	
(5) Monitoring Project on Legal Setup and Development Plans	MRMEWR	Wylayat Salalah	
(6) Pamphlets and posters distributed to the residents	MRMEWR	Wylayat Salalah/ MRMEWR	MOE
(7) Information boards	MRMEWR	Wylayat Salalah/ 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)										

3. IMPLEMENTATION PLAN

3.1 Restoration and Afforestation

3.1.1 Existing Mangrove Area

Location and Area	There is no mangrove in this khawr. (Figure 2 Location Map)
Conditions of Existing Mangrove	N/A

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 to 10 years
Water Salinity and PH	(“Attachment 5: Surface Water Quality in Khawr Dahariz”)
Soil Conditions	Surveyed data is in the “Attachment 4: Soil Profile in Khawr Dahariz” of this technical specification.
Potential Area	Both banks near mouth of khawr. See “Figure 3 Planting Map” . The areas of both banks near mouth of khawr are possible for transplantation. Soils of these areas are deep and coarse sand but the area is very small.

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	Nature Reserve (NR) Area
------------------	--------------------------

3.1.4 Required Action for Conservation and Management

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 Wylayat 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	N/A
Facilities Required for the Conservation and Management Activities	Direction 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 wild life as well as mangrove are also necessary.

3.2 Monitoring

3.2.1 Soil and Water

Monitoring Method	Monitoring soil and water in and around mangrove vegetation by using attached table “ Attachment 3: Field Monitoring Sheet for Soil and Water (Khawr Dahariz) ”
Frequency	Soil: No need monitoring work Water: Before (Apr) and after (Nov) monsoon season (Every year) (Outflow water at low tide should be measured.)
Monitoring Target	Attachment 3
Baseline Data	See attached table “ Attachment 4: Soil Profile in Khawr Dahariz ” and “ Attachment 5: Surface Water Quality in Khawr Dahariz ”

3.2.2 Fauna and Flora

Monitoring Method	Monitor fauna and flora by using the attached “ Attachment 6: Field Monitoring Sheet for Fauna and Flora and Pollution. ” 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 base.
Frequency	At least twice a year
Monitoring Target	Attachment 6
Baseline Data	The result of field reconnaissance of flora and fauna is shown in “ Attachment 7: Result of Field Reconnaissance of Flora and Fauna and Pollution in Khawr Dahariz ”

3.2.3 Pollution (garbage and waste)

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

3.2.4 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 2 Location Map

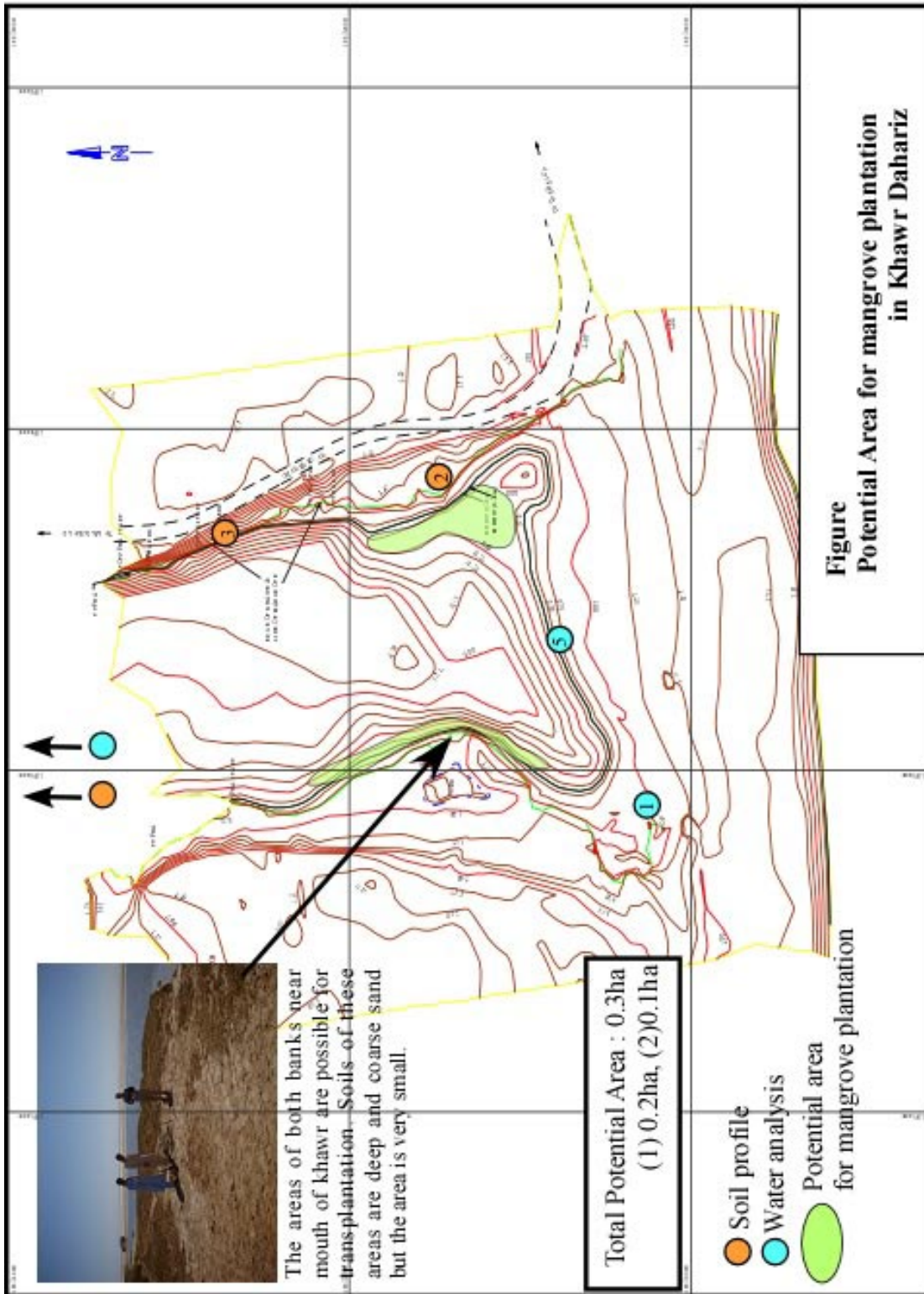


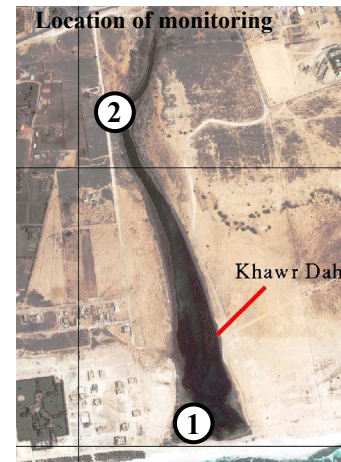
Figure 3 Planting Map

“Attachment 3: Field Monitoring Sheet for Soil & Water (Khawr Dahariz)”

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

General Condition in plantation area:

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



● Soil ○ Water

(1) Soil Condition

Coordinate		Easting		
		Northing		
Surface condition				
Soil Texture	0-10cm		No soil monitoring work at this site	
	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: _____ : _____)

		Khawr mouth ①	Mid khawr ②	
Coordinate	Easting			
	Northing			
Surface waste				
pH				
Salinity (%)				
Temperature (C)				
DO (mg/l)				
Turbidity / Colour				

“Attachment 4: Soil Profile in Khawr Dahariz”

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
Da-1	West share, swamp area	199266	1883812	Core sample, under surface water			Clay -loamy	Loamy - organic m.	-	Olive black	Olive black	Loose	Loose
Da-2	West share, beach side	199567	1883155	20	-	-	Sand	Sand	Sand	Grey - black	-	Firm to friable	Loose
Da-4	East share near beach	199546	1883264	No water			Sand	Sand	Sand	Dull yellowish brown	Grey - greyish olive	Very firm	Firm

Data of hardness in parenthesis by hand observation

“Attachment 5: Surface Water Quality in Khawr Dahariz”

No.	Location	Coordinate (UTM)		Colour/ Visibility	pH	Salinity (%)	Temperature (C)	DO (mg/l)	COD (mg/l)	NO3 (mgNO3/l)
		Easting	Northing							
1	Inmost upstream of khawr	199335	1883857	±	8.0	1.3	23.3	5.3	5-10	-
2	Mouth of khawr	199389	1883035	+	8.3	1.5	22.7	10.30	5±	-
3	Midstream of west shore	199335	1883555	+	8.2	1.5	25.0	8.80	10±	-
4	Inmost upstream of khawr	199266	1884479	±	7.7	1.0	33.4	2.9	-	-
5	Mouth of khawr	199470	1883052	-	8.3	1.3	34.0	5.40	-	-
6	Midstream of west shore	199338	1883845	±	8.1	1.3	34.5	5.10	-	-

Observation Date: 12-14 January 2003 for sample No.1-2, 31 May 2003 for sample No.4-6

“Attachment 7: Result of Field Reconnaissance of Fauna and Flora and Pollution in Khawr Dahariz”

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

Location	Khawr Dahariz	Date	05/01/2003
Time	15.00	Tide	non-tidal
Recorder	N.V. Clarke		
Bird counts:	species:	12	number: 63

8 coot, 2 moorhen, 3 common snipe, 7 teal, 4 shoveller, 3 mallard, 16 small waders, 5 herons (grey, purple, western reef, little egret) and 32 gulls on the beach. Little Bittern & Yellow Bittern not seen.

Pollution:

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

Domestic/feral animals: grazing by camels and goats

Vegetation:

Submerged plants were not seen, although filamentous green algae were present. The edge of the water was lined by reeds (*Phragmites australis*) except at the seaward end. In the water behind the reeds, a zone of the grass, *Paspalum vaginatum*, occurred. An open gap of wet mud about 2m wide then separated the water from the bank edge. On the eastern side the grass, *Sporobolus virginicus*, dominated the bank edge, while on the western side, the woody succulent *Arthrocnemum macrostachyum* was abundant. Clumps of the rush, *Juncus rigidus*, occurred behind the reeds occasionally in the same places as in 1993. At the mouth of the khawr behind the sandbar fresh sand has been deposited over the grass zone recorded in 1993. Only wet bare sand occurred with occasional plants of *Eclipta alba*.

The drier sand bank vegetation consisted of *Suaeda vermiculata*, *Urochondra setulosa*, *Cyperus conglomeratus*, *Sporobolus spicatus*, *Cressa cretica*, *Limonium axillare*, *Ipomoea pes-caprae* and *Heliotropium fartakense*. On dry shelly sand *Suaeda aegyptiaca* and *Aizoon canariensis* occurred. At the landward end, the tree, *Prosopis juliflora*, now occurs along both sides.

Animals:

A few large holes that could belong to *Cardisoma* crabs were seen. Smaller holes belonged to juvenile ghost crabs (*Ocypode*). No evidence of *Uca* fiddler crabs or *Callinectes* shrimps was seen. Shrimps (*Palaemon* sp) were observed. Sieving sand samples revealed a very small bivalve (cf *Musculista senhousia*) and *Hydrobia* snails. Damsel fly and dragonfly were common. The fish, *Aphanius dispar*, was abundant.

Other comments: The salinity was about 1.5%, within the range observed in 1993 (0.8-2.6%). Compared with 1993, the khawr is similar but a muddy gap has developed between the vegetation in the water and the bank, perhaps due to flooding followed by grazing and trampling. The succulent bush, *Arthrocnemum*, has increased its distribution and the tree, *Prosopis juliflora*, has also spread. The grass zone at the khawr mouth has disappeared under sand.

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

Location	Khawr Dahariz	Date	15/07/03
Time	12.00	Tide	non-tidal
Recorder	N.V. Clarke		

Bird counts: species: 6 number: 50 (+50 gulls & terns on beach)

30 moorhen (breeding), 7 grey heron, 15 waders (whimbrel, plovers), 1 graceful warbler.

Characteristic species: Little Bittern & Yellow Bittern not seen. These two Bitterns are expected in the reed beds on the landward end of this khawr, seen most easily early in the morning.

Pollution:

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

Domestic/feral animals: camels abundant

Vegetation:

Submerged plants were not seen, although filamentous green algae were present. The edge of the water was lined by reeds (*Phragmites australis*) except at the seaward end. In the water behind the reeds, a zone of the grass, *Paspalum vaginatum*, occurred. An open gap of wet mud about 2m wide then separated the water from the bank edge. On the eastern side the grass, *Sporobolus virginicus*, dominated the bank edge, while on the western side, the woody succulent *Arthrocnemum macrostachyum* was abundant. Clumps of the rush, *Juncus rigidus*, occurred behind the reeds.

The drier sand bank vegetation consisted of *Suaeda vermiculata*, *Urochondra setulosa*, *Cyperus conglomerates*, *Sporobolus spicatus*, *Cressa cretica*, *Limonium axillare*, *Ipomoea pes-caprae* and *Heliotropium fartakense*. On dry shelly sand *Suaeda aegyptiaca* and *Aizoon canariensis* occurred. No sign of *Limonium axillare* was seen. At the landward end, the tree, *Prosopis juliflora*, now occurs along both sides.

Animals:

Ghost crabs (*Ocypode*) on the beach side. No evidence of *Uca* fiddler crabs or *Callichirus* shrimps was seen. Shrimps (*Palaemon* sp) were observed. The fish, *Aphanius dispar*, was abundant and milkfish (*Chanos*) was common.

Other comments:

Similar condition to previous visit. *Prosopis juliflora* should be removed by hand to avoid damage to the other vegetation.

“Attachment 8: Site Photos”

General Condition



Upstream of khawr from west band



Mid-stream of khawr from east band

Introduced *Prosopis juliflora*



Prosopis juliflora (Mesquite) at upstream of khawr

Soil Condition



West shore, swamp area (Profile No. Da-1)



East shore near beach (Profile No. Da-3)

Attachment 9: Soil Profiles in Khawr Dahariz

(Profile No.Da-1)		(K. Dahariz) West shore, swamp area		
Location	(K. Dahariz) West shore, swamp area			
Coordinate (UTM)	Eastng: 199266	Northng: 1883812	Slope	
Physiologic position	Medium terrace	Humaqueptic (Mollic) Fluvaquents		
Soil Classification	Alluvial deposit	Depth of free water	Not determined	
Parent material	Beside the reeds vegetation, Observation of core sample *1			
Vegetation/ mangrove	Description of soil profile *2)			
A	0-4cm	Greyish yellow brown (10YR 4/2) very soft and very sticky consistency; many brownish black (10YR 3/2) mottle; clear boundary		
C	4-7cm	Olive black (5Y 3.5/2) very soft with very sticky consistency; common very small roots; gradual boundary		
C	7-17cm	Greyish olive (5Y 4/2) very soft sandy loam with slightly sticky consistency; many very small roots; gradual boundary		
C	17-38cm	Olive black (5Y 3/2) very soft sandy loam with slightly sticky consistency; many dark olive brown (2.5Y 3/3) mottle; many very small roots; many organic matter; gradual boundary		
C	38-71cm	Brownish black (10YR 3/2) very soft silty loam with slightly sticky consistency; many very small roots; many organic matter; gradual boundary		
C	71-94cm	Greyish olive (5Y 4/2) silty clay with sticky consistency; common 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

(Profile No.Da-3)		(K. Dahariz) east shore		
Location	(K. Dahariz) east shore			
Coordinate (UTM)	Eastng: 199546	Northng: 1883264	Slope	
Physiologic position	Medium terrace	Typic Psammaquents		
Soil Classification	Marine deposit	Depth of free water	38cm	
Parent material	Scarce grasses			
Vegetation/ mangrove	Description of soil profile *2)			
O	0-7cm	Accumulation of woods and organic matters; gradual smooth boundary		
C	7-21cm	Dull yellowish brown (10YR 5/4) sand with massive structure and non-sticky consistency; accurate way boundary		
C	21-31cm	Grey (5Y 4/1) loamy sand with single grain structure and non-sticky consistency; gradual way boundary		
C	19-43cm	Greyish olive (5Y 4/2) sand with single grain structure and slightly sticky consistency		

*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 Khawr Balid

1. SITE DESCRIPTION

1.1 Location

Governorate/ Region	Dhofar
Wilayat	Salalah
Distance from the Centre of Wylayat	Khawr Balid is located on the Central part of Salalah city.
Nearest Locality	Salalah
Fame of the Site/ Distinctive Features	<p>This khawr is a very famous archaeological site, the city of Balid, is situated on the banks of this khawr. The khawr is designated as an archaeological park and included in the protected area. The goals of this Al Balid Archaeological Park are stated as followings.</p> <ul style="list-style-type: none"> • Provide for the preservation of the natural resources • Develop an educational programme to inform visitors to the site of the rich and varied history of the early settlements of the Salalah coast • Provide a major visitor attraction
Facilities in the Site	None
Features of Surrounding Areas	Located near to the city centre. Khawr Balid is surrounded by agricultural land and rarely connects to the sea. It is a freshwater system and salinity was about 0.6% in January 2003.

1.2 Natural Conditions

Climate Zone	Dhofar Zone
General Terrain	Flat plain
Geological Features	No data
Soil	<p>Khawr Balid locates on the flat plain in the central south area of Salalah. The northern areas of this khawr have been traditionally utilized as cultivated area. The khawr is cut off by sandbar from sea. The channel of the khawr is divided into two channels at the midstream of channel. West khawr has been kept up as public park and bank are graded by earth and sand. The deep soil lies at the sandbar on the shore of khawr mouth. The soils covered by reeds are deep and silty with humic substances on surface and sandy in subsurface. The back areas behind reeds on west shore of khawr are covered by halophytes and the soil of this area is relatively shallow with gravel layer. Shallow soils on the bedrocks are widely recognized on the south shores of west water channel.</p> <p>Details are shown in attached table “Attachment 4: Soil Profile in Khawr Balid” and “Attachment 9: Soil Profile Samples in Khawr Balid”</p>
Water	<p>Salinities of water in this khawr were less than 0.7%, which was lowest salinity in the khawrs in Dhofar. The water supplied from northern areas may be affects on the low salinity. DO of khawr water was more than 6mg/l and COD was 5-10mg/l.</p> <p>Details are shown in attached table “Attachment 5: Surface Water Quality in Khawr Balid”</p>

Fauna	<p>Caridean shrimps (<i>Palaemon</i> sp), Pup fish (<i>Aphanius dispar</i>) and the sleeper fish (<i>Ophiocara porocephala</i>) adapted to freshwater conditions. Holes of ghost crabs <i>Ocyropode</i> were present on the sandbar.</p> <p>(Birds were abundant in January 2003, including: 8 moorhen, 2 pheasant-tailed Jacana (feeding on floating mats of <i>Najas</i>), 55 tufted ducks, 14 teal, and 4 pochard, 1 little grebe, 1 common sandpiper and 1 marsh harrier. The birds were very shy and flew up whenever approached. In the summer the moorhen is a common breeding resident.</p> <p>Balid has a largely freshwater fauna with insects such as damselfly, dragonfly, pondskater and mosquito larvae. There are also small <i>Hydrobia</i> snails and amphipods.</p>
Flora	<p>In the water, the rooted submerged plant, <i>Najas marina</i>, was abundant in shallower water along the edges. A filamentous green alga was also present. The edge of the water was lined by reeds (<i>Phragmites australis</i>), occasionally interrupted by <i>Typha angustifolia</i>. The grass, <i>Sporobolus virginicus</i>, grew on the landward edge. In wetter muddy depressions behind the reeds the woody succulent <i>Arthrocnemum macrostachyum</i> was abundant. Clumps of the sedge, <i>Juncellus laevigatus</i>, occurred behind the reeds occasionally. To the west of the khawr mouth, mounds of vegetation consist of <i>Ipomoea pes-caprae</i>, <i>Sporobolus virginicus</i>, and <i>Sueda vermiculata</i>. Compared with studies in 1993, the khawr is similar but the succulent bush, <i>Arthrocnemum</i>, has increased its distribution. Development of the historical site at the west end, involving building a visitor centre and footbridge, has removed large sections of reed bed and aquatic plants.</p> <p>Along the beach on each side of the sandbar, dune vegetation consisted of <i>Halopyrum mucronatum</i>, <i>Atriplex farinosa</i> and <i>Ipomoea pes-caprae</i>. This vegetation was one of the best examples of dune vegetation in Salalah but was removed during 2003.</p> <p>Experimental planting of mangroves has taken place with <i>Rhizophora mucronata</i> from Baluchistan (planted in 1983) on the south west side and <i>Bruguiera gymnorrhiza</i> from Japan (planted in 1983), <i>Lumnitzera racemosa</i> from Thailand (planted in 1984) and <i>Conocarpus erectus</i> from the Americas (unknown when planted) on the north east side near the pump house. Some <i>Avicennia marina</i> seedlings have recently been planted on the south east side of the khawr mouth.</p>
Impacts from the Surrounding Areas	None

1.3 Socio-economic Situation

Population of the Wilayat (2001)	162 thousand
Population of the Nearest Locality (1993)	162 thousand
Main Economic Activities	Agriculture, tourism base, commercial and residential area
Infrastructure	All utility and infrastructure available. Highway passing near the site.
Main Usage	Use for recreational and educational activities of peoples in the Salalah City as well as tourists.
Community Interference with the Area	Farmland and development of commercial facilities.
Cultural Significance	None

1.4 Legal Setup and Development Plans

Land Ownership and Land Use Designation	The Khawr was designated as a Nature Reserve (NR) by Royal Decree 49/97 dated 28/6/97 with the Ministry of Regional Municipalities and Environment as the managing authority. The reserve now also includes the Al Balid archaeological site, which is one of the “Frankincense Trail” series of sites inscribed on the UNESCO World Heritage List. The site is therefore protected by the Convention Concerning the Protection of the World Cultural and Natural Heritage, the National Heritage Law and Royal Decree 16/2001.
Development Plans in the Site and the Surrounding Area	In the context of the site’s archaeological interest, a Development Concept Plan was prepared for “Al-Balid Archaeological Park” by the U.S. Department of the Interior National Park Service, Midwest Region” (U.S. DINPS). For implementation of the concept, further research and detailed planning and design were envisaged by the U.S. DINPS. Some developments have taken place recently and a new Visitor Centre and bridge over the khawr have been built, paths around the site created and landscaping and “cleaning” undertaken – under the auspices of the Office of the Adviser to H.M. the Sultan for Cultural Affairs (OACA). A Management/Co-ordination Committee exists for the World Heritage Site on which the MRMEWR is represented by the DG for Nature Conservation. However it is not known if a Management Plan for the World Heritage Site(s) exists and no detailed plans and designs for implementation of the “Concept” have been examined, though it is understood that these have been prepared for OACA. The MRMEWR Management Plan recognises the archaeological value of the site and the 1995 Development Concept Plan and supports an approach that allows sustainable development for tourism while protecting the natural resources and archaeological attributes. The Development Concept Plan also recognised the value of the natural attributes of the site and recommended that a natural resources management plan be prepared to ensure the continuation of the site’s flora and fauna.
Existing Conservation Proposal	None

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 board walking or pedestrian bridge. Footpath should be designated but not paved. No permanent commercial buildings such as restaurants hotels shops and mechanized 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 minimum) and setback 150 m from the edge of Mangrove.

2.2 Description of Programmes

Facility Development Programme	(1) Mangrove Research Centre Development
Restoration and Afforestation Programme	(2) Mangrove planting project for Mangrove Research Centre
Monitoring Programme	(3) Mangrove monitoring project (4) Soil and water monitoring project (5) Fauna and flora monitoring project (6) Pollution monitoring project (7) Change 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) Mangrove Research Centre Development	MRMEWR	Wilayat Salalah	MCI
(2) Mangrove planting project for Mangrove Research Centre	MRMEWR	Wilayat Salalah	
(3) Mangrove monitoring project	MRMEWR	MRMEWR/ Omani Institute for Birds	
(4) Soil and Water Monitoring Project	MRMEWR	Wilayat Salalah	
(5) Fauna and Flora Monitoring Project	MRMEWR	MRMEWR/ Omani Institute for Birds	
(6) Pollution Monitoring Project	MRMEWR	Wilayat Salalah / MRMEWR	
(7) Monitoring Project on Legal Setup and Development Plans	MRMEWR	Wilayat Salalah	
(8) Pamphlets and posters distributed to the residents	MRMEWR	MRMEWR/ Wilayat Salalah	MOE
(9) Information boards	MRMEWR	MRMEWR/ Wilayat Salalah	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	There is no natural mangrove community in this khawr (Figure 2 Location Map)
Conditions of Existing Mangrove	N/A

3.1.2 Plantation Area

Tidal Condition	Normal: mouth is closed
Wave and Wind	Calm in Winter, Drifted sand damages seaward fringe
Flood	Every 5 to 10 years
Water Salinity and PH	(“ Attachment 5: Surface Water Quality in Khawr Balid ”)
Soil Conditions	Sandy soil with aerobic condition. Surveyed data is in the “ Attachment 1: Soil Profile in Khawr Balid ” of this technical specification.
Potential Area	In Mangrove Research Centre . Figure 3 Planting Map. Land reclamation will be carried out for construction of Mangrove Research Centre. Sandy soil will be transfer to plantation area.

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

	Designated Area	Area (ha)
Area-1		0.4

3.1.3 Planting Schedule

Total Planting Area	0.4 ha
Planting Season and Timing	Winter (January ~ February)
Seed/ Seedlings Supply Source and Location	Plant Nursery has been constructed in Khawr Kabir west of this site by MRMEWR
Planting Method	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											0.4

Table 3.3 Seeds/ Seedling Supply Schedule

Year	1 st	2 nd	3 rd	4 th	5 th	6 th	7 th	8 th	9 th	10 th	Total
Season/ time			Jan/Feb								
Planting area (ha)			0.4								0.4
Number of seed/ seedling (thousands)			4								4

3.1.4 Conservation Area

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

3.1.5 Required Action for Conservation and Management

Inspection	Monthly observation by management body, 2 to 3 times of inspection by MRMEWR (Mangrove Management 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	Required, daily ordinary patrol by police office in Wilayat, park management body regularly inspect facilities conditions and littering and waste disposal to the ground and water both NR area and Park area.
Restoration and Rehabilitation Work	
Facilities Required for the Conservation and Management Activities	Direction sign along and the highway and entrance to the access road(s), guide sign in the site, information board in the NR area to explain the significance of the reserve and major flora and fauna can be seen in the area. Foot path and board walk for observation of wild life as well as mangrove plantation experimental site.

3.2 Monitoring

3.2.1 Mangrove

Monitoring Method	Existing mangrove: Select and label trees for monitoring. Monitor mangrove by using the attached “ Attachment 1: Field Monitoring Sheet for Mangrove ”. Mangrove planted: First 4 years: tree height, canopy X:Y After 4 years: follow monitoring sheet
Frequency	Existing mangrove: Every 2 years Mangrove planted: First 4 year: annual monitoring After 4 year: every 2 year
Monitoring Target	Existing mangrove: 1) BL-OT2: Coordinate Easting 195502 /Northing 1882796 Mangrove planted: Select 20 trees at random and monitor them.
Baseline Data	Baseline data and monitoring trees are listed in “ Attachment 2: List of the Observed Points in Khawr Balid ”.

3.2.2 Soil and Water

Monitoring Method	Monitoring soil and water in and around mangrove vegetation by using attached table “ Attachment 3: Field Monitoring Sheet for Soil and Water (Khawr Balid) ”
Frequency	Soil: (New plantation area) Before plantation and Every 2 year after the plantation (Existing mangrove area) Every 2 Year Water: Before (Apr) and after (Nov) monsoon season (Every year) (Outflow water at low tide should be measured.)
Monitoring Target	Attachment 3
Baseline Data	See attached table “ Attachment 4: Soil Profile in Khawr Balid ” and “ Attachment 5: Surface Water Quality in Khawr Balid ”

3.2.3 Fauna and Flora

Monitoring Method	Monitor fauna and flora by using the attached “ Attachment 6: Field Monitoring Sheet for Fauna and Flora and Pollution. ” 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 base.
Frequency	At least twice a year
Monitoring Target	Attachment 6
Baseline Data	The result of field reconnaissance of flora and fauna is shown in “ Attachment 7: Result of Field Reconnaissance of Flora and Fauna and Pollution in Khawr Balid. ”

3.2.4 Pollution (garbage and waste)

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

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

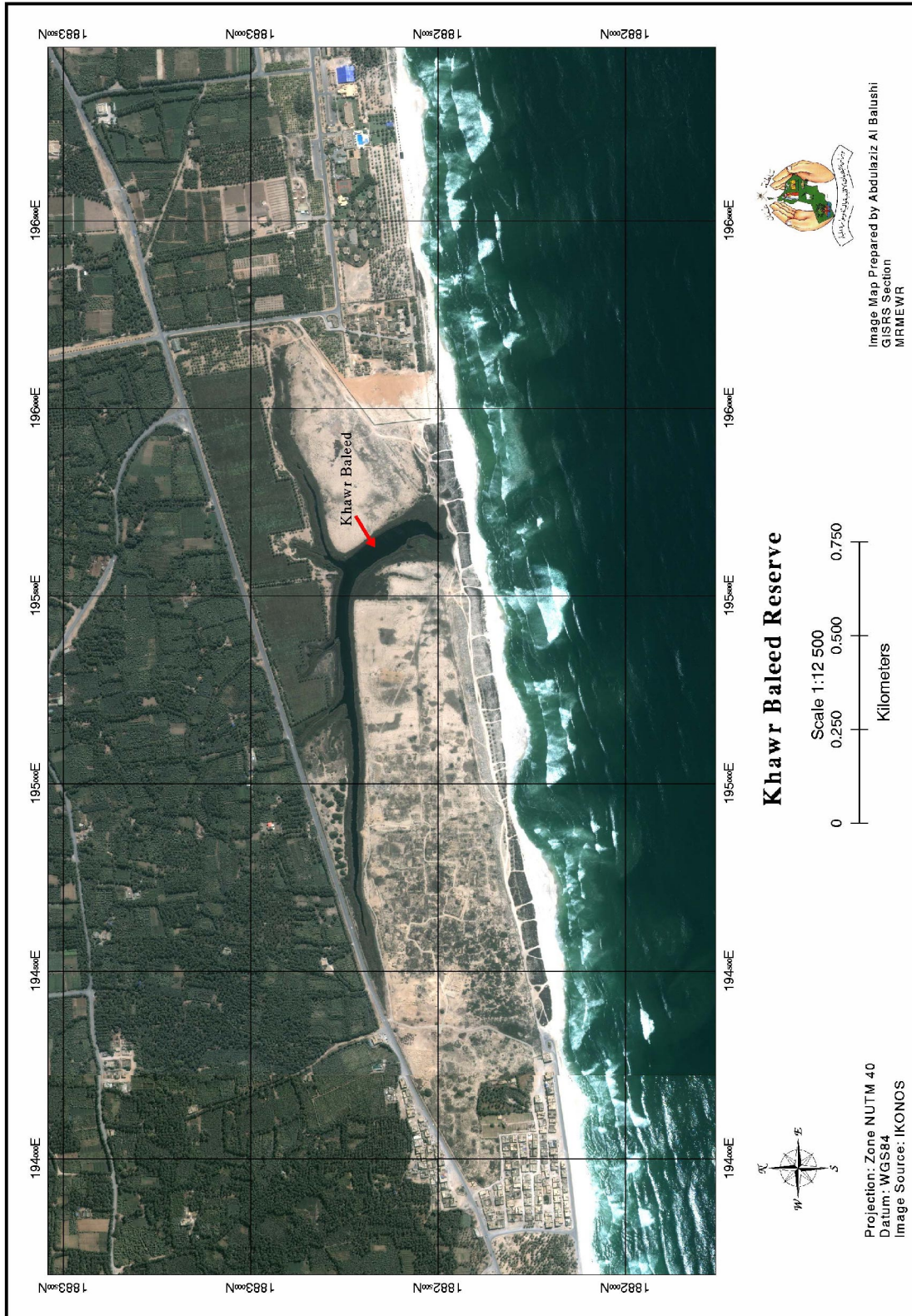


Figure 1 Key Map

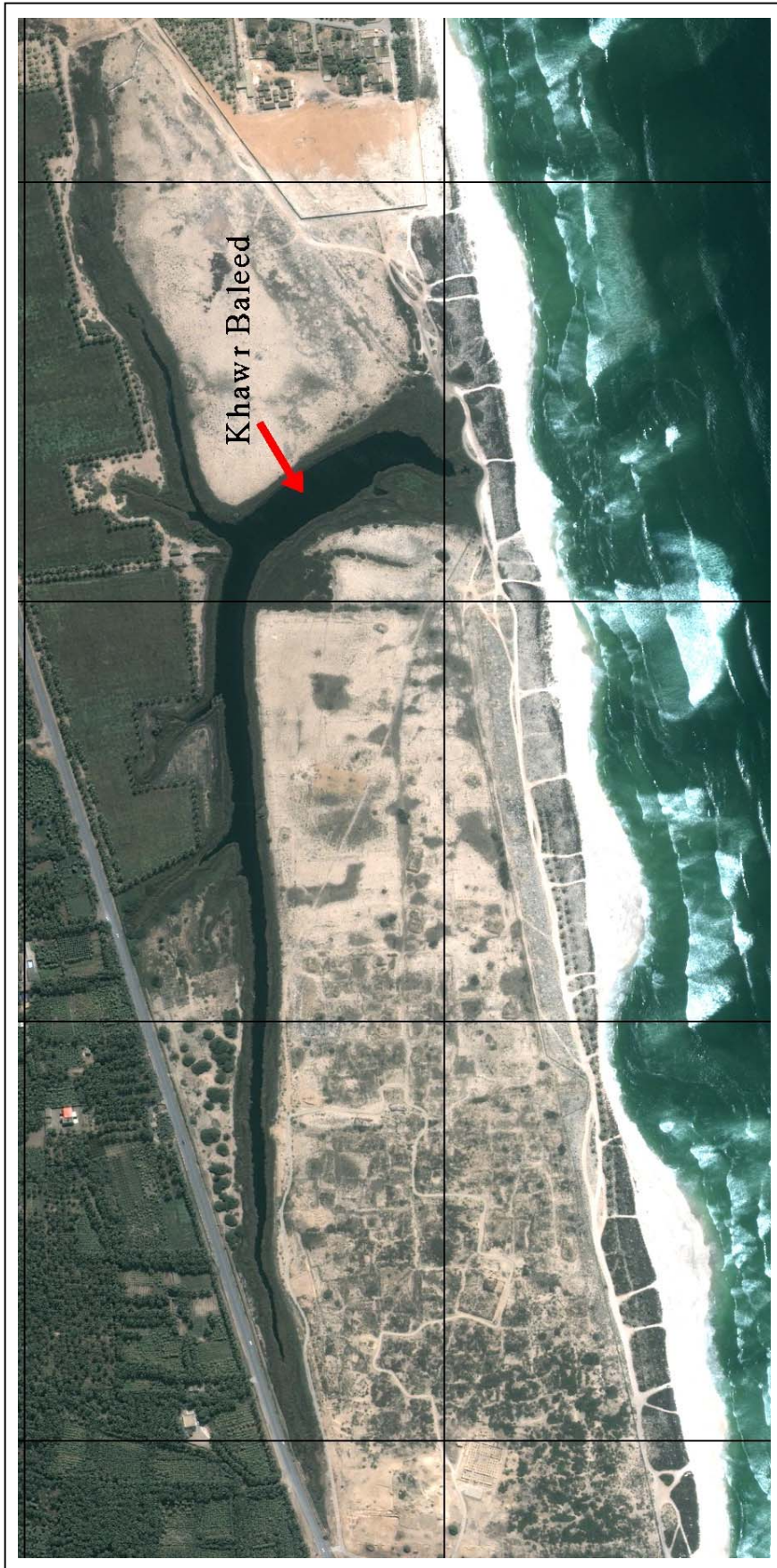


Figure 2 Local Map

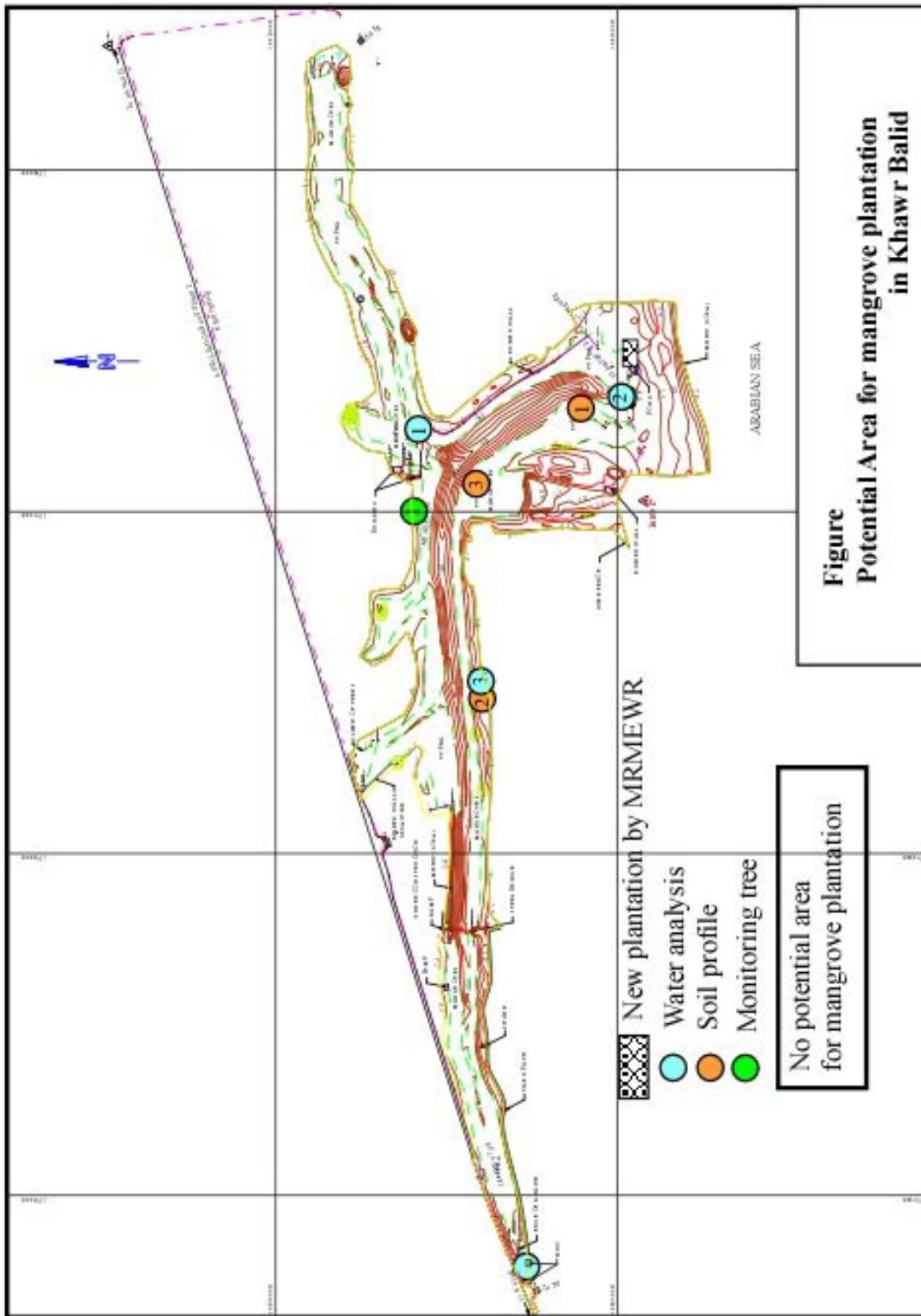


Figure
Potential Area for mangrove plantation
in Khawr Balid

Figure 3 Planting Map

“Attachment 1: Field Monitoring Sheet for Mangrove”

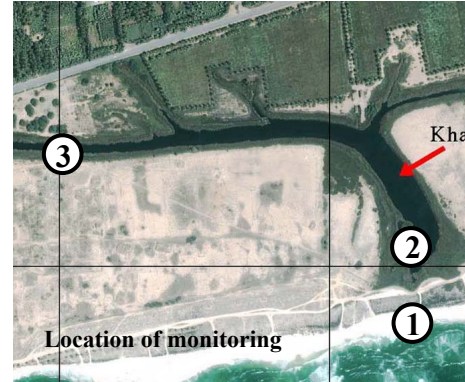
Mangrove Observation Records													
<p>1) Identification No. _____</p> <p>2) Location by GPS (WGS 84, UTM) Easting: _____ Northing: _____</p> <p>3) Photograph No. _____</p> <p>4) Observation of tree size and shape a) Tree Height (cm) <input style="width: 80px; height: 20px;" type="text"/> b) Trunk diameter near bottom (cm) <input style="width: 80px; height: 20px;" type="text"/> c) Live branches at the position about 1.3m off the centre of tree bottom (painted) 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>Memo: (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 Tree shape: _____ Sign of cut in the past: _____</p> <p>b) Health Nodes with leaves: _____ Inter-node length: _____ Leaf length: _____ Leaf colour: _____ Looks / die back: _____</p> <p>c) Environment Soil depth / texture: _____ Surface water Salinity: _____ Ground level: _____ Position: _____</p>													
<div style="border: 1px solid black; padding: 5px; min-height: 80px;"> <p>Note:</p> </div>													

“Attachment 2: List of the Observed Points in Khawr Balid”

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		
Balid	BL-OT1		22 Dec '02	195502	1882796		437	20.2	9.8	7.7										Bruguiera gymnorrhiza
Balid	BL-OT2	1	22 Dec '02	195502	1882796	balidtree 1a & 1b	693		20	19	12	19	7.8	14	13	11				Lumnitzera racemosa
Balid	BL-OT3		22 Dec '02				853		44											Lumnitzera racemosa
Balid	BL-OT4		22 Dec '02				690		5.2											Pizophora mucronata

“Attachment 3: Field Monitoring Sheet for Soil & Water (Khawr Balid)”

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



General Condition in plantation area:

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

(1) Soil Condition (Plantation for Mangrove Research Centre)

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	Khawr mouth② near plantation	Upstream Khawr③ at bridge
Coordinate	Easting	-	195660	194890
	Northing	-	1882500	1882700
Surface waste				
pH				
Salinity (%)				
Temperature (C)				
DO (mg/l)				
Turbidity / Colour				

“Attachment 4: Soil Profile in Khawr Balid”

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
BA-1	Reeds area near mouth	195640	1882577	50	-	-	Clay - Sand	Sand	Sand	Brownish black – greyish yellow	Greyish yellow	(Firm)	(Friable)
BA-2	Mid-stream of west water channel, reeds	195206	1882721	Core sample			Silty	Sand	Sand	Black - olive black	-	(Very friable)	(Friable)
BA-3	Halophytes bush, west water channel of khawr	195584	1882651	46	-	-	Clay loam	Sand	Sand	Dark greyish yellow	Dark greyish yellow	Big stone at 20-40cm	

Data of hardness in parenthesis by hand observation

“Attachment 5: Surface Water Quality in Khawr Balid”

No.	Location	Coordinate (UTM)		Colour/ Visibility	pH	Salinity (%)	Temperature (C)	DO (mg/l)	COD (mg/l)	NO3 (mgNO3/l)
		Easting	Northing							
1	Inmost upstream of eastern khawr	194515	1882655	±	8.1	0.7	24.6	7.70	5-10	-
2	Mouth of khawr	195660	1882480	+	8.1	0.7	23.2	8.50	10±	-
3	Midstream of khawr	195220	1882765	±	8.1	0.7	24.6	11.30	5-10	-
4	Mouth of khawr	195670	1882480	±	8.0	0.4	34.2	6.60	-	-
5	Midstream of khawr	195244	1882717	±	8.2	0.3	34.0	8.30	-	-

Observation Date: 12-14 January 2003 for sample No.1-3, 31 May 2003 for sample No.4-5

“Attachment 6: Field Monitoring Sheet for Flora and Fauna and Pollution”

Location	Khawr Balid
Date	
Time	
Tide	
Recorder	

Bird counts: species:	number:
Expected winter birds: moorhen, pheasant-tailed jacana, tufted ducks, teal, pochard, little grebe, common sandpiper, marsh harrier.	
Expected summer birds: moorhen (breeding), grey heron	

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

Domestic/feral animals:

Vegetation:
submerged plant:
edge of the water:
dune vegetation:

Animals:

Other Comments:

“Attachment 7: Result of Field Reconnaissance of Fauna and Flora and Pollution in Khawr Balid”

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

Location Khawr Balid
Date 07/01/2003
Time 08.30
Tide non-tidal
Recorder N.V. Clarke

Bird counts: species: 8 number: 86
 Birds were abundant, including: 8 moorhen, 2 lesser moorhen (feeding on floating mats of *Najas*), 55 tufted ducks, 14 teal, and 4 pochard, 1 little grebe, 1 common sandpiper and 1 marsh harrier. The birds were very shy and flew up whenever approached.

Pollution:

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

Fishing: nets none

Domestic/feral animals: none

Vegetation:

In the water, the rooted submerged plant, *Najas marina*, was abundant in shallower water along the edges. A filamentous green alga was also present. The edge of the water was lined by reeds (*Phragmites australis*), occasionally interrupted by *Typha angustifolia*. The grass, *Sporobolus virginicus*, grew on the landward edge. In wetter muddy depressions behind the reeds the woody succulent *Arthrocnemum macrostachyum* was abundant. Clumps of the sedge, *Juncellus laevigatus*, occurred behind the reeds occasionally. To the west of the khawr mouth, mounds of vegetation consist of *Ipomoea pes-caprae*, *Sporobolus virginicus*, and *Suaeda vermiculata*. On higher sandy or rocky banks, vegetation consisted of *Urochondra setulosa*, *Cyperus conglomeratus*, *Suaeda aegyptiaca*, *Sporobolus spicatus*, *Sporobolus ioclados* and occasionally the woody composite bush, *Pluchea ovalis*. On each side of the sandbar, dune vegetation consists of *Halopyrum mucronatum*, *Atriplex farinosa* and *Ipomoea pes-caprae*. Car tracks have caused erosion of the dune vegetation.

Animals:

Baleed has a largely freshwater fauna with insects such as damselfly, dragonfly, pondskater and mosquito larvae. There are also small *Hydrobia* snails and amphipods. Caridean shrimps (*Palaemon* sp), Killi fish (*Aphanius dispar*) and the sleeper fish (*Ophiocara porocephala*) were abundant being adapted to freshwater conditions. Holes of ghost crabs (*Ocyropode*) were present on the sandbar.

Other Comments:

Khawr Baleed is surrounded by agricultural land and rarely connects to the sea. It is a freshwater system and salinity was about 0.6%. Compared with studies in 1993, the khawr is similar but the succulent bush, *Arthrocnemum*, has increased its distribution. Development of the historical site at the west end, involving building a footbridge, has removed a section of reed bed.

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

Location Khawr Balid
Date 16/07/03
Time 13.00
Tide non-tidal
Recorder N.V. Clarke

Bird counts: species: 2 number: 23
 20 moorhen (with chicks), grey heron

Pollution:

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

Fishing: nets none

Domestic/feral animals: none

Vegetation:

The reeds and submerged plants in the western arm where visitor facilities are being built, have been removed mechanically. This contravenes the management plan for the nature reserve.

On each side of the beach sandbar, dune vegetation (*Halopyrum mucronatum*, *Atriplex farinosa* and *Ipomoea pes-caprae*) had also been mechanically removed.

Rooted submerged plant, *Najas marina*.

Edge of the water with reeds (*Phragmites australis*), and *Typha angustifolia*.

In wetter muddy depressions behind the reeds the woody succulent *Arthrocnemum macrostachyum* was abundant.

Animals:

Baleed has a largely freshwater fauna. Caridean shrimps (*Palaemon* sp), Killi fish (*Aphanius dispar*) and the sleeper fish (*Ophiocara porocephala*) were abundant. Holes of ghost crabs (*Ocypode*) were present on the sandbar.

Other Comments:

Development of the historical site at the west end, involving building a footbridge and visitor centre, has removed a large section of reed bed on both sides of the western arm. Submerged vegetation was also being removed. The development should make use of the natural features of the khawr as much as possible.

The same applies to the dune vegetation in front of the khawr. These plants protect the beach against erosion and should be allowed to grow again.

“Attachment 8: Site Photos”

General Condition



Reeds at mid-stream at west water channel



Halophytes at upstream of east water channel

Mangrove Vegetation



Introduced mangrove



Transplanted mangroves

Soil Condition



Reeds area near mouth (Profile No. Ba-1)



Mid-stream of west water channel, reeds (Profile No. Ba-2)



Attachment 9: Soil Profiles in Khawr Balid

(Profile No.Ba-1)

Location	(K. Balid) Reeds area near mouth		
Coordinate (UTM)	Easting: 195640	Northing: 1882577	
Physiologic position	Middle terrace	Topography	Gentle slope
Soil Classification	Humaqueptic (Mollic) Fluvaquents		
Parent material	Marine deposit	Depth of free water	Not determined
Vegetation/ mangrove	Halophyte Observation of core sample *1		
Description of soil profile *2)			
O	0-3cm	Brownish black (2.5Y 3/1) clay with single grain structure and very sticky consistency; common olive brown (2.5Y 4/3) mottle; few very small root; many organic matter; abrupt boundary	
A	3-6cm	Brownish black (2.5Y 3/1) clay with single grain structure and very sticky consistency; common very small root; many organic matter; abrupt boundary	
C	6-13cm	Brownish black (2.5Y 3/2) silty clay with very sticky consistency; many very small root; many organic matter; clear boundary	
C	13-18cm	Dark greyish yellow (2.5Y 4/2) silt sand and slightly sticky consistency; many very small root; common organic matter; abrupt boundary	
C	18-49cm	Greyish yellow (2.5Y 6/2) sand with massive structure and non-sticky consistency; clear boundary	

*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.Ba-2)

Location	(K. Balid) Mid-stream of west water channel, reeds		
Coordinate (UTM)	Easting: 195206	Northing: 1882721	
Physiologic position	Middle terrace	Topography	Slope
Soil Classification	Humaqueptic (Mollic) Fluvaquents		
Parent material	Alluvial deposit	Depth of free water	Not determined
Vegetation/ mangrove	Reeds Observation of core sample *1		
Description of soil profile *2)			
AC	0-8cm	Black (5Y 2/1) silt with sticky consistency; many very small root; clear boundary	
C	8-14cm	Olive black (5Y 3/2) silty clay loam with sticky consistency; many medium very small root; gradual boundary	
C	14-28cm	Brownish black (2.5Y 3/1) silt with slightly sticky consistency; clear boundary	
C	28-cm	Soft sand	

*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