5.4. Conclusion and Recommendation

Two plans, consisting of (1) groundwater recharge trench and (2) the combination plan of groundwater recharge trench and detention dam, are recommended as the groundwater augmentation facility. The effects of these plans was based on the supposition that the trenches are located along Wadi Siji, Wadi Khadrah and Wadi Shoukah. The effectiveness for each plan was given in following table:

Table 5.3.4. Comparison of Efficiency of Groundwater Recharge

Groundwater Augmentation Facility	Basic Items for facility	Effectiveness for groundwater Recharge
Groundwater Recharge Trench	3 Sites (Wadi Siji, Wadi Khadrah, Wadi Shoukah) Depth; 6 m, Length; 1 km	Total 0.3 MCM/a
Groundwater Recharge Trench + Detention Dam	3 Sites (Wadi Siji, Wadi Khadrah, Wadi Shoukah) Reservoir Capacity 2.46 MCM/a (W. Siji) 2.46 MCM/a (W. Khadrah) 3.28 MCM/a (W. Shoukah)	Total 1.97 MCM/a

The maximum effect was as large as 1.97 MCM/a, which was obtained from the combination facility plan of Groundwater Recharge Trench and Detention Dam. If this amount of 1.97 MCM/a was added to the 19.5 MCM/a of the sustained yield, the total amount of 21.5 MCM/a will be cited as available resources to be utilized in the Groundwater Development Plan in the Study Area.

Water cost was evaluated based on two conditions: natural yield and the artificial yield produced by the groundwater augment facility. For natural yield, it means the sustained yield maintained due to the groundwater recharge from the surface. Therefore, the extraction from this resource can be made from the Upper Aquifer. The pumping was made only by a tube well deepened to 150 m by a submersible pump with an intake level of 100 m deep.

On the other hand, the cost relating to the artificial yield was evaluated from both sides of the groundwater augment facility and related pumping cost as well. The respective water costs are given as follows.

Table 5.3.5. Comparison of Water Cost

Type of Facility	Water Cost (Dhs/m^3)	Components of Applied Facility
Water Well and Pump for withdrawal		
(Depth:75m)	1.5	Well Depth=100m, Pump Cap.=7900m^3/a, H=76m, KW=1.1
(Depth:100m)	2.0	Well Depth=150m, Pump Cap.= 7900m^3/a, H=148m, KW=2.2
(Depth:200m)	3.0	Well Depth=250m, Pump Cap.= 7900m^3/a, H=214m, KW=3.7
(Depth:300m)	7.9	Well Depth=350m, Pump Cap.= 7900m^3/a, H=328m, KW=7.5
Groundwater Trench	7.8	Wadi Siji, Wadi Khadrah, Wadi Shoukah(3 sites @ 1km= 3km)
Groundwater Trench + Detention Dam	10.7	Groundwater Trench: Wadi Siji, Wadi Khadrah, Wadi Shoukah (3 sites @ 1km= 3km) Detention Dam: Wadi Siji, Wadi Khadrah, Wadi Shoukah (3 sites)
Pipe Line for Desalinated Water	10.0	Pipe Line: Sharjah - Dhaid, Desalinated Water: 1.25$/$m^3$

Figure 5.1.1-1 Layout of Water Saving Farm (Option-1)

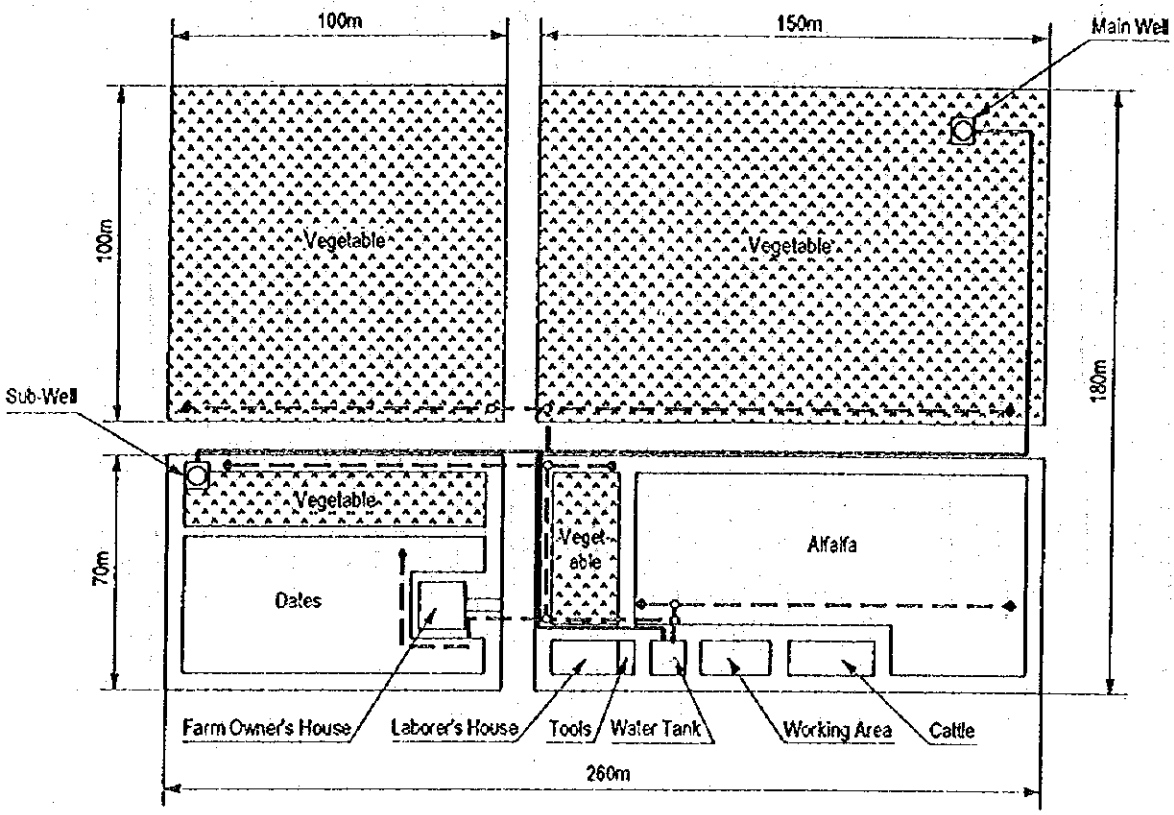


Table 5.1.1-1 Dimension of Water Saving Farm (Option-1)

	Area (ha)	Area and Shape (m²,m×m)	Crop	Yearly water requirement (m³/year)	Rate of water requirement	Daily water requirement in dry season (m³/day) *1
Total Area	4.680	(46800m²=260×180) *2				
Road	0.440	(4400m²=260×10+180×10)				
House	0.050	(500m²=400+100)				
Tools	0.005	(50m²=5×10)				
Cattle	0.025	(250m²=25×10)				
Tank	0.005	(50m²=5×10,100m³=5×10×2)				
Working Area	0.020	(200m²=20×10)				
Cropping Area	4.000	4,000		41,787	100.00%	167
	2.688	2,688	Vegetable	16,093	38.51%	64
	0.427	427	Dates	8,034	19.23%	32
	0.885	885	Alfalfa	17,659	42.26%	71
Others	0.135					

*1 Dry season = 250 day/year
*2 Total farm size is not recommended here.
It is assumed to estimate unit facility cost.

Figure 5.1.1-2 Layout of Water Saving Farm (Option-2)

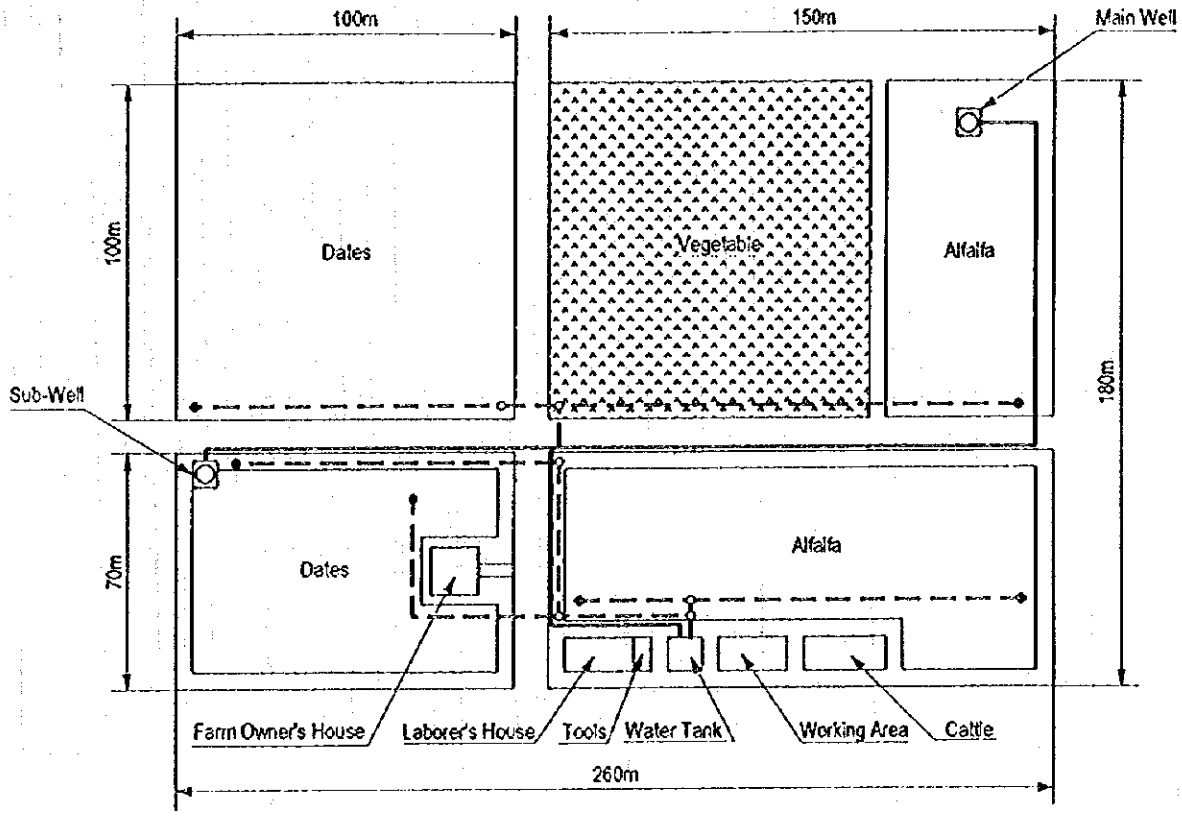


Table 5.1.1-2 Dimension of Water Saving Farm (Option-2)

	Area (ha)	Area and Shape (m^2,m×m)	Crop	Yearly water requirement (m^3/year)	Rate of water requirement	Daily water requirement in dry season (m^3/day)*3
Total Area	4.680	(46800m^2=260×180)*4				
Road	0.440	(4400m^2=260×10+180×10)				
House	0.050	(500m^2=400+100)				
Tools	0.005	(50m^2=5×10)				
Cattle	0.025	(250m^2=25×10)				
Tank	0.010	(100m^2=10×10,200m^2=10×10×2)				
Working Area	0.020	(200m^2=20×10)				
Cropping Area	4.000	4,000		63,008	100.00%	252
	1.010	1,010	Vegetable	5,962	9.46%	24
	1.592	1,592	Dates	29,550	46.90%	118
	1.397	1,397	Alfalfa	27,497	43.64%	110
Others	0.130					

*3 Dry season = 250 day/year
*4 Total farm size is not recommended here.
It is assumed to estimate unit facility cost.

Table 5.2.1. Catchment and Storage Capacity of Recharge Dam

Dam site	Catchment (km^2)	Capacity (Flood of 25-year return period) (MCM)	Sedimentation Volume (MCM)	Recharge Dam	
				Surface Area (km^2)	Full Water Level (m)
wadi gauge (Siji)	86.6	2.5700	0.8901		
Siji dam site	83.1	2.4658	0.8583	0.8559	16.5
wadi gauge (Khadrah)	215.6	3.2500			
Khadrah dam site	217.8	3.2836	2.0043	1.0406	13.5
Shokah Index Point	54.0	2.6600			
Shokah dam site	50.0	2.4630	0.5489	2.5072	16.5

Table 5.2.2. Spillway Dimension of Recharge Dam

Dam site	Catchment Area (km^2)	Flood Discharge 10,000-year return period (m^3/sec.)	Full Water Level (m)	Design Flood Level (m)	Crest Height (m)	Coefficient of velocity C	Spillway Width (m)	Spillway Crest Width (m)	Surface Area of Dam Storage (km^2)
wadi gauge (Siji)	86.6	584							
Siji dam site	83.1	560	16.50	18.00	20.50	1.81	169	0.20	1.02
wadi gauge (Khadrah)	215.6	713							
Khadrah dam site	217.8	720	12.50	14.00	16.50	1.81	217	0.20	1.25
Shokah Index Point	54.0	527							
Shokah dam site	50.0	488	23.50	25.00	27.50	1.81	147	0.20	0.80

Table 5.2.3 Estimated Construction Cost of Recharge Dam

Recharge Dam	Crest Height	Dam Length	Volume of Embankment	Excavation cost	Spreading and compaction cost	Construction cost ($)
Siji Dam (main)	25.5	380	423,091	125,601	4,436,927	$4,562,528
Saddle Dam (A)	15.5	160	70,591	37,744	739,841	$777,585
Spillway		169		12,731,942	207,362	$12,939,304
Conduit				9,475	3,574	$13,049
Subtotal			493,682	12,904,763	5,387,704	$18,292,467
Khadrah Dam (main)	20.5	700	520,014	198,252	5,463,361	$5,661,613
Saddle Dam (A)	10.5	280	61,785	52,803	649,143	$701,946
Saddle Dam (B)	10.5	580	129,310	109,377	1,364,555	$1,473,932
Saddle Dam (C)	5.5	120	8,840	16,950	92,855	$109,805
Spillway		217		216,639	266,587	$483,226
Conduit				8,058	3,220	$11,278
Subtotal			719,949	602,080	7,839,720	$8,441,800
Shokah Dam	25.5	580	646,734	191,707	6,786,602	$6,978,309
Saddle Dam (A)	10.5	180	39,576	33,945	415,169	$449,113
Saddle Dam (B)	10.5	140	30,736	26,401	322,226	$348,627
Saddle Dam (C)	10.5	280	61,785	52,803	649,143	$701,946
Spillway		147		1,426,714	180,581	$1,607,295
Conduit				6,633	9,620	$16,252
Subtotal			778,831	1,738,203	8,363,341	$10,101,543
					Subtotal	$36,835,810
					Survey	$1,841,791
					Supervision	$1,841,791
					Contingency	$3,683,581
					Total	$44,202,972

Table 5.2.4 Estimated Construction Cost of Recharge Trench

Description	Unit	Price ($)	Quantity	Total cost ($)
1 Leveling	m^3	$1.82	70,000	$127,273
2 Excavation and remove	m^3	$4.55	9,000	$40,909
3 Gabion work	m^3	$45.45	12,000	$545,455
4 Back-fill	m^3	$13.64	35,250	$480,682
Subtotal				$1,194,318
5 Survey				$59,716
6 Supervision				$59,716
7 Contingency				$119,432
Total (1,000m Trench)				$1,433,182
1,000m Trench×3				$4,299,545

Table 5.3.2 Dimension of Desali-Pipeline

Section	Extension (km)	Diameter (mm)	Flow Rate (m^3/sec)	Velocity (m/sec)	
1 Delivery Pipeline	58.0				
Section 1	23.0	1,000	1.58	2.01	multi-stage pumping
Section 2	22.0	1,000	1.58	2.01	multi-stage pumping
Section 3	13.0	1,000	1.58	2.01	multi-stage pumping
2 Distribution Pipeline	45.0				
Branch A	5.0	600	0.28	0.99	gravity
Branch B	5.0	700	0.56	1.46	gravity
Branch C	5.0	700	0.56	1.46	gravity
Branch C'	30.0	600	0.28	0.99	pumping

Table 5.3.3. Estimation for Pipe Construction

Section	Cost ($)
1 Delivery Pipeline	
Pipe Works	29,295,709
Pump Station	93,414,167
Others	21,739,636
Sub Total (1)	144,449,513
2 Distribution Pipeline	
Pipe Works	41,537,718
Pump Station	4,134,360
Others	8,260,145
Sub Total (2)	53,932,224
Sub Total (1) + (2)	198,381,736
Survey	9,919,087
Supervision	9,919,087
Contingency	21,821,991
Total	240,041,901

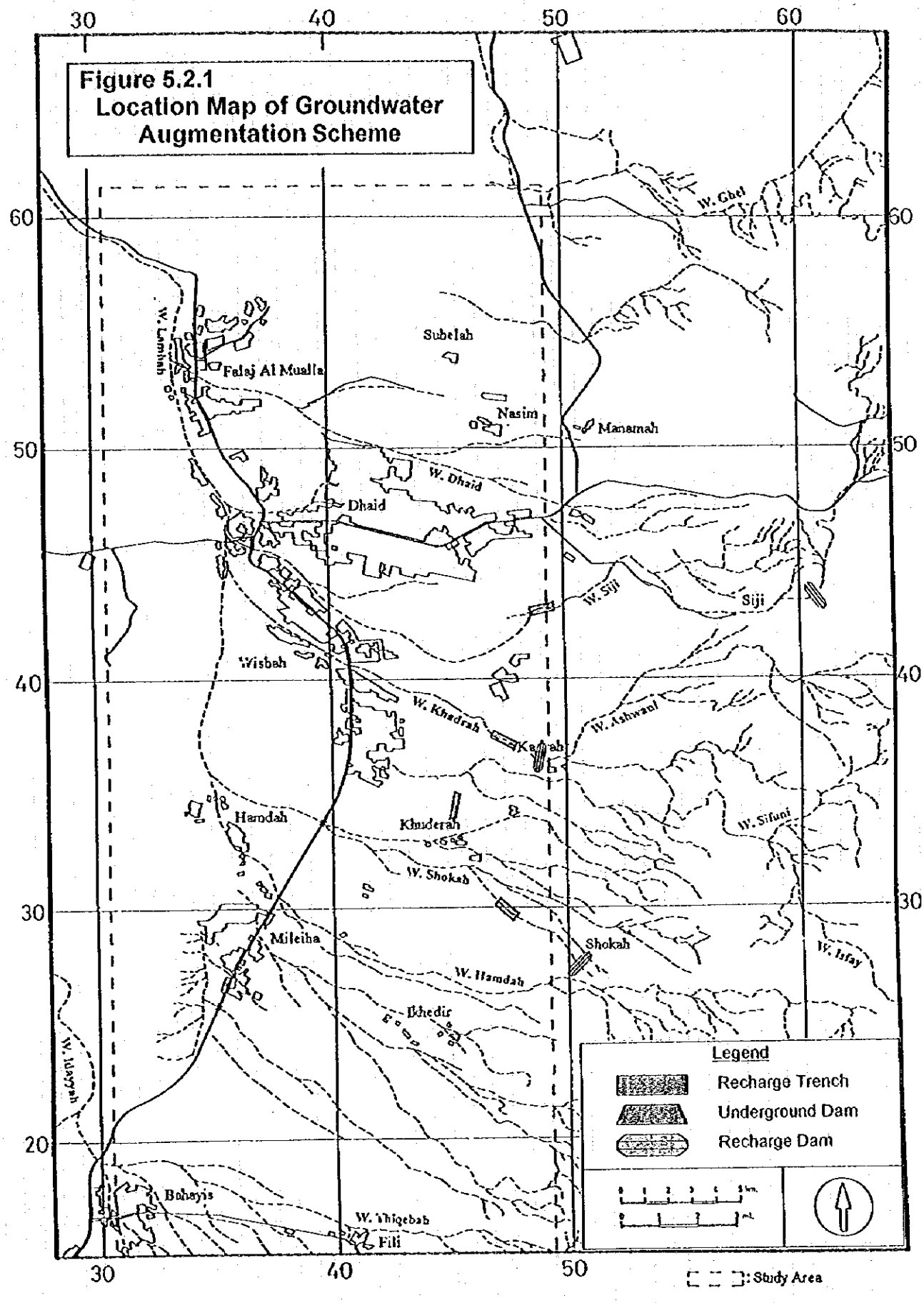
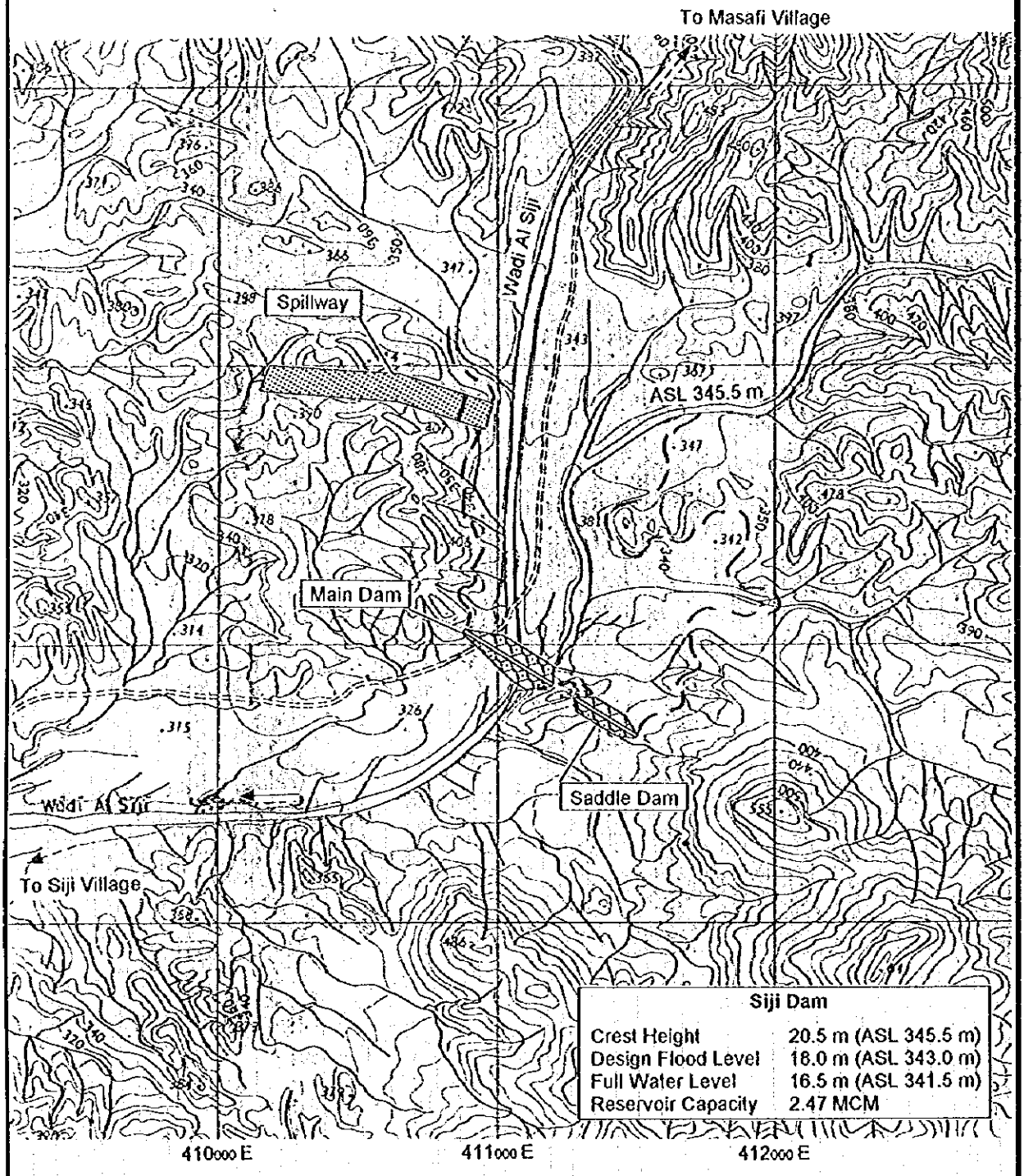


Figure 5.2.1
Location Map of Groundwater Augmentation Scheme
30
40
50
60
20
W. Gbel
W. Lamlah
Falaj Al Mualla
Subelah
Nasim
Manamah
W. Dhaid
Dhaid
W. Siji
Siji
Wisbah
W. Khadrah
W. Ashwaul
Hamdah
Khuderah
W. Sifuni
W. Shokah
Mileiha
Shokah
W. Isfay
W. Hamdah
Bhedis
W. Jayyah
Bahayis
W. Thiqebah
Fili
Legend
Recharge Trench
Underground Dam
Recharge Dam
: Study Area

Figure 5.2.2 Siji Recharge Dam Site



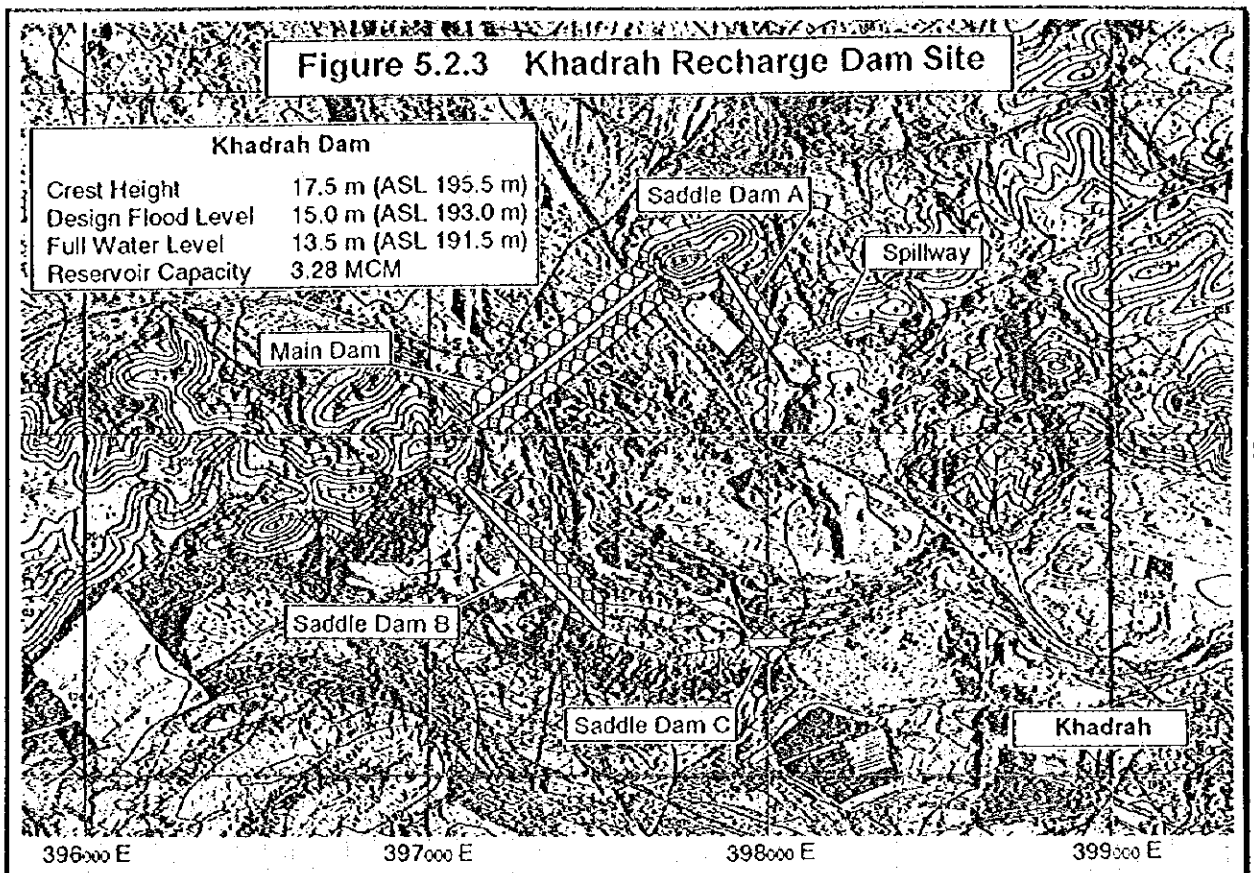


Figure 5.2.3 Khadrah Recharge Dam Site
Khadrah Dam
Crest Height 17.5 m (ASL 195.5 m)
Design Flood Level 15.0 m (ASL 193.0 m)
Full Water Level 13.5 m (ASL 191.5 m)
Reservoir Capacity 3.28 MCM
Saddle Dam A
Spillway
Main Dam
Saddle Dam B
Saddle Dam C
Khadrah
396000 E
397000 E
398000 E
399000 E
2788000 N
2787000 N
2786000 N

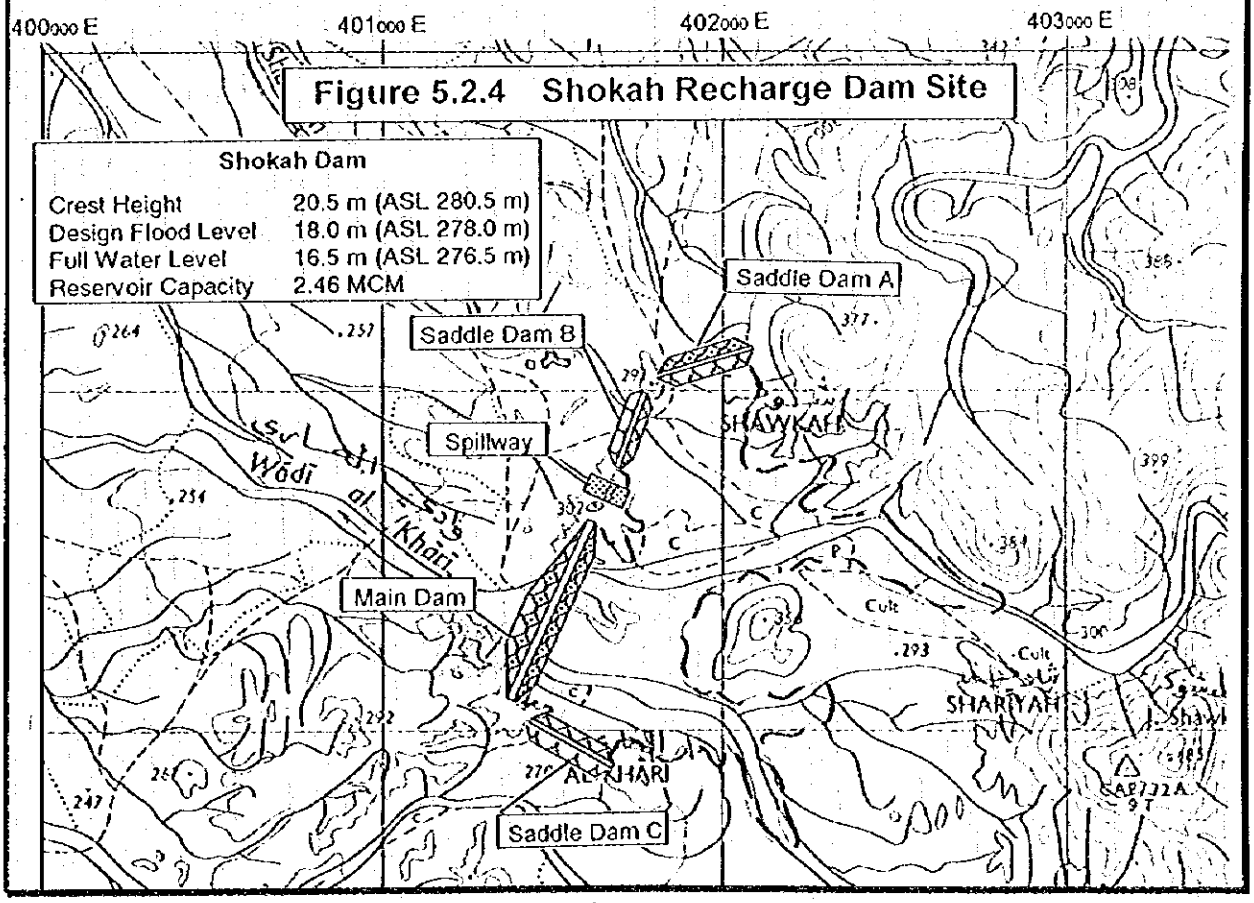


Figure 5.2.4 Shokah Recharge Dam Site
Shokah Dam
Crest Height 20.5 m (ASL 280.5 m)
Design Flood Level 18.0 m (ASL 278.0 m)
Full Water Level 16.5 m (ASL 276.5 m)
Reservoir Capacity 2.46 MCM
Saddle Dam A
Saddle Dam B
Spillway
Main Dam
Saddle Dam C
Wadi al-Khari
SHAWKAH
SHARYAH
AL-JHARI
400000 E
401000 E
402000 E
403000 E
2778000 N
2777000 N
2776000 N

Figure 5.2.5. Typical Dam Cross-Section

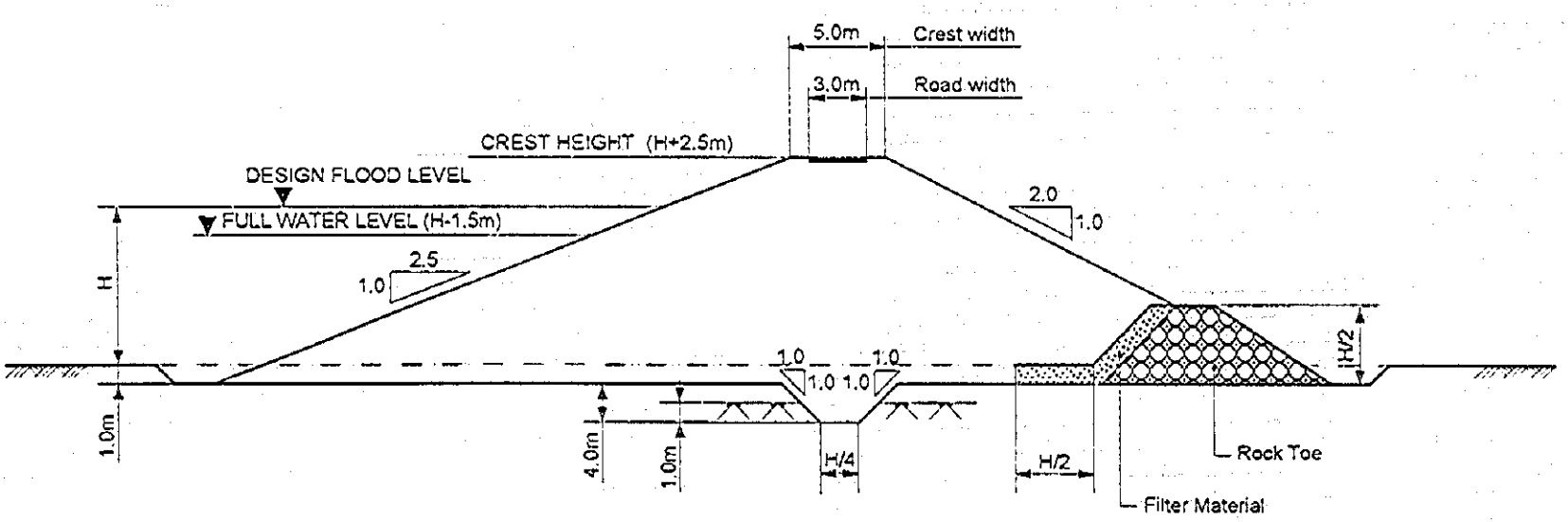


Figure 5.2.6. Spillway Cross-Section

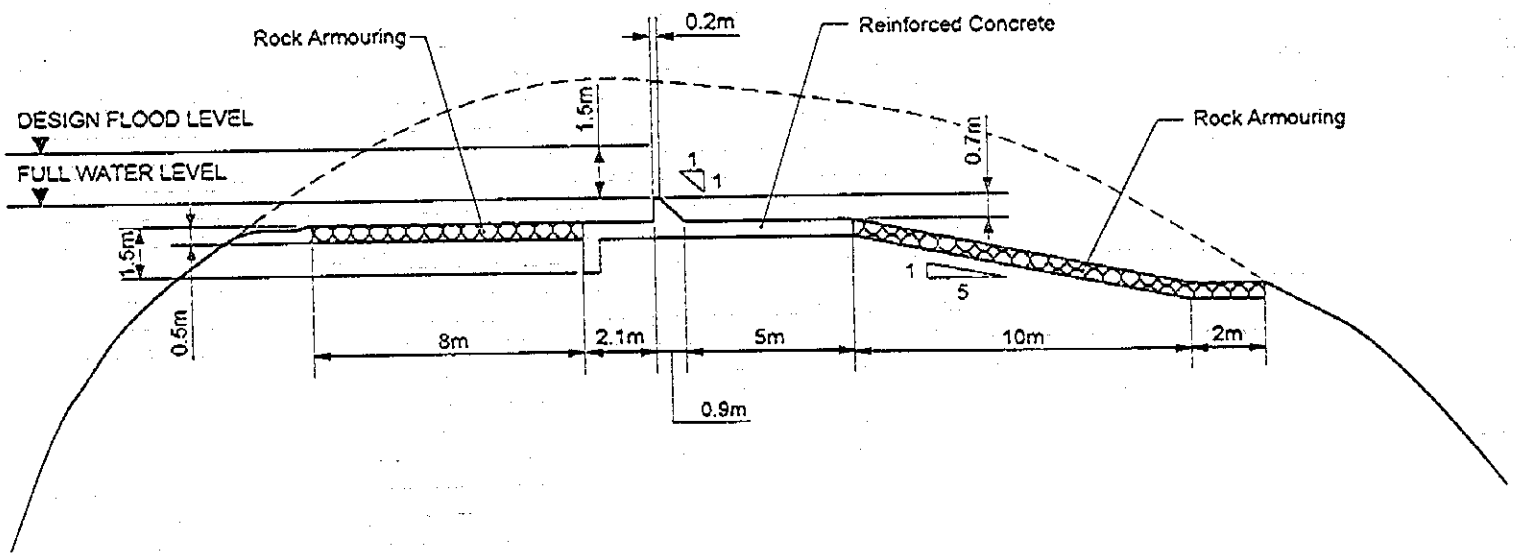


Figure 5.2.7. Typical Dam Vertical Section

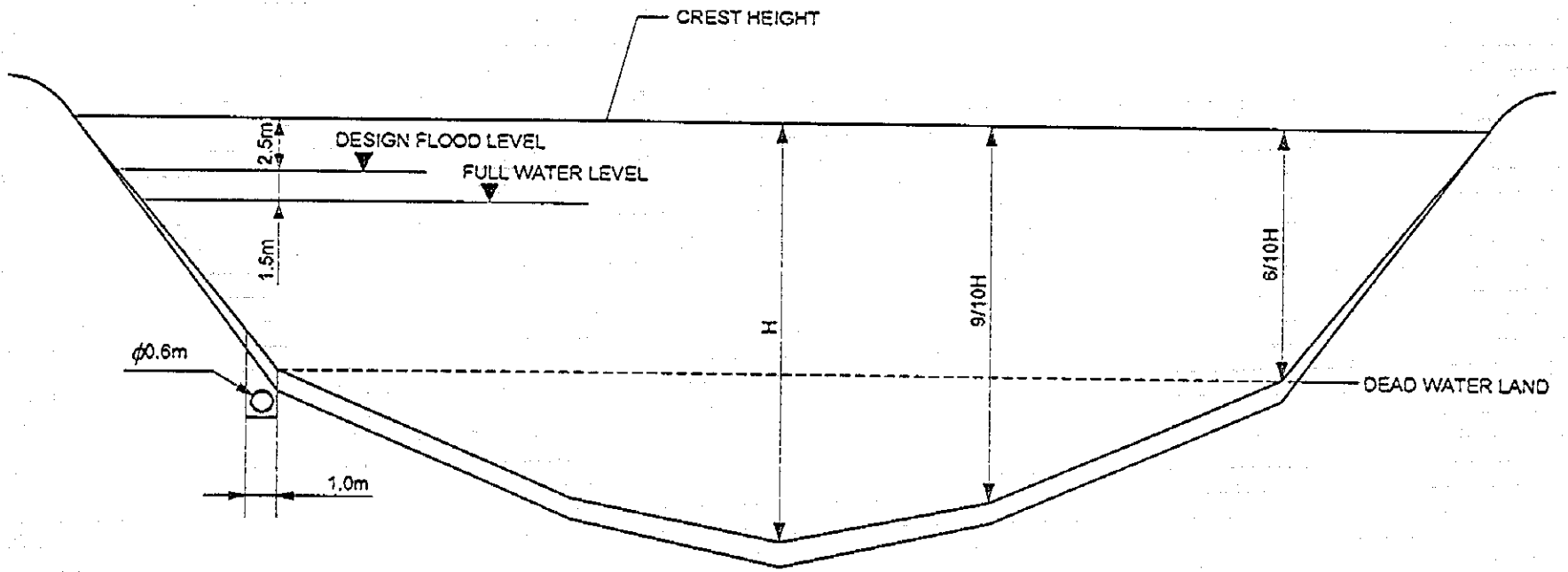
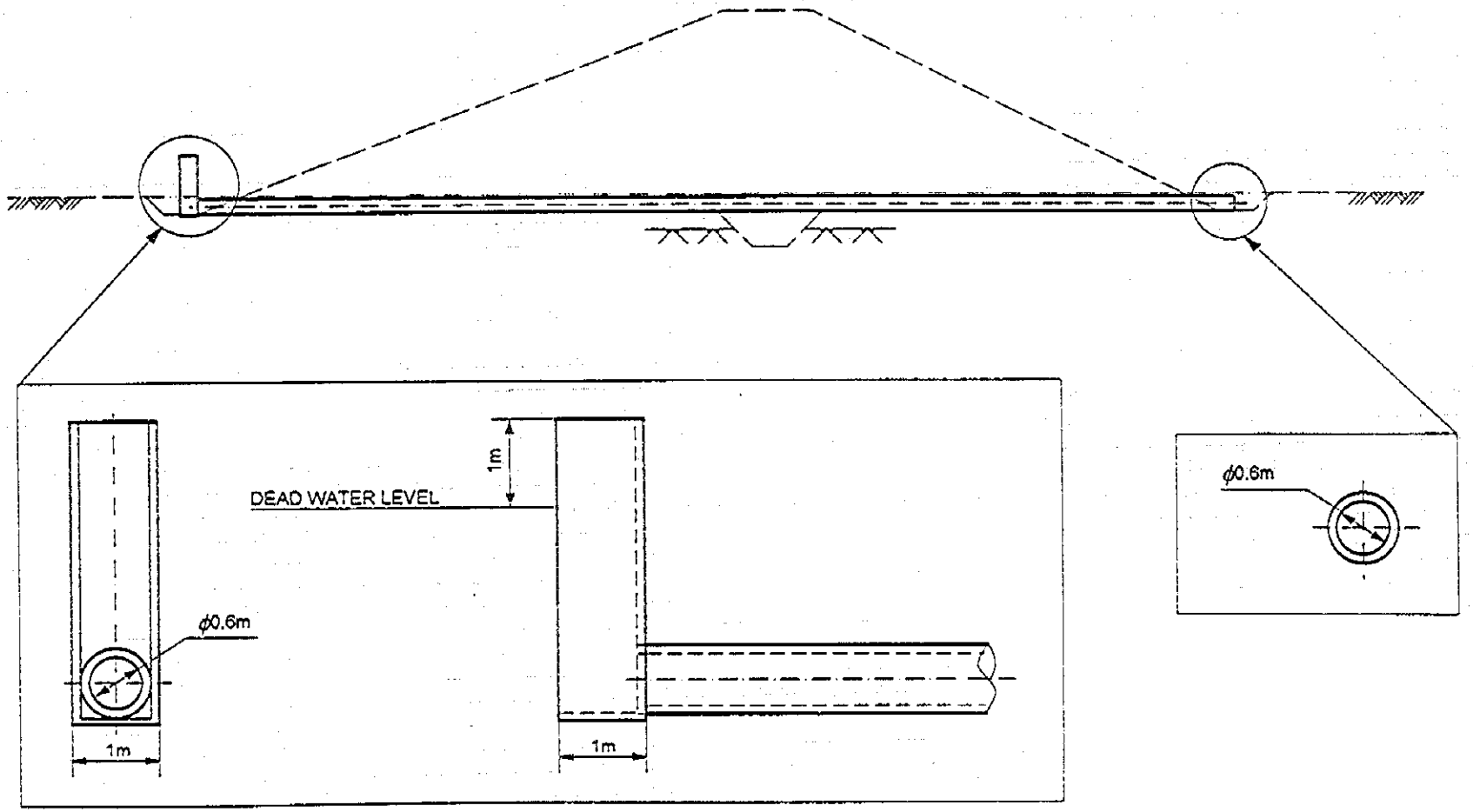


Figure 5.2.8. Outlet Cross-Section



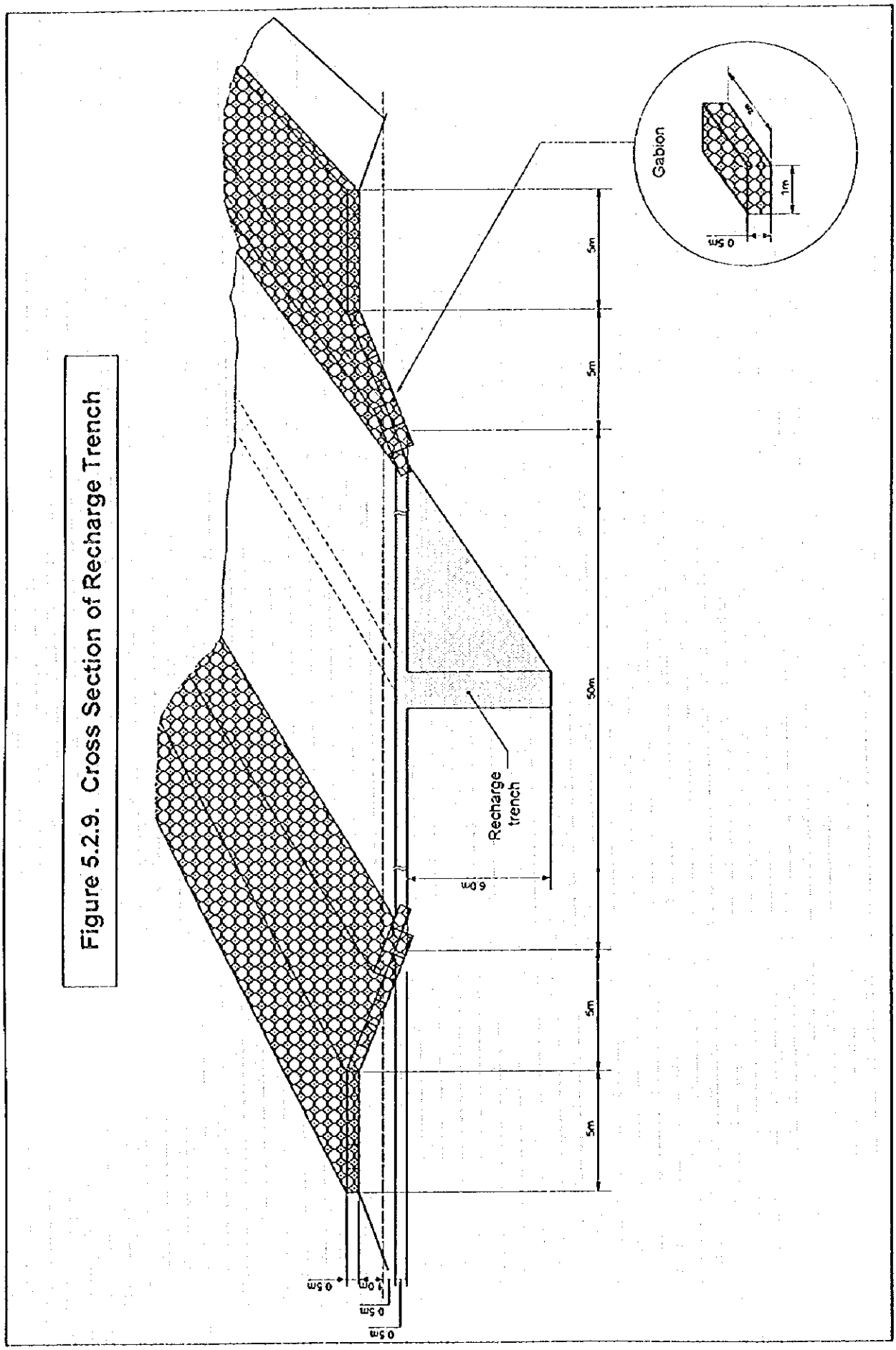


Figure 5.2.9. Cross Section of Recharge Trench

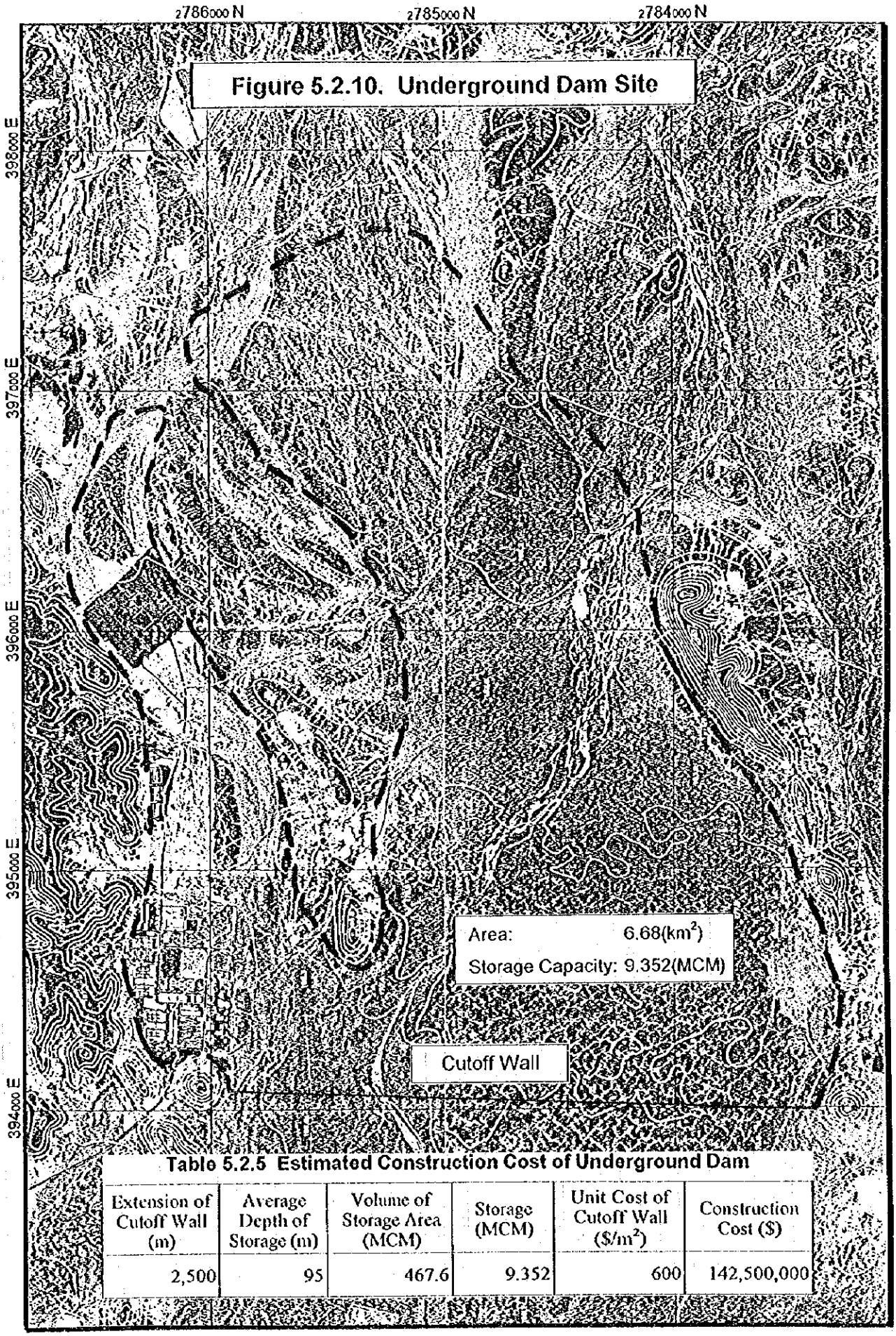


Figure 5.2.10. Underground Dam Site

Table 5.2.5 Estimated Construction Cost of Underground Dam

Extension of Cutoff Wall (m)	Average Depth of Storage (m)	Volume of Storage Area (MCM)	Storage (MCM)	Unit Cost of Cutoff Wall ($/m²)	Construction Cost ($)
2,500	95	467.6	9.352	600	142,500,000

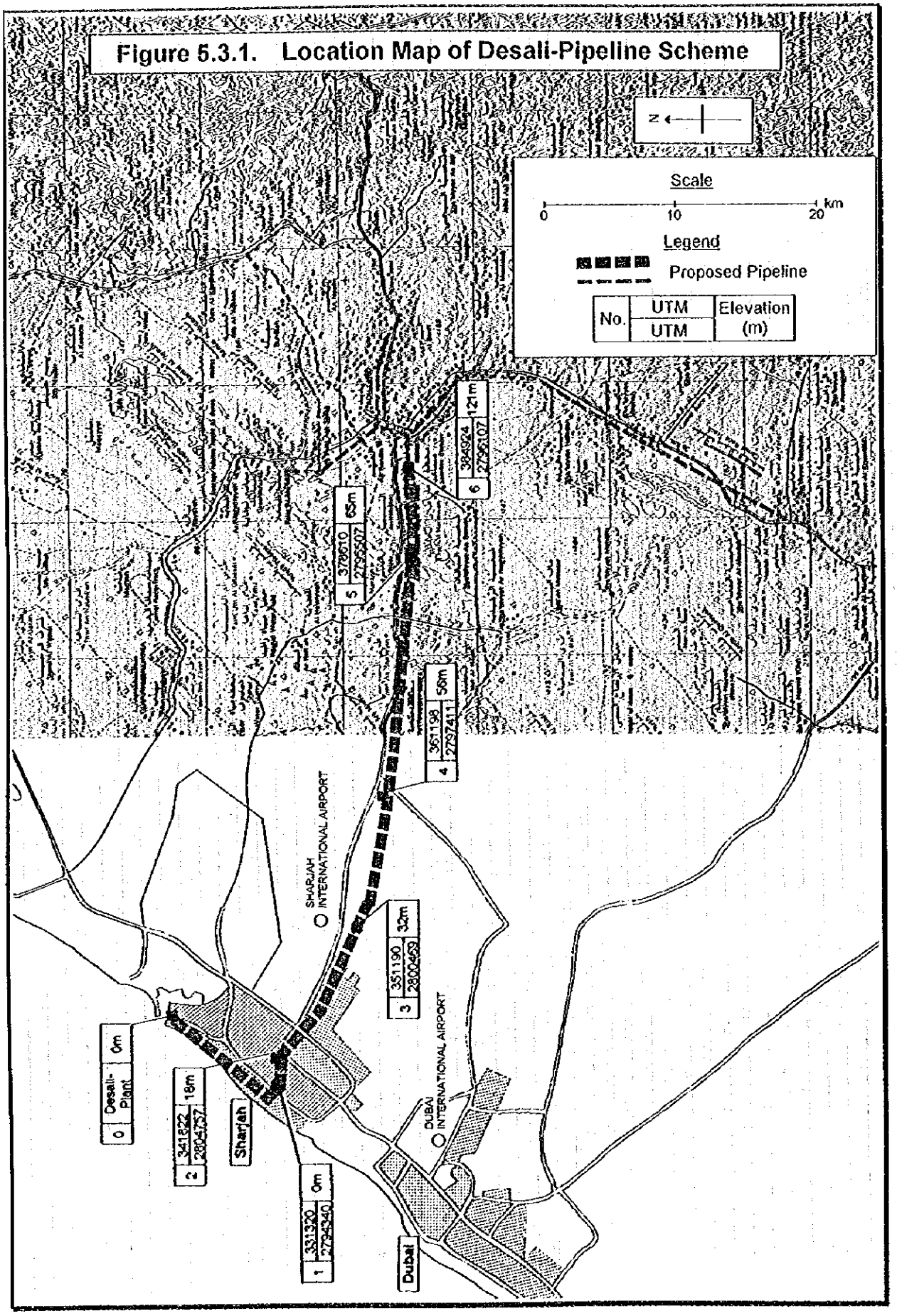


Figure 5.3.1. Location Map of Desali-Pipeline Scheme
N
Scale
0
10
20
km
Legend
Proposed Pipeline
No.
UTM
UTM
Elevation (m)
0 Desali-Plant 0m
1 331320 2794340 0m
2 341822 2804757 18m
3 351190 2800459 32m
4 361198 2797411 58m
5 378610 2795507 85m
6 384924 2796107 121m
Sharjah
Dubai
SHARJAH INTERNATIONAL AIRPORT
DUBAI INTERNATIONAL AIRPORT

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CHAPTER SIX : ENVIRONMENT AND WOMEN IN DEVELOPMENT

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CHAPTER SIX : ENVIRONMENT AND WOMEN IN DEVELOPMENT

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CHAPTER SIX : ENVIRONMENT AND WID

6.1. General

The Study Area covers 850 km^2 in the vicinity of Al Dhaid which has been seriously affected by groundwater depletion and the abandonment of farms due to water shortages. In face of the above mentioned problems, the main objective of the Study is to prepare a master plan on groundwater resources development to supply irrigation water for existing farm lands. The Study does not, however, contemplate the development of any new farm lands.

Generally, most agricultural development activities which go together with groundwater development have some effect on the environment. Keeping this in mind, the study on environmental aspects started by the assessing basic environmental conditions in the Study Area and the related environmental laws and organizations.

The objective of the Study on environmental aspects is to determine whether it is necessary to make a further detailed assessment (Environmental Impact Assessment) for the implementation of the Project.

From the environmental point of view, the main points of discussion are as follows:

- Depletion of groundwater resources due to pumping for irrigation purposes,
- Salt accumulation incurred by irrigation practices which in turn lead to soil deterioration; and
- Impact on flora and fauna.

6.1.1. Social Conditions

The Study Area straddles parts of five emirates: Sharjah, Umm Al Qaiwain, Ras Al Khaimah, Ajman and Fujairah. Of these emirates, Sharjah Emirate occupies the largest area. There are 12 towns scattered in the area.

According to the 1985 Population Census, the total population of the towns of Al Dhaid and Falaj Al Mualla is 18,630.

Main economic pursuits in the Study area are agriculture, including livestock and bee keeping; quarrying and the manufacturing of building materials, and some factory garment manufacturing.

There are 2,018 farm holdings and agricultural land covers a total of 6,181 ha in the Study area, which represents a small percentage of the total land area. Due to the shortage of irrigation water, however, only 4,584 ha, or 74% of total agricultural land is under

cultivation. Thus average amount of agricultural land per farm is 5.5 ha while the cultivated area per farm is 4.2 ha. Main agricultural products are forage crops and Dates, which account for 57% and 24% of total crop production, respectively. Others crops include Squash, Tomato and Lemon.

According to the farm inventory survey carried out by the Study Team, owners who are full-time farmers represent less than 10% of the total number of farmers; most of the rest leave the management of their farms in the hands of their employees who are usually foreigners. As of 1993 the Central Region of MAF had 843 dry wells, 8187 productive wells, 6,585 electricity generators and 3,956 pumps. Also, there are tree falajes in the Study Area but they were dry at the time of the study.

The approximate percentage of irrigation methods applied in the Study Area are traditional methods, 40%, and modernized methods, 60%; of the modern irrigation methods, sprinklers account for 33%, bubblers for 35%, and drip systems for 29%.

6.1.2. Natural Conditions

(1) Geological Conditions

Geologically speaking, the Study Area can be divided into the Al Dhaid Alluvial Plain and the Central Desert.

The Al Dhaid Alluvial Plain was formed by alluvial sediment from intermittent streams and is covered mainly by fluvial deposits consisting of gravel, sand and silt. Soil in the area is mainly torrifluvents, which is characterized as mostly deep, non-saline to moderately saline soils.

The Central Desert is formed from poorly graded sand dunes and other sandy deposits. Soils in the area are Torripsamments and their characteristics are mostly saline to strongly saline. They also have a calcareous composition and small areas of loam.

(2) Flora and Fauna

The Arabian peninsula is a contact zone of three of the world's major zoogeographical regions: tropical Africa, the Orient and the Palaearctic. It is also at the center of the Eremic desert zone which extends from Morocco to Western China. Therefore, a great variety of flora and fauna can be founded in the UAE.

Especially, reptiles are quite common because prevailing arid conditions provide the ideal environment for their proliferation, and the appropriate heat level required to maintain their body temperatures. These reptiles survive on little food as they have low metabolic rates.

Human activity, however, such as overgrazing and hunting has recently brought about

many changes in the fauna and flora. The lowering of the water table, also, has had a damaging impact the ecology.

The Main endemic species of fauna and flora that are found in the Study Area are shown in Tables 6.1.1. and 6.1.2.

6.2 Environmental Institutions

6.2.1. Environmental Organizations

Before 1993, environmental management activities in the UAE were the responsibility of the Higher Environment Committee, which was part of the Ministry of Health. In 1993, based on the Committee, the Federal Environment Agency (FEA) was constituted under Federal Law No. 7. This Agency is an independent entity, both financially and administratively, and is annexed to the Cabinet. Its headquarters is in Abu Dhabi.

In the law it is stipulated that the Agency is managed by a Board of Directors chaired by the Minister of Health. This Board has nine members who are responsible for environmental development issues within the different instances of the government. The Minister nominates the members; their nominations are sanctioned by a cabinet resolution.

The objectives for creating the Authority are as follows:

- To protect and develop the environment within the State
- To determine the necessary plans and policies to safeguard the environment from the damaging effect of activities, particularly those affecting human health, agricultural crops, wildlife, marine life, other natural resources and atmosphere.
- To implement such plans and policies.
- To take all suitable measures and actions to prevent deterioration of the environment.
- To fight environmental pollution of all kinds.
- To minimize the effects of pollution for the welfare of present and future generations.

As of 1995, the Agency had a staff of 6 people who are working on the preparation of a definitive environmental law; the details concerning such a law are under discussion within the different state organizations related with the environment issues.

There is an Environment Division in the Ministry of Health in Dubai. A tentative organization plan of the FEA is shown in Figure A-6.2.1; it must be noted that the lower echelon has not been decided yet.

6.2.2. Environmental Law and Regulation

Up to now, there has been no environmental law and regulation in the UAE. However, a federal law concerning preservation and development of the environment is now being elaborated under the guidance of the Federal Environmental Agency.

Among other regulations related to the Study, there is a MAF decree which bans the application of highly toxic and residual agricultural chemicals for farming. The banned substances are shown in Table 6.2.1.

6.2.3. International Conventions

UAE has ratified the convention on International Trade in Endangered Species of Wild Fauna and Flora, and signed the United Nations Convention on the Law of the Sea, Basel Convention and Convention on Biological Diversity.

Of the animals inhabiting the Study Area, only *Uromasyx spp* is specified by the Convention on International Trade in Endangered Species of Wild Fauna and Flora and there is no fauna registered by the conventions on Biological Diversity in the Study Area. There is no conservation area of natural resources nor an area registered for Conservation for the Protection of World Cultural and Natural Heritage.

6.3. Initial Environmental Examination

Social and natural environmental impacts related to the implementation of the Project have been assessed. IEE (Initial Environmental Examination) system prepared by JICA is applied to the Study under the agreement between the Study Team and Director General of Federal Environmental Agency because no comprehensive evaluation/ assessment system is established. The main objective of the examination is to evaluate whether further study on EIA (Environmental Impact Assessment) is necessary.

Table 6.3.1. summarizes the estimation of the environmental changes; assessment of the influence by the changes; and environmental items for screening are discussed as follows:

6.3.1. Social Environment

(1) Resettlement

The Study does not includes work which requires resettlement of inhabitants.

(2) Economic Activities

Economic activities in the Study Area will be stimulated through the implementation of

the project as a result of increased agricultural production through groundwater development. However, development may not impact on the environment.

(3) Traffic and Public Facilities

The project does not greatly affect traffic facilities because the project mainly consists of improvement of the water supply system.

(4) Split of Community

There are no communities at the boring site.

(5) Cultural Property

There are some cultural treasures or relics in the area but they are still under excavation. The project does not affect them because it does not include the expansion of farm land area.

(6) Water Rights

There are no private water rights for groundwater in the area.

(7) Public Health Conditions

The project does not include aspects which may cause deterioration of sanitary conditions such as, increase in rubbish or human waste or outbreaks of infectious diseases.

Application of agricultural chemicals may increase due to progress coming with groundwater development. However, a MAF decree (Decree No. 97, Enacted in 1993) bans the application of strong toxic pesticides as shown in Table 6.3.1. for protecting groundwater quality, and human and animal health. The importation of such chemicals is also banned.

Other chemicals used in the Study Area are mainly applied to vegetables, and the amount is very small; only 0.9% of the farmers in the Study Area apply pesticides and the average application rate is 0.17–0.44 lit/ha, and their toxicity is lower than that of banned chemicals. The application amounts would not increase because farm land is not expected to be expanded in the future.

Application of the chemicals in the Study Area, therefore, would have little effect on groundwater and human health.

(8) Waste

No residual materials will be produced.

(9) Hazard

There is no risk of hazard because the project does not include big construction works.

6.3.2. Natural Environment

(1) Topography and Geology

Though the project does not include land reclamation, it will not induce any topographic change.

(2) Soil and Land

According to MAF data from 1993, 40% of farmers in the Study Area apply traditional irrigation methods and apply 60% modernized methods. However, there is some salt damage in the area.

SAR value of groundwater is comparatively low and symptoms of salt damage are barely observed in the Study Area. However, this issue is very important to arid agriculture.

Generally, salinization of soil is affected by water quality and irrigation methods. To avoid salt accumulation in the soil, the following countermeasures are proposed in the Study:

- Introduction of a water-saving cropping pattern.
- Water saving irrigation methods to meet crop water requirements.
- Water saving irrigation methods and a water distribution system to reduce conveyance losses.
- Improvement of drainage facilities for leaching of salts.

Consequently, by applying the above mentioned countermeasures, salt damage could be controlled. On the other hand, monitoring of salt accumulation in the soil is necessary for sustainable agricultural development.

(3) Groundwater

Groundwater resources of the Area are divided into two types: fossil and rechargeable water. It is estimated that rechargeable water represents about 10% of the total irrigation water used in the Study Area. Water saving and the increase of rechargeable groundwater are given a high priority in the Study.

From the point of view of water saving the following policies may be recommended:

- Establishment of water saving cultivation systems including suitable crop selection and

appropriate irrigation methods.

- Establishment of a sustainable amount of water based on an evaluation of groundwater consumption, development potential and the recharge rate.
- Other alternative water resources for irrigation may be proposed.

To increase groundwater recharge for the continuous use of water resources, the following countermeasures are also proposed:

- Recharge dams
- Recharge trenches
- Underground dams

If these countermeasures proved successful, a sustainable groundwater resource usage may be achieved.

Monitoring of the groundwater level would still be necessary, however, to ensure that the measures to implement the sustainable use of water resources are effective and to gather data for further development.

According to the chemical analysis of groundwater during the test drilling carried out in the Study, there is a high content of fluoride, 5–14 mg/L, and chromium, 0.8–1.7 mg/L, in the southern part (PW-2, -3, and -5). According to WHO criteria, the upper limits for these substance are 1.7 mg/L and 0.05 mg/L, consequently, to avoid any hazard to health, it is necessary to urgently seek other sources of drinking water.

(4) Hydrological Situation

There are no rivers or lakes into which to discharge the drainage water.

(5) Flora and Fauna

The project does not contemplate new farm land expansion. Consequently, the implementation of the recommendations of the Study will not affect the indigenous species of flora an fauna shown in Tables 6.1.1. and 6.1.2.

(6) Meteorology

There are no large construction works large enough to have any meteorological effects.

(7) Landscape

Topographic changes are not expected to take place because the project does not include land reclamation or large construction works.

6.3.3. Pollution

(1) Air Pollution

There are no air pollution sources.

(2) Water Pollution

There are no water pollution sources.

(3) Soil Contamination

There are no soil contamination sources.

(4) Noise and Vibration

Noise and vibration will occur during drilling activities. However, they will not affect human activities because the drilling areas are very far from inhabited areas.

(5) Land Subsidence

Land subsidence is not expected to occur after the drawing of groundwater because the land foundation consists of limestone and sandstone, which is not yielding like clay.

(6) Offensive Odors

There are no sources of offensive odors.

6.4. Conclusions and Recommendations

6.4.1. Initial Environment Examination (IEE)

Social and natural environmental impacts related with to implementation of the project have been assessed.

Table 6.3.1. summarizes the estimation of the environmental changes and assesses the influence of those changes. Since very few people live in the Study Area and the project does not include new land reclamation works, the implementation of the project will have little impact on its inhabitants as far as resettlement is concerned.

It is clear that the groundwater resources in the Study Area have become very scarce and

valuable. Water resources are crucial for irrigation to sustain agriculture and as drinking water for the inhabitants. To ensure the sustainable use of the resources, the appropriate amount for consumption should be evaluated. In this context, the groundwater should be monitored continuously.

According to the farm inventory survey, groundwater quality varies depending on depth and area. Consequently, in some cases salinization has become a problem that affects soil characteristics. Once the soil deteriorates, it becomes unsuitable for cultivation and its rehabilitation is very difficult. Based on the field survey and results of water analysis, it seems that deterioration may occur in the Study Area. Continuous monitoring soil and groundwater quality should be placed at a high priority.

From the IEE, EIA is necessary for further study, especially on the subjects of groundwater level, groundwater quality and soil.

6.4.2. Special Issues

(1) Urban Waste

Urban waste from Al Dhaid is dumped at a place near the town situated in the upper stream section of the groundwater flow in the Study Area. There is a high risk that the dumped waste may contaminate the groundwater resources. In turn, the polluted water would induce a decrease in productivity due to toxicity produced by accumulation of pollutants in the cultivated fields. As a result of this process, human health could be seriously affected. It is strongly recommended that the dumping ground should be moved to another place where water quality would be less affected.

(2) Desert Pollution by Agricultural Materials

Horticulture is widely practiced in the Study Area, requiring that a high amount of materials such as vinyl sheeting be used to cover young plants. After use, the farmers dump the materials in the desert. One can find those materials scattered all around the desert areas in the Study Area. As a consequence, the landscape is spoiled while the ecosystem of the flora and fauna is also expected to be affected. It is recommended that the materials should be collected and treated to protect the ecosystem of the desert.

6.4.3. Women in Development (WID)

(1) Existing Situation

Almost all agricultural field works in the Study Area are carried out by foreign workers; local women are practically uninvolved in them. Due to diverse factors, this situation is

not expected to change in the future.

In other sectors, for example female participation in the labor force and the number of female students things have changed remarkably in recent years.

Approximately 185 female students entered as part of the university's first enrollment in November 1977. Most females enrolled in the Education Department at that time. In recent years, the number of women students has been increasing at the UAE university and women students now exceed men, as shown in Table 6.4.1. The range of subjects that women study is now also more diverse.

The history of local women's participation in the formal sector dates back to 1964, before the formation of the UAE, when the Kuwait office hired two women to teach at schools in Sharjah. These two women were among the four secondary school graduates of Sharjah's first female graduating class. As of 1977, out of a total of 2,357 female instructors employed by the Ministry of Education, 199 or 8.4 percent were local women. Employment in government ministries is considered to be the most acceptable employment for UAE women. Outside of the Ministry of Health, Education, and Labor and Social Affairs, however, the number of women employed was extremely limited. More recently, since the government embarked on a policy which encourages female participation in the labor force, the number of women administrative staff in the government has been increasing.

As shown in Table 6.4.2., there is a strong preference for national women to take on the top positions in many divisions.

(2) Role in the Development

In recent years, however, the government has launched a policy of promoting the role of women in society. Taking this into consideration, the project should involve women; they are expected to play the following roles:

a) Management of Marketing Information

According to the survey, one of the problems of agriculture in the area is that marketing information does not reach the farmers. This situation creates disadvantages as far as farm income is concerned. Consequently, the Study recommends establishing a market information system. Women are more than capable of meeting the challenges of such as system and it would involve them still further in economic life.

b) Campaign for Water Conservation Education

Women can also play a major role in the sense that they can teach the importance of

conservation of groundwater resources to their children as, by tradition, they are responsible for the education of the children. In this context, it is recommended that the project should involve women in promoting the concept of the sustainability of water resources in the desert.

Table 6.1.1. Endemic Species of Fauna in the Study Area

Geckoes:	*Hemidactylus turcicus, Hemidactylus ??flaviviridis, Teratoscincus scincus, Pristurus rupestris, Stenodactylus doriae, Stenodactylus arabicus, Stenodactylus leptocosymbotes*
Agamid lizards:	*Uromastyx microlepis, Agama jayakari, Agama sinaita, Phrynocephalus arabicus, Phrynocephalus maculatus*
Lacertid lizards:	*Acanthodactylus boskianus, Acanthodactylus opheodurus, Acanthodactylus schmidti, Mesalina adramitana*
Shinks:	*Mabuya tesellata*
Worm lizards:	*Diplometopon zarudnyi*
Monitor lizards:	*Varanus griseus*
Toads:	*Bufo arabicus, Bufo dhufarensis*
Cobras:	*Walterinnesia aegyptia*
Vipers:	*Cerastes gasperettii, Echis carinatus sochureki*
Colubrid snakes:	*Psammophis schokari* (Venomous), *Spalerosophis diadema* (Non-venomous), *Lytorhynchus gaddi,Coluber rhosorachis, Malopon moilensis*
Boas:	*Eryx jayakari*
Gerbillus nanus:	*Gerbillus nanus, Meriones libycus, Meriones crassus*
Jerboas:	*Jaculus jaculus*
Rat:	*Acomys dimidiatus, Acomys russatus*
Hedgehogs:	*Paraechinus aethiopicus dorsalis, Lepus capensis cheesmani*
Mongooses:	*Ichneumia albicauda albicauda*
Badgers:	*Mellivora capensis*
Antelope:	*Gazella dorcas saudiya* (Very rare), *Gazella gazella arabica* (Rare)
Dogs:	*Vulpes vulpes arabica, Vulpes rueppelli sabaea* (Rare)
Cats:	*Felis margarita* (Endangered)
Birds:	*Alaemon alaudipes, Ammomanes deserti, Coracias benghalensis, Corvus ruficolis, Eremopterix nigriceps, Francolinus pondicerianus, Galerida cristata, Lanius excubitor, Merope orientalis, Nectarinia asiatica, Passer domesticus, Prinia gracillis, Pterocles exustu, Phcnonotus xanthopygos, Streptopelia senegalensis, Turdoides squamiceps*

Source: The National Atlas of the United Arab Emirates

Table 6.1.2. Endemic Species of Flora in the Study Area

Very common	
Grasses:	*Stipagrostis plumosa*
Shrubs:	*Hammada elegans, Leptadenia pyrotechnica, Ochradenus arabicus, Ochradenus aucheri,*
Trees:	*Acacia tortillis*
Other annuals:	*Asphodelus fenuifolius, Savignya parviflora, Schweinfurthia papilionacea*
Common	
Grasses:	*Astenatherum forskalii*
Shrubs:	*Tephrosia persica*
Trees:	*Prosopis cineraria*
Other perennials:	*Cyperus conglomeratus*
Uncommon	
Grasses:	*Cenchrus pennisetiformis, Tragus berteronianus*
Shrubs:	*Capparis cartilaginea, Rhazya stricta, Salvadora persica*
Trees:	*Calotropis procera*
Other perennials:	*Morettia parviflora, Polycarpea spp.*

Source: The National Atlas of the United Arab Emirates

Table 6.2.1. Pesticides Banned by the Ministry of Agriculture and Fisheries Decree (Decree No. 97, 1993)

Insecticide	:	Parathion, Aldrin, HHDN, Dieldrin, HEOD, Chlordane, Heptachlor, PCP, BHC, HCH, Heachlorocyclohexane, Ethylenedibromide, DDT, Chlordimeform, Chloropicrin, Disulfoton, Methoxychlor, Demeton, Sodium Fluoride, Fluoroacetmide, Endrin, Camphechlor, Chlordecone, Mirex, Strobane, Schradan, Leptophos, Telodrine, Kelevan, Aldicarb, Parathion, Phosphamidon, Lindane, Gamma BHC, Aluminium phosphid, Zinc phosphide, Dicofol, Methamidophos, Methyl bromide, Monocrotophos, Carbofuran, Dichlorvos, TEPP, Ethyl Pyrophosphate, Chlorobenzilate, Cyhexatin
Rodenticide	:	Arsenic compounds, Sodium Fluoracetate, Thallium sulphate
Fungicide	:	HCB, Hexachlorobenzene, Mercury compounds, Captafol
Herbicide	:	2,4,5-T, Amitrole, Nitrophen, Mercury compounds, Dinoseb, Paraquat
Nematocide	:	DBCP, Dibromo-Chloropropane

Source: The National Atlas of the United Arab Emirates

Table 6.3.1. Screening and Scooping (1/2)

No.	Environmental Item	Discretion	Evaluation	Notes	Marks	Remarks
Social Environment						
a	Resettlement	Resettlement by land occupation (Transfer of rights of residence, land ownership)	No	No expansion of farm land	C	
b	Economic Activities	Loss of production base (land , etc.) and change of economic structure.	Yes	Acceleration of agricultural development	C	Positive effect on regional economy
c	Traffic and Public Facilities	Impacts on existing traffic, schools, hospitals, etc. (e.g., traffic jam, accidents)	No	Low traffic density	C	
d	Split of Communities	Separation of regional communities by hindrance of regional traffic	No		C	
e	Cultural Property	Loss or deterioration of cultural properties, such as temples, shrines, archaeological assets, etc.	No	There are cultural remains but the project does not affect them	C	
f	Water Rights and Right of Common	Obstruction of fishing rights, irrigation and water rights	No	No water right	C	
g	Public Health Condition	Worsening of health and sanitary condition due to generation of garbage and appearance of harmful insects, increasing of agricultural chemicals	Yes	Increase in consumption of agricultural chemicals	C	Ban on using of high toxic and residual chemicals
h	Waste	Generation of construction waste, surplus soil, sludge, domestic waste, etc.	No	No source	C	
i	Hazards(Risk)	Increase in risk of cave-ins, ground failure and accident	No	No large construction work	C	
Natural Environment						
a	Topography and Geology	Change of valuable topography and geology due to excavation and earthfill	No	No land reclamation	C	
b	Soil and land	Topsoil erosion by rainfall after land reclamation or deforestation, salt accumulation by irrigation, degradation of soil fertility	Yes	Salt accumulation by irrigation due to high contents of salt in water	B	Expansion of less salt accumulation methods
c	Groundwater	Lowering of groundwater table due to overdraft and turbid water caused by construction work	Yes	Deterioration of ground- water resource because of over consumption	A	Requirement of monitoring on ground water level
d	Hydrological Situation	Change of discharge and water quality due to reclamation and drainage	No	No discharge of drainage water	C	
e	Flora and Fauna	Interruption of reproduction or extinction of species due to change of habitat condition	No	No expansion of farm land	C	
f	Meteorology	Change of micro-climate, such as temperature, wind, etc., due to large scale reclamation, and construction	No	Not large scale development	C	
g	Landscape	Deterioration of aesthetic harmony by structures and topographic change by reclamation	No	No expansion of farm land	C	

Table 6.3.1. Screening and Scooping (2/2)

No.	Environmental Item	Discretion	Evaluation	Notes	Marks	Remarks
Pollution						
a	Air Pollution	Pollution caused by exhaust gas or toxic gas from vehicles and factories	No	No source	C	
b	Water Pollution	Water pollution of river and groundwater caused by drilling mud and oil	No	No source	C	
c	Soil Contamination	Contamination caused by discharge or diffusion of sewage or toxic substances	No	No source	C	
d	Noise and Vibration	Generation of noise and vibration due to drilling and operation of pumping machines	Yes	Noise due to drilling machine	C	Far from resident area
e	Land Subsidence	Deformation of the land and land subsidence due to lowering of groundwater table	No	No land subsidence because the aquifer consist of limestone	C	
f	Offensive Odor	Generation of offensive odor and exhaust gases	No	No source	C	
Overall Evaluation :		EIA is necessary for the project implementation	Yes	EIA is need on groundwater for sustainable use		

Mark classification : A: Impact is deemed strong; B: Some impact; C: Impact is very small and not subject to Environmental Impact Assessment

Table 6.4.1. Number of Student at the UAE University by Sex

	91/92	92/93	93/94
Male	2,611	2,401	2,611
Female	6,706	7,245	8,777
Total	9,317	9,646	11,388

Source: U.A.E. Census 95

Table 6.4.2. Distribution of National Administrative, Technical and Teaching Staff According to Jobs and Sex in 1993/94

Jobs	Male	Female	Total
Administrative Staff			
Principal	105	280	385
Vice-Principal	102	294	396
Supervisor	74	193	267
Secretary	96	411	507
Store-keeper	3	84	87
Total	380	1,262	1,642
Technical Staff			
Social Service Specialist	135	439	574
Librarian	5	126	131
Laboratory	2	148	150
Technical Total	142	713	855
Teaching Staff			
K.G.	0	542	542
Primary	255	2,418	2,673
Prep+Secondary	169	1,539	1,708
Religious Ed.	9	0	9
Technical Ed.	4	0	4
Total	437	4,499	4,936
Grand Total	959	6,474	7,433

Source: Summary of Educational Statistics 1993 - 1994, Ministry of Education