Supporting Report XVI Natural and Social Environment and Resettlement Plan

FEASIBILITY STUDY
ON
WATER RESOURCES DEVELOPMENT
IN
RURAL AREA
IN
THE KINGDOM OF MOROCCO

FINAL REPORT

VOLUME V
SUPPORTING REPORT (2.B)
FEASIBILITY STUDY

SUPPORTING REPORT XVI
NATURAL AND SOCIAL ENVIRONMENT
AND
RESETTLEMENT PLAN

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NATURAL AND SOCIAL ENVIRONMENT AND RESETTLEMENT PLAN

Natural

XVI1 Natural Environmental Impact Assessment (EIA)

XVI1.1 Background

JICA Study Team conducted an Initial Environmental Examination (IEE) in the First Phase of the Study from February to July 2000. Environmental screening and scoping for all the 25 dam sites were completed in this IEE (sometimes referred to as a preliminary environmental study), and those results were reported as part of a Master Plan (M/P) in the "Interim Report" of August 2000. With the result of the IEE and other technical and economic aspects of the project, 4 dam sites (N'Fifikh, Taskourt, Timkit and Azghar) have been selected for a subsequent Feasibility Study (F/S) in the Second Phase of the JICA Study from August 2000 to March 2001.

As for the environmental study in the F/S stage, specific terms of reference (TOR) for more detailed environmental study with additional primary data and more detailed analysis in natural and social environmental aspects of the project were also prepared with the IEE. Field investigations of the Environmental Impact Assessment (EIA) presented in this report, therefore, have been conducted upon the TOR.

Environmental study including both IEE and EIA for the project has been conducted primarily based on the environmental guidelines of JICA since an EIA guideline was not established officially in Morocco. On the other hand, resettlement of the villagers around the dam sites has been identified as a critical issue for the project so that JBIC's guideline for resettlement has been used in this study. Consequently, the outcome of this study should be of international standard and satisfy JICA as well as the Government of Morocco on environmental consideration for the project.

XVI1.2 Objectives

Environmental Impact Assessment (EIA) is defined as the systematic identification and evaluation of the potential environmental impacts (effects) of proposed development projects, plans and programs. The primary purpose of the EIA is to ensure environmental considerations in planning and decision-making and to ultimately develop project activities, which are more environmentally

compatible manner. Impact mitigation measures and alternative project activities to reduce negative environmental impacts are crucial aspects of the study. Furthermore, Environmental Management Plan (EMP) including a long-term environmental monitoring procedure and environmental management system is an integral and critical part of the EIA.

XVI1.3 Approach

XVI1.3.1 Main Concepts

Natural environment is dynamic and functions in a complex manner so that it is difficult to distinguish impact by a project as “negative” or “positive” within a given ecosystem. It is, therefore, defined in this study that any alterations to natural conditions by large-scale human activities are considered basically as “negative impacts” from ecological point of view.

On the other hand, impact on social environment is evaluated with a viewpoint of local villagers living around the project sites. Therefore, social impact by the project is determined as “negative” or “positive” with a value judgment of the villagers concerning their living standards and intention regarding the project. This social aspect is presented separately in this report.

XVI1.3.2 Basic Approach

EIA system has not been fully established in Morocco so that JICA’s environmental guidelines are used in this study. However, there is a draft form of EIA guideline that is prepared by the Ministry of Environment (Secretary of State), Morocco. Furthermore, there is National Council of Environment (NCE) to assist the Ministry of Environment in the assessment of environmental study for development projects. This council consists of several ministries as permanent members and plays a main role in the process of EIA.

JICA Study Team has consulted with the Ministry of Environment to apply environmental considerations by the Ministry in this study. It is, therefore, suggested that the implementing agency (DGH) of the project maintain an appropriate communication with the Ministry and to acquire an agreement by the NCE in prior to the actual implementation of the project.

XVI1.4 Scope of the Assessment

Management actions to reduce negative environmental impacts have to be taken readily after some impacts are detected. This is particularly important after the construction is completed. Therefore, the establishment of a long-term environmental monitoring and feedback system is the most critical aspect of the

environmental consideration. Environmental monitoring data have to be applied for management actions so that institutional setup plays a key role in its implementation.

Based on the results of the IEE (refer to NE1 of Volume VII Data Book) mainly using a JICA's environmental checklist in the First Phase of the study, field surveys for the assessment of impacts on natural environment at post construction stage are focused on the analysis of the following items:

(1) Water Quality

- Upstream of the dam sites: Possibility of eutrophication
- Immediate downstream of the dam sites: Changes in a level of groundwater
- Downstream of the dam sites: Changes in water quality with irrigation (use of agricultural chemicals)

(2) Ecosystem

- Existence of any endangered or rare wildlife species (fauna & flora) upstream and downstream of the dam sites
- Selection of native plant species and locations for planting upstream to reduce a level of erosion (long-term environmental conservation)
- Status of present environmental condition around the project sites has been described, and potential environmental impacts are assessed using the results of the field surveys in the Second Phase of the study.

XVI1.5 Terms of Reference (TOR) for EIA

XVI1.5.1 Objectives

One of the most important objectives of the EIA is to develop strategies to reduce and mitigate the level of negative impacts with the project. Preparation of an Environmental Management Plan (EMP) including an environmental monitoring system and institutional setup is, therefore, EIA important part.

This TOR for field investigation is to collect primary data that will be a basis for the EMP and it is focused on the following factors:

- Impact on water quality and quantity (surface water and groundwater),
- Impacts on ecosystems downstream and in the areas that will be submerged (including quarry sites) upstream,

XVI1.5.2 Location for the Investigation

Based on the results of the IEE, field data should be collected to describe detailed status of the present environmental condition at the four dam sites of N'Fifikh, Taskourt, Timkit and Azghar.

XVI1.5.3 Water Quality Analysis

(1) Objective

Objective of the water quality analysis is to collect current data on the quality of water around the proposed dam sites. Deterioration in the surface water in a dam reservoir (e.g. eutrophication) and groundwater downstream of the site possibly occur particularly after construction. Therefore, collection of the baseline data before construction is crucial. Also, measurement of groundwater level is important.

(2) Survey Items:

- Surface Water: All 23 parameters listed in the following Table.
- Groundwater: Level of groundwater should be taken, and the parameters listed as No. 1, 7, 8, and 13 in the Table are to be analyzed.

Parameters for Water Quality Analysis

No	Parameters	No	Parameters
1	Physical profiles (color, odor, hardness and temperature)	13	NO_3-N (Nitrate Nitrogen)
2	BOD (biochemical oxygen demand)	14	T-P (Total Phosphorus)
3	COD (chemical oxygen demand)	15	PO_4-P (Orthophosphate Phosphorous)
4	DO (dissolved oxygen)	16	As (Arsenic)
5	SS (suspended solid)	17	Cl (Chloride)
6	TDS (total dissolved solid)	18	F (Fluorine)
7	Ph	19	Fe (Iron)
8	Electric Conductivity (salinity)	20	Mn (Manganese)
9	Alkalinity	21	Sulfate (SO_4)
10	T-N (Total Nitrogen)	22	Zinc (Zn)
11	NH_4-N (Ammonia Nitrogen)	23	Total coliforms
12	NO_2-N (Nitrite Nitrogen)		

- Sampling Locations: (Total of 28 points)

  (Surface Water) two points each for upstream and downstream at all sites (16 points)

  (Groundwater) three points downstream of each site (12 points)

- Sampling Frequency: Once between September to November 2000

- Sampling Methods: Moroccan standardized methods should be applied, and the level o water should also be measured at each sampling point.
- Reports to be submitted:

i. Submission: 3 copies in English and 3 copies in French shall be submitted by the end of November 2000.

ii. All reports/data shall be submitted on diskettes as a rich text file (RTF).

iii. Methodology of the field sampling/measurements and laboratory analysis shall be described precisely in the report.

- All results must be presented in a table in comparison with the water quality standards (for irrigation and drinking purposes) of Morocco.
- Water quality modeling to predict its future status shall be included if possible.
- Photograph showing the sampling locations and sampling process shall be taken and attached to the reports.

XVI1.5.4 Analysis of Fauna and Flora

(1) Objective

This survey is to analyze present condition of the ecosystems that will be submerged in a dam reservoir. It is important to investigate if any important habitat of endangered or rare wildlife species exists upstream and downstream.

(2) Survey Items

Species composition of representative species of fauna and flora

- Fauna: Species composition of terrestrial wildlife species, particularly mammals and birds (aquatic and invertebrate species if possible)
- Flora: Species composition of terrestrial natural plant species, particularly overstay vegetation such as trees and shrubs
- Sampling Locations: Important ecosystems downstream and quarry sites and areas that will be submerged in a dam reservoir at each dam site.
- Sampling Frequency: Once between September to November 2000
- Sampling Methods: Field investigation, literature review and interview with local villagers
- Reports to be submitted:

i. Submission: 3 copies in English and 3 copies in French shall be submitted by the end of November 2000.

ii. All reports/data shall be submitted on diskettes as a rich text file (RTF).

iii. Methodology of the field sampling shall be reported precisely.

iv. Ecological characteristics of the fauna and flora listed in the report shall be described.

v. Conservation strategy for fauna and flora

vi. Plant species that can be planted upstream as a strategy to reduce erosion shall be recommended (native tree and/or shrub species).

vii. If there is a wildlife species that requires intensive management actions, management techniques (e.g. translocation or preservation) shall be suggested.

viii. Photograph showing the sampling locations (patches of forest) shall be taken and attached to the reports.

XVI2 Survey Methods

XVI2.1 Water Quality and Quantity

XVI2.1.1 Sampling Details

Water samples were collected for different purposes from various locations around the four dam sites, N'Fifikh (No. 5), Taskourt (No. 9), Timkit (No. 10) and Azghar (No. 17). Potential negative impacts in relation to water quality and quantity on a long-term basis are listed in the following Table.

Water Sampling and Analysis in Relation to Potential Negative Impacts at Each Dam Site

Location of the Samples	Samples	Primary Negative Impacts in Post Construction Stage
1. Upstream	Surface water	Eutrophication in s dam reservoir
2. Immediate downstream	Groundwater	Reduction of a level of groundwater
3. Downstream	Surface water	Deterioration in the quality of water due to the irrigation activities

Water samples were collected between October and November 2000 when surface water was available for sampling. Sampling locations at each dam site is shown in the following Table and Figure XVI2.1.1 to Figure XVI2.1.4.

Parameters for analysis are presented in the TOR in the section of XVI1.5.3 (Water Quality Analysis). Surface water was analyzed for all 23 variables, but groundwater samples from open wells were analyzed only for selected parameters. The wells were selected particularly with a heavy drinking demand.

Sampling Location at Each Dam Site

Site	Sampling Location
1. N'Fifikh (No. 5)	Surface water, 1 km upstream of the dam site
	Groundwater from wells, immediate downstream of the dam site
	Surface water, 15 km downstream of the dam site
2. Taskourt (No. 9)	Surface water, 1 km upstream of the dam site
	Groundwater from wells, immediate downstream of the dam site
	Surface water, 15 km downstream of the dam site
3. Timkit (No. 10)*	Surface water, 2 km upstream of the dam site
	Groundwater from wells, immediate downstream of the dam site
4. Azghar (No. 17)	Surface water, 700 m upstream of the dam site
	Groundwater from wells, immediate downstream of the dam site
	Surface water, 2 km, 6 km and 10 km downstream of the site

* Surface water downstream reaches are not available when the sampling was made in the field

XVI2.1.2 Analytical Methods

Moroccan standardized analytical methods (laboratory analysis) were applied in this study (NE2 of Volume VII Data Book). Sampling locations were determined at each dam site in September 2000, but field sampling for surface water was delayed up to November 2000 because there was no running water in the rivers.

XVI2.1.3 Water Turnover of the Dam Reservoirs

Water turnover ratio of the dam reservoirs was particularly important as an indication of eutrophication and stratification of reserved water with different temperatures (releasing cold water). Water turnover ratio of the dam reservoirs (α) was calculated such as:

$$\alpha = Q_0 / V_0$$

where,

Average annual water turnover of a dam reservoir (α)

Annual inflow (Q_0)

Total storage of water in a reservoir (V_0)

$\alpha > 10$: Water of a dam reservoir is not likely to be stratified with temperature of the water

$\alpha < 10$: Water of a dam reservoir is likely to be stratified by temperature of the water (occur mainly from late spring to summer)

XVI2.1.4 Specific Discharge Ratio

Discharge rate of the river at each dam site fluctuates largely with different seasons, and the surface water of some rivers gets dried for several months of the year (Supporting C). In this circumstance, specific discharge was calculated as one of the parameters for a possible maintenance flow of the rivers. Calculation was made such as:

Specific Discharge = Average Discharge (m^3/sec) / Catchment Area (km^2)

XVI2.2 Fauna and Flora

XVI2.2.1 Sampling for Analysis

Present status of fauna and flora around the four dam sites was surveyed with the field observations for the total of 13 days as shown in the following Table. This investigation was to examine if any important habitats of endangered or rare species of both aquatic and terrestrial wildlife exist around the dam sites. Field survey was focused primarily on submerging areas upstream, but ecosystems downstream reaches were also sampled.

Field Sampling for Fauna and Flora

Dam Site	Date	Duration of the Field Work
1. N'Fifikh	29 Sep. – 01 Oct. 2000	3 days
2. Taskourt	14 – 18 Oct. 2000	4 days
3. Timkit	19 – 22 Oct. 2000	3 days
4. Azghar	10 – 13 Oct. 2000	3 days
Total	-	13 days

XVI2.2.2 Terrestrial Fauna

Existing literature on distribution and species composition of terrestrial wildlife species around the study site was reviewed. Then field observations were made in sampling areas around the dam sites. The investigation was focused on relatively small animals in body size, because those species are most likely to be affected with the dam construction and operation compared with species in a large body size.

XVI2.2.3 Aquatic Fauna

Benthic invertebrates were the main constituents of the aquatic ecosystems in the study areas. The qualitative sampling of invertebrates was, therefore, carried out using a water net (areas with vegetative cover), *troubleau*, and entomological clamps (areas with stones) in the rivers where surface water was not dried when a field investigation was conducted.

One sampling was taken upstream and downstream of Taskourt, and only one sample was collected in the submerging area of Timkit. The samples collected in the field were fixed in alcohol and identified in the laboratory using a magnifying scope.

XVI2.2.4 Terrestrial Flora

Field sampling was conducted with a plot of 100 m^2 at each dam site, and plant species were identified mainly in the field. Unknown species were brought back to the laboratory, and more careful identification was made with the reference of

- The new flora of Algeria (Quezel, Rosa)
- Flora of arid regions (Negre)

XVI3 Present Status of Natural Environment

Based on the survey results shown in NE2 of Volume VII Data Book, present status of natural environment are as follows:

XVI3.1 Water Quality and Quantity

XVI3.1.1 General Characteristics in Water Quality

Depth to reach the surface of groundwater in the open wells that are located immediate downstream of each dam site is shown in the following Table. This information can be used as baseline data for a long-term monitoring on changes in the level of groundwater with impact by the dam construction.

Depth of the Wells Located Immediate Downstream of the Dam Site

Dam Site	Sampling Wells*		
	G1 (m)	G2 (m)	G3 (m)
1. N'Fifikh (No. 5)	4.4	6.8	4.8
2. Taskourt (No. 9)	-	12.0	17.0
3. Timkit (No. 10)	24.3	170.0**	44.0
4. Azghar (No. 17)	12.5	5.0	8.0

*) See the section XVI2.1.2 **) Bore well (length of the pipe)

Groundwater quality was also analyzed for some parameters, and the result was good in general as shown in Table XVI3.1.1. Quality of the water sampled at G 3 in Taskourt area was deteriorated, but it is used for cooking, drinking and irrigation purposes. Conductivity of the sample (3111 μ S/cm) was higher than the low category of Moroccan standard (2700-3000 μ S/cm). A value of pH and NO_3 also belongs to the low category. Overall surface water quality was also found to be good. The value of SO_4 (409 mg/l) from the sample collected upstream of Timkit site was higher than the low category of the standard (250-

400 mg/l). Water discharge is generally limited at Timkit site, and the water level was low when sampling was conducted. Therefore, this low availability of surface water might have affected the result. Another site where a higher concentration of SO_4 (266 mg/l) was found was N'Fifikh. Water availability at the S1 sampling site was also very low when a sample was taken at N'Fifikh.

XVI3.1.2 Water Turnover of the Dam Reservoirs

Water turnover ratio (α) at each dam site is shown in the following Table. When the volume of water that is released from a dam is relatively lower compared with water inflow to a dam reservoir, the water turnover ratio (α) of the reservoir is reduced. When the α value is lower than 10, it is usually predicted that eutrophication and the alteration of thermal regimes in a reservoir are likely to occur. An α value of all the proposed dams is much less than 10 so that the retention time of the water of these reservoirs is quite long.

Water Turnover Ratio (α) of the Dam Reservoirs

Dam Site	Annual Inflow (mil m^3)	Reservoir Storage (mil m^3)	Annual Turnover (α)
1. N'Fifikh	13.32	19.2	0.7
2. Taskourt	44.65	71.7	0.6
3. Timkit	11.71	7.5*	0.4
4. Azghar	53.21	29.5	1.8

*) Temporally reservoir storage from flood of 20.0 mil m^3 is excluded.

XVI3.1.3 Specific Discharge Ratio

Specific discharge of the rivers at each dam site is shown in the following Table. Most of the dam sites have several months of dry periods in the year, and surface water gets dried completely during these months (see Hydrology Section for more details). Therefore, specific discharge was calculated using an average discharge value. Specific discharge value of at least 0.003 is usually required for maintenance flow. Taskourt and Azghar sites meet this minimum requirement, but discharge rates of N'Fifikh and Timkit sites are much lower than this value. These results indicate that surface water can be stored and released throughout the year at Taskourt and Azghar sites. However, the rivers at N'Fifikh and Timkit have a natural attribute of high fluctuations in the discharge and that surface water flow is difficult to be maintained throughout the year.

Specific Discharge of the Rivers at Each Dam Site

Dam Site	Specific Discharge (m^3/sec/km^2)	Average Inflow (m^3/s)
1. N'Fifikh	0.001	0.42
2. Taskourt	0.003	1.42
3. Timkit	0.001	0.37
4. Azghar	0.006	1.69

XVI3.2Fauna

XVI3.2.1 Terrestrial Fauna

There is no record or observation of critically endangered wildlife species inhabiting around the dam sites or within the submerging areas of the proposed dams. However, some threatened wildlife species and 2 species of endangered mammal have been recorded. Reptiles, birds and mammals that were recorded around the study areas are listed in the Data Book.

Wildlife species listed in the Data Book are distributed around the dam sites, but the specific ecology such as precise distribution, habitat condition and population status of those species is largely unknown. Lists of species presented in the Data Book should, therefore, be treated as minimum knowledge on biological diversity around the sites, because the field survey was conducted only for a single season with a short duration in the limited sampling areas. Species richness of wildlife species at each site should increase with additional field sampling.

The list of reptiles is represented by Oder Squamates, which is relatively low in diversity. A total of 8 threatened species have been identified, and of which, 6 species were found in Timkit. With a consideration of this dry environment, the result indicates that more variety of specialized reptiles inhabit in this area.

A total of 58 species of bird were identified, and of which 33 species were threatened. N'Fifikh had the lowest species richness, which indicates a monoculture characteristic in the ecosystem. On the other hand, Azghar had the highest diversity and hold relatively diverse patches of microenvironment. Timkit and Azghar presented relatively higher numbers of threatened species than those of N'Fifikh and Taskourt. Biological characteristics of the threatened avian species are also presented in the Data Book. A total of 38 mammalian species were found around the dam sites. Endangered species of *Felis caracal* was recorded in N'Fifikh and Azghar. Endangered species of *Ammotragus levia* were recorded in Taskourt, Timkit and Azghar.

XVI3.2.2 Aquatic Fauna

There was no surface water running at N'Fifikh and Azghar dam sites when the field investigation was conducted in September 2000. River flow at the other dam sites such as Taskourt and Timkit was also limited, but the survey was conducted focusing on the species composition of aquatic invertebrates in the rivers. The results of field samplings are listed in the Data Book, and endangered species or rare species of aquatic wildlife that require specific management actions was not observed in this survey.

It was found that the aquatic ecosystem at Taskourt is relatively diverse, and 19 species of invertebrate, 2 fish species and 1 species of amphibian were found in the field. Since field sampling was conducted in a single season, the species listed in the Data Book should be considered as minimum diversity. Species richness of aquatic organisms in the ecosystems is likely to increase if additional samples are taken in different months of the year.

The environment at Timkit is generally very dry, and surface water is not available for more than half of the year. Several plots in the submerging area of the site was sampled, and 13 species of invertebrates and 1 species of fish (*Gambusia affinis*) were found in this study. Similar to the Taskourt site, field study was conducted only in a single season within limited areas, so this result should be treated as a minimum diversity of the aquatic animals. There is no information or observation that indicates distribution of any endangered or rare species of wildlife in this ecosystem.

XVI3.3 Flora

XVI3.3.1 No.5 N'Fifikh

Major plant species (14 species) that have been identified around the N'Fifikh dam site are listed in the Data Book.

It was noted that *Phyllerea angustifolia* is relatively abundant on the hilly areas upstream, and *Vitex agnus castus, Nerium oleander* and *Pistacia lentiscus* are the common species on the riverbed around the site. On the river banks, some *Eucalyptus* species were recorded, and a small number of fig trees (*Ficus carica*), orchards and *Olea europea* were also observed.

XVI3.3.2 No.9 Taskourt

It was observed that natural vegetation was deteriorated upstream of the dam site, and 26 species of terrestrial plant species and 3 species of aquatic plant were recorded (Data Book).

On the higher slopes of the left bank of the dam site, some species of the dwarf vegetation such as *Sueda fruticosa, Luarus nobilis, Juniperus oxycedrus, Ephedra fragilis, Asparagus acutifollius, Deltis australis* and *Euphorbia helioscopea* were found. *Cynodon* is a dominant species in a wet area on the left bank of the site. On the riparian forest, *Populus* spp. including *Populus alba* are dominant, and *Nerium oleander, Fragmites communis* and *Fraxinus communs* were also recorded. Various crops include alfa alfa, potatoes, carrots and mint are also abundant in this area.

Natural vegetation is less abundant on the right bank compared with that of the left bank. Major species of vegetation includes *Populus alba*, *Cynodon*, *Parentucellia viscosa*, *Lythrum junceum* and *Celtis australis*. *Ziziphus lotus* and *Ephedra fragilis* were also recorded on the slope of the bank.

XVI3.3.3 No.10 Timkit

This dam site is located in a dry canyon and that vegetation is dispersed scarcely in some patches. Major plant species observed in the field investigation is listed in the Data Book.

Natural vegetation is scarce around this site, but *Ziziphus lotus* was relatively abundant on both banks of the site. *Ephedra fragilis* and *Centaurea calcitrapa* were also observed on the slopes around the site.

Riparian areas are more vegetated and a main vegetation type of *Populus euphratica* mixed with *Centaurea calcitrapa* and *Lavandula marocana* was recorded. There is a high density of *Nerium olender* community on the riverbed, and *Tamarix gallicda*, *Fragmites communis*, *Reseda alba* and *Sisymbrium crassiforlium* have also been observed.

XVI3.3.4 No.17 Azghar

Major plant species that have been observed around the dam site are listed in the Data Book. Period of the field investigation was limited, but 22 species were recorded as a result of the field sampling.

On the left bank of the site, vegetation is relatively abundant, and *Pistacia lenticus*, *Fraxinus communis*, *Juneperus oxycedrus* and *Quercus idex* were the main species of the plant community. *Anthyllis tetraphylla* occurs at the lower part of the hill, and a few patches of *Chamaerops humilis* were also observed. *Retama monosperma* shows only sporadic distribution.

Vegetation is relatively scarce on the right bank of the site compared with that of the left bank. Only low abundance of *Juneperrus phoenica*, *Chamaerops humilis*, *Zizifhus lotus*, *Pistacia lentiscus* and *Olaea europea* were recorded.

There is a dense community of *Nerium oleander*, which is the dominant species on the riverbed upstream. *Pistacia lentiscus*, *Populus* spp and wild rose bushes grow naturally, and olive, fig and grenade trees are often planted around this site.

Vegetative composition on the riverbed downstream reaches is similar to that of upstream areas where *Nerium oleander* is dominant. *Pistacia lentiscus*, *Juneperus phoenicea* and *Olaea europea* were also observed in this area.

XVI4 Assessment of Impacts: Construction Stage

XVI4.1 Main Sources of Impact in Construction Stage

During the dam construction, negative environmental impacts associated with subsidiary construction activities are the main concerns. Main sources of negative environmental impacts during construction were identified as follows:

(1) Establishment of access road to the dam sites

(2) River diversion to allow dam construction

(3) Quarry site and borrow pit to provide construction materials

(4) Construction activities at the dam sites

However, detailed planning of construction and subsidiary activities has not been completed at the current stage of the study. Therefore, an additional environmental study and mitigation measures with more detailed information on construction may be required in the subsequent detailed design (D/D) stage.

XVI4.2 No.5 N'Fifikh

XVI4.2.1 Access Road

There is an existing road extending to the dam site on both banks downstream reaches of the dam site. These roads are to be upgraded as an access road for the dam construction. Natural forest or fragile ecosystems that are susceptible to this road development have not been identified around the area so that environmental impact associated with this development is predicted as minimal.

XVI4.2.2 River Diversion

Annual discharge of the river, Daliya River, on this site is only 8.8 million m^3 (0.28 m^3/s), and the dam site in the river is dry for a considerable period of the year. However, before the construction, river flow should be altered not flowing through the construction site. The river should be diverted in the prior to the construction using a culvert type waterway so that drained water from the dam construction will not be flown into the river. Therefore, the water quality will not be affected with the construction.

XVI4.2.3 Quarry Site and Borrow Pit

The dam at N'Fifikh will be an earthfill type (zone type) and that a quarry site and borrow pit supplying considerable amount of dam embankment materials will be necessary.

To minimize environmental impact associated with the collection of construction materials (maximum of 20,000 m^3), the quarry and borrow pit will be located in rocky areas on the right bank of the site where there is not much vegetation. Therefore, the impact is predicted as minimal.

Construction materials such as earth and filter materials (gravel and sand) will also be collected from the surrounding slopes and riverbed downstream of the dam site. The riverbed will be excavated for 2 to 3 m in depth to gather the materials, and larger rocks will be collected from the rocky slopes on the right bank downstream of the site. There is no vegetative cover on those slopes and that the impact on natural environment is considered as minor with this activity.

XVI4.2.4 Construction Activities at the Dam Site

Construction activities will generate noise, dust and vibration, particularly when heavy machinery is used for excavation and other civil work. Since forest cover or a sensitive ecosystem has not been identified around the dam site, negative impact to natural environment should be limited for this site.

XVI4.2.5 Other Sources of Major Impacts

A spillway will be constructed on the right bank of the river, Daliya River. Construction material such as concrete will be used for its construction, which has a potential to increase alkalinity and turbidity of the water. Turbidity of the surface water usually increases during construction, and alkalinity may affect water quality as well. However, surface water at the dam site flows in limited time of the year; furthermore, the river flow will be diverted not running through the construction site. Therefore, the increase of turbidity and alkalinity in the water during the construction stage is not likely to cause serious impacts on the surrounding environment unless an unexpected scale of flood affects the site during the construction period.

XVI4.3 No.9 Taskourt

XVI4.3.1 Access Road

Dam site is located in a deep canyon, and the main access road to the dam construction site will be established on its valley floor. The width of dry part of the valley floor (riverbed of Assif al Mal) is wide enough (> 30 m) to establish the road so that heavy machinery, other construction equipment and materials will be supplied using this road. There is also an existing road on the slope of the right bank, and this road will be further developed for more frequent and daily access. The width of this road is rather narrow and that the use of this road is difficult at present time, particularly when it rains.

No sensitive ecosystem has been identified around the site so that this road development is not likely to cause serious impacts on natural environment around the site. Therefore, environmental impact in association with those roads is predicted as minimal.

XVI4.3.2 River Diversion

The rive, Assif al Mal, has running surface water most of the period of the year (annual discharge of 37 mil m^3). Therefore, the river should be diverted in the prior to the construction using a culvert type waterway. Drained water from the dam construction will not be flown into the river so that the water quality will not be affected with the construction.

XVI4.3.3 Quarry Site and Borrow Pit

The type of the dam at Taskourt will be concrete gravity. Quarry site will not be established for the construction, because a considerable amount of river sediment is available around the dam site. River sediment particularly upstream of the site will be collected as the construction material.

A bed material sampler, screening different size of gravel for the collection of construction material will be placed in a wide area of the valley floor upstream of the dam site. This facility is rather small in size compared with a normal aggregate batching plant that crushes rocks. Therefore, quarry activities at this dam site are unlikely to cause serious negative impact to natural environment around the site.

XVI4.3.4 Construction Activities at the Dam Site

Since the flow of sediment is active in the river, Assif al Mal, the depth of the river sediment is deep. Therefore, excavation in the surrounding area of the dam axis will have to be deep to reach the bedrock. Excavated materials should be utilized for construction, and if there are excessive materials, those should be placed in an environmentally safe area.

Other environmental impacts in association with the dam construction are mainly noise, dust and vibration. However, sensitive ecosystems have not been identified around this dam site, and negative impact to natural environment is likely to be minor.

XVI4.3.5 Other Sources of Major Impacts

Since the dam is the concrete gravity type, a considerable amount of concrete and cement will be used. Increase in alkalinity and turbidity of the water around

the site is likely to occur. Even though no sensitive ecosystems around the dam site have been identified, these factors can lead to diverse effects so that potential impacts should be minimized. It is usually recommended that acidic materials be applied as a chemical treatment for the drained water carrying cement. In addition, settling basins to permit settlement of bad load of water borne materials, suspended sand and silt lord should be placed before drained water is released into a river or main drainage.

XVI4.4 No.10 Timkit

XVI4.4.1 Access Road

There is an existing road reaching to the dam site on the left bank, and it will be further developed as the access road for construction. This existing road is used currently as a conduit to some villages upstream of the site. Therefore, a new road reaching the villages upstream will be constructed on the rocky slope of the left bank. The length of this road has not been determined, but there is not much vegetative cover on the slope and that it is predicted that impact associated with the construction of the road be minor.

XVI4.4.2 River Diversion

The dam site is located in a valley that is dry except in the rainy season. However, occasional flood is expected at the site, and undercurrent (approximately 200 – 300 l/m) flows at the dam axis even in the dry season so that a river diversion will be necessary in prior to the construction.

The undercurrent will be blocked upstream of the site and released downstream using a culvert. Drained water from the dam construction will not be flown directly into the river so that impact on the water quality is predicted as minimal.

XVI4.4.3 Quarry Site and Borrow Pit

There is plenty of gravel and other construction materials on the valley floor of the site. Similar to the Taskourt site, the type of this dam is concrete gravity (BCC), and construction materials will be collected in the areas upstream using a bed material sampler so that environmental impact should be minimized.

XVI4.4.4 Construction Activities at the Dam Site

Environmental impacts such as noise, dust and vibration are temporary phenomena. The dam site is located in a dry, rocky valley and that there is not much natural vegetation around the site. Therefore, impact on natural environment in association with this dam construction is predicted as minor.

XVI4.4.5 Other Sources of Major Impacts

The dam site is located on the base of limestone so that a large amount of cement and grout (mixture of cement and water) will be applied for grouting. Increase in alkalinity and turbidity of water with grouting often cause environmental impacts. However, a period that running surface water is available in the river, Oued Arhbalou n'kerdous, is limited for the rainy season or occasional floods. Therefore, a high concentration of alkaline water and turbid water are unlikely dispersed around the site.

XVI4.5 No.17 Azghar

XVI4.5.1 Access Road

There is an existing road extending to the dam site and that will be upgraded as an access road for construction. The dam site is located relatively close to an existing paved road so the civil work associated with this road development is limited only for a few kilometers so that its impact is likely to be minor.

XVI4.5.2 River Diversion

Earthfill type dam usually requires a larger diversion compared with that of a concrete dam, because it is more vulnerable to overflow and flood during construction. The river, Oued Zloul, is necessary to be diverted, and it is planned to make a tunnel (Length 350 m, Diameter 5 m) on the left bank of the site. However, the area with less vegetative cover has been selected for the establishment of the tunnel.

XVI4.5.3 Quarry Site and Borrow Pit

It has been identified that there is a sufficient amount of gravel around the river, Oued Oarya, which flows in an adjacent watershed to the dam site. Core materials for the dam will be collected from a borrow pit in the submerging area, and other materials will be gathered using a bed material sampler and that the normal type of batching plant will not be required. Therefore, the environmental impact associated with the collection of construction materials is predicted as minor.

XVI4.5.4 Construction Activities at the Dam Site

Sensitive ecosystems or ecologically important vegetative cover have not been identified around this dam site. Therefore, the impact (noise, dust and vibration) on natural environment with the construction activities at this dam site is likely to be limited.

XVI4.5.5 Other Sources of Major Impacts

A spillway will be constructed on the right bank of the river, Oued Zloul. Construction materials such as concrete and cement will be used for the construction, but the geological formation of the site is fitted as a dam site and that grouting does not seem to be extensive compared with that of other sites. Furthermore, running surface water in the river is dried in the dry season so that increase in alkalinity and turbidity of the water is predicted as minimal.

XVI5 Assessment of Impacts: Post Construction Stage

XVI5.1 Water Quality and Quantity

XVI5.1.1 Groundwater

Quality of groundwater at all the sites is good as presented in section XVI3.1. It is predicted that impact on groundwater quality by dam construction be minor, but it might alter underground aquifer. As a result, water level of the wells downstream reaches might be lowered or dried. It is known that some wells play critical roles as a main source of water for many purposes so that maintaining this water supply is important for the villagers in downstream reaches. Therefore, the wells sampled in this study should be designated as fixed monitoring stations where changes in groundwater level are to be measured regularly.

XVI5.1.2 Surface Water

Particularly during the first years following the filling of a new dam reservoir, the amount of organic substance and nutrient is likely to be excessive because of decomposition of the organic materials and nutrient in the soils in the submerging areas. It is usually recommended that organic materials be removed from impoundment before filling, but complete removal is almost impossible. It takes about 5 years to reach new nutritional equilibrium in the impoundment.

Concentration of nutrient in the water before filling is an important indication for eutrophication so that surface water upstream of the dam sites was analyzed for phosphorous (P), nitrogen (N) and other nutritional substances in this study. At the four candidate dams, nutrient status of the current water quality is not high but eutrophication is likely to occur in the reservoirs. In addition to decomposition of the organic substance in the submerging areas, the water turnover rate of all the reservoirs is very low so that the retention time of the water is long enough to become rich in nutrient. Furthermore, worm climate of Morocco increases decomposition and photosynthesis that speeds eutrophication.

Eutrophication is connected to unpleasant smell and pollution, which makes the water undrinkable. If eutrophication occurs in the dam reservoirs and the water is to be used, some treatment will be necessary. Early detection of eutrophication is, therefore, critical for the health of the people who use the water. Therefore, the establishment of water quality monitoring system is inevitable for the project.

XVI5.1.3 Cold Water

Alteration of thermal regimes derived from surface or deep waters of the dam reservoirs may occur because of the low water turnover rate of the reservoirs. Thermal stratification of the dam reservoirs is likely to occur particularly in the summer time with the formation of a higher temperature of epilimnion (surface water) and a lower temperature of hypolimnion (deep water). When the outlet of a dam is placed only at the base of a dam, only cold water at the bottom layer is likely to be released downstream and cause some impacts on aquatic ecosystems and the growth of crops in the irrigated areas.

However, it is said that this phenomenon has not been observed in Morocco. At the candidate dam sites, there is a distance between the dams and the irrigation areas except Azghar so that temperature of the water will increase before it reaches the irrigation sites. So, impact with cold water is not likely to be serious.

XVI5.1.4 Changes in Water Regime (Maintenance Flow)

Water discharge of the rivers at the proposed dam sites fluctuates largely in natural condition. Furthermore, surface water in the rivers of all the dam sites gets dried up for several months of the year. Therefore, impact particularly to aquatic environments in association with changes in water regimes by the dams is predicted as minor.

XVI5.2 Fauna

XVI5.2.1 Terrestrial Fauna

Wildlife species and their habitats that have high conservation values were focused and particularly investigated in this study. Mobility of terrestrial fauna such as small mammals, insects, reptiles and amphibians is limited and that those animals inhabiting in the submerging areas will likely to be affected with impoundment. The most significant impact will be the loss of habitats of endangered and rare animal species. Two endangered mammal species, *Felis caracal* and *Ammotragus levia* were found to be distributed around some of the dam sites. However, mobility of those species (cat and ungulate) is quite high so that the population size is unlikely seriously reduced unless there is a significant loss of their habitat. Critical habitats of those species in the study areas have not been identified and that the impact is unlikely to be significant.

Impact to avi fauna should be minor unless there are ecologically important areas such as critical nesting grounds or feeding grounds. There is no information or observations indicating such areas exist in the submerging areas.

XVI5.2.2 Aquatic Fauna

A dam usually prohibits movement of aquatic organisms between upstream and downstream. At the candidate dam sites, running surface water does not exist all the year around, which indicates such organisms' movement is naturally limited.

It has been reported that benthos and other invertebrate communities are strongly affected with the changes in the temporal patterns of water discharge and sediment supply. Fluvial processes in rivers are characterized by riverbed degradation in downstream reaches by armoring, invasion of different vegetation and deposition of the sediment materials.

It is known that species richness would be decreased, because environmental diversity is likely to be reduced with a dam. However, population size of some species that can adapt the changes is likely to increase. This ecological shift in the community structure including species composition of the benthic organisms is largely unknown at this stage. A long-term ecological study is necessary to predict how aquatic ecosystem changes with the impact of the dam.

XVI5.3 Flora

Distribution of endangered and rare species of flora in submerging areas at the dam sites has been investigated, but such species have not been identified. There is no complete information on the distribution and occurrence of those species, but they will be lost if they exist in the impoundment.

Controlling water regimes with dams can also affect vegetation communities in riparian areas downstream. Floods often carry seeds of some plant species such as *Salix* and *Populus* spp., and this seed dispersal with water (hydrochory) plays an ecologically important role. However, dams reduce the frequency of flood and its magnitude, which may also reduce pioneer species and alter species distribution biased to some species in the later stages of natural succession. This is an important ecological aspect of the conservation of riparian forests particularly around wetlands.

There is no wetland downstream reaches of the candidate dam sites in this project, but it has been observed that riparian species such as *Populus alva* and *Populus euphratica* grow in Taskourt and Timkit respectively. Therefore, regeneration of these species needs to be monitored.

XVI6 Environmental Management Plan (EMP)

XVI6.1 Long-Term Environmental Management Targets

Environmental standards of Morocco should be the main targets of the management system. Moroccan national standards for water quality are listed in the Data Book, should be respected as a target for conservation.

There is no international or durable standard for ecosystem management. It is, however, important to conserve particularly the key organisms that constitute each trophic level of an ecosystem. Management target is often focused on endangered and rare species of fauna and flora and that those species should be monitored to maintain biological functions of an ecosystem. Furthermore, wildlife species specifically adapted to a given ecosystem (e.g. arid environment and mountainous ecosystem) should be carefully monitored because those are sensitive to any changes in environmental condition.

Vegetative condition upstream of the dam sites is particularly important as erosion control. Vegetative coverage of the slopes around the dam reservoirs should be maximized.

XVI6.2 Water Quality and Quantity Monitoring System

Sampling locations of the water quality analysis of this study should be used as a basis for monitoring of river water and ground water. Sample size, sampling frequency and parameters for analysis of this study should be treated as the minimum requirements for the monitoring system. Similar to the objectives of this study, the monitoring system should be focused on the following items:

- Upstream: Monitor a level of eutrophication (chlorophyll-α)
- Immediate Downstream: Monitor a level of groundwater
- Downstream: Monitor changes in water quality with irrigation activities

Measurement of chlorophyll-α and transparency in the dam reservoirs is an important variable to monitor the level of eutrophication so that it should be included in the monitoring system. Furthermore, lead (Pb) should also be included as an additional variable to monitor water quality of both upstream and downstream reaches. For upstream, there might be some mining activities and other sources of pollution. Some agricultural chemicals containing lead might be used so that this variable is also important to be monitored particularly at downstream reaches.

For water quality of the flood, a sample size of at least 3 times during a flood is necessary for a water quality simulation. Flood plays an important role at proposed dams so that its water quality should also be monitored carefully.

XVI6.3 Ecosystem Management

Since it is predicted that eutrophication is likely to occur in the dam reservoirs, some fish species that can reduce phytoplancton and grass in the reservoirs. However, any exotic aquatic wildlife species should not be introduced (this is often practiced), but herbivorous native fish species may be introduced. This should be decided with recommendations with experts, not to harm the impoundment as well as natural ecosystems around the reservoirs. The choice of the fish species to be introduced should be carefully studied so that the introduction will not be resulted in negative consequences. A long-term field investigation and monitoring is necessary to understand the effects of this action.

For the selection of fish species to be introduced into the dam reservoirs, the following aspects should be considered:

- Native to Morocco or species that were introduced long time ago so that the species could be considered as one of the constituents of natural ecosystems in Morocco.
- High survival rate in lake ecosystems with possible eutrophication
- Species with a basic knowledge of life history (feeding behavior, spawning, population dynamics and etc.)
- Availability of artificial breeding techniques
- Potential to become a fishing resource
- Data availability from previous introduction

Two species of carps such as grass carp (*Ctenopharyngodon idella*) and silver carp (*Hypophthalmichthys molitrix*) has been successfully introduced elsewhere in Morocco. Based on the existing information, these species have a high potential to be introduced into N'Fifikh and Timkit sites. The elevation of Azghar and Taskourt sites might too high (823 m and 942 m respectively) to allow those species to survive.

It has also been suggested that Tilapia (*Tilapia galilea*) could be introduced, but the ecological effect of this species is still largely unknown. Ecological consequences with the introduction of this species should, therefore, be studied before and after the introduction.

XVI6.4 Erosion Control

Tree planting (afforestation) as a means of erosion control is suggested. Erosion is a serious problem particularly at Taskourt site, and a comprehensive watershed management program (i.e. tree planting, overgrazing issue, land use planning, proper agricultural techniques and etc.) is necessary to reduce erosion effectively. However, establishment of such a program is beyond the scope of this environmental study for the project. Details of the tree planting program is, therefore, still needs to be formulated with an emphasis on particular areas upstream of the dam sites.

Among the four dam sites, some tree planting is urgently required in the areas upstream of Taskourt site. Overgrazing with sheep and goats is exaggerating a level of erosion at the site. This proposal should be further developed in the subsequent D/D stage identifying appropriate areas for tree planting, tree species and others. Fencing for planting should also be planed if necessary.

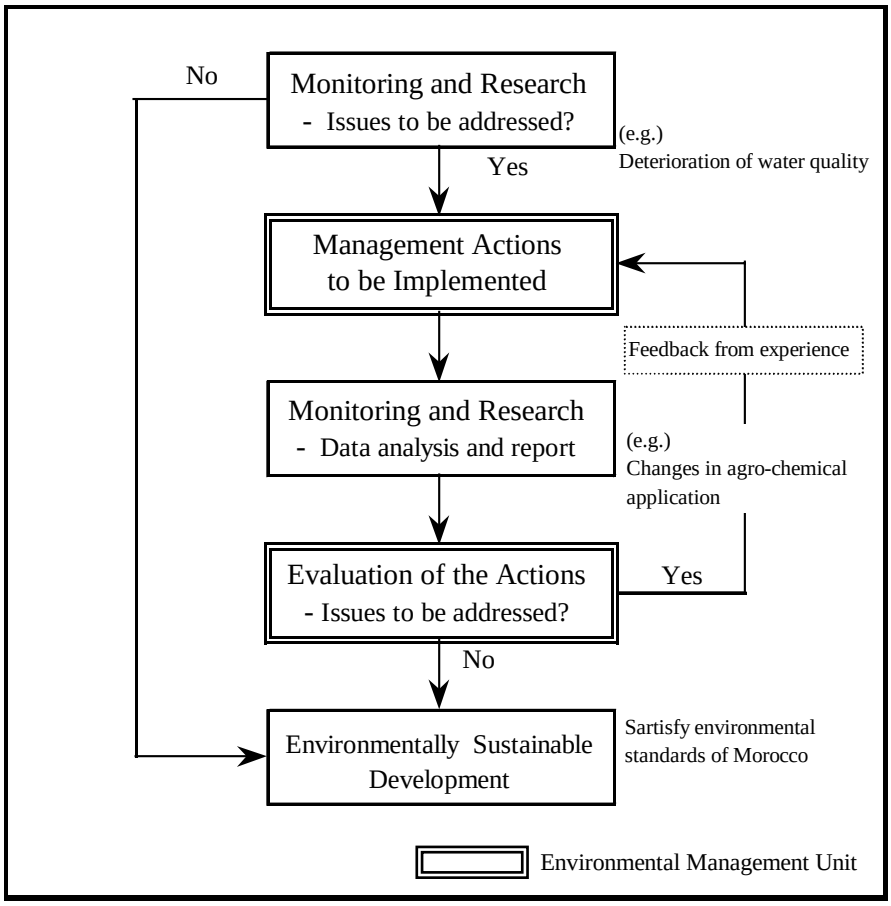
The following tree species are tentatively suggested for planting:

- Argan trees (*Argania sideroxylon*)
- Acacia spp (*Acacia cyanophylla*)
- Cider
- Oak
- Juniper
- Pine
- Olive
- Almond

XVI6.5 Institutional Framework of the EMP

XVI6.5.1 General Framework

General framework of the Environmental Management Plan (EMP) for the project is shown in the following Figure. This systematic flow of the EMP should be consistent throughout the duration of the construction as well as operation stage (monitoring stage). The main feature of this management system is that all environmental issues and management actions are discussed, decided, controlled and evaluated by the Environmental Management Unit (EMU) as a main decision-making body (described in the following section).



General Work Flow of Environmental Management Plan (EMP)

When any environmental issues and problems are identified with scientifically sound data, appropriate management actions should be taken, and the results of those actions must be evaluated subsequently for the future management purposes. Having this feedback from previous management actions is the most important aspect of this environmental management framework. Without this feedback system, the management actions cannot be upgraded and adapted to overcome current environmental issues. This systematic flow of management system is the basic concept of the EMP.

Monitoring and research section of the management system also plays a key role in the EMP because feedback is not possible without a systematic and long-term collection of the field data. This section of the system is to collect relevant environmental information including baseline data to be used as a basis for making management decisions by the EMU. This activity involves not only a variety of professional knowledge and experience but also facilities (i.e. laboratory) and equipment so that different institutions on a contract basis can conduct field sampling, investigation, analysis and other activities. Then, an

environmental status report (i.e. water quality and quantity) should be submitted to the EMU. If serious deterioration in any of the environmental parameters is detected, appropriate management actions to reduce negative impacts should be applied.

For the smooth implementation of environmental management actions, inter sectional effort is inevitable. For instance, when aquatic animals are killed with an overdose of agricultural chemical application, the Ministry of Agriculture should modify farming techniques with guidance. Implementation of the management actions should, therefore, be decided and controlled by a multilateral committee such as EMU.

After the implementation of some management actions, effects of such actions have to be monitored with systematic sampling procedures. Then the results should be forwarded to the EMU for an "official" evaluation. If it is decided that further management actions are required, alternative strategies should be taken until the environmental condition reaches management targets of the EMP (environmental standards of Morocco).

XVI6.5.2 Institutional Structure of the Environmental Management Unit (EMU)

Environmental Management Unit (EMU) plays a main role as a decision-making body in the EMP. Overall institutional structure of the environmental management system for the project is proposed as shown in Figure XVI6.5.1.

This institutional organization will have to be maintained as to perform a long-term environmental monitoring including after the completion of the dam construction. Environmental issues are locally based problems so that environmental officers should be appointed at each local office of the dam site. These officers are in charge of environmental management that includes field data collection and reporting the results to the Headquarters of DGH. Environmental management cannot be implemented without competent local environmental officers.

EMU plays a main role in this environmental monitoring and management system where the unit functions as a main decision-making body. DGH should act as a leading agency of the EMU because it is the project-implementing agency. The meeting of EMU should, therefore, be convened by DGH, which can call for a meeting whenever required. Directorate of Technical Affairs of DGH can coordinate technical assistance with other governmental bodies, institutions and professionals for a meeting according to a topic of discussion. Specific duties and assignments of each sector are as follows:

(1) General Directorate of Hydraulics (DGH):

- Responsible for implementing environmental monitoring (i.e. water quality monitoring)
- Responsible for making environmental management actions when environmental problems are identified in association with the dams
- Call for an environmental meeting of the EMU when necessary
- Select relevant technical advisors for a specific environmental issue
- Evaluation of environmental actions

(2) Directorate of Technical Affairs (Ministry of Equipment):

- Provision of logistics support to DGH, particularly communicating with other governmental bodies and technical advisors
- Select relevant technical advisors for specific environmental issues
- Organizing meetings as EMU

(3) Technical Advisers:

- Provide assistance to reduce negative impacts from technical points of view (e.g. agricultural and biological points of view)
- Make recommendations on particular studies or implementation of specific mitigation measures

(4) Directorate of Regional Hydraulics (DRH):

- Each DRH is responsible for collecting field data on a regular basis
- Prepare an environmental monitoring report which should be submitted to the Headquarters of DGH
- Clear identification of environmental problems and report them to the Headquarters of DGH

XVI6.6 Budget Planning

XVI6.6.1 Water Quality Monitoring

Cost of surface water monitoring is estimated in the following Table. Unit price for a single sample with recommended parameters at each site is estimated at 4,995 DH. Therefore, a total cost with sample size of 4 (2 upstream, 2 downstream) and sampling frequency of 12 times/yr. is 23,7840 DH. For underground water, changes in water level are the most important parameter, which involve only travel and staffing so that its cost would be negligible.

Cost Estimate of Surface Water Quality Analysis

No	Parameters	Unit Price (DH)
1.	Physical profiles (color, transparency, odor, hardness and temperature)	-
2.	BOD (biochemical oxygen demand)	200
3.	COD (chemical oxygen demand)	340
4.	DO (dissolved oxygen)	160
5.	SS (suspended solid)	100
6.	TDS (total dissolved solid)	100
7.	pH	-
8.	Electric Conductivity (salinity)	-
9.	Alkalinity	150
10.	T-N (Total Nitrogen)	150
11.	NH_4-N (Ammonia Nitrogen)	300
12.	NO_2-N (Nitrite Nitrogen)	180
13.	NO_3-N (Nitrate Nitrogen)	160
14.	T-P (Total Phosphorus)	180
15.	PO_4-P (Orthophosphate Phosphorous)	145
16.	As (Arsenic)	150
17.	Cl (Chloride)	100
18.	F (Fluorine)	430
19.	Fe (Iron)	250
20.	Mn (Manganese)	200
21.	Sulfate (SO_4)	110
22.	Lead (Pb)	380
23.	Zinc (Zn)	380
24.	Total coliforms	90
25.	Chlorophyll- α	700
	Total	4,955

Total cost of the monitoring with different sampling frequencies is presented in the following Table. It is recommended that the sampling frequency be 12 times/yr. at least for a few years after the construction of the dams.

Cost Estimate of Surface Water Quality Analysis at each Site with Different Frequencies

Sampling Frequency (per Year)	Sample Size (n)	Unit Price (DH)	Total Cost (DH)
12 times/yr.	4	4,955	237,840
6 times/yr.	4	4,955	118,920
4 times/yr.	4	4,955	79,280

XVI6.6.2 Tree Planting

Tree planting in the watershed of the dam sites is suggested in this study, but details of the planting still need to be studied with the Department of Forestry. Tree species to be planted, place and size of planting areas, acquisition of

seedlings, access roads and others have not been determined so that a precise cost estimate for the planting is not possible at this stage. It is, therefore, only a rough estimate was made with an assumption of approximately 1,100 seedlings /ha are to be planted. Cost of tree planting is 8,900 DH/ha in Morocco. This estimate includes opening of planting areas, transporting seedlings, planting and basic maintenance.

XVI7 Conclusions and Recommendations

XVI7.1 Conclusions

(1) Water turnover ratio of all the dam reservoirs in this project is low so that eutrophication is likely to occur in the dam reservoirs.

(2) Alternation of thermal regimes in the dam reservoirs is likely to occur, but negative impact with cold water is predicted as minor.

(3) It is only natural that river discharge fluctuates largely and the surface water at the dam sites is not available throughout the year. Therefore, the impact by controlling water regimes with dam is predicted as minor.

(4) Specific discharge value of all the dam sites, particularly of N'Fifikh and Timkit sites is estimated as too small to have a maintenance flow.

(5) Two species of endangered mammal were found around the study areas but mobility of the endangered species, cat (*Felis caracal*) and ungulate (*Ammotragus levia*), are high so that those animals can avoid impoundment easily.

(6) Impact on aquatic ecosystem particularly changes in benthic community is largely unknown and unpredictable at this stage. However, it is predicted that the impact be minor because water discharge is limited naturally at all the sites.

(7) Construction of the dams is planed to be minimized by:

- Upgrading existing access roads and not constructing new roads
- Avoiding vegetative patches for the establishment of a river diversion channel at Azghar
- Quarry sites and borrow pits will be located in the submerging areas
- Most of the construction materials will be collected from the riverbed using a bed material sampler so that a baching plant crushing rocks will not be used.

- Increasing alkalinity of the water by using cement (concrete and grout) will be minimized with chemical treatment.
- Turbidity of water will be minimized with settling basins establishment.

(8) The establishment of environmental monitoring system within the DGH is one of the most important environmental management practices.

XVI7.2 Recommendations

(1) Consult the Ministry of Environment (Secretary of State) to acquire an environmental permit.

(2) Report project status as well as environmental impacts of the project to the Ministry of Environment, and available information be disclosed.

(3) A long-term environmental monitoring system be established as an Environmental Management Plan (EMP).

(4) Environmental Management Unit (EMU) be established, and DGH be responsible for the implementation of the EMP.

(5) Remove organic substances from the submerging areas as much as possible to minimize eutrophication.

(6) Chlorophyll- α and transparency of the dam reservoirs also be analyzed to monitor a level of eutrophication.

(7) Native fish species be introduced into the dam reservoirs to minimize eutrophication.

(8) Develop tree-planting program as a counter measure for erosion problem particularly at Taskourt site.

(9) Full involvement of the Ministry of Forestry for the tree planting program (the Ministry be involved as a regular member of the Steering Committee so that appropriate counterpart be appointed).

Social

XVI8 Social Environment and Resettlement Plans

XVI8.1 Introduction

XVI8.1.1 Background

Within the framework of the feasibility study for the development of water resources in rural areas, an evaluation of the social impact was accomplished in 25 dams as a first step. The findings of this study and other parameters (technical and economic) were used to rank and choose 4 dams.

In this second step, the socio – economic feasibility study of the four selected dams is accomplished in a detailed manner. The findings of this study are established according to the terms of references submitted earlier in the mid term report.

Both studies, the preliminary and the detailed evaluation on how to minimize the resettlement impact were conducted by referring to the JICA's guidelines. However, the participatory approaches used in this study to identify the resettlement plans with people were also based on the national jurisdiction.

XVI8.1.2 Justification

In the past, the socio – economic infrastructure of projects were supposed to automatically improve population's quality of life and achieve the development's objectives. However, several studies in the world questioned this established paradigm. Therefore, negative effects may affect the environment such as partial or total natural resource damage, increase in air pollution, increase in gaps between wealthy and poor people, a reappearance of diseases, a reinforcement of malnutrition and/or an imbalance in the gender issue. In the social environment, the negative effects are very important when dealing with the resettlement issue and/or the acquisition of population's goods which may neutralize the positive economic effects sought by the project.

In the past decades, the access to rural space to build dams was much more easier than is the case today. Generally, a compensation was sufficient for the land owners. Presently, the situation becomes more difficult because of the population's growth and the competition in the space occupation. Therefore, a compensation is often not enough for householders, after their resettlement, to generate the same incomes as what they get now and to have the same level of life. The resettlement, without agree of population, generally reinforces the disparities between the upstream and the downstream populations. It increases the poverty among the transferred population.

In several countries, the civilian society (NGO) mobilizes in support of social aspects during the settlement of economic infrastructure. These movements are particularly met in India, Turkey, Pakistan, …This situation dictates to financial bankers and governments to review their policy when dealing with population's resettlement. Several participatory approaches were thus designed and established and could be used during the resettlement stage.

Participation as perceived by experts in development does not simply mean a consultation of people and letting the planning, implementation and evaluation stages of the alternative resettlement plans to be taken in charge by the administrative or technical offices. In an actual participatory approach, people should be involved in all the decision process and concerned by all participation's forms. The instructional lack or weaknesses among people, the lack of knowledge and skills could be serious handicaps to people's participation in taking themselves in charge. It is thus essential to reinforce peoples' capabilities and organizations by considering their knowledge, skills and the innovations to be diffused and adopted by the new system.

XVI8.2 Objectives

The main objectives assigned to this study at the upstream level were as follows:

- Minimize the negative social impact as a result of dam building, by considering the gender issue;
- Identify aspects which could be compensated financially and those which could not and seek participatory approaches to minimize the different deficiencies.
- Establish a resettlement plan with people;
- Identify the initial socio–economic situation and predict the project's impact;
- Advise on how to reduce negative impacts on gender;
- Identify the accompaniment measures to implement during the population resettlement;
- Make an inventory of the entitled beneficiaries and their goods;
- Seek possibilities for distributing state agricultural land in the downstream level.
- Regarding the main objectives of this study in the downstream level, they were as follows:

- Implement a feasibility social study at the downstream level (present socio – economic situation, eligible persons, farming land status, women's situation,…);
- Clarify the potential socio–economic impact on people as a result of the project;
- Predict the potential conflicts as a result of the project's implementation (entitled beneficiaries, leaseholders, business associates,…);
- Clarify the impact on women and recommend an action plan to improve women's situation,
- Identify the accompaniment measures to be implemented in order to increase the value of investments undertaken in the irrigated area by the dam.

More care is giving to Taskourt as the population number to resettle is very high.

XVI8.3 Sampling Frame and Research Methodology

To accomplish this study, different techniques were used to collect the needed information. At the beginning, the spatial entrance has been favored to understand how land and villages are occupied. Social maps were made for the whole of the upstream villages These maps made it possible to spatially locate the various households and also to highlight the importance of dwellings, occupied or otherwise, temporary or permanent residents, the number of underprivileged families, women heads of families, the location of private and collective goods, etc. The participatory elaboration of the land map or a participatory parcels' chart was also established and an inventory of entitled beneficiaries and their goods (land, equipment, plant fruits and others) was completed. Those maps were finalized in order to take stock of the eligible persons, their goods (land property, equipment, plantations, etc) and their locations. Others tools were used: matrix, diagram, calendar,…etc.

In addition to these instruments, semi-structured interviews were conducted and household questionnaires were administered both upstream and downstream.

Upstream, the questionnaire concerned all those eligible residents (present during the survey); on the three sites. The number of people who were interviewed totaled 6,33, 37 and 402 in Azghar, Timkit, N'Fifikh and Taskourt, respectively. The guide was performed with the help of the semi- structured interview involving one or two groups per village. The focal groups were

heterogeneous or homogenous groups of men and women. Table on the next page sums up the sampled number in each site.

A field visit to the study area was made with a view to confirming the property goods, involving residences and equipment of the eligible persons.

Downstream, the household questionnaire was performed using a representative sampling of villages per commune and the number of families per village. Social category representation was strictly respected by conducting a survey involving 2 to 3 households per class 44 households were surveyed in Azghar, 53, 77 and 65 in N'Fifikh, Timkit and Taskourt, respectively.

The guide was used with men and women's heterogeneous groups in the village under study and of growers taken as references (having introduced new techniques to improve farming). The villages studied downstream totaled 7 in Azghar, 8 in Timkit and N'Fifikh. The number of groups contacted in each site was 9 in Azghar (of which two women groups),12 in N'Fifikh (of which 4 women groups),and 10 in Timkit (of which 3 women groups).The total number of persons met during the study is shown in the table on the next page.

At the downstream level in Taskourt, group and household interviews were also conducted. 8 villages were deeply studied and were selected among a data basis of 127 villages. All the villages concerned by the traditional irrigation network compose this data basis. Two main criteria were used to choose these villages : (1) Get at least one village in each " commune rural", (2) Get close and far villages from the traditional collinear dam because this distance influences the farming systems. The selected villages have a population of 5,908 people (about 12% of the total population of the beneficiaries in irrigation water's network). The interviews were conducted with 12 groups (of which 5 women groups and 150 persons). These interviews enabled us to identify the main physical and human characteristics (number of households, literacy and instructional rates, production factors and incomes' sources, socio–economic infrastructure,…). The group interviews helped in selecting the sample of households to be questioned. The households were selected on the basis of wealth's level to make sure that all social categories of the population were involved in this study. The interviews concerned 75 households. Some complementary or reference data were gathered among other villages.

Furthermore, In each site several contacts were established with different institutions (Province, DPA, commune rural, local authority, agricultural administration, DEP, services du MSP, …) to gather complementary data specially on demography and concerning the floods and inundation and to involve them in the resettlement plans analysis.

Persons involved in the study (figures limited to eligible residents only)

Site	Household survey		Group survey	
	Upstream	**Downstream**	**Upstream**	**Downstream**
Azghar	6*	44	35	135
N'Fifikh	37	53	95	210
Timkit	33	77	35	242
Taskourt	402**	75	402**	150

*all families ** residents or representative of residents

The study was conducted in two stages: the first sought data collection and the second restitution, complementary data collection and the discussion of the resettlement plans with local authorities and elected persons

XVI9 Current Conditions in Upstream Areas

XVI9.1 Administrative Framework

The following table summarizes the administrative setting of each site and shows the villages concerned by the resettlement.

Administrative Breakdown of Upstream Areas

Site	Province	Cercle	Caidat	Communes	Douars
Azghar	Sefrou	Ribat Elkhair	Ribat Elkhair	Ighezrane	None. Only scattered houses of which one is a main house
N'Fifikh	BenSlimane	BenSlimane	Mellila	T. Ziaida	-Lakhbeziine -Ouled Slimne
Timkit	Errachidia	Guelmima	Aghbalou Akardous	Aghbalou Akardous	Tamayost
Taskourt	Chichaoua	Mejjat	Sidi BouOthmane	Adassil Assif El Mal	Ighz, Tiliwa, Kerni, Talborjt, Assais, Immin Rkha, Zaouia Ilemti, Ilemti et Talat Ilemti

The upstream part of Taskourt is included in the province of Chichaoua, Cercle of Mejjat, caïdat of Sidi Bou Othmane and the rural communes of Adassil and Assif El Mal. The concerned villages are Ighz (CR of Adassil), Tiliwa, Kerni, Talborjt, Assais, Immin Rkha, Zaouia Ilemti, Ilemti and Talat Ilemti all included in the CR of Assif El Mal. The set of the 4 villages; Tiliwa, Kerni, Talborjt and Assais are commonly named by the population " Tiguidares hauts " and the 4 other villages ; Immin Rkha, Zaouia Ilemti, Ilemti and Talat Ilemti are named " Tiguidares bas ". The two sets share several things such as farming lands, fruit trees, …etc.

XVI9.2 Human Framework: Population and Social Structures

XVI9.2.1 Population: Number, Structure, and Dynamics

The number of households as well as of inhabitants was computed by the community itself with the help of facilitators. This computation was made possible thanks to the use of the social map, examples of which will be presented in the appendix of this document. The same procedure was adopted to assess the migration flows, women heads of households and the disadvantaged people (women alone, disabled persons, beggars, etc).

The total population in the upstream part of the site of Taskourt is made of 2610 people. 78% of them are permanent residents (2036 persons). The number of families is of 301 and the number of households is of 410. The average number of people in each family and household are respectively of 8.7 and 6.4. The total number of women in charge of their households is of 31. In the others sites we notice that the number of households who are resident in Azghar is very low (6 households), followed by N'Fifikh (31) and Timkit (39). As to the number of households, it is more important in Timkit (64) than in N'Fifikh and Azghar totaling 38 and 10 households respectively. The total number of the population living in each site amounts to 42 inhabitants in Azghar,187 and 342 in N'Fifikh and Timkit. The number of households is important to show because the resettlement plan will be based on this number. The table on the next page sums up all the demographic data per site.

From the structured interviews and the demographic analysis which were performed, it was clear to see that the two sites of Taskourt, Timkit and N'Fifikh developed little or not at all mainly because of the economic crisis generated by the successive periods of drought and water scarcity.

Population and Social Structures of the Villages to Resettle

Site	Number of families		Residents		Number of workers outside		Women heads of household	Destitute families*
	R	NR	House	Pop.	Morocco	Outside		
Azghar	6	141	10	42	2	0	0	0
N'Fifikh	31	34	38	187	31	2	1	2
Timkit	39	76	64	342	52	2	3	2
Taskourt	301	87	410	2,610	280	0	31	22

*Destitute families, the disabled, entirely or partially dependent on the community.
R: residents, NR: Non residents

XVI9.2.2 Education and Literacy

It was difficult to have an idea about the level of education in Azghar mainly because there are no schools and children are schooled somewhere else. In the

other sites, the education rate is higher in Timkit than in N'Fifikh. However, these results are advantageous to school boys than to girls. As to the rate of literacy, it is almost equal in the two sites (30% for men and 2% for women). This low literacy rate is not conducive to empowering the populations quickly to take care of themselves during the resettlement process. Taskourt rate of schooling and literacy are the lowest rates. Their average is of 15% for boys and 7% for girls. This situation could be explained mainly by the fact that population is shared between the river of Assif El Mal where instructors are deficient, and l'aâzib where schools are absent. Regarding the literacy rate, it is of 8% for men and 0% for women as shown in the following table.

Situation of Education and Literacy in Upstream Areas

Sites	**Residents**	**% of schooling**		**% of literacy**		**Observations**
		Boys	**Girls**	**men**	**Women**	
Azghar	42	-	-	10	2	Off-site education
N'Fifikh	187	50	25	30	2	Pop. With city contacts
Timkit	342	70	60	30	0	Required assistance to women during resettlement process
Taskourt	2,610	15	7	8	0	Required assistance to men and women during resettlement process

XVI9.2.3 Migration Flows

Except for Azghar, temporary migration hits harder more than a two- thirds of male population. Women's mobility is low. Migration to foreign countries is equally negligible. Men tend to move mainly inside Morocco to the big cities or to the main agricultural plains. The quest for an extra income is one of the main reasons for these movements. These displacements are so important to the extent that the descendants of a whole family are found outside the site. As for Azghar, the site is considered a secondary residence area. In fact, only one house is occupied permanently (Phase 1). The other dwellings are generally secondary residences. Therefore, the difficulty to analyze the demographic dynamics in a reliable way. Generally women and children remain on site. As soon as an income -generating job is landed, family reunion on work site is operated.

The permanent and temporarily emigration are one of the main characteristics of the Taskourt's population at the upstream level. More than 22% of families emigrated permanently during the last decade (10 years). They emigrated to large cities such as Marrakech, Tiznit, Agadir, Casablanca,…Concerning the temporarily emigration, it concerns 68% of active men (households' heads or children) in all the villages. The main reason for emigration is to seek a job which may enable workers to response to the needs of their families. For those who emigrate to big cities (Marrakech, Casablanca,…), they get positions in

different sectors such as farming, building, services (restaurants, cafe, …). Women are seldom concerned by emigration (1%) except those who get married outside their villages.

The period of time spent outside the site is in average of 9 to 10 months each year ; where this period is relatively low at the downstream level (two to three months). People generally come back to the site during the harvesting periods of almonds, olives and cereals or when sowing cereals. Some of them return just in Aïds' occasions.

XVI9.2.4 Current Condition and Scope of Women Upstream

(1) Women's condition

In the four sites upstream, women's condition reflects the level of development achieved by these sites. Except for Azghar where women have reached an appreciable scope of development at the level of the family cell, women from the other sites, on the other hand, have achieved none of these, either within the family cell or in the community.

Currently, women's condition seems to be complex and difficult to grasp as it is undergoing a transition period marked by the relics of the past and the vicissitudes of the present. This is one of the reasons we have tried to provide detailed information on gender condition in the reports on the sites.

The percentage of women who are heads of families in the four sites is very low (average 6%) compared to the national average (16% CERED, 1995). This seems to be in contradiction with the data on migration flows. Only the analysis of the past and present conditions of women could help us to properly appreciate this contradiction. In the past, the social structure was so stratified and hierarchically organized that it had far-reaching implications: i.e., endogamous rules, on women. This implies a clear-cut division of gender work. Consequently, the current social structure does not reflect the reality on the ground any longer as men's migration has reached considerable proportions in the 3 sites (Timkit, Taskourt, N'Fifikh).

Not only must women take care of their families, but must also assume full responsibility for farm management and stock breeding, thus, performing tasks that were strictly reserved to men. By shouldering this responsibility women should normally be entitled to hold the position of heads of the family. The rate of women, heads of families, should be higher than the national average. This situation does not in any way reflect the reality through the above-mentioned data. By virtue of customs and traditions, men will not accept any change that

affects the status of women. Therefore, no change is foreseeable in the near future as long as women have no confidence in their ability to initiate change.

Also because of an age-old mentality, current social and traditional structures are slow to disappear (i.e. inertia of a group of women and strong resistance by others, mainly to preserve acquired privileges). In many areas of concern, the current situation seems to be a duplication of the past situation (mainly because decision-making is still a man's privilege in many fields). The evolution through task distribution and responsibility-sharing has resulted in women's being underprivileged. As a matter of fact, women's access to resources through task distribution and responsibility -sharing did not result in enabling women to have control over these resources, and by extension, leading to a degradation of their current condition compared to that of the past.

In the four sites, women fully shoulder all the reproduction activities and also play a major role in production. Among the activities, which women deem hard, to carry out is gathering wood for fuel. In fact, in Timkit the degradation of the natural resources has resulted in forcing women to cover long distances to search for wood. Within thirty years time span this distance has gone up from five to twenty five kilometers. Despite wood scarcity, home cooking extensively depends on wood use except for preparing hot drinks (gas use). As to housework per se, the simplicity of people's living styles and the absence of modern kitchen appliances require that women spend extra time performing these home chores. Life in family groups: i.e. 2 to 3 women per family makes it possible for women to share the tasks equitably. Life in family groups is more marked in Timkit than in other sites. The table below assesses the participation of women and the level of decision-making accruing to them in the areas of production and reproduction. In Azghar, women participate for 64% in the production activities and only 20% in the decision- making process, whereas those of N'Fifikh and Timkit participate for 60 and 70%, respectively. On the other hand, their share in the decision-making process is only 10%. As for the reproduction activities, women fully shoulder this responsibility except in the Lakhbiziine village, where men do in fact contribute in firewood collecting and, partially, in home water delivery. Despite the strong and active participation of women in the reproduction activities, decision-making is still shared with men, yet unequally.

In Taskourt, the woman is very involved in the production activities. She contributes to 50% of their implementation. Most of the activities related to harvesting, livestock management, making carpets, …are women specialties. Women are generally not paid for doing these activities, but they indirectly contribute to generate households' incomes. Women who get paid are the poorest ones in the villages and concern 83 households. The salaries they get are at least

50% lower than those owned by men when accomplishing the same activities. The women's contribution to the decision in the production activities is low and does not exceed 12%.

Women implement most of the reproduction activities. They contribute to 82% in their implementation. The women's involvement in the decision process for these kind of activities is of 30%. The reproduction activities concern children's education, meals' preparation, water seeking for households and livestock,…etc.

Women's Condition Upstream

Dam	Production activities (%)		Reproduction activities (%)		Community activities	
	Implementations	Decision-making	Implementations	Decision-making	Implementations	Decision-making
Azghar	64	20	100	80	0	0
N'Fifikh	60	10	90	90	0	0
Timkit	70	10	100	50	30	0
Taskourt	50	12	82	30	24	0

In the four sites, women are barred from participating in decision-making in matters concerning community life. In Timkit, women have done their share of work to build a mosque and are involved in ensuring the upkeep and water delivery to the construction but they are never consulted about communal life. In Taskourt, regarding the community activities which may concern the construction of roads, irrigation chanels, organizing festivities, establishing norms for paying the " fquih ",…women are not very involved in their implementation. The women's contribution to the implementation and the decision process are respectively of 24% and 0%.

Women's important participation in production activities is mainly due to the absence of men. Women perform all types of activities except tilling the soil, in which their participation is very limited. Men's absence has made it a requirement for women to take over the responsibility of managing family matters and the farm cottage. Despite the presence of many women per family, their work schedule is still overloaded. They work for more than 14 hours per day. Women generally work up to 16 hours a day. They have several difficulties to accomplish their tasks because of the lack in infrastructure such as electricity, drinking water and hospitals. They sometimes work in the dark when milking or seeking water in the river. Those hard conditions of work could have a negative impact on the hygiene and may develop diseases among people and livestock.

Temporary migration is still a scarce phenomenon in women's circles. Only 4 women work outside the site of Timkit, 10 in N'Fifikh and none in Azghar. Their monthly wage does not exceed 500 dh and is periodically directly forwarded to their parents.

While in Azghar and in N'Fifikh women enjoy a relative mobility and can have access to the weekly market, women's mobility in Timkit, on the other hand, is limited to the scarce visits she or her children can make to the doctor. During these visits, a family member must always escort her.

(2) Women's Self Dimension

If the practical conditions downgrading women are imposed on them because of a lack of social infrastructure and of financial means, a woman's responsibility and the level of her commitment within her family or community is, nevertheless, very considerable. As a matter of fact, women's self-esteem is lower than the esteem they have towards their men's partners. Even when men grant a responsibility of a strategic nature to women, because of lack of confidence in their capacity to perform the work, or out of fear of men, they do not assume this responsibility (psychological problems). Take the case of Timkit, 50% of men who have migrated elsewhere allow their wives to market agricultural products while they are away . Still, women will not carry out such a task because they are afraid that they might carry it out improperly. Therefore, products sale will have to be performed by a relative or a neighbor, instead. Indeed, except for old widows, young wives are not allowed to go to the weekly market.

In general, the sale or purchase of products is primarily a man's activity. Because of this, women have neither access to nor control over financial resources. Also, women have little or no chance at all to deal with considerable sums of money. In Timkit, women admit that the maximum amount of money they are ready to deal with is 1,500 dirhams. In fact, 40% have never had more than 30 dh cash; 30% have never had more than 100 dirhams; 20% have never had more than 150 dirhams; and 10% have in the best cases been able to use 250 dirhams. The question begging for an answer is to see how these women will be able to run and reinvest their compensation after the resettlement.

Women in the four sites support dam building. However, the bad practical and strategic conditions in which they operate and their low self-esteem within their respective family cells or communities make it a requirement to provide them with the necessary support after resettlement, to boost their morale and equip them with the rudimentary tools to build up confidence.

(3) Access to social and economic services

In spite of commendable efforts provided by the Ministry of Public Health, women,at the local level,feel that the services have neither increased nor improved. Also the lack of health dispensaries, adequately equipped and relatively close to them bars women from access to health care centers and

health counseling, particularly for women from Taskourt and Timkit. According to these women, mobile health teams sent by the ministry of health to distribute contraceptive means for birth control fail to respect the regular distribution schedule (normally this takes place every term according to women). Women complain that these health teams do not contribute to heighten men's awareness on key health issues and that the distributed contraceptive means are not enough or not diversified. Contraceptive pills are the only means used. Other means are either little known or unknown or not at all adapted to women's needs. Others are simply not accessible (i.e. ligatures and fallopian tubes). On the other hand,even pills are taken without any prior medical check up. This creates health problems, resulting in some women's total refusal to take pills again.

Total abstention from using pills results in close and innumerable pregnancies, which do not allow women a moment to think about alternatives and to hope for a change. Other problems linked with hygiene and drinking water shortage prevail. They result in a number of child diseases such as diarrhea, skin diseases, trachoma, typhoid, etc.

XVI9.2.5 Social Organization

The current situation of social organization seems both difficult and complex to grasp as it encompasses all the changes and the recent evolutions. This type of evolution reflects both the history and the civilization of the sites. We find sites where social organization is still very vivid despite the fact that it has been dispossessed of many of its functions. Consider Timkit where this organization has completely disappeared (the N'Fifikh case) or it has never existed because of the nomadic nature of its former residents (e.g. Azghar). What follows will shed light on, and will explain the meaning attached to a conventional type of organization as perceived of by the people of Timkit and the likelihood of its usefulness to them should the populations be resettled. In fact, all the spaces, old ksours, agricultural land, range land and unproductive land form the basis of a genuine social and economic organization unit. Common interests of the ksours make it possible for this unit to integrate a larger level of organization. The most significant example is the irrigation community. This is valid for upstream and downstream areas. Every unit has its own Jmaa (traditional assembly), which does not escape from the implications of social hierarchy and social stratification. The Jamaa is formed by the heads of the families or by influential descents and is headed by a cheikh (elderly) He, in his turn, appoints his aids in order to have his " administration " which will be entrusted with the responsibility to run and manage space and communal life in the organization unit. The Jmaa settles the conflicts among people, and seeks to develop relations with other communities. It also directs collective work in the community, such as irrigation and water

turns, the fixation of the agricultural schedule (harvesting dates). It grants building plots for extending the dwellings of applicants. One of the other tasks, which the Jmaa has to discharge, is to appoint “community employees”, such as a waterman, a fkih or koranic teacher, a guard to monitor farm plots. At present, and despite the burgeoning of formal associations run by decree 1958 (See site report), the Jmaa still plays a vital role in the community. Its role in resettling the Timkit population will be very decisive, particularly when considering the complexity of the land status and its sharing among many population fractions in upstream and downstream areas. However, this conventional type of organization will have no other role to play in other sites.

In Taskourt, the social environment is very well structured in spite of the lack of formal (institutional) organizations (cooperatives, associations,…). In the different villages, several persons have key social positions. They got those positions after a long time and a hard work. Those leaders are very well integrated in the social network and are influent. They are the local social and technical references for others. They are the key persons in problem solving and in managing conflicts. However, those people don’t have the same influence and thus the same level in leadership. All the leaders and the population in different villages of Taskkourt site are supervised by the fquih of Assaïs (Aït Lafquih Si Hamid). Those leaders should be involved in the resettlement plan.

XVI9.3 Infrastructure, Equipment, and Housing

The four sites have a very low social and economic infrastructure. There are not any tourist, cultural and archaeological sites. We will give a brief review of the stock of the existing infrastructure (more details are given in the report on sites), the equipment and dwellings before presenting the estimated costs relative to all goods and specifying their respective status.

XVI9.3.1 Public Infrastructure and Equipment

In all the sites, the social infrastructure is very poor. Except for Timkit site, which has a suitable yet badly managed track, the road infrastructure is in poor shape. This track makes the dwellings within reach. Its cost has not been estimated, though. The other road tracks do not lead there. There are no sanitation equipment and infrastructure in the four sites.

(1) Sanitation Center

In Taskourt, the closest one is located at Adassil at a distance of 4 kilometers. It has also staff deficiencies. In Timkit the closest one is located at Ifegh (3km)

(2) Schools

The only school infrastructure is in Tamayoste; Timkit site has a three - classroom school and a school residence for teachers and in Taskourt: Three small primary schools (annexes) are available in the villages of Assais, Immin Rkha and Zaouia.

(3) Roads

In Taskourt, the population built the unique available road linking the CR of Adassil and Assif El Mal. This road was built in two periods of time. A part of it was done in 1995 and the other in 1999. These two dates are graven in the memory of people.

(4) Drinkable Water and Electricity

They are not available in all the concerned villages in the four sites.

XVI9.3.2 Collective Infrastructure and Equipment

Worship and religious infrastructure in Taskourt:

(1) Mosques

They are 10 and equiped with 6 " matfias ". Their state is fair except two of them which were fit out by the population in the villages of Assais and Zaouia Ilemti, and are now used for Friday's prayers.

(2) Zaouias

They are two and located in Assais and Zaouia Ilemti.

(3) Marabouts

They are 10 and do not present a particular interest for the population.

These collective goods occupy a global built surface of 2,902 m². The mixed materials for building represent 48%, the local materials 34% and the reinforced concrete represent 18%. The approximate value of these goods is of 1,197,700 DH. In others sites, there is only religious and cult premises are in Tamayouste (Timkit site) has a mosque built collectively by the community.

Water collective infrastructure: Tamayoste has a khetara equipped with a storage basin and a system for tapping water.

XVI9.3.3 Private Infrastructure and Equipment

The private infrastructure consists of only an oil factory and a water well in Azghar. Among the hydro-agricultural equipment available in Timkit, there are 34 wells of which 21 have motor pumps and 22 have a small water storage basin. Depth varies from 6 to 14 m (the average depth is 10.15m). In N'Fifikh, there are 45 private wells whose depths vary from 6 to 8 m located along the river. 7 wells have motor pumps for irrigation purposes and 11 wells use animal force in traditional pumping systems (Naora). There is a collective well in Tamayoste (Timkit site).

Both dwellings and their equipment are very simple with some specific characteristics for each site. In Timkit, dwellings are very spacious and have a garden inside the house courtyard (6,858 square meters of built area). Most of them are built using local and mixed building materials. However, in Azghar most of the houses are wooden houses, except for one house built in concrete (1,202 square meters of built area). In N'Fifikh, most of them are built with mixed building materials (2,327 square meters).

The global values related to the social and economic infrastructure, the dwellings and the equipment are shown in the Table on the following page. We notice that the global value of real estate in Azghar amounts to $464x10^3$ dh, in N'Fifikh 852.10^3 dh and in Timkit it reaches $2,927x10^3$ dh, mainly because the houses are very spacious.

In Taskourt, the constructions and equipment of the entitled beneficiaries correspond to their houses, two wells and the processing units presented earlier. The built surface is estimated at 49,342 m² where 86% are made of local materials and 14% of mixed materials. The total approximate value of these goods is of 15,823,370 DH. In this site, the constructions are very old. However, the estimation cost giving by population is very higher.

XVI9.3.4 Economic Infrastructure

The economic infrastructure is only in the Taskourt site and it is limited:

Oil works (maâsras) : Their number is of 9 and all of them are traditional units and using animals' energy. The trituration period goes from December to the end of marsh if the olives' production is good. The trituration's capacity of each unit (in 24 hours) is one tone of olives. The oil works' owners are payed in nature. They perceive the tenth of the oil produced.

(1) Mills

They are 14 and 13 are watermills and one is a gazolinemill. Watermills are functioning when water is abundant in the Assif El Mal river. The permanent functioning mill is the one located in Immin Rkha which uses gazoline.

(2) Groceries

11 small groceries were sensed. It should be noticed that all the oils works, mills and groceries belong to privates persons.

(3) Weekly Market (Souk)

The weekly market of Adassil (Monday) is the most frequented by people. People could sell their products and buy the needed commodities from market.

Goods in Upstream Areas (value in dh1000)

Site	Public infrastructure	Collective infrastructure	Private infrastructure	Habitations	Total
Azghar	0	0	37	427	464
N'Fifikh	0	0	107.5	745	852.5
Timkit	213.6	60	130	2,523	2,926.6
Taskourt	1,197.7		15,823.37		17,021.07

The basic infrastructure is as follows:

XVI9.4 Physical and Natural Potentialities

XVI9.4.1 Real Estate: Land

In general, land is available in the areas of the selected sites. Nevertheless, the value of land is determined by the availability or absence of water. Water is a factor of determining influence .The price of land changes according to the proximity of a water source or a khettara e.g. Tamayost. In principle, land status affects but in a lesser degree price fixing. The peopling of sites from time immemorial, in addition to the various historical phases have added up to the natural conditions to finally yield a multitude of land statuses. We will review the different statuses, highlighting their importance site-wise. We will also give a summary of space organization and the specific characteristics of each site.

(1) Melk Status (Land Ownership)

Three categories of private land ownership are distinguished in the melk status:

- Land inherited from father to son called " Jidia ";

- Land with a " rsam " or legal deed (a certificate obtained from a notary) and registered in the court justifying the right for property of the deed holder;
- Land with a sale contract, describing the relatively recent acquisition.

All these land categories are found in the three sites with varying importance from one site to another as shown on the Table below. Land registration in the cadastral department is uncommon.

Delimiting the boundaries of melk land is easy to make in Timkit, as they are located in irrigated oases. It is worth mentioning that the land used for dwellings and in nearby gardens have changed statuses, moving from collective property to private property after being appropriated to their owners by the Jmaa soulalia (traditional association).

In the two other sites, N'Fifikh and Azghar, melk property is found in both the irrigated and rainfed areas.

(2) Collective Status

By using the term collective, we mean everything that belongs to a community or to a portion of this community. This type of status is prevalent primarily in the Timkit site. Collectively -owned lands are located outside the oases. They are mainly used as range lands with the closest used for extending the dwellings.

(3) Habous Status (Religious Endowment)

They are lands generously donated to pious foundations: mosques, zaouia (religious fortresses), maraboutic families(shrines).This type of status prevails only in Azghar over very small land areas.

(4) Public Status

They are state-owned lands run by different ministries. We mainly find the public hydraulic domain and the forestry domain. The first is located along the rivers, and is very often run by riparian populations. The second is represented in all the sites endowed with important land areas. The following table shows the different status rates' in each site.

Reality Check of Land Property Excluding State-Owned Lands

Sites	**Collectives lands**	**Habbous Lands**	**Melk lands**
Azghar	0	0.75	99.25
N'Fifikh	0	0	100
Timkit	60	0	40
Taskourt	0	0.2	97.5

No current estimate has been made of the lands belonging to the forestry domain mainly because the limits of the land reservoir were not clearly defined when this study was undertaken.

XVI9.4.2 Lands: Status, Type, Parceling-Out and Farming Patterns

(1) Azghar

By looking at the definitions we have provided, it is very noticeable that the land heritage of both the residents and non-residents in Azghar is 99% melk, 0.75% habous. Within these percentages, the Azghar residents eligible for land have a total area of 42.8 ha, of which 9 ha of purchased land and 33.8 ha inherited from father to son. Therefore, 21% of lands are purchased and 79% are inherited. As for the eligible non-residents, the land status melk is the most predominant. The habous percentage is very low(1.05%). The total area is 283.7 ha of which 25.4 ha bought and 258.3 ha inherited. The lands with no title deeds represent 91% of melk lands. The total land area of both residents and non-residents is 326.5 %. The remainder of the flooded land part belongs to the water and forestry domains. Almost all of the land is cropped directly. Tenants in exchange of the payment of a fee crop only Habous land.

As for soil texture, there are three major soil types: hamri 11.24%, biada 78.32% and mezrar (an schistose soil) 11.24%). For each soil texture and for total land area, a detailed account is provided on soil gravel content in the report on the site. The parceling- out nature of the land and its dispersion are important elements to take account of. On average, the number of cropped farm plots is 3. The average area per plot is 0.83ha. The number of plots amounts to 403.

(2) Timkit

The cropped land is located along the water stream near the aqueduct, in Tamaysout and Tyzgha. Generally, they are very small plots made-up by growers themselves. The rocky soil is covered with a pre-sifted earth layer. Thus, growers are able to correct the slope. Most of these lands are inherited melk (Jeddia: 98.2%) and are cultivated. The total land area is 16.9 ha of which 11.5 are irrigated (67.8%), 4.8 rainfed (28.4%) and 0.6 ha barren (3.8%). These lands belong to almost 124 owners .It is worth noticing that the area of 88.5% of owned land does not exceed 0.3 ha. As for the farming pattern, 90% is cropped directly by the users .10% are managed by the family or in partnership. The hamri soil texture prevails in the irrigated system. The gravel/stone in the rainfed areas. Each time growers purchase land from the Jmaa (collective assembly), they remove stones from the fields to turn it into an arable land. They build walls and start cropping their gardens.

Parceling out is very important .The number of plots / growers is from 1 to 25 with an average of 4.3 plots. The area of irrigated plots varies from 0.005 to 0.8 ha per grower. The measuring unit in this site is the square meter.

(3) N'Fifikh

The lands in the area to be flooded belong to 65 owners, of whom 31 are residents. The total area per grower varies from 0.05 to 12 ha (including the rainfed area). 85% of these are inherited melk (Jeddia) and 15% purchased with a legal deed.

Three types of soil texture are found: the chehab (33%); the dahs (43%); and the mezra (35%).It was also noticed that 27% of the plots are rocky lots,57.7% moderately stony and 14.4% slightly stony. The slope is very steep in 39.2% of the plots. It is moderate in 41.4% and slight in 19.4%. The dahs, a more fertile soil, is found near the river. Most of the plots are sloppy and gravelly except in irrigated plots made up by growers on the edge of the river, and sometimes even in the riverbed.

These plots are subjected to flooding and erosion. These factors impose on growers to till the land in a very archaic way (animal-drawn ploughs, manual harvesting and threshing).

Parceling out is most frequent in irrigated plots. Its number per grower varies from 1 to 5. We have counted 113 plots. The total land area is 111 ha .The irrigated system represents 14.1% (15.7 ha), the rainfed 58.7% (65.3 ha), rangeland 27.2% (30 ha). It is worth noticing that 75% of irrigated land (11.8 ha) and 63% of the rainfed (37 ha) actually belong to the residents.

(4) Taskourt

Agricultural lands owned by the entitled beneficiaries have a surface of 682 hectares with 161 hectares irrigated (24%) and 521 hectares located in rainfull areas (76%). The average farming size is 2.15 hectares and the average number of parcels is 9. The dominant type of soil is " biada " (84%) followed by " hrach " (12%) and other types (4%). The dominant land tenure is the property "melk "where farming land is inherited (94.6%) or bought (2.9%). The state land status is low (2.3%) and the " habous " is insignificant (0.5%).

The slope is low for irrigated parcels because farmers prepared terrace cultivation. However, the slope is relatively important for rainfall parcels.

XVI9.4.3 Grazing Sources

(1) N’Fifikh

The forest is the most important source for animal grazing. The tree species available are the thuya, the eucalyptus, the jujube, the dro, the thyme and other plant species. As far as the fauna is concerned, local inhabitants point out the presence of the boar, wild hares, foxes and partridges. Spoors of boars are reported to be close to the residents’ dwellings. Local inhabitants ascribe the extensive damages to their crops in irrigated lots to the boars, particularly during the periods of drought.

The drying up of the river and the vegetation during the successive periods of drought in recent years must have impacted negatively on wild vertebrates.

In the forest, areas of young plantations, animals are banned from grazing. The sanction can reach up to dh 2,000 per herd of cattle. For authorized pastures, people have to pay a fee of dh 2 per ovine head and 3.5 per bovine head. Goats are not allowed access to the forest.

Private pastures: many growers (26.6%) own barren land which they use for animal grazing. The populations on the site make a living essentially from livestock breeding.

(2) Azghar

It boasts to treasure one of the most important natural riches: the forest. The forest is found all along the mountain. It harbors many tree species, such as oleaster, cedar, cork and cypress trees. On the other hand, many plant species of economic and ecological interests are found (aromatic, medicinal and honey-making plants), mainly white armoise, thyme and pouliot mint. As to the fauna, hares, foxes, boars and wolves abound. People who crop the land of the forestry domain must pay fines to the local services of the water and forestry department. One-dirham tax on each sheep or goat is paid while use is made of the pasture of the forestry domain.

(3) Timkit

The forestry domains or collective lands are the only sources of animal grazing mainly because of the smallness of the farming plots and of terraced plantations in the oases.

However, taking into account the degradation of the plant resources, their exuberance in terms of quantity and diversity has decreased steadily. Pasture lands are generally located outside the flooded zone.

(4) Taskourt

The main pasture source for sheeps and goats is l'aâzib except the village of Ighz which does not have a " aâzib ". The other villages have at least one aâzib. These aâzib are named as follows :

Talaânt Ou Aghroum for Tiliwa ;

Ighil Inamarane for Kerni ;

Ouaroughad and Tlilde for Talborjt ;

Amagudoul, Ighi N'Talghamt, and Izokatanes for Assais ;

Azrou El Mal for Immin Rkha ;

Takassamt for Ilemti and Zaouia Ilemti ;

Amassine for Talat Ilemti.

Regarding the castles, their number is relatively low and the main pasture sources used are the neighboring parcels of villages and the stubble field.

XVI9.4.4 Water Resources and Management

(1) Water Resources

i. Azghar

The existing water resources mainly consist of the river Zloul, wells and natural springs. However, the number of wells and springs is very limited. On the whole, there are 3 private wells with an average depth of 10m and 3 springs. These sources are particularly used for water supply. The cost for digging a well varies depending on the depth and the soil texture. The price is from dh5000 up to 16000. The Zloul river dries up in summer but its water is mainly used to water animals, to irrigate and for domestic purposes but not for personal human consumption. However, water from springs and wells is used for drinking in addition to other domestic uses.

ii. N'Fifikh

Water intake points are essentially made up of individual wells used for drinking water, watering animals and irrigation. Their equipment is very simple; only 7 wells have motor pumps and 11 wells use working equines in traditional

pumping systems (Naora). The N'Fifikh river dries up during the summer period. In recent years, the drying up has increased extensively. At present, wells are the major water resource and are used for different needs (human consumption, watering animals and irrigation).

Well water is very well appreciated for drinking purposes by populations. Water supply chores involve 33% women, 15% children; 52% men. The time spent to fetch water is low, because the wells are nearby.

iii. Timkit

In Tamayost, there is a khettara equipped with a water storage basin to irrigate the acreage. The private wells (individual or family-owned) are dug close to the residences. They serve mainly to irrigate the gardens in or outside homes, to water animals and to meet domestic needs. Some of the wells are simply not used because there is no water inside. We have computed 34 wells of which 21 are equipped with motor pumps and 22 have a small water storage basin. Depth varies from 6 to 14 m (average depth10.15m). There is also a collective well for community use.

A deep 100 meter drilling has been performed by the department of equipment for the purpose of supplying local communities with water. The well is not used yet although it contains water.

iv. Taskourt

Natural sources located in the Assif El Mal river are the main water resources used for irrigation and human and animal consumption. However, it should be noticed that two private wells exist at Ighz and Immin Rkha which are 3 and 12 metres deep. Six collective mattfias exist and used mainly for religious objectives. Each one of them has an average capacity of 50 tonnes. They are located in the villages of Zaouia Ilemti, Assais and Kerni.

(2) Water Use and Management

i. Timkit

Water management is well- organized because the resources are collective property (See downstream). Around the khettara of Tamayost, people have to take water turns, or nouba, to irrigate their feddans, or acreage, once the water reservoir is filled. Whereas in Thyzra, spring water is distributed by nouba among the eligible persons. They all live downstream with land property upstream. There are two sources which are run according to an inherited distribution pattern as follows: Every ksar or community -based village has a

number of water turns in terms of eligible persons. The Jmaa or collective assembly of the elderly appoints a person called Amghar (renowned for his virtues) to organize the water distribution. Both eligible residents and non residents wait for their nouba downstream. For other natural resources.

ii. Others Sites

In others sites, water from the river and the wells or spring is managed on an individual basis. There is no water right.

XVI9.4.5 Other Naturals Resources

The population has uncultivated land along the two banks of Assif El Mal river. This land is generally used by people to collect medicinal plants which contribute highly to households' incomes (cf. § income sources). The main species collected are the " armoise ", the caper bush, the " sauge " and the " thym ". The collected plants, by men and women, are bought by wholesalers who process them in the villages or resell them at Marrakech or Casablanca.

XVI9.5 Assessment of Productive Capital

The Table below shows the values related to both the land heritage and the plantations in the three sites. This includes the property of the eligible and the non eligible residents. What is worth noting is that land heritage is more important in Azghar, followed by N'Fifikh and then Timkit. As for the plantations, they are more important primarily in the oases of Timkit, Azghar and N'Fifikh. The water rights are very important in Timkit due to the presence of springs and a khettara (See part on water resources).

Reality Check of the Capital Production Goods (value in dh1,000)

Sites	Lands	Plantations	Water
Azghar	3,933	11	No water right
N'Fifikh	2,405	353	No water right
Timkit	1,812	2,635	Water right for springs and Khettaras
Taskourt	39,450.4	48,970. 95	No water right

XVI9.6 Economic and Income-Generating Activities of Eligible Residents

The study of the economic activities and the generated incomes has concerned the eligible residents only. In fact, this is the target population to be displaced should a dam be built. The economic impact can be easily highlighted if we take into account the resettlement scenarios and the current resident incomes.

XVI9.6.1 Farming Activities

It was not easy to grasp the importance of each economic activity in N'Fifikh, particularly because of the population's mentality. However in the two other sites, local populations' collaboration was very useful.

In the four sites, the three pillars of the economy are: livestock breeding, farming and migrant workers' remittances. The participation rates of each activity differ from one site to another. The breakdown of the importance of each activity is provided in the report corresponding to the site .We will give a brief overview hereafter.

(1) Timkit

i. The Plantations

We have taken stock of the plantations taking account of the plant species and their age (See report on the site).

Most of the plots are cropped with date palms (1,735 adult trees (A), 965 medium-aged (M) and 409 young trees (Y); almond trees (992 adult, 263 medium- aged,189 young); olive trees (414A, 201M and 94 Y). The total number of other fruit trees such as figs, apricots, quince, pears and vine amounts to 878A, 359M and 157Y. Thirteen tree species are recorded. The plantations are located along the water stream in Tamayost and Thyrza .The plots called feddans are narrow. The plantations are very dense and are grown in association with annual crops. Part of these plantations is close to the dwellings (groves).

Yield-based classification ranks almond trees first followed by date palms, olive trees and other trees.

ii. Annual Crops

The major crops are: hard wheat, barley, corn, ilane (muillet:an wheat-like crop), alfalfa and market gardening products. Production is very low due to the limited area of cropped land and the shade effect (crops associated with arboriculture). Most of the production is for self- consumption, except for ilane and a part of the cereals sold in the market.

The ilane, or(anly in Berber), is a cereal which was introduced in the area in the 1980s. It is a summer season crop (July-August), with a short -growth cycle (2 months) and is cropped after hard wheat and before corn. It requires a lot of water and fertilizers (every 6 days). In Tamayoste, this crop practice has decreased recently mainly because of water shortages. In Ifegh, nonetheless, it is

relatively abundant as water is quantitatively abundant, too. Because of its profitability, growers invest more inputs in this crop than in other crops.

The main important annual crops are: hard wheat/barley (35%), ilan (25%), corn (20%), alfalfa (10%), market gardening (10%).

iii. Livestock Breeding

It is mainly an extensive type of breeding. Due to the drought, the total number of cattle is generally underestimated. There are local bovine, ovine and caprine breeds. We have counted 21 bovines, (10 adults and 11 youngs), 139 sheep (85 A and 54Y) and 260 goats (196A and 64Y). Growers have at least one working equine. Production is sold in the markets of Tinjdad, Goulmima or Tinghir.

iv. Wage-earning activities

75.8% of residents are laborers who work either locally, in other cities such as in Tangier and Nador or abroad in France. In general, every household has at least one person working outside the area. We sometimes find cases of 2 to 3 persons per family. Masonry is the major activity of this workforce. It is not a highly specialized one and therefore, it can be used in agriculture, cattle rising or in other sectors. On average, the concerned people are away from their homes 8 months a year. Two heads of families work abroad (France). Some other people are involved in handicraft activities or benefit from rent services (a grain mill).

(2) Azghar

i. Plantations and annual crops

Cereals are the main crops. Barley is annually grown over 60% of the cropped area and hard wheat 25%. Legumes are also cropped with a soil use percentage reaching 25% (15% for lentils and 10% for broad beans). These crops are inserted inside olive and almond groves. They are mainly conducted in bour, or rainfed areas, except for the plots closer to the river in which fruit trees such as figs, apples and vines grow. Three growers who have settled down in the area for the last ten years do not have any plantations. For the others, the number of trees varies from 3 to 519. Almost 75% of the land is hilly. Cropping is done manually using the jouja or two animals to draw the plough. The remainder of the land (25%) is hard for access to the machinery (ie tractors, combines, etc.).The level of technology is very low for most growers. Also soil fertility is low. According to the growers we were able to interact with the yields reach 15 quintals per hectare. The gross profits per hectare vary between 2000 and 2500 dh. Also the legumes yield does not exceed 10 quintals per hectare, with gross profits

between dirhams 2,000 and 3,000 per ha. It is worth noting that fallow land occupies 30% of agriculturally potential areas. It is also important to underline that a mature olive tree can yield up to 70 kg of olive fruit.

ii. Stock Breeding

As mentioned above, stock breeding is the major economic activity upstream. It allows to generate incomes, which are rather important. The herd is made up of sheep and goats specifically. Bovine breeding is very scarce but some growers do actually own from one to four cows (a total of 10 cows, on- and off- site).

On average, the size of the herd is 79 goats and 61 sheep (on- and off- sites). The highest number of a sheep herd is 120 and 100 for goats. Also the lowest number of sheep is (10) and that of goats is (15). The fact that the breeds are local makes cattle raising 100% extensive. The major part of animal feed comes from forest pastures located close to the lands of the residents and non residents or from private pastures (fallow land). Sale prices change according to season and year.

iii. Other Activities

Among the other activities, we note down the contributions from 1% to 3% of the military personnel in trade incomes.

(3) N'Fifikh

The major wage earning activities are trade and the labor force (44%), followed by stock breeding (31%) and agriculture (25%). The importance of these activities depend on the size of farmsteads and also on the presence or absence of irrigated land. The change in the economic activities is relatively recent. It is essentially due to the successive periods of drought and the degradation of the grazing land potentials.

They are mainly subsistence crops, the farmsteads are small and non-mechanized and the yields are not abundant.

i. The Plantations

Fruit trees and leguminous crops are grown in the irrigated plots. Among the fruit trees we find: vines (1861 adult trees (A), 1080 medium-aged (M) and 1456 young (Y)), pomegranate (192A, 38 M and 44Y), figs (231A, 40M and 31 A), olive trees (38 A, 3M and 10Y).There are also other fruit trees,such as apples, apricots, pears, and almond trees totaling 33 heads including all ages. The production of these plantations is partly for self -consumption and for sale in the market.

ii. Annual Crops

The bour predominates as it covers a big area .50% of the agriculturally potential area is cropped with cereals (soft and hard wheat, barley) and 50% with legumes (broad beans, chickpeas, green beans and lentils). Onion and corn are scarcely cropped.

Although irrigation involves only a small portion of the area, it is more profitable for growers than rainfed areas, especially during the drought. The crops grown are potatoes, pumpkins, green pepper, tomatoes, mint and parsley. The irrigated plots are used on a full -time basis provided irrigation water is rather sufficient. Three crops are grown in the same plot annually. There are up to seven cuttings for mint per year.

Production is partially consumed or sold in the local market (souk). Barley and broad beans are also used for feeding animals.

iii. Livestock Breeding

It is mainly an extensive type of cattle raising with local and sometimes crossbreeds. Ovines are the most frequent (350), bovines (78), caprines (96) and equines (53). Except for equines, the animal production is sold in the local market.

iv. Other Activities

a) Trade

On average, the marketing of vegetables constitutes15% of the family income in N'Fifikh. Traders in vegetables market their own production but they also buy vegetables to resell later.

b) Outside Work

The contribution of this activity varies according to the years. The populations move out of the area to look for jobs and tend to stay longer during the drought periods. Landless young residents very often work outside. They work as manual laborers on other farms or in masonry. The contribution of this activity in the family's income is 29%.

(4) Taskourt

i. Agricultural Activities

The Fruit trees play an important role in households' incomes. The total trees' number is of 105,246 where 88,308 (84%) are fruit trees and the 16% remaining (16,938) are forestry species. Olives, almonds and bot carobs are the most important species with respectively 20,397 ; 46,583 and 2,323 trees (in data book the trees are speared by species and age. The average yields for an adult olive's tree are respectively of 80 and 100 kg in " Tiguidares hauts " and " Tiguidares bas ". This difference is explained by the availability of irrigation water in " Tiguidares hauts " which gives sturdy fruits. 50% of the olives' production is sold and the remaining quantity is consumed by the family. This is just an indication. In fact, the quantity sold depends on farmers' evaluation of the next year's production. The majority of the oil olives' stocks are sold if the next production is judged to be good, otherwise, most of it is kept at home for consumption. It is common to find in households oil olives which is 3 or 4 years old. The olives' production cost of one kg is estimated at 2 DH. This cost includes organic fertilization, manpower for irrigation, harvesting cost, …

The average yield of an almond tree is of 2 kg (Kg). The almond cost production of one kg is estimated at 20 DH. This cost includes the expenses related to the production process and harvesting. 80% of the total production is sold. Almonds are an actual farmers' treasurer ship. In each market day, farmers sell 3 to 4 kg. The bot carob is also an important tree and contribute to households' incomes. The average yield per tree is 100 kg and the sold price is of 4 DH. The production cost is of one Dirham each kg. This cost corresponds mainly to harvesting expenses and transport. The whole production is sold.

The main annual crops are barely (irrigated and rainfall), corn and market gardening. The barely yields vary between 8 and 15 quintals in a hectare. The production cost varies between 700 and 1,600 DH a hectare. This variation could be explained by the mineral fertilization use level and paid manpower. The gross margins vary between 1,300 and 2,400 DH. Most of the production is aimed at human and animal consumption. Market gardening's production is also aimed at consumption.

ii. Livestock Activities

All the species of livestock (sheeps, goats and cattles) exist with different proportions in all villages at the upstream level. A total of 4,000 goats, 2,000 sheeps and 600 cattles exist. At Ighz, cattles' breeding is the most important (150), followed by sheeps (120) and goats (100). In the other villages, goats are

the most important breeding followed by sheeps and cattles. As mentioned earlier, this is a logical situation because Ighz does not have lands at l'aâzib. In " Tiguidares hauts ", the number of goats, sheeps and cattles are respectively of 2,500, 1,100 and 200 where in " Tiguidares bas ", they are respectively of 1,400, 780 and 250. The main production of sheep and goats is meat where is milk and meat for cattles. Milk is used mainly for consumption and meat is produced for the market. The livestock is made of local breeds and is extensively conducted. The average selling price of lambs, kid gloves and veals are respectively of 550 ; 275 and 4,500 DH.

iii. Other Activities Generating Incomes

Besides agricultural and breeding activities which contribute respectively up to 41% and 15% in elaborating households' incomes, other activities generate incomes at the upstream level. The manpower contributes with 22%, selling medicinal plants with 13%, trade with 5% and other miscellaneous activities with 4%.

Regarding their contribution in generating incomes, the internal activities carried out inside the site of Taskourt contribute with 40% and the external activities (manpower, farming, livestock, trade,…) contribute with 60%. This situation may vary and depends mainly on climatic conditions. During drought years, manpower is the main activity carried out to generate incomes.

XVI9.6.2 Generated Incomes

The incomes were computed for all eligible residents. A breakdown of the Azghar case is provided to illustrate the approach adopted in the analysis and a summary for all the other sites is presented in the Table on the next page. Current prices are used to calculate incomes generated from animal and plant productions (October 2000).

Assessment of Incomes(values in dirhams1000 and activity contribution in %).

Site	**In –site**		**Out-site**				**Global**	
	Agriculture	Breeding	Agriculture	Breeding	Income from migration	Marketing	**On- site**	**Off-site**
Azghar	4.7 (8%)	12.1 (20%)	9.2 (15.3%)	28.8 (48%)	5.1 (8.5%)	0	16.76 (28.8%)	43.13 (71.8%)
N'Fifikh	5.5 (21%)	5.4 (20.8%)	4.1 (15.8%)	1.4 (5.5%)	6.4 (24.6%)	3.2 (12.3%)	10.9 (42%)	15.1 (58%)
Timkit	7.8 (32%)	3.3 (14%)	5.2 (22%)	0.6 (2%)	7.2 (30%)	0	11.1 (46)	13 (54)
Taskourt	5.32 (40%)		3.99 (25%)		(22%)	(13%)	5.32 (40%)	7.98 (60)

(1) Azghar

The on-site average agricultural income is dh 20,633/year and dh 21,971.25 off-site. The total average agri- income on and out site is, therefore, dh 42,604.7250 /year. If this figure is correlated with the number of households, the average agri-income on site is dh 12,380.1/year and dh 13,182.75/year out site. The on and out-site average agri-income is dh 25,562.82/year The maximum agri-income is 144,734.64 dh/year and the minimum is dh10,951.5/year. It is important to notice that the data listed are influenced by big farm. If we discard this one,then on site average agri-income becomes dh 7,457.77/year and dh 14,721/year off-site, with a total of dirhams 22,178.78/year. If these figures are correlated with the number of households,then we will have an average agri-income of dirhams 4.661/year on -site and dh9,200.63/year out site with a total of dh13,861.73/year.

The average livestock breeding income is dh 48,866.67/year on site and dh 40,366.67/year out site. If we correlate these figures with the household numbers, then the average income is dh 29,320/year on site and dh 24,220/year off site, with a total of dh 53,539.98/year.

The maximum livestock breeding income is dh 208,000/year and the minimum is dh56,000/year. As in the case of plant production, the data are influenced by the income of a big grower .If no account is taken of his income, then every household's income would be dh18,150/year on site and dh 22,775/year off-site. We need not forget that in livestock breeding, animal flocks are moved back and forth, from the site to elsewhere. By examining the time spent away from the site, we can easily ascribe one third of the incomes to the off-site grazing pastures. Also, the genuine average income on site is dh 12,100/year and is dh 28,825/year off -site, with a total of dh 40,925/year, including both.

The upstream economy relies tremendously on animal breeding. The contribution percentage of each activity excluding the big grower is 68.2% for breeding, 23.3% for agriculture and 8.5%for migration and miscellaneous activities as shown on the Table above.

(2) N'Fifikh

The average household income is DH $26x10^3$/year of which 42% (i.e. dirhams$10.9x10^3$/year) yielded by activities performed on the sites and 58% or dh$15.1x10^3$/year resulting from activities carried out off site. Migrant labor force alone contributes for 24.6%, followed by agriculture and stock breeding inside the site with 21% and 20.8%, respectively as shown on the Table above.

(3) Timkit

The average household incomes are dh24.1x10^3/year of which 46% i.e. dh11.1x10.^{3}/year yielded by activities performed on site and 54% or dh 13x10.^{3}/year resulting from activities performed off-site.

Agriculture inside the site is the most rewarding with dh 7.8x10^3 (32%) followed by the remittances of the migrant labor force which contributes with 30% or dh7.2x10^3.

Outside the site, agriculture contributes 22% or dh 5.2x10^3/year as shown on the Table above. Stockbreeding represents 13% (i.e. dh 3.3x10^3) of the global income of the site and only 2.5% (i.e. 0.6x10^3/year) off-site.

(4) Taskourt

The incomes were computed by confronting the data collected with focus groups and those collected by interviews with individual households. The average household's income in a year is of 13,284 DH. Differences between and within villages exist. Between villages, incomes vary from 5,830 DH in Kerni and 25,050 DH in Tiliwa.

Within villages, the variations are also important. At Ighz for example, incomes vary from 5,500 to 27,500 DH. Concerning the production expenses, they are relatively high for wealthy farmers and low for the poorest ones. The use level of paid manpower could explain this situation, which is relatively high for the first category of farmers and low for the second one.

In other respects, it is important to notice the contribution of agricultural and livestock activities in generating households' incomes. This contribution is relatively important for the wealthiest entitled beneficiaries who represent 24% of the population (97 households) and is very low for the poorest farmers who represent 60% of the population (246 households).

At Assais for example, this contribution is of 66% for the wealthy stratum and only 14% for the poor category. For the latest, manpower is the main source of its incomes. The same tendency is observed in the other villages. It is also important to notice that for the poorest social category (20% of households), incomes stemmed from manpower are of 96%.

Globally 60% the income of the population is from out side.

The l'Aazib and the natural resource contributed about 25% in the income.

XVI10 Assessment of Potential Impact of the Dams and Resettlement Plans

XVI10.1 Assessment of Potential Negative Impact

XVI10.1.1 Impact During the Dams Construction

(1) Impact on Familial and Social Cohesion

During the parcels' chart establishment, several conflicts emerged among people, particularly those having family connections in Timkit and Taskourt . These conflicts are related to farming lands and trees inheritance. The source of this problem comes from the fact that a large majority of lands have a " jeddia - melk " status (95%) which are not reregistered. In Timkit some families believe that the women can be authorize the men represented her. In the other hand, in Taskourt several families (more than 22%) emigrated definitely to big cities and let their farming lands and trees to be worked in association by others. The permanently emigrated population returns seldom to the villages for few days' vacation or to get their parts of oil olive. With time, people in the villages (youngest of them) are now confused and have difficulties to distinguish between the landowners and the partner associates. The partner associates made arrangements by working the soil, planting the land with trees,…etc. The landowners showed up when they had echo of this study and came to register their goods. In Timkit and in Taskourt Serious conflicts exist between some of the land and trees owners and their partner associates. Rarely, some of the associates consider themselves as the owners. These conflicts could be managed and neutralized if the local association (Jamaa soulalia) and the leaders in each village, with the support of the " fquih of Assais " are involved before the resettlement stage. It will be nice to organize an awareness campaign to show the positive impact on the compensation process when the problems related to inheritance are eliminated. This campaign should involve a multi - institutional and multidisciplinary team. The team should be made up of the representative of the local authority, the local population and different specialist matter (rural sociologist, jurisdiction, civil engineer,…etc). The rural sociologist could ensure the leadership with a good experience in rural communication.

Than, it would be important to preserve the familial and social cohesion at the time of resettlement especially between gender equability. The most vulnerable groups are people without properties (young couples), the poor families and women heads of households. Those groups will be have a little or none compensation. So it is necessary to try to preserve the familial and social balance to preserve the present solidarity. In the same sense, it would be necessary to attend and to orient the illiterate people.

In Azghar, there is no major impact to highlight. However, on -site work priority should be given to neighbouring upstream and downstream populations which will be affected by the construction nuisances.

(2) Impact on Psychological and Social Dimensions

Even though people support the idea of the dam building project, they can't hide the strong ties they developed overtime with their environment. They love their fresh and free irrigation water, the shadow of olive trees in summer time, the freshness and taste of vegetables and fruits consumed immediately after harvesting,…etc. In the other hand, the mobility of the majority old persons of entitled beneficiaries is very low and the scope of their references is thus weakened. A state of anxiety settled among those people who consider resettlement as an adventure. One way to minimize this negative impact is to ensure a monitoring to populations. A multidisciplinary team composed by men and women should carry out this monitoring. Its main objective is to show that is possible to have a better living outside the site of Taskourt. Some of the countrymen, exposed to experiences in other environments and enthusiastic about resettlement, should be associated to support the team's enterprise.

The zaouias' transfer is a mean to relieve people. People suggest their transfer to the aâzib. The zaouia of Assais should be transferred to one of its Aâzib and the zaouia of Zaouia Ilemti to Takassamt.

In the other hand, it should be noticed that anxiety exists also among the influential persons (opinion leaders) who worked very hard in the past to have access to high positions in the social network. Those leaders used to be very well respected in their environment, the main judges, the spokesperson and the interfaces for the population. They organize festivities in the their community. They are also the technical references for others and vehicles for social and technical change. The opinion leaders are afraid to loose their social positions after resettlement. To minimize this negative impact, these opinion leaders should be recognized as leaders and involved in all the resettlement process (before, during and after dam building).

(3) Impact Differentiate According to Gender

i. Impact on Men

This step constitutes an opportunity for men to work and be paid. It will allow people to have a steady job next to their homes. It will also enable them to improve their incomes by eliminating several expenses related to food, transportation and accommodation. This is an actual positive impact on men's

population. The question that should be asked is to examine to what extent the dam building could absorb all the available manpower in the different villages at the upstream level? At this stage, the involvement of opinion leaders is necessary to seek adapted solutions which may satisfy the interests of different actors (population, building's dam company, state representatives, financial institutions,…etc.). This is an opportunity to involve the identified influential people and a group of them could be selected by the fquih of Assais. Appropriate solutions could be found such as establishing a quota system where a given amount of work days will be affected to each village,...

ii. Impact on Women

The local value system doesn't allow women work with men when building the dam. During this step, women risk to be unsettled and excited because they will be living a period of uncertainty. One way for minimizing this negative impact is to organize training sessions for them to increase their awareness and prepare them to start efficiently their activities after resettlement. Several subjects could be addressed during these practical training sessions such as technical and economic analysis of small projects, population education, financial support for projects,…etc. The participation of men population is necessary to ensure success to planned programs. Men should be involved because women's involvement in the decision process is low (less than 14%). The opinion leaders should also be involved. The activities that should be implemented must be related to potentialities of the resettlement environment.

XVI10.1.2 Impact After Dams Construction

(1) Impact on Land Property and on Plantations

For Azghar, N'Fifikh and Timkit the land capital of the upstream is: dirhams 3,933; 2,405; and 1,812, whereas the plantation values are: dh1,735 ; 353; and 2,635 respectively. Water resources are hectic and limited in both Azghar and N'Fifikh but they are relatively sufficient in Timkit.

In Taskourt: As mentioned earlier, land capital's amount is made of 682 hectares. 521 ha are located in rain full areas and 161 in irrigated ones. The dam's building will exclude this capital from farming. Its approximate value is 39,450,400 DH where 74% go to irrigated lands and 26% to rain full lands. The estimated values of one hectare were respectively of 180,000 DH for irrigated lands and 20,000 DH for rain full ones. The fruit and forest trees are very important at the upstream level. Over a total of 105,246 trees, 84% are fruit trees and the remaining 16% are forest trees. The number of fruit trees is 88,308 where 60% are made of almonds, 30% of olives, 2% of both carobs and 8% of

other species. The dam building will exterminate these trees with a value estimated to 48,970,950 DH.

The unitary values are quite high due to the quasi total absence of land property transactions and the limitations of the land heritage in these sites. On the other hand, some expatriate workers think of no other way to invest but simply to use their savings to purchase agricultural land and acquiring lands means access to prestigious social positions. This in turn leads to a spiral of land price increases and inflation, which do not reflect the reality on the ground when we consider the low profitability of these land and plantations.

(2) Impact on Collective and Private Constructions and Equipment

In Taskourt: The constructions and private equipment of entitled beneficiaries correspond to habitations, two wells and the processing units mentioned earlier. The global built surface is 49,342 m² where 86% are made of local materials and 14% of mixed materials. Building the dam will eliminate these constructions and equipment which have an estimated value of 15,823,370 DH. In the same site, the collective constructions and equipment gather 3 primary schools, 10 mosques, 3 zaouias, 10 marabouts and 6 matfias. The built surface is of 2,902 m² where 48% are made of mixed materials, 34% of local materials and 18% of reinforced concrete. The dam building will eliminate these goods which have an approximate value of 1,197,700 DH.

The approximate total value of entitled beneficiaries at the upstream level of Taskourt, which will be destroyed is of 105,442,400 DH where 47% correspond to trees' value, 37% to farming lands and 16% to constructions and equipment. This estimated a multidisciplinary team should refine value at appropriate time.

We notice that the global value of real estate in Azghar amounts to $464x10^3$ dh, in N'Fifikh $852x10^3$ dh and in Timkit it reaches $2,927x10^3$ dh, mainly because the houses are very spacious.

(3) Impact on Right of Water and Natural Resources

Right of water concerns only Timkit farmers. The dam will convict sources and the khettara of this site. The right of water of the populations is established since more of a century years. These populations ask to take their right of water downstream the dam.

(4) Impact on Solidarity and Social Cohesion

In all sites (except Azghar), some people are supported by the communities regarding their land water ownerships or by their families (young couples sitting

in the parents' house). However, people without proprieties represented by young couples, poor families and women alone, heading households will have lower or none compensation offer by the Moroccan Government, if paid implemented. Therefore, a strong measure is necessary to maintain familial and social balance to preserve-to-preserve solidarity. This solidarity is most important in Taskourt.

(5) Impact on Schooling

The sites infrastructure is very poor. Schooling can be a problem. In fact, except for Azghar, children go to schools located either in or near the flooded area. In spite of low instructional rates of children, which are of 15% for boys and 7% for girls, children have the opportunity to go to schools because 3 primary schools exist at the upstream level. It is thus necessary to build schools where the population will be resettled. At l'Aâzib for example, it will be nice to build these schools at Takassamt, Ighi N'Talghamt, Talaânt Ou Aghroum, Ouaroughad, Azrou El Mal and Amassine. These localizations will permit to have schools next to people.

This will entail synchronising resettlement either with the beginning or end of the school year and to initiate the task of looking for solutions to provide schooling premises in the resettlement sites.

(6) Impact on Gender and Development

It is difficult to assess the impact on gender without taking into account the resettlement schemes that will be adopted. At this stage of the study, two levels of impacts can be distinguished (i) the first is directly linked to the resettlement proper;(ii)the second is related to the construction of the dam. The former will mainly concern women in N'Fifikh and to a lesser extent those in Timkit. Those in Azghar are accustomed to commuting between their two residences. Also a supervision provided to the women in the first two sites would be extremely helpful. This supervision could take place during dam construction. The latter is intimately associated with the agreed -upon resettlement schemes. In case a compensation is made, the impact can only be profitable if women are involved equitably. However, if the compensation is paid to the heads of families directly, then women will only have 6% to represent them. They will, therefore, not take part in the big decisions relating to land compensation. Because of illiteracy, weak mobility and low contact and openness on the external world, women have no power to chalk out their own destiny.

If the resettlement is operated downstream, the production systems will be quite intensive and women will stand a chance to contribute to discharge new tasks

within the farmsteads. These tasks will require new skills and a new know-how to be administered by competent advisers (See supportive measures, downstream part). In addition to the training and information sessions for men and women, the introduction of new technologies to help them to discharge the domestic chores will be very precious. This will be instrumental in making it possible for women to free themselves for the new tasks generated by the new production systems.

For the populations to be resettled at l'Aâzib of Takassamt for example, they should seek water for human and animal consumption in matfias. When water is not available in the matfias, people should cover a distance of 10 kilometers to get water in Ouaroughad or Talaânt Ou Aghroum. When the number of people in households is high and also does the number of animals, this distance should be covered several times each day. As mainly women accomplish this activity, their activities will thus become more difficult than presently. The accomplishment of this task will be made to the detriment of other activities generating incomes. It is thus necessary to establish a water supply plan from the dam for the resident population at l'Aâzib.

As for the minority group of women who will have decided to live in the city, the focus will be made on reproduction activities. The problem, which can resurface for these women, relates to the way they manage their free time. Heightening awareness of women on ways and means to perform new jobs is one of the ways conducive to alleviate this negative impact.

(7) Impact on the Income

All the residents in the flooded areas in Azghar and Timkit will not sustain any damage. Only few families from N'Fifikh who exclusively live on agriculture and stockbreeding could see their incomes reduced. So the resettlement plan will be proposed a solution can resolve this problem.

In Taskourt as mentioned earlier, the resettlement plan is determinant in this business. The populations resettled at l'Aâzib should not exceed a given number to preserve equilibrium between natural resources and the space's occupants (people and animals) and maintain households' incomes at least at their present level. The number of animals per hectare should be reasoned rationally. Otherwise, the risk is too high for these people to become poorer compared to those living at the downstream level.

(8) Impact on Social Stratification

If the resettlement plans and follow-up put forth in the study are strictly observed the impact on social stratification will be insignificant if not nil. This fairness will impact positively on people as most of those who live upstream are poorer than those downstream and this is true for all sites.

(9) Impact on Hillside Next to the Upstream Level

The hillside reforestation will restore the ecological equilibrium of the environment, which is presently highly damaged. This damage occurred by a combination of two main factors: the prolonged drought of the last years and the highly human and animal press ions on the environment by grazing and collecting medicinal plants.

(10) Impact on Natural Resources at l'Aâzib

It is sure that a portion of the population will be resettled at l'Aâzib with risks to be overpopulated. The forest and the pasture are the two privileged places of farmers. The risk is that farmers will deforestation to have larger lands to be farmed. The forest will thus serve the human needs who are willing to extend their farming lands and animals who will be looking for graz to satisfy their nutritional needs. A high risk of affecting the ecological equilibrium exists. To minimize this risk, just a part of the entitled beneficiaries should be resettled at l'Aâzib and other solutions should be found for the remaining population (cf. resettlement plan). Seeking firewood is another damaging factor for forest. Getting people aware of this risk by encouraging them to use butane gas and electricity is a way to contribute in saving the natural resources.

(11) Impact on Women's Health

Presently, people have two hospitals located at Adassil and Sidi Bou Othmane. The mean distances separating them from the villages are respectively of 4 and 6 kilometers. The populations who will be resettled at l'Aâzib for example will be enclosed because the road linking the Aâzib to Mzouda is not suitable for motor vehicles when rain fall. Mzouda is located at 20 Km far from l'Aâzib. The risk on people's health is high, mainly for pregnant women willing to give birth. It is thus necessary to build as a first step a small hospital to take care of urgencies and as a second step, build a road suitable for motor vehicles. Concerning the populations who will be resettled at the downstream level, the dam's impact will be positive on people's health because they will be next to one of the two hospitals located at Mejjat or Mzouda. The situation will be even better for those who will be resettled in big cities.

XVI10.2 Resettlement Plans

Resettlement plan in case of N.W.L 1,020.00m is mentioned below for Taskourt, but finally the N.W.L is lowered to 995.00m in this feasibility study.

XV10.2.1 Current Situation and Future Prospects

Taking into account these incomes, one might be tempted to pose the following questions to see whether the site is endowed with potentialities sufficient enough to meet the local populations needs or is it simply a hosting place? What does the site represent to the populations outside economic aspects? Do they have a historical, cultural or social relation with the site? Would there be any adverse psychological repercussions after the populations are resettled?

If we compare on and off sites populations' incomes, then we notice that whatever site we take for consideration the populations draw more incomes from sources external to the site. In Azghar, for example, 72% of the incomes originate from sources off the site. This rate is 54% and 58% in Timkit and N'Fifikh, respectively. Globally, populations earn more outside the site. Internal revenues are mainly the result of breeding and farming activities in which women play a major role while their husbands are away from home. Nevertheless if we combine the adverse effects caused to the natural resources to eke out a living and the hardship of the chores on women's health, namely rearing animals and the insignificant profits drawn from the sale of these animals, then we are in a position to ask what we mean by sustainable development. In order to elucidate the origins of the extra out site revenues, we present the rate of families having invested money in opportunities outside the site (downstream or elsewhere) as shown on the table below. The location of goods or land property outside the site will certainly influence the perception people make of a subsequent resettlement. The following Table shows also the investment perception with type and spatial location.

Spatial Location of Goods and Property of Eligible Persons in the Flooded Area and Future Outlooks

Site	**With goods out-site dam area (%)**						**Investment perception (%)**					
	Downstream		**Elsewhere**			**AGR**	**Downstream**		**Elsewhere**		**AGR**	
	M	T	M	T	AG	%	M	T	M	T	AG	%
Azghar		34	100	66	Mi	50		34		66	C	25
N'Fifikh	23*	13	13	35	Mo,Mç, C	44	75	75	17	8	Mo,C	17
Timkit	36	64	15	0.08	Mç; Et	76	76	76	86	7	3	31
Taskourt	0	3	36	30	Mo, C,	74	60	30	25	10		25

AGR :Income-generating activities; T : land ; M: house Mi: Military; Mo: Labour; Mç: Masonry; C: Commerce; Et: Abroad ; *Downstream or in Mlila

(1) Timkit

Tamayost's inhabitants originate from Ifegh. They all have a right to the lands of Jemaa Soulalia, located both upstream and downstream. They also have property elsewhere (Table 10). 34% and 64% of residents own homes and property in Ifegh (Timkit). The lands are located either in irrigated or rainfed areas. They have also the right to inherit irrigation water (reaching 66 minutes for some of the families). All the Tamayost inhabitants have a right for 1/6 of upstream collective lands (together with some population segments from Taghya and Irbeben) and the land equivalent downstream for the segment of Timkit. This corroborates the findings of the study, which show that almost all the aged heads of families own either land or a house downstream. Less than 1% of families own property elsewhere. 30% of the families own secondary residences downstream and 15% of them have residences elsewhere. This situation results from the fact that the Tamayost inhabitants come from Ifegh (see social structure in corresponding report). This underlines the interest they devote to downstream areas and explains why they cling to them. In fact, 86% of the families plan to purchase property in Ifegh against only 7% who wish to buy elsewhere.

If 76% of male population currently works outside to supplement their incomes, only 31% of them plan to perform two jobs after the dam is constructed.

(2) Azghar

A former forest, all the eligible residents originate from Bni Souhane's tribe. All of them own land downstream (34%) and homes (66%) and they sometimes practice agriculture.

The incomes obtained from outside the flooded areas are twice as high as those got locally. Some families practise irrigated and rainfed agriculture .We need to recall that during the identification stage only one house was used permanently. The populations to be resettled would want to extend and modernise the farmsteads they already own downstream (34%) or elsewhere (66%). In this case, a customised supervision taking into account the needs and orientations of everyone is needed after compensation. Generally, 25% of the young prefer investing in cities to diversify their incomes or to escape living in rural areas. In Azghar, only the populations with property downstream consider to settle down downstream.

(3) N'Fifikh

Both the attitude and the behavior of the eligible residents located upstream have impeded the application of the approach tremendously. Despite the real desire of

these populations to leave the place as it offers very limited resources to them, they try to show the contrary. In addition to this, very rarely do they mention owning property in the flooded zone or being involved in supplementary activities on top of agriculture. This situation has led us to look for resourceful persons to provide us with supplementary information. The survey shows that 48% of the land area varies from 0.1 to 20 ha .It is mainly rainfed land with tirs soil texture. 23% of the families own a house either downstream, in Melila centre. 13 % own a house in other villages.

In case the dam is constructed, 75% of the people wish to invest and settle downstream. Others plan to expand their current secondary activities, namely, vegetable trading and stockbreeding.

(4) Taskourt

In general, entitled beneficiaries are in favor of the dam's building. The proof is that they signed commitments. This attitude could be explained by the importance of inundation's damages that affected mainly the farming lands and trees. Three historical inundations are graven images in peoples' minds (1967, 1983 et 1999). In 1999 for example, one third of farming lands and trees were destroyed in Talat Ilemti. The second factor, which may explain farmers' attitude, is the fact that they heard frequently about the dam's building. People were thus discouraged to invest in their farms or their habitations. However, it should be noticed that people attach great value to their social and physical environment. They like their farming lands, irrigation water and trees, particularly old olive trees. Olive trees are sacred and constitute a source of happiness but also of conflicts because an olive tree could belong to several inhabitant persons. Despite of this, people are ready to move if they get a fair compensation.

Concerning people's resettlement, the majority (50%) of entitled beneficiaries would like to move to l'Aâzib. This option is dominant because it is reassuring. The entitled beneficiaries have goods and know perfectly this environment. In this environment, they have 145 houses and farming lands varying between 0 and 3.5 ha. However, 25% of the population would like to be resettled at the downstream level or in the big cities. This category is composed of people who were exposed to other experiences and have other activities generating incomes such as trade particularly. For those who would like to be resettled at the downstream level, they wish to buy small farms (3 to 4 ha), the necessary equipment and build a house. The last category of the population (25%) does not already have a clear opinion. In this category, we have people who would like to wait to see the compensation amount and establish then an investment plan, and poor people who are dependent in their living of others.

XVI10.2.2. Social Issues and Resettlement Plans

The findings of the study highlight the following:

(1) Azghar

Resettlement does not pose any problem because the dam site cannot be an appropriate residence socially, economically or culturally. A simple compensation in compliance with Moroccan legal standards is enough .A follow-up will be necessary to conduct with a view to orientating men and women as to the kind of investment they wish to make taking into account their needs.

(2) N'Fifikh

The fact that 75% of the families hope to settle downstream when only 48% currently own plots will necessarily entail looking for public or private lands to resettle them. According to our analysis, the problem will be hard to bear particularly for those who live on agriculture or stock breeding and/ or those who do not receive any family support from outside. 10 families from the site fall within this category. Solutions to the problem of resettlement are possible using SODEA lands downstream. Other possible solutions consist in land sharing among upstream and downstream growers (through sales at the current price) of the large scale farmsteads located downstream. According to some resourceful persons (i.e. the president of the rural commune of Mlila), this is a possibility to consider. This scenario is worth keeping in mind but it will entail involving and negotiating with the downstream beneficiaries before starting any work on the dam.

Whatever the scenario that will be adopted is, the requirement will be to allocate land on family group -basis according to rules and regulations governing the work of co-operatives. Support by the local governments, the provincial departments of agriculture and the rural commune is indispensable. The resettlement process should start earlier to allow family displacement in compliance with the most adapted forms. It would be judicious to start with the families with property elsewhere.

(3) Timkit

Except for some residents who might be tempted to go to the cities to work in masonry, most of the families want to stay and look after their land downstream. They also hope to benefit from the distribution of collective lands (a process halted ten years ago). This willingness on the part of the families to congregate downstream immediately requires the support and presence of the local

governments to avoid conflicts. As for the families who are considering the possibility to settle downstream, it would be sensible to negotiate with the Jmaa Soulalia to transfer (through sale) more land to them than the lot they are entitled to get in the enlargement area. In principle, they are entitled to 1/6. In parallel with the compensation budget, they can buy land to expand their farmstead in such a way as to strike up a balance between the various population segments downstream.

(4) Taskourt

The entitled beneficiaries is a heterogeneous population which could be divided into 4 social categories: (1) Entitled beneficiaries having clear and well identified projects; (2) entitled beneficiaries who will be resettled at l'Aâzib; (3) entitled beneficiaries who don't have clear and identified projects; and (4) entitled beneficiaries having serious difficulties.

Entitled beneficiaries having clear and well-identified projects: This social category is composed of relatively wealthy farmers and contains around 100 households (25% of the total resident population). Besides farming, this category practices other activities generating incomes such as trade's activities. Farmers of this category have a tendency to travel and exchange experiences with other people they meet mainly in the weekly markets. They are ready to pursue the same itinerary by organizing their activities differently. They wish to acquire a farm at the downstream level (few hectares). It is necessary to ensure for them a monitoring and advise to improve their knowledge and skills in modern farming. The technicians of the CT could have a leading role in this matter if they are well trained in modern production and processing techniques.

Entitled beneficiaries who will be resettled at l'Aâzib: They are 120 households in this situation (30% of the total resident population). This number corresponds to those who have already a habitable house and farming lands (a mean of 2 ha) at l'Aâzib. This category could invest in extending its livestock and planting fruit trees and improving the houses' state. As it has been mentioned earlier, the basic infrastructure should be installed (suitable roads for motor vehicles, drinkable water supply, electricity supply, building schools and a hospital). Monitoring and advise should be ensured for those who will be engaged in planting fruit trees.

Entitled beneficiaries who don't have clear and identified projects: This category contains 100 households (25% of the total resident population). For considerations related to natural resources protection and ecological equilibrium, this category should not be resettled at l'Aâzib. 50% of this category should be encouraged to join the first category and the remaining 50% will be resettled at the downstream level on the lands named " mahroum " (cf. 4th category).

Entitled beneficiaries having serious difficulties: They are 90 households in this category and 140 with 50 families from category C). There are the farmers having few production factors (farming land, equipment, livestock,…). A specific solution should be found for this group by affecting to them farming lands at the downstream level. Possibilities exist in the “ mahroum ” lands that belong to the collective “ soulalia ”. They have good soils but uncultivated at this time. They could be cleared. Assuming that a farm size of 5 ha is the viable unit, the lan capital which should be gathered is of 700 ha to satisfy the needs of the 140 entitled beneficiaries (90 add 50 of the third category). The entitled beneficiaries could be organized in cooperatives to have facilities in input supply,…If 3 new villages are born, 3 primary schools, 3 mosques and 3 roads should be built. Among this category, there are 22 families who are considered to be the poorest people among all the groups. Theses families without proprieties represented by young couples (sitting in the parent’s house), poor families, old persons and women alone, heading households and making a small-scale agriculture activities in the submerged area. Strong measure is necessary to maintain familial and social balance to preserve-to-preserve solidarity. A special counter- measure such a moving to old people’s homes should be given to them with careful monitoring during the resettlement.

XVI10.3 Supportive Measures and Monitoring

XVI10.3.1 Supportive Measures

To draw up a supervision and follow-up strategy for each site, programs with a view to sensitizing and orientating people in accordance with the socio-economic and organizational data should be worked out. These programs should focus on involving women in all the resettlement stages. This way they will be prepared to move whatever the selected resettlement scheme is.

To finalize the resettlement plan with all the institutions involved in the central level and local level:

- To validate the final resettlement plan with population, collect all the reactions, if there are, and beginning on the dialogue

- To establish a strategy for monitoring and assess the socio-economic spin-offs of the investment projects and to highlight the training needs and the institutions responsible for such training.

- To draw up a program to reintegrate and to accommodate school children and see to it that there are no dropouts.

- To ensure equity of chances between genders in terms of fair access to resettlement benefits.

- To set up an institutional network with a view to ensure follow up and to facilitate resettlement (i.e. the ministries of interior, equipment, agriculture, health, education, the CR, ONEP and ONE, local governments, traditional organizations and resourceful persons).

- To ensure coherence of the whole set of actions, a co-ordination committee at the central and local levels must be set up for each site. These committees will be called upon to co-ordinate all the operations and will ensure follow-up of the resettlement and integration process of the populations in their new environment.

XVI10.3.2 Monitoring

A multidisciplinary and institutional team including men and women and different specialist matters will ensure the monitoring function. People of this group should be available to be able to act at the appropriate time. Depending on the problems to be solved, a specialist may act alone or with other team members. The monitoring concerns the different steps of the project; before, during and after the dam's building. The monitoring should be intensive during the first and second steps and according to needs during the third step because the entitled beneficiaries will be autonomous to some extent.

XVI10.4 Budget

The budget's evaluation is very approximate because the limited submerged area is not yet fixed when this study done. The earning shortage was evaluated by overestimating the present households' incomes by 20%.

- Azghar: 6,351 x 10^3 DH
- N'Fifikh: 4,109 x 10^3 DH
- Timkit: 7,992 x 10^3 DH
- Taskourt: 35,700 x 10^3 DH

XVI10.5 Fundamental Strategy of the Resettlement Plan

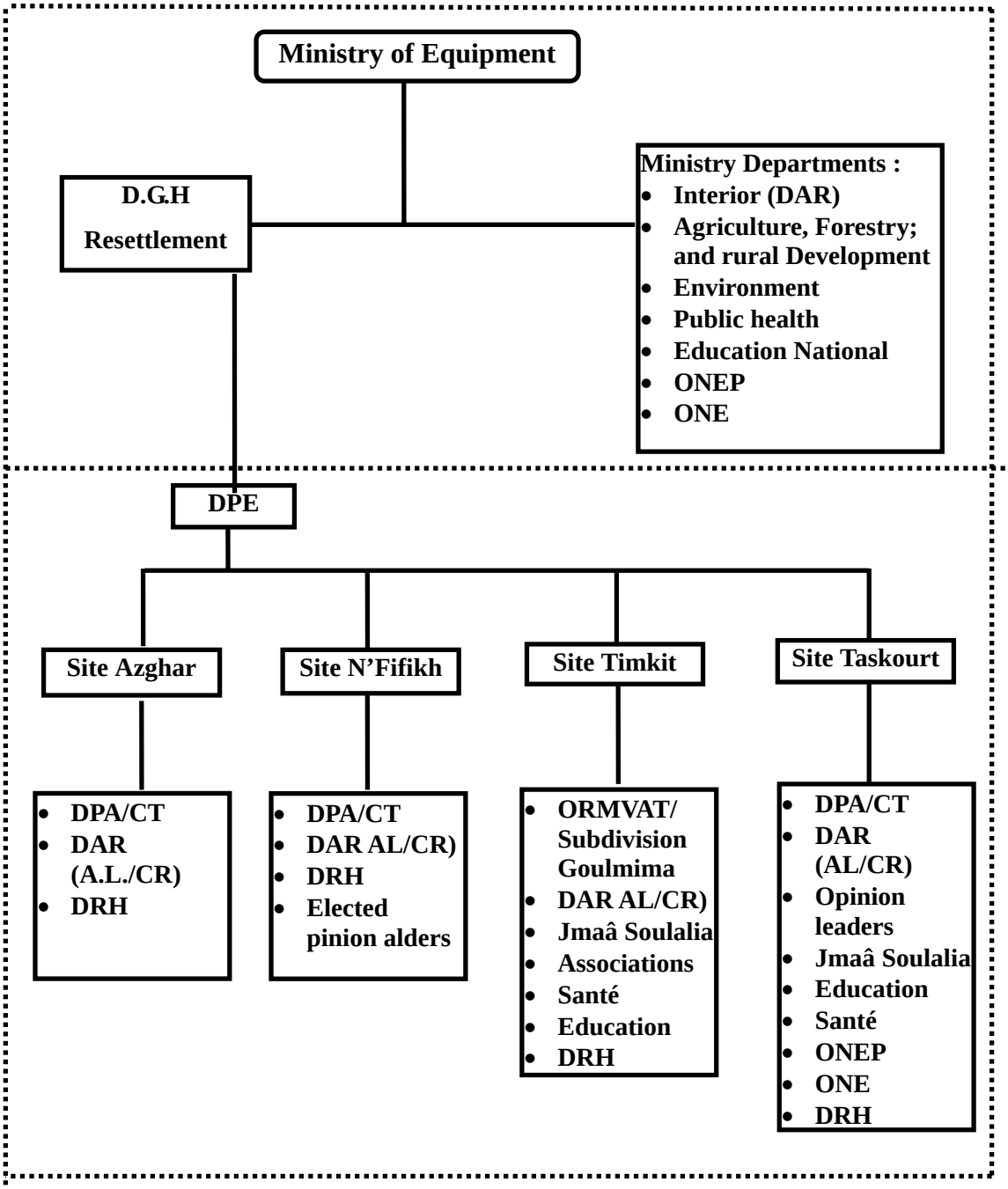
In each site, the resettlement of the population would be adapted specific strategy when the plans were validate by the different institution involved in the processes (see Institutional Unit of social management) and finalized with people with DRA (demand responsive approach) modified to dam project.

The accompaniment measures below are necessary during the implemented phase to minimize the negative impact and respect the resettlement plan application. Some of them are presented in the supporting report.

For implementation of the resettlement plan and the supportive measures, the installation of an institutional unit would be indispensable. A simplified diagram for this unit installation is presented following:

So, all the activities should be implemented by a multi - disciplinary and multi – institutional team (figure below). The leading institution is the Ministry of Equipment, which is represented at the central level by the DGH. The DGH will ensure the co - ordination of the different Ministry Departments (Interior, Agriculture, Environment, Health, Education, ONEP and ONE). At the local and regional level, the co – ordination is ensured by the DPE and the team is composed by the DPA/CT, the DAR (AL/CR), the traditional organizations jmaâ soulalia and influential persons, the ministries' representatives of Health and Education, the ONEP, the ONE and the DRH. To maximize its efficiency, this team should have the necessary logistical means and autonomy in action to be able to take appropriate decisions at the appropriate time.

Institutional Unit of social management



XVI11 Downstream Part

XVI11.1 Administrative and Infrastructure Framework

In the Table below we present the administrative affiliations of the villages in each site. It is important to underline the fact that when the study was launched the exact limits of each perimeter were not well- defined yet. We took great care to work only in the areas susceptible to be incorporated in the district. This was done with the intention not to give high hopes to the populations about later integration into the scheme.

Administrative Breakdown of Surveyed Irrigated Parts

Site	Province	Circle	Caïdat	Commune	Douar
Azghar	Sefrou	Ribat Al Khaïr	Ribat Al Khaïr	Ighzrane	Bni Lchaâ, Taghza, Nass Daoud, Nass Saïd et Tichou Tamallalt
				Od M'koudou	Mghila
				Ribat Al Khaïr*	Zitouna
N'Fifkh	Ben Slimane	Ben Slimane	Fdalate	Od Yahia Louta	Bni Karzaz et Biad
			Ziaïda	Mouline Ghaba	Od Tarfaya
				Tlat Ziaïda	Mssaâda
		Bouznika	Bni Yakhlef	Mansouria	Bni Rached
					Bni Makraz
Timkit	Goulmima			Aghbalou Akerdas	Timkit, Izoukalen, Irbiben, Taghya
				High Farkla	Ait Hamou, Ait Bzem, Ait Boutekhsiam, Tamardout, Ait Erah, Ait Aissa, Ait Bouhadou, Sidi Yahya (Kmach), Ait Assem, Numéro, Ait Bennacer, Set, El Kherbates, Amllal, Azyghmouchen, Bour*, Taghya, Ait Derouich, Imelouane, Ait Saïd, Ihendar, Toughach, Ait M'hammed
				Low Farkla	Zaouia, Ait Maâmar Lkdim, Tallalt, Tayrza, Tighfart, Ktaâ Elouad, Ait Ba Omar, Jdida, Ksiba, Dar Amira, Ait Ourgham, Kettarat Laytama, Isilf (Ksar), Ait My mamoun, Ait Ba Maâti, Tizzogharine
				Tinjdad**	Gardmite, Ait Maâmar Jdide, Tighdouine, Tinjdad Centre
Taskourt ***	Chichaoua	Mejjat	S. B. Ottman	Assif El Mal	Tafroukht, dar Akimakh et dar Nams
			Mejjat	Guemassa	Azib Miloud
				Mejjat	Lahrarcha
			Mzouda	Mzouda	Tiguammi N'Oumghar, Ait Hssain, et Ait M'hand.

* * Urban municipality * Non concerned at that date,

*** included 127 villages, represented only those involved in the intensive study.

Timkit included 3 schemes: Ifegh, Tinjdad and Chitam. Timkit. The filed work is limited at two first schemes. Indeed, to the date of the survey the availability as water to be sufficient the 3 perimeters was not even known, then we preferred to avoid to let waiting at the population. Nevertheless, numerous families inhabiting Tinjdad incline land to Chitam.

XVI11.2 Human Environment: Demography and Social Structure

XVI11.2.1. Population

(1) N'Fifikh

In this location, our sampling has concerned 6 villages belonging to 4 different rural communes. The last belong to two different administrative caidats: Fdalate and Beni Yakhlef and to the circles of Ben Slimane and Bouznika. The villages total population is 4,360 distributed over 645 families and 1,040 households. The average size of the households is 4 persons per household according to the group survey and 5 according to the household survey as shown in the following Table. Therefore, average households size is 5 per household. There are 49 women who are heads of families (5%). Also average grower age is 57. They are relatively old growers. The schooling rate is high among boys and girls. This is due to the proximity of large urban centers, school availability also junior high school within reasonable distance from the villages. The literacy rate among men is average (55%)to low among women (24%).

Demographic Characteristics of the Four Sites

Site	Families No.	Household No	Population	FCM (%)	Schooling rates		Literacy rates	
					Boys	Girls	Men	Women
Azghar	576	873	6,076	6	88	78	44	9
N'Fifikh	645	1,040	4,360	5	96	89	55	24
Timkit*	2135	3,199	17,559	6	81	76	47	10
Taskourt	909	1,230	5,908	6	78	65	21	3

(FCM)Women heads of households; populations benefiting directly from the dam
*: all the beneficiaries directly or indirectly are recorded

(2) Azghar

At present, there are 6,076 inhabitants in the 7 villages of which the Azghar downstream site is made distributed over 576 families and 873 households Average size of households is 7 and the household survey confirms this. The population breakdown is 43% women and 57% men. According to the same survey, growers ' average age is 60. 45 women are heads of families. They, therefore, represent 6% of the households, lower than the 16% national average (CRED 1994). The schooling rate is high both for boys (88%) and girls (78%). This is due to the proximity of schools to the villages.

The literacy rate is relatively average for males (44%) and very low for females (9%). This clearly shows why women have claimed to get more literacy programs for them.

(3) Timkit

In Timkit, the situation is slightly different from the other sites. In fact, the dam will be beneficial in that it will store runoff waters but it will also permit to recharge the wells and the khettaras through infiltration. In this study, a particular interest was paid to the direct beneficiaries. 24 villages were computed but our study only concerned a sample of 19 douars (villages). 4 belong to the rural commune of Aghbalou Akardous, 11 to the rural commune of High Ferkla and 4 to Low Ferkla and 4 to the municipality of Tinjdad. These ksours represent the localities of Ifigh, Tinjdad and Chtam.

The total number of the villages population concerned by surface water is 17,559 inhabitants distributed over 2,135 families and 3,199 households. Average size of the household is 5 persons per household. The percentage of women who are heads of families is 6%. On the other hand, the population that will directly or indirectly benefit is 59,697 spreads over 4,505 families and 10,189 households. 263 households are run and managed by females. This rate is very low compared to the national rate.

The schooling rate is also high among boys and girls. On average, it reaches 81% for boys and 76% for girls. In fact,all the villages have a school.

The literacy rate is almost average for males (47%) and low for females (10%).

(4) Taskourt

Regarding the villages concerned by the irrigation network, they are 127 composed by 7,851 families and 10,468 households. The total estimated population is made of 51,032 people. The villages break down as follows: 42% belong to Mzouda, 24% to Guemmassa, 17.5% to Mejjat and 16.5% to Assif El Mal. A sample of 8 villages was selected for detail study (cf. § Methodology).

As noticed earlier, the total population of the 127 villages is estimated to 51,032 people. The 8 selected villages for this study belong to the communes rural of Assif El Mal (villages of Tafroukht, Dar Akimakh and Dar Nams), Guemmassa (village of Azib Miloud), Mejjat (village of Lahrarcha) and Mzouda (villages of Tiguammi N’Oumghar, Ait Hssaine and Ait M’hand). The total population for these villages is of 5,908 people. The average number of people in each family is 6.5 and is of 4.8 in each household. 6% of women are heads of households.

The instructional rates are relatively high in the studied villages. They are of 78% for boys and 65% for girls. This situation could be partially explained by the schools' availability which are located at an average distance of 0.4 Km. Concerning the literacy rates, they are very low and their values are respectively of 21% and 3% for men and women.

(5) Migratory Movements

In Taskourt dounstream, the migratory movements concern mainly the men's temporarily emigration. 50% of active men's population are concerned with emigration. They go to big cities where they stay and work for two to three months. They work in bakeries, cafes, public bathrooms (hammam),…4% only of women are concerned by emigration. They go to big cities to work as house keepers, employees in restaurants or cafes, …The main reason of people's emigration is the lack of employment in their own villages accentuated by the severe drought of the last few years.

In the others sites, the population are situation is similar but with a n important number of families emigrated to Europe. In Tinjdad more than 2/3 adult men work out site the area. In Azghar, the men's population are concerned with emigration worked specially in the military. But the area is still poor.

XVI11.2.2 Women's Condition and Place in Society

(1) Current Situation

Participation of Women in the Implementation and in the Decision-Making Process of Various Types of Activities

Site	Production activities (%)		Reproduction activities (%)		Community-based activities	
	Implementation	Decision-making	Implementation	Decision-making	Implementation	Decision-making
Azghar	64	20	100	50	0	0
N'Fifikh	20	0	100	60	0	0
Timkit	65(45)	14	100	50	0	0
Taskourt	40	40	90	60	0	0

(45) questionnaire survey

i. Timkit

A distinction must be made between the women of Ifegh, a landlocked locality close to the dam and those of Tinghir. Tinghir has a better infrastructure than Ifegh. From this we can distinguish two women groups with different conditions and different perceptions.

The condition of women in Ifegh is not quite different from that existing upstream, except for the schooling and literacy levels that are slightly different. We will not return to what has been said about upstream localities once again. However, for the Tinjdad women in particular, it is important to underline the mutations brought about by the drought and the emergence of new categories of women. In fact, thirty years ago, the women's share in agricultural production was 50% and 80% in animal production This resulted in a 65% global participation of women. Nowadays, the males' absence has yielded a greater involvement of women in farming production activities. Despite this increase, time devoted to this activity has generally decreased .In addition, since production activities are no longer limited to agriculture; women's participation has also decreased (45%). This is confirmed by the data yielded by the household survey. Except for an insignificant number of animals tended by old peasants, the agricultural activity has become a sporadic one occurring only during flood periods .The absence of males is an indicator of the absence of agriculture. This has forced women to perform tasks that formerly used to be men's tasks (tillage and irrigation). The findings of the household survey show that women participate for 14% in the decision-making process in matters relating to production. These same data underline the take-over of reproduction activities by women with an equitable share in the decision-making process concerning the implementation of the activities.

ii. Azghar and N'Fifikh

In both sites women play a basic role in family economy. They responsible for number of tasks inside and outside their houses. She is first and foremost a mother with all its concomitant responsibilities. In addition to raising children, preparing and preserving foods, on average she also participates for 64% in production activities. It is mainly her involvement in agriculture in her capacity as a family helper or a seasonal labourer that is worth underlining. Women play a tremendous role in agriculture. Some tasks are specific to women. They include olive picking, legume tending and collecting and harvesting cereals especially when soil work has been done traditionally.

In N'Fifikh, the scene is quite different. Women's involvement in production activities is limited compared to Azghar They participate for almost 20% in production, particularly in legume cropping as labourers. They have also got their share of animal breeding especially inside the homes.

As for reproduction activities, they are performed almost 100% by women in Azghar. Men's involvement in this activity is very limited. Women are responsible for collecting wood especially in winter. Fetching water is another

additional chore for women, in the villages that are not connected yet to the water network. As for N'Fifikh, women are less involved in reproduction, with an average value of 42% according to the household survey. In fact, men and women collect wood for fuel on an equal basis. But women's involvement in water supply is incumbent on the spatial location of the water intake points . When these are distant, women's involvement in the transport of water is limited to 5% on average .In this case, only single- household women and those who are elderly shoulder this responsibility together with men.

In addition to the usual activities of agriculture and housework, women in Azghar practise some handicraft activities, such as weaving djellabas (hoods), making wool carpets and blankets. However, the marketing of these products is limited to the local markets, in addition to the existence of a small scale income –generating stock breeding, such as poultry and rabbit rearing .

iii. Taskourt

The woman's contribution in implementing the production activities is high. Her contribution varies from 30 to 50%. She contributes in carrying out several activities such as manual cereals' harvesting, almonds and olives harvesting, livestock management,…etc. Regarding the decision process, she is involved and contributes up to 50% and her involvement varies between 30 and 50%.

In the other hand, women complete most of the reproduction activities. Their contribution level is located between 80 and 100%. In the decision process, their involvement varies from 40 to 80%. It is high when women are heads of households

(2) Scope Inside the Family and Community Cell

i. Azghar

Women participate for 50% in decision -making except for decisions related to the choice of productions. In fact, a form of dialogue exists between men and women but the men have the final say.

Unlike some other regions in Morocco, women go to the market. They are the ones who generally make the weekly errands from the souk. They also have their own incomes.

As to community-based matters, women are indirectly involved in community decisions because of the weight they have inside their families. On the other hand, family ties are very strong in most of the villages, which make it possible for women to indirectly consolidate their participation.

ii. N’Fifikh

However, women’s involvement in decision -making is insignificant (6% on average). There is sometimes some form of concentration between men and women but men again have the final say. Except for women laborers, the rest have an insignificant income. Despite their openness on the external world and their level of instruction, women from N’Fifikh are less involved in decision-making; therefore, they have a weak scope within their community. However, they have their own feminine organisation at community-based and grassroot levels. It is mainly a traditional Jmaa with a moquadema. This one is the equivalent of a judge. She settles disputes among women and provides them with advice when needed. She also organises women’s gatherings during feasts or funerals. From time to time, women give her some money as a compensation for services provided.

iii. Timkit

Men’s migration and the development of other men’s crafts have led to an evolution in the socio-economic space yielding new women categories depending on jobs offered. This has prompted the emergence of new women categories based essentially on the social and economic status of the husbands. In most cases we find the following:

- Spouses of big traders, expatriate workers or civil servants (15%);
- Spouses of local manual laborers (bricklayers), small-scale traders and civil servants (15%);
- Spouses of the workers based in other areas of Morocco 65%);
- Widows without resources (5%).

If a typology based on agricultural activities cannot be made for women as is the case in other rural places in Morocco, it only means that this activity has become insignificant for them. Furthermore, the work timetable of the women in Tinjdad is not overloaded for the reasons we referred to earlier and also because of the presence of many women per family (3 on average).

Because of this situation most of young women from the qsours are now attending the feminine club, to learn clothe making and handicraft skills. Whatever category women belong to, they are responsible for children, the elderly and the housework.

The women's mobility has also evolved. If in the past this mobility was strictly limited to the qsar and the feddan, now all women without any distinction go to the weekly market and 70% of them are able to visit Tinjdad without male escort for handling various matters. Women have almost replaced their husbands in the management of family affairs. This acquired responsibility subsequent to the migration of males and combined with the effects of the satellite dish thanks to electrification has contributed to heighten females' awareness about their present condition. This awareness has impacted positively on the schooling of girls. In the different qsours of Tinjdad,the rate of schooling of girls is almost similar to that of boys in primary schools and in junior high schools. However the number of girls in senior high schools and in university is still low.

iv. Taskourt

Regarding the women's contribution in implementing the community activities, it is very low and so is the case for their involvement in the decision process.

Women have difficulties to implement their activities. These difficulties are related to deficiencies in the sources generating incomes caused by the drought of the last years. The deficiency in irrigation water remains thus the main difficulty for this category of the population.

(3) Access to Social Services

i. Timkit

Women's access to the services, particularly those from Tinjdad are made easy by the proximity of the center. On average, they are less than two kilometers distant from junior high school, senior high school and from the dispensary. Yet, medical doctors are visited only when someone contracts a disease.

ii. Azghar

Access by women to the social services is not a problem. In fact, 86% of the villages are less than 5 km away from the nearest urban center equipped with all the necessary facilities. However, accessibility cannot be measured by distance. A number of parameters related to both the institution or the population can have an impact on it .If we look at the dispensary, the study shows that 71% of the villages are less than 2 km away from it. Cars are frequently used as a means of transportation (50% on average). Some others use animals or go on foot. For those who go on foot, it takes them between 16 to 41 minutes to cover the distance. Regarding medical examinations, 75% of the villages surveyed go to the dispensary from time to time but at low frequencies the year round (4 to 6

times a year) .We can say that despite the closeness of the dispensary and despite the ease of access to it, people in the whole of the villages very rarely go to the medical center. Therefore, a campaign needs to be waged with a view to sensitizing people on health issues and encouraging them to go there regularly. On the other hand campaigns organized by the ministry of health need to be staged quite often in the rural world.

iii. N'Fifikh

The fact that dwellings are so scattered does not help the douars to have a proximity infrastructure except for El Mansouria and Lamsaada villages affiliated with the rural commune of Tlat Ziaida. Other douars in the valley of N'Fifikh make use of the facilities in the city of Ben Slimane. Schools alone are available in these douars and women, on average, cover a distance of 5 km to go to the nearest dispensary.

iv. Taskourt

The access by women to the social services is not easy. There is only one sanitation center located in Majate.

XVI11.2.3 The Social Organization

(1) Timkit

The current situation of social organization seems complex and hard to understand as it encompasses all the recent changes and evolutions. This evolution reflects the history and civilization of the site. In this site, social organization is still very vivid although it has been stripped of some of its functions. The following will explain the meaning attached to traditional social organization as is met in Timkit and the end use we can make of in case populations are resettled. In fact, all the spaces, i.e. qsar agricultural land, grazing and infertile lands form the basis of a true social and economic organization (called machyakhat Ifegh). Common interests shown by other ksours make it possible for this unit to integrate a larger unit level. The most significant example is the irrigation community. This is true for both downstream and upstream areas. Every unit has its Jmaa and does not avoid the implications of hierarchy and social stratification. The Jmaa is made up of heads of families or people from influent lineage and is headed by a cheikh. In turn, this one designates his aids to form a so-called " administration" to run the space and the community life in the organisation unit. The Jmaa settles the conflicts among people, looks after its relations with other communities and monitors collective actions, such as irrigation and fixation of agricultural calendar (e.g.

date harvesting). It grants land plots for extending dwellings, etc. On the other hand, it appoints " community-based employees ", such as the waterman, the koranic teacher and a guard for the farming plots. Despite the birth of formal associations run by dahir 58 (water supply and electrification associations), the Jmaa still plays a vital role .Its role in helping to resettle the Timkit populations will be decisive, especially if we examine the land status and its sharing among segments of populations upstream and downstream This organisation is not available in the other sites. For a better illustration, the appendix contains the family tree of the machyakha of Ifigh, which shows the family ties populations have upstream or downstream. The same chart shows how for century's population segments in Ifigh have shared water resources, land and pastures upstream and downstream. Despite all this, the work of this conventional or formal organisation is still limited to the management of social infrastructure and collective resources. Support and supervision are required to turn it into a professional organization. In fact, the few attempts to set up farming co-operatives have ended up in failure.

(2) Azghar and N'Fifikh

The organisations, which are still operational, are those entrusted with the management of the mosque. In N'Fifikh, an irrigation water association and some systems for fresh water supply do exist but they are not operational.

The creation of an irrigation district will certainly require supervision in community-based and professional organization matters. This supervision should start as soon as possible for the organizations to be functional to participate in the district development, even before launching irrigation work.

(3) Taskourt

The rural society at the downstream level is very well structured. The local population manages all the collective goods. The management of coranic schools and mosques, collective lands and irrigation water are revealing indicators of how well people are informally organized. These informal organizations have credibility among people and should be considered as a lever when implementing the resettlement plan.

The most important formal (institutional) organizations at the downstream level are the six milk cooperatives. 4 of them are located in the communes rural of Guemmassa and Assif El Mal (two in each commune rural) and two are included in the rural communes of Mejjat and Mzouda (one in each commune). The milk cooperatives are functioning relatively well because they meet a real farmers' needs which is the milk selling. This need couldn't be achieved individually.

The second type of formal organizations is the Irrigation Water Users' Associations (AUEA). They are three and were established from 1996. They sought to participate in the irrigation network management. They were created on the basis of existing traditional organizations mentioned earlier. The prolonged drought during last years didn't allow a normal functioning of these organizations. Their efficiency could not be evaluated at this time. It should be mentioned that two input supply groups were created in Assif El Mal and Adassil which are not functioning now because of farms' financial capacities which are very limited. In the PAGER program, new associations have been created lately and others will be created in the next future. The association created in 1998 in the village of Ait Hssaine is an example.

XVI11.3 Social and Economic Infrastructure

XVI11.3.1 Timkit

Downstream, the basic infrastructure is relatively important.

(1) Dwellings

100% of the douars are grouped together. They are mainly ancient qsours whose dwellings have been divided. Some of them are still partially inhabited. In addition, constructions built using local materials are the most frequent (84% on average). Concrete constructions form around 13%. Remainder is of mixed type.

(2) Access

More than 3/4 of the douars are close to a surfaced road (from 0 to 2km). However the downstream Ifegh douars are very landlocked (34 km of road).

(3) Fresh Water Supply and Mode of Supply

More than 2/3 of the studied douars are supplied with water either through ONEP, or through associations in the framework of PAGER. 1/3 of the villages is on the agenda for a future connection to the water system. Tinjdad is supplied by ONEP and Ifegh by a user association. The water intake points used as well as the supply mode and management are detailed in the report on sites.

(4) Electrification

100% of the douars are either electrified or scheduled for electrification. Generators are used to feed the douars with electricity and in Ifegh the plans are to equip the village with such generators. In downstream Ifegh, associations use a generator to provide electricity to people.

(5) School Infrastructure

100% of douars have a primary school. Sometimes one school is commonly used by 2 or 3 neighbouring qsours. Junior and senior high schools are in Tinjdad.

(6) Health Infrastructure

Only Ifegh and Tinjdad have a dispensary. Other douars are 0.5 to 3 km away from the dispensary. Despite this proximity, health centres are either under equipped or not equipped at all. Furthermore, in the institutional analysis, populations make a clear distinction between staff and infrastructure. As to medical check-ups, patients pay a visit to the health centre only in case of serious trouble.

(7) Religious and Cult Infrastructure

There is a mosque in each qsar. Some qsours pool their resources to collectively run a mosque for the Friday prayers.

(8) Economic Infrastructure

24% of the villages have to cover a distance of approximately 34 km to come to the weekly market. This is mainly the case of the villages in downstream Ifegh. The rest of the villages are located 0.5 to 6 km from the souk.

XVI11.3.2 Azghar

(1) Dwellings

All the villages are grouped except for the Mghila douar. The analysis of the nature of the dwellings shows that the constructions built in concrete are the most frequent (67%on average). Those made of local or mixed materials are about 17% and 196%, respectively.

(2) Access

All the villages are accessible easily except the Mghila douar, 7 km from the surfaced road.

(3) Water Supply and Mode of Supply

43% of the downstream villages have internal house connections, 14% are being connected and connections are scheduled for 43% in the future.

(4) Electrification

57% of the villages are scheduled for electrification, 29% are connected and 14% are in the process of being connected. Therefore, for any future connection to the grid, the villages located downstream of the flooded area, which the study did not cover, must be targeted.

(5) School Infrastructure

86% of the villages are less than 2 km away from school.

(6) Health Infrastructure

71% of the villages are less than 2 km away from a dispensary.

(7) Religious and Cult Infrastructure

Every douar has its own mosque except for Nass Said village which does not.

(8) Trade Area

Sales and purchases take place in the weekly market of Ribat El Kheir. The local populations have to cover a distance varying between 4 and 15 km to reach the market.

(9) Economic Infrastructure

The economic infrastructure is relatively important compared to other places in Morocco. On average, 57% of the villages have at least 3 and a maximum of 5 shops, which reflects a correct purchasing power. Furthermore, the study has revealed that each douar has, on average, 2 grain-crushing mills. Similarly, 43% of the douars have,on average, 9 olive oil factories,with a maximum of 16 factories in Mghila. The considerable number of oil plants reflects the importance of oil production in the area.

XVI11.3.3 N’Fifikh

(1) Dwellings

50% of the studied villages are split and 30% are scattered. Msaada is the only grouped douar. Analysis of the nature of dwellings show that the concrete constructions are the most predominant (88% on average). However, the constructions built with mixed or local materials are scarce and their number is almost equal (6% on average).

Access: it has been difficult to assess the problem of landlocked villages since dwellings are so scattered, but in general, villages close to the main road or tracks are very often well-fitted out.

(2) Water Supply and Mode of Supply

1/3 of the villages is connected to the system,1/3 is not and 1/3 is scheduled for connection.(see site report).

(3) Electrification

33% of the villages get electricity and 67% are for a future connection.

(4) Health Infrastructure

50% of the villages have a dispensary available and in the other 50% people have to cover distances varying between 7 and 15 km to reach a dispensary located in Tlat Zyaida or in Ben Slimane.

(5) School Infrastructure

2/3 of the villages have a school and 1/3 are located 0.1 to 3 km away from school.

(6) Trade Area

The populations have to cover relatively important distances to buy things from the weekly market.

(7) Religious and Cult Infrastructure

Almost every village has its own mosque except for the Beni Rachad and the Beni Makraz villages which have four.

(8) Economic Infrastructure

50% of the villages have one shop and a maximum of 21 in Beni Rachad village. Furthermore, 50% of the villages have a grain mill, with a maximum of 3 in Lamsaada village.33% have an oil factory.

(9) Cultural and Tourist Infrastructure

Mansouria has a youth hostel, a hotel and a beach in the Beni Makraz village.

Taking account of this summary, we notice that in the downstream areas the social infrastructure is either sufficiently developed or in the process of being developed. At this level, improvements should bring to bear on increasing women's access opportunities and service quality. On the other hand, the economic infrastructure does not exist. Incentives in the farming and agri-business sectors are necessary in order to upgrade the dam investment.

XVI11.3.4 Taskourt

(1) Social Infrastructure

According to the data collected from the local authority, among the 127 concerned villages, 31 are already equipped with electricity and the remaining villages are planned for the next six years. We should in fact distinguish two groups of villages: (1) the villages located between Taskourt and Sidi Bou Othmane, or intermediate villages between the upstream and the downstream and (2) the villages located at the downstream level. The first category could be better supplied by the power station that will be set next to the dam. For the second category, a connexion to the ONE system seems to be more appropriate.

Regarding water for domestic use (cf. § water resources and their use), 21 villages have drinking fountains. In two of these villages (village of Zaouia at Mejjat and Taskourt at Assif El Mal), people are individually connected to drinking water supply. 3 projects are running to install drinking fountains in the village of Azib Ait Abdallah at Guemmassa and in Tigurares and Taloutimt at Assif El mal. Presently, the populations are generally not satisfied about the drinking water supply. They argue this opinion by water deficiencies, mainly during the drought seasons, which was the case for the last 4 years. It would be desirable if people are connected to the ONEP system. Concerning the created villages after resettlement, it will depend on which scenario is privileged in the resettlement plan (cf. resettlement plan).

Concerning the 8 villages deeply studied, all of them have roads suitable for motor vehicles and are located next to a national road linking Mzouda and Mejjat. The fairest village from the national road is at a distance of 2 Km. 4 villages over 8 have already electricity and the remaining are planned for the next years. The drinking water supply is available in just one village (Dar Nams), planned in three others and is lacking in 4. Except the village of Aazib Miloud, primary schools exist in all other villages.

(2) Economic Infrastructure

The main economic infrastructures in the studied villages are as follows:

- 35 small groceries;

- 6 mills ;
- 28 oil works;
- One collective bathroom (hammam) ;
- 5 bakers' ovens ;
- Two cafes.

Besides these economic infrastructure, people make transactions in the weekly markets located at Mejjat (Sunday's market), Mzouda (Saturday's market), Guemmassa (wensday's market), and Assif El Mal (wensday's market). The studied villages are located at distances varying between 0.5 and 13 Km from the weelkly markets.

(3) Religious Infrastructure

In the 8 studied villages, religious infrastructure is limited to 10 mosques, 3 zaouias and 2 marabouts. It should be noticed the lack of tourist infrastructure.

XVI11.4 Physical and Natural Potentialities

XVI11.4.1. Water Resources and Their Management

(1) Water Resources

i. Timkit

In Tinjdad, underground water is the only resource available. But due to the depletion of the water table through intensive pumping and the succession of drought periods not permitting its recharge, this poses a big ecological problem and therefore is a hurdle standing in the way of the economic development of the area. Below, we present the various types of water intake points,their state and their use.

a) The Khettaras

They are used to irrigate crops, to water animals and to supply water in case homes are not connected. The number of khetaras for all the communes in the two areas is 25 (see basic report on Timkit). They are also used to supply douars through seguia or aqueduct.

b) The Wells

Due to the overexploitation of the water table and the ecological problems caused to the date palm groves, the populations are reluctant to declare the

number of wells they use. We were able to notice contradictions in the statements made during the group interviews, the resource persons and in the household surveys. We only recorded the results yielded by the group interviews and the resource persons. We have computed a total of 921 wells, with a maximum of 356 wells in the municipality of Tinjdad, followed by High Ferkla with 411 (See basic report of Timkit). Generally, these wells dry up quickly and are functional only during the rainy season. To date (October 2000 beginning of the survey), only 10% of the wells are partially functional. Pumping duration varies from 15 to a maximum of 60 minutes. Water is mainly used to irrigate some micro plots. The water table drawdown is estimated by growers to be 2 meters. To meet plant and domestic requirements, growers continue to dig galleries with the hope to increase the well retention volume. Some growers have even resorted to setting up a co-operative to dig wells exceeding 120 meters. But the results have been far from encouraging .At present, growers are tired and there is a general disinterest. Most of them have sold their motor pumps and changed jobs. But the nostalgia to practise agriculture in the best possible conditions is still very vivid.

ii. Azghar

The water resources of the villages (Bni Lachaa,Nass Said and Tichout Tamallalt) depend extensively on the Zloul river, with wells and natural springs located along the same river.

Wells average depth is 15 meters. Water from the wells and the springs is mainly for human consumption and other uses. According to the populations, water is of a good quality except for Tichout Tamallalt.

iii. N'Fifikh

Water resources mainly come from wells and springs. The number of wells availabe in the villages of N'Fifikh and Mansouria amounts to almost 1029 of which 11 are collective wells. Depth varies depending on the topography of the village. It reaches 10 m in areas close to the N'Fifikh River and between 30 and 60 m in remote places. There are 10 natural springs.

(2) Water Resources Management

i. Taskourt

The main sources of irrigation water and domestic use are natural sources, canalizations (seguias), inundation, matfias and wells. The total number of wells is 573 where 44% are located at Guemmassa, 36,5% at Mejjat and the remaining

19,5% at Mzouda and Assif El Mal. The equipped wells with motor pumps are 142 (25% of the total number of wells). The total number of natural sources is 75 where 80% are located at Assif El Mal and Mzouda. The water quality is well appreciated (fresh water), but deficient because of the drought of the last years. The total number of matfias is 3 449 where 70% are located at Mzouda and 12% at Assif El Mal and the remaining 18% at Guemmassa and Mejjat. These matfias are supplied by seguias which themselves are supplied with inundations and natural permanent sources.

Regarding specific data related to water supply, they were gathered among the 8 studied villages and showed that:

Water transportation is done manually in 53% of cases where animals are used in 47% of cases. Manual transportation is used when supply sources are close to habitations, for example matfias located inside the houses;

Seeking water is accomplished in 64% of the cases by women, followed by children (28%) and then by men (9%);

The time allowed to seeking water varies between 15 and 60 minutes depending on how far is the supply water source and the household and livestock sizes.

The seguias' network driven from the river of Assif El Mal is traditional and is composed of 18 seguias which could be categorized in three kinds : (1) The permanent seguias corresponding to Taslimant, Taourdast, Igouramne and Tazerdakht ; (2) The seasonal seguias gathering Targa Ouguallid, Tamatoust, Choueihiya, Afroukh, Asfoul, Jdida, Laaouar, Tafchtalt, Tadraouit and Oulad Aissa ; and (3) The seguias which drain only inundation's water corresponding to Ait Bella, Bourekba, El Hararcha and Sbaït. The seguias' network allows to have perimeters with permanent irrigation water and perimeters with seasonal irrigation water where irrigation could be practiced 6 to 8 months a year, mainly in winter season, but with no irrigation water in summer time and finally perimeters with inundation irrigation water and irrigated by spreading irrigation water with a high variability (annual and inter – annual) in the irrigated farming lands.

The seguias are dependent and interfere with each other. One seguia could feed another by the game of connection in series. The existing water in Taslimant (a seguia at the upstream level in the seguias' network) may reach Laaouar (far away from Taslimant). During summer time, the farmers located at Mzouda rent the irrigation water from farmers located at Mejat with small farms and low soil quality. At Mzouda also, the farmers who are far from the seguias' network (irrigation water will make a lot of time to achieve their farms, 4 hours up to Ait

Hssaine) rent their irrigation water to other farmers located next to the network. There are periods (summer time) where one hour of irrigation water could be rented at 1,000 DH. The rented irrigation water is generally used to save crops for market (watermelon, melon, …etc). Some type of formal organizations is the Irrigation Water Users' Associations (AUEA or AWUA) exist but the water management is doing by the traditional association.. They are three and were established from 1996.

They sought to participate in the irrigation network management. They were created on the basis of existing traditional organizations mentioned earlier. The prolonged drought during last years didn't allow a normal functioning of these organizations. Their efficiency could not be evaluated at this time

ii. Timkit

Conventional standards still prevail in the management of water resources both upstream and downstream. In Tinjdad and excluding water from wells, the Jmaa Soulalia (traditional association) runs and organises the distribution of flood waters. In Ifegh, management is more complex. There are 13 water turns. Every qsar has a number of turns based on the number of the eligible persons. The jmaa appoints someone called Amghar to organise the distribution. Some agricultural water users' associations (AWUA) exist but the water management is doing by the traditional association like in the Taskourt.

iii. N'Fifikh

There is a big water user's association. This association is no working because there is no enough water in the river.

iv. Azghar

Only one grower has the right of water. He has an official permission to pump up to 10 litres per second from the Zloul River.

XVI11.4.2 Characteristic of the Lands

Melk is the most predominant land property status in both Azghar or in N'Fifikh.On average, melk is 100% in Azghar and 88% in N'Fifikh. The remainder of the land is mainly collective property in N'Fifikh (6% on average) or falls under another status category (i.e. cooperative or association -based statuses). In Timkit, however, collective land property status is the most frequent (66% on average). Melk is less important (34%).

But the detailed analysis of the data collected in the rural commune of Aghbalou Akerdous and in High Farkla,melk is the most predominant(77.5%), whereas collective status represents,on average, only 22.5%.

Land Property Status in the Three Sites

Site	State-owned land	Collective land	Habous land	Melk land	Others
Azghar	0	0	0	100	0
N'Fifikh	0	6	0	88	6
Timkit	0	66	0	34	0
Taskourt	0	34	0	66	0

(1) Soil Types

The major soil texture types existing in Azghar are Hamri (42%) and Biada (43%). In Timkit, however, Hamri is in short stock (9%)compared to clay (63%) and rmel (28% soils).

In N'Fifikh, the soil fertility is higher than in other sites. In fact, tirs soil is the most frequent (41%) followed by hamri (37%) and the dehs (17%). Some soil types like the hrach and the chhab were seen but with very limited farming importance (3% and 2%). For the rural commune of Mansouria, hamri is the most predominant (60% on average),followed by kzaz (40%).However in downstream N'Fifikh, tirs is the most predominant soil type with 61.5 % on average. Therefore, there is enough evidence to suggest that land is more fertile in downstream N'Fifikh than in the rural commune of El Mansouria.

(2) Land Use Patterns and Parceling-Out

In the three sites, direct land use by growers is the most predominant. On average rates are 90% in Azghar, 88% in N'Fifikh and 94%in Timkit. There are also land pattern uses through association or rent, which were recorded, but the cases are very limited.

Land Use Patterns, Parceling–Out and Farmstead Size

Site	Land use pattern			Plots and growers No	Average cropped area (ha)
	Direct	Leasing	Association		
N'Fifikh	88	6	6	3	8.2
Azghar	90	0	10	5	4
Timkit	94	1	5	9	2
Taskourt	71	5	24	5	4

Parceling- out is more marked in Timkit than in N'Fifikh. It exists in Azghar but is relatively of less importance. In fact, the average number of plots per grower is 9 in Timkit, 5 in Azghar and 3 in N'Fifikh. As to the average size of farms, it is more important in N'Fifikh than in other sites. It reaches 8 ha in N'Fifikh, 4ha in Azghar and 2 ha in Timkit.

In Taskourt: The farming lands in the 8 studied villages, the average farm size is of 4 hectares. The dominant land tenure (annex 3) is the inherited property (66%) and the collective property (34%).

The parcels' mean in each farm is of 5. Several types of soil exist: " arkouane " is the dominant with 75%, " hrach " with 14% and other types with 11%.

These data correspond to those collected from the agricultural technician of Mejjat where the soil types were as follows: 75% for arkouane, 15% for hrach and 10% for rmel. The arkouane type is very good and the soil is very deep. It could achieve 5 meters in depth. The sharecropping status is relatively low and concerns 29% of farms where farming by landowners concerns 71% of cases.

XVI11.4.3 Animal Feed Resources

The Azghar site is the richest in terms of natural resources. The forest is the main source and is located in the mountains. It hosts many tree species, such as oleaster, cedar, cork and cypress.

On the other hand, many other species of ecological importance are found (medicinal, aromatic and honey-making species). Plant species such as white armoise, thyme and pouliot mint are also found. The fauna consists of hares, foxes, boars and wolves.

Nevertheless, despite monitoring ensured by the department of water and forests,deforestation and human and animal pressures exerted on the forest continue. The populations have become accustomed to the sanctions and the degradation continues because of lack of alternatives for them.

In Timkit, however, collective grazing pastures are the only sources of animal feed both in downstream Ifegh and in Tinjdad.

Unlike Ifegh, plant resources are so degraded in downstream Tinjdad that the site is banned for use at the moment.

As to N'Fifikh, the grazing sources are made up of either collective or private pastures (fallow land).

Collective pastures host medicinal plant species such as mentha, pouliot, thyme, sarghine and myrtle.

In Taskourt: The main pasture sources used are stubble and the fallow fields. The collective uncultivated lands " mahroum " are also used.

XVI11.5 Economic and Income-Generating Activities

XVI11.5.1 Economic Activities

(1) Timkit

i. Agricultural Activities

The areas of Ifegh and Tinjdad are treated separately as they have quite different characteristics in terms of water availability and irrigation. Water is either absent or scarce in Tinjdad while it is relatively abundant in Ifegh.

In Ifegh, the most predominant plant productions are cereals (hard wheat, barley, ilan and maize), fodder crops (alfalfa) and vegetables (potatoes, tomatoes and zucchini).The intensification index is relatively high and,on average, it reaches 120% .Yields for the major cereals (wheat and barley) are around 20 quintals per ha. Costs are round dh700 and 1000 per ha. This variation is explained by the use or non- use of chemical fertilizers and of a wage-earning labor force. The productions are geared to meet self-consumption and animal consumption in the first place. Gross profits made are around dh 4000 per ha. Only excess production is sold in the market. As for fruit plantations, date palms, almonds and olives mainly dominate them. The locally cropped dates range from low (khalt) to medium quality varieties (boufaggous). Yields are very medium, around 50 kg/date palm tree and gross profits are between dh 120 and 200/tree.

Almost the same crops are grown in the Tinjdad area but in a very hostile climatic environment. Yields are very low (5 quintals per ha for the main crops). Yields have almost been insignificant for some years. Therefore, agriculture increasingly plays a more marginal role in income formation. Productions are mainly geared to meet self-consumption needs.

ii. Livestock Activities

Most of the reared species are ovine and bovine ones in the whole of the communes in Aghbalou Akardous where goats are available.

In Ifegh, the average number of animal heads per household is relatively important. They are 2.4 bovine heads, 8.4 sheep and 10.4 goats. Ovines and caprines are local breeds but bovines are mixed (local and crossbreeds). Livestock raising is an extensive type of activity and production is for meeting local consumption needs (dairy production and meat) and for sale in the market. A year - old calf costs between dh 2.500 and 5.000, a lamb between dh 400 and 700 and a young goat between dh 200 and 400.As for growers’ qualifications, they are relatively low.

In the Tinjdad area, the number of animals per household is very low, less than one bovine and around 4 ovines. Production is for self-consumption and the sale of lambs in the market.

iii. Other Income-Generating Activities

In addition to agricultural activities (i.e. animal and plant productions), which contribute to the formation of household revenues, wage-earning activities (seasonal or permanent) also play a vital role in income-generation. This contribution can reach 75% (case of the municipality of Tinjdad). It is 60%in high and 55%in low Farkla. This contribution is relatively lower than above in the area of Ifegh, where agriculture and livestock activities contribute 73% (40% for livestock breeding and 33% for agriculture) because of water availability for irrigation, which permits growers to master the production process.

(2) Azghar

i. Annual Crops and Arboriculture

The findings of the group survey and the household survey highlight the fact that, the major crops downstream are cereal crops with different percentages of soil use according to the type of cropped cereals. On average, soil use is 57% for hard wheat, 34% for barley and 1% for soft wheat. Leguminous crops rank second with 7% soil use. Vegetables are very scarce and according to the group and household surveys their percentage of soil use is 1% and 0.3%, respectively. On average, soil use for vegetables is 1%.

In general, annual crops are interspersed by arboriculture and the existing tree species are olive, almond and apple trees in particular. Under the conditions prevailing in Azghar, an adult olive tree can produce up to 70 kg of olives; the populations to be dh1.5 estimate a medium age 35 kg .

The gross profit of one kg of olives. To calculate a tree yield, the tree age is taken into account .On average fallow land represents 42% of land suitable for agriculture .In addition, the intensification index is 68%, on average.

Growers' technicality is low in most villages. This results in yields varying between 13 and 17 quintals per ha on average for cereals and 11 for legumes. Gross profits range between dh 2,000 and 2,700 per ha for cereals and dh1,500 and 4,000 for lentils.

On average, land suitable for agriculture is 5 ha downstream. Therefore, average agricultural income is dh11,811.5 per year or 32% of global income.

ii. Livestock Breeding Activities

Downstream, the major animal species are sheep and goats. Bovines are less frequent. According to the household survey, the average size of the herd is 4 sheep and 3 goats per grower

The type of livestock rising is extensive and is based on range land grazing and transhumance.

Sheep and goats are of a local breed and cows, too, with a small proportion of crossbred cows.

The average livestock breeding income is dh 4.200 per year or 11% of the global income. This is very low compared to the average income upstream.

iii. Wage-Earning Activities

These are mainly represented by the incomes of the military personnel, the administration employees, the retired staff and the seasonal labor force. The generated income is dh 14,000

yearly for a military, dh 2,900/year for administration. Employees and retired people and dh 2,900/ year for seasonal labor force.

iv. Other Activities

Trade, forestry cooperatives and expatriate workers contribute to the global revenue but very insignificantly (1% for every activity). The generated income is,therefore, dh 400 for each activity.

(3) N'Fifikh

i. Agricultural Activities

Cereals (i.e. mainly soft and hard wheat) predominate in the crop systems under practice. The cropped land areas vary from one village to another and are around 60% in Ouled Tarfaya, 90% in Beni Makraz. Leguminous cropping is also variable from 0% in Beni Makraz to 50% in Ouled Tarfaya. Market gardening is practiced in Beni Rachad and Beni Makraz and represents almost 10% of the cropped area. Vine trees are specific to the village of Beni Rachad .The average rate of intensification is 88%. The yield per hectare of the various crops is variable and is between 15 and 40 quintals for the main crops. This yield variability is due to the farming practices and to the level of technicality of the growers and their capacity to purchase inputs (i.e. selected seeds, fertilizers).

This situation yields costs/ha, which are also variable, between dh 1,000 and 3,000 for cereals. Consequently, gross profits / ha are very variable and are between dh1,200 and 8,000. The obtained production is used mainly for self - consumption and for animal feed (mainly barley). The remainder is either sold or converted into other consumer goods or investments in the farmstead.

ii. Livestock Breeding Activities

The predominant species in the villages under study are ovines, bovines and caprines. Their proportion is variable according to every village. For example, goats do not exist in the villages of Labied, Ouled Tarfaya and Lamsaada. The contribution in income -generation of each of these species is also variable. Bovine breeding ranks first in Ouled Tarfaya and Lamsaada, and is second in other villages. Breeds are local for sheep and goats and are generally of a mixed type for bovines. The sale price of a year- old calf is between dh 7,000 and 10,000, lambs are sold between dh350 and 1,300 and young goats between dirhams300 and 500. Sales variability finds an explanation mainly in the type of practiced cattle raising. High prices are paid to those with an intensive type of breeding. As for the technicality of cattle raisers, it is globally low or average.

iii. Other Income-Generating Activities

In addition to agricultural and livestock breeding activities which contribute to generate household incomes in proportions of 42% and 38%, there are other activities which permit to generate art of the revenues. The wage -earning activities (seasonal or permanent) rank third and contribute 10%. Also trade and small-scale jobs contribute 7.5 % and 2.5%. This situation is valid in a rainy season but if it is the contrary then the wage- earning activities become more important.

(4) Taskourt

i. Agricultural Activities

The main crops produced are cereals (wheat and barely), fodder crops, vegetables and fruit trees. When irrigation water is available, the intensification rate is relatively high and is in average of 98%. The production cost of one hectare of cereals could vary between 500 and 4,500 DH depending mainly on the rent or not of irrigation water. The yields of cereals are relatively low at Assif El Mal (8 to 10 quintals a hectare) and high at Mzouda (40 to 60 quintals a hectare). At Mejjat and Guemmassa, they vary between 25 and 30 quintals a hectare. Consequently, the gross margins stand between 1,800 and 12,000 DH a hectare. Concerning vegetables, they are meant for market. They are cultivated

mainly at Mzouda and their gross margins could exceed 40,000 DH a hectare. Some interviews with leaders people revealed that farmers developed strategies to neutralize the random climate characterize by :

- Digging wells;
- Introducing new crops oriented to the market such watermelon, melon,…etc;
- Adopting new technologies such as the use of certified seeds, sowing machines, drop by drop irrigation system, chemical fertilizers and soil analysis ;
- Diversifying the production system to minimize the risks related to market.
- Farmers who adopted those strategies came from other regions of the country and were encouraged to invest because of the underground water availability.

ii. Livestock Activities

The dominant species are sheeps, cattles and goats. The average numbers per household are made of 2 cattles, 3 sheep and 0.25 goats. Sheeps and goats breeding aim is to produce meat where cattle's' objective is to produce milk and meat. The local breeds are used for sheep and goats where mixed breeds are used for cattles. The transactions related to livestock are generally made at the weekly market of Mejat where most of the milk production is delivered to milk cooperatives.

iii. Other Activities Generating Incomes

Beside farming and livestock activities, which contribute up to 78% in generating households' incomes, other activities contribute also. The manpower's (permanent and seasonal) contribution is of 15%, the trade's activity contributes with 6% and miscellaneous activities with 1%.

XVI11.6 Generated Incomes

XVI11.6.1 Timkit

The average household income for the whole of the communes is dirhams 20,000 per annum. It varies between dh17,600 in High Farkla and dh28,450 in Tinjdad. In Ifegh average incomes are dh19,300.

The contribution made by the various activities in the area is about 38% and the external activities contribute to 62% (mainly the labor force).

In the Tinjdad area, the trend is completely reversed. The incomes generated by the workers migration reflect a quite alarming social situation although these workers contribute tremendously in the economy of the area. In fact, the successive drought periods and the increasing depth of the water table have resulted in the noticeable decrease of the incomes of both agriculture and livestock breeding. This has led to an important migration flow out of the area. The contribution of internal activities (i.e. agriculture, livestock breeding and trade) is very low .It is only about 25% in the municipality of Tinjdad and amounts to 40% and 45% in High and Low Farkla, respectively. Annual expenses per household represent 80% of total income. This result shows the weakness of investments made to boost both the productive activities as well as in the households' performance.

XVI11.6.2 Azghar

The military personnel's contribution to the economy of the area is very significant. A case in point is the study of the migration flows, which has clearly shown that the temporary migration of the young totals 40% on average and mainly concerns the military. Agricultural activities rank second with a contribution of 32% in the total income. However, the contribution of livestock breeding is lower than that of the upstream (11% in the global income).

This is due to transhumance, which is specific to upstream areas**.** Nevertheless, the share of livestock breeding in the downstream economy remains relatively important compared to other income-generating activities, such as trade and small-scale businesses.

XVI11.6.3 N'Fifikh

Unlike other sites, the situation is quite different. Agriculture and livestock breeding occupy a choice place in the area. This is due mainly to the level of technicality of the growers, which is relatively more important than in other sites, also by the contribution of urban investors and a better soil quality. The average annual family income is about dh 48,000. When related to the household, the income is dh 24,000 (the household number per family is equal to 2). Variability in the average incomes of the different communes exists. The incomes per household / per year vary between dh21,600 in Ouled Yahia and dh28,650 in Tlat Ziaida. The contribution of agriculture and stock breeding activities is about 70%. Actually, this corroborates with the findings of the group interviews mentioned earlier. As for the weekly expenditures, on average, they stand at dh16,000 per household / year. They vary between dh14,540 in Ouled Yahia Louta and dh18,550 in Al Mansouria.

XVI11.6.4 Taskourt

The households' incomes are of 28,634 DH. They vary between 15,300 dh at Guemmassa and 34,950 DH at Mzouda. The proportion of incomes coming from farming and livestock is of 78% and the other activities contribute with 22%. The annual households expenses are around 16,300 DH and vary between 9,660 DH at Guemmassa and 23,260 DH at Mzouda.

Breakdown of Annual Income/Household and the Contribution Importance of Each Activity (%)

Site	Income in dhs/year/household	Share of each activity in the		Income %	
		Agriculture	Stock breeding	Migration	Others
Azghar	37,000	32	11	39*	18
Nfifikh	24,000	42	38	8	12
Timkit	19,650	11**	6**	62	21
Taskourt	28,634	78		22	

*: The contribution of the military personnel specifically
** In recent years mainly

XVI11.7 Level of Technicality and Obstacles

Growers lack technicality in the three sites .We have scarcely noticed pesticides or fertilizers being used. However, we need to underscore the negative impacts of the drought and the lack of motivation of the growers to use new technologies. On the other hand, we have been able to talk to potential growers and have noticed the important yields they get. These growers have generally come from elsewhere and have invested in the best state of the art technologies. Nevertheless, their efforts did not meet with total success as they still complain about the lack of professional organization of storage and marketing infrastructures.

Also, lack of agri-business and processing facilities, and lack of support actions and information likely to help them market their products easily. Limitations to upgrade irrigation will persist as long as a land consolidation program is not implemented, particularly in Azghar and in N'Fifikh.

Such operation is unrealistic and even delicate to implement in an oasis system, such as Timkit.

Another obstacle consists mainly in access to bank loans. In fact, growers who do not have legal property deeds are barred from access to loans or to investment. This is exactly the case in Azghar and in Timkit.

However, state banks and the likes can possibly implement collateral schemes while awaiting the reorganisation of the situation.

XVI11.8 Potential Negative Impacts

We will only highlight the negative aspects necessitating both an analysis and an approach to minimize their intensity. Positive impacts are generally known and do not need any action.

The only problem likely to emerge during the construction stage is the one related to land property conflicts. This will be all the more important in collective land property areas.

XVI11.8.1 Impact on Gender Development

In principle, any improvement in the economic family level is likely to result in improving women's standards of living. However, if irrigation brings improvements in growers' incomes, women, very often, see their strategic conditions being degraded, compared to a slight improvement in their everyday life conditions. The concomitant result accruing from this is further reinforcement of men's positions.

Irrigation will certainly result in changes in the production systems. Therefore, women will be asked to contribute to the implementation of some tasks inside the farmsteads. These tasks will entail the use of new skills and a new know-how, which will have to be administered by expert advisers. To ease the process of the introduction of new home technologies to alleviate women's burden from the chores of everyday life, training and information sessions geared for both men and women are indispensable. This will free women for the new tasks required by the new production systems.

Under the special conditions of collective property lands, women will be deprived of right of access. This will be felt more particularly in Taskourt and in Timkit, except for women in the rural commune of High Farkla. As of 1982, this commune has replaced customary law (ourf) by islamic law (chariaa). Women have, therefore,the right to inherit half the land of their deceased brothers.

XVI11.8.2 Social Impact

The lands without legal property deeds such as Melk, Jidia and collective ones, most frequently found in Taskourt, Timkit and in Azghar are likely to cause social conflicts. These conflicts can erupt between the eligible residents, or among these and the heirs to the land who have left the place for decades, even for generations. Other conflicts on water rights can resurface between the populations located upstream and downstream. This is more particularly so for the Timkit site. In fact, the eligible persons upstream are either residents

downstream or do in effect originate from it. Currently, these residents own property near the dam and they require to have water turns downstream.

XVI11.8.3 Immigration Impact

This impact will be felt tremendously in Timkit. In fact, the availability of job opportunities together with the ease to purchase plots for home building and the presence of the adequate infrastructure could prompt nomads who still live in nearby mountains to settle down in the place. To these nomads, we need to add the upstream populations who have expressed their wish to settle downstream. The accumulation of these migrant people could pose serious problems to the accommodating capacity of the social infrastructure, namely to individual fresh water supply, in addition to school and health facilities.

XVI11.8.4 Schooling Impact

Without waging a campaign to heighten populations' awareness about schooling, a negative impact relating to the schooling of rural girls will be tremendously felt. Furthermore, family labor, free of charge, will be sought, especially during the preliminary stages of the launch of irrigation work (growers still have a very low economic potential).

XVI11.8.5 Impact on the Environment

The intensification of the production systems requires generally an increase in the input use such as fertilizers and pesticides. Those aspects should be observed closely to avoid unbalanced ecological system, which may be hard to restore if it occurs.

XVI11.8.6 Impact on Health of Human and Animal

Animal's and human's health impact already illnesses hydriqueses (water-dependent). Most vulnerable of them are, the uro-genital Bilharzioze and the malaria. Those diseases are known in morocco and relatively controlled. However, adequate measures must be taken in consideration to irrigation setting.

XVI.11.9 Accompaniment Measures

The accompaniment measures presented below are necessary conditions to be implemented in order to minimize the negative impact of the project:

(1) The human resources of the CT are limited to few technicians (all men) and are supposed to have in the future a key role in informing and organizing training sessions for farmers. Therefore, in service training

sessions addressing advanced techniques in fruit growing, market gardening, livestock (particularly cattle's milk) are necessary.

(2) Young technicians should be hired to substitute those approaching the retirement stage. The new technicians should be men and women;

(3) Strongly program for gender development should be establish before implementation of irrigation.

(4) Farmers' training is necessary to address the technical domains to improve their technical skills as well as the social aspects to increase their awareness on the role of formal professional organizations. Women should also be targeted with respect to their contribution level in implementing different activities and taking decisions.

(5) The solution for the problem of marketing and agriculture production transformation should be found.

(6) The problem of financing the agriculture at farmers should be resolve by giving the special facility.

(7) Establish a collaborative pact of irrigation water management system to make sure that water and inputs (pesticides and fertilizers) are used rationally. Those factors used rationally will save water, preserve the underground water from pollution and furnish a healthy product to consumers. This pact should be previously discussed and negotiated with all actors in the rural community (farmers, commune rural, CT, local authority, cropping protection service,…etc).

(8) The regrouping of farming lands to be irrigated should be established to avoid potential conflicts related to irrigation water management.

(9) The existing irrigation water users associations (AUEA) in Timkit, Taskourt and N'Fifikh should be reinforced to manage the irrigation water's network. Farmers should be convinced of the associations' interest and the representatives should be credible. In Azghar and also in the others schemes, the new associations should be created after conducting an awareness campaign and organizing visits in the perimeters, which have a long tradition in this domain.

(10) Individual water meters should be established to minimize the potential water wasting.

Feasibility Study on Water Resources Development in Rural Area in the Kingdom of Morocco

Final Report

Volume V Supporting Report (2.B)

Feasibility Study

Supporting Report XVI

Natural and Social Environment and Resettlement Plan

Tables

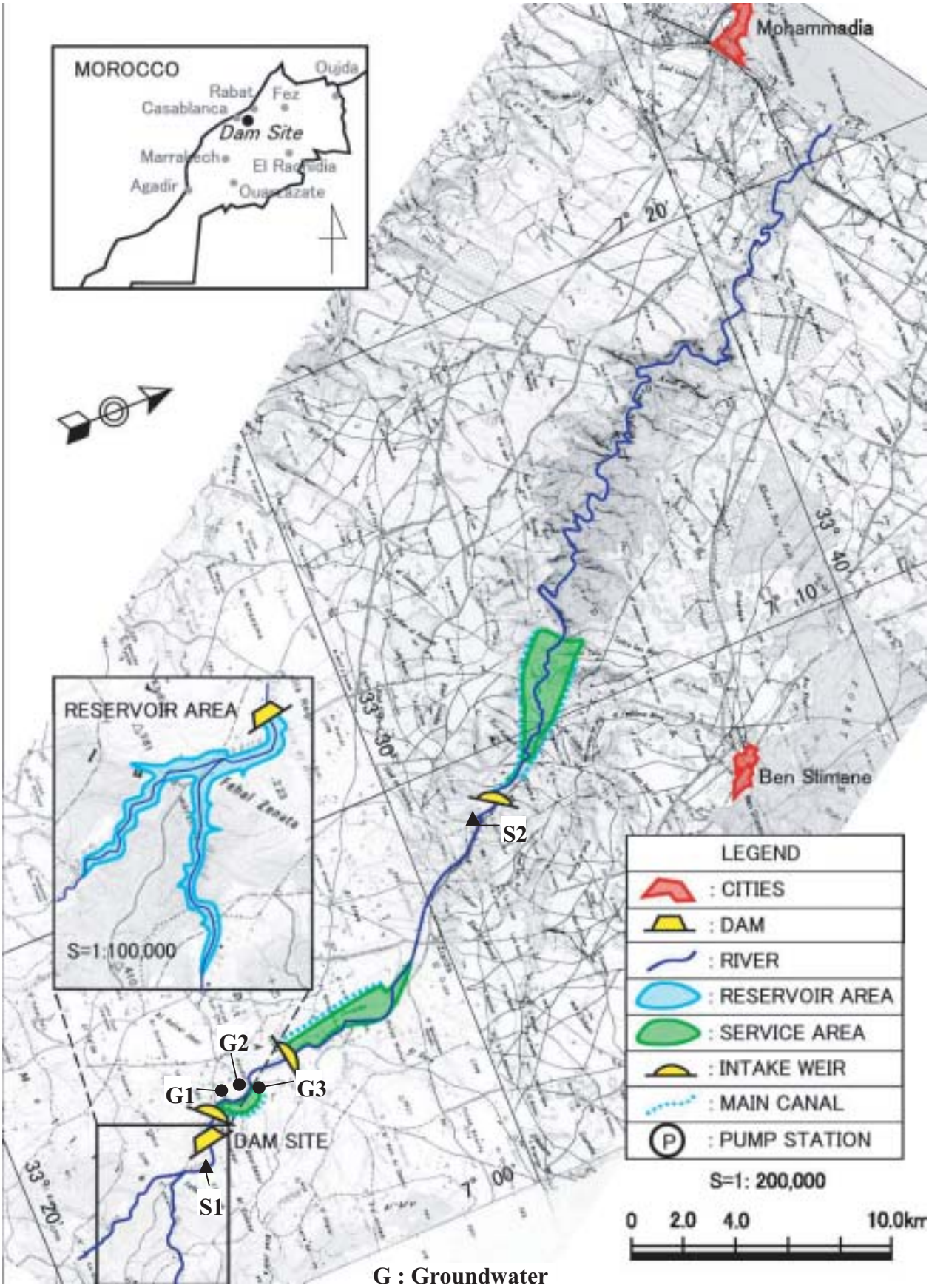
Table XVI13.1.1: Classification of Groundwater and Surface Water Quality at Each Sampling Site

Sampling	Site*	Temp	pH	Cond	DO	Odor	Color	BOD	COD	PT	PO4	TN	NH4	NO3	SO4	Cl	F	Fe	Mn	Zn	TC	Classification
N'fifikh	S 1	E	E	A	E	E	E	E	E	G	E	E	E	E	L	G	E	E	E	E	G	Low
	S 2	E	E	A	E	E	E	E	E	G	E	E	E	A	A	A	E	E	E	E	G	Average
	G 1	G	E	A	-	E	E	-	-	-	-	-	-	G	-	-	-	-	-	-	-	Average
	G 2	G	E	A	-	E	E	-	-	-	-	-	-	G	-	-	-	-	-	-	-	Average
	G 3	G	E	A	-	E	E	-	-	-	-	-	-	G	-	-	-	-	-	-	-	Average
Taskourt	S 1	E	E	E	E	E	E	E	E	G	E	E	E	E	G	E	G	E	E	E	E	Good
	S 2	G	E	E	E	E	E	E	E	G	E	E	E	E	G	E	E	E	E	E	E	Good
	G 1	G	E	E	-	E	E	-	-	-	-	-	-	E	-	-	-	-	-	-	-	Good
	G 2	E	E	B	-	E	E	-	-	-	-	-	-	E	-	-	-	-	-	-	-	Good
	G 3	G	L	D	-	E	E	-	-	-	-	-	-	L	-	-	-	-	-	-	-	Deteriorated
Timkit	S 1	E	E	A	E	E	E	E	E	E	E	E	E	G	D	A	E	E	E	E	G	Deteriorated
	G 1	G	E	A	-	E	E	-	-	-	-	-	-	G	-	-	-	-	-	-	-	Average
	G 2	G	E	A	-	E	E	-	-	-	-	-	-	G	-	-	-	-	-	-	-	Average
	G 3	G	E	A	-	E	E	-	-	-	-	-	-	E	-	-	-	-	-	-	-	Average
Azghar	S 1	E	E	E	E	E	E	E	E	G	E	E	E	G	E	E	E	E	E	E	G	Good
	S 2	E	E	E	E	E	E	E	E	G	E	E	E	E	E	E	E	E	E	E	G	Good
	S 3	E	E	E	E	E	E	E	E	G	E	E	E	E	E	E	E	E	E	E	E	Good
	S 4	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	Excellent
	G 1	E	A	E	-	E	E	-	-	-	-	-	-	E	-	-	-	-	-	-	-	Average
	G 2	E	E	E	-	E	E	-	-	-	-	-	-	E	-	-	-	-	-	-	-	Excellent
	G 3	E	E	E	-	E	E	-	-	-	-	-	-	E	-	-	-	-	-	-	-	Excellent

*) Location of sampling site is shown in XVI2.1.2., (G): Groundwater, (S): Surface water

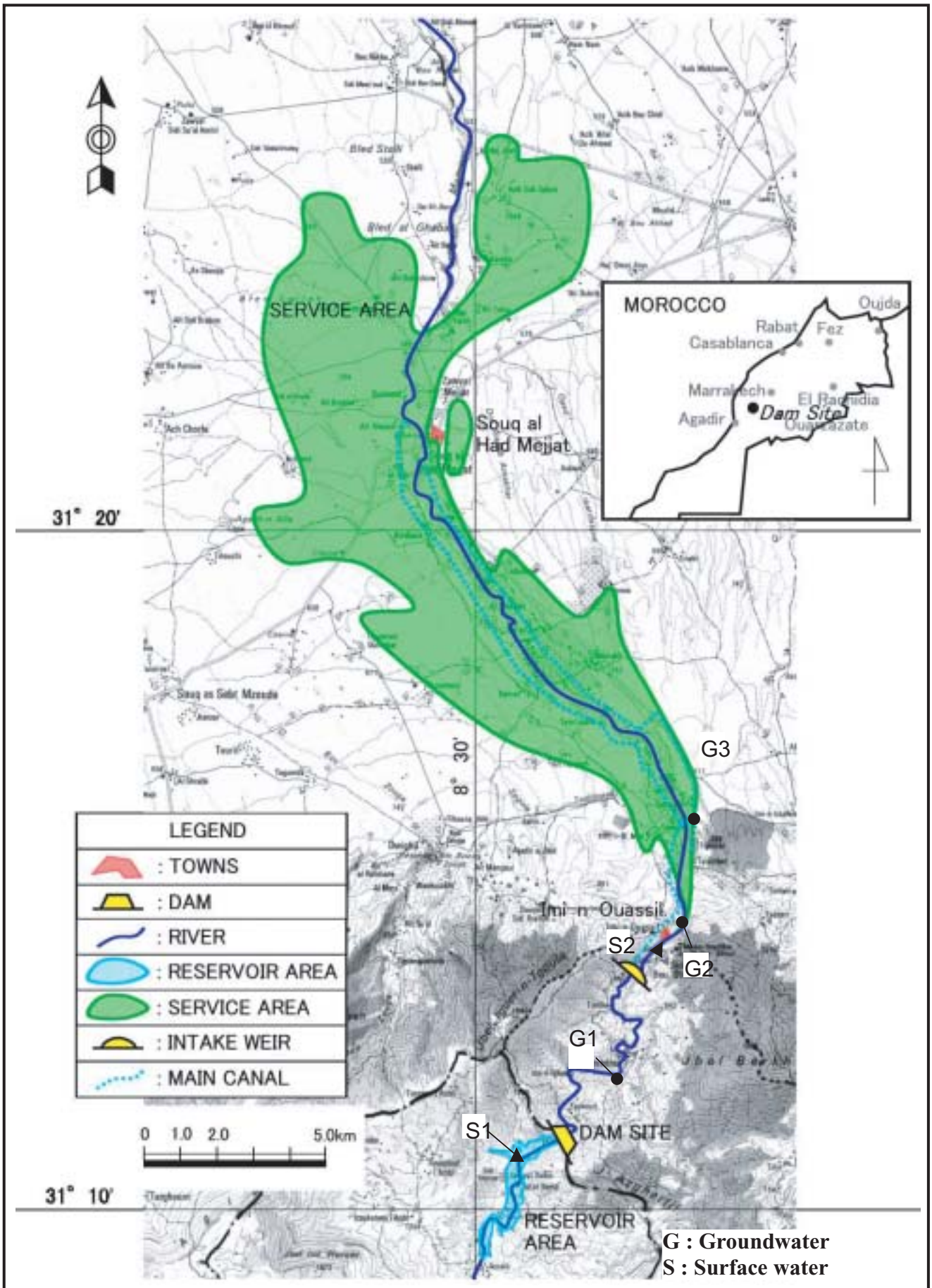
E: Excellent; G: Good; A: Average; L: Low; D: Deteriorated

Figures

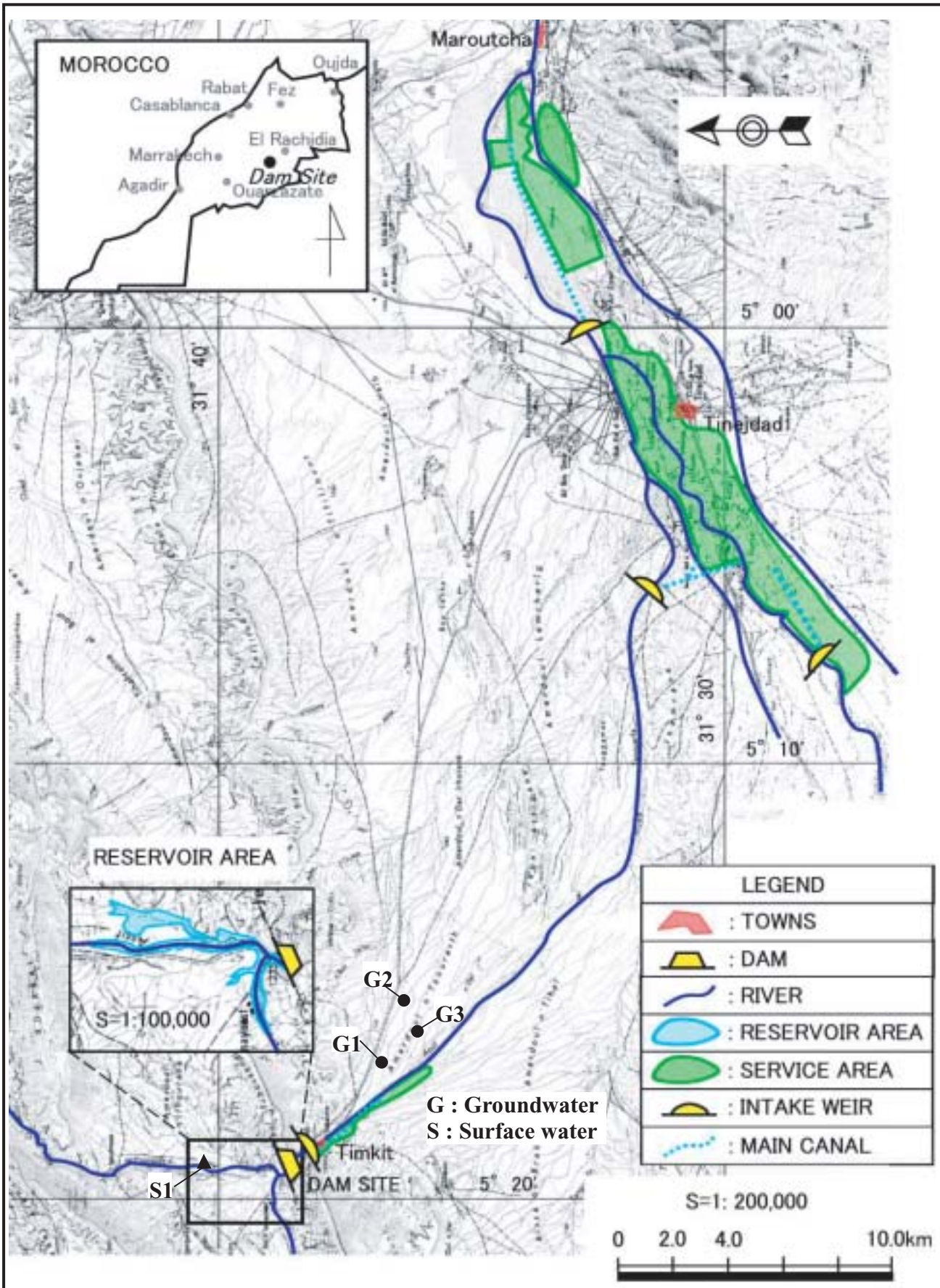


G : Groundwater
S : Surface water

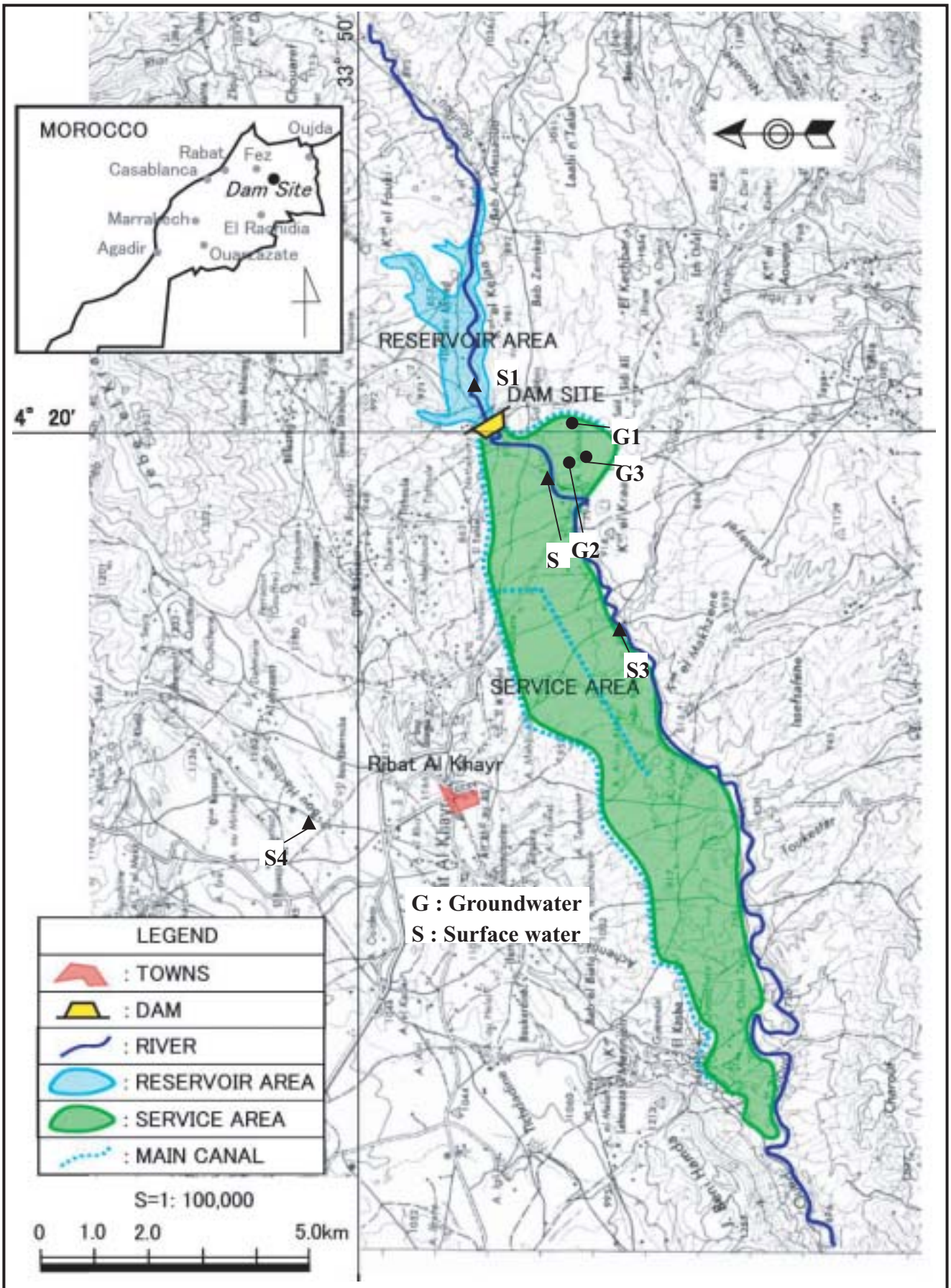
FEASIBILITY STUDY ON WATER RESOURCES DEVELOPMENT IN RURAL AREA	**Figure XVI12.1.1** **Water Sampling Sites at NFIFIKH (No.5)**
JAPAN INTERNATIONAL COOPERATION AGENCY	



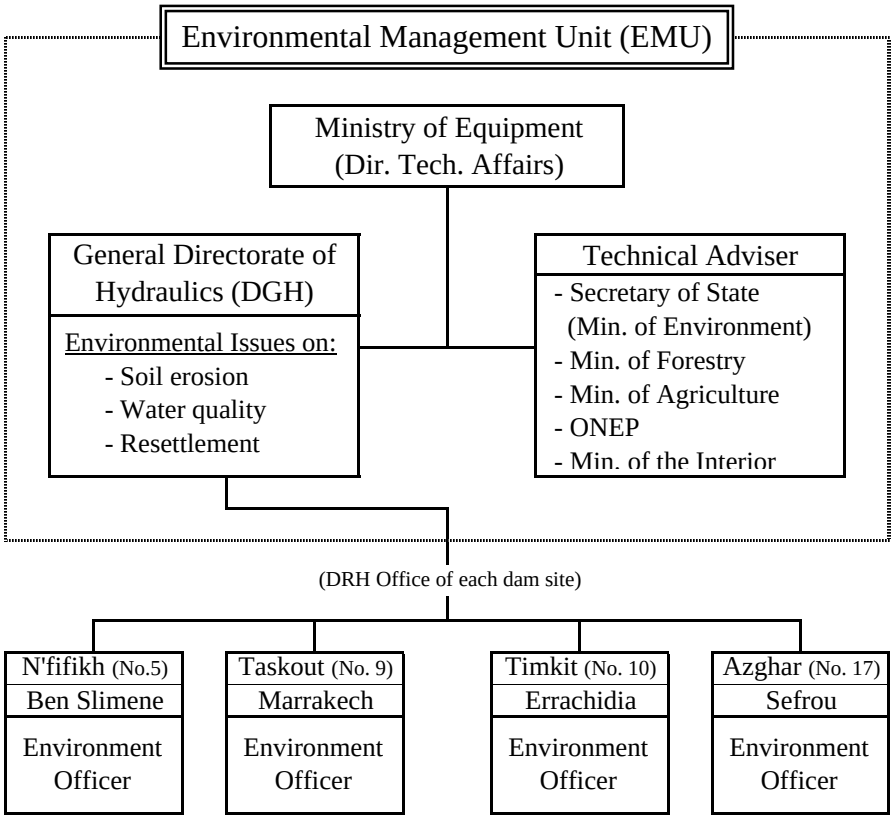
FEASIBILITY STUDY ON WATER RESOURCES DEVELOPMENT IN RURAL AREA	**Figure XVI2.1.2** **Water Sampling Sites at TASKOURT (No.9)**
JAPAN INTERNATIONAL COOPERATION AGENCY	



FEASIBILITY STUDY ON WATER RESOURCES DEVELOPMENT IN RURAL AREA	**Figure XVI2.1.3** **Water Sampling Sites atTIMKIT (No.10)**
JAPAN INTERNATIONAL COOPERATION AGENCY	



FEASIBILITY STUDY ON WATER RESOURCES DEVELOPMENT IN RURAL AREA	**Figure XVI2.1.4** **Water Sampling Sites at** **AZGHAR (No.17)**
JAPAN INTERNATIONAL COOPERATION AGENCY	



FEASIBILITY STUDY ON WATER RESOURCES DEVELOPMENT IN RURAL AREA	**Figure XVI6.5.1** **Institutional Structure of the Environment Management Unit (EMU)**
JAPAN INTERNATIONAL COOPERATION AGENCY	