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WATER AND SANITATION
FOR HEALTH PROJECT

SITE SELECTION FOR UPGRADING SANITATION IN LOW INCOME NEIGHBORHOODS IN TUNISIA

Operated by
CDM and Associates

Sponsored by the U.S. Agency
for International Development

WASH FIELD REPORT NO. 143

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Prepared for
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Urban Development Office in Tunis
Request Memorandum No. 110

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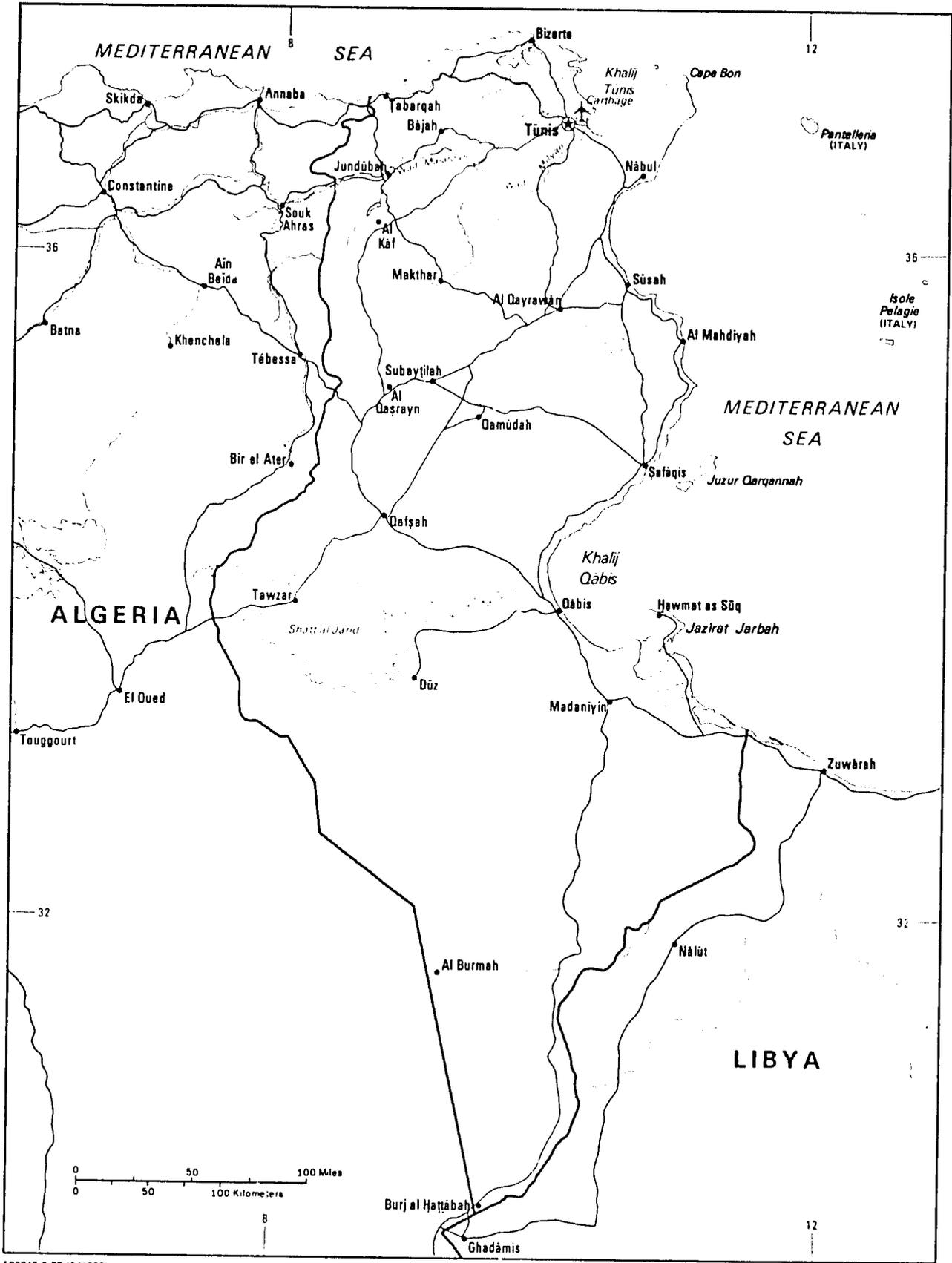
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Tunisia



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- Railroad
- Road
- ↑ Airport

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ACRONYMS

| | |
|--------------------|---|
| AEUD | Ingénieurs Conseils Tunisiens (Privés) |
| AFH | The Land Development Agency (Agence Foncière d'Habitation) |
| BOD ₅ | Same as BOD ₅ (Biological Oxygen Demand) |
| FX | Foreign Exchange |
| ha | Hectare |
| IBRD | The International Bank for Reconstruction and Development |
| ICN | Ingénieurs Conseils Néerlandais |
| KDF | The Kuwaiti Development Fund |
| LC | Local Costs |
| m | Meter |
| m ^l | Lined Meter |
| m ^l /ha | Lined meter per hectare |
| m ³ /h | Cubic meter per hour |
| MOE | The Ministry of Equipment |
| MOP | The Ministry of Plan |
| ONAS | The National Sewerage Agency (Office Nationale de l'Assainissement) |
| Oued | Dry River Bed (sometimes with stagnant water) |
| PDT | Project Design Team |
| PP | Project Paper March 1984 |
| SCET | Ingénieurs Conseils Tunisiens (Privés) |
| SONEDE | The National Water Authority (Société Nationale d'Exploitation et de Distribution des Eaux) |
| SNIT | Tunisian National Housing Authority |
| SOTUTEC | Ingenieurs Conseils Tunisiens (Privés) |
| STEP | Sewage Treatment Plant |
| TD | Tunisian Dinar |

EXECUTIVE SUMMARY

In March 1984 the Water and Sanitation for Health (WASH) Project assisted the Regional Housing and Urban Development Office (RHUDO) in Tunisia to prepare a Project Paper for upgrading sanitation in low-income neighborhoods. The project authorizes \$32 million in Housing Guaranty Program funds to be used to co-finance the World Bank-funded Thirty Cities Project and the Kuwaiti-funded Greater Tunis Project. The Project Paper team, which developed a list of sites based on available data, recommended that before the project was finalized, another team actually visit each site to confirm the choice. The Mission requested WASH assistance and WASH was authorized to carry out the site-visit assignment. Consequently, a team consisting of a civil engineer and a social anthropologist visited the potential sites from November 19 - December 15, 1984. This is a report of their findings.

The team confirmed the Project Paper's choice of Thirty Cities Project sites with one exception: Mahares was dropped and replaced by El Djem. The team found that Mahares is not predominantly low income but is solidly middle class. Of possible sites in the Greater Tunis Project, only Central Tunis met the low-income-residential criteria. Thus, the following sites were recommended for inclusion:

| | |
|-----------------------|---------------|
| Bizerte | Ksour Essaf |
| Menzel Temime | El Djem |
| Sayada/Lamta/Bou Hjar | Sbeitla |
| Ksar Hellal | Sidi Bou Zid |
| Teboulba | Nefta |
| Kalaa Sghira | Medenine |
| Sahline | Tataouine |
| M'Saken | Central Tunis |

The social anthropologist found that the beneficiaries' homes are frequently in densely packed neighborhoods in the medinas. Nearly all homes surveyed had SONEDE connections consisting of a single faucet (but no showers or baths), squat toilets, and electricity. Although of mixed socio-economic levels, a majority of the residents of these medinas fall into the category of working class poor. In addition, most live in their community of geographic origin creating a stable population characterized by social solidarity.

The sanitation problems were evident. Rivulets of individual household wastewater joined together to form wider open sewers meandering down the center of urban streets. Animals were observed drinking from and children seen playing in these grey water streams. The streets, sewers, drainage canals and any open public space were littered with loose solid waste in most areas. Several areas in each urban site were used as rather systematic dump sites for more compacted household waste such as that put into refuse collection carts. This was especially true of oueds (semi-dry river beds) or patches of uncultivated land on the edges of settlements.

The technology proposed to solve these problems is the best suitable and the simplest that can be used under local conditions in Tunisia. Basic and sound engineering is used throughout this project. Improvements consist primarily of

sanitary collectors and house connections and sewage pumping and treatment facilities. The team was informed that the construction documents for most cities should be available in March 1985 for inspection by AID and Bank experts.

Part of the work of the team was to review and revise where necessary all project costs, paying special attention to verifying what percentage qualifies for Housing Guaranty Program funds. The results of that review and revision are presented in a number of tables in Chapters 2 and 3. During discussion with ONAS, the Tunisian National Sewerage Agency, it was made clear to the team that cost estimates as presented in preliminary documents were being revised on the basis of new geological information and new costs of material and labor. Revised estimates and construction drawings and tenders documents should be completed for most sites by March 1985.

The team raised a number of issues to be considered as this project goes into implementation. The most important of these is that the impact of the project in actually solving sanitation problems will depend heavily upon the evolution of domestic sanitary habits. In addition, cultural norms about responsibility for private familial space versus public space enter into the picture. The team feels that without some program of public education, the mere presence of new sewers will not solve the problems.

Finally, the team recommended that a new design for manholes be adopted by ONAS. Drawings of the manhole cover recommended are included in the report.

Chapter 1

INTRODUCTION

1.1 Background

In March 1984 the Water and Sanitation for Health (WASH) Project assisted the Regional Housing and Urban Development (RHUDO) office in Tunisia to prepare a project paper for upgrading sanitation in low-income neighborhoods. The project paper team, which developed a tentative list of sites based on available data, recommended that a team visit each site to confirm the choice of sites after the approval of the project. RHUDO/Tunis requested this assistance from WASH in November 1984. Consequently, a team consisting of Francois Lalande, a civil engineer, and Carole S. Ayad, a social anthropologist, were selected. They carried out the work from November 19 - December 15, 1984.

The project authorized \$32 million in Housing Guaranty (HG) Program funds to finance upgrading/sanitation of low income neighborhoods and towns characterized by slum conditions. The HG funds will be used to co-finance the World Bank-funded Thirty Cities Project and the Kuwaiti-funded Greater Tunis Project. The HG financing will be limited to on-site costs of sewerage and drainage works that benefit low income neighborhoods and towns as well as a proportion of the costs of off-site infrastructure that is directly related to improvements of the low income sites.

1.2 Scope of Work

The overall purpose of the assignment was to finalize the list of eligible sites and eligible costs for HG financing and to assist the Tunisian national Sewerage Agency (ONAS) in its preparation of the program delivery plan. The major tasks were as follows:

- Determine what type of housing the on-site infrastructure serves predominantly.
- Describe the sewerage-drainage problem and the improvements proposed.
- Review and revise cost estimates.
- Review costs to verify what percentage qualifies for HG financing.
- Review and revise as necessary the formula for financing that specifies on-site and off-site improvements and defines the percentage of each that qualifies for financing.
- Review and evaluate construction plans for each site.

A detailed scope of work is included in Appendix A.

1.3 Preparation

The team spent two days at WASH gathering information and preparing the schedule for the site visits. In addition, they met with World Bank representatives knowledgeable about the Bank-funded Thirty Cities Project.

Upon their arrival in Tunis, the team met with Sonia Hamman and David Liebson of RHUDO/Tunis. Both RHUDO/Tunis and ONAS accepted the team's work plan. ONAS also agreed to make available some of its local staff engineers and technicians to help the team perform its task (see Appendix B for the team's itinerary).

1.4 Methodology

The field methodology used for site selection included direct observation and selected interviews with projected beneficiaries. Approximately half a day was spent in the actual field work for each site. Findings reported in the socio-economic analysis are based on two or three individual interviews per site, mainly with women residents in different areas. The technical analysis was accomplished through a visual appraisal of the engineering aspects of each site. Finally, the financial analysis was undertaken based on the latest cost estimates. Twenty-five sites were visited out of a potential thirty sites; timing constraints did not allow for more visits.

It was strongly suggested by ONAS that the team should not meet with local officials for information during the visits but should rely mostly on ONAS's local representatives whenever available.

ONAS had planned for the team to meet with some of its engineers along the way. This was done for Bizerte, Menzel Tenime and some of the Sahel sites. All the other sites were visited by the team alone, this being more practical and less time-consuming (see Appendix C for a list of ONAS staff available to the team during their site visits).

The team drew up a list of the major aspects they wanted to look for at each site. These lists are given below.

1.4.1 Socio-Economic Analysis

- General socio-economic status of community
- Housing conditions
- Household amenities such as water, electricity, cooking stove, refrigerator, TV, toilet facilities, etc.
- Family size and composition
- Geographic origins of residents
- Community infrastructure

- Occupation and educational level of household members
- Monthly income
- Daily food expenses
- Health conditions: available health facilities, visibility of solid waste, domestic wastewater, frequency of diarrhea, etc.

1.4.2 Engineering Analysis

- Availability of potable water, water supply in general, and sanitary facilities
- Existence of a sewer system in the city
- Septic tanks
- Soakage pits
- Open dumping of wastewater into the yard and or the street
- State or condition (visual) of existing sewage system
- Drainage -- paved or dirt roads, natural drainage: ditch, oued, etc.
- Treatment plant facilities
- Spreading areas
- Solid waste conditions
- Aesthetic perception of public space

Chapter 2

SITES VISITED: THIRTY CITIES PROJECT

2.1 Sites Selected for Inclusion

The team visited all but five potential sites for the Thirty Cities Project. Mateur, Ras Jebel, and Dar Chaabane were not visited because enough information had been collected on them during the preparation of the Project Paper. Hount Souk and Zarzis were left out because of lack of time.

The team concurred with the Project Paper's choice of sites except for Mahares, which was dropped and replaced by El Djem. Upon visiting Mahares the team found that the most frequent kind of housing going up there was the expensive "villa" (see Photos 1-4). Owners, natives of the region, are building with money from abroad. The unit cost of investment is probably among the highest in the country. Much of the town appears to be middle class. Even working class homes have gas for cooking, paved courtyards, adequate indoor space, a water supply from the National Water Authority (SONEDE), and squat toilets. Some families have refrigerators. The team's conclusion is that sanitary services are required but that home owners should be able to pay for those services themselves.

2.2 Overview of Social Analysis

The goal of the socio-economic analysis is to make sure that the sites meet the criteria of being predominantly low income. HG guidelines for project financing require the explicit identification of neighborhoods characterized by slum conditions where residents earn an income that is below or at the median income level.

Information has been developed for each site and is given in this report, in addition, a few general remarks can be made about the sites visited.

The most densely populated areas to be served by the project are the old "medinas" (towns) with their characteristic narrow streets and traditional architecture. These old towns are inhabited generally by the descendants of the original occupants, rather than in-migrants from surrounding towns or other regions.

Although these communities are homogenous as far as geographic origin is concerned, they are peopled by families of mixed socio-economic levels. The socio-economic standing of the families depends mainly upon their age. Homes may be occupied by older parents and unmarried young adults or perhaps a younger married son and his wife and children. (The other married children might already have left the old town to build in a newer neighborhood.) If the ancestral home is occupied by a young family with children, it is generally a poor working class family as yet unable to afford new housing elsewhere. If the home is occupied by older parents and their grown-up children, they are usually middle class.

Photos 1-4: New Housing in Mahares.



Photo 1

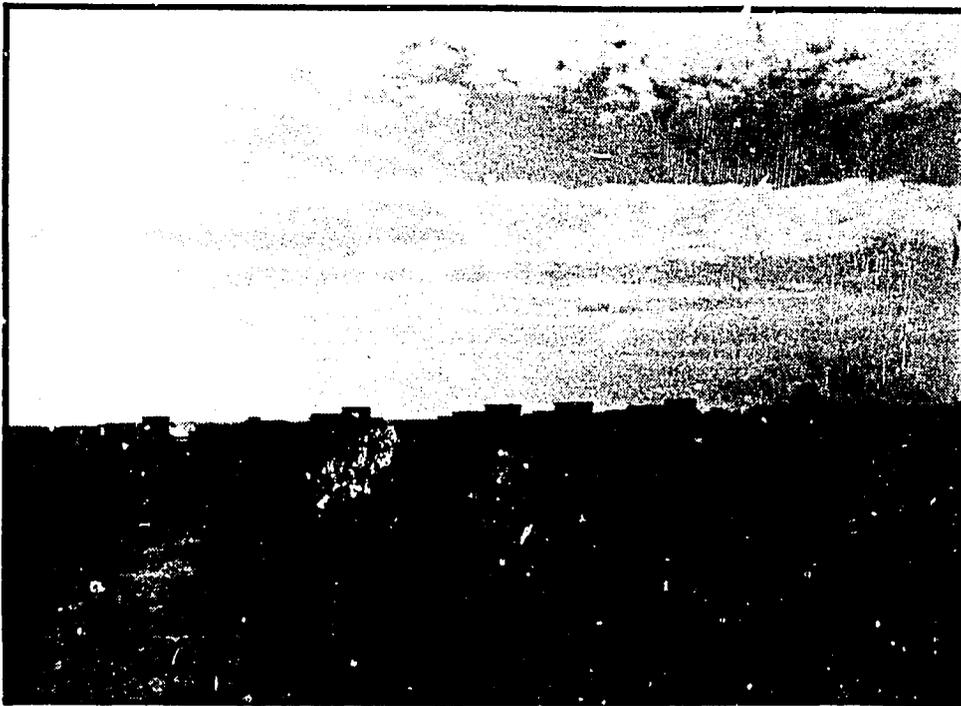


Photo 2



Photo 3



Photo 4

No matter what else a family had or did not have in the way of housing conditions or material comforts a television set was present in virtually 100 percent of the homes surveyed. Even those without electricity managed either to have one electric cord strung in over the courtyard wall from the neighbors or had a battery set. The importance of television to Tunisian family life and hence as an educational tool for behavior modification cannot be underestimated.

Tables 1 and 2 present the team's findings regarding the socio-economic level, the condition of communal areas, and the presence or absence of a basic communal infrastructure for the approved sites.

For each site the primary land use pattern was assessed (see Table 3). To be included in the project, sites must be predominantly residential.

Table 1
GENERAL SOCIO ECONOMIC LEVEL OF SITES

| | 1984 population by commune* | 1984 mean household** size by commune* | General socio-economic level of site | | |
|----------------------------------|--------------------------------|---|--------------------------------------|-------------------------|----------------------------|
| | | | low income working class | mixed SES levels-low | mixed SES levels-middle |
| Bizerte (Medina/Zarzouna) | | | | | |
| commune of Bizerte | 58,744 | 5.0 | + | | |
| commune of Zarzouna | 16,319 | 5.2 | | + | |
| Menzel Temime | 23,753 | 5.5 | + | | |
| Sayada/Lamta/Bou Hjar | 14,757 | 5.3 | | | + |
| Ksar Hellal | 23,946 | 5.3 | | | + |
| Teboulba | 18,775 | 5.4 | | | + |
| Kalaa Sghira | 12,476 | 5.3 | | | + |
| Sahline | 11,510 | 5.1 | | | + |
| M'Saken | 41,217 | 5.2 | | | + |
| Ksour Essaf | 19,415 | 5.5 | | | + |
| El Djem | 12,791 | 5.8 | + | | |
| Sbeitla | 12,022 | 5.7 | | | + |
| Sidi Bou Zid | 19,218 | 5.4 | | | + |
| Nefta | 15,511 | 5.4 | + | | |
| Medenine | 26,602 | 5.5 | + | | |
| Tataouine | 30,371 | 6.4 | | | + |
| Tunis Medina (arrondissement) | 43,520 | 4.5 | | | + |

* Institut National de la Statistique figures for 1984

** I.N.S. defines household as those members of a family group who eat together

Table 2
PREDOMINANT COMMUNAL CONDITIONS AND INFRASTRUCTURE IN AREAS TO BE SERVICED

| Site | + = yes, - = no | | | | | | | | | | |
|---------------------------|----------------------------------|-----------------------------|---------------------------------|---------------------|-----------------------|---|---------|-----------|-------------|-----------------|--------|
| | dense old medina type housing | Housing | | | | Roads | | | Solid waste | | |
| | small homes (1-3 rooms) | villas (1-2 story homes) | neighborhood public lighting | paved sec. roads | unpaved sec. roads | open waste H ₂ O drainage | present | scattered | absent | | |
| Bizerte (Medina/Zarzouna) | + | + | | some | some | + | + | + | | | - |
| Menzel Temime | + | + | | + | some | + | + | | + | Skalba clean | - - |
| Sayada/Lamta/Bou Hjar | + | + | | some | some | + | + | + | | | + |
| Ksar Hellal | + | + | + | + | + | some | + | | + | | + |
| Teboulba | + | + | | - | | + | + | | + | | + |
| Kalaa Sghira | + | + | | + | | + | + | | + | | + |
| Sahline | + | + | | + | | + | + | | + | | + |
| M'Saken | + | + | + | + | some | + | + | + | | | + |
| Ksour Essaf | + | + | | + | some | + | + | + | | | + |
| El Djem | + | + | | - | | + | + | | + | | + |
| Sbeïtla | | + | | - | some | + | + | | + | | + |
| Sidi Bou Zid | | + | | - | | + | + | + | | | + |
| Nefta | | + | | some | some | + | + | | + | | + |
| Medenine | | + | | some | some | + | + | + | | | + |
| Tataouine | | + | + | - | | + | + | | + | | + |
| Tunis Medina | + | | | + | + | some | + | + | | | + |

Table 2

PREDOMINANT COMMUNAL CONDITIONS AND INFRASTRUCTURE IN AREAS TO BE SERVICED (cont'd)

| Site | public transportation | | schooling | | | mosque | health facilities | | | SONEDE connections (H ₂ O) | TV television in homes |
|---------------------------|-----------------------|----------|--------------|---------|------------|--------|----------------------|----------------------------------|----------|---------------------------------------|------------------------|
| | local | regional | kindergarten | primary | secondary | | public bath (hammam) | dispensary/other health facility | hospital | | |
| Bizerte (Medina/Zarzouna) | - | + | + | + | in city | + | + | + | in city | + | + |
| Menzel Temime | - | + | + | + | in town | + | in town | + | in town | + | + |
| Sayada/Lamta/Bou Hjar | - | + | -L +SBH | + | -BH +SL | + | + | + | - | + | + |
| Ksar Hellal | - | + | + | + | + | + | + | + | + | + | + |
| Teboulba | - | + | + | + | + | + | + | + | - | + | + |
| Kalaa Sghira | - | + | + | + | + | + | + | + | - | + | + |
| Sahline | - | + | - | + | 3yrs | + | + | + | - | + | + |
| M'Saken | - | + | + | + | + | + | + | + | - | + | + |
| Ksour Essaf | - | + | + | + | + | + | + | + | - | + | + |
| El Djem | - | + | + | + | + | + | + | + | - | + | + |
| Sbeïtla | - | + | + | + | + | + | + | + | + | + | + |
| Sidi Bou Zid | - | + | + | + | + | + | + | + | + | + | + |
| Nefta | - | + | + | + | + | + | + | + | - | + | + |
| Medenine | + | + | + | + | + | + | + | + | + | + | + |
| Tataouine | - | + | + | + | + | + | + | + | + | + | + |
| Tunis Medina | + | + | + | + | + | + | + | + | + | + | + |

Table 3

PRIMARY LAND USE PATTERN IN THE
PROJECT ZONES OF RECOMMENDED CITIES

| City | Land use patterns | | | | |
|-----------------------|-------------------|---------------------------|------------------|---------------------|--------|
| | low income | spontaneous settlement | middle income | admin./ commerc. | indust |
| Bizerte | X | X | X | | |
| Menzel Temime | X | ? | | X | |
| Sayada/Lamta/Bou Hjar | X | | X | X | |
| Ksar Hellal | | X | X | X | X |
| Teboulba | X | | X | X | |
| Ka'aa Sghira | X | | X | X | |
| Sahline | X | | X | X | |
| M'Saken | X | ? | X | X | |
| Ksour Essaf | X | | X | X | |
| Sbef'tla | X | ? | X | X | |
| Sidi Bou Zid | X | ? | X | X | |
| Nefta | X | | | | |
| Medenine | X | ? | X | | |
| Tataouine | | ? | X | X | |

Notes: X Assessed by SST
? Difficult to assess by SST

2.3 Overview of Technical Analysis

A fair amount of information for the technical analysis is presented graphically in tables.

2.3.1 Sources of Financing

Tables 4 and 5 list all sixteen sites and show where the funds for the improvements will be obtained. Table 4 shows total disbursements and Table 5 gives USAID contributions. The project is receiving funds from three sources: the government of Tunisia, USAID (through the Housing Guaranty Program), and the International Bank for Reconstruction and Development (IBRD).

2.3.2 Eligible Costs

Table 6 ranks the cities according to their rate of growth and the improvements proposed and shows what percentage of the improvements qualify or are eligible for AID Housing Guaranty Program financing.

2.3.3 Project Costs

Tables 7-10 break down the costs of the fifteen projects in various ways and show material costs, network costs, treatment costs and local and foreign exchange project investment costs. In addition, in Section 2.5, in which each site is described, there are tables showing detailed costs for all improvements.

2.3.4 Construction Schedules

Tables 11 and 12 are schedules prepared by the Tunisian National Sewerage Agency (ONAS). Table 11 was prepared in 1983, Table 12 in 1984.

2.3.5 Construction Plans

The improvements planned for each site are summarized in Table 13, along with the size of the area served and the number of beneficiaries. Table 14 shows what kind of sewage treatment will be used on each site, and Table 15 tells whether construction and infrastructure will take place on- or off-site.

The final construction plans were not available at the time of the visit but should be completed by March 1985. The plans consulted in putting together these reports are listed in Table 16.

Table 4
ESTIMATED TOTAL DISBURSEMENT BY SITE/YEAR
FOREIGN AND LOCAL CASH
(IN 1000 TD)

| City (est. Disbursement/qtr.) | 1984 | 1985 | 1986 | 1987 | 1988 | TOTAL |
|----------------------------------|--------|----------|----------|-----------|----------------------|------------------------|
| Bizerte (137,12) | 205,68 | 137,12 | | | | 342,80 |
| Menzel Temime (170,85) | | | 341,70 | 683,40 | | 1 025,10 |
| Sayada/Lamta/Bou Hjar (186,03) | | | 558,09 | 744,12 | 558,09 | 1 860,30 |
| Ksar Hellal (136,62) | | | 409,86 | 546,86 | 409,86 | 1 366,20 |
| Teboulba (125,92) | | | 377,76 | 503,68 | 377,76 | 1 259,60 |
| Kalaa Sghira (193,57) | | | | 774,27 | 387,13 | 1 161,40 |
| Sahline (161,83) | | 485,48 | 677,32 | 161,83 | | 1 294,60 |
| M'Saken (257,22) | | 771,65 | 128,61 | | | 900,26 |
| Ksour Essaf (154,49) | | | 618,00 | 618,00 | 231,70 | 1 467,70 |
| El Djem (135,79) | | | 339,47 | 543,16 | 407,37 | 1 290,00 |
| Sbeitla (111,05) | | 444,21 | 444,21 | 166,58 | | 1 055,00 |
| Sidi Bou Zid (389,72) | | | | 974,30 | 974,30 | 1 948,60 |
| Nefta (195,66) | | 391,32 | 782,66 | 782,66 | 391,32 | 2 347,90 |
| Medenine (131,05) | | 262,10 | 524,20 | 524,30 | 262,10 | 1 572,60 |
| Tataouine (103,00) | | 154,50 | 412,00 | 360,50 | | 927,00 |
| Total/Year | 205,68 | 2 646,38 | 5 613,80 | 7 383,28 | 3 999,63 | 19 848,97 |
| Local Cost (58,6) | 120,53 | 1 550,78 | 3 289,69 | 4 326,60 | 2 343,78 | 11 631,50 |
| Foreign Cost (41,4) | 85,15 | 1 095,60 | 2 324,11 | 3 056,68 | 1 655,85 | 8 217,47 |
| W./Physical L. | 12,05 | 155,08 | 328,96 | 432,66 | 234,38 | (rounding) 1 163,15 |
| Contingencies 10% F. | 8,52 | 109,56 | 232,41 | 305,67 | 165,59 | 821,74 |
| W./Price Costings L. | 42,43 | 545,88 | 1 157,97 | 1 522,96 | 825,01 | 4 094,29 |
| (32%) F. | 29,97 | 385,65 | 818,09 | 1 075,90 | 582,86 | 2 892,55 |
| TOTAL | 298,65 | 3 842,55 | 8 151,23 | 10 720,47 | 5 807,47 | 28 820,70 |
| | 305,80 | | | | | |
| | | | | | (Base for estimates) | 29 000,00 |

Revised by François Lalande 12/14/84.

Table 5

ESTIMATED LOCAL COSTS BY SITE QUALIFYING FOR USAID
FUNDING DISBURSEMENTS (USAID)
(IN .000 TD)

| | <u>% QUALIFY- ING</u> | <u>1984</u> | <u>1985</u> | <u>1986</u> | <u>1987</u> | <u>1988</u> | <u>TOTAL</u> |
|------------------------|---------------------------|-------------|-------------|-------------|-------------|-------------|--------------|
| 1. Bizerte | 100 | 210,61 | 140,17 | | | | 350,78 |
| 2. Menzel Temime | 60 | | | 170,85 | 341,70 | | 512,5 |
| 3. Sayada/Lamta | 66 | | | 327,04 | 436,05 | 327,04 | 1 090,1 |
| 4. Ksar Hellal | 70-30 | | | 240,18 | 320,24 | 240,18 | 800,59 |
| 5. Teboulba | 100-60 | | | 221,37 | 295,16 | 221,37 | 737,90 |
| 6. Kalaa Sghira | 50-75 | | | | 387,14 | 193,57 | 580,70 |
| 7. Sahline | 80-75 | | 284,49 | 396,91 | 94,83 | | 758,64 |
| 8. M'Saken | 100-50 | | 662,82 | 110,47 | | | 773,2 |
| 9. Ksour Essaf | 80 | | | 362,15 | 362,15 | 135,78 | 860,07 |
| 10. El Djem | 100 | | | 138,07 | 220,91 | 165,68 | 524,67 |
| 11. Sbeitla | 60 | | 260,31 | 260,31 | 97,62 | | 618,2 |
| 12. Sidi Bou Zid | 50 | | | | 570,94 | 570,94 | 1 141,88 |
| 13. Nefta | 100 | | 229,31 | 458,64 | 458,64 | 229,32 | 1 375,9 |
| 14. Medenine | 80 | | 153,59 | 307,18 | 307,18 | 153,59 | 921,54 |
| 15. Tataouine | 30 | | 90,54 | 241,43 | 211,25 | | 543,22 |
| <hr/> | | | | | | | |
| Direct | | | | | | | |
| Total Costs (USAID) | | 210,61 | 1 821,22 | 3 234,6) | 4 103,81 | 2 237,47 | 11 607,7 |
| (estimated) Local | | | | | | | |
| Foreign Costs (WB) | | 148,79 | 1 287,15 | 2 386,52 | 3 136,63 | 1 715,84 | 8 674,40 |
| Physical (10%) L. | | 21,06 | 182,12 | 323,46 | 410,38 | 223,75 | 1 160,77 |
| Contingencies | | | | | | | |
| F. | | 14,88 | 128,71 | 238,65 | 313,66 | 171,58 | 867,44 |
| Price Contingencies L. | | 79,13 | 641,07 | 1 138,58 | 1 444,54 | 787,59 | 4 085,9 |
| (32%) | | | | | | | |
| F. | | 52,37 | 453,08 | 840,05 | 1 104,09 | 603,97 | 3 053,39 |
| TOTAL (WB + USAID) | | 521,84 | 4 513,35 | 8 161,86 | 10 723,72 | 5 742,20 | 29 449,62 |
| Financing (30424.000) | | | | | | | |
| Base | | | | | | | |
| 55%) USAID | | 305,84 | 2 644,41 | 4 696,64 | 5 958,73 | 3 248,81 | 16 854,39 |
| 42%) World Bank | | 216,04 | 1 868,94 | 3 465,22 | 4 764,99 | 2 493,39 | 12 808,58 |
| 03%) G. of Tunisia | | | | 208,24 | 277,20 | 275,66 | 761,10 |

Table 6

RANKING OF CITIES BY RATE OF GROWTH AND SCOPE OF WORK
PROPOSED (%QUALIFYING FOR HG FINANCING/NUMBER
OF HOUSEHOLD CONNECTED BY SANITATION SYSTEM)

| | Rate of | | No. of Household Items | Predominant Type of Work | % Qualif. ing. (2) |
|------------------------------|-------------|------|---------------------------|-----------------------------|-----------------------|
| | Pop. Growth | Rank | | | |
| 1. Bizerte (Medina/Zarzouna) | 3.2 | 10 | 310 | drainage & sanitary | 100 |
| 2. Menzel Temime | 4.5 | 05 | 520 | sanitary | 60 |
| 3. Sayada/Lamta/Bou Hjar | 3.9 | 07 | 960 | sanitary | 66 |
| 4. Ksar Hellal | 2.3 | 12 | 1 620 | sanitary | 50 |
| 5. Teboulba | 1.9 | 15 | 990 | sanitary | 60 |
| 6. Kalaa Sghira | 6.5 | 02 | 965 | sanitary | 75 |
| 7. Sahline | 3.4 | 08 | 935 | sanitary | 80 |
| 8. M'Saken | 2.3 | 12 | 420 | drainage | 50 |
| 9. Ksour Essaf | 2.3 | 12 | 1 120 | sanitary | 80 |
| 10. El Djem (1) | 3.3 | 09 | 1 000 | sanitary | 100 |
| 11. Sbeitla | 4.5 | 05 | 770 | sanitary | 60 |
| 12. Sidi Bou Zid | 4.9 | 04 | 1 075 | sanitary | 50 |
| 13. Nefta | 2.5 | 11 | 2 400 | sanitary | 100 |
| 14. Medenine | 6.6 | 01 | 1 180 | sanitary | 80 |
| 15. Tataouine | 5.0 | 03 | 900 | sanitary | 50 |

NOTES: 1) Team replaces Mahares by El Djem

2) Team appraisal per site is a revision of the March Mission Project Paper

Table 7

MATERIALS COSTS PER SITE

| | Material costs | | | | |
|---------------------------|------------------|------------------|------------------|------------------|---------------------|
| | Pipes A.C. ml | Pipes B.A. ml | Manhole Cover | Catsh Bassins | Total Costs (TD) |
| Bizerte (Medina/Zarzouna) | 2 400 | 2 380 | 113 | 120 | 93 900 |
| Menzel Temime | 9 030 | 3 040 | 225 | 250 | 172 700 |
| Sayada/Lamta/Bou Hjar | 15 670 | 4 180 | 432 | - | 203 700 |
| Ksar Hellal | 23 380 | 1 200 | 597 | - | 269 300 |
| Teboulba | 15 030 | 4 780 | 413 | - | 240 100 |
| Kalaa Sghira | 10 090 | 1 320 | 265 | - | 15 000 |
| Sahline | 11 560 | 5 270 | 150 | - | 8 500 |
| M'Saken | - | 2 640 | - | 150 | 541 000 |
| Ksour Essaf | 14 400 | 1 450 | 1 247 | 240 | 714 900 |
| El Djem | 11 200 | 2 060 | 332 | - | 140 000 |
| Sbeïtla | 15 735 | 2 830 | 465 | - | 199 100 |
| Sidi Bou Zid | 18 280 | 1 480 | 495 | - | 218 500 |
| Nefta | 19 990 | 4 370 | 610 | - | 273 700 |
| Medenine | 28 000 | 1 550 | 740 | - | 320 100 |
| Tataouine | 17 200 | 500 | 442 | - | 193 400 |

Table 8

NETWORK COSTS PER SITE

| | Laying Ml | Cost DT | Pumping civil work | Station equipment | Others curl work (civil work) | Total costs (TD) |
|---------------------------|--------------|------------|--------------------------|----------------------|-------------------------------------|---------------------|
| Bizerte (Medina/Zarzouna) | 4 780 | 320 400 | - | - | 109 000 | 429 400 |
| Menzel Temime | 12 070 | 471 500 | - | - | - | 471 500 |
| Sayada/Lamta/Bou Hjar | 19 850 | 475 300 | 14 800 | 45 100 | - | 535 200 |
| Ksar Hellal | 24 580 | 592 300 | 5 500 | 19 600 | 8 200 | 625 600 |
| Teboulba | 19 810 | 559 900 | 5 500 | 19 600 | - | 585 000 |
| Kalaa Sghira | 10 570 | 281 200 | - | 40 300 | - | 281 200 |
| Sahline | 16 820 | 474 200 | 11 400 | 40 300 | - | 525 900 |
| M'Saken | - | - | - | - | - | - |
| Ksour Essaf | 17 080 | 424 900 | - | - | - | 424 900 |
| El Djem | 13 260 | 333 100 | 5 500 | 19 600 | - | 358 200 |
| Sbeitla | 18 565 | 492 000 | - | - | - | 492 000 |
| Sidi Bou Zid | 19 760 | 507 500 | - | - | - | 507 500 |
| Nefta | 24 360 | 685 500 | - | - | 27 300 | 712 800 |
| Medenine | 29 550 | 693 700 | - | - | - | 693 700 |
| Tataouine | 17 700 | 400 700 | - | - | - | 400 700 |

Table 9

TREATMENT AND TOTAL COSTS PER SITE

| | Lots Epuration Treatment costs | | | | | | Total costs |
|---------------------------|--------------------------------|----------|-----------------------------|-----------|-------------------|---------|-------------|
| | Laying ml | Costs DT | Pumping station Civil Works | Equipment | Treatment Station | Cost | |
| Bizerte (Medina/Zarzouna) | - | | | | | | 523 300 |
| Menzel Temime | - | | | | 27 300 | 27 300 | 671 500 |
| Sayada/Lamta/BouHjar | - | | | | 479 600 | 479 600 | 1 218 500 |
| Ksar Hellat | - | | | | | | 894 900 |
| Teboulba | - | | | | | | 825 100 |
| Kalaa Sghira | 840 | 8 300 | 5 500 | 19 100 | 327 000 | 359 900 | 760 900 |
| Sahline | - | - | - | - | 143 900 | 143 900 | 848 100 |
| M'Saken | - | | | | | | 541 000 |
| Ksour Essaf | - | - | 24 500 | 8 200 | 320 500 | 353 200 | 961 400 |
| El Djem | - | - | - | 8 200 | 320 500 | 353 200 | 851 400 |
| Sbef'tla | - | - | - | - | - | - | 691 100 |
| Sidi Bou Zid | - | - | 27 300 | 13 100 | 510 000 | 550 500 | 1 276 500 |
| Nefta | - | - | 26 200 | 8 700 | 516 700 | 551 600 | 1 538 100 |
| Medenine | - | - | - | | 16 400 | 16 400 | 1 030 200 |
| Tataouine | - | | | | 13 100 | 13 100 | 607 200 |

TC: 13 239 100

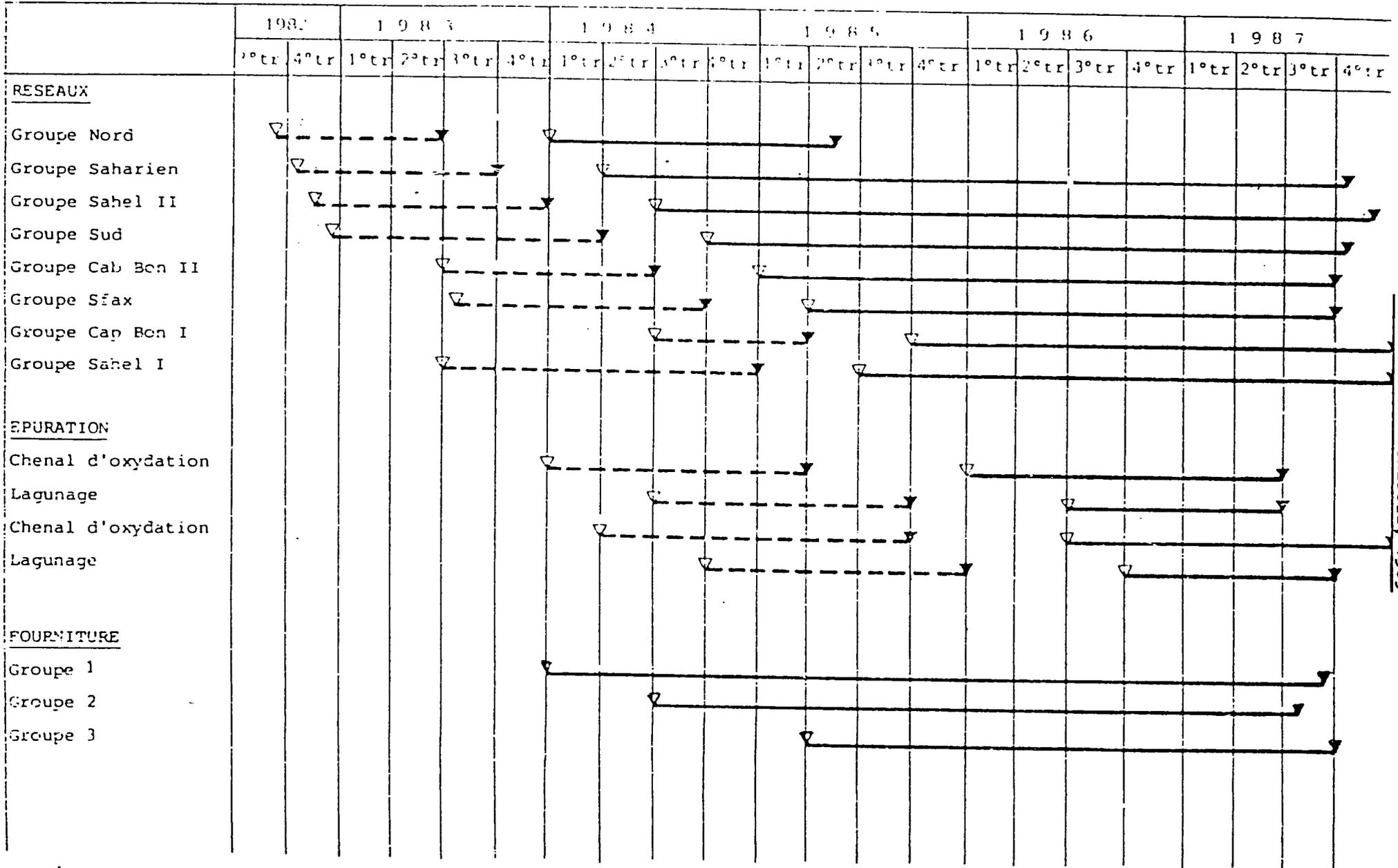
Table 10

PROJECT INVESTMENT COSTS

| | Investment DT | | | Investment in FX | | | Total costs | |
|------------------------------|---------------|---------|-----------|------------------|---------|-----------|-------------|---------|
| | Materials | Network | Treatment | Material | Network | Treatment | TD | FX |
| Bizerte (Medina/Zarzouna) | 51 645 | 231 876 | - | 42 255 | 197 524 | - | 283 521 | 239 779 |
| Menzel Temime | 94 985 | 254 610 | 14 742 | 77 715 | 216 890 | 12 558 | 364 337 | 307 163 |
| Sayada/Lamta/ Bou Hjar | 112 035 | 289 062 | 258 984 | 91 665 | 246 238 | 220 616 | 660 081 | 558 519 |
| Ksar Hellal | 148 115 | 337 824 | - | 121 185 | 287 776 | - | 485 939 | 408 961 |
| Teboulba | 132 055 | 315 900 | - | 108 045 | 269 100 | - | 447 955 | 377 145 |
| Kalaa Sghira | 65 890 | 151 848 | 194 292 | 53 190 | 129 352 | 165 508 | 412 030 | 348 770 |
| Sahline | 98 010 | 283 986 | 77 706 | 80 190 | 241 914 | 66 194 | 459 702 | 388 298 |
| M'Saken | - | 292 140 | - | - | - | - | 292 140 | 248 860 |
| Ksour Essaf | 100 815 | 229 446 | 190 728 | 82 485 | 195 454 | 162 472 | 520 989 | 440 411 |
| El Djem | 77 000 | 193 428 | 190 728 | 63 000 | 164 772 | 162 472 | 461 156 | 390 244 |
| Sbeitla | 109 505 | 265 680 | - | 89 595 | 226 320 | - | 375 185 | 315 915 |
| Sidi Bou Zid | 120 120 | 274 050 | 297 270 | 98 280 | 233 450 | 253 230 | 691 440 | 584 960 |
| Nefta | 150 535 | 384 912 | 297 810 | 123 165 | 327 888 | 253 690 | 833 257 | 704 743 |
| Medenine | 176 000 | 374 598 | 8 856 | 144 000 | 319 102 | 7 544 | 559 454 | 470 646 |
| Tataouine | 106 370 | 216 378 | 7 074 | 87 030 | 184 322 | 6 026 | 329 822 | 277 378 |

- Etude
- Travaux

PLANNING ETUDES ET TRAVAUX PAR LOT PROJET 30 VILLES



CONSTRUCTION SCHEDULE, 1983
Table 11

ANNEX B
TROISIEME PROJET D'ASSAINISSEMENT URBAIN
Planning de Construction

| OBJET | ZONES | 1982 | | | | 1983 | | | | 1984 | | | | 1985 | | | | 1986 | | | | 1987 | | | | 1988 | | | | 1989 | | | |
|-----------------------------------|--------------|------|---|---|---|------|---|---|---|------|---|---|---|------|---|---|---|------|---|---|---|------|---|---|---|------|---|---|---|------|---|---|---|
| | | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| ACHAT DE TUYAUX | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Contrat 1 | 1-2-3 | | | R | | | | B | | | | | | | | | | | | | | | | | | | | | | | | | |
| Contrat 2 | 4-5-6 | | | | | R | | B | | | | | | | | | | | | | | | | | | | | | | | | | |
| Contrat 3 | 7-8 | | | | | | | | | R | | B | | | | | | | | | | | | | | | | | | | | | |
| RESEAU D'ASSAINISSEMENT | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Nord | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Intérieur | 2 | | | | | R | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Sahel II | 3 | | | | | R | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Sud | 4 | | | | | R | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cap Bon II | 5 | | | | | | | R | | | | | | | | | | | | | | | | | | | | | | | | | |
| Sfax | 6 | | | | | | | | | R | | | | | | | | | | | | | | | | | | | | | | | |
| Cap Bon I | 7 | | | | | | | | | R | | | | | | | | | | | | | | | | | | | | | | | |
| Sahel I | 8 | | | | | | | | | R | | | | | | | | | | | | | | | | | | | | | | | |
| STATION D'EPURATION | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Equipement | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Génie Civil 1er Groupe | 2-4-6 | | | | | P | | S | | R | | | | B | | | | | | | | | | | | | | | | T | | | |
| Equipement | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Génie Civil 2eme Groupe | 3-5-7-9 | | | | | | | P | | | | R | | | B | | | | | | | | | | | | | | | T | | | |
| DIVERS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Bureaux | Tunis | | | | R | | | | | B | | | | | | | | | | | | | | | | | | | | | | | |
| Achat d'équipement d'exploitation | Toutes Zones | | | | | | | B | | | | B | | | B | | | B | | | | | | | | | | | | | | | |
| Etude de factabilité | | | | | | | | | | | | S | | | | | | | | | | | | | | | | | | | | | |
| Etude informatique | | | | | | | | | | P | | S | | R | | | S | | R | | F | | | | | | | | | | | | |

Etudes et Préparation des documents

T-Tests
P-Préqualification
R-Révision (ONAS ou Banque)

--- S ---
... B ... Appel d'offres
--- W --- Travaux

↑ Changement d'activité
▼ Fin de chantier
F Rapports définitifs

Etat au 26 nov. 1984

World Bank-24400

Revised ONAS 12/12/84

CONSTRUCTION SCHEDULE, 1984

Table 12

Table 13

SUMMARY OF CONSTRUCTION BY SITE

| | New area serviced | New population serviced | Collector | Secondary collector | Branchment | Pumping | Treatment |
|---------------------------|-------------------|-------------------------|-----------|---------------------|------------|---------|-----------|
| Bizerte (Medina/Zarzouna) | 12 | 1 775 | 300 | 2 400 | 310 | NN(1) | F(2) |
| Menzel Temime | 22,5 | 2 955 | 3 730 | 5 300 | 520 | NN | F |
| Sayada/Lamta/Bou Hjar | 57 | 5 525 | - | 13 100 | 970 | P(3) | P |
| Ksar Hellal | 108 | 9 235 | - | 22 680 | 1 620 | NN | F |
| Teboulba | 62 | 5 750 | - | 14 670 | 990 | NN | F |
| Kalaa Sghira | 407 | 5 790 | 2 430 | 8 140 | 965 | P | P |
| Sa'iline | 40 | 5 400 | - | 8 000 | 935 | P | P |
| M'Saken | - | - | (2 090) | - | - | NN | F |
| Ksour Essaf | 60 | 6 325 | 2 680 | 14 400 | 1 150 | P | P |
| El Djem | 56 | 6 200 | - | 11 200 | 1 000 | P | P |
| Sbeitla | 75 | 4 800 | 3 566 | 15 000 | 770 | NN | F |
| Sidi Bou Zid | 83,5 | 6 665 | 3 061 | 16 700 | 1 075 | P | P |
| Nefta | 120 | 12 000 | 1 500 | 18 000 | 2 400 | P | P |
| Medenine | 140 | 6 440 | 1 550 | 28 000 | 1 180 | NN | F |
| Tataouine | 86 | 4 000 | - | 17 200 | 900 | P | F |

Notes:

- 1) NN (Not Needed)
- 2) F (Future - none in this project)
- 3) P (Included in this project)

Table 14
TYPE OF TREATMENT PROPOSED BY SITE

| | Location | Date | Treatment |
|---------------------------|-----------------------------|------|--------------------------|
| Bizerte (Medina/Zarzouna) | Coastal | No | No treatment now |
| Menzel Temime | Coastal | 87 | Spreading (should treat) |
| Sayada/Lamta/Bou Hjar | 1-2 Coastal and 3 inland | 88 | Oxydation channel |
| Ksar Hellal | Inland | 85 | To Moknine |
| Teboulba | Coastal | N/A | To Moknine |
| Kalaa Sghira | Inland | 88 | Lagoon type 2 |
| Sahlina | Coastal | 88 | Extension to Dekhila |
| M'Saken | Inland | N/A | No but should |
| Ksour Essaf | Inland | 88 | Lagoon type 3 |
| El Djem | Inland | 88 | Lagoon type 3 |
| Sbeitla | Inland | N/A | No but should |
| Sidi Bou Zid | Inland | 87 | Lagoon type 2 |
| Nefta | Inland | 88 | Oxydation channel |
| Medenine | Inland | 88 | Spreading (should treat) |
| Tataouine | Inland | N/A | No but should |

Table 15

SUMMARY OF CONSTRUCTION, INFRASTRUCTURE (ON-OFF-SITE)

| | Construction | | Infrastructure | |
|--------------------------|--------------|----------|----------------|----------|
| | On-site | Off-site | On-site | Off-site |
| 1. Bizerte | X | | X | |
| 2. Menzel Temime | X | X | | X |
| 3. Sayada/Lamta/Bou Hjar | X | X | X | X |
| 4. Ksar Hellal | X | X | | |
| 5. Teboulba | X | | | X |
| 6. Kalaa Sghira | X | X | X | X |
| 7. Sahline | X | X | X | X |
| 8. M'Saken | X | X | | |
| 9. Ksour Essaf | X | X | X | X |
| 10. El Djem | X | X | X | X |
| 11. Sbeitla | X | X | | |
| 12. Sidi Bou Zid | X | X | X | X |
| 13. Nefta | X | X | X | X |
| 14. Medenine | X | X | X | X |
| 15. Tataouine | X | X | | X |

Table 16

LISTED OF PLANS CONSULTED

| SITE | CONSULT | DATE | SCALE | PLAN NO. |
|------------------------------|---------|---------|----------|-------------------|
| 1. Bizerte (Medina/Zarzouna) | ICN | NONE | 1:10 000 | 3-4361-10-10-1 |
| | | | | |
| 2. Menzel Temime | ICN | NONE | 1:2 000 | 3-3261-10-10-4(A) |
| | | | | (A) Two plans |
| 3. Sayada/Lamta/Bou Hjar | ICN | NONE | 1:5 000 | 3-4361-10-10-16 |
| | AEUD | Dec. 83 | 1:5 000 | SLB: 100 |
| 4. Ksar Hellal | ICN | NONE | 1:2 000 | 3-4361-10-10-17 |
| | AEUD | Apr. 84 | 1:1 000 | KH: 200 |
| 5. Teboulba | ICN | NONE | 1:2 000 | 3-4361-10-10-18 |
| | AEUD | Jun. 84 | 1:2 000 | TB: 200 |
| 6. Kalaa Sghira | ICN | NONE | 1:5 000 | 3-4361-10-10-12 |
| | AEUD | Feb. 84 | 1:2 000 | KS: 200 |
| 7. Sahline | ICN | NONE | 1:5 000 | 3-4361-10-10-13 |
| | AEUD | Jan. 84 | 1:2 000 | SH: 201 |
| 8. M'Saken | ICN | NONE | 1:2 000 | 3-4361-10-10-14 |
| | AEUD | Jun. 83 | 1:2 000 | MS: 101 and 102 |
| 9. Ksour Essaf | ICN | NONE | 1:2 000 | 3-4361-10-10-20 |
| | AEUD | Aug. 83 | 1:2 000 | KE: 100 |
| 10. El Djem | ICN | NONE | 1:5 000 | 3-4361-10-10-21 |
| | | | | |
| 11. Sbeitla | ICN | NONE | 1:2 000 | 3-4361-10-10-24 |
| | SOTUTET | Dec. 83 | 1:4 000 | 527: 2.2.1.03 |
| 12. Sidi Bou Zid | ICN | NONE | 1:2 000 | 3-4366-10-10-25 |
| | SOTUTET | Jan. 84 | 1:5 000 | 527: 2.3.1.03 |
| 13. Nefta | ICN | NONE | 1:2 000 | 3-4366-10-10-26 |
| | SOTUTET | Jul. 83 | 1:2 000 | 527: 2.1.1.06 |
| 14. Medenine | ICN | NONE | 1:5 000 | 3-4361-10-10-29 |
| | SCET | Mar. 84 | 1:5 000 | 82-459-142-1.1 |
| 15. Tataouine | ICN | NONE | 1:2 000 | 3-4366-10-10-30 |
| | SCET | Jan. 84 | 1:5 000 | AU: 83-04-03: 1.1 |

2.4 Methodology for Presenting Findings on Sites

In addition to the information presented in the tables, there is a separate section on each site in which the social and technical characteristics of the sites are outlined and the improvements are described. A map of each site is included, and, as mentioned already, a table outlines the cost of all improvements. A number of photographs illustrate the problems that the project seeks to alleviate.

2.5 Report on Sites Recommended for Inclusion

2.5.1 Bizerte

In Bizerte the team visited Zarzouna and the old medina.

2.5.1.1 Social Analysis

Zarzouna is a relatively new community whose residents are working class or poor unemployed, many from rural areas around Bizerte. The large proportion of newcomers has made for a lack of social solidarity. People do not know their neighbors or socialize with them.

Households consist of nuclear families. Monthly revenue for laborers is estimated at 90 to 100 Dinars, when work can be found. Daily food expenses range from 1.5 to 2 Dinars. A one room stone house with a corrugated metal roof, surrounded by a small courtyard, rents for 10.5 Dinars a month. Such a dwelling is not connected to the electric lines or serviced by the National Water Authority (SONEDE).

Building began in Zarzouna in 1945, but the greatest growth has occurred during the past decade. Many one or two room houses built around courtyards are currently going up.

Generally the public utilities that are available to most residents of Zarzouna have just recently been completed or are in the planning stages. Often people have to go some distance on foot to reach a public faucet. If a house has water from SONEDE, there is usually just a single faucet in the courtyard. Families without piped water sometimes have wells or obtain drinking water from neighbors whose homes are connected to the SONEDE system. Squat toilets are used.

Meals are cooked on gas stoves or kerosene burners, and light is provided mainly by electricity but sometimes by kerosene lamp.

The Bizerte medina, like most medinas visited, is inhabited by families who have lived there for generations. Most of these families are working class poor with salaries ranging from 80 to 85 Dinars a month, although some middle class families, with salaries of about 150 Dinars per month, are scattered about. Some houses are small and cramped; others are built according to the typical plan for extended families in which there are a number of nuclear family rooms around a large courtyard.

SONEDE faucets provide potable water, but old wells in the courtyards and collected rainwater are used for wash water. Some houses have been built below street level and therefore become flooded in rainstorms. In addition, squat toilets used as a deposit for household wastewater quickly overflow into living areas during storms.

Cooking is done on gas stoves or kerosene burners.

Oued Rega, which runs through the medina, carries sewer water and solid waste from the streets. People can be seen dumping kitchen garbage directly into it.

2.5.1.2 Technical Analysis

Identification: Zarzouna is a small city about 4 hectares in size located south of the Canal de Bizerte and near the industrial zone. The Bizerte medina is an eight hectare zone located north of the downtown area. The Oued Rega is a natural drainage ditch that passes between houses and carries solid waste and rainwater.

Physical Characteristics: Zarzouna is a low-lying area with little or no drainage (see Photos 5 and 6). In the Bizerte medina sanitary wastes flow onto paved roads and overflow under normal rain conditions into adjacent houses built below grade level (see Photos 7 and 8). Oued Rega is becoming too small to drain a newly built-up well-off sector to the west. It is choked with solid wastes and presents a messy and unhealthy situation (see Photos 9 and 10).

Improvements: Secondary sanitary sewers and house connections will be provided for Zarzouna and the Bizerte medina. The medina will also get primary sanitary sewers to solve the sanitary waste overflow problem. A storm drain will be built in Zarzouna. That, along with the secondary sanitary sewers will benefit the entire population of the area.

The recalibration of Oued Rega will directly benefit the adjacent buildings, although it drains a much larger area.

Costs of Improvements: The total cost is 369,000 Dinars as listed in Table 17.

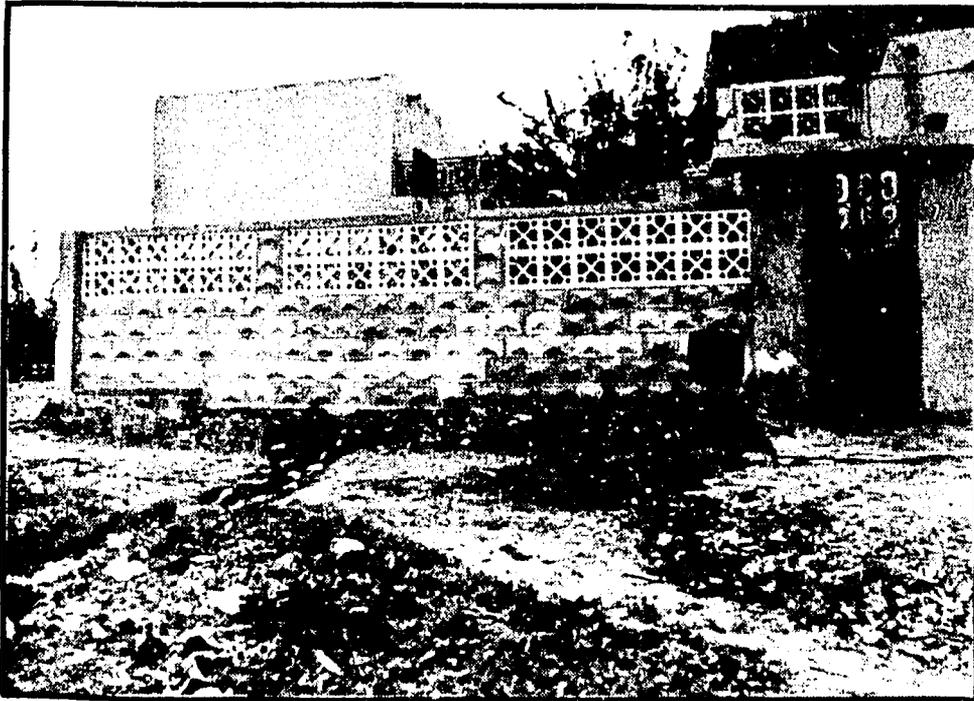


Photo 5: Zarzouna, sanitary wastes from soakage pits overflowing into the street.



Photo 6 Zarzouna, drainage and sanitary wastes.



Photo 7: Bizerte medina, sewer overflow.



Photo 8 Bizerte medina, a kitchen floor lower than street level is flooded at every rainfall.



Photo 9: Oued Rega, hydraulic and solid waste problems.



Photo 10: Wastewater from new housing draining into Oued Rega.

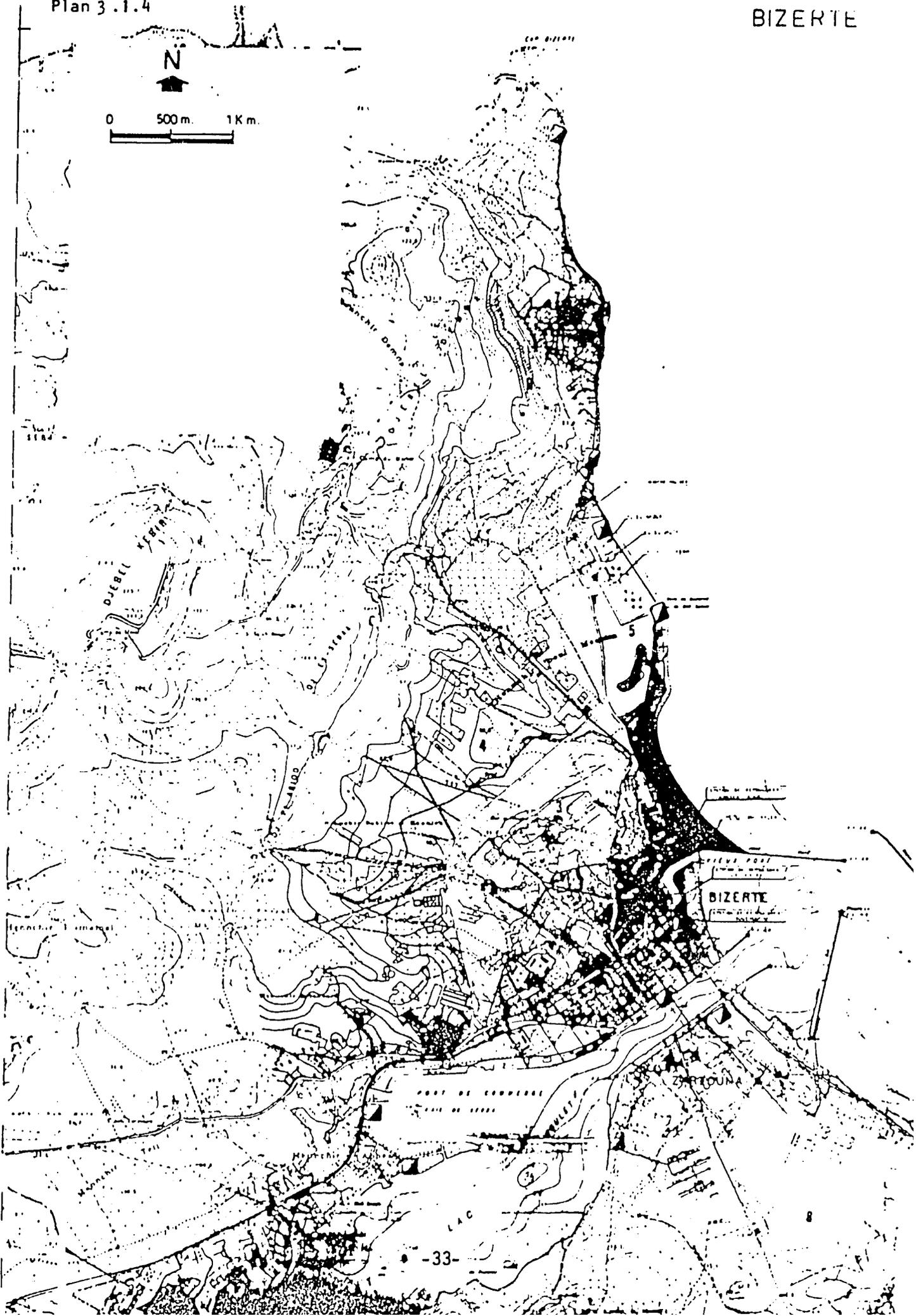


Table 17

BIZERTE: COST OF IMPROVEMENTS

TOTAL INVESTMENT 1981
369.00 TD

| | Dia. | Units | Cost | Total |
|-------------------------|---------|----------|-------|-----------------------|
| Primary sanitary | 800 mm | 300 m | 115 | <u>35 000</u> |
| SUB-TOTAL "A" | | | | 35 000 |
| Drainage | | | | |
| Recalibration Oued Rega | 1 200 | 400 | 250 | 100 000 |
| Collector 19B-19A | 225/100 | 430 | 320 | <u>140 000</u> |
| SUB-TOTAL "B" | | | | 240 000 |
| House connections | | | | |
| 8 ha x 200 ml/ha | 250 | 1 600 ml | 30 | 48 000 |
| 4 ha x 200 ml/ha | 300 | 800 ml | 45 | <u>36 000</u> |
| SUB-TOTAL "C" | | | | 84 000 |
| | | | TOTAL | <u><u>369 000</u></u> |

N.B.

House connections 310

Population served 1 775

ONAS expected population served

1991 = 86%

= 86 000

2.5.2 Menzel Temime

Two main areas were visited in Menzel Temime: Cite Hamari, a neighborhood to the southeast of the center of town, and Skalba, a small village just to the northwest.

2.5.2.1 Social Analysis

Cite Hamari is populated by young families of the working class poor. Day laborers make about 4 Dinars a day and daily food expenses are about 1 Dinar a day.

The community is quite stable because most inhabitants are originally from Menzel Temime and their relatives still live there, some right in Hamari itself.

The housing is relatively new. The average house has two rooms built around a dirt or concrete courtyard. Not all homes are connected to SONEDE. When the SONEDE connection is lacking, water is obtained either from public fountains or individual wells inside the courtyard. Food is cooked on gas burners fueled by bottled gas. Sanitary facilities consist of squat toilets. Household wastewater is swept out the front door via a small drainage canal into the street.

Skalba is an old agricultural village that will be enveloped by the expanding city in the not too distant future. Currently its residents are mainly small farmers with 5 or 10 hectares who have inhabited the region for generations. In spite of its dirt roads and the ubiquitous trickles of household wastewater, Skalba is a clean village as far as solid waste is concerned. This fact may perhaps be accounted for by the town's social solidarity as a kin related community which fosters a sense of public responsibility for communal areas such as the town's center.

Housing consists of extended family ancestral dwellings where each nuclear family inhabits a room around the central courtyard. As in Hamari, in Skalba squat toilets and gas cooking stoves are the norm. Where there is no SONEDE connection, a spring is available or water is piped in via a hose from neighbors without charge, again reflecting the presence of kinship ties.

2.5.2.2 Technical Analysis

Identification: Menzel Temime, located in the eastern part of the Cap Bon region, is a coastal city serving a sprawling population. Improvements will be made in Cite Hamari, a densely populated area of about 4 hectares in the southeast sector of Menzel Temime, and Skalba, a small village to the northwest. The entire site has a gentle slope of about 1 percent toward the sea.

Physical Characteristics: In Cite Hamari sewage flows right onto the dirt roads. Some people are still using old surface wells dug into the rock. (These are about 2 meters in diameter and 10 meters deep.) In one instance an old dry well, less than 50 meters between two of these wells, is being used to dump solid waste and drainage (see Photos 11 and 12). In Skalba sewage flows into all dirt roads (see Photo 13) and soakage pits are used as solid waste dumps.

In Menzel Temime itself secondary roads are not paved and have virtually no drainage.

Improvements: Secondary sanitary sewers and house connections will be installed for Hamari (about 600 persons) and for Skalba (about 2,355 persons). In Skalba the primary off-site collectors will be extended from the center of town. Storm drainage will be provided for four main roads in the center of Menzel Temime.

Costs of Improvements: The total cost is 616,000 Dinars as listed in Table 18.

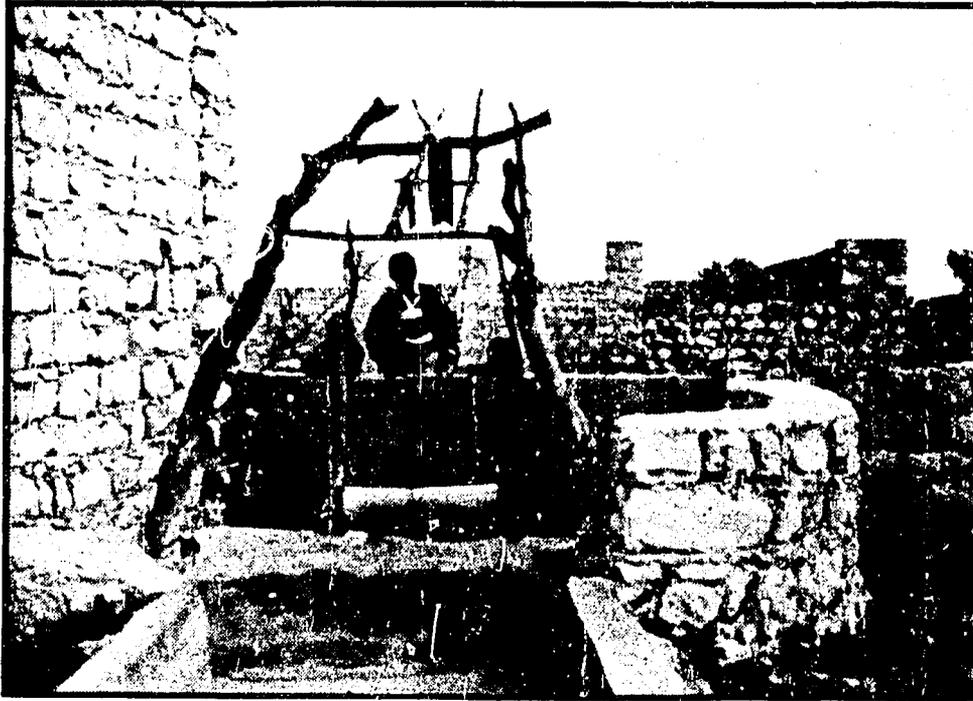


Photo 11: Old well in Cite Hamari.

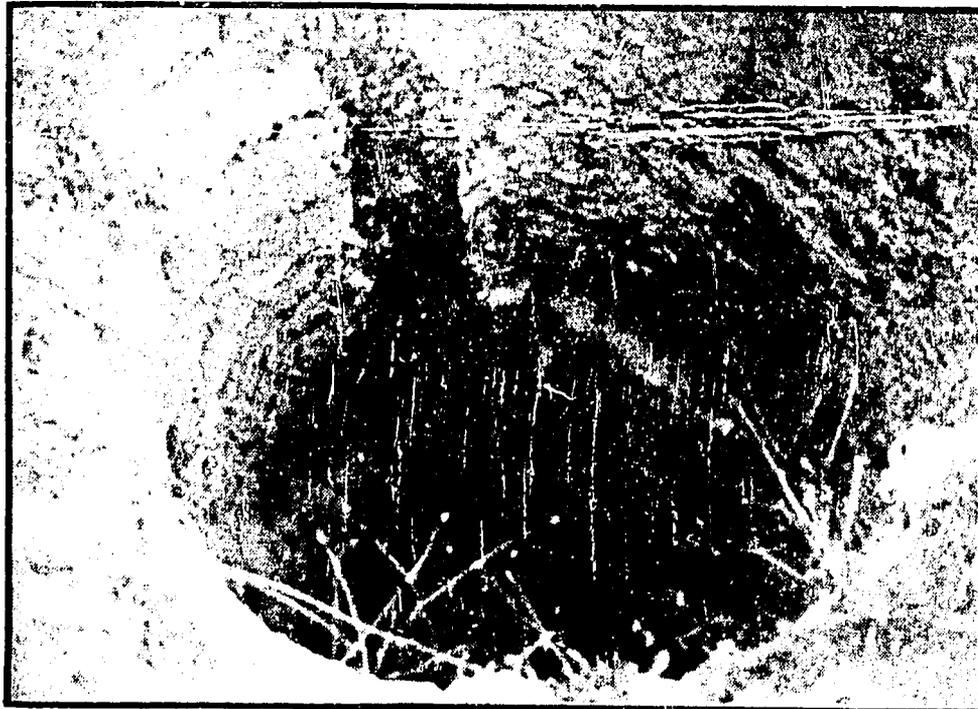


Photo 12: Dried up well used as solid waste dump less than 50 meters from well shown in Photo 11.

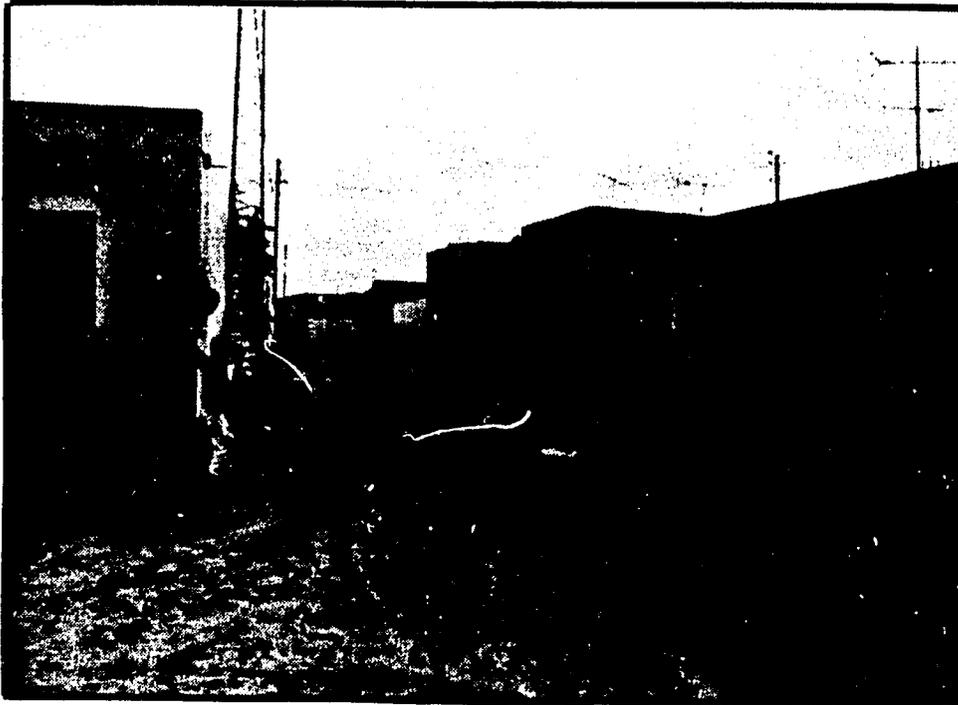
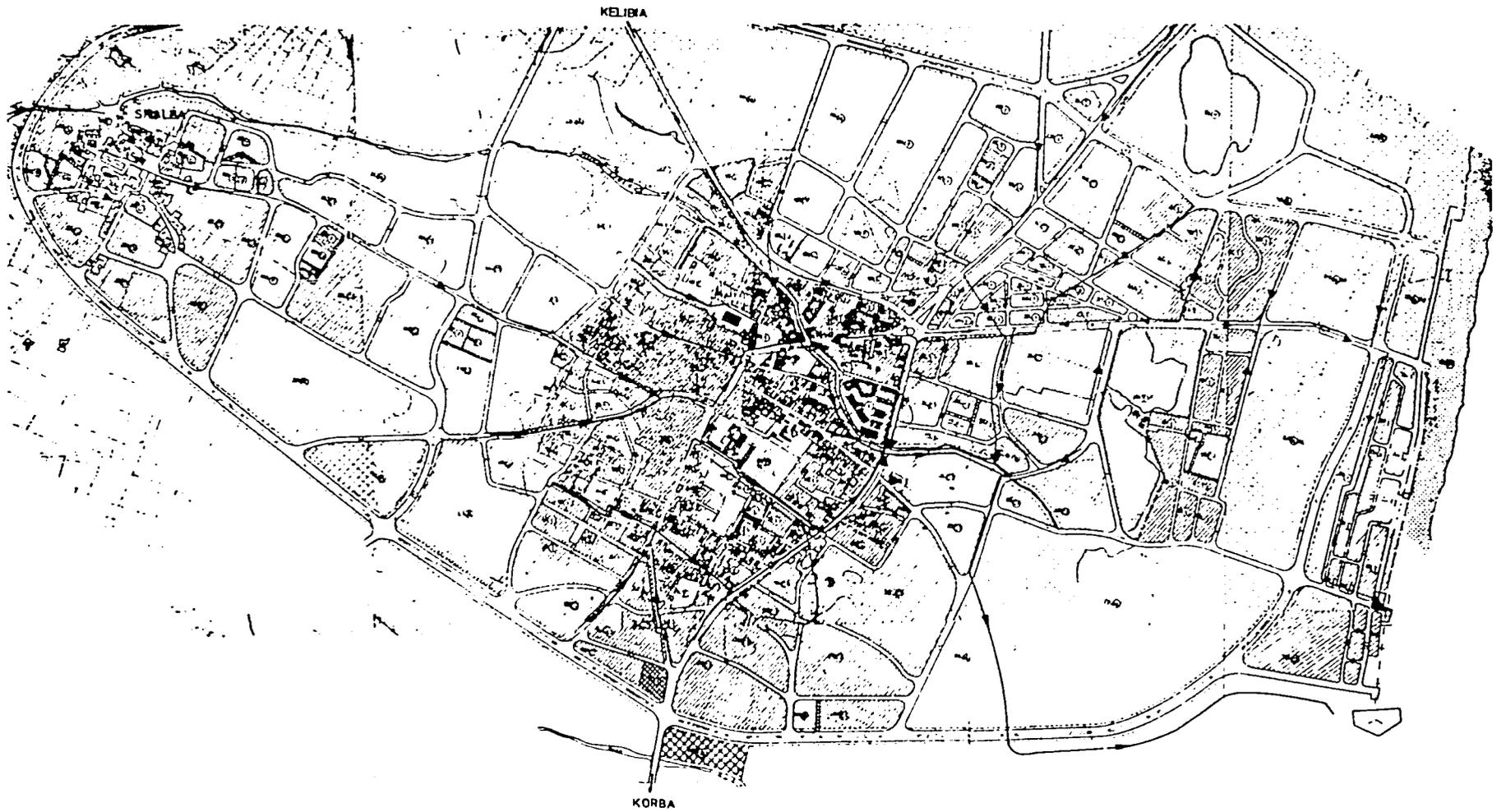


Photo 13: Sanitary wastes flowing into the streets in Skalba.



MENZEL TEMIME

Table 18

MENZEL TEMIME: COST OF IMPROVEMENTS
TOTAL INVESTMENT
 616.000 TC (1/1/82)

| | <u>Diam.</u> | <u>Unit</u> | <u>Cost</u> | <u>Total</u> |
|----------------------------|--------------|-------------|-------------|----------------|
| Primary sanitary collector | | | | |
| Collector C (Extension) | 250 mm | 208 | 42 | 8 740 |
| Collector B (Extension) | 250 mm | 3 520 | 35 | <u>123 200</u> |
| SUB-TOTAL A | | | | 132 000 |
| Primary storm drains | | | | |
| Collectors | N/A | 3 040 | 89 | 270 000 |
| Catch bassins | | 250 | 120 | <u>30 000</u> |
| SUB-TOTAL B | | | | 300 000 |
| House connections | | | | |
| 4 ha X 200 ml/ha | 250 mm | 800 | 30 | 24 000 |
| Skalba | | 4 500 | 30 | <u>135 000</u> |
| SUB-TOTAL C | | | | 159 000 |
| Spreading | | | | |
| | | | | <u>25 000</u> |
| SUB-TOTAL D | | | | 25 000 |

N.B.

House connections 520
 Population served 2 955

ONAS expected polulation served (%)

1991 = 72 %
 = 23 700

2.5.3 Sayada/Lamta/Bou Hjar

2.5.3.1 Social Analysis

Three small neighboring towns make up one project site. In each there is an old center or core of traditional medina-type houses surrounded by newer middle class dwellings. These towns are inhabited by people born there, but there is a mixture of social economic levels. However, the average image of the medina areas is of working class poor. Communal infrastructure is basically complete except for Lamta which has no kindergarten and in which public lighting is limited to the central area of the town.

Earnings vary. In Lamta a weaver was producing traditional cloth in his home loom. This activity brought in 1 Dinar per day. In contrast, a factory textile worker earns 95 Dinars a month. Poor families spend 1 to 1.5 Dinars a day for food. Those somewhat better off spend twice that and may even own a refrigerator. A two-room home around a small courtyard rents for 20 Dinars a month. Meals are cooked on gas or kerosene burners. Toilets are mainly the squat type; most are made of cement, a few of enamel. There are a few sit-down toilets.

2.5.3.2 Technical Analysis

Identification: Lamta and Sayada are on the coast -- Lamta to the north and Sayada to the south -- and Bou Hjar is inland just west of Lamta. The area comprises some 57 hectares.

Physical Characteristics: Sayada is the largest of the three towns. It is fairly hilly with drainage mainly to the sea and is built on rock formations. Mostly residential, Sayada has a fishing harbor and pier. Its main roads are paved but secondary roads are in bad condition and there are many narrow dirt roads, especially in hilly areas.

Lamta is a historical site. It is hilly west of its main roads but the sea shore area is very low lying. The river receives storm and sanitary wastes as well as solid wastes. For example, solid wastes from small private olive processing plants were seen flowing into the streets (see Photos 14 and 15).

Bou Hjar is a densely populated area on a small hill. Two major roads and one secondary road are paved and in good condition but there are also narrow dirt roads with sewage flowing into them (see Photo 16). Some soakage pits were seen in Bou Hjar and in Sayada (see Photo 17).

Improvements: Construction of sanitary collectors, secondary sanitary pipes in the built-up areas, and house connections are proposed for the three towns. The systems will drain toward the sewage treatment plant located north of Lamta. Because of the low-lying areas in Sayada, its sewage will be pumped to Lamta and from Lamta it will be pumped again to the sewage treatment plant. Sewage from Bou Hjar will flow by gravity to the plant.

All sanitary piping used below the water table influenced by the sea should be made of PVC pipes or other materials equally resistant to salt.

Cost of Improvements: The total cost is 1,118,000 Dinars as shown in Table 19.



Photo 14: Main open ditch collecting sanitary and olive wastes. Note blackness of water.

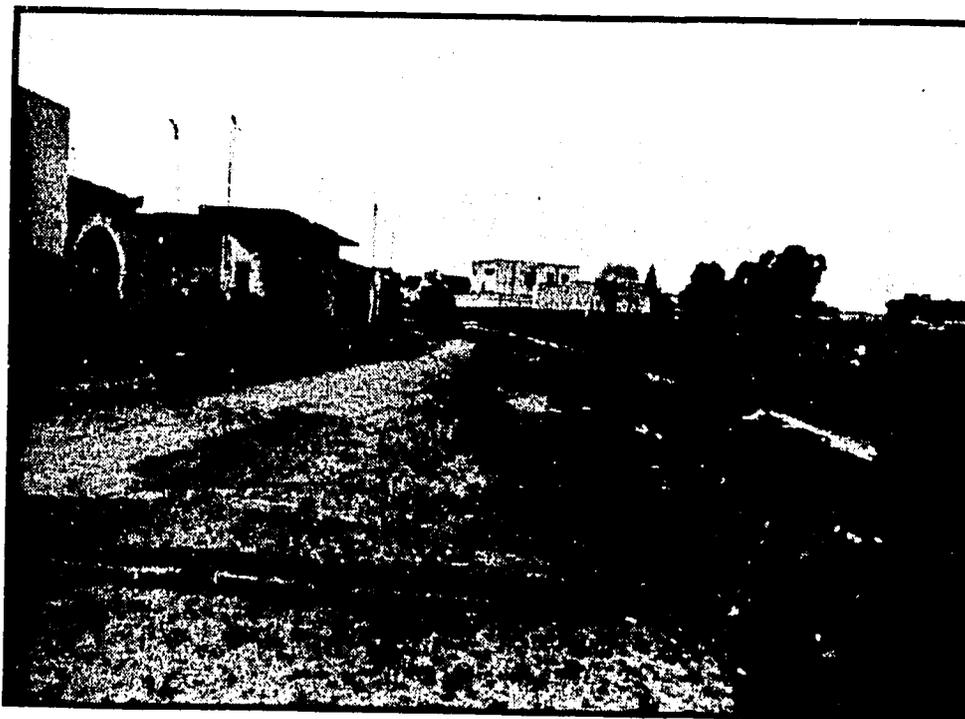


Photo 15: Sanitary and storm problems in Lamta.



Photo 16: Drainage and sanitary problems in Bou Hjar.



Photo 17: A soakage pit in Bou Hjar

Plan 3-3.4



LAMTA

SAYADA

BOU HJAR

44

SAYADA-LAMTA-BOU HJAR

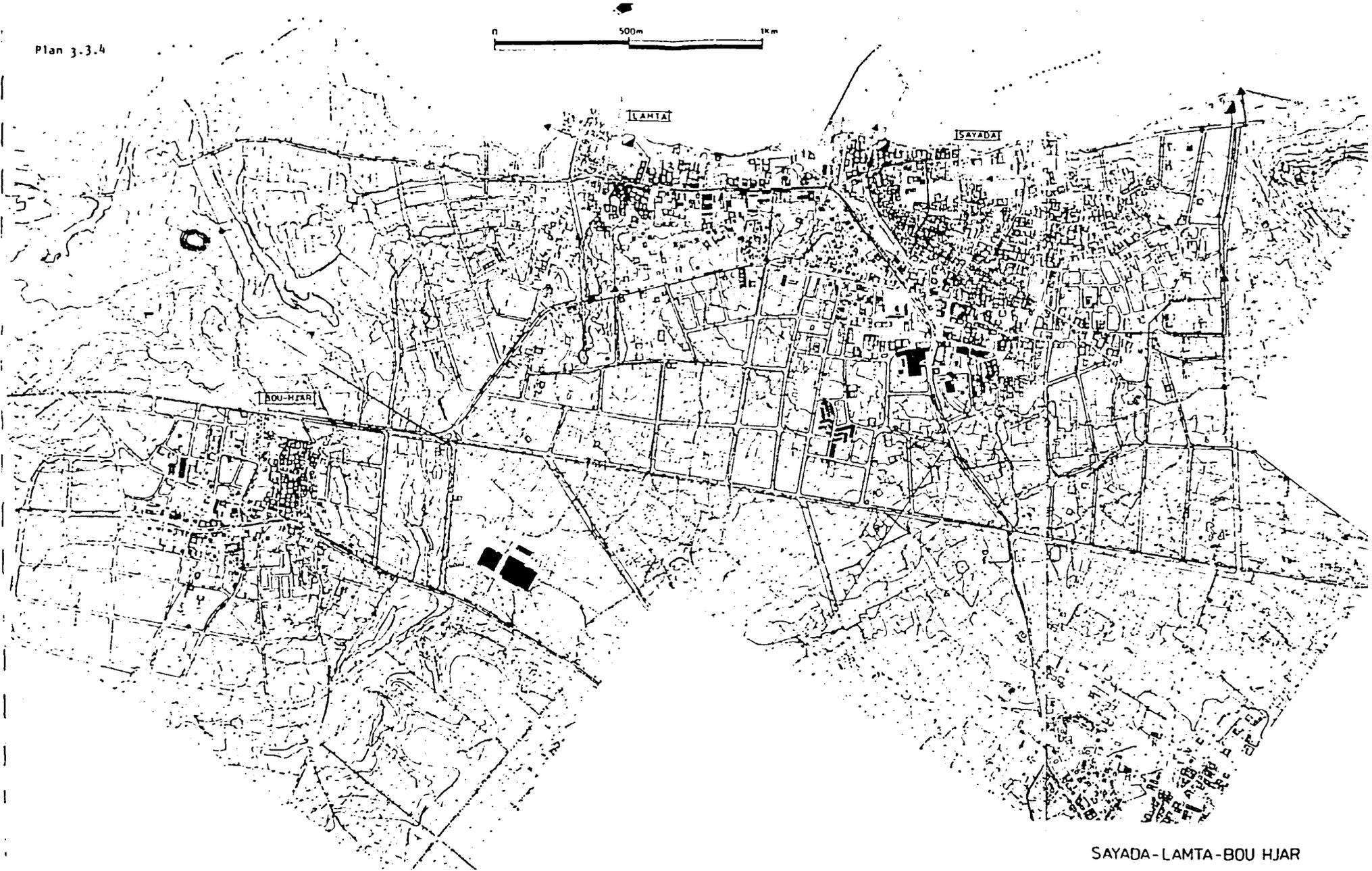


Table 19

SAYADA/LAMTA/BOU HJAR: COST OF IMPROVEMENTS

TOTAL INVESTMENT
1.118.00 TD (1/1/82)

| <u>PRIMARY SANITARY COLLECTOR</u> | DIAM. MM | UNIT | UNIT COST | TOTAL COST |
|-----------------------------------|-------------|-----------------------------------|--------------|------------|
| Collector Sayada | 400 | 300 | 55 | 16 500 |
| | 300 | 880 | 43 | 37 840 |
| Collector Lamta | 300 | 220 | 36 | 7 920 |
| | 400 | 550 | 62 | 34 100 |
| Collector Bou Hjar | 400 | 230 | 47 | 10 810 |
| | 300 | 650 | 51 | 33 150 |
| Pumping station Sayada | | 150 m ³ /h | | 27 500 |
| Pressure main | 200 | 700 | 16 | 11 200 |
| Pumping Station Lamta | | 150 m ³ /h | | 27 500 |
| Pressure main | 200 | 1.870 | 16 | 29 000 |
| Main collector Bou Hjar | 300 | 1.350 | 36 | 48 600 |
| | | | Subtotal | 285 000 |
| <u>SECONDARY SANITARY</u> | | | | |
| 57 ha. x 230 ml/ha | | 13.100 ml at 30 | | |
| House connections: 970 | | Inhabitants: 5.525 | | |
| | | | Subtotal | 393 000 |
| <u>TREATMENT</u> | | | | |
| % ONAS 1991 : 44% | | 13 200 inhabitants | | |
| DB0 ₅ Total | | 585 kg DB0 ₅ /d | | |
| Capacity STEP | | 550 kg DB0 ₅ /d at 800 | Subtotal | 440 000 |

2.5.4 Ksar Hellal

2.5.4.1 Social Analysis

Ksar Hellal is dominated by the textile industry. Consequently, at the present time there is very little unemployment. In addition to a dense old medina settlement of homes which have been inhabited for generations, much new construction of middle class villas is present. The old medina dwellings seen were well maintained with families cooking on gas stoves and ovens and owning refrigerators. Daily food expenses were in the 5 Dinar range. Available domestic space seemed to be slightly greater than in the other communities visited. Nevertheless, homes still contained only one indoor faucet and cement squat toilets.

The medina area of Ksar Hellal is homogeneous socio-economically and peopled with natives of the town, ensuring the social solidarity of the community. Communal infrastructure appears complete.

2.5.4.2 Technical Analysis

Identification: The entire town, comprising 108 hectares, will be connected to the sewage treatment plant under construction in Moknine.

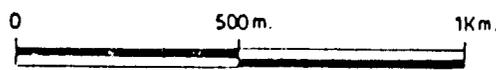
Physical Characteristics: There is an urgent need to improve the sanitary conditions of the city by getting rid of the soakage pits overflowing into the streets and private courtyards. These are also an eyesore.

Improvements: The center of Ksar Hellal is to be equipped with sanitary sewers. The hospitals, located outside the center of town, will be connected to the new sewage treatment plant via a lift station, and the entire city will be connected to the sewage treatment plant in Moknine. Flow will be by gravity. These improvements involve construction of two collectors (F-5 and F-7), realignment of existing collectors, one lift station, and a pressure main.

Cost of Improvements: The total cost is 821,000 Dinars as listed in Table 20.



ST. EP. MOXNINE



KSAR HELLAL

Table 20

KSAR HELLAL: COST OF IMPROVEMENTS

TOTAL INVESTMENT
821.000 TD (1/1/82)

| <u>PRIMARY SANITARY COLLECTOR</u> | DIAM. MM | UNIT | UNIT COST | TOTAL COST |
|-----------------------------------|-------------|------------------------------|--------------|----------------|
| Collector F-5 | 600 | 700 | 100 | 70 000 |
| Collector F-7 | 300 | 500 | 51 | 25 000 |
| Separation Box | | | | 7 500 |
| Removal of collector | | 700 | 5 | 3 500 |
| Pumping station | | 100 m ³ /h | | 23 000 |
| Pressure main | 200 | 700 | 16 | 11 200 |
| | | | Subtotal | <u>141 000</u> |
| <u>SECONDARY SANITARY</u> | | | | |
| 108 ha. x 210 ml/ha | | 22 680 ml at 30 | Subtotal | <u>680 000</u> |
| House connections: | 1 620 | Inhabitants: | 9 235 | |
| <u>TREATMENT</u> | | | | |
| % ONAS 1991 : | 72% | 20 100 inhabitants | | |
| DBO ₅ total | | 1 185 kg DBO ₅ /d | | |
| To STEP Moknine | | 1 185 kg DBO ₅ /d | | |

2.5.5 Teboulba

2.5.5.1 Social Analysis

Extended family households with one nuclear family per room around a communal courtyard were found living in their ancestral housing in the old medina of Teboulba. While each nuclear family had a separate kitchen and cooked on gas stoves or ovens, the cement squat toilet, television, refrigerator, and single water faucet in the courtyard were shared by all.

Although socio-economic levels are mixed, a majority of families fall into the working class category of small farmers, fishermen, day laborers and the like. Food costs ranged from 2 to 3 Dinars a day. A fisherman working on someone else's boat can make 3 Dinars a day when there is work. In summer there is steady work for fishermen in Teboulba, but in winter work is available only six to seven days per month. Income is supplemented during the winter months by crafts such as knitting. An unmarried daughter of one of the fishermen interviewed has a knitting machine. She works on the machine about three hours a day producing an average of two sweaters per day. This nets her only about 0.4 Dinars.

2.5.5.2 Technical Analysis

Identification: The center of Teboulba, about 62 hectares, is the target area.

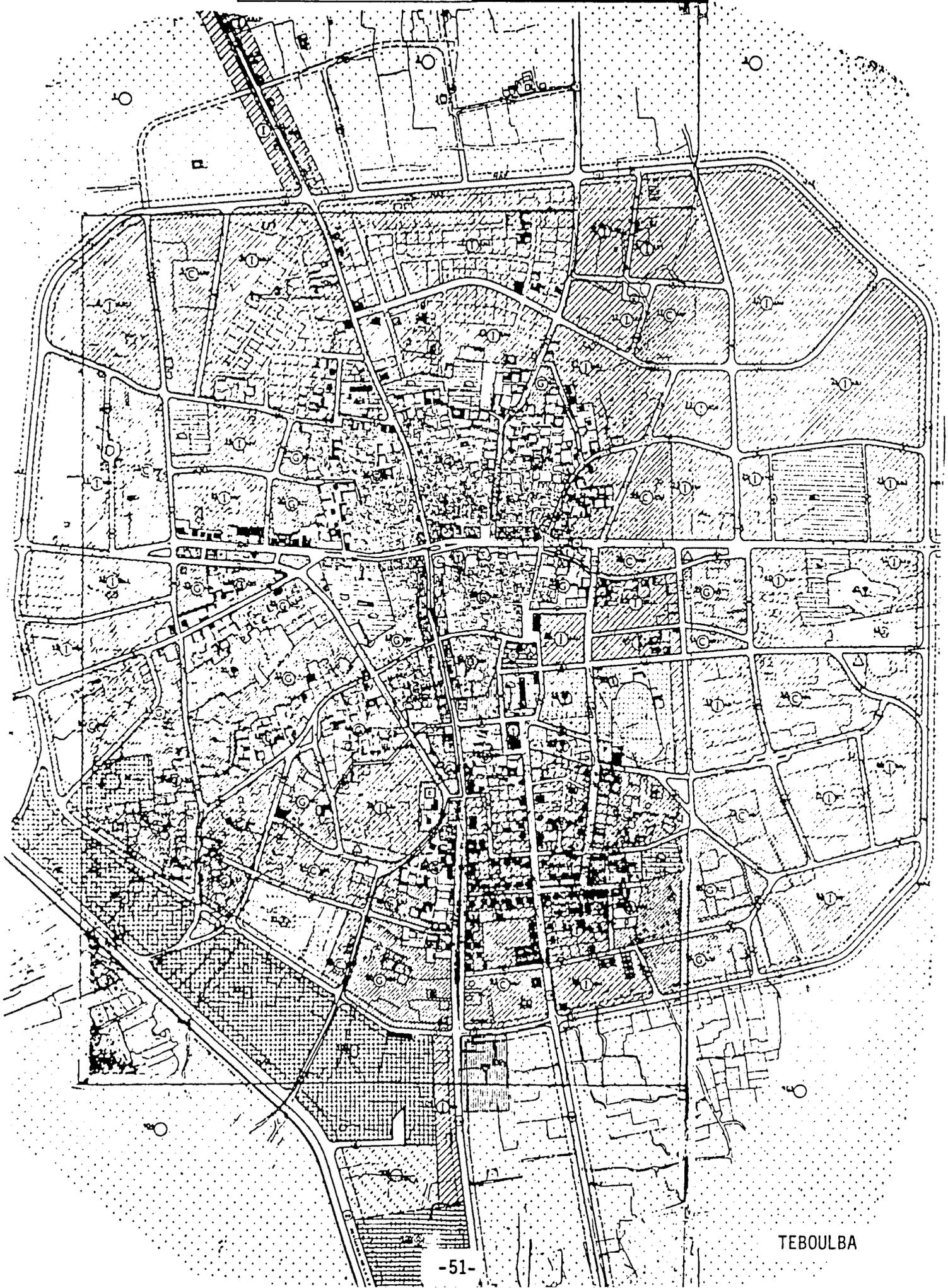
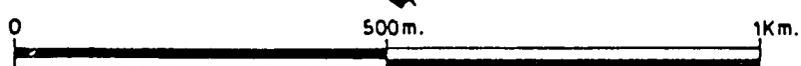
Physical Characteristics: In Teboulba there is an extensive use of soakage pits, and raw sewage drains off onto dirt roads. An open ditch carries storm water and sanitary waste (see Photo 18).

Improvements: A main collector will be constructed to move sewage to the Moknine sewage treatment plant. This will eliminate the major problems of sewage draining into roads and fields. Sanitary wastes will be drained into the collector, while only storm water and excess flow from the collector will remain in the open ditch. Also, the collector will pass through olive groves where cattle, sheep, and goats pasture. In conjunction with the above, small mains, a lift station, and a pressure main will be constructed. Household connections and secondary collectors will be provided for 990 houses.

Cost of Improvements: The total cost is 757,000 Dinars as listed in Table 21.



Photo 18: End of collector flowing into open field in Teboulba.



TEBOULBA

Table 21

TEBOULBA: COST OF IMPROVEMENTS

TOTAL INVESTMENT
757.000 TD (1/1/82)

| <u>PRIMARY SANITARY COLLECTOR</u> | DIAM. MM | UNIT | UNIT COST | TOTAL COST |
|--|-------------|--------------------|-----------------------|----------------|
| Collector II | 300 | 500 | 51 | 25 000 |
| Pumping station | | Civil Works | | 5 000 |
| | | Equipment | 100 m ³ /h | 18 000 |
| Pressure main | 200 | 360 | 16 | 5 760 |
| Main collector | 500 | 880 | 58 | 51 000 |
| | 300 | 490 | 51 | 25 000 |
| Collector to Moknine Section (Teboulba) | 600 | 2 910 | 64 | 186 000 |
| | | | Subtotal | <u>317 000</u> |
| <u>SECONDARY SANITARY</u> | | | | |
| 62 ha. x 236 ml/ha | | 14 670 ml at 30 | Subtotal | <u>440 000</u> |
| House connections: 990 | | Inhabitants: 5 750 | | |

TREATMENT

% ONAS 1991: 48% 10 400 inhabitants

DBO₅ Total 565 kg DBO₅/d

To STEP Moknine 565 kg DBO₅/d

2.5.6 Kalaa Sghira

2.5.6.1 Social Analysis

In Kalaa Sghira the basic medina pattern of mixed income levels and old ancestral homes is again repeated. Though most families use gas burners and have cement toilets as well as basic connections to municipal water and electricity, some families are much poorer. A family was interviewed who lived in one room around an unpaved courtyard with a corrugated metal roofed kitchen. They had neither electricity nor toilet facilities of any kind though they did have a water faucet in the courtyard. Fecal matter was collected in a basin and dumped at a relative's home or in a nearby neighbor's toilet. They were quite insistent that they did not dump it into the open wastewater sewers in the street. This was one of the few families interviewed throughout urbanized Tunisia who had neither television nor radio and who used only kerosene light. The family spends 1 Dinar per day on food. They receive all their expense money from a nephew, a primary school teacher who supports them and his own family. The old father has no pension from his former work as a day laborer. However, other medina dwellers, though not generally middle class, are certainly better off than this example.

2.5.6.2 Technical Analysis

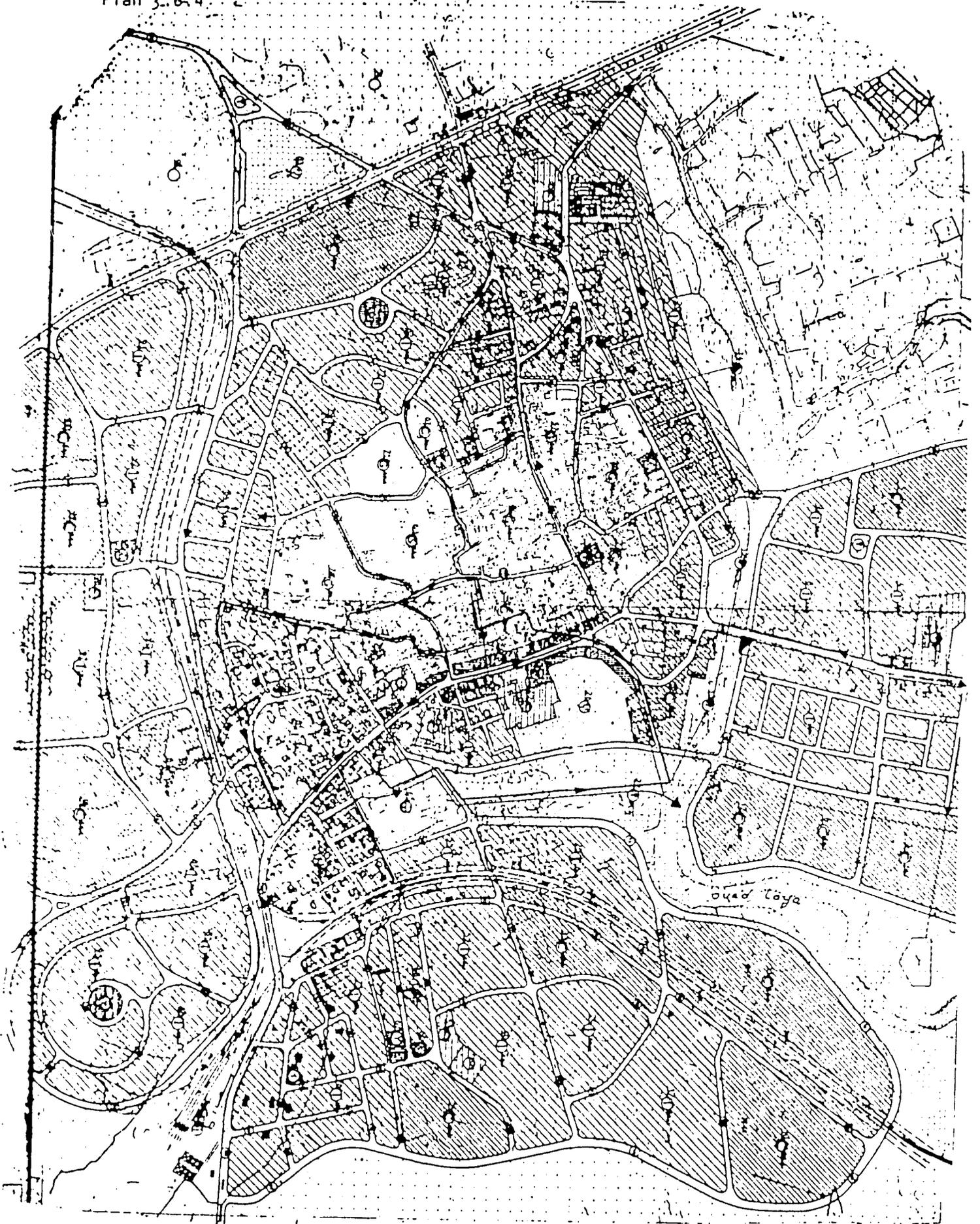
Identification: The target area for this project is the old medina located on the hill in the city center. This area is about 40.4 hectares.

Physical Characteristics: No sanitary sewer exists in this sector, although most streets are paved. The natural drainage flows into Oued Laya and then, if there is sufficient rainfall, into the sea near Hammam Sousse, in the tourist area.

Most houses use soakage pits or gullies in the center of roads or on the sides of narrow streets for the disposal of household water. After each storm, some of this sewage drains downhill and into the marketplace which lies in a flood sensitive zone.

Improvements: Sanitary services will be installed in the medina, including primary and secondary sanitary collectors, connections for 965 houses, a pumping station, a pressure main, and a treatment plant. Once these services are installed, roads will be free of most sanitary wastes; however, this project will not solve all flooding problems in Kalaa Sghira.

Cost of Improvements: The total cost is 698,000 Dinars as listed in Table 22.



KALAA SGHIRA

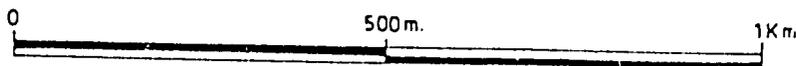


Table 22

KALAA SGHIRA: COST OF IMPROVEMENTS

TOTAL INVESTMENT
757.000 TD (1/1/82)

| <u>PRIMARY SANITARY COLLECTOR</u> | DIAM. MM | UNIT | UNIT COST | TOTAL COST |
|-----------------------------------|-------------|-----------------------------------|--------------|----------------|
| Collector A1-Pumping sta. | 400 | 360 | 62 | 22 320 |
| " A3.1.-A3.1.1. | 250 | 300 | 42 | 12 600 |
| " B1-Pumping sta. | 300 | 670 | 51 | 34 170 |
| " B1-B2 | 300 | 291 | 51 | 14 840 |
| " B2-B2.1 | 250 | 108 | 42 | 4 500 |
| " B2.1-B2.2 | 250 | 432 | 42 | 18 145 |
| " B2.1.-B2.1.1. | 250 | 267 | 42 | 11 215 |
| Pumping station | | 90 m ³ /h | | 22 500 |
| Pressure main | 200 | 840 | 16 | 13 440 |
| | | | Subtotal | <u>154 000</u> |
| <u>SECONDARY SANITARY</u> | | | | |
| 40,7 ha. x 200 ml/ha | | 8 140 ml at 30 | Subtotal | <u>244 000</u> |
| House connections: 965 | | Inhabitants: 5 790 | | |
| <u>TREATMENT</u> | | | | |
| % ONAS 1991: 67% | | 10 900 inhabitants | | |
| DBO ₅ Total | | 445 kg DBO ₅ /d | | |
| STEP Capacity | | 400 kg DBO ₅ /d at 750 | Subtotal | <u>300 000</u> |

2.5.7 Sahline

2.5.7.1 Social Analysis

Sahline presents another old medina settlement typical of the Sahel region. Housing is Arab-style with rooms around a central cement courtyard.

The walls and doorways of many homes seemed less well maintained than in other sites visited in the region. The population is native to the town and region, normally an indication of social solidarity. However, this community was rather closed and it was difficult to interview the inhabitants. The women were reticent to talk and called men over to answer questions.

Medina dwellers appear to be mainly working class. Young people find it difficult to find work. Some families have refrigerators and a number have enamel squat toilets in addition to courtyard water faucets. Cooking is on gas stoves or ovens. Families spend from 3 to 5 Dinars per day on food, depending on their size.

2.5.7.2 Technical Analysis

Identification: The project covers all 40 hectares of the city and includes as beneficiaries most of the existing population.

Physical Characteristics: This city has no sewerage system. Most houses use soakage pits, septic tanks, or simply the street as a sanitary waste system. In 1976 more than 1,000 homes were dumping sanitary wastes directly into the ditch alongside dirt or paved roads. Most of these problems will be corrected by the project.

Improvements: The entire city will be equipped with sanitary service. The collector north, pumping stations A and B, the forced and gravity main, and the extension of the Dekhila sewage treatment plant are all off-site improvements. The remaining parts of the system -- secondary sanitary connections and house connections -- are local improvements.

Cost of Improvements: The total cost is 778,000 Dinars as listed in Table 23.

Plan 3.7.4

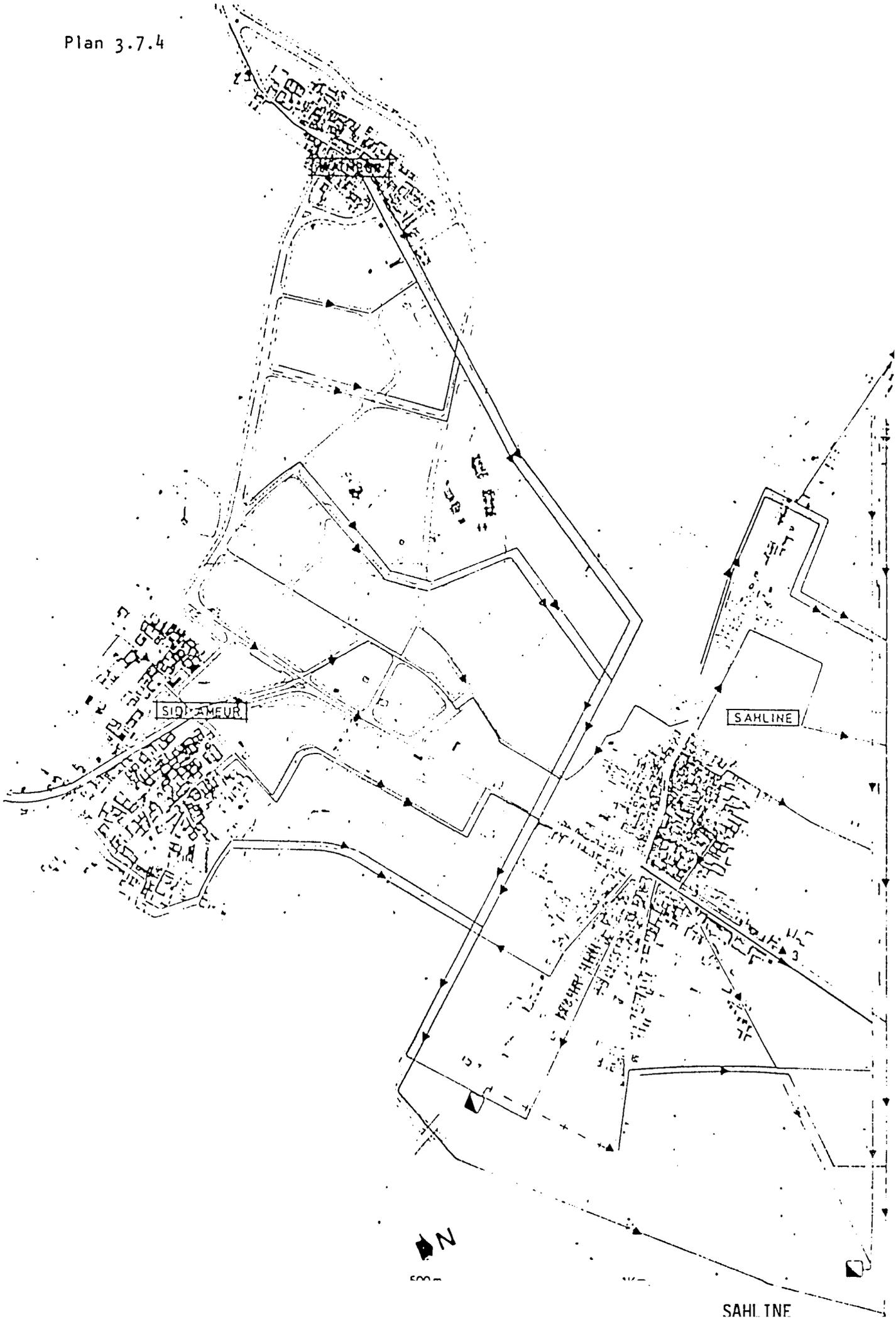


Table 23

SAHLINE: COST OF IMPROVEMENTS

TOTAL INVESTMENT
778.000 TD (1/1/82)

| <u>PRIMARY SANITARY COLLECTOR</u> | DIAM. MM | UNIT | UNIT COST | TOTAL COST |
|-----------------------------------|-------------|-------------------------------|--------------|------------|
| Collector Principal North | 300 | 450 | 36 | 16 280 |
| | 400 | 434 | 47 | 20 400 |
| " 2, 3/1, 4, 5 | 300 | 1 790 | 36 | 64 440 |
| Lift Station "B" | | 115 m ³ /h | | 27 500 |
| Pressure Main | 300 | 1 107 | 24 | 27 120 |
| Gravity Main | 500 | 353 | 58 | 20 475 |
| Lift Station "A" | | 60 m ³ /h | | 20 000 |
| Pressure Main | 200 | 463 | 16 | 7 410 |
| Gravity Main | 300 | 883 | 36 | 31 790 |
| Collector Principal South | 500 | 1 012 | 58 | 58 700 |
| Collectors 6, 7, 8/1, 8/2 | 300 | 1 585 | 51 | 80 835 |
| | 250 | 746 | 58 | 31 330 |
| | | | Subtotal | 406 000 |
| <u>SECONDARY SANITARY</u> | | | | |
| 40 ha. x 200 ml/ha | | 8 000 ml at 30 | | |
| House Connections: 935 | | Inhabitants: 5 400 | | |
| | | | Subtotal | 240 000 |
| <u>TREATMENT</u> | | | | |
| % ONAS 1991: 69% | | 9 100 inhabitants | | |
| DBO ₅ Total | | 355 kg DBO ₅ /d | | |
| Extension STEP DEKHILA | | 350 kg DBO ₅ /d at | | 132 000 |

2.5.8 M'Saken

2.5.8.1 Social Analysis

M'Saken consists not only of an old medina but also of an extensive area of new middle-class villas built with money earned abroad. The medina is inhabited by middle and working class families who are native to the town and immediate surrounding region. Both areas will benefit from the drainage project.

In the old medina extended and nuclear family units live in one or more rooms built around a paved courtyard. Houses have municipal water and electricity. Many doorways are well maintained and decorated with tiles as are balcony walls in apartment style homes. Cooking is done on gas stoves and ovens. Many families have refrigerators. Daily food expenses fall in the 2 to 5 Dinar range. Older homes have cement or enamel squat toilets, but in the newer villas toilets are western style.

Public infrastructure is good with adequate night lighting.

2.5.8.2 Technical Analysis

Identification: M'Saken has a population of around 40,000.

Physical Characteristics: The existing sewer system of M'Saken is mostly a combined sewer which is too small to absorb a normal rainstorm. Flooding occurs in the center of the city and overflows into poor neighborhoods. Oued Melah, which receives most of the drainage and sanitary wastes from the city is a solid waste disposal dump with a serious odor problem (see Photos 19 and 20).

A sanitary main collector, although recommended as a good solution for M'Saken's sewerage problems, cannot be accepted for financing since it stops in the Oued Melah on the southeast side of the city. A project to connect M'Saken to the sewage treatment plant in Sousse should be carried out in the near future. At that time, financing of the collector should be acceptable.

The new area near the stadium is mainly for wealthy people and hence not acceptable for financing by Housing Guaranty funds.

Improvements: The project is to install a new storm collector in the city center to alleviate the overflow problem. Most of the population will benefit from this improvement since it will remove excess rainwater from the existing sewage system and eliminate most overflowing of sewers.

Cost of Improvements: The total cost is 541,000 Dinars as listed in Table 24.



Photo 19: Oued Melah in M'Saken showing sanitary and solid waste problems.



Photo 20: Oued Melah in M'Saken. Note blackness of highly septic, malodorous water.



Table 24

M'SAKEN: COST OF IMPROVEMENTS

TOTAL INVESTMENT
541.000 TD (1/1/82)

| <u>PRIMARY STORM SYSTEM</u> | DIAM. MM | UNIT | UNIT COST | TOTAL COST |
|-----------------------------|------------------|------------------------------|--------------|------------|
| Collector e10-e0 | 200/120 | 1 200 | 250 | 300 000 |
| " b2-b1 (part.) | 200/100 | 375 | 220 | 82 500 |
| " b1-b0 | canal maçonné | 220 | 100 | 22 000 |
| | 250/150 | 295 | 400 | 118 000 |
| Catch basin | | 150 | 120 | 18 000 |
| | | | Subtotal | 541 000 |
| <u>SECONDARY SANITARY</u> | | | Subtotal | |
| <u>TREATMENT</u> | | | | |
| % ONAS 1991 : 81% | | 36 780 inhabitants | | |
| DBO ₅ Total | | 1 480 kg DBO ₅ /d | | |

2.5.9 Ksour Essaf

2.5.9.1 Social Analysis

Ksour Essaf is characterized by old medina housing. Families are mostly working class, but not all enjoy steady work. The population is stable old time residents of the town; people of varying socio-economic levels live side by side. However, the overall image is of a rather poor community with an agriculturally based economy.

Homes consist of a couple of rooms around a courtyard. They have cement squat toilets, a single faucet, and cooking by gas burners. Since the arrival of SONEDE, old wells inside the courtyard are used as dump sites for household wastewater.

Ksour Essaf has solid waste and open sewers in the streets. One of the worst refuse dumping sites viewed was on the road between Ksour Essaf and Moknine where solid waste lined both sides of the road in piles the shape of overturned garbage collection carts.

2.5.9.2 Technical Analysis

Identification: The project will involve 60 hectares of Ksour Essaf.

Physical Characteristics: There is no storm or sanitary sewer system in Ksour Essaf. Currently people use soakage pits, septic tanks, and open dumping into ditches to get rid of their garbage. In addition, the entire city is highly susceptible to flooding due to its low elevation and the proximity of two sizeable rivers, Oued Boudabboussa and Oued Assaker. A major diking program is underway to protect the city from the overflowing of these two oueds, and storm drainage is being improved by La Direction de l'Hydraulique Urbaine (see Photos 21-24).

Improvements: The project consists mainly in the construction of the main collectors in a 60 hectare area to service the entire city. Off-site improvements include collectors A, A.1, A1.1, the lift station, and the sewage treatment plant. On-site improvements include collectors B, secondary sanitary mains, and house connections.

Cost of Improvements: The total cost is 882,000 Dinars as listed in Table 25.

Photos 21-24: Sanitary and storm problems in Ksour Essaf.



Photo 21

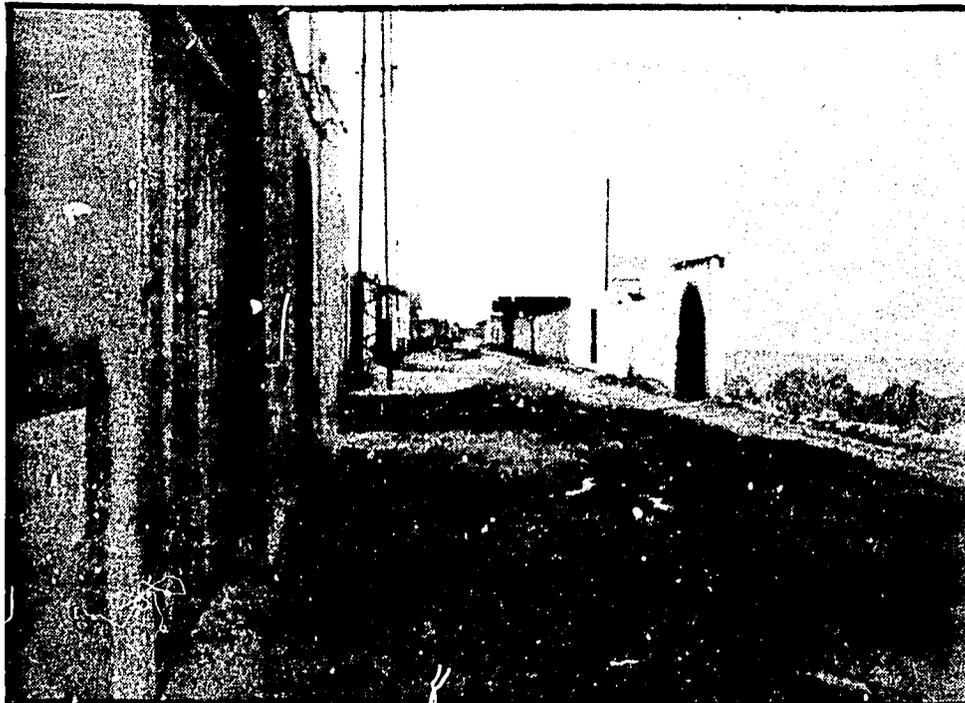


Photo 22



Photo 23

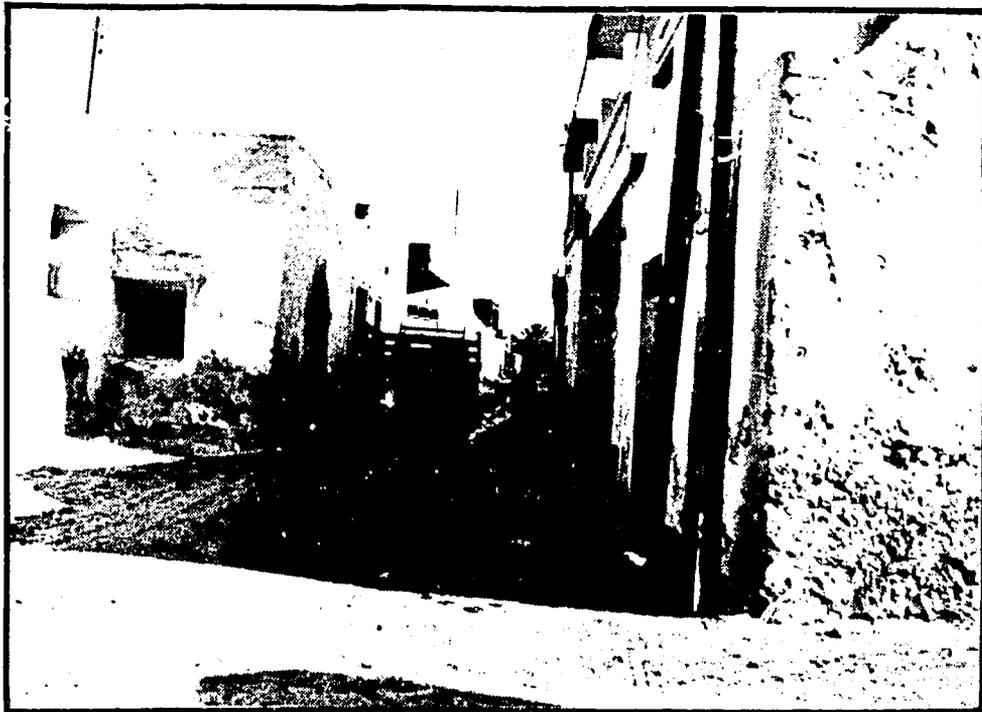


Photo 24



Table 25

KSOUR ESSAF: COST OF IMPROVEMENTS

TOTAL INVESTMENT
882.000 TD (1/1/82)

| <u>PRIMARY SANITARY COLLECTOR</u> | | DIAM. MM | UNIT | UNIT COST | TOTAL COST |
|---|---------|-------------|------|--------------|----------------|
| Collector | A-A1 | 400 | 415 | 55,500 | 23.030 |
| | A1-A1.1 | 300 | 625 | 43,500 | 27.190 |
| | B-B1 | 400 | 130 | 55,500 | 7.215 |
| | B1-B2 | 400 | 235 | 55,500 | 13.040 |
| | B2-B3 | 400 | 80 | 55,500 | 3,330 |
| | B3-B3.1 | 300 | 375 | 43,500 | 16.310 |
| | B3-B4 | 300 | 200 | 43,500 | 8.700 |
| | B4-B5 | 300 | 620 | 43,500 | 26.970 |
| | | | | Subtotal | <u>126.000</u> |
| <u>SECONDARY SANITARY</u> | | | | | |
| 60 ha. x 240 ml/ha. = 14.400 ml at 30 | | | | | Subtotal |
| House connections inhabitants: 6.325 | | | | | <u>432.000</u> |
| <u>TREATMENT</u> | | | | | |
| % ONAS 1991 : 45% = 10.900 inhabitants | | | | | |
| DBO ₅ total = 460 kg DBO ₅ /d | | | | | |
| Capacity STEP + 500 kg DBO ₅ /d at 588 = | | | | | 294.000 |
| Lift station 60 m ³ /h = | | | | | 30.000 |
| | | | | Subtotal | <u>324.000</u> |

2.5.10 El Djem

2.5.10.1 Social Analysis

El Djem is a brief tourist stop for people wishing to tour the Roman colosseum. However, not much revenue from this touristic site filters back into the community. The town is almost entirely old medina type housing of working class poor. Unlike many communities observed, El Djem does not show the rampant residential construction going on throughout Tunisia. It appears to be stagnating economically. Though a basic communal infrastructure exists, transportation within the town is lacking as is public lighting, except on the main streets.

Narrow dirt roads riddled with meandering trickles of wastewater wind around the old medina. One or two room houses with squat toilets, a SONEDE faucet, gas or kerosene stoves, and small dirt paved courtyards were observed.

Day laborers cannot find steady work and hence daily food expenses were estimated at only 0.5 Dinars for many families.

The town is for the most part socio-economically homogeneous and comprised of residents who are natives of the town and region.

2.5.10.2 Technical Analysis

Identification: El Djem lies on a barren hill on a Roman city site (see Photo 25). Its center (56 hectares) will receive a sanitary sewer system to replace the existing combined system. The city of El Djem was omitted in the March 1984 Project Paper. Following the site visit, and after discussion with the World Bank, it is recommended for financing to replace Mahares.

Physical Characteristics: The existing sewer system is combined and some sectors are too small and misaligned.

Improvements: The misconception and misalignment of the present system will be corrected. A lift station and a sewage treatment plant to receive and treat all sewage of the city will be constructed. About 1,000 house connections are included.

The off-site project includes the sewage treatment plant. The on-site project includes mostly house connections and recalibration and realignment of existing collectors.

Cost of Improvements: The total cost is 781,000 Dinars, as listed in Table 26.

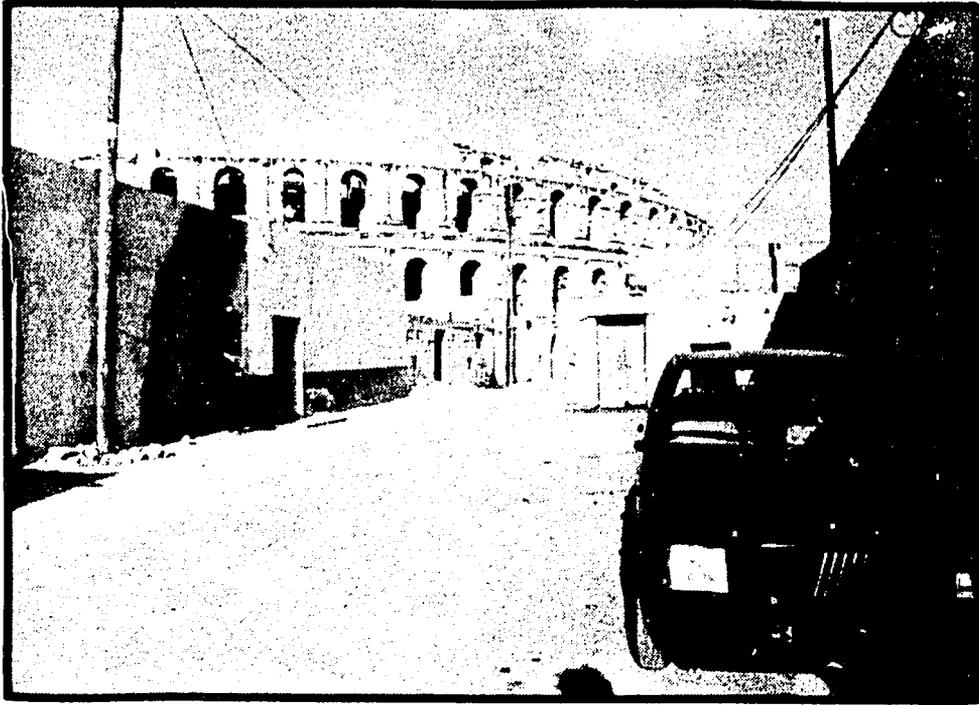
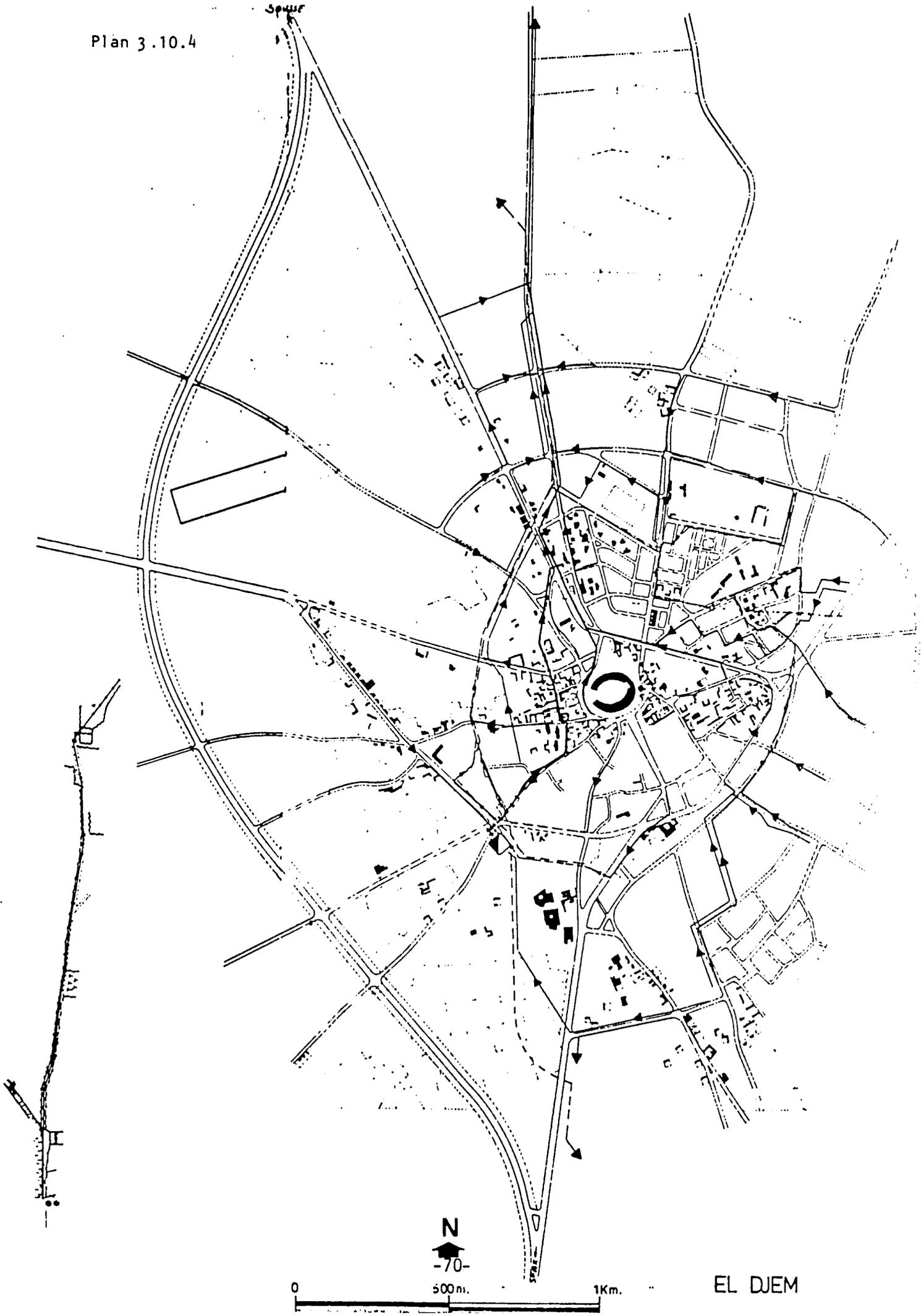


Photo 25: El Djem.

Plan 3.10.4



N
-70-

0 500m. 1Km.

EL DJEM

Table 26

EL DJEM: COST OF IMPROVEMENTS

TOTAL INVESTMENT
781.000 TD (1/1/82)

| <u>PRIMARY SANITARY COLLECTOR</u> | DIAM. MM | UNIT | UNIT COST | TOTAL COST |
|--------------------------------------|-------------|----------------------------|--------------|----------------|
| Collector A Recalibration | 300 | 500 | 51 | 25.500 |
| R | 300 | 710 | 51 | 36.210 |
| IX | 300 | 850 | 36 | 30.600 |
| Removal and relaying of collector | | 1.200 | 5 | 6.000 |
| Lift Station | | 100 m ³ /h | | 23.000 |
| | | | Subtotal | <u>121.000</u> |
| <u>SECONDARY SANITARY</u> | | | | |
| 56 ha. x 200 ml/ha. | = | 11.200 ml at 30 = | | |
| House connections: 1.000 | | inhabitants: 6.200 | Subtotal | <u>336.000</u> |
| <u>TREATMENT</u> | | | | |
| % ONAS 1991: 74% | = | 14.600 inhabitants | | |
| DBO ₅ total | = | 575 kg DBO ₅ /d | | |
| Step Lagoon type 2 | 500 | kg DBO ₅ /d | = | 294.000 |
| Lift Station | | m ³ /h | = | 30.000 |
| | | | Subtotal | <u>324.000</u> |

2.5.11 Sbeitla

2.5.11.1 Social Analysis

Sbeitla is a community with a sizeable population from outside the town. Like other towns in Central Tunisia, prior to independence Sbeitla was a small community with a dispersed rural population of transhumant origin. Nowadays perhaps a third of the population is not native to the region but has been assigned there as government bureaucrats, teachers, or other middle class white collar workers.

A Tunisian National Housing Authority home rents for 16 Dinars a month while other houses of much lower quality and with poorer inhabitants rent for 20 Dinars a month. Housing varies from one room Arab style to two-floored extended family dwellings in villa style. Not all houses are connected to SONEDE. Families without water share water costs with their neighbors. The poorest use kerosene burners for cooking, with the better off having gas stoves or even gas ovens. A few refrigerators are present. Squat toilets are the norm but there is some distinction between the many with cement squat toilets and the few with enamel ones.

The lowest income found was 30 Dinars a month for a family of eight ranging to 180 Dinars a month for a family of nine in a neighborhood of native Sbeitlans. Daily food expenses are estimated at 1 to 5 Dinars a day with most in the 2.5 Dinar range.

Sbeitla thus shows a mixed economic range (unemployed, day laborers, farmers, and merchants) as well as middle class bureaucrats from various parts of the country within the area inhabited by natives of the region. A rather poor looking section of the town houses army families from other areas of Tunisia. The team was not allowed to interview any residents in this section.

2.5.11.2 Technical Analysis

Identification: The city of Sbeitla is mostly agricultural with sheep raising, olive groves, and an olive oil refinery. The project covers most of the old city plus a sanitary main to drain the lycee into the system. About 75 hectares will be equipped with house connections.

There is quite a lot of government housing either recently built or under construction on the periphery of the sector to be improved. These houses generally have complete services.

Physical Characteristics: There is no sanitary sewer system in Sbeitla. Residents use soakage pits or septic tanks to dispose of garbage. Sanitary wastes flow into dirt roads or ditches. Because the soil in this area is pervious, this sewage flow pollutes the water table beneath the city. Migration to the city center will worsen this poor environmental condition. Sewage from the lycee flows in a raw state along the road leading to the center of the city. The project will solve problems in the center of the city as well as at the lycee. A sewage treatment plant is not included in this project due mostly to financial shortages but is projected in the near future.

Improvements: Construction of primary sanitary mains to collect waste from the center of the city and drain it into oueds is planned. Collectors 1 and 3 drain Qued Ech-cheraia to the south of the city and collector 2 drains into Qued Rmel to the northeast of the city. The new main collector will be extended to the lycee. About 770 house connections are proposed.

The future sewage plant will be constructed on the south side of the city station.

Cost of Improvements: The total cost is 633,890 Dinars, as listed in Table 27.

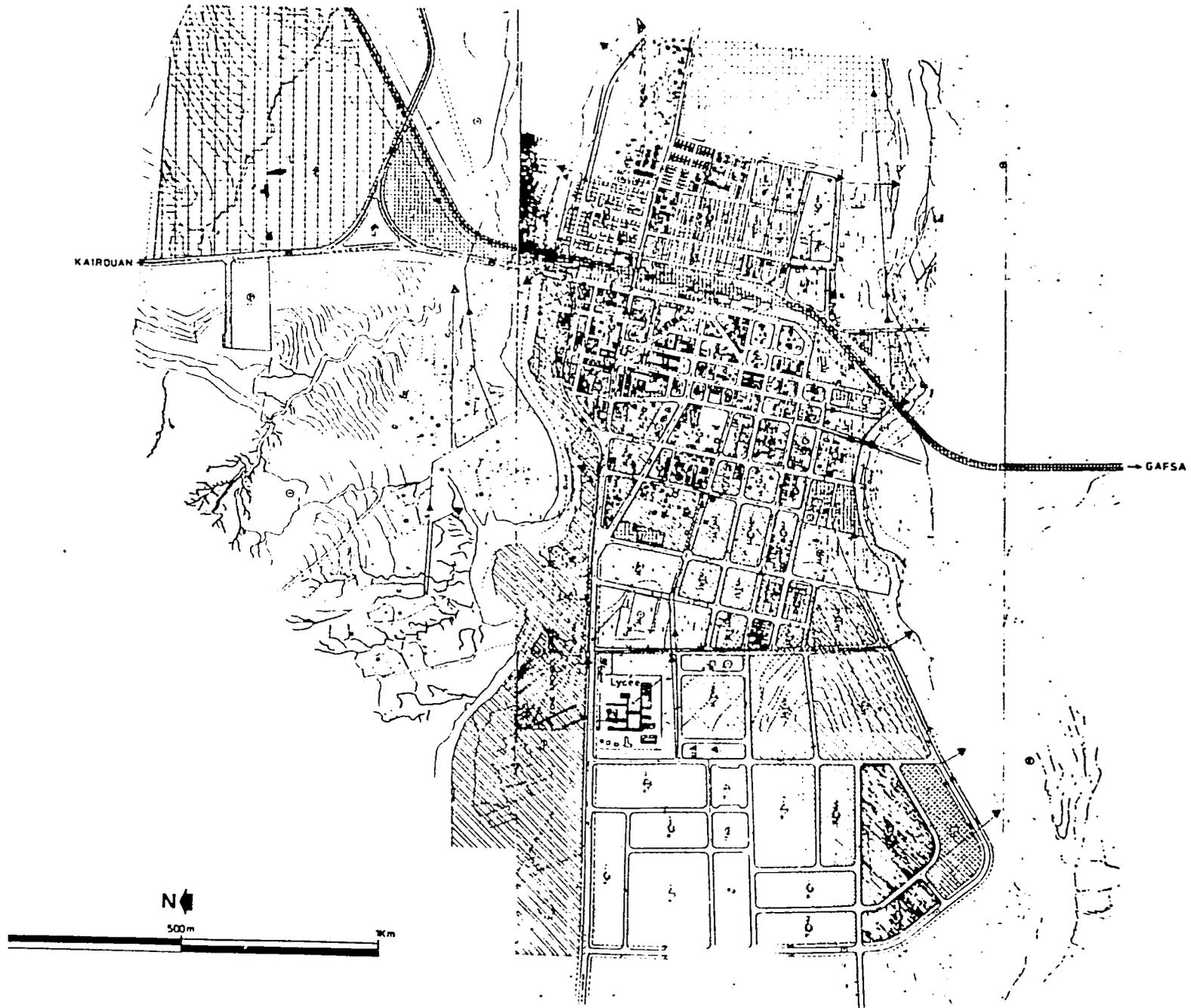


Table 27

SBEITLA: COST OF IMPROVEMENTS

TOTAL INVESTMENT
633.000 TD (1/1/82)

| <u>PRIMARY SANITARY COLLECTOR</u> | DIAM. MM | UNIT | UNIT COST | TOTAL COST |
|-----------------------------------|-------------|----------------------------|--------------|----------------|
| Collector III | 300 | 560 | 51 | 28.560 |
| " IV (187-27) | 300 | 617 | 51 | 31.470 |
| " V (173-25) | 300 | 320 | 51 | 16.320 |
| " II (66-11) | 400 | 812 | 62 | 50.345 |
| " (78-66) | 300 | 522 | 51 | 26.620 |
| " VI (115-101) | 250 | 735 | 42 | 30.870 |
| | | | Subtotal | <u>183.890</u> |
| <u>SECONDARY SANITARY</u> | | | | |
| 75 ha. x 200 ml/ha. | = | 15.000 ml at 30 = | Subtotal | <u>450.000</u> |
| House connections 770 | | inhabitants: 4.800 | | |
| <u>TREATMENT</u> | | | | |
| % ONAS 1991: 52% | = | 7.700 inhabitants | | |
| DBO ₅ total | = | 465 kg DBO ₅ /d | | |

2.5.12 Sidi Bou Zid

2.5.12.1 Social Analysis

The town of Sidi Bou Zid was only a small village thirty years ago. Since then it has been drawing people in from the countryside at an increasingly rapid rate. The urbanization process has mushroomed particularly in the past twelve years and new housing can be seen going up all over town. Even though it has just recently been urbanized, Sidi Bou Zid is socio-economically homogeneous since it draws its population from the landed farmers in the surrounding countryside.

The population grew from 10,000 in 1975 to 28,000 in 1980 and is still growing at a very fast pace. It should reach 46,000 by the year 2000.

Apparently, those with some land are able to afford house construction in town and have moved in while poorer small farmers or those who are agricultural day laborers still live in the countryside. In many cases children from the poorer countryside are housed with relatives or in school dormitories in Sidi Bou Zid while their families remain outside the town.

The local communal infrastructure is rather complete except for public lighting which was reported to be only on the main streets near the center of town.

Families seem to be more lower middle to middle class with food expenses ranging from 2 to 5 Dinars a day and monthly salaries varying accordingly. Cooking is done on gas stoves, some with ovens, and several homes have refrigerators. Many people own their own Arab-style extended family homes. Rents are relatively high at 30 Dinars a month reported for Arab-style homes of two and three rooms around a small courtyard. Squat cement toilets are the norm as are SONEDE connections consisting usually of a single faucet in the courtyard.

2.5.12.2 Technical Analysis

Identification: The project covers the entire old city but does not cover the sector west of the center and to the north of the lycee. Improvements will be for about 83.5 hectares.

Physical Characteristics: The small center city core is equipped with a sanitary sewer system. However, all the surrounding sectors have no services and rely only on soakage pits, septic tanks, and direct overflow onto dirt roads. Garbage is also dumped on the outskirts of Sidi Bou Zid (see Photos 26 and 27). Less than 30 percent of the houses already serviced by a sewer system are connected. The Tunisian National Sewerage Agency (ONAS) expects the connection ratio to reach 80 percent with the completion of this project.

To protect the city from flooding two major dikes were constructed, one north and one south of the city. Sidi Bou Zid gets its water from wells located about 30 kilometers northwest of the city. This major twin piping travels above ground for about 10 kilometers on piles.

Improvements: Construction of primary sanitary collectors, house connections, secondary sanitary collectors, a lift station, and a sewage treatment plant are needed. The treatment plant will be built on the east side of the city. In addition to the residential sewage, it will receive industrial wastewater from the olive oil refinery, cannery, tile factory, and slaughter house (150 heads per day).

Cost of Improvements: The total cost is 1,171,000 Dinars, as listed in Table 28.

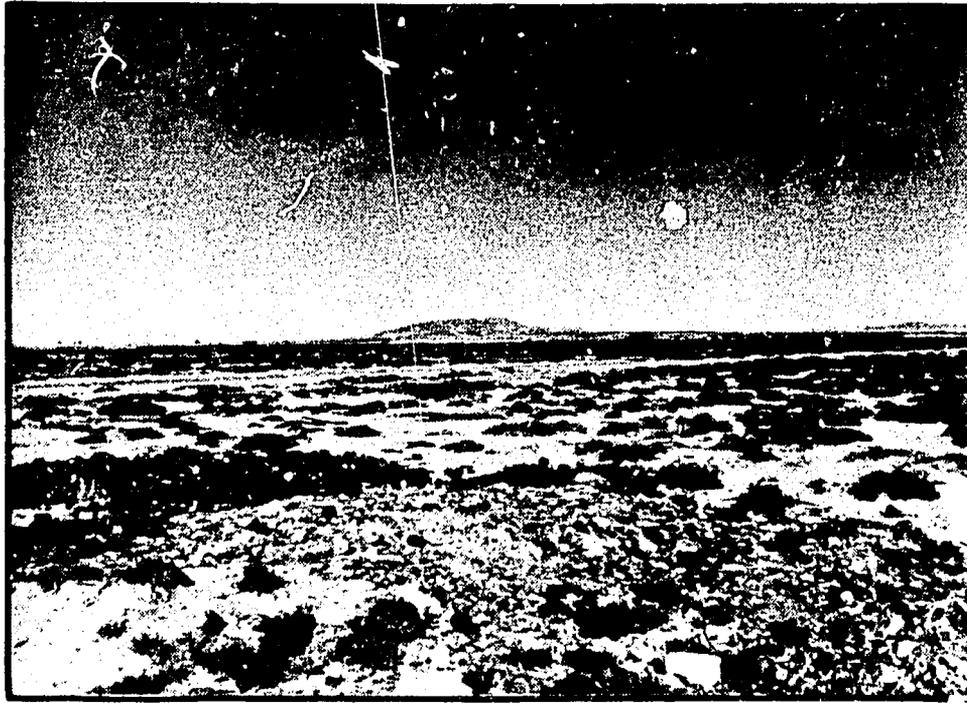


Photo 26: An extensive dump site on the outskirts of Sidi Bou Zid is littered with tin cans and household garbage.



Photo 27: The dump is near a new industrial park near Sidi Bou Zid.

Table 28

SIDI BOU ZID: COST OF IMPROVEMENTS

TOTAL INVESTMENT
1.171.000 TD (1/1/82)

| <u>PRIMARY SANITARY COLLECTOR</u> | DIAM. MM | UNIT | UNIT COST | TOTAL COST |
|-----------------------------------|-------------|---------------------------------|------------------------|----------------|
| Collector I (35-43) | 400 | 400 | 62 | 24.800 |
| III | 250 | 1.583 | 42 | 66.490 |
| | 300 | 80 | 51 | 4.080 |
| | 400 | 703 | 61 | 43.590 |
| Collector I (to STEP) | 600 | 295 | 89 | 26.250 |
| | | | Subtotal | <u>165.000</u> |
| <u>SECONDARY SANITARY</u> | | | | |
| + 83.5 ha. x 200 ml/ha. = | 16.700 | ml at 30 = | Subtotal | <u>501.000</u> |
| House connections: 1.075 | | inhabitants: 6.665 | | |
| <u>TREATMENT</u> | | | | |
| % ONAS 1991: 69% | = | 13.700 | inhabitants | |
| DBO ₅ total | = | 800 | kg DBO ₅ /d | |
| STEP Capacity | | | | |
| Lagoon type II | 800 | kg DBO ₅ /d at 585 = | | 468.000 |
| Lift Station | 130 | m ³ /h | = | <u>37.000</u> |
| | | | Subtotal | <u>505.000</u> |

2.5.13 Nefta

2.5.13.1 Social Analysis

One of the poorest sites visited was Nefta. Families with many children live in one room homes of stone and mud with perhaps a thin layer of cement on the front wall. Courtyards are often of dirt with muddy water running from the faucet area to the canal under the front door. Animals share the courtyards. Normally squat toilet facilities consist of a small depression dug in the corner of the courtyard with pieces of palm logs stretched across for people to balance their feet on. The toilet area is shielded from the rest of the yard by a palm frond fence. Children are poorly dressed and often barefoot. Though frequent diarrhea was not reported, many children had bad colds with runny noses.

Not everyone has electricity but most have gas burners for cooking. Daily food expenses range from 1 to 3 Dinars a day in working class families, many of whom report only occasional work, mainly as agricultural day laborers in the oasis.

The small portion of the community who find work in the tourist industry at the Sahara Palace Hotel enjoy a slightly better living standard with such amenities as a concrete paved courtyard, concrete squat toilet and the like. In general, however, the area is quite homogeneous both socially and economically with a population that is native to the town and region.

2.5.13.2 Technical Analysis

Identification: Nefta is an oasis dating back many generations. It is divided by the highly fertile oasis and the main road, GP3. Dates and cattle raising are prime industries here. The two sectors are called El Aioun (lower sector) and El Acil (upper sector). The project will provide services to most people in these two sectors. About 120 hectares are to be equipped.

Physical Characteristics: The present sewer system was started and built by the municipality and was designed mainly to connect a few houses to a main which then drained into a soakage pit. This solution was used extensively throughout the city. The main problems noted are that the pipes and soakage pits are undersized. Also, soakage pits are located in impervious soils and because they have no access covers, they cannot be maintained and cleaned periodically.

The team noted numerous rivulets of sewage in the dirt roads and saw cattle, sheep, goats, dogs and cats drinking from sewage runoff in the streets. Photos 28-31 illustrate Nefta's sewage problems.

There is a water shortage in this area; however, there is a great danger in allowing animals to drink from sewage. Furthermore, unless adequate treatment is provided, wastewater should not be reused for agriculture. There is an urgent need for this project in Nefta.

Improvements: Construction of a great variety of collectors from 250 to 600 mm, a ditch to carry storm water away from the city center towards the

south oved and most important, about 2,400 house connections for 12,000 inhabitants are planned. Also included is a sewage treatment plant and a lift station. On this project only collector EU-2, the treatment plant, and lift station can be described as off-site costs; the remaining costs are on-site.

Cost of Improvements: The total cost is 1,411,000 Dinars, as listed in Table 29.

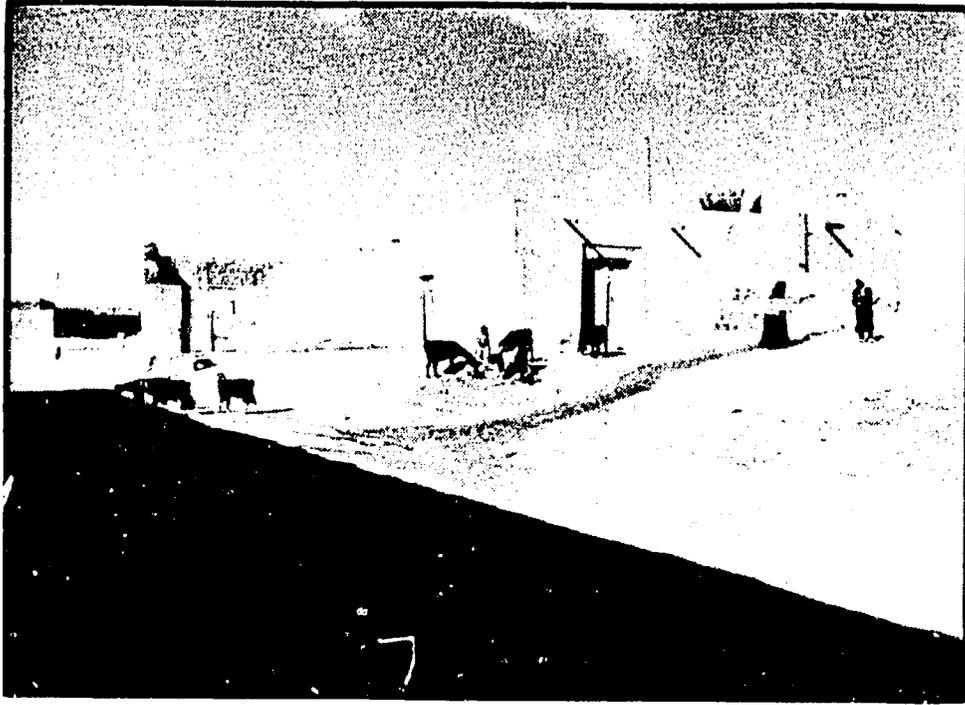


Photo 28: In Nefta goats, sheep, and dogs are prime solid waste eaters.

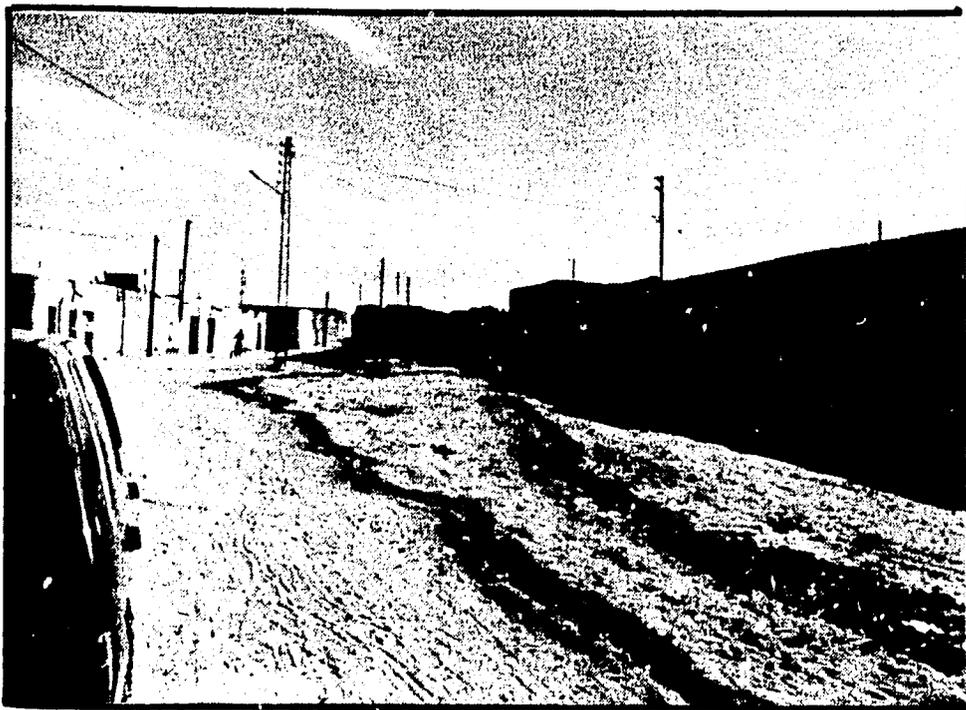


Photo 29: Sanitary waste flowing openly in a main street in Nefta.



Photo 30: Sanitary waste flowing in a secondary street in Nefta.



Photo 31: Dog drinking sanitary waste water coming from overflow of a soakage pit in Nefta.

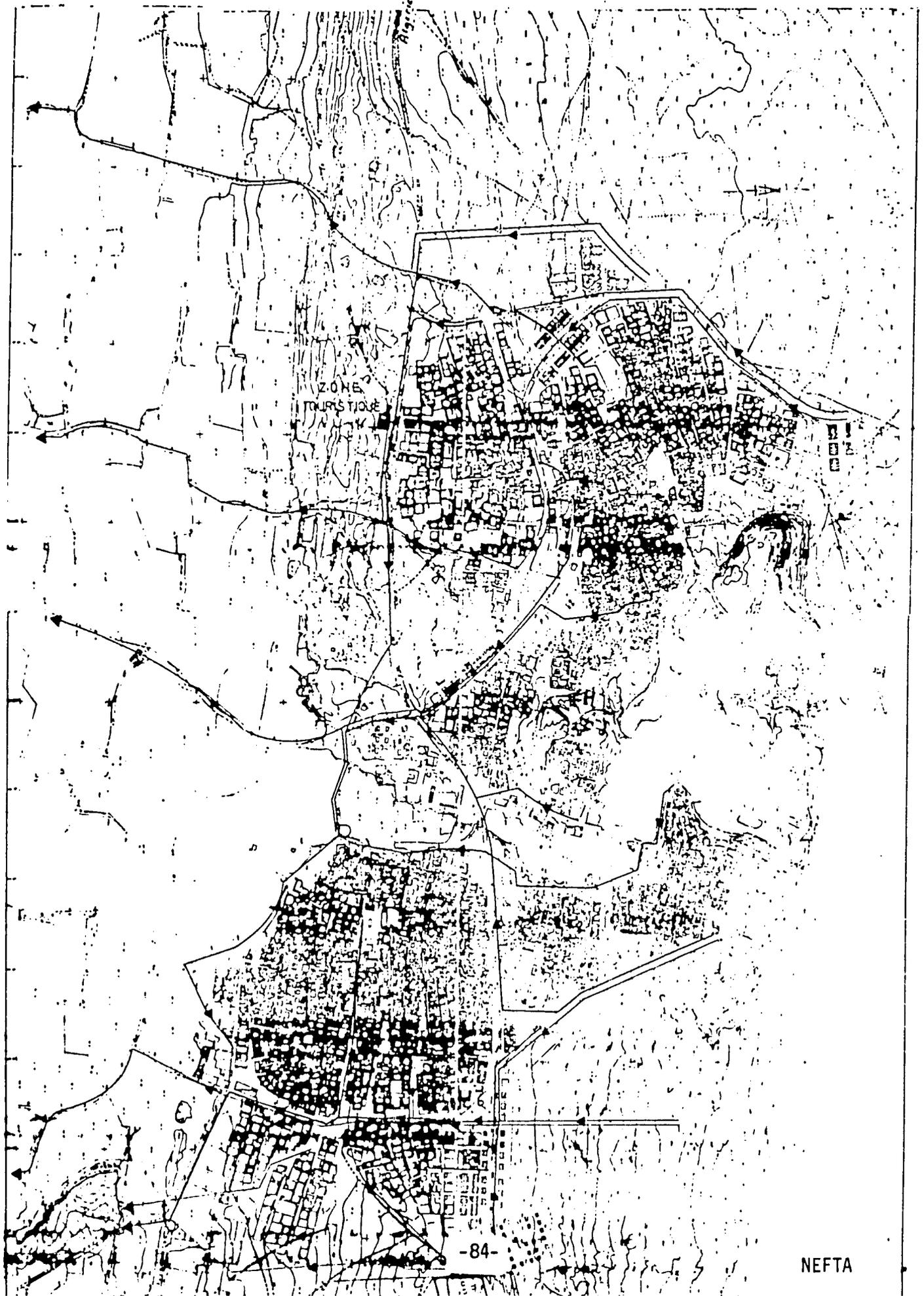


Table 29

NEFTA: COST OF IMPROVEMENTS

TOTAL INVESTMENT
1.411.000 TD (1/1/82)

| <u>PRIMARY SANITARY COLLECTOR</u> | | DIAM. MM | UNIT | UNIT COST | TOTAL COST |
|-----------------------------------|-------|-----------------------------------|-------|--------------|----------------|
| Collector | PS1 | 400 | 1.903 | 62 | 117.985 |
| | | 500 | 354 | 75 | 26.550 |
| | | 600 | 102 | 89 | 9.080 |
| " | PS1.1 | 300 | 170 | 38 | 6.460 |
| " | PS1.3 | 300 | 235 | 38 | 8.930 |
| | | 400 | 634 | 62 | 39.310 |
| " | PS1.4 | 300 | 340 | 38 | 12.920 |
| | | 400 | 290 | 49 | 14.210 |
| | | 600 | 340 | 89 | 30.260 |
| " | PS1.5 | 250 | 900 | 42 | 37.800 |
| " | EU2 | 250 | 790 | 30 | 23.700 |
| " | EU4 | 250 | 300 | 42 | 12.600 |
| Splitting box (storm) | | | 3 | | 10.000 |
| | | | | Subtotal | <u>350.000</u> |
| <u>PRIMARY SYSTEM (STORM)</u> | | | | | |
| Collector | | in earth | 1.500 | 10 | 15.000 |
| | | | | Subtotal | <u>15.000</u> |
| <u>SECONDARY SYSTEM</u> | | | | | |
| 120 ha. x 150 ml/ha. | = | 18.000 ml at 30 | = | Subtotal | <u>540.000</u> |
| House connections: 2.400 | | inhabitants: 12.000 | | | |
| <u>TREATMENT</u> | | | | | |
| % ONAS 1991: 72% | = | 13.300 inhabitants | | | |
| DBO ₅ total | = | 595 kg DBO ₅ /d | | | |
| STEP capacity | | 600 kg DBO ₅ /d at 790 | = | | 474.000 |
| Lift station | | 85 m ³ /h | = | | <u>32.000</u> |
| | | | | Subtotal | 506.000 |

2.5.14 Medenine

2.5.14.1 Social Analysis

In Medenine there is a wide range of socio-economic levels. New villas are being built near the hospital with money from Libya and France but there are also lower middle class housing and housing for the working and unemployed poor in the medinas (see Photos 32 and 33). Most housing is in the latter three categories.

A two room middle class house rented by a high school teacher for 35 Dinars a month included a large paved courtyard for a family of eight with a monthly income of 200 Dinars. Lower middle and working class housing rents for 20 Dinars a month for two rooms and a tiny courtyard. The poorest housing found was one room either owned by the resident or rented at 8 Dinars a month. In some cases these houses lack electricity and SONEDE connections. Squat toilets are made of cement. Most cook on gas stoves or on kerosene burners. The poorer families use wood. Daily food expenses range from 0.5 to 4 Dinars with most in the 1 to 2 Dinar range.

Generally people are native to the Medenine region or other southern areas, some having migrated north from Libya a generation ago. Young people who cannot find work look to Libya for skilled job opportunities. Unskilled workers usually end up in seasonal agricultural day labor.

2.5.14.2 Technical Analysis

Identification: The project will service the central core of the city.

Physical Characteristics: Medenine has virtually no collection system. It uses about 20 soakage pits (approximately 2 meters in diameter and 5 or 6 meters deep). The expected life of these soakage pits is about 10 years. They were dug by private citizens without any supervision or approval from the city. Because they are close to the oueds, their useful life is seriously limited (see Photo 34.)

Lack of sanitary drainage facilities is evident throughout the city. Sewerage flows in dirt roads. Soakage pits are overloaded and oueds are being used as open dump sites for sanitary and solid wastes. Water in the oueds is polluted with rotting dead animals half submerged (see Photos 35-37). The team saw animals drinking this water and women picking some herbs in the flood plain not far away from a dead cow.

In 1981 ONAS completed a collector to service the hospital. This collector is 5.2 kilometers long and will be used to connect smaller collectors to the new system. The population is already requesting that the discharge for this collector be extended at least 500 meters further east (see Photo 38).

The construction of the site for the collector in the oued was left unfinished (see Photo 39). The manhole covers used are badly manufactured and will cause problems in the future.

ONAS should be asked to build the sewage treatment plant as soon as possible. The connection of nearly 1,200 houses to the collector will only worsen the

already bad environmental condition at the effluent. Solid waste disposal in the oued makes a bad situation even worse.

Improvements: The bulk of work consists of house connections and two small sections of collectors. All improvements are on-site except for less than 2 percent allowed in the spreading area.

Cost of Improvements: The total cost is 945,000 Dinars, as listed in Table 30.

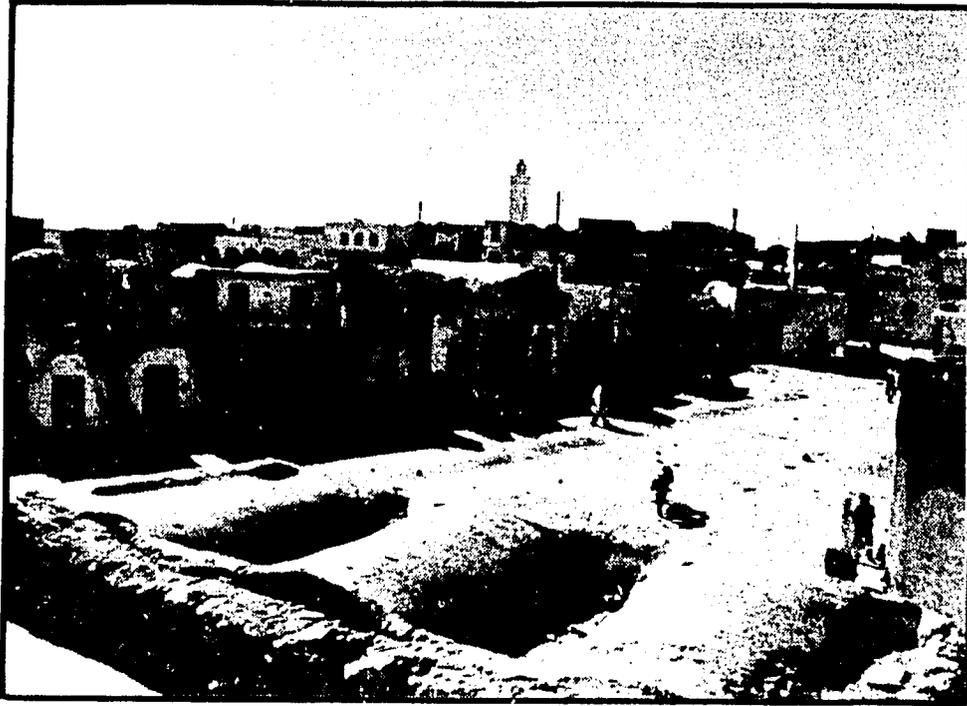


Photo 32: The medina in Medenine.



Photo 33: The hospital in Medenine.

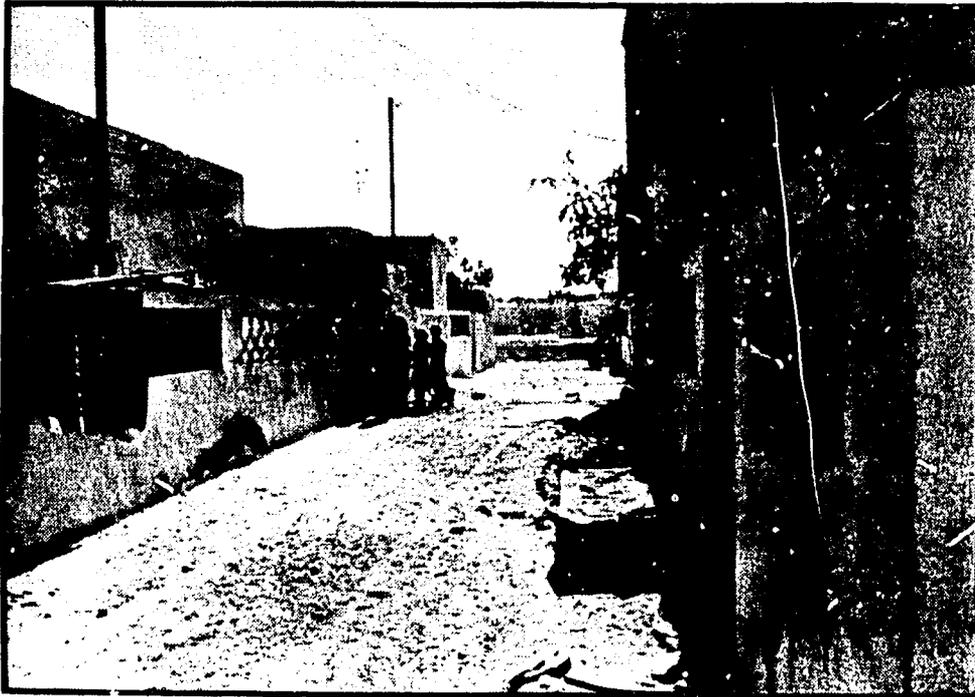


Photo 34: Soakage pits along front yard walls in Medenine.



Photo 35: The oued in Medenine.



Photo 36: Dead animals in the oued in Medenine.



Photo 37: Septic, polluted water in Medenine's oued.

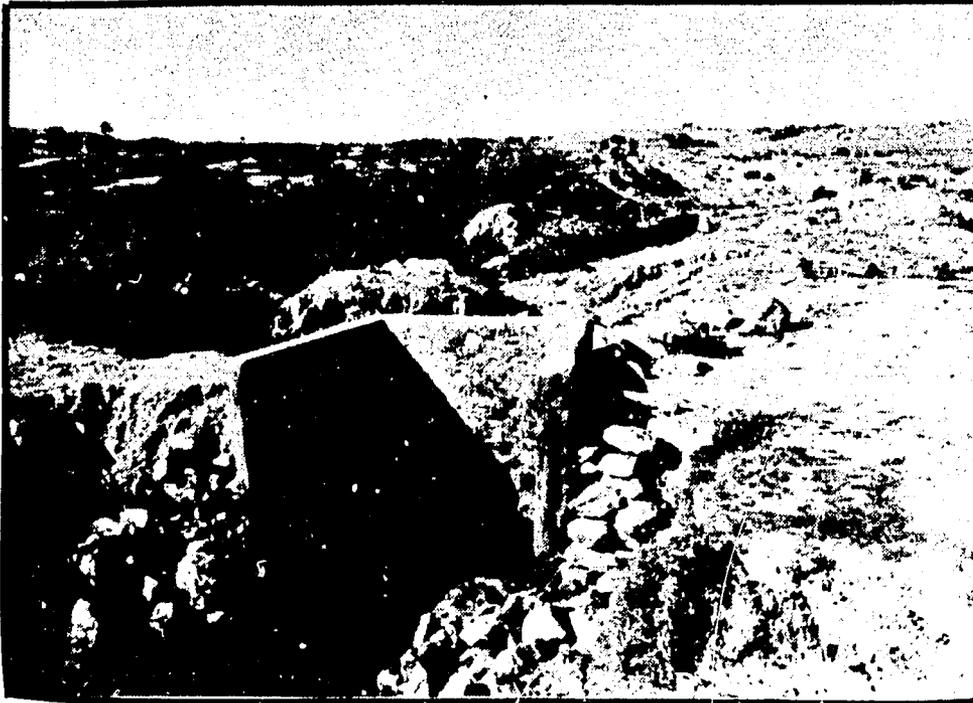


Photo 38: Outlet of existing sanitary collector dumping raw sewage in Medenine.



Photo 39: The construction site as left after the passing of the collector in the Oued, Medenine.



Table 30

MEDENINE: COST OF IMPROVEMENTS

TOTAL INVESTMENT
945.000 TD (1/1/82)

| <u>PRIMARY SANITARY COLLECTOR</u> | | DIAM. MM | UNIT | UNIT COST | TOTAL COST |
|-----------------------------------|--------------|-------------|------------------------|--------------|----------------|
| Collector | C | 300 | 600 | 54 | 30.600 |
| " | D | 400 | 950 | 62 | 58.900 |
| | | | | Subtotal | <u>90.000</u> |
| <u>SECONDARY SANITARY</u> | | | | | |
| 108 ha. | x 260 ml/ha. | = 28.000 | ml at 30 | Subtotal | 840.000 |
| House connections: | 1.180 | | inhabitants: | 6.490 | <u>840.000</u> |
| <u>TREATMENT</u> | | | | | |
| % ONAS 1991: | 37% | = 15.500 | inhabitants | | |
| DBO ₅ total | | = 765 | kg DBO ₅ /d | | |
| Spreading | | = 765 | kg DBO ₅ /d | | <u>15.000</u> |
| | | | | Subtotal | <u>15.000</u> |

2.5.15 Tataouine

2.5.15.1 Social Analysis

Tataouine is alive with new home construction in almost every sector of the city. Money for this massive building is coming in from workers in Libya and France. Inhabitants of Tataouine within the project zone are natives of the region and are a socio-economically homogeneous middle class population.

Though most communal infrastructure is available, public lighting is reported to be present only on the main streets.

In a poorer neighborhood covered by the project, large nuclear families (ten or more persons) with adolescent and primary age children are living in three to four room Arab-style homes owned by the household head. These homes have large paved indoor courtyards, squat toilets, electricity, and a SONEDE faucet. Cooking is done on gas stoves, some with ovens, and many households have refrigerators. Food expenses come to about 4 to 5 Dinars a day out of a monthly family income of 150 Dinars.

There is also a considerably poorer, older section of town, but it is not connected to SONEDE for the most part and will not be included in the project area.

2.5.15.2 Technical Analysis

Identification: The area to be serviced by this project is the center of the city, about one-half the total city area.

Physical Characteristics: Of all the sites visited and studied, this site is the least known to ONAS and to most government agencies. There was little or no historical documentation available to ICN (Ingenieurs Conseils Neerlandais) or to the team. At present, other than new collectors built by ONAS, there is no sewage system. Houses now use soakage pits and septic tanks.

Improvements: The center of the city will be connected to the ONAS collector via a series of secondary sanitary sewers. House connections are also planned. There are plans to lengthen the collector and construct a structure for spreading -- both off-site improvements. The effluent of Tataouine will be spread in the oued farther to the northeast toward an industrial park now under construction. (The industrial park will not be served by this project.) Environmental assessment should be closely monitored to prevent future sanitary problems in this area.

Cost of Improvements: The total cost is 557,000 Dinars, as listed in Table 31.

N

0

500m.

1Km.



TATAQUINE

Table 31

TATAQUINE: COST OF IMPROVEMENTS

TOTAL INVESTMENT
557.000 TD

Secondary system

| | | | | | |
|------------------------|---|--------------------|---|----------|--------------------------|
| 86 ha. x 200 ml/ha. | = | 17.200 ml at 30 | = | Subtotal | <u>515.000</u> |
| house connections: 900 | | inhabitants: 4.000 | | | <u><u> </u></u> |

TREATMENT

| | | | | | |
|------------------------|---|----------------------------|---|-----------|---------------|
| % ONAS 1991: 47% | = | 9.700 inhabitants | | | |
| DBO ₅ total | = | 395 kg DBO ₅ /d | | | |
| Gravitaury main | | 500 ml Ø 500 at 60 | = | | 30.000 |
| Spreading | | | | | <u>12.000</u> |
| | | | | Subtotal: | 42.000 |

Chapter 3

SITES VISITED: GREATER TUNIS PROJECT

3.1 Introduction

The site selection team visited four sites under the Kuwaiti-funded Greater Tunis Project: the Medina in central Tunis, Djebel Djelloud, Sidi Daoud, and Aouina.

3.2 Central Tunis--Medina

3.2.1 Social Analysis (See also Tables 1 and 2 in Chapter 2.)

In the Tunis Medina mixed socio-economic levels -- wealthy families, middle class, and poor -- live side by side. Though the old aristocracy used to inhabit the medina and some are still left, many have subdivided their homes, rented them out as apartments, and have moved out and built villas elsewhere. Those remaining generally are long time residents of the medina whether middle class or poor.

In one instance a small two room apartment on the ground floor was renting for 15 Dinars a month for a working class family who has rented there for the past eighteen years. The upper floors were renting for 20 Dinars a month for exactly the same apartment. People cook on gas stoves with ovens and have refrigerators and western-style toilets. Normally there is only one household faucet, and that is located in the kitchen. Food expenses are about 5 Dinars a day. Poorer families have only one room, squat toilets and spend 1 to 2 Dinars a day on food. Some are without home SONEDE connections and get potable water from public faucets.

Streets are generally paved with large paving stones except for the smaller alleyways. Night lighting is adequate on the main medina streets but the warren of sidestreets is only sparsely lighted or even dark in some areas.

On the edges of the medina there are also older houses. Living in them are some middle class and many poor families who, though not ancestrally native to the capital or the Tunis region, have been settled in geographically homogeneous neighborhoods for the past generation.

The drainage problems of the lower medina and the streets below it were visible following a heavy two day rain. A citizen was seen opening a manhole cover in downtown Tunis near the Majestic Hotel to allow storm drainage. Stagnant water about six inches deep filled with solid waste remained inside the entryway to apartment buildings in a working class neighborhood in the southeast quadrant of the downtown area even three days after the storm. Particularly in the eastern end of the city roads were heavily flooded and water was sloshing up over the sidewalks.

3.2.2 Technical Analysis

Identification: Located in central Tunis, the medina is the oldest built up area of Tunis. Approximately 100,000 people live in this 690 hectare area. Since the area is fully occupied, no increases in the population are foreseen.

Physical Characteristics: The sewer system of the medina is the combined type, i.e., it receives both storm and sanitary waters. During dry spells, the system seems adequate but when it is rainy, sewage overflows onto the streets and onto floors below street level.

The improvements of the project will benefit not only the residents, but also the considerable commercial, administrative, and touristic interests in the medina.

Improvements: A series of collectors is proposed to correct major flooding problems occurring within the periphery of the medina. The main collectors proposed are off-site of the medina, but they will directly benefit medina dwellers as well as the numerous merchants and residents living in the same drainage basin.

Cost of Improvements: The total cost is 3,991,724 Dinars as listed in Table 32. All costs for the project qualify for AID Housing Guaranty Program financing. Table 32 also gives the source of financing.

Plans Consulted: ICN 3-4366-11-05-11 (820818)
ICN 3-4366-11-05-19 (820813)

Final construction plans were not available at the time of the team's visit but should be completed by March 1985.

Construction Implementation: Tables 11 and 12 in Chapter 2 show ONAS construction schedules.

3.3 Djebel Djelloud

3.3.1 Social Analysis

Djebel Djelloud is a 100 percent industrial zone containing factories and warehouses. There are only three or four poor-looking dwellings in the entire project area. These are attached to industrial buildings and appear to house the guardians' families. No children were viewed anywhere on the site though some washing was being hung out to dry by a couple of poorly dressed women.

Djebel Djelloud has a severe drainage problem. Much stagnant water from a severe rainstorm of four days before was still sitting in large pools in the streets between factory lots. Lots of mud and solid waste could be seen everywhere in the public space.

There is a great contrast between the very clean parking lot and roadways inside the factory walls and the public space just outside the factory gates through which all employees -- white and blue collar alike -- must drive or walk to get to work. Inside a sewer pipe factory, for example, the team saw a

Table 32

GREATER TUNIS: COST OF IMPROVEMENTSGREATER TUNIS

1- Central Tunis - Recalibration

| | <u>Foreign Cost</u> | | <u>Local</u> | <u>Total</u> |
|---------------|---------------------|----------|--------------|--------------|
| | Direct | Indirect | | |
| Labor | 326 400 | 217 600 | 1 770 000 | 2 314 000 |
| Material | 99 540 | 66 360 | 387 100 | 553 000 |
| Sub Total | 425 940 | 283 960 | 2 157 100 | 2 867 000 |
| Miscel.10.5% | 44 724 | 29 816 | 226 496 | 301 036 |
| Inflation 26% | 122 372 | 81 582 | 619 735 | 823 689 |
| TOTAL | 583 036 | 395 358 | 3 003 331 | 3 991 724 |
| | (1) | (2) | (3) | (4) |

NOTES:

- 1) If US AID does lateral financing
Add (1) + (2) + (3) = (4) 3,991,724 TD
- 2) If US AID does co financing with Kuwait
Add (2 + 3) 3,398,689 TD
- 3) Data in ICN report do not allow breakdown of drainage project by Labor and Materials. It was estimated roughly 71% labor and 29% materials.

spotless driveway and smooth cement parking lot being swept by a cleaning woman. Flower beds lined the walls and no solid waste was visible. A high cement wall topped with shards of glass shielded this well maintained environment from the area outside.

3.3.2 Technical Analysis

Although the area needs help in solving its sewage problems, this project cannot finance the necessary improvements since they would affect mostly an industrial zone.

3.4 Sidi Daoud

3.4.1 Social Analysis

Two sections of Sidi Daoud were identified. In the first, the children were rather well dressed with shoes and boots. Housing in this site is almost entirely middle class or wealthy villas for single families. In the center of town near the mosque the streets and storm canals were drained and clean of solid waste two days after a heavy rain storm. This was possibly the cleanest site viewed. Some older poorer homes are located near what was the original center of the settlement but they make up only about 5 percent of the dwellings in this section.

The Ain Zaghuan area of Sidi Daoud has large villas along the main road into the site from the highway. However, back in among the trees several very narrow muddy streets house a small densely populated neighborhood of poor residents. Some smaller villas are being constructed on the edge of this settlement but well off the main road and shielded from view by a thick grove of trees. This poor section is probably a spontaneous settlement as the population seemed distinctly suspicious of the team.

3.4.2 Technical Analysis

A project for Sidi Daoud was rejected by the team because most of the population is not low income.

3.5 El Aouina

3.5.1 Social Analysis

El Aouina has a severe drainage problem. Two days after a heavy rain, there were still large pools of stagnant water filled with solid waste in the muddy streets. Most houses in El Aouina are middle class villas. There are numerous new ones said to house national guard personnel from the national guard headquarters nearby. Another section of the El Aouina site is full of government housing authority apartment buildings. Some house twenty families and others forty families.

The team identified a poorer section of El Aouina with even more severe stagnant water problems than the middle class section. In the poor section there is an open sewer so wide that people must put sheets of metal across it in places so pedestrians will not fall in (see Photo 40). This neighborhood is populated by people of mixed geographic origin. However, the second generation has been raised and has married in El Aouina, and their children have been born there. Inhabitants are working class or poorer.

3.5.2 Technical Analysis

In El Aouina streets are wide but not paved. Water holds in the low lying areas and becomes stagnant. There is virtually no drainage. The project proposed is sound but does not cover the area where poor people are living. Instead it would benefit people with medium income or better. Therefore, the team rejects this site until a larger project to include the poorer area is presented.



Photo 40: Sanitary/storm problems in El
Aouina.

Chapter 4

OTHER SITES VISITED

4.1 Mahares

As mentioned in Chapter 2, after the site visit to Mahares, the team dropped it from the list of approved sites.

Many sections of Mahares are under construction and wealthy villas are the most frequent type of new housing going up. Owners, natives of the region, are building with money from abroad. Much of the town appears to be middle class. Even working class homes use gas for cooking and have paved courtyards, adequate indoor domestic space, a SONEDE faucet, cement squat toilet and a refrigerator. Houses have been owned by such families for several generations. A woman lamented that her living room had mats lining the walls rather than the decorative tiles her neighbors had.

The large area to the north and west of the city is going through a vast construction program by private individuals. The unit cost of investment is probably among the highest in the country. Sanitary services are required but house owners should be capable of paying for those services.

4.2 The Kelibia Sewage Treatment Plant

Although Kelibia is not a target city, the team visited the treatment plant there. It was dusk when the team arrived, but from what could be seen, the place and the operation seemed to be adequate, neat and well under control. However, the laboratory report as well as the control lab in Tunis show BOD₅ and COD are measured only on a monthly basis. This plant rates among the best operated in the country (see Appendix D for a list of sewage treatment plants in Tunisia as of 1983, and Appendix E for data on the operation of these plants.) The raw BOD₅ was noted to vary from +/- 95 PPM to +/- 950 PPM with an average of 468. This value is obtained by removing the maximum and the minimum figures from the annual average.

The team recommends that more frequent measurements of MES, BOD₅ and COD be taken.

4.3 The Moknine Sewage Treatment Plant

The sewage treatment plant at Moknine is being enlarged to receive sewage from other cities in this project. Though still under construction, the treatment plant should be operational in late 1985. Although the team's visit was made without warning during working hours, neither the contractor nor anyone from ONAS was on site.

An attempt should be made by the USAID Mission in Tunis to visit this plant when it becomes operational. What happens at this new plant could be an indication of how ONAS will carry out future construction projects such as the improvements foreseen in this project. During the visit the team commented on

the slow progress of construction, but nobody offered any explanation as to why (see Photos 41-45).

4.4 Quardanine

This potential target city in the Thirty Cities Project was rejected in March 1984 in the Project Paper. The team maintains the same position. The proposed project should be carried out, but local owners should be capable of supporting the financial burden.

4.5 Bekalta

Bekalta is a sister city to Teboulba and came very close to being accepted. The team maintains the same position as the Project Paper. If another site in addition to the fifteen selected were to be added, Bekalta would be the team's choice.

In the most densely settled area of town, the old medina, large extended families live with one nuclear family per room and per kitchen around traditional indoor courtyards. Each family cooks meals separately using a combination of gas stove (sometimes an oven as well) and kerosene burners. Other amenities such as a television set, a single SONEDE faucet, a cement squat toilet and a refrigerator are shared by all the nuclear units within the extended family courtyard.

Food expenses are estimated at 3 Dinars a day per nuclear household. This is mainly a working class neighborhood but as it is old medina housing, mixed socio-economic levels can be found living together. More than in many other towns, women are participants in earning household income through the practice of traditional crafts such as blanket making and basket weaving. The crafts are sold to market middlemen. (Generally such crafts are produced for home consumption only.) However, the income from these crafts remains minimal since women can devote only a couple of hours a day to this activity and they are poorly paid for the final product.

4.6 Banlieu Sfax (suburbs)

The team visited four of the five sites proposed in the project and found that the communities which are to be served by the proposed project are all relatively well off middle class towns with much building going on. The proposed collector would benefit only commercial and middle class residential housing within a short distance of either side of the central artery in each community.

The decision of the Project Paper is maintained. Although the services are required, local owners seem to have incomes well above the national average. Most houses are large, multistory and very well kept. It is not a high density area.

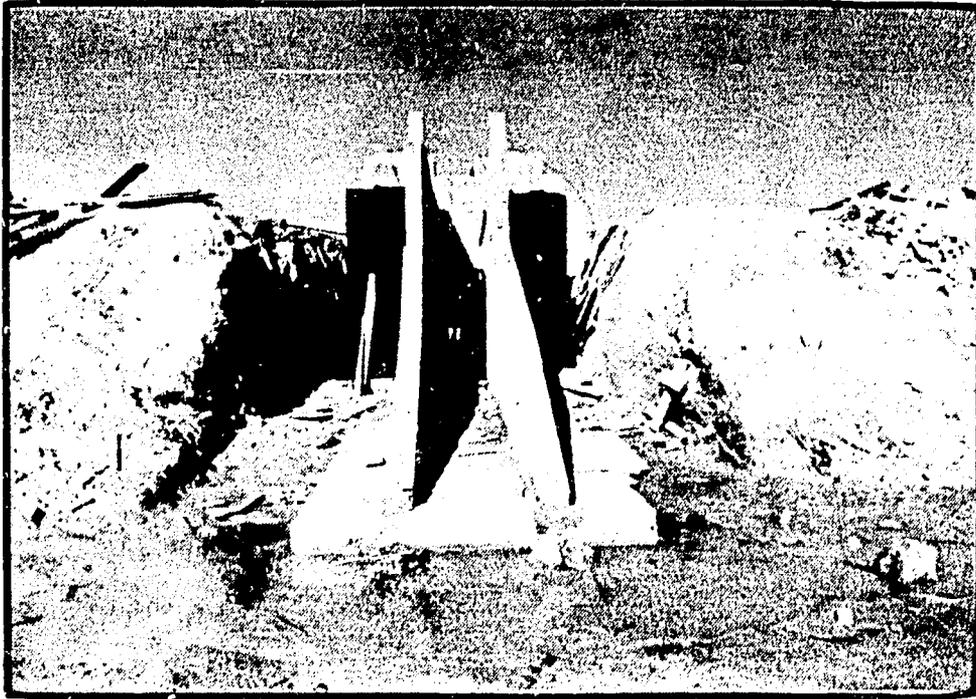


Photo 41: Moknine sewage treatment plant, division wall.



Photo 42: Moknine sewage treatment plant, embankment construction.

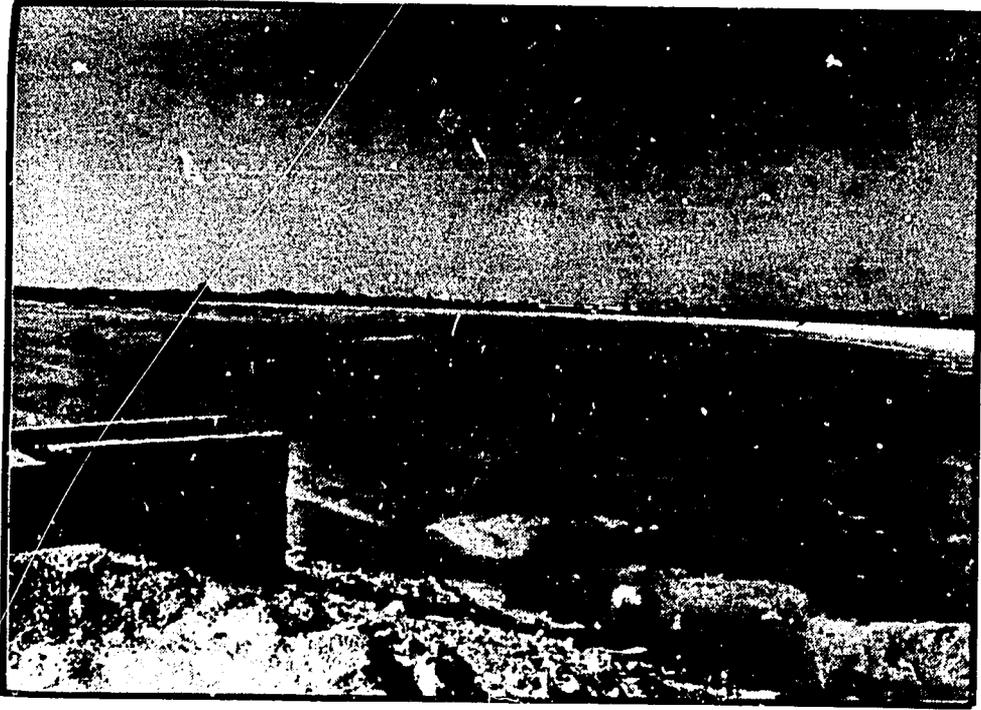


Photo 43: Moknine sewage treatment plant, aerated lagoon.



Photo 44: Moknine sewage treatment plant, division wall between lagoons. Pumping station is visible on the right.

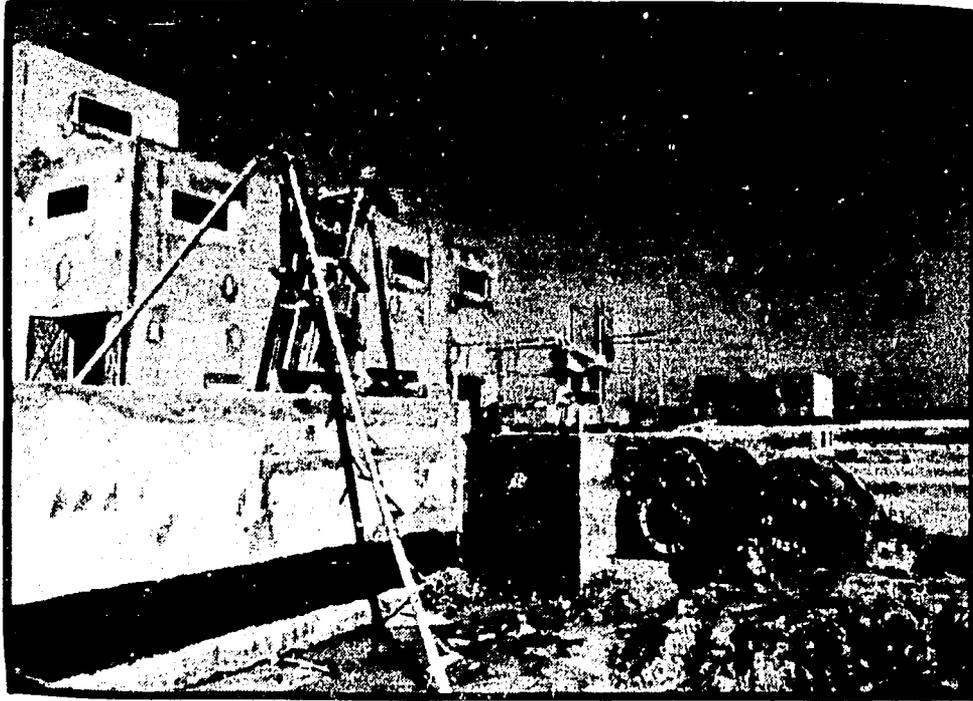


Photo 45: Moknine sewage treatment plant, pumping station.

4.7 Zaghouan and Other Cap Bon Sites

A visit to Zaghouan and other Cap Bon sites not included in the recommended project cities confirmed the inadvisability of AID funding being used for these areas. In Zaghouan the project would benefit mainly government buildings and commercial zones. On Cap Bon, Korba, Beni Khalled, Menzel Bou Zelfa and Soliman were briefly visited. Each have old medina settlements but these were found to be substantially better off than medinas in the recommended sites despite scattered working class homes. Outside the older sections of these towns, much new construction was in evidence. This was particularly the case in Korba where a section of single family luxury villas was already inhabited or under construction along the beach front. Other beach areas were being filled in with gravel and sand for a future neighborhood.

Beni Khalled and especially Menzel Bou Zelfa are in the heart of the Cap Bon orange groves. Owners of small and middle-sized farms are living in town in well maintained homes. The area is planted with healthy mature citrus groves. Soliman, on the edge of the main citrus region, has rich soil devoted to truck farming as well as a rapidly developing beach front area including tourist hotels and newly planned residential tracts. In view of the rich agricultural base of this entire region, these wealthier Cap Bon villages were not included in the recommended list of projects.

Chapter 5

ISSUES

During the site visits, several issues emerged which should be considered by the USAID Mission. This chapter discusses those issues and makes some suggestions for dealing with them.

5.1 Solid Waste

During the numerous site visits done, one universal problem stood out among all the others -- solid wastes. This problem should be addressed now by the government of Tunisia with support by the international and bilateral agencies. The solid waste problem is partly responsible for the flooding of many storm sewer systems. The team even saw ditches overflowing because of solid waste in Bizerte, Oued Rega, and Central Tunis, for example. An educational program covering solid waste could be prepared, possibly using television as the medium.

5.2 Use of Wastewater

Wastewater from the kitchen and from bathing is used to clean floors in the house. It is then swept out onto the concrete yard and finally through the main door onto the sidewalk in front of the house. Good sanitation requires that this wastewater be disposed of safely. Perhaps with the coming of services from SONEDE and ONAS, people may change their habits, but it is more likely that a concentrated educational program will have to be launched or a technical solution found.

5.3 Attitude Toward Communal Spaces

The team noticed that homes and industrial property were kept clean while the public open spaces around them were littered with solid and liquid waste originating very likely from the surrounding buildings. The team also noticed that most privately owned areas are relatively clean, whereas public spaces such as roads, parks, communal spaces and particularly oueds are used mainly as open dump sites. Once this attitude is changed, then the sewer systems and water use will improve.

5.4 Documentation

In this assignment, the team did not have any official documentation from USAID or ONAS explaining the team's mission. In the future, the local authority should authorize the visiting team to travel and meet with local people. An official document from the local country should be in the hands of the visiting team at all times. This document will help the team in military and police road checks.

5.5 Project Monitoring

This project, once started, should be monitored by experienced staff from RHUDO so that monthly or quarterly progress reports can be evaluated and payments can be monitored.

The team recommends that local USAID personnel be trained for a short duration in the United States or Canada in English and/or French as an active participant on construction sites similar to those that will be found in Tunisia. This experience should be very valuable in monitoring the project.

5.6 Choice of Materials

During the visit in Medenine, the poor workmanship of cast iron manhole covers was noted. The type used was outdated and poorly cast. The team recommends that ONAS discontinue using these manhole covers and use instead the type shown in Appendix F. This change will involve no extra cost. The type now used by ONAS is obsolete and creates sewer maintenance and handling problems.

The manhole cover now used by ONAS is a sunken cover usually filled with dirt, concrete and asphalt. Every time the cover is lifted some of those fill-in materials fall into the manhole and obstruct the flow of sewage. The use of any one of the more modern models shown in Appendix F will prevent dirt from falling into the manhole.

5.7 Timing

According to the documentation, the entire implementation program appears to be one year late. Therefore the total cost of the projects should be adjusted.

APPENDIX A
Scope of Work

DRAFT
Scope of Work
for Site Selection

I. Background and Objective

A project for use of \$32 million in HG funds to finance upgrading/sanitation of low-income neighborhoods and towns characterized by slum conditions, has been authorized. The HG financing will be limited to on-site costs of sewerage and drainage works that benefit low-income neighborhoods and towns, and a proportion of the costs of off-site infrastructure that is directly attributable to improvements of these low-income sites.

The HG financing will be used to co-finance:

1. with the IBRD, selected sites in secondary towns on a "joint financing" basis with the HG funding being limited to local costs of low-income site upgrading;
2. with the KDF on a "parallel financing" basis, the total costs of financing sewerage and drainage improvements in selected low-income neighborhoods of Greater Tunis.

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The objective of the assistance requested is to finalize the list of eligible sites and eligible costs for HG financing and to assist ONAS in its preparation of the Program Delivery Plan. More specifically, the purposes of this assistance is to:

- a) verify site selection and, working with ONAS, verify "eligible" cost estimates for AID financing for each eligible site;
- b) assist ONAS in preparing information required for the Program Delivery Plan;
- c) review and evaluate construction plans for each site.

The information to be reviewed is to serve primarily as part of the Program Delivery Plan to be submitted by ONAS for approval. It is expected that the team would work closely with ONAS to review information developed for the project by ONAS and by the PP team and in assisting it to prepare information needed for the Program Delivery Plan.

An initial list of eligible sites has been established in smaller towns, the World Bank assisted Thirty Cities Project, and in the KDF assisted Greater Tunis program. The costs of improvements have been broken down by on-site (secondary

systems) and off-site (primary systems, treatment plants) sewerage and drainage works. These costs have been further broken down by local and foreign exchange components. (See Attachment A for financing formula for two programs estimates of eligible costs and site selection methodology.)

II. Specific Tasks

RHUDO requests services of engineer and socioeconomist planner to:

visit initial set of sites selected for upgrading/sanitation component in order to verify and finalize site selection process.

The engineer would:

1. determine with socioeconomist what type of housing/neighborhood on-site infrastructure serves predominantly, i.e. low-income, spontaneous settlement, older central medinas, middle income, administrative buildings;
2. describe type of sewerage-drainage problem in each site and activity to be undertaken to correct the problems, dividing that

to on-site, off-site and by construction elements of on-site and off-site infrastructure;

3. review "eligible cost estimates" for each site prepared for PP, review these costs with ONAS and establish revised estimates as appropriate, review disbursement schedule with ONAS and revise as appropriate;

4. review cost estimates broken down by local and foreign costs for off-site infrastructure prepared for PP and determine what percentage of planned off-site works will serve existing low-income neighborhoods and is therefore attributable to eligible low-income neighborhoods where secondary systems are being installed (providing a detailed methodology of how estimates are arrived at if they differ from those in the PP);

5. based on site visits for each site, review formula for eligible costs for financing that specifies on-site and off-site works and defines percentage of each that qualifies for financing, and revise as appropriate.

The engineer's report will describe for each site visited:

1. identification of area to be served with infrastructure using maps and identifying number of hectares involved;
2. physical characteristics of sites covering sewerage and drainage problems to be corrected;
3. types of physical improvements being proposed on-site and off-site;
4. costs of improvements broken down by on-site/off-site costs of sewerage and drainage (local and foreign exchange cost component);
5. "eligible costs" of sewerage and drainage works;
6. sources of financing for each site by infrastructure component;
7. construction plans for each site;
8. construction/implementation schedule for each site.

In the event that sites do not meet the criteria of being predominantly low-income, then alternative sites would be visited and selected.

The socioeconomic planner would:

1. undertake review of methodology used in PP for site selection and estimates of percentage of population below median income;
2. visit sites with engineer to determine type of neighborhood being served by proposed sewerage and drainage works;
3. based on site visits, verify selection of neighborhood according to income and housing characteristics, evaluate predominant types of incomes and verify estimates of proportion of population served that is low income on the basis of housing characteristics, interviews with local officials on employment and income characteristics of residents, and other data that may be available;
4. determine which sites require socioeconomic survey to determine predominant income characteristics of neighborhoods;

5. for each site visited provide the following information:

- a. estimates of income characteristics and proportion of population below median income,
- b. predominant housing characteristics,
- c. estimate of size of population within neighborhoods,
- d. estimates of density.

Consultants are urged to be totally familiar with the HG-004A-2 Project Paper and Annexes in preparation of this assignment.

III. Timetable and Reporting

One week for briefings and review of documents in Washington.

During this time consultant should:

1. speak to John Tomaro and François Lalande, the two consultants who undertook technical analysis and cost estimates for this project;
2. meet with IBRD staff responsible for Third Urban Sewerage Project and review available documentation.

Nov. 16th Briefing at WASH
Nov. 19 - Dec 15th

Field work: 1 month starting o/a ~~October 16th~~

A second visit of 2 weeks would be required by
engineer to approve construction plans

Finalization of report: 2 weeks in Washington*

*A draft report providing tables of eligible costs, income and housing characteristics, methodology for establishing eligible cost proportions and for verifying income and housing characteristics, and site selection list are to be left in the field.

Attachments:

pp. 17-22 PP.

Annex H HG-004A-2 PP.

Annex F - Tables 1,3,5,6 PP.

Clearance:

RHUDO:DLeibson (draft)

cc:RHUDO-2;C&R-2;DIR;PROG;PRE/H, AID/W

RHUDO:SHammam:cs

Document No. 0165U

10/2/84

APPENDIX B
The Team's Itinerary

Work Plan for the Mission

- | | | | | |
|----------|-------------|-----------|--|------------------------------------|
| 1. | WASH - P.M. | - 14 Nov. | - Briefing | Dave Fred Carole François |
| 2. | WASH - A.M. | - 15 Nov. | - Study session | Carole François |
| | | P.M. | - 15 Nov. - N.E. Bureau Work Plan | |
| 3. | WASH - A.M. | - 16 Nov. | - World Bank | Carole Fred François |
| | | P.M. | - 16 Nov. - Team issues | |
| 4. | WASH - ORLY | - 17 Nov. | Carole/François | |
| 5. | ORLY/Tunis | 18 Nov. | Carole/François | |
| 6. | Tunis A.M. | - 19 Nov. | - RHUDO/NE office Sonia - Carole - François (FCS) Briefing (old plan and new \$10 M) | |
| | | P.M. | Meetings with <u>ONAS</u> (FCS) <u>PLAN</u> (FCS) | |
| 7. | Tunis A.M. | - 20 Nov. | Office Analysis of Documents | |
| | | P.M. | Meetings ONAS/PLAN/NE Set meetings for sites/dates | |
| 8. | Visits | 21 Nov. | SBEITLA | |
| | | 22 Nov. | SIDI BOU ZID | |
| | | 23 | NEFTA | |
| (weather | | 24 | TATAQUINE | |
| delays | | 25 | MEDENINE | |
| not | | 26 | MAHARES | |
| counted) | | 27 | KSOUR ESSAF | |
| | | 28 | KALAA SGHIRA - SAHLINE | |
| | | 28 | TEBOULBA | |
| | | 28 | KSAR HELLAL | |
| | | 28 | SAYADA/LAMTA/ BOU HJAR | |
| | | 29 | MENZEL TEMIME - BIZERTE | |

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Work Plan for the Mission (cont'd)

- | | | | |
|-----|-------|------------|---|
| 9. | Tunis | 30 Nov. | Resume of visits Debriefing with Sonia |
| 10. | Tunis | 1-2 Dec. | Visits |
| 11. | Tunis | 3-7 Dec. | Report - Calculations - Preliminary write-ups - Meetings with ONAS PLAN GOT AFG |
| | Tunis | 10-14 Dec. | Office - Work on report - Meetings with SONIA NE (Final approach) ONAS |

APPENDIX C

ONAS Staff Available During Site Visits

| | | |
|-------------|---------------------------------|---|
| 21 Novembre | Menzel Temime : | M. MOUMNI - Tel.: 0285623-0286359 Address: Av. BELAHOUANE - 9 rue Mohan MedAAzzine, Nabeul 8000 |
| 22 Novembre | Bizerte (Medina- : Zarzouna) | M. BEN MUSTAPHA - Tel.: 02 33457 address: 22, rue Ibn Kholdoun - Bizerte |
| 23 Novembre | Sbeitla | |
| 24 Novembre | Sidi Bouzid | |
| 25 Novembre | Nefta | |
| 26 Novembre | Tataouine | Melle GHORBEL: tel.: 04 25 438 |
| 27 Novembre | Medenine | address: 58, rue Tahar Sfar - Sfax |
| 28 Novembre | Mahares | |
| 29 Novembre | Ksour Essaf | M. Aoun: tel.: 03 27 072- 03 27 533 |
| 3 Decembre | Msaken | Address: 1, rue Massaicault - Sousse |
| 4 Decembre | Kalaa Sghira | (a cote de SOUSSE-PALACE) |
| 2 Decembre | Teboulba | M. BEN SALAH: Tel.: 03 60 845 |
| 2 Decembre | Ksar Hellal | 03 60 686 |
| 3 Decembre | Sahline | Address: Rue Salem Bchir (pres kiosque |
| 4 Decembre | Sayada/L/BH | AGIP) - Monastir. |

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APPENDIX D
Sewage Treatment Plants in Tunisia

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LISTE DES STATIONS D'EPURATION ET LEURS CARACTERISTIQUES
EN EXPLOITATION DANS LES VILLES ET ZONES TOURISTIQUES PRISES EN

CHARGE PAR L'OHAS

ANNEE 1983

| STATIONS | Débit de dimensionnement m ³ /j | Charge polluante de dimensionnement Kg DBO ₅ /j | PROVENANCE DES EAUX BRUTES EN POURCENTAGE | | | Procédé d'épuration des boues | Traitement | Rejet actuel des eaux épurées |
|---------------|---|---|---|-------------|--------------|-------------------------------|---------------|-------------------------------|
| | | | Sédente | Indus-triel | Touris-tique | | | |
| CHARGUIA | 60 000 | 24 000 | 50% | 50% | - | B. Activées | Digestion | Lac de Tunis |
| SUD MELIANE | 33 550 | 15 000 | 50% | 50% | - | Chenal d'oxydation | - | O. Meliane |
| COTIERE NORD | 15 750 | 5 000 | 90% | 10% | - | Lagunage facultatif | - | Canal Khaliij |
| RADES | 700 | 240 | 100% | - | - | Étang de stabilisation | - | Mer |
| TOTAL ORGT | 111 000 | 44 240 | - | - | - | - | - | - |
| SE1 | 6 564 | 1 320 | 0 | 0 | 100% | B. Activées | Stabilisation | O. Moussa |
| SE2 | 9 550 | 2 200 | 54% | 0 | 46% | B. Activées | Stabilisation | O. Zermech |
| SE3 | 6 997 | 1 400 | 0 | 0 | 100% | Chenal d'oxydation | Concentrateur | O. Melah |
| SE4 | 14 100 | 5 900 | 91,7% | 0 | 8,3% | B. Activées | Digestion | O. El Kébir |
| PHENICIA | 638 | 130 | 0 | 0 | 100% | B. Activées | Concentrateur | O. Bettan |
| DIAPAC | 300 | 110 | 0 | 0 | 100% | B. Activées | Stabilisation | O. El Faoura |
| KELIBIA | 2 200 | 880 | 100% | 0 | 0 | B. Activées | Stabilisation | O. Chiova |
| TOTAL CAP BON | 38 700 | 11 940 | - | - | - | - | - | - |
| SOUSSE NORD | 13 000 | 4 050 | 51% | - | 47% | B. Activées | Stabilisation | O. El Hammam |
| SOUSSE SUD | 18 700 | 7 600 | 80% | 5% | 15% | B.A. et lit bactérien | Stabilisation | O. El Hallelouj |
| MONASTIR | 2 600 | 1 300 | - | - | - | Lit bactérien | Digestion | Mer et irrigation |
| DKHILA | 3 100 | 970 | - | - | 100% | B. Activées | Stabilisation | - |
| KAIROUAN | 12 000 | 3 500 | - | - | - | B. Activées | Stabilisation | Oued |
| TOTAL CENTRE | 49 400 | 17 420 | - | - | - | - | - | - |
| SFAJ | 17 700 | 10 300 | - | - | - | Lagunage aéré | - | Mer |
| SOUHEL | 1 200 | 200 | - | - | 100% | B. Activées | Stabilisation | Mer |
| DAR JERBA | 1 200 | 300 | - | - | 100% | B. Activées | Stabilisation | Mer |
| TANIT | 1 000 | 300 | - | - | 100% | Lit bactérien | Digestion | - |
| SIDI SLIM | 1 800 | 650 | - | - | 100% | B. Activées | Stabilisation | Mer et irrigation |
| SIDI MEHPEZ | 1 000 | 300 | - | - | 100% | B. Activées | Stabilisation | - |
| LELLA MERIAM | 1 100 | 350 | - | - | 100% | Lagunage aéré | - | Mer |
| TOTAL SUD | 25 000 | 12 400 | - | - | - | - | - | - |
| TOTAL GENERAL | 224 100 | 86 000 | - | - | - | - | - | - |

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APPENDIX E

Evaluation of Operations at the
Sewage Treatment Plants

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PAPAMETRES DE FONCTIONNEMENT DES STATIONS

D'EPURATION EXPLOITEES PAR L'ONAS

ANNEE 1983

| STATIONS | PH | | MES | | | O ₂ | | | DCO | | | CHLORURE |
|---------------|--------|--------|--------|--------|----------------|----------------|--------|----------------|--------|--------|----------------|----------|
| | ENTREE | SORTIE | ENTREE | SORTIE | RENDE- MENT | ENTREE | SORTIE | RENDE- MENT | ENTREE | SORTIE | RENDE- MENT | SORTIE |
| CHARGUIA | 7,5 | 7,7 | 336 | 22 | 93% | 215 | 20 | 91% | 563 | 75 | 87% | 619 |
| SUD MELIANE | 7,6 | 7,9 | 129 | 24 | 81% | 137 | 16 | 83% | 408 | 65 | 84% | 1,283 |
| COTIERE NORD | -- | -- | 245 | 27 | 89% | 195 | 10 | 95% | -- | -- | -- | -- |
| RADES | 7,7 | 8 | 366 | 81 | 78% | 213 | 73 | 66% | 577 | 256 | 56% | 918 |
| DRGT | 7,6 | 7,8 | 269 | 36 | 86% | 190 | 29 | 84% | 516 | 132 | 74% | 940 |
| SE1 | 7,6 | 7,9 | 198 | 25 | 87% | 146 | 14 | 90% | 823 | 53 | 83% | 507 |
| SE2 | 7,5 | 7,9 | 549 | 19 | 96% | 319 | 10 | 96% | 817 | 53 | 93% | 393 |
| SE3 | 7,4 | 8,2 | 309 | 17 | 94% | 296 | 9 | 97% | 676 | 51 | 92% | 264 |
| SE4 | 7,6 | 8,1 | 584 | 33 | 94% | 419 | 22 | 94% | 1,133 | 90 | 92% | 635 |
| PHENICIA | 7,7 | 8 | 52 | 18 | 65% | 115 | 8 | 93% | 241 | 43 | 82% | 287 |
| DIAPAC | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| KELIBIA | 7,7 | 8,2 | 822 | 35 | 95% | 468 | 30 | 93% | 1,108 | 97 | 91% | 584 |
| CAP BON | 7,5 | 8 | 419 | 24 | 94% | 293 | 15 | 94% | 799 | 64 | 91% | 445 |
| SOUSSE NORD | 7,4 | 7,9 | 299 | 14 | 95% | 211 | 18 | 95% | 541 | 50 | 90% | 546 |
| SOUSSE SUD | 7,4 | 7,8 | 392 | 27 | 93% | 327 | 23 | 93% | 787 | 76 | 90% | 519 |
| MONASTIR | 7,4 | 7,7 | 525 | 34 | 91% | 270 | 35 | 87% | 774 | 107 | 86% | 787 |
| DYMILA | 7,5 | 8 | 132 | 10 | 92% | 98 | 7 | 92% | 284 | 42 | 85% | 660 |
| KALROUAN | 7,4 | 8 | 477 | 12 | 97% | 327 | 11 | 96% | 915 | 50 | 94% | 506 |
| CENTRE | 7,4 | 7,8 | 365 | 19 | 94% | 246 | 17 | 93% | 660 | 65 | 90% | 603 |
| CFAX | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| SOUHEL | 7,8 | 8,3 | 285 | 44 | 85% | 121 | 9 | 93% | 312 | 64 | 79% | 872 |
| DAP JERBA | 7,4 | 7,7 | 254 | 49 | 81% | 116 | 12 | 90% | 452 | 91 | 80% | 1,717 |
| TANIT | 7,7 | 7,9 | 160 | 21 | 87% | 118 | 17 | 86% | 297 | 77 | 74% | 821 |
| SIDI SLIM | 7,5 | 7,7 | 499 | 34 | 93% | 170 | 8 | 95% | 470 | 72 | 85% | 1,198 |
| SIDI VERPEZ | 7,6 | 7,6 | 74 | 31 | 58% | 50 | 8 | 84% | 208 | 89 | 57% | 2,253 |
| LELLA MERIAM | 7,6 | 8,7 | 81 | 46 | 43% | 139 | 18 | 87% | 320 | 90 | 72% | 1,017 |
| SUD | 7,6 | 7,9 | 225 | 37 | 83% | 112 | 12 | 89% | 343 | 80 | 76% | 1,313 |
| TOTAL GENERAL | 7,5 | 8 | 322 | 30 | 92% | 213 | 18 | 92% | 560 | 70 | 87% | 819 |

* unité = mg/L

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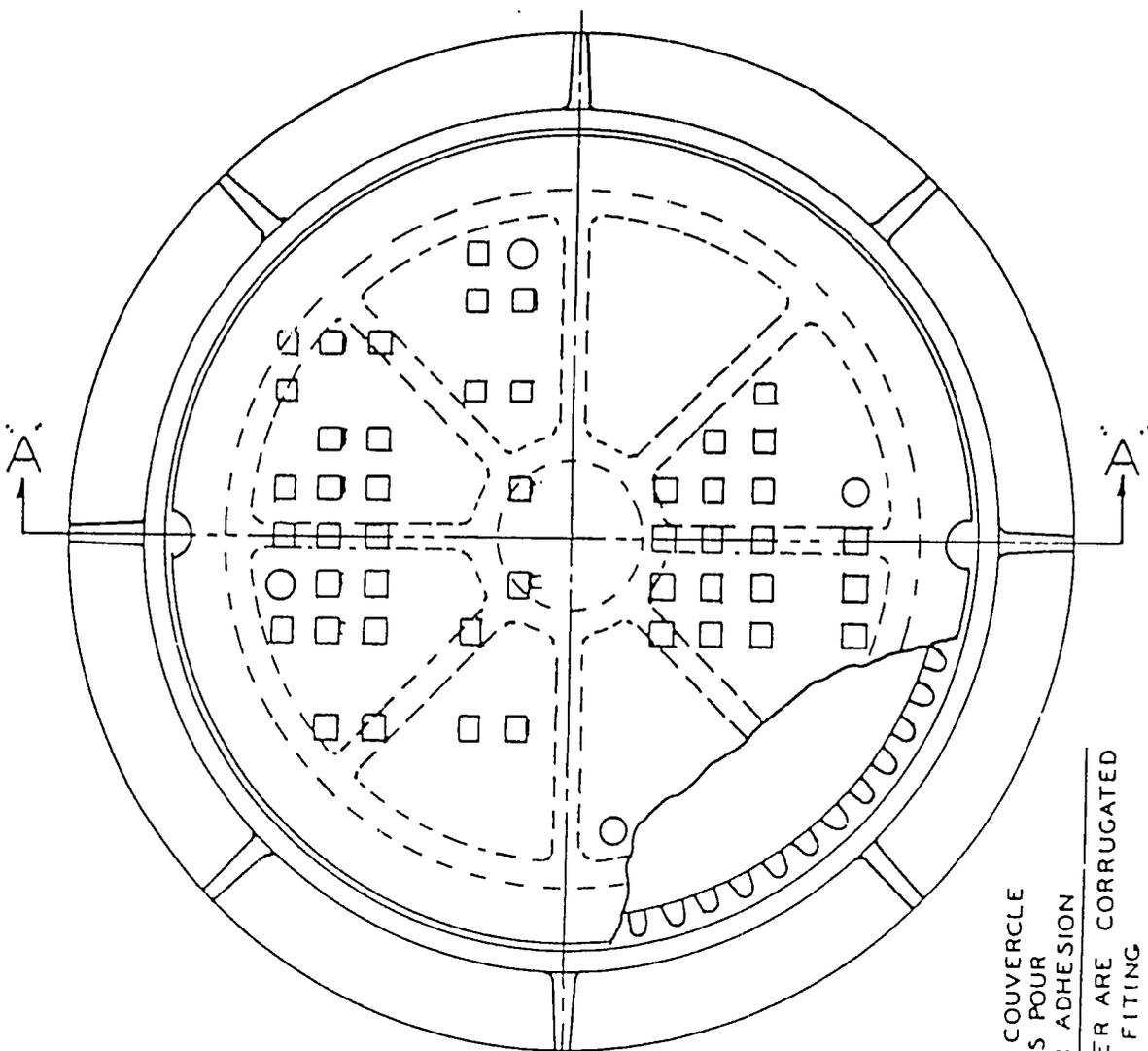
APPENDIX F
Manhole Cover Plans

LIST OF PLANS

| | |
|------|---|
| C-4 | Manhole cover sewer frame & cover |
| C-4A | Frame & cover |
| C-4B | Frame & cover |
| C-4S | Frame & cover |
| C-6 | Manhole cover sewer frame & cover |
| C-6A | Manhole cover sewer frame & cover |
| C-7 | Manhole cover sewer frame & cover |
| C-8 | Frame & cover manhole cover for water valve |
| C-9 | Frame & cover manhole cover for water valve |
| C-10 | Catch basin |

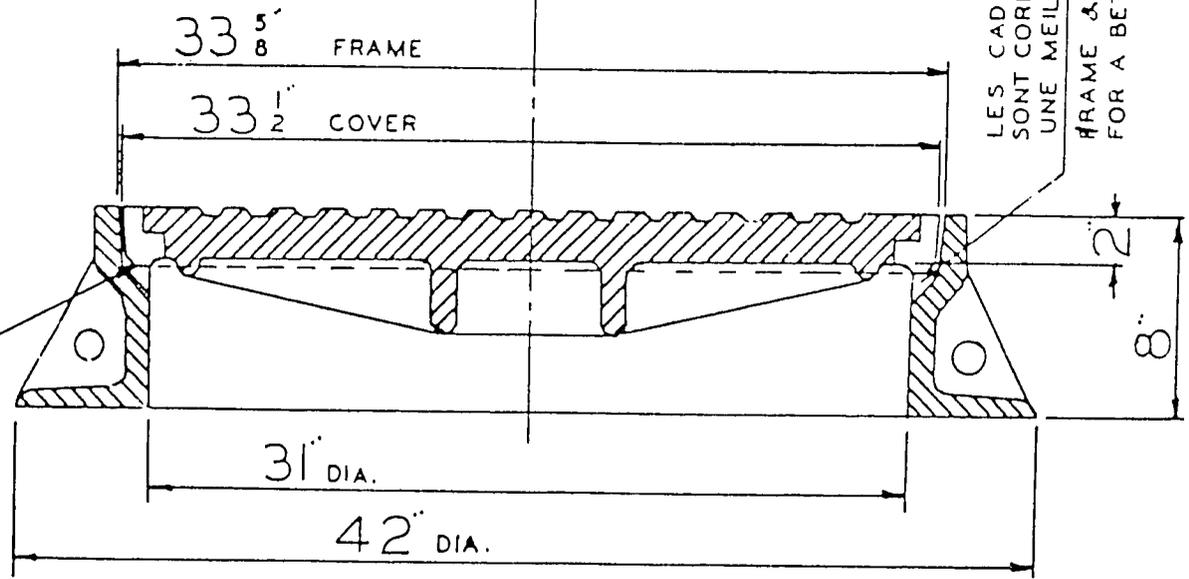
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C-4A



LES SURFACES PORTANTES SONT MACHINEES
 FITING SURFACES ARE MACHINED

LES CADRE & COUVERCLE
 SONT CORRUGES POUR
 UNE MEILLEUR ADHESION
 FRAME & COVER ARE CORRUGATED
 FOR A BETTER FITTING



SECTION 'A-A'

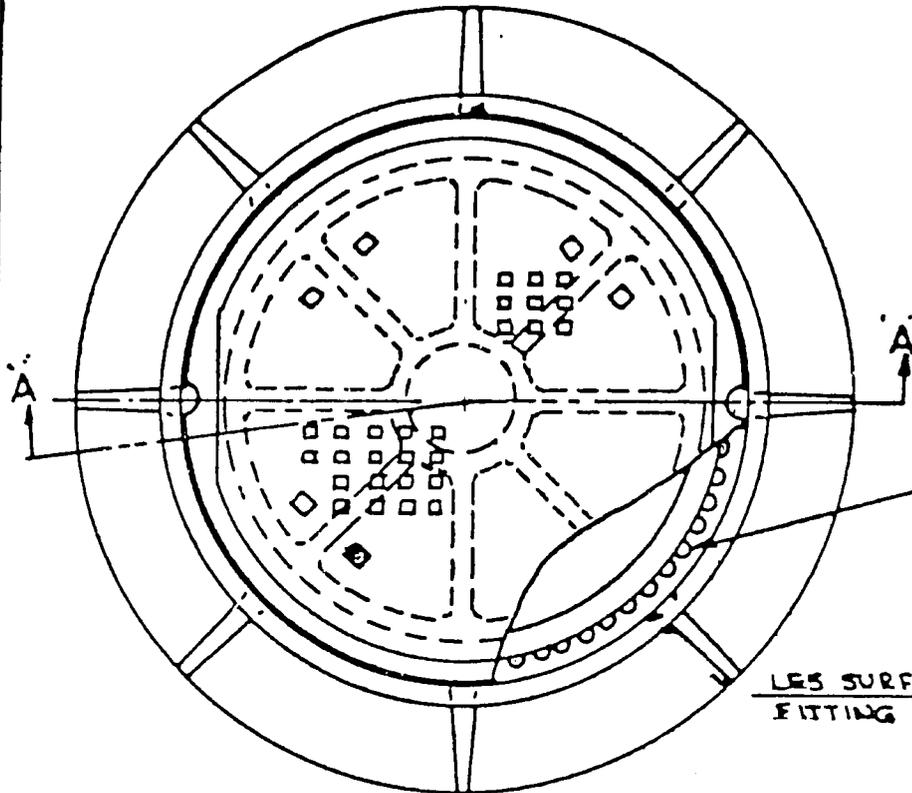
FONDERIE
 LAPERLE
 FOUNDRY LTD
 ST-OURS.. QUE...

CADRE & COUVERCLE

FRAME & COVER

POIDS TOTAL ... 915 LBS
 MAT'L ... FONTE GRISE
 GRAY IRON

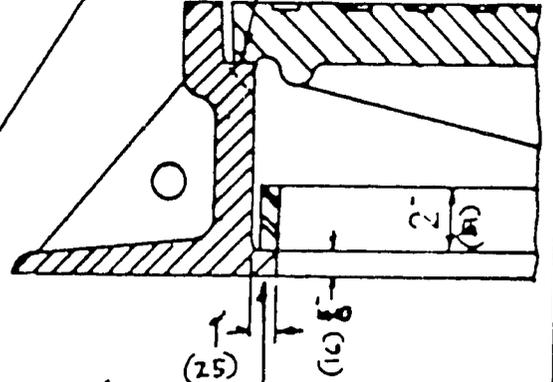
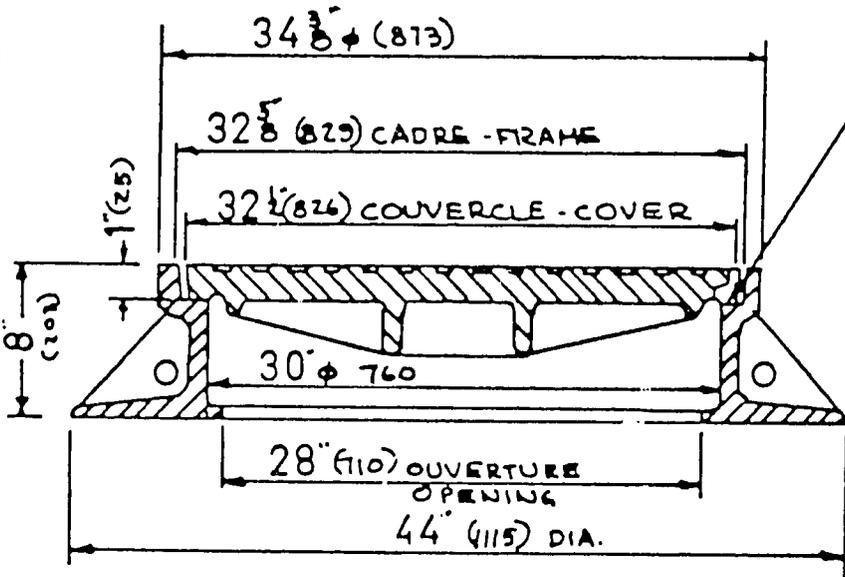
DESS. PAR ... J. D.



LES CADRE & COUVERCLE SONT CORRUGES POUR UNE MEILLEUR ADHESION

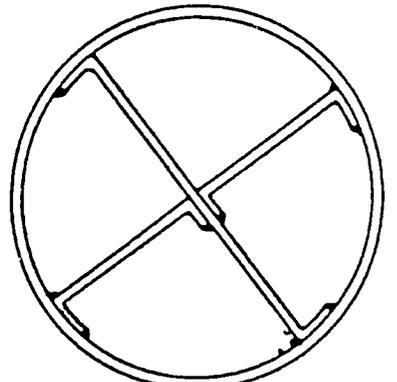
FRAME & COVER ARE CORRUGATED FOR A BETTER FITTING

LES SURFACES PORTANTES SONT MACHINEES
FITTING SURFACES ARE MACHINED



COULEE AVEC OU SANS RIBORD
CAST WITH OR WITHOUT FLANGE

COUPE SECTION A-A



GRILLE de SECURITE
SECURITY GRATE

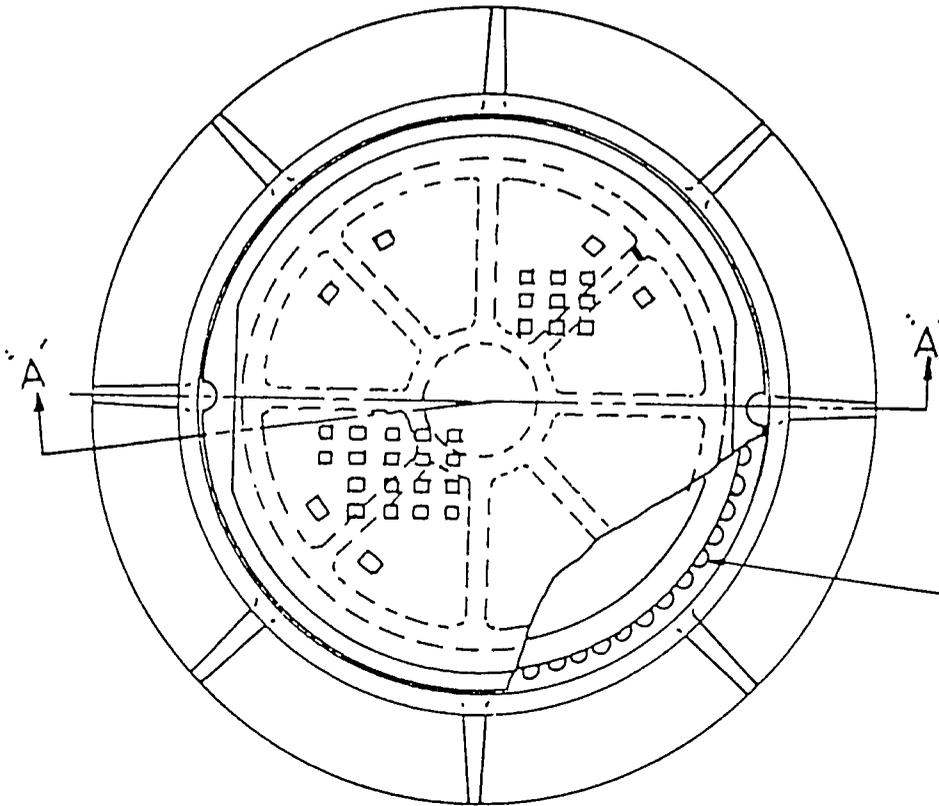
| | |
|-------------------|-------------------------|
| CADRE - FRAME | 435 LBS - 198 Kg |
| COUVERCLE - COVER | 320 LBS - 145 Kg |
| TOTAL | 755 LBS - 343 Kg |

MAT'L - FONTE GRISE
GRAY IRON

FONDERIE
LAPERLE
FOUNDRY LTD
ST. JEROME, QUE.

CADRE & COUVERCLE
FRAME & COVER

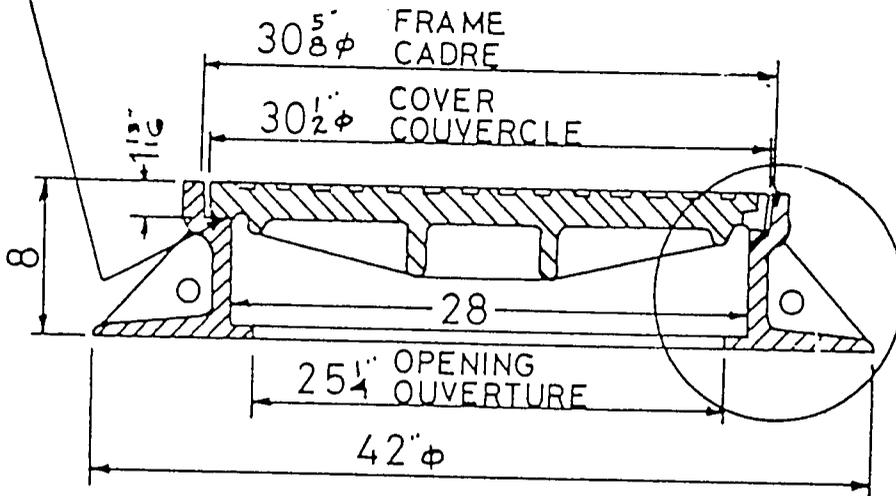
BY. J.D.



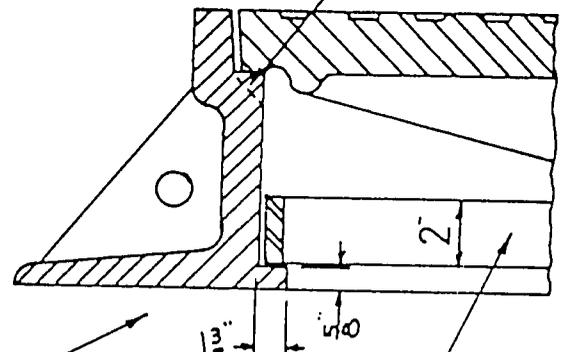
LES CADRE & COUVERCLE
SONT CORRUGES POUR UNE
MEILLEUR ADHESION

FRAME & COVER ARE
CORRUGATED FOR A
BETTER FITTING

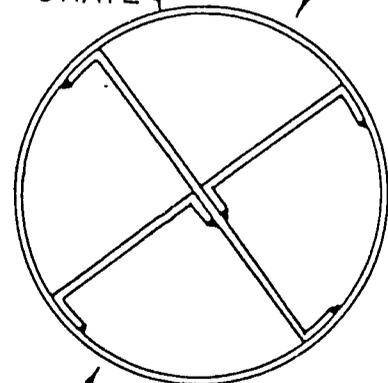
LES SURFACES PORTANTES SONT MACHINEES
FITING SURFACES ARE MACHINED



SECTION A-A



SECURITY
GRATE



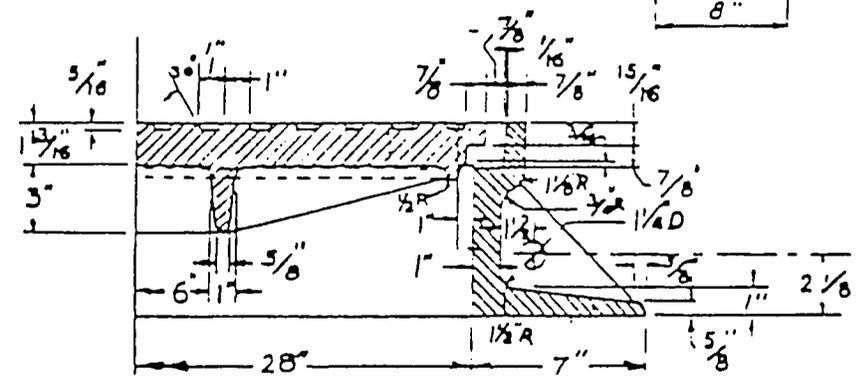
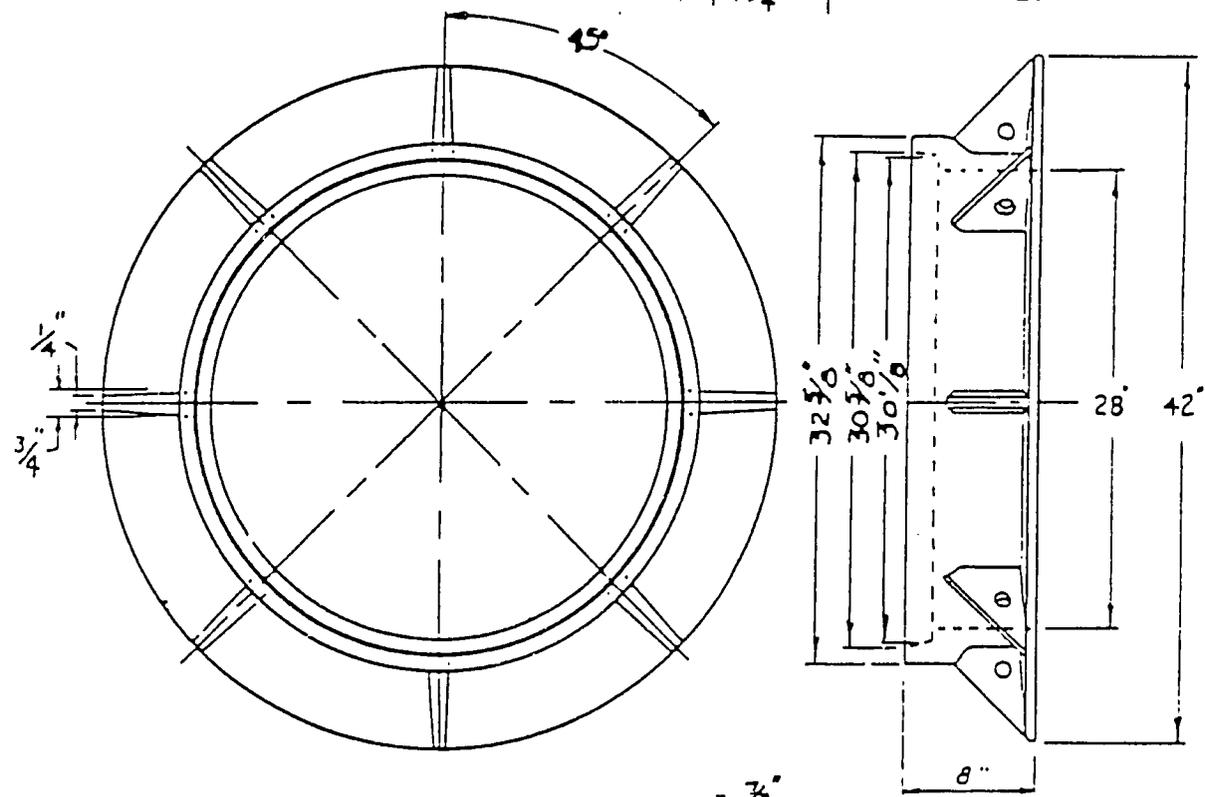
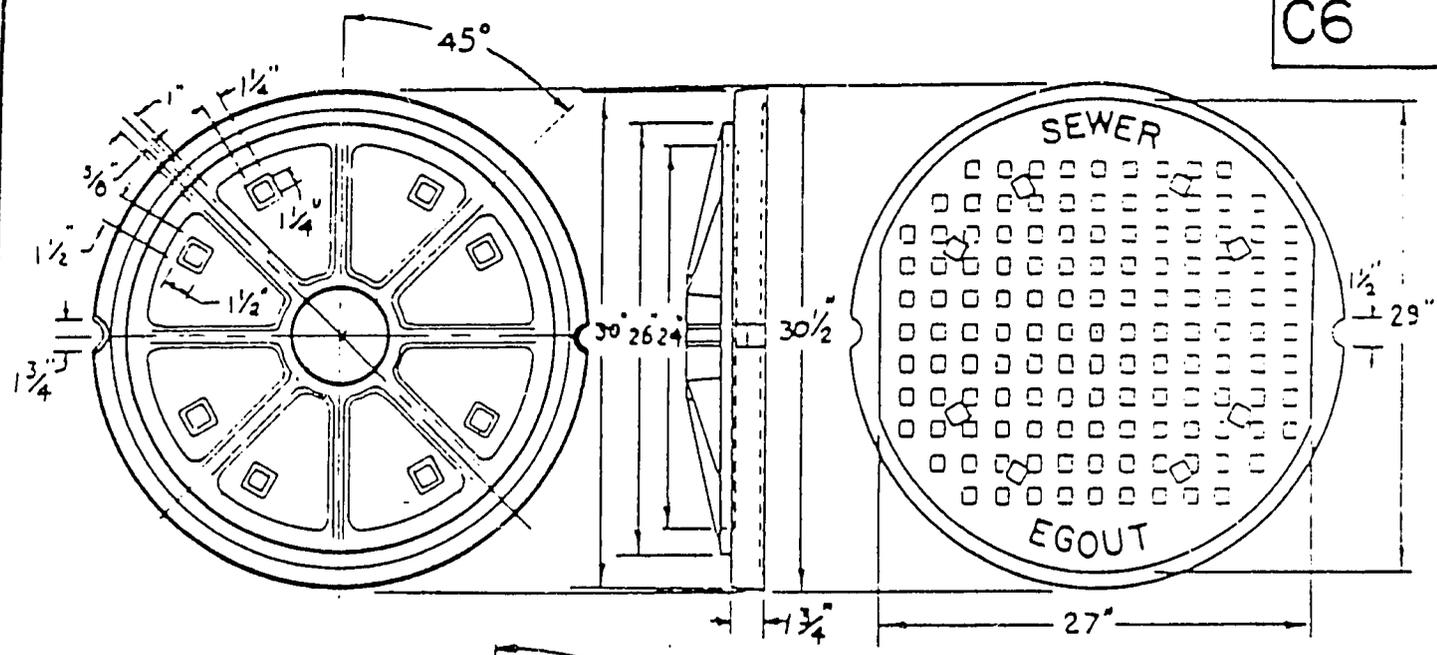
GRILLE DE SECURITE

FONDERIE
LAPERLE
FOUNDRY LTD
ST.OURS, QUE.

CADRE ET COUVERCLE
FRAME AND COVER

POIDS TOTAL 700..LBS
MAT'L: FONTE GRISE
GRAY IRON

DESS. PAR J. D.



COUPE DU CADRE & TAMPON

FONDERIE
LAPERLE
 FOUNDRY LTD
 ST-OURS, QUE.

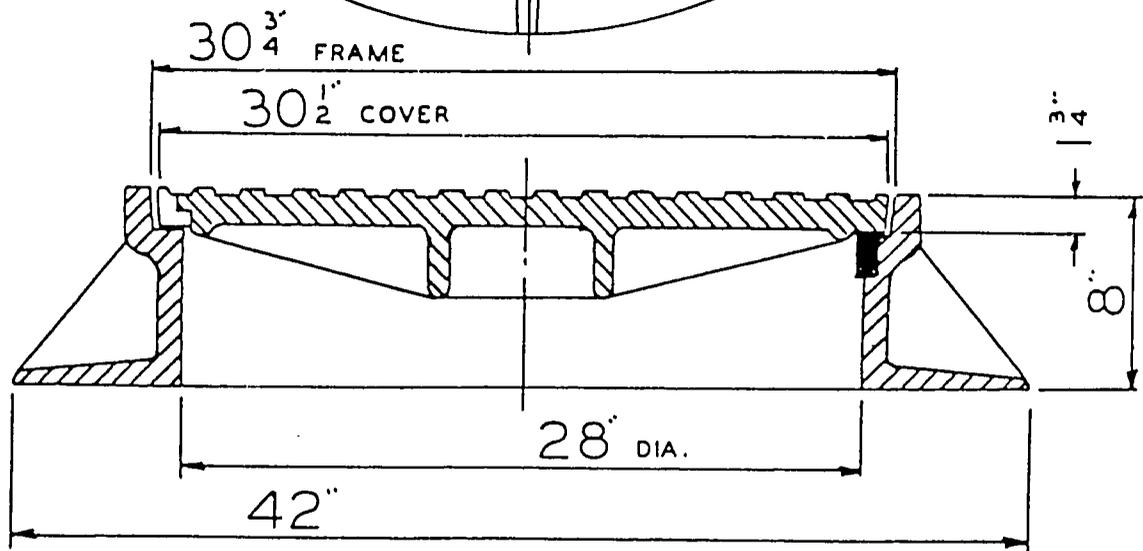
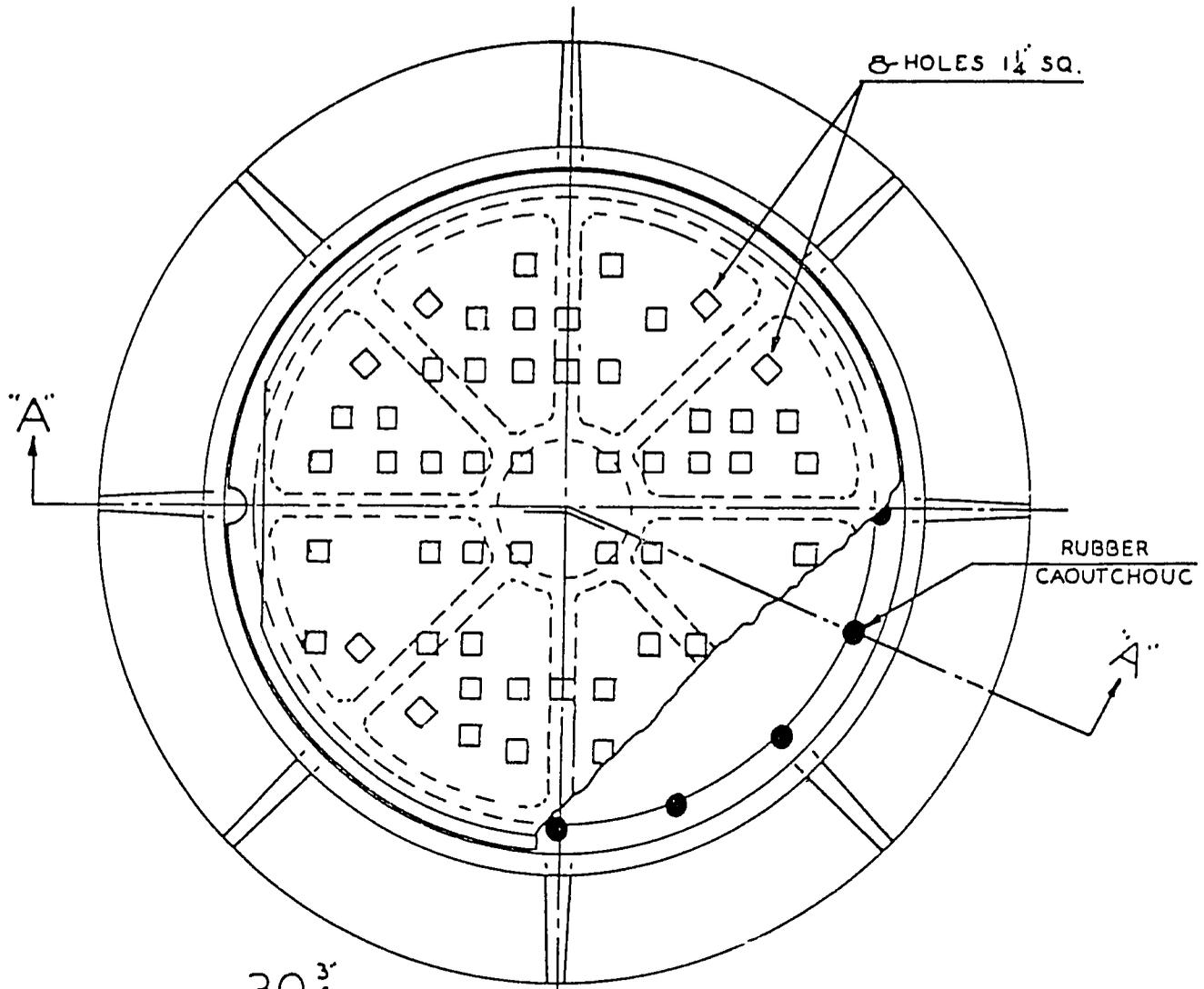
CADRE & TAMPON
 POUR REGARD D'EGOUT
 MAN HOLE COVER SEWER
 FRAME & COVER

STANDARD - MACHINE
 POIDS TOTAL 680 LBS
 MAT. FONTE GRISE
 GRAY IRON

SIEGE MONTE SUR CAOUTCHOUC — 16-1" DIA. X 1 3/4" LG.

C-6A

RUBBER MOUNTED SEAT — 16 REQ'D — 1" DIA. X 1 3/4" LG.



SECTION 'A-A'

FONDERIE
LAPERLE
FOUNDRY LTD
ST-OURS...QUE...

CADRE & TAMPON
POUR REGARD D'EGOUT

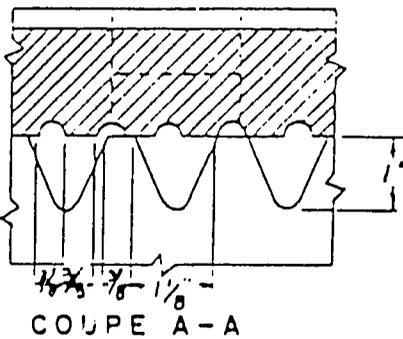
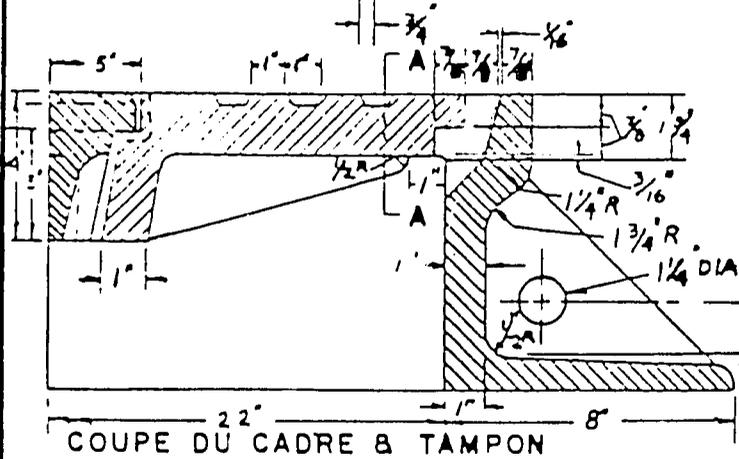
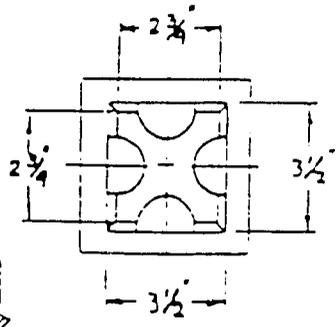
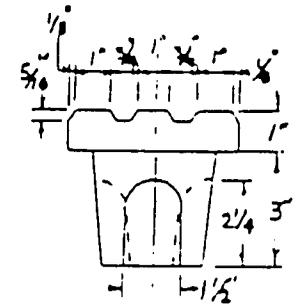
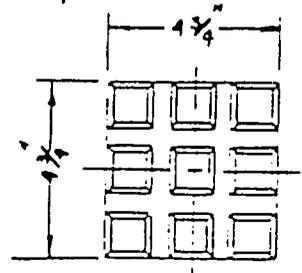
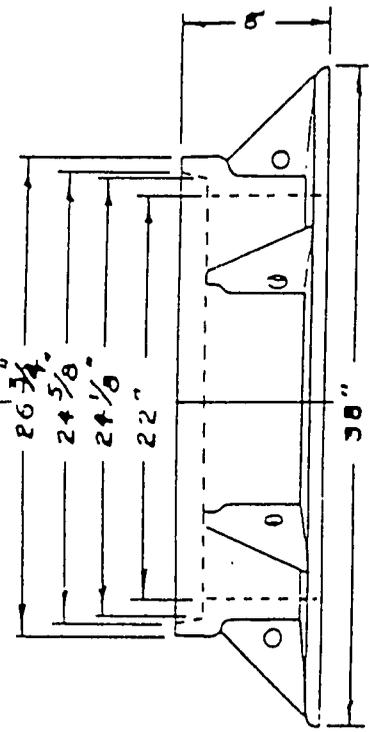
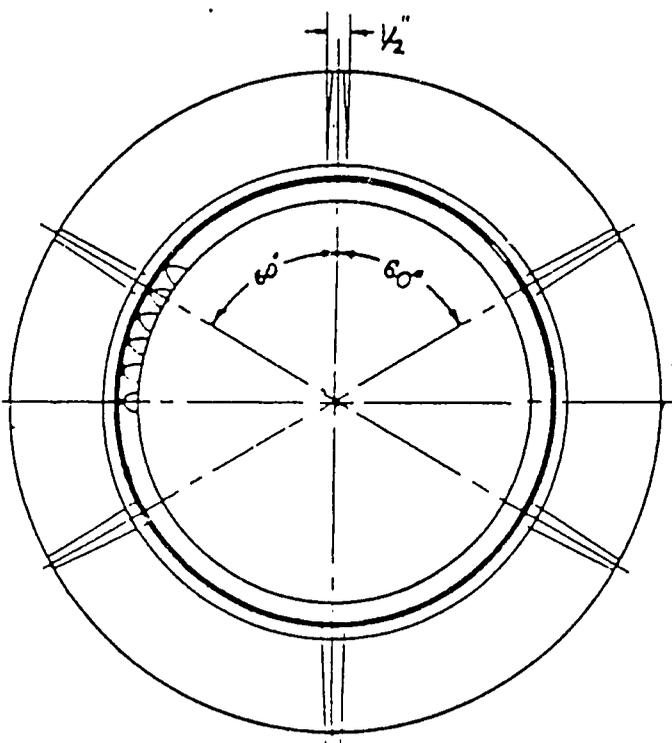
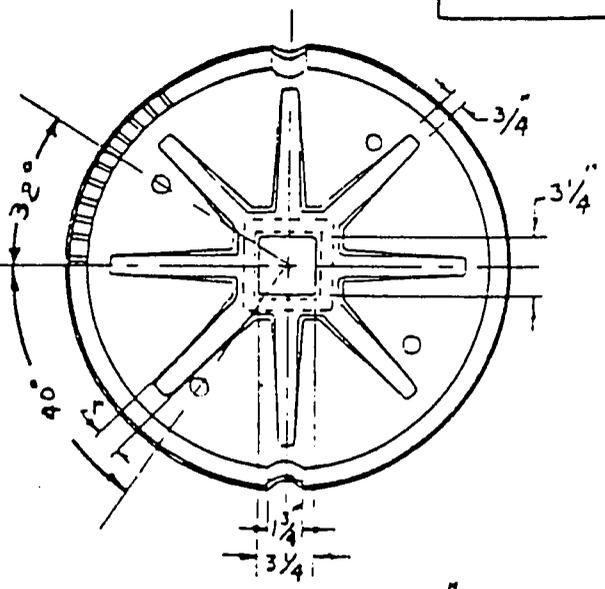
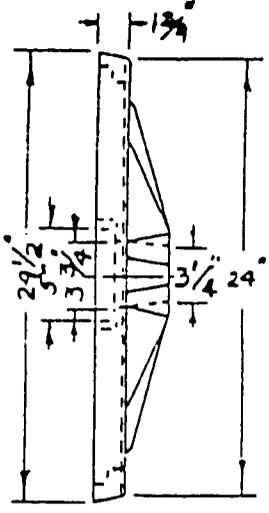
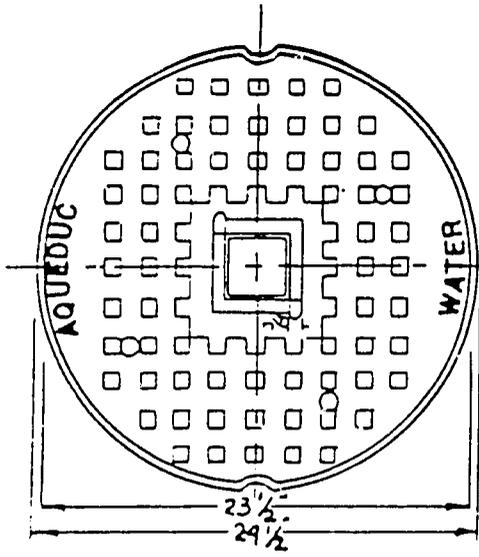
MANHOLE COVER SEWER
FRAME & COVER

POIDS TOTAL.... 680 LBS.
MAT'L.... FONTE GRISE
GRAY IRON

DESS. PAR... J. D.

NOTE: SPECIFICATION CITE DE MONTREAL

C8



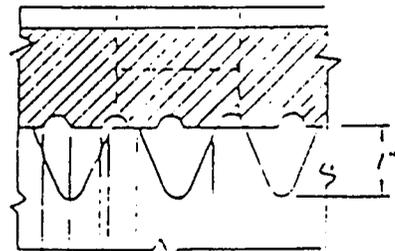
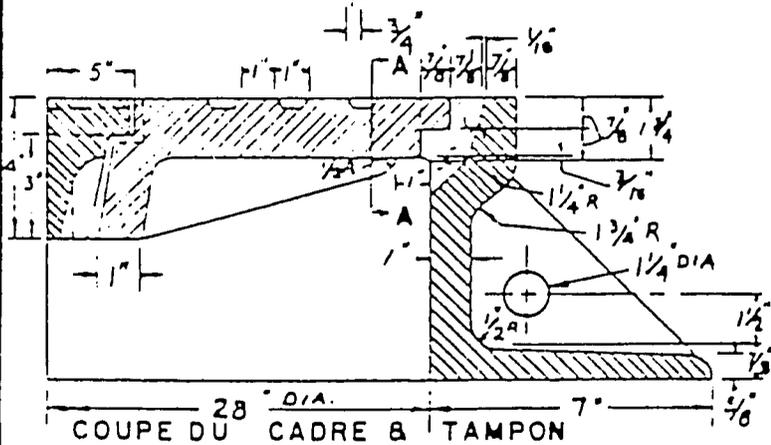
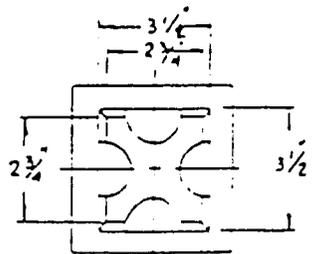
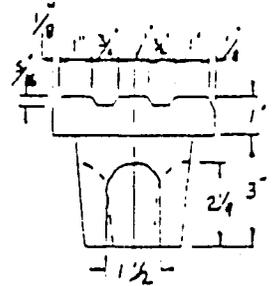
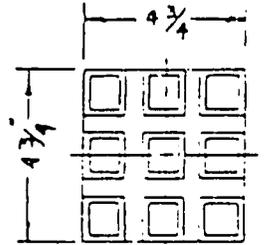
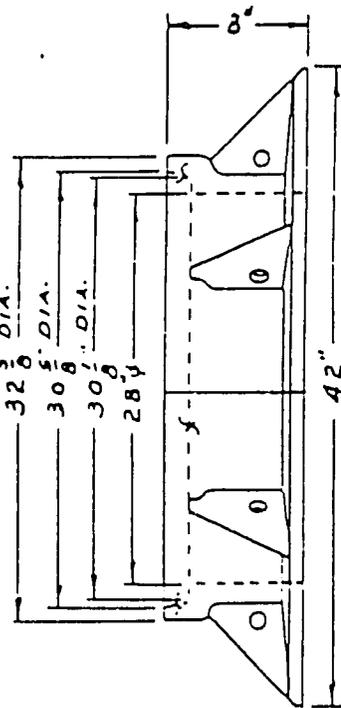
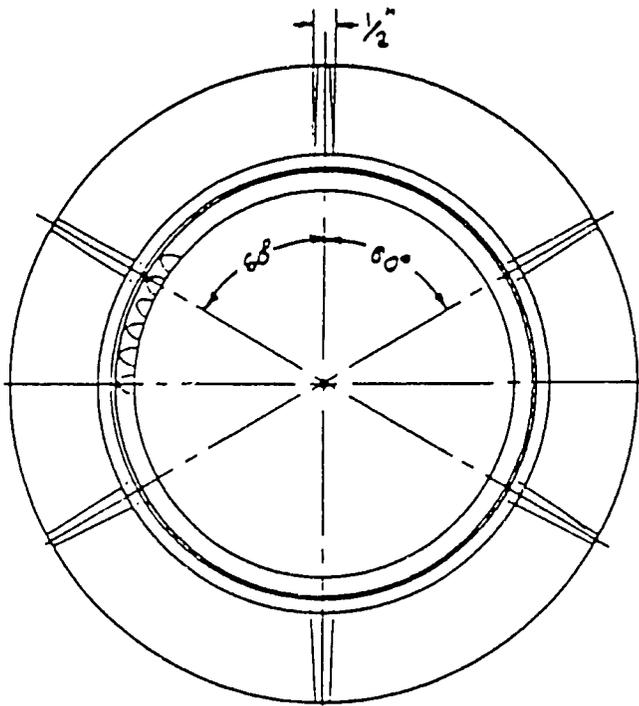
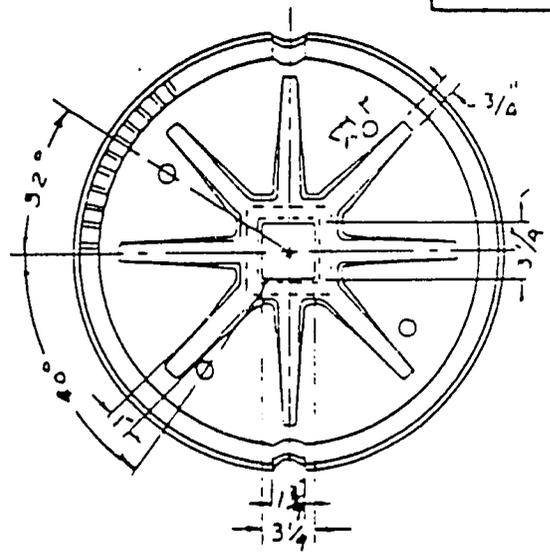
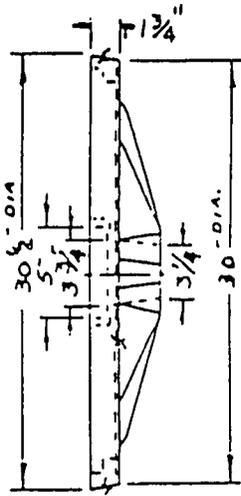
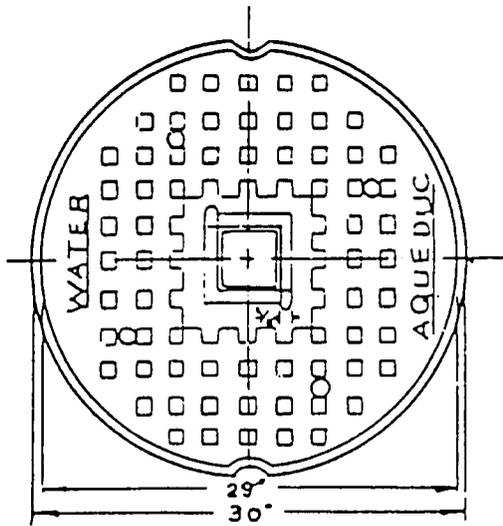
COUPE DU CADRE & TAMPON

COUPE A-A

FONDERIE
LAPERLE
FOUNDRY LTD
ST-OURS, QUE.

CADRE & TAMPON
POUR VALVE D'AQUEDUC
FRAME & COVER
MAN HOLE COVER FOR WATER VALVE

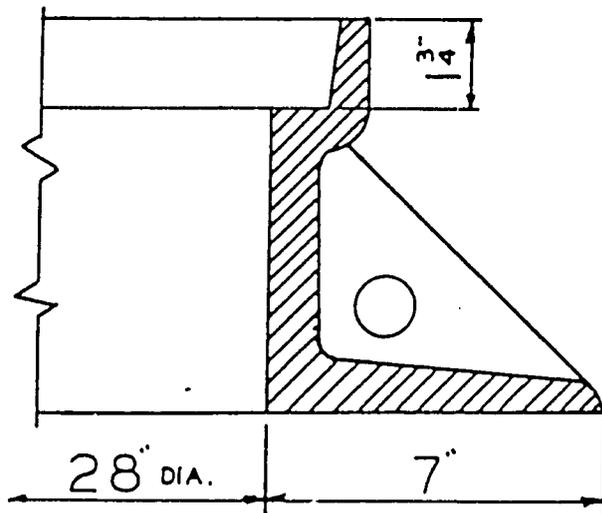
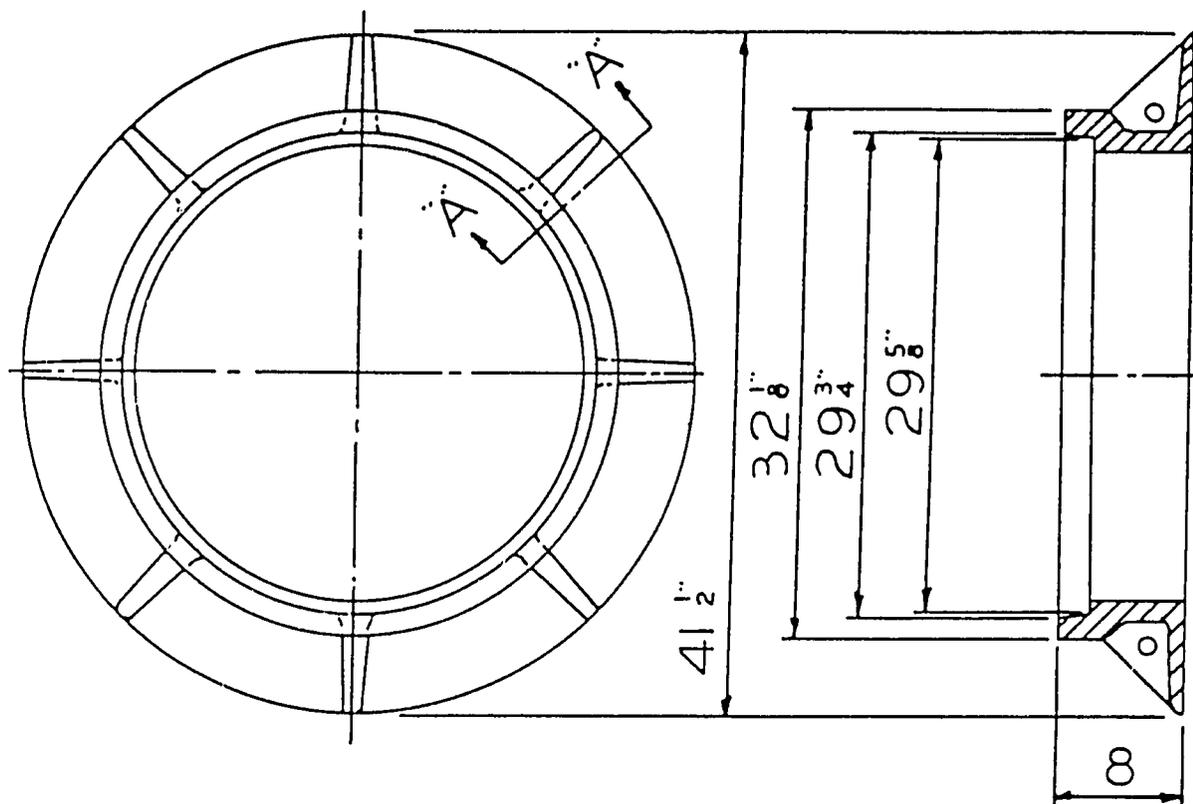
MACHINE
POIDS TOTAL: 560 LBS.
MAT: FONTE GRISSE
GRAY IRON



FONDERIE
LAPERLE
FOUNDRY LTD
ST-OURS, QUE.

CAORE & TAMPON
POUR VALVE D'AQUEDUC
FRAME & COVER
MAN HOLE COVER FOR WATER VALVE

MACHINE
POIDS TOTAL: 685 LBS.
MAT: FONTE GRISE
GRAY IRON



SECTION A-A

LES GRILLES P-1, P-2, P-3 & P-3A SONT ADAPTABLES SUR CE CADRE.

THE GRATES P-1 P-2 P-3 & P-3A ARE ADAPTABLE ON THIS FRAME.

FONDERIE
LAPERLE
FOUNDRY LTD
ST-OURS...QUE.

PUISARD DE RUE
CATCH BASIN

POIDS TOTAL... 400 LBS
MAT'L... FONTE GRISE
GRAY IRON

DR..J. D.

1447

APPENDIX G
Bibliography

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BIBLIOGRAPHY

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