Report:

KIRKENS NØDHJELP

Water Assessment Mission to Afghanistan

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Part F. Urban Water Supply Systems in Afghanistan

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by D Banks, with contribution on Jalalabad by MH Hamid, Norwegian Church Aid

1. *Kabul*

HISTORICAL SITUATION

Kabul has never had a global water supply system, but rather several local systems, fed by largely independent sources.

The first water supply network of Kabul City was designed and constructed more than one hundred years ago (1890s) and was called the Paghman Water Supply Network. The source of the water was a karez in the Paghman district, located about 15 km from Kabul. Water flowed by gravitation through some 18 km of cast-iron pipe to Kabul City. The water was distributed to the Royal Palace and to the main government buildings, houses and some streets of the city. At the present time this network is not functioning. (Eng. Orya, HABITAT, 27/1/02; Eng. Salem, ICRC 27/1/02, Hamid 2002).

Some 60-70 yr. ago a large karez system was piped into Kabul (Mr Latif 22/1/02 – this is thought to be the Qargha system).

The Alaudin wellfield was developed sometime between the 1930s (Eng. Salem, ICRC 27/1/02) and 1954 (Hamid 2002).

In 1969, the Royal Government of Afghanistan (1969) stated that the water supply comprised only an intermittent service to part of the city. Demand so far outstripped supply that the system was shut down for 20 hours of the day. The actual water supply at that time was calculated as 33 litres/pers./day (including losses) to the less than 45% of the population with access to the network. The two sources supplying the network were:

- springs (+ karez) below the Qargha Dam, first developed some 50 years previously, yielding 870 m^3/day and distributed via the Da-Afghanan reservoir.
- 4 deep wells at Alaudin, yielding some 6 m^3/minute (100 l/s).

The remainder of the population even then relied on shallow wells and irrigation canals. The public water supply network did not extend to the suburbs. There was no public sewerage, the population used largely vault/drop latrines.

During the 1960s/1970s, the Afshar and Logar wellfields were developed (Eng. Salem, ICRC 27/1/02).

Immediately prior to the civil war (around 1990) only 60% of the city's population had access to piped water, mostly from the three largest networks (all fed by deep wells): the Logar, Afshar and Alaudin networks. The rest of the city sources its water from an estimated 100,000 shallow wells (Solidarités 1995). At this time, the maximum production rate of CAWSS's piped networks was 86,000 m^3/day (1000 l/s) and the population was some 1.4 million (Salem, ICRC, 27/1/02). This 86000 m^3/day was distributed between:

- Afshar, 6 deep wells, 11,500 m^3/day (133 l/s)
- Alaudin, 7 deep wells, 32,000 m^3/day (370 l/s)
- Logar, 10 deep wells, 34,000 m^3/day (394 l/s)
- Qargha karez, 5000 m^3/day (58 l/s)
- Individual well systems, 3500-4000 m^3/day (41 – 46 l/s)

By 1991/92, damage to the network had reduced the capacity to some 25-30,000 m^3/day (289 – 347 l/s). In 1994, major internal conflict resulted in the destruction of the electrical supply system and to many of the water sources. The only system left operating was the gravity-fed Qargha system, at a rate of 5000 m^3/day. At this time, much of the population were using poorly protected groundwater or surface water and cholera reached epidemic proportions. At this time, ICRC became involved and started chlorinating shallow wells, but this had little effect. Another approach involved a program to construct protected deep wells with handpumps (drilled to >10 m below static water table) and to improve latrines. To date, some 46,000 improved latrines have been built. Even this latter program is regarded as unsatisfactory, largely due to poor rates of handpump maintenance. After this, ICRC became involved in public supply network rehabilitation (supply of parts and pumps and electrical system rehabilitation). Today, the capacity of the public distribution system has risen to 28-30,000 m^3/day (according to Eng. Salem, ICRC, 27/1/02).

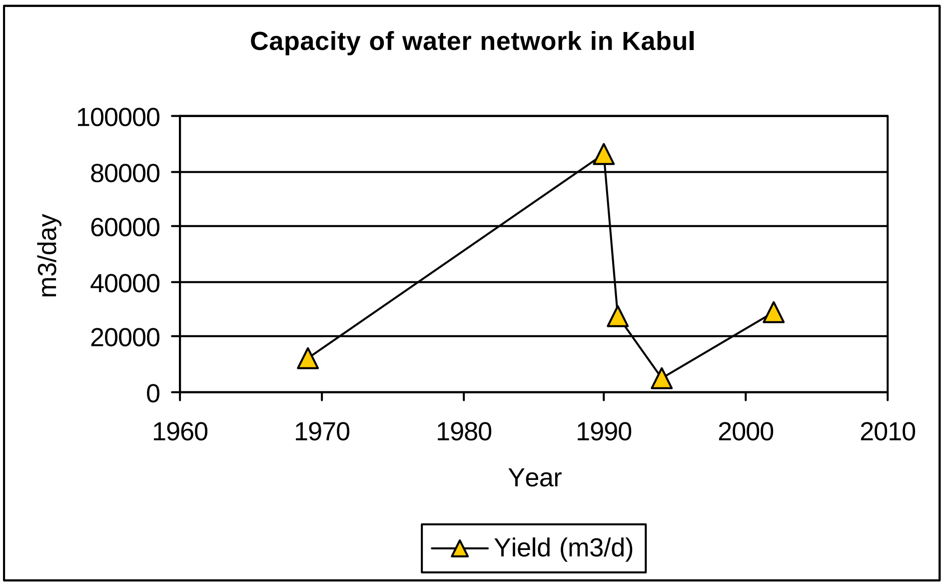

Figure F1. Capacity of Kabul water supply network by year

CURRENT SITUATION

Most private homes have their own wells or boreholes, which have formed the basis of supply for the majority of the population over the past 20 years. Currently, KfW (2002) and Hamid (2002) estimate that CAWSS networks provide some 20,000-21,000 m^3 water to Kabul, while the Microrayon networks supply 8,000 m^3. A further 20,000 m^3 are believed to be derived from wells with handpumps.. HABITAT (pers. comm. to G. Valle) currently estimate that 30% of the population use public shallow wells with handpump, 20% receive water from distribution networks and 50% use private shallow wells.

According to CAWSS staff (Hamid 2002), in the year 2000, some 7 million m^3 was produced from the CAWSS networks and distributed as follows:

Public	1,516,325 m^3
Religious organisations	44,720 m^3
Administrative sections	515,320 m^3
Losses	2,148,937 m^3
Private	2,567,628 m^3

The water losses from the main water supply networks are estimated as around 6,000 m3/day (approximately 30% of production in 2001) according to CAWSS staff (Hamid 2002).

Comparing the situation in 1990 with that now, Eng. Salem (ICRC, 27/1/02) estimates the following statistics for access to public piped water supply:

	1990	**2002**
Kabul city	60% access to piped drinking water	20%
Provincial cities	15%	5-10%

Timmins (1996) carried out a survey of Kabul's water supply and concluded that Kabul's water supply systems had begun to disintegrate since the Soviet withdrawal in 1991. During the Soviet occupation and civil war years, people fleeing the countryside built illegal houses (*zorobads*) in parts of the city not served by public utilities. This resulted in more open wells in areas where the shallow water table was available, and decreased access to water in areas where the water table was salty and unpotable. In these latter areas (e.g. the Wazir Abad and Kwaje Bogra areas east of Khair Khana), people collect drinking water by walking substantial distances (Solidarités 1995).

Currently most of Kabul's citizens receive water from open wells with poor well-head protection. Attempts have been made to rehabilitate parts of the piped water supply network but interventions by NGOs have been characterised by (Timmins 1996):

- generally poor sustainability
- they were improperly thought through
- lack of payment ability
- lack of comprehensive feasibility studies prior to rehabilitation.

There are thus several sources of supply to Kabul's citizens (Timmins 1996):

- Open wells. The most important source in terms of population served. Water abstracted by bucket. Drawbacks: poor well-head sanitation and protection, often polluted, often dry in the dry season. Benefits: simple, cheap, proximity to user.
- Wells / boreholes with handpumps. These may be quite shallow, penetrating as little as 2 m below the water table. There is often confusion in maintenance and reporting routines – they are the theoretical responsibility of CAWSS, but in practice are often maintained by the Dept. of Rural Rehabilitation and Development and by NGOs.
- Springs and karezes
- Public distribution networks (see below). In the past Kabul was supplied by several different networks, operated by CAWSS. These were badly damaged in the war years and not maintained.

According to Timmins (1996), a survey of 4560 families (presumably outside the area of any distribution network) yielded the following results, suggesting that people have some awareness of the benefits offered by good well-head protection in the context of potable water:

Source of water	**Open wells**	**Wells/boreholes with handpump**
for drinking	61.8%	38.2%
for cooking	86.8%	13.2%

KABUL'S WATER SUPPLY NETWORKS

According to Solidarités (1995), Kabul's piped public water supply comprises fifteen discrete networks. Twelve of these are relatively modest, but three are of substantial extent. In 1995 (Solidarités 1995), all 12 small systems an one of the large systems (Afshar) had been rehabilitated and were being operated by NGOs and were supplying water to some 350,000 people daily. These systems typically comprise:

- a source, usually deep wells, with an electric pump
- a transmission network
- often, but not always, a reservoir
- a distribution network to houses or public standpipes, and also to schools, hospitals etc. Pipes are normally c. 1 m underground (MH Hamid).

Currently, the Kabul water supply networks function only partially, and with only an intermittent supply. This is not primarily due to lack of resources: the main problem is ensuring an electricity supply to the system. In particular, there is a lack of money to pay pumping costs and to buy diesel to power generators. It is estimated that some 50-60% of the network has been damaged during the past 20 war years, especially during the post-Soviet civil war (MH Hamid 21/1/02).

The three main networks are the Afshar, Logar and Alaudin networks:

Afshar System

Description: The **Afshar** system was financed by KfW Bank and established in 1977 (Hamid 2002). The system was designed for 15,000 families. The water is used mostly in Khair Khana area (District 12) of Kabul. During the Kabul war the system was badly damaged. CARE International rehabilitated the wells and the pump station in 1995.
Source: The system is fed by 6 deep boreholes of depth 80-90 m at the Afshar wellfield near the Paghman River. The boreholes are equipped with electric submersible pumps of capacity 17-40 l/s. The groundwater level varies between 12 and

28 m bgl in the various boreholes. Ideally, 5 of the 6 wells would be pumped 24hrs pr day (the sixth being pumped only 2 hrs pr day due to a fall in groundwater head). In actual fact, irregular electricity supply (the wellfield can be 2 days without electricity) means that pumping is highly inefficient. A backup generator exists but is not used due to lack of diesel and poor maintenance. Additionally the system suffers from old equipment, lack of spare parts, lack of tools and heating for staff and worn-out non-return valves.

Transmission: The length of the transmission pipeline (steel and asbestos cement) from the water source to the water distribution network is about 7 km, at diameter 400 mm.

Storage: Water is pumped from Afshar to two large covered concrete reservoirs (c. 2 x 5000 m^3 estimated) on the hillside behind (i.e. to the west of) the Intercontinental Hotel. When inspected, the reservoirs were functioning but were almost empty (i.e. no residence time). It is stated that it takes 12 hrs to empty the reservoirs if no pumping takes place at Afshar.

Treatment: There is a gas/powder chlorination system at the wellfield but this has not functioned for over one year, due to lack of chlorine supply. Currently, chlorination occurs at the reservoirs behind the Intercontinental Hotel by an operative daily throwing in 4 Kg chlorine powder to the reservoirs.

Distribution: From the reservoirs behind the Intercontinental, water is distributed (on a rotational basis) to (amongst others) Karte Parwan and to another large reservoir (c. 5000 m^3) on a hillside above Khair Khana, from which Khair Khana is fed by gravity. The total area covered by the distribution network is about 40 km^2 and the total design length of the network was around 8 km. The network pipe is of asbestos cement (and cast iron ??).

Current Operation and Need for Rehabilitation: The wellfield is connected to the electricity network of the City, but the reliability of the connection is poor. Groundwater heads are also declining, possibly by 2-4 m over the past few drought years (KfW 2002, Hamid 2002). Dynamic water level is such that pumps are in danger of pulling air. Currently between 1 and 3 of Afshar's boreholes are non-functional due to this (Eng. Orya, Habitat 27/1/02; Eng. Salem, ICRC 27/1/02), and the initial wellfield capacity of 14,500 m^3/day has declined to around 10,000 m^3/d. Due to defective power supply, even this capacity cannot be achieved (KfW 2002). Currently, water is only distributed for drinking purpose for 1-2 hours per week in some parts of Khair Khana. The Afshar system has been variously rehabilitated by CARE, Solidarités and RADA, and is maintained with the assistance of ICRC. Recently, ICRC has repaired one part of the network which was struck by an American bomb. Original borehole data and hydrogeological assessments have been lost. There is a need for a CCTV survey to inspect boreholes and optimally position pumps (Eng. Najibullah, CAWSS, 3/2/02).

NCA Involvement: NCA funded rehabilitation of this system in 1998, by its (now defunct) partner RADA. The rehabilitation comprised (i) reinstallation of electrical grid and connection of submersible pumps (ii) repair of 1 pump (iii) cleaning of reservoirs. NCA has no continued involvement in the project (due to the demise of RADA), and responsibility for maintenance has transferred to the Kabul Municipality Water Supply Department of CAWSS. The estimated number of beneficiaries is unknown in detail but is likely to reach several hundred thousand.

Sources of Information: The system was viewed by the authors on 26/1/02 and interviews were held with operational staff at the wellfield. Notes of Hamid (2002) following interviews with CAWSS and inspection of CAWSS data.

Logar System

Description: The Logar network (also known as the Bagrami network) is the largest in Kabul and supplies the eastern part of the city. According to Hamid (2002) it was constructed in 1972 for 7,000 families. The number of inhabitants in the target area was estimated about 10,000 families. According to Engineers Ehsanullah (NPO, 27/1/02), Salem (ICRC 27/1/02) and Najibullah (CAWSS, 3/2/02), the Logar system was completed in 1983, with the assistance of a loan from the World Bank. During the Kabul war (1992-1995), the electricity supply to the water source area was severely damaged. Oxfam and HABITAT commenced rehabilitation of the system in 1995 and eventually (1996) only completed the portion of the network from the wellfield to the transmission system (pumping station equipped with generators, transmission line checked).

Source: The system is fed by a wellfield to the south-east of the city, comprising 10 deep boreholes near the Logar River at Bagrami. The wellfield capacity is cited as 30,000 m^3/d from the ten wells (KfW 2002). According to Hamid (2002), the diameter of the wells is 400 mm, the depth is 60-70 m and the capacity of each is about 40 l/s.

Transmission: 1.5 km x 400 mm diameter steel, using booster pumps of 12 m^3/h (??) capacity, according to Hamid (2002).

Storage: Concrete reservoir of capacity 7000 m^3

Treatment: Chlorination in the reservoir by chlorine powder.

Distribution: The total area covered by the distribution network is around 380 km^2 and the total length of the network was designed as c. 28 km. The distribution pipe is steel, asbestos cement and plastic.

Current Operation and Need for Rehabilitation: At present, the Logar scheme functions with a capacity of approx. 10,000 m^3/day, the sources being powered by generators. Water is only distributed for drinking purposes 5-6 hours per day. The treatment plant, transmission pipe and reservoir function. The wellfield's main problem is with electricity supply (lack of reliable hydropower and no money to provide fuel for generators). Current needs are therefore:

- electrification from power lines 14 km away, estimated cost 159,000 USD
- rehabilitation and leakage detection of distribution system, estimated < 500,000 USD.

NCA Involvement: None
Sources of Information: Notes of Hamid (2002) following interviews with CAWSS and inspection of CAWSS data.

Alaudin System

Description: The **Alaudin** system (see Figure F2), was designed to be fed by 7 deep boreholes (c. 80 m deep, yield 30-40 l/s each, according to Eng. Alem, CAWSS, 14/2/02) along the Kabul River, supplying the largely destroyed southwestern part of the city. It was designed and constructed by Japanese engineers in 1954 (Hamid 2002). At the present time, this network is utilised by c. 2,000 families, although it was originally designed for 5,000 families (Hamid 2002). During the civil war (1992-1996) most parts of the system were damaged or destroyed. In 1995, Alaudin was completely non-functional. Since then it has been partially rehabilitated by CARE in 1998 (drilled 1 new well and rehabilitated 2 others).
Source: Today, the wellfield functions to some extent, with four wells in operation (Figure F2):

- one just south of the former Soviet Embassy,
- one in the CARE compound
- two other wells further north at the foot of Sher Derwaza mountain

Power supply is provided by diesel generators 5 hrs/day (Eng. Orya, Habitat, 27/1/02; Eng. Salem, ICRC 27/1/02). Although the theoretical capacity of the four wells is 10,000 m^3/d, only 1,000 m^3/d are produced.
Transmission: 500 mm diameter (according to CAWSS Engineer Alem, 14/2/02) transmission mains (2-2.5 km long) to Demazang reservoir. Hamid (2002) cites the transmission pipes as being steel and asbestos cement of diameter 200mm.
Storage: 7000-7500 m^3 concrete reservoir at Demazang, on the hillside north of Sher Derwaza,
Treatment: Chlorination in reservoir by chlorine powder.
Distribution: Distributed by gravity through asbestos cement and steel pipes from Demazang. The total area covered by the distribution network is about 16 km^2 and the total length is about 4 km.
Current Operation and Need for Rehabilitation: The treatment plant, transmission pipes and reservoir are functioning and operated by CARE. The distribution network is only partially functioning (leakages) and water is only distributed some 5-7 hours/day due to shortage of water from sources. There is a need to rehabilitate and clean a further two boreholes (one in the former Soviet Embassy and one just north of it – Figure F2) in addition to the four that are already functioning. The system needs connection to a reliable electrical power supply at an estimated cost of 60,000 – 80,000 USD (Eng. Najibullah, CAWSS, 3/2/02). CAWSS have a proposal to extend the network into Karte Seh (Figure F2), although this would be ill-advised at present due to the existing water shortage in the network.
NCA Involvement: None
Sources of Information: Notes of Hamid (2002) following interviews with CAWSS and inspection of CAWSS data. Visit to view system 14/2/02, with Engineer Alem of CAWSS.

Lesser Networks

Of the lesser networks, the **Qargha network**, fed by gravity from a spring/karez, is the most important, feeding (along with the Afshar wellfield) the Karte Parwan region of the city, via a reservoir on the hillside just south of the Intercontinental Hotel. However, due to the drought, the Qargha source is currently dry. Two wells have recently been drilled on the Qargha network to supplement supply to this (Eng. Orya, Habitat, 27/1/02).

Additionally, CAWSS have responsibility for 19 individual borehole sources throughout the city. All are reported to be functioning, but many have an unsatisfactorily low specific capacity and cannot run continuously. Six of these feed directly into main networks and others feed their own reservoirs. Some also suffer from irregular electricity supply (Eng. Najibullah, CAWSS, 3/2/02).

For example, the **Deh-Afghanan network** was designed and constructed in 1950, based on one deep well, located on the bank of the Kabul River, near the Pul-e-Hartal Bridge. The capacity of this well is about 92 l/s, its diameter 300 mm and its depth 30m. Water is distributed to the centre of Kabul, mostly in the Deh-Afghanan area and District No.1(Hamid 2002).

The **Wazirabad system** was designed and constructed by Solidarités in 1995. The reservoir is located in the western part of District 4 (Parwane-III) of Kabul City. The network served 500 families in the Parwane-III and Wazirabad areas and is operated by CAWSS. The water source is three deep wells: two of these are connected to the network and one to the reservoir. The capacity of one of the wells is 8 l/s. Water treatment is powder chlorination. The total length of the 100 mm GI transmission pipeline from the water source to the water distribution network is about 2 km. The concrete water reservoir is located about 2 km from the water source and has a volume of 150 m^3. The total area covered by the water distribution network is about 12 km^2 and the total length of the network about 7 km. Distribution is by gravity via 100 mm GI pipe, under gravity (Hamid 2002). The system is currently largely functioning normally, although the distribution net is prone to leakage.

Distribution Networks

The distribution network in Kabul comprises largely cast iron piping. In the Afshar system, the mains are constructed of asbestos-cement (Eng. Aini, 23/1/02). The network is not especially biased towards richer areas. KfW (2002) believes that water losses due to defective distribution networks account for 50% of water produced, while CAWSS estimate a figure of 30% (Hamid 2002).

MICRORAYON SYSTEM

Microrayon is a large complex of 381 Soviet-built six-storey apartment blocks (9500 apartments), developed between 1960 and 1980, towards the airport from the city centre. The apartments used to house high-ranking civil servants and have the best water in the city. Today the population is very socially mixed. Water is supplied via 13 deep abstraction boreholes of depth 100-120 m, and installed with electrical submersible pumps of capacity 25-40 l/s. From these, water is distributed throughout the complex, ideally via hillside reservoir. Sewage is collected from the complex via 4 local pumping stations, transferred to a single large pumping station outside the complex and thence to a treatment plant. From this, treated effluent is discharged to the Kabul River. NCA funded rehabilitation work in 2000, by its partner RADA. The rehabilitation comprised:

- reinstallation of electricity and transformers to the boreholes
- repairs to main pipeline for water
- rehabilitation of reservoir
- reinstallation of electricity and transformer to main sewage pumping station, enabling sewage to be treated.

NCA has no continued involvement in the project (due to the demise of RADA), and responsibility for maintenance has transferred to the Department for Maintenance of Water Supply for Microrayon. The estimated number of beneficiaries could be in the region of 40,000 persons, and the effluent load to the Kabul river is presumed to have decreased. The project cost was some 52,000 USD.

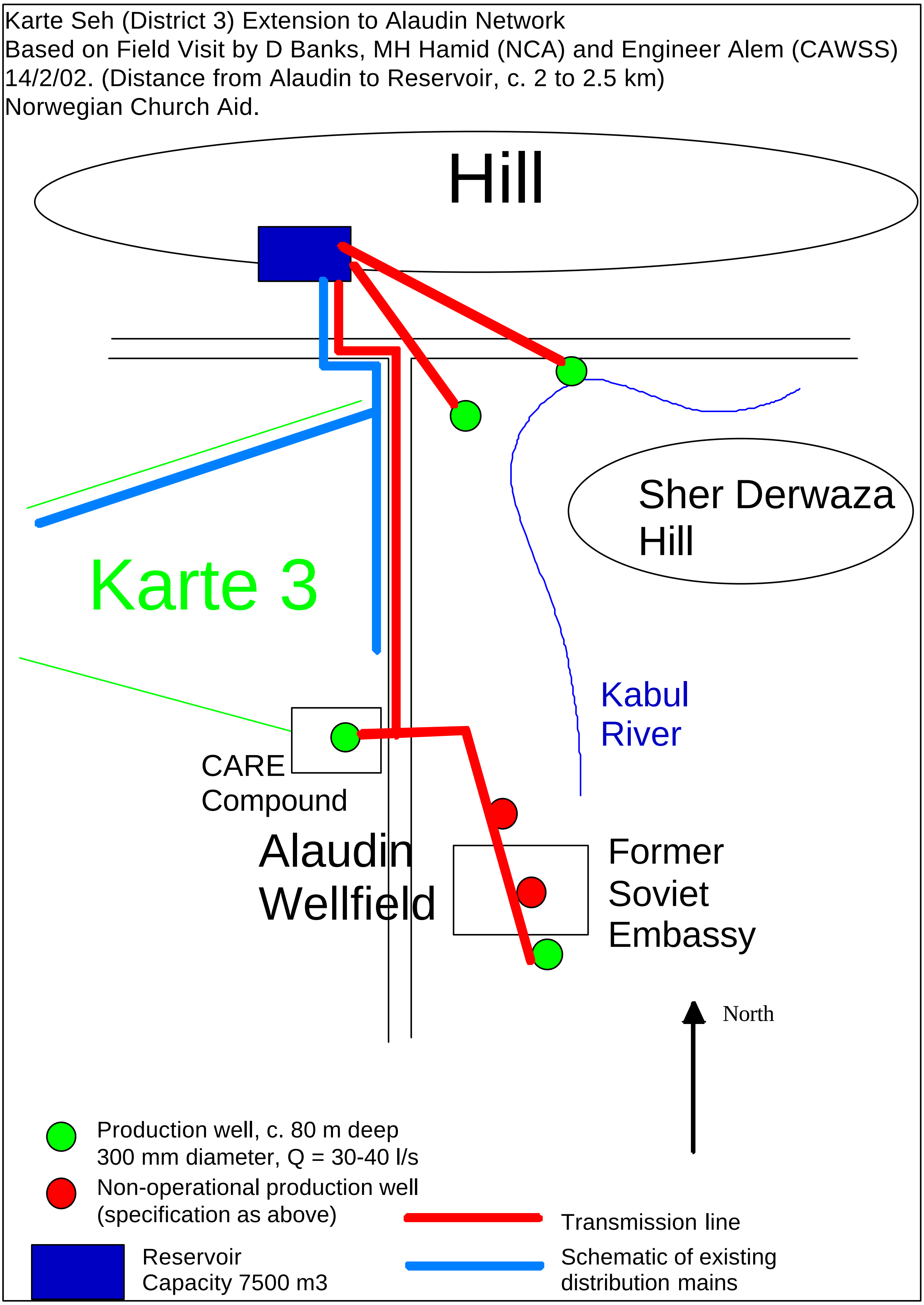

Figure F2. Schematic of Alaudin source and transmission network, and location of proposed Karte Seh (District 3) extension.

The scheme was visited on 26/1/02 and interviews were held with operational staff and with Mr Muhamed Khan, the former project director with RADA.

The water supply system should function 24 hrs/day and, indeed, electricity is supplied 24 hours per day. However, water is actually only supplied from 0600 am to 1430 p.m. due to (i) age of pipes (the relevance of this is not clear for the limited working hours) and (ii) the lack of capacity for sewage effluent treatment (see below). Chlorination systems at the wellfields do not function due to lack of chlorine powder. Water should be delivered via a hillside reservoir, but is currently pumped directly into the network. The reservoir has been rehabilitated and is ready to function when a 24-hrs water supply exists (although it is unclear why this is a precondition for use of the reservoir). The direct pump pressure on the 40-year old distribution net may exacerbate leakages. Water reaches either the 5^{th} or 6^{th} stories of the apartment blocks.

The sewage pumping station has three large electrical pumps, of which only one is currently functioning (replaced by ICRC). This lack of waste water capacity is the main constraint on supply of water to the complex.

The Microrayon complex used to have separate systems for supply of hot water and central heating, from a nearby central power station, which is no longer operating.

KABUL POLYTECHNIC UNIVERSITY SYSTEM

The Kabul Polytechnic water supply and sewerage network (WSSN) was designed and constructed by Russian WSSN engineers in 1958. The network is designed for the 3000 students, 145 professors' family houses and for more than 700 employees. Furthermore the water is used for the experimental research of the Hydraulics Department laboratories, central heating during the winter period and partly for irrigation of grounds of the University.

The water sources are two deep wells of diameter 300mm and depth 75m, located about 3.3 km south of the reservoirs (which lie within the Polytechnic grounds). Water is pumped from the wells by two submersible 6" pumps of capacity of 160 m^3/h, through two separate 200 mm iron transmission pipes (6.6 km total length) to two concrete reservoirs of capacity 500 m^3 each, located within the Polytechnic compound. The reservoirs could not be built high enough on the hillside (due to proximity of former military installations) to be able to supply the topmost floors of the campus, so water from the reservoirs is pumped by six booster pumps of diameter 4, 6 and 8". Two of these pumps are reserved for the fire-fighting system.

Sewerage drains by gravity to the west side of the campus, from where it is pumped up into a large elevated settlement pond. From there, it is pumped north to a reservoir on the hillside, whence effluent is distributed under gravity to irrigate the University gardens.

The Polytechnic's water supply and sewerage network functioned normally from 1958 up to 1992, producing some 1,000 m^3/day. During subsequent conflicts, the wellhouses, pumps and switchgear were destroyed. The wells still exist although their status is unknown (blocked?). There is now no mains electricity supply to the wellhouses, and the nearest mains supply is probably at least 3 km distant. The reservoir pumphouse was also looted for pumps and switchgear was destroyed. Similarly, the University sewerage system was also severely damaged and equipment was looted.

Currently, the campus receives a minimal amount of water from the Qargha reservoir, while pit latrines are installed in the grounds.

As regards rehabilitation, MH Hamid, estimates total costs to be maybe 300,000 USD to its "as was" condition. However, given the apparent inefficiency of design, savings may possibly be made on this figure. For example, six booster pumps seems an excessive number. Also, the reservoir could conceivably be sited higher on the hillside. Alternatively, it may be possible to negotiate with CAWSS for a gravity water supply from the Afshar water reservoir (some 700 m north of the Polytechnic), in exchange for the Polytechnic's two wells (which could conceivably be used to supply the proposed Karte Seh extension of Alaudin).

SANITATION

There are two main types of sanitation system in Kabul (Timmins 1996):

- Traditional drop (or vault) latrine. This has the advantage of being dry and that collected faeces can be used as a fertiliser. There used to be both public and private night soil collection systems, delivering material either to Kabul's landfill at Chimtalla or to private farmers. The night soil was often used without composting, running the risk of pathogen transfer to crops (Solidarités 1995). After 1990, the system for collection of night soil broke down. ICRC started to pay and train 10 night-soil collectors to collect and compost wastes. By 1999, there were more than 800 (private) night-soil collectors, but quality control of procedures and composting is regarded as inadequate. There is a need for retraining (Eng. Salem, ICRC 27/1/02).
- Septic tanks. These are common in wealthier houses and blocks, but suffer from lack of maintenance and emptying.

and three subsidiary types (Timmins 1996):

- Pit latrines
- Piped sewerage systems. The main one of these serves Microrayon and was the subject of NCA-funded rehabilitation, implemented via RADA. This discharges, after treatment, to the Kabul River.
- Cesspits (i.e. settlement of solids, but with little digestion taking place)

Otherwise, wastewater flows via canals or pipes to be discharged, untreated to the Kabul River system (Solidarités 1995).

ICRC have implemented around 46,000 improved drop latrines in Kabul since the 1990s, involving a vent pipe, larger vault, separation of liquid and solid, fly control and a door on the vault (Eng. Salem, ICRC 27/1/02).

WATER QUALITY

Timmins (1996) conducted a water quality survey in Kabul, which involved the analysis of 1400 samples for faecal coliforms, nitrate, nitrite and phosphate. The findings are summarised as follows (the relevant WHO drinking water standard is 5 *E. coli* per 100 ml):

Source	***E. coli* > 5 per 100 ml**	***E. coli* > 100 per 100 ml**	***E. coli* > 500 per 100 ml**
Well with handpumps	45.2%	11.1%	1.3%
Open wells	76.5%	31.9%	4.2%
Distribution networks	49.0%	15.7%	1.96%

The following results were found for nitrate in groundwater sources:

Source	**Average nitrate concentration mg/l NO_3^-**	**Minimum concentration**	**Maximum concentration**	**Percentage >45 mg/l NO_3^- (WHO standard)**
All sources	41.65	<	150	10.8%
Well with handpumps	39.5	<	150	32.5%
Open wells	51.25	4	140	44.3%
Deep wells	37.6	8	85	24.1%
Springs /karezes	34.1	<	90	33%

NB: < = less than detection limit

The above results indicate the significant advantages offered by properly completed wells with handpumps over open wells. They also suggest that water quality from handpumps is superior to that obtained from piped supplies.

According to Timmins (1996), the main area of groundwater contamination is in the Sher Derwaza gorge area.

GROUNDWATER RESOURCES

Kabul is situated on both sides of the Kabul River at the point of breakthrough (the Demazang Ravine) across a mountain chain rising to 400 m above the Kabul plain. On either side of the mountain chain are two recent sedimentary basins, with a ground level of some 1800 m asl (Homilius 1966, Timmins 1996):

- west of the town, the Upper Kabul Basin, traversed by the Kabul, Paghman and Karga Rivers
- east of the town, the Lower Kabul Basin, traversed by the Kabul and Logar Rivers

The basement comprises Precambrian metamorphics (gneisses, granite-gneiss, amphibolite, mica schist, quartzite, marble) with some younger (Upper Palaeozoic-Mesozoic) limestones and marls in the south and east margins of the basins. The basins are infilled with the following series of generally poorly-sorted Neogene and Quaternary sediments, of largely fluvial and lacustrine origin and of several hundred metres thickness (Homilius 1966, Timmins 1996):

- Series 5b (Youngest Fluvial Deposits) – fluvial gravel, pebbles, sand and loess
- Series 5a (Youngest Basin Deposits) – loess, with sand and pebble lenses
- Series 4 (Talus / Alluvial Fan Deposits) – gravel, pebbles, talus, loess
- Series 3 (Basin Deposits) – loess, some sand and gravel, partially lithified
- Series 2b (largely Fluvial Deposits) – gravel, sand, loess, often partially lithified
- Series 2a (Basin Deposits) – largely loess
- Series 1 (Older Basin Deposits of Pliocene to Pleistocene age) – marl, clay, siltstone, sandstone, conglomerate.

The Neogene sediments were deposited to a base-level higher than the level of the current plain and were then eroded by river valleys. Within these valleys, the Quaternary sediments were subsequently deposited. These Quaternary sediments contain the main aquifer horizons, the base of the aquifer complexes being formed by the more compact Neogene sediments or by basement. There are four distinct (but presumably interconnected groundwater basins: the Upper Kabul, Lower Kabul, Paghman and Logar basins (Timmins 1996).

According to Homilius (1966), the main aquifers (groundwater horizons II and III) belong to series 2b and 3, at depths of some 15 to 40 m, but these only occur in limited areas. In series 4, 5a and 5b, a near-surface aquifer (groundwater horizon I) is developed, and it is this that is used intensively by the many shallow wells in Kabul city. In this upper aquifer, the direction of groundwater flow is typically towards the valley plains of Paghman, Kabul and Logar. Groundwater quality is reasonable, but chloride and sulphate concentrations increase down-gradient. In the Lower Kabul Basin, some areas of saline groundwater have developed (Homilius 1966), especially a kidney shaped area extending east-west from Wazir Abad to the Airport (Solidarités 1995). Hydraulic conductivities of alluvial aquifer sediments in the range 40-60 m/d are suggested by Najibullah (1996).

According to Timmins (1996), the Quaternary aquifer complex comprises an upper sand / gravel aquifer layer and a lower conglomerate / gritstone layer, both with hydraulic conductivities in the range 9-40 m/d. These are covered by Quaternary sandy loams of up to 17 m thickness and with hydraulic conductivities in the range 10-70 m/d.

Precipitation in Kabul is some 318 mm per year on average, most of which falls in March and April (Royal Govt. of Afghanistan 1969). Groundwater recharge is derived from run-off from mountainsides, direct infiltration of precipitation, irrigation losses and river infiltration. The water table is relatively close to the surface. Groundwater level maxima occur in May/June and minima in August/September (Timmins 1996). The annual fluctuation in the water table is 3 to 5 m in the Upper Kabul basin and 2 to 2.5 m in the Lower Kabul basin, according to Homilius (1966), but only 1 m according to Ehsanullah (1996).

According to Ehsanullah (1996) Kabul municipality ideally requires 6.2 m^3/s for its water supply, but in 1996, the Alaudin, Afshar and Logar wellfields were only producing some 5-7% of this figure. One year's recharge is estimated to provide the equivalent of 5 years' resource.

<u>Strategies for Future Development</u>

HABITAT's 2.5 year strategy for Kabul comprises the following priorities:

(i) Rehabilitation of existing systems (>500 km of network comprising a variety of materials)
(ii) Improving existing open wells by installing handpumps
(iii) Development of networks to "unofficial" suburbs currently unserved by networks
(iv) Development of new sources – Logar phase II and Afshar phase II

There exist, however, no detailed strategic plans or costings, although it is known that new networks cost around 5 to 8 USD per person to develop.

Logar Phase II comprises the expansion of the Logar wellfield. 10 new wells have already been drilled but pumps, housings, electrical installations etc. have not been completed (27/1/02).

Afshar Phase II will comprise 5 new deep boreholes, equipment and electrification. None of this work has commenced (Orya 27/1/02).

ICRC's perception of priorities for Kabul are as follows (Eng. Salem, ICRC, 27/1/02):

- Rehabilitation of Logar network
- Capacity building of CAWSS
- Leakage prevention (maybe 50% leakage losses from a total network of 810 km pipeline)

2. Jalalabad

Much of the following information was collected by Mr MH Hamid during a visit to CAWSS office in Jalalabad on 26/1/02.

Jalalabad is the centre of Nangarhar Province. It is located about 74 km from Afghan-Pakistan border (Torkhum) and more than 130 km from Kabul city. The population of Jalalabad city is estimated at about one million.

The water supply system of Jalalabad was designed and constructed by Japanese water supply specialists in 1973, and is operated by the Jalalabad Water Supply Department. Since 1975, this Department has been a part of CAWSS, under the Ministry of Public Works in Kabul. Currently, this department has four water supply engineers, seven technicians and one chief mechanic. During the 23 years of civil war, most parts of the network sustained damage and the system functions unsatisfactorily. In 1993-1996, WHO and DACAAR partly rehabilitated the water supply network (MH Hamid 26/1/02).At present, the Jalalabad water supply system is partially functioning, but the network needs repair and rehabilitation. Only about 60% of inhabitants (from four main districts of the city) have access to drinking water from the network.

Sources: There are two types of water sources to the system: karezes and deep wells.
- Firstly, the two karezes, about 20-30 m above the city (Eng. Arifullah, AREA, 22/1/02), each have a capacity of some 45 l/s (although now the average discharge has decreased to 25 l/s).
- Secondly, there are two wells, each with a discharge of about 30 l/s. The water table is at around 5–8 m depth. Water is lifted from these by submersible pumps with capacities of c. 30 lit/sec. At the present time, one of these submersible pumps is not functioning.

Currently, the karezes form the main source of supply. If water is insufficient, one of the wells is used as a supplementary source.
Treatment: Water should be treated by a treatment plant, comprising:
- sedimentation of particles, achieved by two basins, each with a capacity of 1000 m^3
- chlorination by powder.

Unfortunately, at the present time, the treatment plant is not functioning.
Transmission: The lengths of the transmission lines from the water source to the water distribution network are as follows:
- from Karez No.1 about 2.5 km;
- from Karez No.2 about 0.5 km; and
- from the two wells, nearly 2.0 km.

The water from the sources flows through transmission pipes of diameter 300mm by gravity.
Storage: Water is stored in two concrete reservoirs, each of capacity 1000 m3.
Distribution: The total area covered by the distribution network is about 24 km^2, containing a total length of about 100-120 km distribution pipe, made from asbestos cement and plastics.

Water supply to inhabitants is, and always has been, free of charge. The main problem suffered by the system has been (Eng. Arifullah, 22/1/02):
- the limited capacity of the source (typically water was provided for only 1 hour in the morning and 1 hour in the evening, two years ago)
- the unreliability of the electricity (hydroelectric) supply to the pumps. This is now improving.

The main conclusions and recommendations offered by Mr Hamid (26/1/02) are as follows:

- The water sources are only partly functioning due to continued drought and lack of regular maintenance. Currently, the network distributes only 4000 m^3/day, enough for only 60% of the inhabitants of Jalalabad city.
- The treatment plant is not functioning: it needs completely rehabilitation.
- The transmission pipe is in some parts damaged, and should be repaired or changed.
- The reservoirs are only partially functioning .
- The distribution network is partially functioning. In some parts of the city, distribution pipes are damaged and the water is leaking from the network. Repair or replacement is needed.
- Due to shortage of water in the network, the water is used only for drinking purposes and distributed for only two hours per day.

The irrigation system of Jalalabad area is fed a Soviet-constructed dam on the Kabul River some 22 m (?) high. Water is carried by canal some 64 km to point of use (MH Hamid 21/1/02).

3. Mazar-e-Sharif

Mazar-e-Sharif currently has a population of around 1 million.

Shallow groundwater in and around Mazar is of varying salinity. Generally, it becomes salty to the north. Deeper aquifers, at depths of 80-110 m are, however, generally fresh (Eng. Sawiz, Habitat, 30/1/02).

Several networks provide water to Mazar, as described in the following sections. Currently, the various systems cover some 50% of Mazar's water supply needs (Eng. Jamil, Balkh Water Supply Dept., 30/1/02). Districts 5, 7 and 9 have especially large water problems and people walk long distances to collect water as local shallow groundwater is often saline, especially beneath District 9 (Mr Sawiz, Habitat, Mazar, 30/1/02).

NAHR'ETOP SYSTEM

The existing main network is based on a wellfield at Nahr'etop, a few km to the south of the city. The network is not well-designed and utilises pipes of varying diameter (Eng. Orya, HABITAT, 27/1/02). It was constructed with Japanese support in the 1970s and only supplies 30% of the city (southern and central sectors). It is believed to supply some 30,000 residents (families?) (Fardi 2002a). It is sourced by six boreholes, of 12" top diameter and c. 100 m depth, with low yields of only 3-6 l/s each. Of these, only three can be used and only one has a functioning submersible pump. The borehole pumps via a chlorination / filtration tank (out of order) to a 1750 m^3 reservoir, thence via electrical booster pumps (only 3 out of 6 are functioning) to a 150m^3 water tower. The main problem is the electricity supply, which is only available 2-3 hrs per day and 8 hours each night. Huge fluctuations in voltage have burned out pumps and other electrical installations. The Japanese-made generator is broken and there is a lack of people qualified to use it. Leakage on the distribution net is large. Currently the wellfield supplies only 150 m^3 water per day, whereas "before" it supplied some 300 m^3. Habitat have a plan for rehabilitation of this wellfield, worth 70,000 USD, involving largely pump repair and replacement, leakage and valve repairs and drilling of one new borehole. They are seeking donors and wish to implement it themselves in collaboration with the Balkh Water Supply Department (Eng. Fardi / Mr Sawiz, Habitat and Eng. Jamil, Balkh Water Supply Dept, Mazar, 30/1/02).

TAKH TAPUL

An early hydrogeological survey (now essentially lost) was carried out of the Takh Tapul area, some 7 km west of Mazar city, on the Mazar-Shebeghan road, and it was recommended that a line of wells, with capacities of 30-40 l/s, could be constructed at separations of around 900 m along the main road (Eng. Ehsanullah, NPO, 13/2/02), supplying water to 70% of Mazar city (especially districts 2, 3, 4, 7 and 8). In 1994, a wellfield was indeed implemented by Uzbekistani engineers, comprising 6 wells (an observation well from the hydrogeological survey, and additional new wells) on c. 8 Ha of land. The wells were drilled, electrical installations (8kVA transformer), a surface concrete reservoir (1500 m^3), booster pumps, water tower (120-150 m^3) and c. 5km of transmission main (nominally 300 mm diameter) were constructed in 1995/96. The Taliban period followed and by 1997 the installation had been comprehensively looted (especially electrical gear) and damaged. The system thus never functioned and all that remain are the wells, the reservoir and the water tower. The wells require cleaning. Additionally, the wells were not constructed in accordance with the original hydrogeological survey, but were constructed at spacings of only 30-50 m. Thus, they are likely to be hydrogeologically very inefficient due to well interference (Eng. Ehsanullah, NPO, 13/2/02). Original reports may still be available in Tashkent.

The transmission main was constructed at 300-400 mm diameter but narrows to a small diameter bottleneck towards Mazar city. The main is thus of very poor quality, with very different diameters and much leakage. The main is currently used for transmission of gas. Habitat have a plan for rehabilitation and implementation of this system, worth 423,000 USD (*not* including re-drilling of the wellfield at 900 m spacings). They are seeking donors and wish to implement it themselves in collaboration with the Balkh Water Supply Department (Eng. Fardi / Mr Sawiz, Habitat and Eng. Jamil, Balkh Water Supply Dept., Mazar, 30/1/02; Fardi 2002b).

The wellfield lies east of the Balkh River, but is believed to induce fresh groundwater flow from the Balkh valley, rather than saline groundwater flow from the east. It is regarded as one of the long-term solutions to water supply in Mazar (Eng. Ehsanullah, NPO, 3/2/02), while treatment of water from the Balkh River may provide another future source (Samantha Reynolds, Habitat, 15/2/02).

MINOR / INDEPENDENT NETWORKS

Within the city, there are some 60 small distribution schemes, based on boreholes, typically > 80 m deep and tapping the 3rd aquifer horizon. These typically supply up to 200-300 families, often via small reservoirs of 25 m^3 capacity. Of 60 such systems, 20 are believed to be inactive and in need of rehabilitation (Eng. Fardi / Mr Sawiz, Habitat and Eng. Jamil, Balkh Water Supply Dept., Mazar, 30/1/02). One of the larger of these systems was viewed at Sultan Razia girls' high school which was badly shelled during recent fighting. The 9" diameter, 110 m deep borehole is believed to have had a capacity of some 7-8 l/s and supplied the school (1000 students) and some 350 families, by pumping directly into the network. The pumphouse and electrical installation are completely destroyed, but the borehole itself and distribution network are believed to be largely intact.

SANITATION

Mazar has no underground sewerage system and more affluent buildings use septic tank systems. There is also an open canalised gutter system in the city, which is the responsibility of the municipality, rather than CAWSS.

IDP CAMPS

As regards the IDP camps around Mazar, there were some 14,000 families in these, but now some IDPs are leaving camps for their original villages. Of these remaining, maybe some 30% are citizens of Mazar town and surrounding villages who come to camps during the day and return to their homes at night. Those from the city come to the camps for food, those from the surrounding villages come to the camps to collect water (Najibullah, NPO, 27/1/02; Ammanullah, NPO, 28/1/02).

4. Kandahar

In Kandahar, there is only one major network, based on 3-4 deep wells. This fed a system comprising a booster pumping station and a single reservoir of 1000 m^3 capacity, providing water to part of the city. The reservoir has been damaged by recent bombing. The capacity of the system has never been sufficient and last year water was supplied to other parts of the city by tankering.

There is also another very small network named Karte Malaemin in the east of the city, based on 2 wells (Eng. Hassan, ADA, 27/1/02).

As of mid January 2002, there was no public water supply to Kandahar and people were using shallow wells (Eng. Hassan, ADA, 27/1/02; Eng. Orya, HABITAT, 27/1/02). As of 18/2/02, some 2,500 m^3 was being delivered to the city of 500,000 people, only 25% of the minimum of 10,000 m^3 required (CAWSS Engineer for Kandahar, 18/2/02).

5. Herat

In Herat conditions are better than in Kandahar. There is a single main network based on wells to the west of the city and near the city centre. This has a very limited supply of water and a supplies only a very limited percentage of the population.

There is, additionally, one small network. The city no longer receives a reliable supply of hydroelectric power and generators are used (Eng. Ehsanullah, NPO, 27/1/02; Eng. Orya, HABITAT, 27/1/02; Eng. Salem, ICRC 27/1/02).

6. Ghazni

In Ghazni there are no very good aquifers and the water supply network is based upon one protected shallow well. Water is pumped from the well to a reservoir 50m above the well and thence to a limited network, supplying a small yield to parts of the city. There also used to be a good karez, which was to be used by the population as potable water following purification, but this scheme was not implemented due to the war (Eng. Orya, HABITAT, 27/1/02).

7. Qalat

In Qalat is a network based on deep wells, which is currently functioning (Eng. Hassan, ADA, 27/1/02).

8. Bamyan

Some 23 years ago, Bamyan city had a population of some 60,000 and an active water supply network serving 500 families, administration buildings and the bazaar. It comprised a shallow well (5.5 m deep) on the river bank. Two 24 Hp diesel suction (?) pumps pumped water, 8 hrs/day (each pump 4 hrs/day) to a c. 10 m^3 water tower near the mosque in the city area (total pumping head of some 78 m) from where is was distributed. Mains pipework is typically 3" diameter. The system did not fall under the CAWSS umbrella. Those connected to the network paid for the employment of an operator, his house, and fuel to run the generator. The large proportion of the population not connected to the network tended to use shallow wells, a spring or the river.

Bamyan was repeatedly destroyed (1998, 1999 and 2001). Several NGOs have tried to rehabilitate the system in recent years and CAWC currently have a proposal for a new attempt. The pumps were destroyed by the Taliban and the network is c. 20% destroyed (Eng. Mayar, Solidarités, 4/2/02; Eng. Haji Ahmad Nawid, CAWC, 4/2/02, 17/2/02). Rehabilitation would need to comprise:

- replacement pumps (diesel, or electric + generator)
- new pumphouse
- repairs to distribution system
- new public tapstands
- possible extension of system to Sarasiyab suburb, near Bamyan airport.

CAWC also believe that a gravity network could be implemented at Foludi village, c. 30 min from Bamyan by car. The village comprises 500 families. The proposed network would use a spring some 850 m from the village, with a capacity of 10 l/min = 14400 l/d. This equates to only some 5 l/pers/day.

9. Charikar (Parwan Province)

The city of Charikar lies towards the northern end of the Shamali Valley, 1 hrs drive north of Kabul. It is located just north of the Taliban / Northern Alliance front line area, and has largely escaped much of the recent destruction visited on the Shamali valley. The city is believed to have a population of some 10,000 families (i.e. c. 60,000 people), of whom 5500 families are connected to the water supply networks. These 5500 are believed to be the inhabitants present when the networks were originally constructed, the other 4500 are largely newer settlers in areas outside the Master Plan. Those connected to the network are served typically by single household taps. No public standpipes were observed, although people were observed collecting water from (i) pipeline leakages and (ii) entry pipes to the lower reservoir, during a field visit (D Banks, U Gürgens, O Svendsen (NCA) and Eng. Ehsanullah (NPO)) on 13/2/02. The water network is theoretically owned and managed by CAWSS. Charikar is served by two independent systems (see Figure F3).

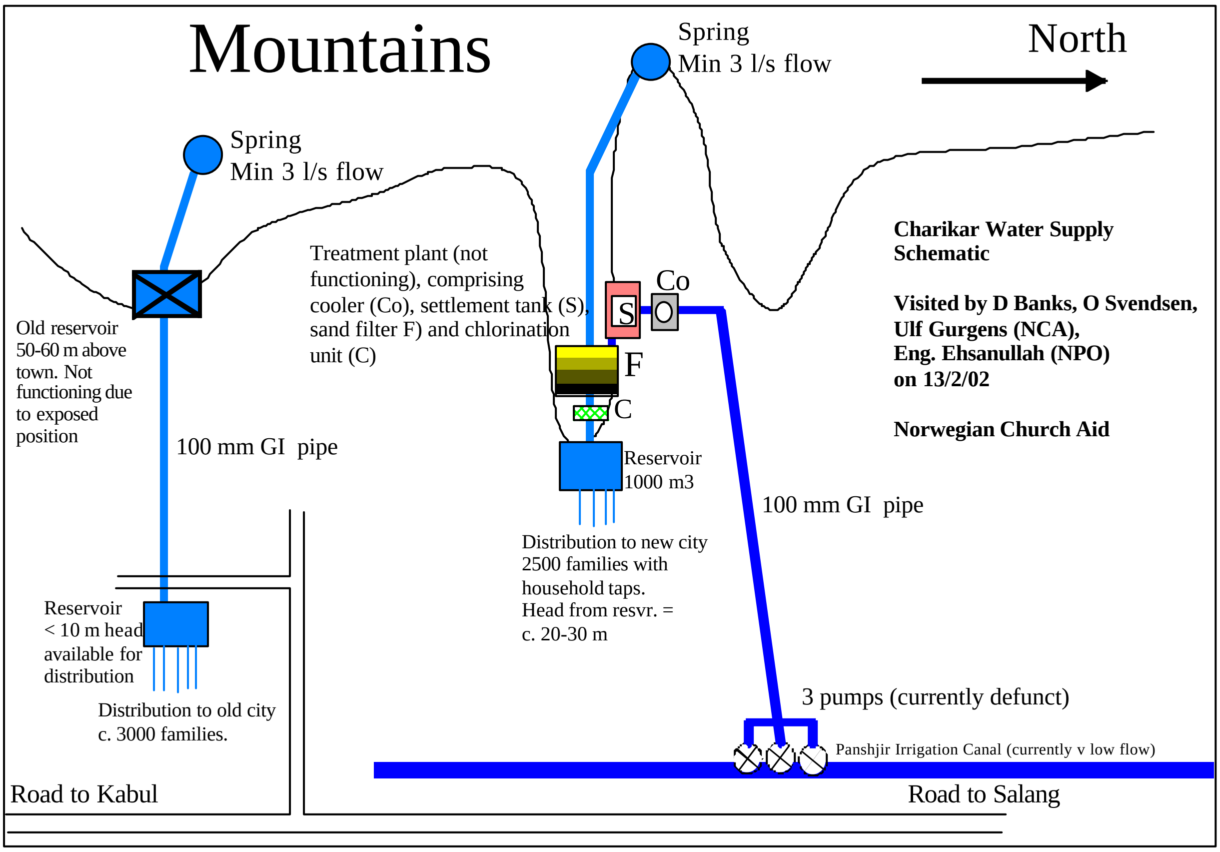

Figure F3. Schematic of Charikar water supply scheme.

SOUTHERN NETWORK (OLD CITY)

The southern part of the city (the "Old City") is fed by a spring in the foothills of the mountains west of the town. During our visit the flow was cited as 3 l/s but doubt must be attached to this figure. The spring intake is stated to simply be an open pipe in a channel leading off from the spring.

The spring was originally piped to a reservoir on a spur some 50-60 m elevation above the village. This reservoir is now by-passed due to its exposed position regarding shelling etc. The spring is currently led down a 4" (100 mm) galvanised steel pipe to a sunken reservoir in the outskirts of the town. The reservoir is very dirty and people were collecting water directly from the unprotected end of the inflow pipe leading to the reservoir. The reservoir was essentially empty during our visit. When full it provides only between 2 and 10 m head to the distribution network. There are 5 pipes (3 x 75 mm, 1 x 50 mm, 1 x 30 mm) leading from the reservoir to households, to the hospital and to the prison. There are stated to be no public tapstands.

If a flow of 3 l/s = 259 m^3/d is to be believed, it corresponds to only 8 l/pers/day. A standard Afghan design figure for rural towns is 15 l/pers/day, while for Kabul a figure of 100 l/pers/day is often used (Ehsanullah, NPO).

NORTHERN NETWORK (NEW CITY)

The northern part of the city (the "New City") is fed by a network comprising two components:

(i) a spring in the so-called "Big Valley", in the mountains west of the town, draining by gravity in a 100 mm galvanised steel pipe to the reservoir at the CAWSS treatment plant area. The spring intake is stated to be similar to that in the southern system. The flow is also stated to be some 3 l/s and this part of the system is currently functioning.

(ii) a pumping station, comprising 3 (non-functional) pumps at a pumping station on the Panshjir irrigation canal (part of the Parwan irrigation scheme). Water from here is pumped via a 100 mm main to a treatment plant on a hillside some 20-30 m above the valley floor. The treatment plant is non-functional and has no guard. The transmission pipes to the plant are only just below ground surface. The treatment plant comprises:
   - a cooler
   - a settlement tank
   - a sand filter
   - a chlorination plant
   - a 1000 m^3 reservoir

A distribution system serves 2500 families in the New City.

POSSIBLE REHABILITATION

A proposed rehabilitation by NPO comprises the following elements:

(i) Old City.
   - Protection of spring intake
   - Leakage and valve repair
   - Reservoir cleaning

(ii) New City
   - Protection of spring intake
   - Leakage and valve repair (especially on line from pump station)
   - Reservoir cleaning
   - Pump replacement
   - Rehabilitation of treatment plant

However, before any rehabilitation is considered, the following need to be considered:

- In the Old City, the current source is inadequate to supply the population currently attached to the network
- Some provision should be made for population without access to household taps (e.g. public tap-stands)
- Resources available in the Panshjir Canal should be mapped and any conflict between abstraction for drinking water and availability of irrigation water considered.
- Future possible rehabilitation of the Parwan Irrigation System should be ascertained.
- Other available resources should be considered and mapped (e.g. availability of deep groundwater from valley floor or from alluvial fans)
- A model for income generation needs to be established. Currently no payment is made for water received.
- The spring areas and upper parts of the network should be assessed by a de-mining team

10. Puliala / Baraki (Logar Province)

On the basis of information provided by CoAR (20/1/02), this community of 2000 inhabitants, has a water supply system designed for 1500 people and constructed in 1978. It is based on deep wells with a total capacity of 10,000 l/hr, abstracted by two submersible pumps of 5000 l/hr capacity. The water table is at 8 m depth.

The sedimentation /filtration treatment plant has a capacity of 2000 l/hr. The 1.5 km transmission main is 120 mm steel pipe, and the system incorporates a number of elevated water towers and concrete reservoirs of typical capacity 2 m^3. A number (four?) of booster pumps are employed of capacity 2000-3000 l/hr. The total length of the distribution network is 1.2 km, comprising steel pipe.

The system is largely derelict, and neither the source pumps, the treatment plant, the transmission main nor the booster pumps are functioning. The system requires full survey and possible redesign.

11. Moqur (Ghazni Province)

On the basis of information provided by CoAR (20/1/02), this community of 1800 inhabitants, has a water supply system designed for 1800 people and constructed in 1977. It is based on deep wells with a total capacity of 10,000 l/hr, abstracted by eight (?) submersible pumps, each of 2000 l/hr capacity. The water table is at 15 m depth.

The sedimentation /filtration treatment plant has a capacity of 3000 l/hr. The 1 km transmission main is of 50-120 mm PVC pipe, and the system incorporates a number of elevated water towers and concrete reservoirs of capacity 1.5 - 5 m^3. A number (four?) of booster pumps are employed of capacity 1500-2000 l/hr. The total length of the distribution network is 1.0 km, comprising steel pipe.

The system is largely derelict, and no part of the system is functional. The system requires full survey and possible redesign.

12. Sayedabad (Wardak Province)

On the basis of information provided by CoAR (20/1/02), this community of 1500 inhabitants, has a water supply system designed for 1500 people and constructed in 1976. It is based on deep wells with a total capacity of 8,000 l/hr, abstracted by two submersible pumps, each of 5000 l/hr capacity. The water table is at 10 m depth.

The sedimentation /filtration treatment plant has a capacity of 2500 l/hr. The 1.5 km transmission main is 100 mm steel and PVC pipe, and the system incorporates a number of elevated water towers and concrete reservoirs of capacity 1-3 m^3. A number (four?) of booster pumps are employed of capacity 1000-1200 l/hr. The total length of the distribution network is 1 km, comprising steel pipe.

Although the source is partially operative, neither the treatment plant, the transmission main nor the booster pumps are functioning. There is reported to be enthusiasm amongst the local population to rehabilitate this system.

13. Khoshi (Logar Province)

On the basis of information provided by NPO/RRAA (18/1/02), this community of 25000 inhabitants has a water supply system designed for 4000 people and constructed in the year 2000. It is based on a 101 m deep well with a total capacity of 2.5 l/s, abstracted by a submersible pump of 2.5 l/s capacity. The water level (dynamic?) is 70 m bgl.

Treatment is by chlorination. The 1550 m transmission main is comprised of steel pipe of diameter 1" to 3", and plastic pipe of diameter 3" to 10" (confusion over transmission and distribution systems ??) to a stone/cement reservoir of capacity 72 m^3. The total length of the distribution network is 1.66 km, covering 9 km^2, and comprising both plastic and iron pipe. 30 taps are installed in the bazaar, the school, hospitals and mosques.

The system is largely functioning as planned, although some problems are noted with the treatment plant.