UNITED NATIONS OFFICE OF THE IRAQ PROGRAMME

CONSULTANCY REPORT

WATER AND SANITATION

JUNE 2000

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OIP Consultancy Report on the Water and Sanitation Sector in Iraq

Background

1. In his presentation on 25 April 2000 to the Security Council Committee established pursuant to resolution 661 (1990), the Executive Director of the Office of the Iraq Programme explained that specialist consultants were being hired to supplement the expertise available to the United Nations Observation mechanism and to make recommendations on the issue of holds, programme implementation and on improved observation and reporting.

2. Mr Werner Labi, an Austrian water and sanitation engineering manager, was requested to undertake a consultancy 1-30 June 2000 on the water and sanitation sector. Mr Labi has 25 years experience in international project management and implementation of water and sanitation projects in many countries, including the Middle East. Terms of Reference are attached at Annex I.

Iraq: the water and sanitation sector

3. Iraq, a desert land, is flat in the centre and south, mountainous in the north. It is fed by two rivers, Euphrates and Tigris, which are the main water sources in the centre and south. The Euphrates enters Iraq from Syria through a desert area with low population density. Ramadi is the first large city on the river and contributes the first major pollution. After Ramadi, the river current slows across the flat land and the current's self-cleaning effect is reduced. The Tigris, coming from Turkey, enters Iraq in a lower elevation and flows with low current through a desert landscape consisting mainly of clay and sand, and picks up a high content of solid matter. The Tigris is the main source for irrigation and drinking water.

4. In the 1970's and 1980's, Iraq started a large programme to supply drinking water from both rivers (mainly the Tigris) to the population and for irrigation, contracted international consultants (Binnie & Partners, UK) to work on the planning of the Baghdad network and build engineering teams for this sector. In order to compensate for the Tigris's low current and having built dams into the river for irrigation, priority was also given to sewage treatment and Iraq undertook substantial investment. At that time, water/sewage treatment units were completely equipped with all facilities necessary for their operation and maintenance. International consultants advised Iraq to use a process of water treatment which could be easily operated and maintained by local personnel, consisting of intake, chlorination, clarification, filter and onward supply to consumer. Complicated operating systems were not implemented (e.g. ozonisation instead of chlorination which would require special filter systems). Most of the treatment units needed pumping of the media because the low or none-existent gradients did not allow feeding and distribution by gravity. Networks were started for water and sewage. This activity went on up to 1981 but the programme slowed thereafter due to financial constraints during the Iran-Iraq war and came to a complete standstill after 1990. Water supply and sewage projects, started before the Gulf crisis, stopped and, to date, remain in

the condition they were at that time and await completion, even though their design standards date from the 1980's.

Implementation of resolution 986 (1995) by the Government of Iraq's water and sanitation authorities

The sectoral situation

5. No accurate picture of what is happening in the sector is available because the responsible Iraqi authorities do not have functioning data systems to provide the required technical inputs. From United Nations observation it is clear that the sector is in crisis with the main effort placed on emergency repair in order to ensure that water supply is maintained to consumers. However both the Baghdad Water and Sanitation Authority (BWSA) and the General Establishment for Water and Sanitation (GEWS) realise that they are at present not able to ensure sustainable water supply either in terms of the quantity or quality of treated water.

6. The Iraqi authorities are implementing projects in the water and sanitation sector, as provided for under resolution 986 (1995), but face a very serious shortage of qualified personnel, inadequate planning capacity, and uncertainties in regard to the arrival of materials ~~in the distribution plan. They have not been able to~~ structure the distribution plan into ~~a useful programming~~ tool and are forced to implement according to essentially unplanned arrivals of materials. They have insufficient budgets and once these are used or overstressed, projects either have to be cut back or stopped. This is a serious impediment to improved implementation.

General strategy in response: what are the Iraqi authorities trying to do?

Relative allocation of resources to water treatment and sewage/sanitation

7. The Iraqi authorities have one clear priority: to maintain the volume of treated water available to domestic consumers. This determines the relative importance of procurement responses both in the distribution plan annexes and in contracts with suppliers.

Immediate and longer terms needs

8. Iraq is faced by three types of water treatment project requirements:

- Those treatment plants which are operational to an extent and need inputs to continue meeting a minimum level of demand.
- Those projects planned in the 1980s which have had their civil works completed in part or in full and, when brought on stream, would serve the current population.

- Larger projects planned between 1980 – 1985 to serve the estimated population in 2025.

9. Most water treatment plants (WTPs) were commissioned between 1950 and 1985 and were partially modified between 1976 and 1982, except Al-Wahda in 1999. In regard to the rehabilitation requirements of plants designed in this period, many suffer from very poor civil structures as well as poor plant and equipment. The anticipated lifetime of such plants was 15-25 years, assuming proper maintenance, and substantial proportion of the installation is simply worn out. Moreover, the normal lifetime of equipment and parts has been shortened by lack of preventive or any other maintenance, improper operation and consequent additional strain on the process. Most of these plants are not coping with increased demand at present and would not meet demand even if they were successfully rehabilitated. Only the addition of new treatment units to these plants would increase their capacity. The cost of such an approach has to be weighed against the benefit of constructing completely new plants with the required design capacity.

10. Those plants whose capacity can be increased have also suffered severely from the drought as well as from aging and malfunctioning plant. The raw water intake needs extension/lowering in 30 out of 220 plants. In response to the drought in 1999, BWSA/GEWS completed these such projects, with help from UNICEF and international NGOs.

11. The Iraqi authorities are currently working on completing projects left uncommissioned in 1990.

12. In regard to the larger projects, two are under consideration, one in Baghdad, the other in Nassiriyah City. Baghdad suffers from uneven water distribution throughout the city so that suburbs experience markedly different levels of supply. Although the average supply in Baghdad is some 135 litres/pers/day, this is misleading because it obscures the fact that in some areas supply is between 220-250 litres/pers/day whereas in others it is as little as 35 litres/pers/day and in areas which have suffered major breaks in the network, residents are dependent on standpipes. Those located in the north and centre of the city are serviced by the Kharkh treatment plant which assures relatively satisfactory quantities to consumers. Those dependent on downstream plants, including major concentrations of poor households in Saddam City, are not well served and BWSA is considering extending the treatment capacity of Daura WTP to increase supply. However, in the current situation, it may be considered that these projects are not without disadvantages: other areas of the country are poorly serviced with water supplies, averaging between 35 and 50 litres/pers/day and suffer contamination, including Salah al-Din, Missan and Basrah.

13. BWSA may be better advised to concentrate on distribution network repair and extension (40,000 km water pipes and 10,000 km sewage pipes) because it is suffering an increase in contamination and because stemming water loss would be an effective means of increasing the amount of water available to households. Given that Baghdad produces approximately 2 million m^3 per day and suffers 40 per cent loss in distribution, were this to be reduced to 30 per cent, Baghdad would have an additional 200,000 m^3 more.

14. In regard to the Nassiriyah extension, this would not appear to be justified in the current situation as it would increase water supply to more than 500 litres/per person/per day for those served, while rural areas of Nassiriyah governorate continue to depend on supply through water tankers, both private and the limited service provided by GEWS.

How much water do Iraqis need and how much are they producing?

15. According to the Iraqi water authorities, since 1987 the population of Iraq has increased at least 50 per cent from 15 million to over 22 million in 2000. According to one estimate by WHO, the Iraqi authorities are anticipating a population of more than 30 million by 2010 and this needs to be incorporated into planning at an early stage. Since 1987 there has been no significant increase in consumer coverage. In Baghdad the last project commissioned was Daura WTP in 1985 and no new systems have been constructed since 1991. Therefore, notwithstanding lost capacity through poorly functioning treatment/distribution and the drought, Iraq would be facing a shortfall of water connection to some seven million consumers.

16. Per capita consumption is a sensitive issue in many countries but it is clear that in Iraq per capita consumption is necessarily high because of the abnormally high ambient temperatures, including 3-4 weeks per year when the temperature is in excess of 50^0 C. Iraqis, therefore, consume twice the average European domestic water consumption. Where operational, domestic air cooling systems usually run on water; an average 125 m^2 or two rooms in a house would require 6 litres per hour of operation. Personal consumption for cooking, drinking and washing would consume a further 45 litres and laundry still more, because of the dusty environment for much of the year. Watering of gardens and washing of streets, which may be considered as over-consumption only by those not living in such conditions, may consume up to a further 25-50 litres. Thus 200 litres/pers/day may be considered a minimum requirement. The Government set the standard as 300 litres/pers/day. This does not include any form of industrial consumption which would increase the consumption per individual to 500 litres/day.

Clean water reference standards and Iraq's inability to meet these standards.

17. WHO international standards state that water, for humanitarian needs, has to be available in sufficient quantity, clear, clean and free from bacteria and virus. The recommended treatment for different water sources to produce water with negligible virus risk is as follows:

Type of source *)	Recommended treatment
Ground water[1]	
Protected, deep wells; essentially free of faecal contamination	Disinfection **)
Unprotected, shallow wells; faecally Contaminated	Filtration and disinfection
Surface water	
Protected, impounded upland water; essentially free of faecal contamination	Disinfection
Unprotected impounded water or upland river; faecal contamination	Filtration and disinfection
Unprotected lowland rivers; faecal contamination	Pre-disinfection or storage, filtration, disinfection
Unprotected watershed; heavy faecal contamination	Pre-disinfection or storage, filtration, additional treatment and disinfection
Unprotected watershed; gross faecal contamination	Not recommended for drinking water supply

18. At present, Iraq is producing water which is insufficiently clean. In more than 50 per cent of treated water, turbidity exceeds 10 NTU against the WHO reference standard of not more than 1 NTU.

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[1] *) For all sources, the median value of turbidity before terminal disinfection must not exceed 1 nephelometric turbidity unit (NTU) and must not exceed 5 NTU in samples taken from treated water entering the distribution network during repairs of the treatment plant. This is normally permitted for up to one week, after which the output would be reduced in order to bring the reading down to < 5 NTU.

Terminal disinfection must produce a residual concentration of free chlorine >0,5 mg/litre after at least 30 minutes of contact in water at pH<8.0, or must be shown to be an equivalent disinfection process in terms of the degree of enterovirus inactivation (>99.99%).

Filtration must be either slow sand filtration or rapid filtration (sand, dual, or mixed media)preceded by adequate coagulation-flocculation (with sedimentation or flotation). Diatomaceous earth filtration or a filtration process demonstrated to be equivalent for virus reduction can also be used. The degree of virus reduction must be >90%.

Additional treatment may consist of slow sand filtration, ozonation with granular activated carbon adsorption, or any other process demonstrated to achieve >99% enterovirus reduction.

**) Disinfection should be used if monitoring has shown a presence of E. coli or thermotolerant coliform bacteria.

19. Iraq's treated water also fails to meet basic bacteriological and parasitological standards.

Bacteriological quality:

20. Water intended for drinking and household purposes must not contain waterborne pathogens. In nearly all epidemics of water borne disease, it has been shown that the bacteriological quality of the water was unsatisfactory and that there was evidence of failure in terminal disinfection.

21. During distribution, the bacteriological quality of water may deteriorate. Coliform bacteria other than E. coli can occur in inadequately treated supplies, or those contaminated after leaving the treatment plant, as a result of growth in sediments and on unsuitable materials in contact with water. They may also gain entrance from soil or natural water through leaky valves and glands, repaired mains or back-siphoning. This type of contamination is most likely to be found when the water is untreated or not disinfected, or when there is limited or no residual disinfectant.

Virological quality

22. Drinking water must essentially be free of human enteroviruses to ensure negligible risk of transmitting viral infection. Any drinking water supply, subject to faecal contamination presents a risk of viral disease to consumers.

23. Two approaches can be used to ensure that the risk of viral infection is kept to a minimum:

- Providing drinking water from a source verified free of faecal contamination, or
- Adequately treating faecally contaminated water to reduce enteroviruses to a negligible level.

24. Neither conditions are met in Iraq for the following reasons. The quality of raw water (rivers, tributaries and branches) has deteriorated drastically since 1990 due to the disposal of untreated sewage and other effluents in these water sources. Of particular concern is the fact that raw water is heavily loaded with faecal contaminant due to non-working sewage treatment (load is up to more than 100 times that recommended by WHO). All cities upstream on the Euphrates (Al Hadithah, Hit, Ramadi) and on the Tigris (Mossul, Al Quayarah, Bayji, Samarra) discharge untreated sewage directly into the rivers. This complicates the water treatment process and, in some cases such as Al Rasheed WTP, threatens the quality of treated water. The drought has also reduced the amount of water in the rivers and the rate of flow, thereby reducing the diluting and self-cleansing action. See Annex II, Bacteriological analysis of the raw water in Baghdad.

25. Waterborne disease has increased dramatically since 1989. According to WHO's Overview of public health in Iraq, June 2000, the Ministry of Health and WHO had the following statistics on the increase of major water borne disease:

Amoebic Dysentery	1998 264.290 cases reported,	1999 609.920	1989 19.615
Cholera	2.560 " "	2.398	-
Giardiasis	509.050 " "	535.140	73.416
Typhoid	19.825 " "	23.392	1.812
Hepatitis	12.124 " "	13.150	1.816

Impact of insufficient or inappropriate inputs at treatment level

See Annex III for a Glossary of terms in regard to treatment plants and distribution networks. See Annex IV for illustrations of current conditions in the water and sanitation sector.

26. Water treatment in Iraq requires water purification chemicals: liquid chlorine gas, aluminium sulphate and calcium hypochlorite, and the equipment to introduce these chemicals at the appropriate stage in water treatment. If the chlorination unit is not functioning or if chlorine is unavailable, there is no disinfection. If aluminium sulphate is not added, flocculation does not occur, leaving solid matter in the water which carries bacteria, destroys pump, reduces filter capacity and can blocks pipes to the consumer. When turbidity is very high (>8,000 ppm) aluminium sulphate is ineffective and a polyelectrolyte is needed to deal with the heavy load. This normally occurs during the rainy season or after the irrigation dams are opened, flushing a higher level of sedimentation down the Tigris and increasing turbidity to between 20,000 and 30,000 ppm.

27. Of particular concern is the fact that a review of water and sanitation materials listed in the distribution plan (phases VI and VII) shows no filter media. Nor do the Iraqi authorities appear to have obtained filter media from local sources or through other imports. This suggests a major lack of understanding of the filtration process: water treatment requires more than pumps and disinfectants. While technical staff understand some major components, there appears to be insufficient understanding of the process as a whole or of other critical hygiene issues e.g. the impact of algae are growing in the settling tanks. The lack of procurement of compressors required for the backwash of filters and the lack of replacement of filter media in many WTPs over the last five years would suggest that the filters are a source of bacteriological contamination. A conservative estimate would suggest that some 8,000-10,000 tons of filter media are required. This is derived from Karkh WTP which requires 2,000 tons for two million m^3 for a population of roughly five million people. Therefore, water production for the current population in the 15 governorates would require over 8,000 tons.

Inability to reverse deterioration in the network

28. A substantial amount of water is lost during distribution to consumers. This is probably more than is lost through leaks in domestic systems. Water losses through the network have increased to about 40 per cent. The incidence of breaks in network have increased threefold since 1990. To repair such network failures, leak detection equipment, repair material, trucks, cranes and construction equipment is necessary. If

leaks are not repaired, the overall cost to the system increases through waste of chemicals and energy – more operating hours and higher maintenance costs for less production. Leaks in the network and over-flowing sewers are also causing damage to roads.

29. As has been reported many times previously, a network without permanent pressure allows polluted groundwater to penetrate into the network. Once pressure is restored and domestic taps open, the polluted water (mostly with colliform bacteria) flushes through the system. The present incidence of power cuts means that water is left standing in pipes at sub-optimal pressure on a routine basis, encouraging the growth of bacteria throughout the system.

30. Garbage has a significant impact on drinking and waste water. In the current situation in Baghdad the collection of garbage does not function sufficiently effectively. Garbage is thrown into the river, into open channels and into sewer manholes. These large objects need to be screened prior to pumping to prevent clogging. Some 30 per cent of pumping stations screens are missing, and of 21 pumping stations which have screens in place, 14 are not working.

Operational environment

Staffing

31. The Water and Sanitation sector in Iraq has been particularly adversely affected by the general stagnation of public employees wages, the loss of skilled foreign labour during the Gulf crisis, and difficulties of attracting qualified personnel since 1990. The average wage for plant technicians and operators is 6,000 – 10,000 ID per month (approximately US$3-US$5 per month). Sanitation workers are paid better because of the difficulty in attracting personnel to do these jobs. Many have left for better paid jobs in the private sector or abroad. Those who remain are often forced to take other jobs to supplement their wage, as staff are now prevented from leaving their posts. In Baghdad the situation is bad but GEWS has been particularly badly affected. It is now undertaking a recruitment campaign and seeking to train them "on the job" but this is partly dependent on having the equipment available. GEWS also realises that it needs foreign consultants to support the training process.

32. The level of understaffing at plant level in particular is very serious. In the industry it is commonly accepted that for each 1,500-2,000 m^3/day of production, one trained technical operator is required. Therefore, Daura WTP, with a designed capacity of 100,000 m^3/day, should have 50 technical personnel. At present it has two.

Planning and monitoring capacity

33. The Iraqi authorities receive equipment and material requirements from individual facilities, collate these and proceed to order accordingly. The identification of requirements is left to individual plant managers who may not have the engineering

knowledge to order replacement equipment with all necessary ancillary items. For example a specification is forwarded to Baghdad for a chlorinator for 500 g/hour or horizontal split case pump, head 50 m, Q 1000 m^3/h with motor. In both cases no additional connection material is specified either for the chlorinator (flexible hose to header, header, booster pump etc), or all connections from and to the pump, (coupling, mounted on frame or not, flow meter, non return valve, fittings, as well as all the electric installation). Most rehabilitation projects have implications for the functioning of the plant as a whole and at facility level this degree of engineering knowledge is rare. In many cases not only the requested item is needed, the complete equipment unit is to be replaced. Rehabilitation of a processing facility entails much more than the replacement of faulty equipment.

34. Equally important is the lack of essential engineering and processing data. At present so much of the recording and reading equipment is out of order that local operators and authorities can only estimate according to equipment (usually pump) capacity. Many "baseline data" cited in observation reports are in fact only assumptions. Iraq's water and sanitation facilities no longer continue previous practice whereby all supplied equipment required detailed specifications, showing all parts, as well as providing for a maintenance and operation manual. Contracts also used to include a training abroad and for larger unit a test run (with inspection by an international compliance company) in the presence of the client. This is rarely the case for equipment procured under resolution 986 (1995).

35. The 250 engineering design staff at BWSA are specialised in particular aspects of water treatment and distribution e.g. pumps or settling tanks but the total requirements of individual plants are, with few exceptions, rarely considered. Moreover, they are working to reference standards from 1980, having been denied access to modern international standards in the water and sanitation industry. As a result, the Iraqi authorities have been largely dependent on suppliers and manufacturers for detailed specifications, even though it is not appropriate to request suppliers to provide this basic information.

36. A particular weakness in the current planning system is the inability of individual treatment plant and departmental managers to track their own orders. With poor vertical communications and the lack of computerised systems, managers tend to repeat their orders if they have not received the equipment requested within a given timeframe (usually 6-12 months). Thus in regard to low and high lift pumps, needed to draw raw water from intake to treatment, Distribution Plans I-V contained 2,100 low and high lift pumps. Distribution Plan VII contained a further 2,500. Given that each treatment plant might expect to have seven low lift and seven high lift pumps, the maximum expected replacement might be 3,080 units. If Iraq proceeds with all of these orders, it will have a major storage requirement for pumps or will need to find alternative uses such as allocating them to new plants.

Procurement and supply capacity

37. Because BWSA has retained a proportionately greater number of qualified personnel, it has taken over responsibility for the procurement (i.e. contract tendering and negotiation) of supplies for GEWS as well as its own orders, even though the distribution plan lists the requirements of GEWS separately and GEWS is specified as the end-user on contract applications.

38. It is also important to note that because of exceptionally poor communications with external suppliers and the reluctance of reputable suppliers to do business with Iraq since 1990, Iraq has depended on middlemen and suppliers' agents who do not appear to be appropriately qualified and have not ensured that the equipment and materials delivered were exactly in accordance with the contract specifications. Several materials arrived with different measurements. This resulted in the need for additional work and material to connect them. Where incorrect or faulty equipment has been supplied this procurement route has exacerbated Iraq's problems in seeking redress. The absence of warranty period in some contracts is a shortcoming as there is no guarantee of the quality and measurement of the equipment supplied (substandard supplies).

39. In several cases, the lowest prices were the decisive parameters in awarding contracts. This resulted in importing inferior quality supplies that had negative consequences on programme implementation. This material was mostly bought through agents.

Material handling procedures

40. The Iraqi authorities state that their procedures require that materials and equipment are trucked from the point of entry to central warehouse, to governorate warehouse , to project site. At each stage the goods have to be unloaded and checked. Thus a 25 km pipeline has to be unloaded 3 times from 1,400 truckloads (1 truck transports 3 x 1200 mm ductile pipes i.e. 18 metres). It has been estimated that the material and equipment listed in Distribution Plan VII represents some 33,000 truck loads or 275 trailer loads/day. It also includes 140 cranes and 1,110 truck-trailers. Each truck is required to undertake a 4 day round trip to collect supplies from the border. The ratio of cranes to lifting capacity appears to have been calculated correctly in Distribution Plan VII.

41. This appears to represent an excessive transportation and auditing requirement which could be avoided if projects were allocated by truck load to specific projects from the border. At present this would be very difficult in the absence of an automated tracking system for deliveries. To date under the programme, Iraq has been authorised to import 90,000 km of pipes. In DP VII the following requirement is stated: ductile pipes (100-1200mm) 2,940 km; UPVC pipe (190-400 mm) 9,024 km and PE pipe (13-225 mm) 5,525 km. This commodity alone represents a very significant transport burden given existing procedures.

Safety standards

42. As in other aspects of Iraqi industry, safety standards have declined. In handling dangerous chemicals, international standards should be observed. Staff in each WTP should have the requisite safety clothing and respirators to handle chemicals appropriately, particularly when so much dosing has to be undertaken manually because automated control systems are malfunctioning. There have been several instances of dangerous accidents since the implementation of resolution 986 (1995). In the latest incident, BWSA stated that in Amara in April 2000, a local chlorine cylinder/drum burst and employees had to wait until it had emptied because they lacked the requisite safety equipment. Some 240 people had to be treated in hospital as a result. The international standard for safe handling of chlorine states that safety equipment must be available, at least three sets for each room where chlorine is stored and utilised, and that indicator spray must be kept to identify the origin of chlorine gas leaks. At present no water treatment plant in Iraq is equipped to meet this standard.

43. Respirators and safety clothing are also needed for any work in sewers. In spite of these requirements, insufficient safety clothing and equipment has been ordered and one of these applications (Comm 50845) has been placed on hold.

Implementation and rehabilitation capacity at the project level

44. Prior to 1990, Iraq used to insist that all projects were properly equipped with ancillary equipment i.e. cars, lorry, at least a shovel with backhoe, crane or tractor crane, water tanker, submersible pump and hoses, safety equipment, and workshops in accordance to international standard. In general the functional auxiliary machinery of the sector, such as garbage collectors, tractors, loaders, lorries, excavators, water and sewage tankers, jetting vehicles, personnel and transport vehicles etc. have dropped by more than 70 per cent since 1991. As construction and earth moving equipment has been degrading for ten years, and only has a 5 – 7 year average lifetime in any case, the sector does not have the logistics infrastructure to undertake the work required. Even though the Iraqi authorities have been adept at cannibalising machinery in order to maintain other equipment in operation as long as possible, the age of most of this equipment means that it is a better investment strategy to replace than rehabilitate it.

45. Another restriction on Iraq's implementation capacity is the lack of sufficient tunneling capacity, particularly when a main sewer pipe needs to cross under a highway. This requires the use of a tunneling machine. Currently sewage is pumped back to another sewer pipe, causing overloading. Clearly such tunneling capacity is necessary, and, according to BWSA, would also be used for other road crossing work.

46. At present, Iraq's rehabilitation capability is rather poor, due to the fact that personnel have become accustomed, with few exceptions, to improvisations. Even if material arrives, installation is not up to accepted international standards, with local contractors being used because the authorities had no alternatives. These contractors have been inadequately equipped and consequently the quality of work is, in general,

poor. Civil work was always implemented in accordance with British Standards, which requires about 15 per cent more steel than German standard (possibly in order to balance possible lower quality of concrete – vibration, not exact size and quality of aggregates). In regard to electrical installations at these facilities, these were previously strictly in accordance to BS, ICE or DIN standard and were sourced only from reputable suppliers. This is no longer the case. Most of the installations are open, unprofessionally connected, and, again with few exceptions, switchboards are out of order. Most equipment is switched on/off by hand.

Maintenance capacity at facility level

47. There is a very serious shortage of adequately trained maintenance staff and equipment. Machine tools, workshops and hand tools are necessary to maintain and repair valves and pumps. This also requires 4-wheel drive vehicles to transport spares and equipment around project sites. Most work at these sites is on unpaved roads, traditionally the last aspect of any project to be completed if funds were available at the end of the project.

Holds on water and sanitation applications

48. The Secretary-General has repeatedly made reference to his concern over the level and impact of holds in this sector. In accordance with the Terms of Reference, the issues relating to holds and individual applications were reviewed to provide a technical commentary. Individual applications on hold as at 26 June 2000 are reviewed in Annex V.

Reducing the level of holds: why should equipment and chemicals be approved?

49. The complexity of the water and sanitation sector stems from its dynamic nature; i.e. it functions in a multi-stage form with the output of each stage dependent on the output of all previous stages. The malfunction or the absence of any of the stages or their components will either render useless or reduce the efficiency with which other stages or components are functioning. The arrival of supplies in an un-programmed manner and the lack of complementary items has reduced the efficiency of repair projects. In water treatment for example, the absence of a functional sedimentation tank will reduce the quality and quantity of treated water even if pumps and other parts of the plant are functioning normally.

50. In fact, from an engineering point, some materials and equipment which are on the 1051 list are necessary for the treatment process. It should be noted that, in the current situation, either *no* alternative equipment choices are possible within the treatment processes used in Iraq, or alternatives may in fact prove *more* sensitive in regard to material composition, operation and handling.

Sensitive equipment

51. The following may be considered sensitive equipment:

Chlorine installation
Aluminium sulphate installation
Polyelectrolyte installation
Chemicals (for process)
Compressors (blowers)
Safety equipment for chlorine rooms
Water hammer
Fire fighting equipment
Gas detection equipment for methane, hydrogen sulphide and carbon monoxide
Leak detection equipment
Laboratory equipment and chemicals
Pressure testing equipment
Computers
Tunneling equipment

52. Notwithstanding the sensitivity of much of this equipment, it remains integral from a process and engineering perspective to both water and sewage treatment. Given the importance of improving the water and sanitation situation to the humanitarian programme as a whole, there are sound technical reasons why the Committee should approve the equipment and materials. At the same time, more rigorous end-use observation procedures need to be designed for some items.

53. End-use/user observation means that such material and equipment not only be subject to an "administrative" check (i.e. to see if tag plates etc. are correct, equipment in place and in use), but also to a quality check. This involves observing whether all special material parts are stamped, whether these pieces are still in place; checking readings of supply (quantity, temperature); checking the volume of chemicals flowing through the network; examining any corrosion; and manual records in regard to each stage of the process.

54. Such observation requires personnel with professional knowledge and qualifications. Other plant equipment can be subject to "standard" observation as presently undertaken by the United Nations observation mechanism.

Auxiliary equipment and machinery

55. Water/sewage treatment installations are in urgent need of auxiliary equipment and machinery. Installation and maintenance requires heavy civil construction equipment as lifting equipment, transport equipment, excavators, bulldozers, compactors, piling equipment, concrete pumps, dump trucks, graders, vehicles, de-watering pumps (well point system), water and fuel tankers, wheel loaders, compressors, dosers etc. as well as process vehicles (cesspit emptier tankers, jetting vehicles), civil construction

material (cement, reinforced steel, structural steel, manhole covers) and electric material (generators, cables, boards, overload, changer, contactors, circuit breaker, fuses, overloads, starters, bulbs etc.), machine tools and machinery (for maintenance and repair of valves and pumps).

56. Without this equipment the plant cannot be constructed, machinery cannot be installed and maintenance cannot be undertaken. Therefore, this equipment needs to be approved by the 661 Committee, but, since most of it is movable equipment, end-use observation conditions would appear to be appropriate. This might include an exact description of location or within which area the machinery/equipment is to be used. In very special cases, it might be made a condition of approval that equipment be parked, if not in use, in a United Nations store where it would be subject to continuous observation. This would apply to tunneling equipment which has an obvious dual-use capability and, therefore, such equipment needs specific end-use observation, actually, supervision on a daily basis.

Construction materials for water and sewage plants and other projects

57. The major construction material is cement, reinforced steel bars and structural steel. Most water treatment plant structures are constructed in reinforced concrete and placed on piles due to low soil bearing capacity. Partially, raw water intake structures also use concrete (on concrete piles) and steel (I- beams). The same basic construction materials are used in sewage treatment plants, although quantities required are much higher, because of the larger number of structures such as digesters, aeration tanks, primary and secondary settling, sand separator, sludge drying beds and screw pumps. Compact units need correspondingly small foundations, but most also require a steel intake structure.

58. The network for water, transporting a clean media under pressure, is smaller in diameter than sewage. Ductile pipes are common in Iraq, being resistant against high soil salinity and very durable. Chambers, made of reinforced concrete, are placed along the pipes at considerable distance from each other. For smaller diameters, plastic pipes are used (up to 200 mm).

59. Sewage pipes, larger in diameter than water pipes, need more excavation work, and have to be placed in a slope, to prevent sedimentation. Chambers and manholes, made of reinforced concrete, are located at shorter distances (for cleaning purposes). Due to the flat gradients, many sewage pumping stations are constructed (in reinforced concrete) to pump the sewage to a higher elevation, thereby allowing it to flow to the sewage treatment plant. However, many of these sewers are not yet connected to a sewage treatment plant. Large diameters, from 1200 mm up, are usually manufactured in concrete and the connections between the single pipes are joined together with concrete.

60. All pipes are embedded in sand. Where distribution networks are within the city, these repairs also entail road repairs after excavation, using gravel, sand and asphalt.

UN observation and reporting procedures and expertise

61. United Nations observation and reporting is dependent to a large degree on reliable information from official authorities. Such information is very limited, simply because they themselves do not have access to exact data, because most of the readings (pressure, quantity) are out of order. Depending on the qualification of the personnel, reports and data are given. However, as most of the plants receiving inputs under resolution 986 (1995) were designed prior to 1985, relevant data and reports tend to refer to design and operating capacities at that time. Despite work under taken by UNICEF and Care Australia at the outset of the programme, the inability of the Iraqi authorities themselves to track what has arrived and been distributed means that there is no complete report available stating what needs replacement (e.g. pump and drive with a certain capacity and check valve, pressure reducing valves).

Observation

62. United Nations observers in UNICEF, MDOU and GOU are understaffed and need strengthening in terms of numbers and qualifications. They are daily confronted with the operational difficulties experienced by the Iraqi authorities in trying to obtain accurate and relevant data. Apart from the environmental hazards involved in observing this sector, they work long and hard to ensure that all requests from the 661 Committee are processed as expeditiously as possible. Given the expansion of observation requirements in regard to waste water, solid waste management and disposal and related environmental issue, MDOU in particular needs to be supported by an additional qualified observer.

63. Current observation by United Nations observers, even if all data are correctly collected, provides a basic tracking capability and may be termed "administrative observation", involving checking numbers on documents and tag plates. However, in regard to sensitive material and equipment (included in the 1051 list), observation procedures should be tightened in order to provide a greater degree of technical assessment.

64. Qualified observation is needed to check, for example, the weight of chemical drums and compare with data, to see whether they are empty, take check flow readings, check whether safety equipment is in place, whether it is used, examine new installation, observe whether material is stamped (i.e. uses special materials), if pumps with stainless steel material are still in operation and whether corrosion can be seen within a short time period of their installation. These are only few detailed examples, to observe whether material has been replaced. These cannot be undertaken unless the relevant weigh scales, balances and gauges are in place.

65. Observers should also be able to look at a plant's physical and operating condition, special material out of order, possible demand, power situation (to know how much chemicals is used under these conditions).

Observations and Recommendations

Structural limitations of current strategy of emergency repairs

66. At present, Iraq is not making optimal use of the resources made available under resolution 986 (1995) because the strategy of emergency response and the severely limited resources to undertake any other response, is inherently potentially wasteful. The same level of resources, properly planned and implemented, could, in the opinion of this consultant, achieve as much as 50 per cent more value.

Need for balance between investment in water and sewage treatment

67. It is understandable that in the current emergency situation the Iraqi authorities have given priority to maintaining or increasing the quantity and quality of treated water. It is normal that priority is given to water because sewage treatment usually requires two or three times the level of resources in terms of personnel and equipment. However, because Iraq is polluting to an unacceptable extent its two main raw water sources, the Tigris and Euphrates, with raw sewage or insufficiently treated effluent, much greater attention needs to be given to sewage treatment under the humanitarian programme. Even with improved pumping capacity and disinfectant supply, the operational capacity of many (and probably most) treatment plants is simply inadequate to counter the level of bacterial contamination in the raw water intake. The treated water is further at risk from the incidence of cross contamination in the distribution network.

Improved submission to 661 Committee: project profiles, timely submission of technical specifications and a new coding system

68. The distribution plan annex for phase VII (see OIP web page: www.un.org/Depts/oip/dp7pdf) is poorly organised with little apparent sequence in the materials listed. As a result, projects are not clearly associated with required equipment and materials. This needs to be redressed. Where major domestic production projects are included (e.g. aluminium sulphate), these need to be supported by feasibility studies.

Improved implementation overall

Need for equipment, consultancies to ensure correct system design, tendering and capacity building

69. It is clear that some treatment plants simply need replacement equipment, auxiliary equipment and vehicles. Some require external assistance to identify and correct maintenance problems but are otherwise functioning satisfactorily. The condition of other plants is so poor that the replacement of specific equipment is insufficient to guarantee an effective production process or the actual civil works, e.g. Nassiriyah sewage treatment plant is so degraded that the cost-benefit of rehabilitation against the establishment of a completely new plant needs to be considered.

70. There is no means of prioritising Iraq's needs in such a situation because in order to ensure continued water supply, optimise investment and maintain what it has, Iraq needs the equipment, enhanced local implementation and maintenance capacity and access to international consultancy services. All three components are needed simultaneously.

How to tackle the issue of Rehabilitation

71. From the engineering point of view, the correct procedure would be:

- Assessment
- Proritisation
- Programming
  - Emergency Phase I (machinery unit supply)
  - Emergency Phase II (equipment supply, installation)
  - Rehabilitation
  - Leak detection, repair
  - Complete projects already initiated
  - Specific new projects are acceptable, if cost benefit is clear.
- Extensions to treatment plants

Assessment

72. No detailed assessment was done at the outset of the programme. Most data are not known, since measuring instruments do not work. Once meters are installed, exact data and demand can be calculated. A model of an assessment form (developed in Bosnia, used by USAID, World Bank and EC) is attached at Annex VI. These data allow a rough estimation and give an overview of what is needed (plant equipment, construction equipment).

Prioritisation

73. In the current situation, most of the activities have to be undertaken simultaneously. The advice is to focus on rehabilitation: once rehabilitated, the plant will operate a period with standard maintenance and all other resources can be concentrated on the other plants.

Programming

74. Programming rehabilitation work needs to take into account a very widespread range of preconditions, relating to the availability of supplies and labour. Beside water/sewage plants the focus should be on leak detection and repair, cleaning and replacement of water/sewer/storm water sewer pipes. In Baghdad, the present production should be about 2 million m^3/day, if we reduce the leakage from the estimated 40 per cent to 30 per cent, than we gain 200,000 m^3/day, a quantity produced in Karamah (old and new plant output combined).

Extensions to treatment plants

75. New projects are acceptable if the repair of old plants (quantity and quality) is not feasible. This should be assessed by the task force in conjunction with the relevant Iraq authorities.

Cash component

76. It is clear from the very serious staffing shortage that the Iraqi authorities have insufficient local funds to implement their water and sanitation projects in an effective manner. Although the use of a cash component would not in itself resolve all constraints on effective implementation, it is essential to improve the operational capabilities of the relevant authorities. For example, in regard to planning and tracking of materials, computers and software are readily available on the local market in Baghdad but neither BWSA nor GEWS can afford to purchase these in order to operate more effectively. The cash component issue is under consideration by the Office of the Iraq Programme and United Nations entities in the field. UNICEF in particular has encouraged the relevant Iraqi authorities to adopt this provision in order to increase the effectiveness of their operations.

Recommended Observation Approach

Component 1 - Water task force

77. It is recommended to establish a water/sanitation task force, working together with the local water and sanitation authorities in programming. This task force must be staffed with engineers with a high professional qualification in water/sewage management, good inter-personal skills, possibly specific country experience.

Component 2 – Assessment

78. Can be done through consultancy, but under UNOHCI/OIP guidelines, working together with the local authorities in collecting and calculating data according to prepared templates. Examples of such templates are attached at Annex VII. This group should consist of water/sanitation engineers (plant design engineers) with minimum 5-10 years experience, have sufficient ability to understand the complexity of production processes and the equipment/material involved.

Component 3 - Observers

79. Experienced in material examination, understand material codes and standards, can estimate consumables consumption, possible experience in water/sewage engineering, able to estimate plant condition, chemical engineering knowledge and a minimum of five years experience.

Duties involved in proposed observation approach

Task Force

80. This is a 50 per cent field activity. The scope of work includes the following:

- Works directly with the local authorities, forms a direct link between UNOHCI/OIP and BWSA and GEWS and governorate directorates general.

- Programmes and sets priorities of projects (rehabilitation, feasibility where rehabilitation is not recommended, where sewage has negative effects on safe drinking water production, network repair, sewage pumping stations, damage prevention etc) and describes measures.

- Examines proposals to ensure that they meet the criteria of equitable distribution.

- Assesses where international consultancy services are necessary, and the use of international contractors for the building and commissioning of plants/projects.

- Supports institutional strengthening, establishes programmes with the local authorities. According to programme, auxiliary equipment and construction equipment is identified.

Assessment

81. Detailed assessment is necessary (this will assist the relevant authorities in project management – cost and progress control). Information needs to be collected on:

Population/population served
Population not served, why?
Water source
Capacity of source
Use of source
Quality of source
Water supply network, length of pipes, diameter, material, loss
Pumping stations
Disinfection
Pollution
Purification
Reservoirs
Power availability
Water hammer measures
Investments planned before 1990 (where relevant)
Rehabilitation/reconstruction investments

82. Such an assessment formed the most important planning tool for the successful rehabilitation/reconstruction in the water/sanitation sector in Bosnia and Herzegovina and used for their programming and prioritising by USAID, World Bank, EC and others.

83. Out of the assessment, weight can be given to agreed criteria and the summary of points forms the priorities for subsequent work.

Potential benefits from advisory role of a task force and improved planning and allocation of resources

84. Close coordination and an overall planning strategy is necessary. World-wide there have been too many examples of large amounts of money being spent on supposedly "quick-fix" or "emergency" solutions, which do not produce the required improvements, because they did not identify or address all key problems in a structured manner, or used inappropriate measures to set unachievable targets. One example where a properly considered approach is necessary is how to achieve a reduction in water loss in Baghdad. As mentioned previously, Baghdad produces about 2 million m^3 per day but loses about 40 per cent of treated water through leaks in the network. If reduced to 30 per cent loss rate, the gain would be 200,000 m^3 per day. A new plant for 200,000 m^3/day will cost more than $40 million. Leak detection and repair would cost much less, maybe as much as 40 per cent less, with the exception of pipes that have to be replaced anyway. A new plant would increase the volume of water flowing through the existing pipe network. This would inevitably increase pressure in the system, creating additional stress in the pipes and increasing the potential for leaks.

85. If properly planned, a leak detection and repair programme could be set up, with a carefully structured approach, with activities being undertaken in the right order, to correct professional standards, with careful observation, to achieve the benefits which both the financier and the receiver are expecting.

Such a programme would:

- identify key issues arising from the pilot zone study and pressure management programme,
- assimilate all relevant available data in a structured manner,
- recommend key criteria for prioritising zones for rehabilitation,
- highlight key issues for the successful completion of the project.

There are many interrelated aspects involved, in particular:

- assess the current volume of loss in Baghdad, or any particular zone,
- identify the key parameters which most strongly influence the present level of loss,
- determine a method for performance comparison which is appropriate to local circumstances,
- identify local problems which, if not addressed, will adversely affect the project.

The implementation of such a programme consists of:
Zone valve control
Zone valve repair
Flow measurement
Pressure measurement
Water meter reading
Leak detection
Leak repair

86. To achieve success, it has to be granted, that all material and equipment is available, this includes also so called sensitive items and construction material/equipment as transport, excavators etc.

87. Initially, effective surge control measures and pressure control facilities at input points to zones must be installed before major rehabilitation commences in any zone for rehabilitation, otherwise many of the potential benefits of the proposed large rehabilitation programme will not be realised.

88. This is only one example, to show how interrelated activities are in regard to the work of a task force, planning, consultancy, material request, supply, repair and observation.

Observation

89. This is divided in two categories:

Administrative observation and end-use/user observation.

90. Administrative observation has been implemented to date, checking item by item in accordance to bill of lading and tags on the units.

91. End-use/user observation looks into so called sensitive items including materials and chemicals stated in the 1051 list. This observation needs special knowledge of material, the use and plant process and will check the following:

Quantities
Operation, function
Material codes and standards
Traces of changes and earlier aging
Consumption (according to readings and records in books)
Estimate plant condition
Raw material quality
Check equipment with problem after short operation
Check store

ANNEX I

RETENTION OF THE SERVICES OF AN EXPERT IN WATER AND SANITATION SYSTEMS TO PROVIDE ADVICE TO THE OFFICE OF THE IRAQ PROGRAMME IN NEW YORK, PURSUANT TO RESOLUTION 986 (1995)

Draft terms of reference

I. Framework

1. The Memorandum of Understanding (S/1999/356) provided for the United Nations observation activities in Iraq to be coordinated at the United Nations Headquarters in New York (para 42) by technical experts and other specialists appointed by the Secretary General of the United Nations or by heads of the specialist agencies.

2. In paragraph 5 of the Supplementary Report (S/1153/1999), the Secretary General has called attention to the increasing complexity and scope of the humanitarian supplies ordered under the programme as well as to their interrelationships within the context of projects and activities.

3. In a note dated 11 September 1999 addressed to the Deputy Secretary General, the Executive Director of the Office of the Iraq Programme has referred to the considerable increase in the size and complexity of the programme. As a consequence, additional demands have been placed on the observation mechanism. In the same note, the Executive Director noted the need to improve the process by which observation personnel are recruited, tasked and managed in order to ensure that the required range and caliber of expertise is made available for sectoral and multi-sectoral observation and analysis.

II. Objectives

1. To engage sector specialists with the mandate to advise the Office of the Iraq Programme on broadening and refining the observation activities in order to render full account of the increased scope and complexity of the programme in the centre/south, and to assist in planning the programme for the three northern governorates where UN agencies implement the humanitarian programme on behalf of the Government of Iraq.

2. Specifically, to engage a specialist in the application of water and sanitation engineering to urban planning to assess the capacity of the programme to improve the quantity and quality of water available to consumers with particular emphasis on reducing the incidence of water-borne diseases in the most efficient manner possible.

III. Tasks

Immediate

1. To review holds on commodities within the water and sanitation sector in order to assess the impact of these holds on the capacity of the programme to meet its objectives and, where required, to provide clarifications on questions raised by the 661 Committee.

2. To participate in discussions on the level and impact of holds with advisors to the Permanent Mission of the United States and the United Kingdom in Washington and London as well as with the relevant experts in UN Agencies and technical ministries in Baghdad.

General

3. To review and analyze the Government's Distribution Plans, the amendments and associated documentation to ensure that the Office of the Iraq Programme is provided with informed commentary.

4. In collaboration with the Office of the Iraq Programme and existing UN observers within UNOHCI and UN agencies, to assist the observation mechanism in designing activities which will:

- improve the quality of regular reports;
- refine the existing tracking mechanisms to enable observers to more efficiently provide assurances that sensitive commodities are used for the purposes for which they were intended;
- assess the capacity of the Baghdad Water and Sewage Authority and the General Establishment for Water and Sewage to receive, store, distribute and install inputs in end-user facilities;
- improve the capacity of the observation mechanism to assess the impact of programme inputs.

5. To review trends in the performance of water and sewage treatment facilities in both urban and rural areas and identify initiatives with the potential for improving their performance.

6. To identify training and public education strategies which will assist in making the best use of existing resources available under the programme.

7. To identify strategies and approaches within existing constraints with the potential to more effectively address public health issues and reduce the incidence of water-borne diseases.

IV. Qualifications

1. Experience must include at least 10 years of fieldwork in the Middle East/North Africa with a background in water and sanitation in the context of urban planning. The candidate must have proven management skills with a good ability to work with a range of technical expertise on policy support issues and the ability to make clear oral and written presentations of technical findings and recommendations. A combination of degrees in water engineering and urban planning is desirable.

ANNEX II: Bacteriological Analysis of Raw Water in Baghdad

- - ANALYSIS	RAW			FINAL		
	MIN.	MAX.	AVE.	MIN.	MAX.	AVE.
COLOR	0/5	0/5	0/5	0/5	0/5	0/5
TEMPERATURE C°	9	34	21	10	35	21
TURBIDITY N.T.U	9	1800	46	0.18	22	3.5
PH	7.5	8.3	8.0	7.2	8.0	7.7
ALKALINITY as $CaCO_3$ MG/L	109	173	138	102	168	133
TOTAL HARDNESS as $CaCO_3$ MG/L	223	560	399	222	536	394
CALCIUM as Ca MG/L	54	152	101	58	149	100
MAGNESIUM as Mg MG/L	18	58	38	17	56	37
CHLOIDE as Cl MG/L	48	178	107	51	178	105
CONDUCTIVITY μs/cm	570	1600	1069	580	1568	1050
ALUMINIUM as Al MG/L	Nil	0.05	0.01	Nil	0.25	0.09
TOTAL DISSOLVED SOLIDS MG/L	317	1100	765	319	1085	741
SUSPENDED SOLIDS MG/L	22	3010	119	-	-	-
IRON as Fe MG/L	0.12	9.0	1.0	Nil	0.46	0.1
SULFATE as SO_4 MG/L	110	465	299	148	490	287
FLUORIDE as F MG/L	0.07	0.35	0.16	0.05	0.25	0.14
AMMONIA as NH_3 MG/L	<0.01	0.28	0.1	Nil	0.2	0.018
NITRITE as NO_2 MG/L	0.0004	0.014	0.005	Nil	0.003	0.0007
SILICA as SiO_2 MG/L	3.0	8.0	5.7	2.0	7.0	5.1
SODIUM as Na MG/L	50	106	85	63	99	85
POTASSIUM as K MG/L	2.1	3.7	3.1	2.1	4.0	3.2
MANGANESE as Mn MG/L	0.002	0.16	0.05	Nil	0.12	0.02
CADIMIUM as Cd MG/L	0.0003	0.0039	0.0028	0.0003	0.0028	0.002
LEAD as Pb MG/L	0.0068	0.009	0.008	0.007	0.009	0.008
COPPER as Cu MG/L	0.003	0.099	0.02	0.002	0.035	0.008
ZINC as Zn MG/L	Nil	0.0039	0.001	Nil	0.003	0.0007
CHROMIUM as Cr MG/L	0.02	0.04	0.028	0.006	0.041	0.016
COBALT as Co MG/L	0.003	0.007	0.005	0.005	0.008	0.006
MERCURY as Hg MG/L	0.0001	0.0006	0.0003	0.0001	0.0004	0.0003
ARSENIC as As MG/L	0.0052	0.0135	0.009	0.0038	0.011	0.008

Lower and upper limits and Outcome Rate of Chemical and Physical tests for raw water supplied for the first half of the Year 1999.

الفحوصات البكتريولوجية

أ- الحدود للفحوصات البكتريولوجية لماء نهر دجلة عند ممصات المشاريع للفترة من شهر كانون الثاني ولغاية نهاية شهر حزيران / ١٩٩٩ ..

المشاريع	PLATE COUNT/1ML	FAECAL COLIFORM/100ML	COLIFORM /100ML
الكرخ	130-700	20-790	80-3300
٧ نيسان	130-1400	230-9200	230-24000
الوثبة	1200-2800	2300-46000	2300-240000
الكرامة	800-3000	700-92000	2300-240000
القادسية	1150-5200	7900-54000	17000-92000
الدورة	5200-40000	79000-540000	160000-1600000
الرشيد	13000-260000	130000-1600000	170000-2400000

ب- معدل الفحوصات البكتريولوجية لماء النهر عند ممصات المشاريع

المشاريع	PLATE COUNT/1ML	FAECAL COLIFORM/100ML	COLIFORM /100ML
الكرخ	329	218	1098
٧ نيسان	455	910	2780
الوثبة	1868	124[illegible]0	34076
الكرامة	1618	20090	110988
القادسية	2262	17256	33836
الدورة	11546	218208	440833
الرشيد	58167	558056	1202777

Bacteriological Tests:

a) Limits for bacteriological tests for Tigris water at the Projects suckers for the period from January through end June 1999.

Projects (in sequence)
Karkh
7 Nissan
Al-Wathba
Al-Karama
Al-Qadisiya
Al-Dora
Al-Rasheed

b) Rate of bacteriological tests for the river water at the Project's suckers:
Projects:
The same as in above

ANNEX III

Glossary of Terms

Pipes

Ductile: Cast iron pipes, inside coated with bitumen or cement, used pipelines and plant installation. Good corrosion resistance against salty water and chlorinated water and soil with high salinity as is common in Iraq. Very durable.

Steel: low resistance against corrosion. Must be protected (in and outside). Galvanised steel pipe is used for smaller diameter, mainly in house installation (up to 4").

PVC: used for aggressive media as aluminium sulphate and for water, smaller diameter.

Intake

In most cases in Iraq river water is used as drinking water resource. Intake consists of steel structure (also concrete) on piles in the river with installation as foot valve (preventing back flow) with stainless steel strainer, suction pipe and pumps (low lift pumps). After raw water intake the water is taken to chlorination. In cases where no river water is available, holes are drilled and ground water is extracted by bore hole pumps.

Disinfection

Double chlorination is necessary, firstly a "shock" chlorination, to disinfect and second chlorination after the filter, where chlorinated water flows through a reservoir. Most chlorine is in gas form, mixes with water and is injected through a booster pump (average 2 mg/l). The installation for chlorine, a very aggressive gas, is in a separate room and made of a stainless steel, preventing corrosion. Chlorine rooms must be equipped with safety equipment (safety clothing, gas mask) minimum 3 sets.

Flocculation

To ensure that solid matter builds flocks and settles as sludge, aluminium sulphate is added as a coagulant. Aluminium sulphate, an other aggressive medium, comes in solid form (crystals) and is mixed in a tiled basin with water (flush mixer) and this solution is injected by dosing pumps to the raw water in the clarifier. Installation is either in stainless steel or in plastic (small diameter).

When water is very turbid (beginning of the rainy season or when dams are opened and sludge washed out), popyelectrolyte is used instead of aluminium sulphate and is introduced through a separate installation.

Clarifier (settling tank)

These are mostly large diameter concrete structures, set on piles. In the inner chamber aluminium sulphate solution is injected, mixing it with raw water, which allows flocks to accumulate and settle at the bottom (sludge) and to be collected by a scraper fixed on a driven bridge. Up to 30 per cent of the sludge is recycled to the inner chamber to save aluminium sulphate. The accumulated larger flocks also catch a certain amount of bacteria and are drawn off by a scraper. Treated water flows over a weir to the filter.

Filter

Usually 2 types: open sand filter and pressure filter. In the open sand filter, water flows by gravity; in the pressure filter water is forced through the filter media (quartz sand) and nozzles where filtered clean water is collected and pumped (high lift either in a net, pipeline or a reservoir). Once filtering capacity is reduced, a backwash process starts. Compressed air with water is pressed in from the bottom side through the nozzles, which lifts the filter bed (sand) and loosens the flocks (sludge) which are washed away over a weir. Once water is clean, the process stops and reverses.

Water hammer

Is an installation to damp a backpressure in a pipeline or network, this prevents damage to the plant and network. A vessel is filled with compressed air up to a certain pressure. Once a backpressure occurs, the air in this vessel compresses and damps the shock (water hammer).

Compact units

For smaller quantities of water treatment, "compact units" are used. These are prefabricated units in container form which have all functional stages of larger treatment plants integrated. Their installation is simple, requiring a raw water connection (from intake or bore hole) and a connection to the network/reservoir. Similar units are applicable for waste water.

Reinforced steel, structural steel

Is needed in large quantities in water and sanitation construction projects. Reinforcement is necessary for the large amount of structures i.e. piling, settling tanks, filter and pump house buildings, chambers, valve chambers (also in pipeline construction), digesters, sludge drying beds, etc.

Structural steel is used for intake structures, pipe bridges (to cross small rivers), manholes, covers, gangways, towers for remote control systems, high elevated steel tanks.

Remote control system

Such systems are used when controlling tanks and reservoirs, also signalling in controlling valves.

ANNEX IV

Illustrations of current conditions in the Water and Sanitation Sector
(See attached photographs)

ANNEX V: Individual applications on hold as at 26 June 2000

A review of applications as of 26 June 2000 gives the following picture:

Chemicals, Chlorine and Aluminium sulphate handling equipment:

50845 Respirators. Any respirator can be for military use. Standard material but also 1051 standard.
600482 Pumps for aggressive fluids (Chlorine). Standard. Specification is not complete.
600701 Chlorinators – spare parts: Are standard spares. It is to consider, local produced chlorine is not of the purity it should be, more nozzles, strainers, pipes etc. are needed for maintenance.
601194 Laboratory equipment: is necessary to fulfil a minimum standard of the final product, which has to be at least in accordance with WHO standard. No lab, no guarantee of quality.
601284 Mobile chlorination system: was always a standard in Iraq, had even before difficulties in handling chlorine equipment, was for emergency. This standard has to remain, the problems in handling have rather increased than decreased.
601404 Chlorinators, sampling equipment: standard for water treatment plants.
601771 Chlorinators and spare parts: standard material for water treatment plants.
50877 Dosing pumps, stainless steel impellers/shafts: is standard material in water treatment plants.
601404 Alum dosing pumps: standard equipment for water treatment plants.
601540 Alum dosing pumps: standard equipment for water treatment plants. Does not state the project.
601602 Chemical injection pumps for Aluminium sulphate : standard equipment.
600947 Chemicals for fire fighting: specification not clear.
Note: Alum dosing pumps have short lifetime if inflowing liquid from the mixing Tank is not clean (sandy, solid material – mainly from low quality aluminium Sulphate from supplier).

Pumps, Valves, Electric Material:

501232 Borehole pumps: used for wells. Have stainless pumps, very common to have stainless steel parts in such pumps to prevent corrosion.
600550 Water/sanitation supplies: carbon dioxide producing and filling line. The potential use in the water treatment facility is not explained, the specification needs clarification.
600859 Water treatment equipment, spares and compact units: technical ok, but specification is very poor, partially unclear.
601024 Valves: Cast iron body and stainless steel disc. The inner diameter is mentioned in metric system. Is a standard material, stainless steel disc ensures butterfly close tight (carbon steel corrodes, does not close properly, leaks and builds pressure).

601358 Spare parts for vertical pumps, exact specified and enduser named (7 Nissan) standard material
601217 Flocculators: necessary for mixing aluminium sulphate with water. Standard.
601220 High lift pumps: standard pumps. Does not mention project.
601224 Generating set: all water treatment plants in Iraq were previous with an emergency generating set equipped (power cuts were always existing). It is a necessary unit.
601433 Water treatment supplies and equipment: standard material, partially with stainless steel shafts and impeller. All items usual in water treatment plants.
601564 Pump spares for Karamah: Standard material.
601632 Spares for treatment and pumps: standard material.
600861 Polyelectrolyte: needed for batteries – remote control system. Chemical specifications not clear (actually missing).
601280 Overload: built in switchboard. If no overload, especially at start up (too much sludge) on full capacity load, motor will burn. Essential.
601714 Supply of starters and switchboards: starters are consumables, is standard.

Sewage equipment:

501139 Street sweepers: is standard equipment.
501201 Sewage equipment: contents of many different materials as valves, pipes, sluices, cables, switches, control boars, hoists up to civil equipment. All specified material is also used in the water/sanitation sector.
601050 Water tanker spare parts: does not specify end user (item code).
601427 Jetting vehicles and spares: necessary for cleaning of blocked sewers. According to specification not of high standard.
700919 Garbage collection vehicle, as per drawing standard model

Civil and transport:

50932 Cranes: Cranes with hydraulic boom and capacity from 5-50 tons are common in the water/sanitation sector. They are used for all activities, loading/unloading, pipe laying, maintenance etc. It must be considered, some of the plants do not have overhead cranes. Is a standard equipment.
501082 Grader: Standard equipment for repairs and pipe laying.
600558 Vehicle parts: standard spares.
600832 Water tanker spare parts: Standard.
601383 Spares for lorries: Pipes and material is transported, these are standard spare parts for lorries.
601386 80 t Crane: technical ok, but it should be explained where so heavy equipment is needed.
601550 Concrete casting and loading machine with spare parts: used for repair and expansions.
601563 Asphalt hot recycler: is a standard in countries not having enough new asphalt. Asphalt from excavated trenches is reused.
601633 Paver finisher: used for repairs and compaction in trenches. Standard equipment.

601635 Wheeled paver spares: Standard equipment.
601644 Concrete pump: used for repairs and expansions. Without concrete pumps repairs are very difficult to implement. It is standard equipment.
601669 Road marking machine: to make marks on roads after excavation and repair. Standard unit.
601674 Crusher plant and parts: use not specified, most probably for crushing and separation of corn size into different fractions for concreting and embedding pipes into sand bed.
700920 Trucks and spare parts (MAN type), standard for transport

Various:

501145 Water hammer system: compressor and dryer are necessary for the system. Water hammer device cannot operate without – risk: the plant can receive Heavy damage.
601019 Water and Sanitation supplies: Is rope packing (for sealing) is a standard material.
601216 Cold milling machine parts: for road repair, standard.
601357 Material for mechanical use: content is consumables which are common in the sector, including for transport and civil equipment.
700798 Hoses: all specified hoses are common used for emergency, dewatering, temporary water supply, sewage tanks etc.
601848 Computers for water works, seems standard, should explain where located to be sure it is for the water sector.
700921 Welding equipment, gloves, tools, safety shoes etc. in smaller quantity, standard.
701003 17+10 fire fighting vehicles with 7000 and 2000 litre, standard, should state end-user.
701005 68 fire fighting vehicles and spares, but no end-user stated.

ANNEX VI

Model of an Assessment Form developed in Bosnia, used by USAID, World Bank and EC showing a) Methodology of the Project and b) Definition and Ranking Measures (Scenarios)

Methodology of the Project

Chapter 3

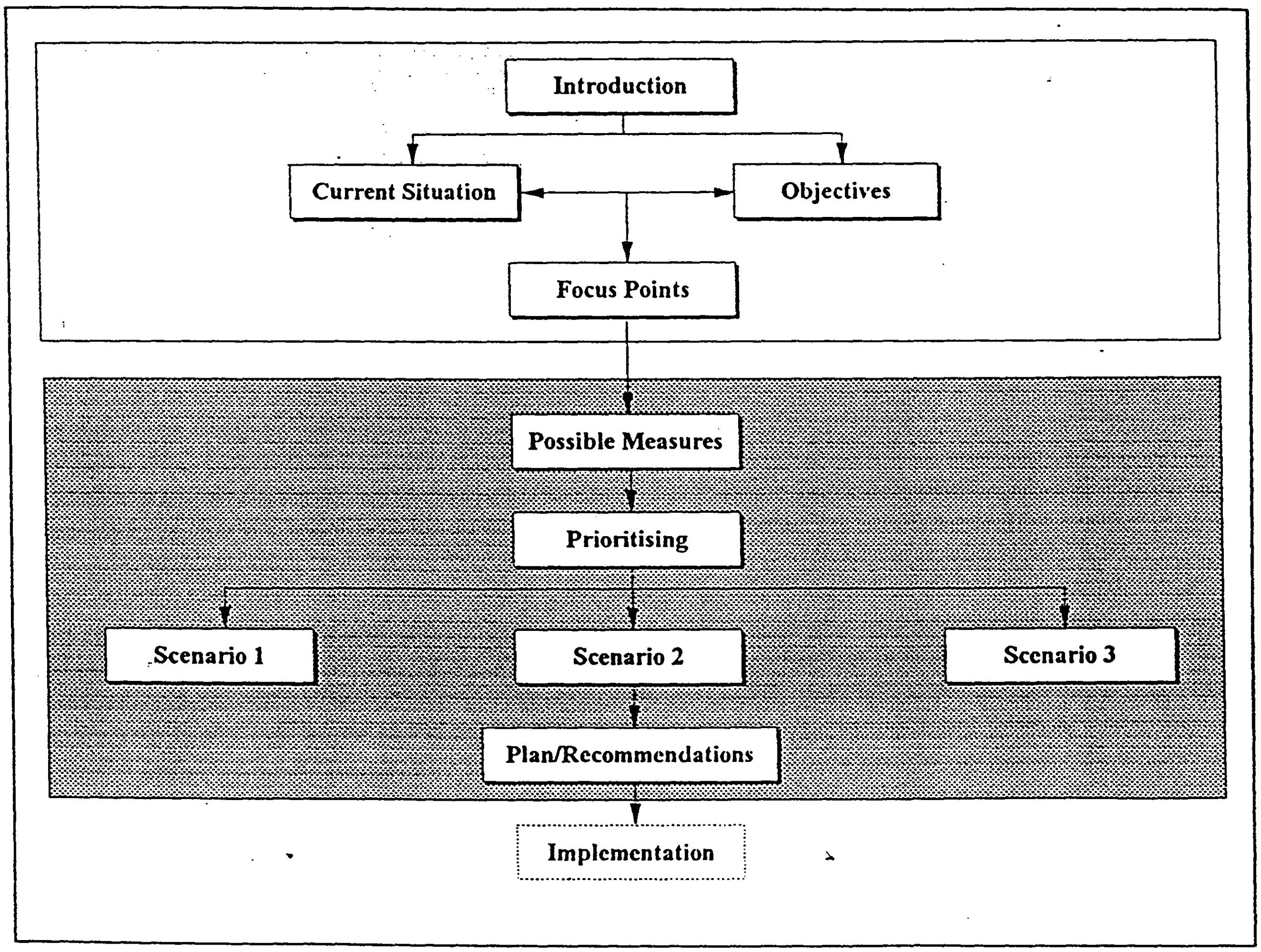
3. Methodology of the Project

3.1 PRIMAVERA/Planning Process

For the prioritising of the solutions to the problems in the Water Supply, Sanitation and Solid Waste sectors the PRIMAVERA methodology has been adopted, supported by the computer program bearing the same name. The PRIMAVERA methodology allows a clear and open prioritisation based on predefined criteria ("focus points"). This chapter presents the planning process which is the basis for PRIMAVERA, the main characteristics of the methodology and the way it was handled in this project.

Figure 3.1 outlines the fundamental planning process upon which PRIMAVERA is based and shows the procedure for the definition and prioritising of measures in the sectors of water, sanitation and solid waste.

Figure 3.1 Planning Process



As shown in Figure 3.1, the procedure adopted for the project can be described as follows:

- based on the results of the data collection (questionnaires), description and analysis of the **current situation** (see Chapter 3.2 and Chapter 4)
- definition of **general objectives** (see Chapter 3.3) for the year 2001 which can be marked as the planning horizon
- identification of **focus points/problems** (see Chapter 3.4) within each sector. The classification of each focus point with the aid of the characteristics „gravity“ and „scope“ allows a detailed analysis for each municipality (Chapter 4) and **definition of technical and economic measures** (Chapter 5.1.3 and Volume II), which aim to meet the objectives
- Prioritisation and consequently, the ranking of possible measures with the aid of the PRIMAVERA computer program, resulting in a **priority list** (Chapter 5)
- based on ranking and classification into emergency measures and rehabilitation/reconstruction measures, definition of several **scenarios** (see Chapter 5.1.4)
- **recommendations** for the **implementation** of the defined measures (see Chapter 6)

It must be stressed that the present project provides only an approximate assessment of possible measures based on interviews and completed questionnaires from the municipalities and the ranking is based on the methodology of PRIMAVERA. The implementation of the measures requires further detailed investigations (feasibility studies and detailed design).

3.2 Field Survey (Data Collection)

3.2.1 General

As mentioned in the introduction, much of the pre-war data is no longer relevant (e.g. population data, industrial data, water quality data, etc.) or is insufficient or not available. All organisations have to start from scratch. In order to get a clear picture of the current situation in the RS in the sectors of water supply, sanitation and solid waste, data collection concerning socio-economic (location and number of inhabitants and refugees) and technical aspects was required. The gathered data illustrate the effect of the war on the infrastructure (comparison between pre-war situation in 1991 and present post-war situation in 1996).

The intensive data collection and survey was under the direction of the Consultant co-ordinated and carried out by Zavod Za Vodoprivredu Pale during August 1996 and September 1996. Eight surveyors of the several field offices of Zavod Za Vodoprivredu have visited all Municipalities. The data collection was based on interviews with local representatives or municipal authorities. In order to compare the gathered data, the surveyors used for each sector, the same questionnaires as prepared for the project in the Federation by DHV-Consultants. As well for our project, additional data was collected concerning industry which was not in the DHV project.

3.2.2 Questionnaire „Water Supply“

The general content of the questionnaire „Water Supply“ can be described as follows in Table 3.1.

Table 3.1: *General content of the questionnaire „Water Supply"*

Chapter	Description
1	Source of Water
2	Water Supply Network
3	Pumping Stations
4	Water Hammer Measures
5	Disinfection
6	Pollution
7	Purification
8	Reservoirs
9	Organisation / Costs / Tariffs
10	Investments

Furthermore, the following items are described in detail:

- functioning of the distribution system
- damage to facilities due to the war
- recent reconstruction works
- on-going activities

3.2.3 Questionnaire „Sanitation"

The general content of the questionnaire „Sanitation" can be described as follows (see Table 3.2).

Table 3.2: *General content of the questionnaire „Sanitation"*

Chapter	Description
1	Socio-Economic and Wastewater Data
2	Sewer Network
3	Pumping / Lifting Stations
4	Wastewater Treatment Plant
5	Public Health and Environment
6	Organisation / Costs / Tariffs
7	Investments

Furthermore, the following items are described in detail:

- functioning of the sewer system
- damage to facilities due to the war
- recent reconstruction works
- on-going activities

3.2.4 Questionnaire „Solid Waste"

The general content of the questionnaire „Solid Waste" can be described as follows (see Table 3.3).

Table 3.3: General content of the questionnaire „Solid Waste"

Chapter	Description
1	**Socio-Economic Data** Household and Industry
2	**Waste Collection and Amount of Waste** Domestic and Industry
3	**Waste Disposal Sites** Surface and Volume
4	**Public Health/Environment Protection**
5	**Cost and Tariffs**

3.2.5 Data Management

The field survey for data collection provides extensive information on the present state of water supply, sanitation and solid waste. In order to handle the tremendous amount of all information, the collected data has been installed in a self-defined dBase-Program, which is running under the software „Visual dBase for Windows". The dBase permits the listing of data by municipality and to retrieve information which is of special interest. As well the dBase provides an important basis for the local authorities for the implementation of a Management Information System. The set-up of the dBase enables easy exchange of all data with other potential users of this new information system (e.g. in the Federation). Furthermore, the dBase can automatically generates special values for PRIMAVERA which the program incorporates for internal calculations (e.g. effectiveness of a measure).

3.3 General Objectives

The general objectives of the project describe the target situation for the year 2001 and have been formulated in the Table 3.4. For each municipality, the existing situation (basis: year 1996) will be compared with the target situation according to the objectives. The general objectives for the several service levels to be achieved are divided into an **emergency phase** and a **rehabilitation and reconstruction phase**. The emergency phase deals with evident problems within a municipality and focuses on measures which should be implemented immediately. The objectives formulated for the emergency phase aims mainly for providing the minimum of essential services for a human existence. The rehabilitation and reconstruction phase focuses on measures which can be executed within a development plan.

Table 3.4: General Objectives

Description	Rehabilitation and Reconstruction Phase	Emergency Phase
	Water Supply	
Supply Capacity	200 l/c/d	30 l/c/d
Quality	WHO-Guidelines	Bacteriologically Safe
Coverage	> 90%	< 50%
Water Losses	< 25%	> 70%
Operation	24 hours per day	5 hours per day
	Sewerage	
Network	Sewer System operable and cleaned	50 % of sewer system operable No public health hazards
Treatment Plant	Completion of Sewage Treatment Plant (under construction)	Reconstruction of existing Sewage Treatment Plant
	Solid Waste	
Collection and Transport	> 70%	< 40%
Waste Disposal Sites	Waste Disposal Final Site controlled	Waste Disposal Sites (Status of Site rating: very negative) closed
Flooding	Rehabilitation of damaged Structures	Prevention of further damage to Structures
Irrigation	Rehabilitation of damaged Systems	

General Objectives for Water Supply:

- The specific **consumption of households (litre/capita/day)** is an important indicator regarding the capacity of a water supply system. The minimum of specific consumption should be in average more than 30 litre per capita and day. In cases lower than 30 l/c/d an emergency phase is identified. The target situation is specified to guarantee a sufficient water supply of at least 200 l/c/d, which includes domestic, institutional, commercial and industrial consumption.

- To prevent public health risks the drinking water should be at first **bacteriologically safe.** Especially the presence of pathogenic organisms (e.g. bacteria coli and bacteria vibrio) endanger the health; especially for children and the elderly. The pollution of water by pathogenic organisms is generally caused by faecal contamination of the water source. The water supplied to consumers should be in accordance with the potable water quality guidelines of the World Health Organisation **(WHO).**

- The population to be served by water supply network should be in a range of about 90 % in the urban centres **(coverage).** People who are not connected to piped water supply systems or who have no access to tapped water, use private wells or surface water as their source. The risk of pollution of these private wells is generally very high. An emergency phase is defined where the coverage is than 50 %.

- Water losses result in high operational costs such as increased energy costs for pumping and use of chemicals for water treatment. Also water losses through leakage from the distribution system offers a potential risk of contamination to the supply due to the possible infiltration of wastewater in the system especially during periods of low service pressure. Because of this, a target of 25 % water losses is aimed for. Where water losses exceed 70 %, an emergency phase is identified.

- A 24 hours per day **supply continuity** is mainly required to ensure that the quality of water meets the target of bacteriological safety. A periodic interruption of supply or the running dry of a pipeline can cause microbiological growth and presence of pathogenic organisms in the water.

General Objectives for Sanitation:

- A well-functioned sewage collection and treatment system is important to minimise the impact to the environment and to avoid **public health hazards.** Leakage from sewer systems can cause infiltration from untreated waste water into the groundwater. Damage to the sewer systems must be identified and broken pipes must be replaced or repaired accordingly. In cases of **damage to sewer systems** which exceeds 50 % of the total system, an emergency phase is identified.

- In order to protect water quality existing **wastewater treatment plants and pumping stations** for municipal sewage must be inspected and (if necessary) reconstructed. The overall target is to finish treatment plants/pumping stations which were under construction before the beginning of the war. An emergency phase is identified to rehabilitate a treatment plant/ pumping station which functioning before the war and is now out of operation. Rehabilitation, upgrading and construction of industrial wastewater plants are not included in this project.

General Objectives for Solid Waste:

- The produced daily waste amount of each municipality must be collected and transported to the disposal site. Therefore **containers and vehicles** (basic equipment) in an adequate number must be foreseen. For the rehabilitation and reconstruction, an effective system of solid waste collection is necessary. A collection rate of 80 % should be aimed for. In cases lower than the target situation, the collection rate has to be increased by using additional containers and truck (vehicles) for solid waste disposal and appropriate technical infrastructure.

- The geological formations in the RS are dominated by a medium to extremely high permeability (karats phenomena) and the average rainfall in an amount of 1250 mm/year is high. Therefore an infiltration of different pollutants from several sources in the groundwater is present and describes a potential long-term risk on public health. Existing solid waste dumps without any protection layer and which have a very negative/negative environmental rating (see Chapter 5.3.2) must be **closed** and rehabilitated as soon as possible once an emergency disposal site is operational. As a parallel activity an emergency site with an adequate basis protection layer which is placed on a better geological formation must be constructed within this period. The lifetime of such an emergency site is approx. three years in accordance with the time-schedule of this assessment and in the end, a site closure and reclamation is foreseen. Emergency sites will be constructed mainly for small municipalities with a predominantly rural character.

- Economic and financial aspects are important and accordingly, sanitary landfills according to the „low-cost-principle" will be constructed or rehabilitated only for the large municipalities with more than 80.000 inhabitants. A single or centralised landfill location should be verified. The technical structure of these landfills will fulfil at least the minimum quality standards equal to **controlled final** sites.

General Objectives for Flooding:

- Dikes along river banks must protect the area and prevent damage to property and reduce the threat of human life. If any kind of major damage is present on flood protection works, then an emergency phase is identified. In a first step the structure should be temporarily repaired in order to **prevent further damages occurring.**

General Objectives for Irrigation:

- Damages to irrigation works (e.g. pumping station for drainage water and intakes) have a great influence of the protection and on the availability of water for the agriculture area and should be reconstructed **(rehabilitation of damaged systems).**

3.4 Focus Points

Definition of **focus points** is an integral part of the prioritising of measures within the computer program PRIMAVERA and is direct related to the above mentioned objectives. **Focus points** are defined as problems which should be solved. Thus, the current situation will be verified by these focus points for each sector. For classification, every focus point is subdivided in a „gravity" and a „scope". All focus points and their related gravity and scope have been formulated in Table 3.6 on the following page.

The **gravity** has been defined as the discrepancy from the current situation (year 1996) to the objectives and is subdivided in five individual categories (0 until 4) with separate values. The gravity demonstrates the seriousness of the problem within a focus point. A gravity 4 is the highest category and represents an extremely poor situation requiring emergency measures to rectify the situation (worst case). From gravity 4, the categories decrease and the lowest category is 0 which is the ideal situation which meets all the objectives. The target situation in the year 2001 is classified with category 0.

Within this project, the **scope** of each focus point in water supply, sanitation and solid waste is characterized by number of inhabitants in the municipality which will be solved by each focus point in the year 2001. The scope is subdivided in four individual categories (1 until 4) with separate values.

Especially for the focus point „Public Health" (B3) an additional classification has been evaluated to get a clear valuation of this focus point, as summarized in Table 3.5.

Table 3.5: Classification for Focus Point „Public Health (B3)"

Population connected	**Increase of Population after the war**			
	0 - 10	**10 - 25**	**25 - 50**	**> 50**
[%]	**[%]**	**[%]**	**[%]**	**[%]**
> 90	**0**	**0**	**0**	**0**
70 - 90	**0**	**0**	**0**	**1**
50 - 70	**0**	**0**	**1**	**2**
25 - 50	**0**	**1**	**2**	**3**
< 25	**0**	**2**	**3**	**4**

As shown in Table 3.5, a potential risk to public health will be assumed for cases of a sharp population increase and growth due to the presence of refugees/migration (increase of population after the war) combined with a low percentage coverage of the sewer system.

Table 3.6 *Focus Points, Gravity and Scope*

FOCUS POINT			Year	GRAVITY (1996)				SCOPE				
			2001	REHABILITATION AND RECONSTRUCTION PHASE			EMERGENCY PHASE	Size of Municipality				
Code	Variable	Unit	Target 0	Slight 1	Moderate 2	Serious 3	Critical 4	Variable	Very Small 1	Small 2	Large 3	Very Large 4
A1_..	Water Supply by Network	[l/c/d]	> 200	150 - 200	100 - 150	30 - 100	< 30	1,000 people *	< 4	4 - 12	12 - 36	> 36
A2_..	Quality of Water Supply	[-]	WHO	←		→	Bacteriologically Unsafe	1,000 people *	< 4	4 - 12	12 - 36	> 36
A3_..	Coverage	[%]	> 90 - 95	90	70 - 90	50 - 70	< 50	1,000 people *	< 4	4 - 12	12 - 36	> 36
A4_..	Water Losses in Network	[%]	< 25	25	25 - 50	50 - 70	> 70	1,000 people *	< 4	4 - 12	12 - 36	> 36
A5_..	Operation	[hours/day]	24	22 - 24	15 - 22	5 - 15	< 5	1,000 people *	< 4	4 - 12	12 - 36	> 36
B1_..	Damage to Network	[%]	operable and cleaned	5 - 10	10 - 25	25 - 50	> 50	1,000 people *	< 4	4 - 12	12 - 36	> 36
B2_..	Treatment Plant Pumping Stations	[-]	completion		under construction		functioned before	1,000 people *	< 4	4 - 12	12 - 36	> 36
B3_..	Public Health	[-]	No Risk	Slight Risk	Moderate Risk	Serious Risk	Emergency	1,000 people *	< 4	4 - 12	12 - 36	> 36
C1_..	Collection and Transport Rate	[%]	> 70 - 80	70	60 - 70	40 - 60	< 40	1,000 people *	< 4	4 - 12	12 - 36	> 36
C2_..	Status of Disposal Sites	[-]	Final Site controlled	rehabilitation possible	fair	negative	very negative	1,000 people *	< 4	4 - 12	12 - 36	> 36
D1_..	Damage to Flood Control System	[-]	No damage	small damage	small damage at more places	serious damage	Structures not safe	Cost of Repair [1,000 DM]	< 50	50 - 100	150 - 450	> 450
E1_..	Reduction of Water for Irrigation	[%]	Rehabilitation	< 15	15 - 40	> 40		Reduced Yearly Income [1,000 DM]	< 50	50 - 100	150 - 450	> 450

* Population Forecast in Year 2001

.. Code of Municipality (e.g. S-01)

3.5 Scope/Population Forecast

As mentioned in Chapter 3.4, the scope of each focus point is related to the population forecast for the year 2001 for the urban centres or present service areas of each sector and is classified in four categories. Because of the war, detailed socio-demographic data is not available and the conflict has caused massive upheavals for the population. Because of the still dynamic and fluid situation in the area, it is difficult to predict future trends for population growth. In order not to present unrealistic or unsubstantiated figures, a conservative approach has been adopted in which it is assumed that the population figure in the year 2001 will correspond to the population figure of 1996.

Furthermore within the scope of focus point related to population, the following were considered:

- present age pyramid of the population is not known
- present political situation is established
- massive economic growth and therefore migration of the population to industrial development areas within the next five years is not expected
- UNHCR target areas within the RS (data submitted by IMG in November 1996) has been anticipated and is integrated in the population data

The estimation of the present population figure is based on the data from the field survey (questionnaires). Thus, the population forecast includes the migration of population and presence of refugees in each municipality.

3.6 Support Aspects

The variable „support aspects" (prerequisites, administrative appreciation and social appreciation) within the computer program PRIMAVERA incorporates an influence of relevant non-technical conditions within the municipality (e.g. population growth) on the ranking of the measures. Socio-economic data is also taken into consideration.

For this project area, the following support aspects are involved:

- **front-line/war damage *(prerequisites)***
- **industrial and agricultural development areas *(administrative appreciation)***
- **presence of refugees/population growth *(social appreciation)***
- **UNHCR return areas *(social appreciation)***

Table 3.7 presents an overview of the applied support aspects including prerequisites, administrative and social appreciation.

Prerequisites

Indices for prerequisites are based on whether a municipality was at a former **front-line** or whether it suffered due to the **war** (e.g. direct damage on houses and infrastructure). In this way, measures in the municipalities which were once at the front-line can be given a higher priority. It is expected that this will give some immediate relief to war caused problems. The yardstick value for municipalities on former front-line is 0 and other municipalities away from the frontlines score -1.

Administrative Appreciation

One of the main conditions is to get the country running back to normal by restoring and strengthening the economy and therefore **Industrial and agricultural development areas** are taken into account. In municipalities with the presence of main-industries (see chapter 4.1.2.2), the yardstick value get the number 1 (stimulating). Other municipalities score 0 on administrative appreciation (neutral). Special attention has been paid to the presence of coal mines, which are highly important with respect to power supply.

Social Appreciation

A large **increase of population** within a short time causes obvious problems on the infrastructure and this is at present the main problem facing the municipalities. It has been decided to support measures for municipalities with the presence of refugees and **UNHCR return areas** (*Sipovo*, *Kljuc* and *Bratunac*).

The yardstick value for municipalities with an increase of population more than 100 % (comparison between pre-war and post-war population figure) and UNHCR return areas is 2 (large), between 25 % and 100% is 1 (slight) and less than 25 % is 0 (neutral).

Table 3.7: Support aspects (yardsticks)

Code	MUNICIPALITY	Prerequisites frontline/war damages 0 = yes / -1 = no	Administrative Appreciation industrial & agricultural development area's 1 = yes / 0 = no	Social Appreciation refugees and UNHCR target area's 2 = large+UNHCR / 1 = slight / 0 = no
N-01	Banja Luka	-1	1	1
N-02	Prijedor	-1	1	0
N-03	Novi Grad	0	1	0
N-04	Kozarska Dubica	0	0	0
N-05	Gradiska	-1	1	0
N-06	Laktasi	-1	0	1
N-07	Celinac	-1	0	0
N-08	Kotor Varos	-1	0	0
N-09	Knezevo	0	0	0
N-10	Mrkonjic Grad	0	0	0
N-11	Sipovo	0	0	0
N-12	Kljuc	0	0	0
N-13	Petrovac	0	0	0
N-14	Doboj	0	1	0
N-15	Teslic	0	0	0
N-16	Prnjavor	-1	0	0
N-17	Srbac	-1	0	0
N-18	Derventa	0	0	0
N-19	Srpski Brod	0	0	0
N-20	Vukosavlje	-1	0	0
N-21	Modrica	-1	1	0
N-22	Samac	0	1	0
N-23	Bijeljina	-1	1	2
N-24	Brcko	0	1	0
N-25	Lopare	-1	0	2
N-26	Sekovici	-1	0	2
S-01	Pale	-1	1	2
S-02	Novo Sarajevo	0	1	1
S-03	Ilidza	0	1	2
S-04	Srpsko Gorazde	0	0	0
S-05	Han Pijesak	-1	1	0
S-06	Sokolac	-1	1	1
S-07	Rogatica	0	0	1
S-08	Visegrad	-1	1	1
S-09	Rudo	-1	0	1
S-10	Cajnice	-1	1	2
S-11	Trebinje	-1	1	0
S-12	Nevesinje	-1	1	1
S-13	Ljubinje	-1	0	0
S-14	Bileca	-1	1	1
S-15	Gacko	-1	1	1
S-16	Srbinje	-1	1	0
S-17	Kalinovik	0	0	0
S-18	Trnovo	0	0	0
S-19	Ugljevik	-1	1	1
S-20	Zvornik	-1	1	0
S-21	Bratunac	-1	1	2
S-22	Vlasenica	-1	1	0
S-23	Srebrenica	0	1	2
S-24	Milici	-1	1	1

3.7 Yardsticks

For the prioritisation with PRIMAVERA, the proposed measures are characterised with the yardsticks (or parameters) of **rentability, effectiveness, costs and time to effect.**

3.7.1 Rentability, Effectiveness and Costs

The result of the technical evaluation is a calculation of the cost effectiveness, called **rentability** within the PRIMAVERA prioritisation program.

The **rentability** (R_m) of a measure is based on four aspects:

- the *effectiveness (EF)* of the proposed measure on solving one or more focus points;
- the *annual costs (CO)* of the proposed measure;
- the *gravity (GR)* of the related focus points;
- the *scope (SC)* of the related focus points.

For the calculation of the **rentability** the following equation (1) is used:

$$R_m = \log \sum \left(\frac{EF_m * GR_{fp} * SC_{fp}}{CO_m} \right) \qquad (1)$$

The value of rentability is between 0 (low rentability) and 10 (high rentability).

The effectiveness (EF_m) of a measure is calculated with equation (2):

$$EF_m = \left(1 - \frac{GR_{after\_m} * SC_{after\_m}}{GR_{before\_m} * SC_{before\_m}} \right) * 4 \qquad (2)$$

In which:

EF	=	effectiveness
GR	=	gravity
SC	=	scope
m	=	measure
fp	=	focus point

The value of effectiveness is between 1 and 4 (see Table 3.8).

The **costs** as used in the PRIMAVERA prioritisation are annual (running) costs. Based on the cost of investment and the lifetime for all equipment the annual costs (depreciation) have been calculated. Furthermore, a percentage of investment costs (split up to mechanical/electrical and civil works) is taken into account for maintenance. Operation costs (power consumption, manpower, etc.) have not been taken into account. The annual costs for each measure are described in summary sheets in the Annexes (see Volume II).

The yardsticks for effectiveness and costs are summarised in Table 3.8.

Table 3.8: Yardsticks for Effectiveness and Costs

INDEX	1	2	3	4
	low	*moderate*	*high*	*complete*
Costs [1.000 DEM]	*< 50*	*50 - 150*	*150 - 450*	*> 450*

3.7.2 Time to Effect

The time to effect relates to the time required to actually achieve the effect envisaged from the relevant measures. The time to effect has been defined as the time required for realisation of the measure (time for implementation) up to the appearance of the target effects and is estimated based on expert judgement and experience from similar measures.

The yardsticks for time to effect are summarised in Table 3.9.

Table 3.9: Yardsticks for Time to Effect

INDEX	+2	+1	0	-1	-2
Time to Effect [year]	*< 1*	*1 - 2*	*2 - 4*	*4 - 8*	*> 8*

Table 5.4: Ranking of Measures in WATER SUPPLY (excluding Emergency Measures); Rank 31 until 60

MEASURES				RENTABILITY	PRE-REQ.	TIME TO EFFECT	APPRECIATION		FINAL PRIORITY
No.	Code	Description	Investment costs [in DEM]	(Cost-effectiveness) [-]	PR	TE	ADMIN AA	SOCIAL SA	
31	S24_AI-2	rehabilitation of intake works and pressure reduce chambers, Milici	100.000	4,2	-1	2	1	1	75
32	S06_AII-2	extension of water supply system, Sokolac	1.700.000	5,6	-1	1	1	1	74
33	S03_AIII-1	UFW programme, leak detection and repair, Ilidza	200.000	2,6	0	-1	1	2	74
34	N23_AIII-1	UFW programme, leak detection and repair, Bijeljina	600.000	3,5	-1	-1	1	2	74
35	S12_AI-2	rehabilitation of treatment plant + construction of reservoir, Nevesinje	680.000	5,4	-1	1	1	1	74
36	S01_AIII-1	UFW programme, leak detection and repair, Pale	200.000	3,2	-1	-1	1	2	74
37	S21_AIII-1	UFW programme, leak detection and repair, Bratunac	600.000	2,6	-1	-1	1	2	73
38	S10_AIII-1	UFW programme, leak detection and repair, Cajnice	400.000	2,6	-1	-1	1	2	73
39	S20_AI-3	rehabilitation of source works, Zvornik	400.000	6,1	-1	2	1	0	73
40	S08_AI-2	rehabilitation of source works and transmission mains, Visegrad	740.000	4,9	-1	1	1	1	73
41	S08_AI-3	rehabilitation of pumping stations and reservoirs, Visegrad	620.000	4,9	-1	1	1	1	73
42	S08_AII-1	water supply to industrial zone, Visegrad	600.000	4,9	-1	1	1	1	73
43	N01_AI-3	replacement of distribution pipeline, Banja Luka	2.250.000	4,4	-1	1	1	1	72
44	S15_AI-2	rehabilitation reservoir + distribution network, Gacko	365.000	4,2	-1	1	1	1	71
45	S12_AII-1	extension of water supply system, Nevesinje	300.000	4,2	-1	1	1	1	71
46	S22_AI-2	supply and installation of pumping equipment, Vlasenica	100.000	5,4	-1	2	1	0	71
47	N02_AI-2	spare parts for pumping stations, Prijedor	100.000	5,4	-1	2	1	0	71
48	N24_AI-2	supply of pumping equipment, and water meters, Brcko	400.000	3,7	0	2	1	0	70
49	S20_AI-2	supply of pumping equipment, Zvornik	100.000	4,9	-1	2	1	0	69
50	S16_AI-2	repair of distribution network, Srbinje	120.000	4,9	-1	2	1	0	69
51	N05_AI-2	protection of Zeravica well field, Gradiska	400.000	6,9	-1	1	1	0	69
52	S14_AII-1	extension of distribution system to higher zones, Bileca	1.000.000	3,1	-1	1	1	1	68
53	S24_AII-1	extension of water supply system, Milici	1.100.000	4,2	-1	0	1	1	68
54	N25_AII-1	construction of water treatment units, Lopare	250.000	4,2	-1	0	0	2	68
55	N25_AII-3	construction of reservoir + extension of distribution network, Lopare	1.200.000	4,2	-1	0	0	2	68
56	N26_AI-2	replacement of transmission main 'Sucani', Sekovici	370.000	2,6	-1	1	0	2	67
57	N25_AII-2	new source works, Medjednika, Lopare	2.400.000	3,7	-1	0	0	2	67
58	N22_AI-2	supply of pumping equipment, Samac	100.000	3,1	0	2	1	0	67
59	N18_AI-2	supply of m&e spare parts, Derventa	50.000	4,9	0	2	0	0	67
60	N15_AI-2	rehabilitation of drinking water treatment plant, Teslic	150.000	4,9	0	2	0	0	67

Table 5.5: Ranking of Measures in WATER SUPPLY (excluding Emergency Measures); Rank 61 until 90

MEASURES				RENTABILITY	PRE-REQ.	TIME TO EFFECT	APPRECIATION		FINAL PRIORITY
No.	Code	Description	Investment costs [in DEM]	(Cost-effectiveness) [-]	PR	TE	ADMIN. AA	SOCIAL SA	
61	N04_AI-2	supply and installation of pumping equipment, Kozarska Dubica	50.000	4,9	0	2	0	0	67
62	S05_AI-2	supply of pumping equipment, Han Pijesak	50.000	4,2	-1	2	1	0	66
63	N21_AI-3	rehabilitation of reservoir, Modrica, done with ICRC funds	100.000	4,2	-1	2	1	0	66
64	N06_AI-2	supply of pumping equipment, Laktasi	50.000	4,2	-1	2	0	1	66
65	N06_AI-3	rehabilitation of reservoirs, Laktasi	550.000	4,2	-1	2	0	1	66
66	S02_AIII-1	UFW programme, leak detection and repair, Novo Sarajevo	400.000	3,1	0	-1	1	1	66
67	S24_AIII-1	UFW programme, leak detection and repair, Milici	200.000	4,2	-1	-1	1	1	66
68	S19_AIII-1	UFW programme, leak detection and repair, Ugljevik	400.000	4,2	-1	-1	1	1	66
69	S22_AII-1	construction of pressure reducing chambers, Vlasenica	450.000	5,4	-1	1	1	0	65
70	S08_AIII-1	UFW programme, leak detection and repair, Visegrad	600.000	2,6	-1	-1	1	1	64
71	S06_AIII-1	UFW programme, leak detection and repair, Sokolac	400.000	2,6	-1	-1	1	1	64
72	N01_AIII-1	UFW programme, leak detection and repair, Banja Luka	2.000.000	2,6	-1	-1	1	1	64
73	N16_AI-2	rehabilitation of drinking water treatment plant, Prnjavor	150.000	6,1	-1	2	0	0	64
74	S20_AII-1	Zelinje new well project, Zvornik	4.200.000	4,9	-1	1	1	0	63
75	S15_AIII-1	UFW programme, leak detection and repair, Gacko	400.000	2,1	-1	-1	1	1	63
76	S14_AIII-1	UFW programme, leak detection and repair, Bilecn	600.000	2,1	-1	-1	1	1	63
77	S12_AIII-1	UFW programme, leak detection and repair, Nevesinje	200.000	2,1	-1	-1	1	1	63
78	N25_AIII-1	UFW programme, leak detection and repair, Lopare	200.000	2,1	-1	-1	0	2	63
79	N19_AI-2	supply of pumping equipment, Srpski Brod	200.000	4,2	0	2	0	0	63
80	N10_AI-2	rehabilitation of source works, Mrkonjic Grad	150.000	4,2	0	2	0	0	63
81	N09_AI-2	supply and installation of m&e equipment, Knezevo	180.000	4,2	0	2	0	0	63
82	N26_AIII-1	UFW programme, leak detection and repair, Sekovici	200.000	1,3	-1	-1	0	2	62
83	S11_AI-2	reconstruction of pumping stations KRS and Oko, Trebinje	580.000	3,1	-1	2	1	0	62
84	S09_AI-2	supply of pumping equipment, Rudo	50.000	3,1	-1	2	0	1	62
85	N21_AI-2	supply of pumping equipment, Modrica	50.000	3,1	-1	2	1	0	62
86	S05_AII-2	extension of water supply system, Han Pijesak	1.100.000	4,2	-1	1	1	0	61
87	S15_AII-1	study into new water source works, Gacko	200.000	0,0	-1	1	1	1	60
88	S20_AII-2	pumping station and transmission mains, Zvornik	2.200.000	3,7	-1	1	1	0	60
89	N24_AII-2	construction of reservoir, Brcko	1.800.000	3,7	0	0	1	0	60
90	N04_AII-1	extension of the distribution network, Kozarska Dubica	900.000	5,1	0	1	0	0	59

Table 5.6: Ranking of Measures in WATER SUPPLY (excluding Emergency Measures); Rank 91 until 120

MEASURES				RENTABILITY	PRE-	TIME TO	APPRECIATION		
No.	Code	Description	Investment costs [in DEM]	(Cost-effectiveness) [-]	REQ. PR	EFFECT TE	ADMIN. AA	SOCIAL SA	FINAL PRIORITY
91	S05_AII-1	construction of Bijele Vode w.s.s., Han Pijesnk	900.000	4,9	-1	0	1	0	59
92	N05_AII-1	construction of new reservoir, Gradiska	1.300.000	4,9	-1	0	1	0	59
93	N20_AI-2	supply of pumping equipment, Vukosavlje	150.000	5,0	-1	2	0	0	59
94	N20_AI-3	rehabilitation of water purification unit, Vukosavlje	100.000	4,9	-1	2	0	0	58
95	N19_AI-3	rehabilitation of water purification unit and wells, Srpski Brod	1.350.000	4,9	0	1	0	0	58
96	S11_AII-1	finalization of the Hrupjela high zone works, Trebinje	1.350.000	3,1	-1	1	1	0	58
97	N22_AII-1	construction of reservoir, Samac	700.000	3,1	0	0	1	0	58
98	N02_AII-1	construction of reservoir Rosulje, Prijedor	3.300.000	3,5	-1	0	1	0	56
99	N12_AI-2	supply of pumping equipment, Kljuc	25.000	3,1	0	2	0	0	56
100	N17_AI-3	rehabilitation of source works, Srbac	400.000	4,2	-1	2	0	0	55
101	N08_AI-2	supply of pumping equipment, Kotor Varos	50.000	4,2	-1	2	0	0	55
102	N21_AII-1	extension of distribution network, Modrica	1.000.000	3,1	-1	0	1	0	55
103	N18_AII-1	extension of source capacity, Derventa	1.700.000	5,6	0	0	0	0	54
104	S07_AIII-1	UFW programme, leak detection and repair, Rogatica	200.000	2,6	0	-1	0	1	54
105	N24_AIII-1	UFW programme, leak detection and repair, Brcko	600.000	2,6	0	-1	1	0	54
106	N14_AIII-1	UFW programme, leak detection and repair, Doboj	1.000.000	2,6	0	-1	1	0	54
107	N03_AIII-1	UFW programme, leak detection and repair, Novi Grad	400.000	2,6	0	-1	1	0	54
108	S20_AIII-1	UFW programme, leak detection and repair, Zvornik	400.000	3,7	-1	-1	1	0	54
109	S18_AI-2	repairs on water supply system, Trnovo	570.000	2,6	0	2	0	0	53
110	N15_AII-1	construction of new reservoir, Teslic	850.000	3,7	0	1	0	0	53
111	S22_AIII-1	UFW programme, leak detection and repair, Vlasenica	200.000	3,1	-1	-1	1	0	53
112	S11_AIII-1	UFW programme, leak detection and repair, Trebinje	1.200.000	3,1	-1	-1	1	0	53
113	N06_AIII-1	UFW programme, leak detection and repair, Laktasi	400.000	3,1	-1	-1	0	1	53
114	N05_AIII-1	UFW programme, leak detection and repair, Gradiska	600.000	3,1	-1	-1	1	0	53
115	N22_AIII-1	UFW programme, leak detection and repair, Samac	200.000	2,1	0	-1	1	0	53
116	S16_AIII-1	UFW programme, leak detection and repair, Srbinje	1.000.000	2,6	-1	-1	1	0	52
117	S05_AIII-1	UFW programme, leak detection and repair, Han Pijesak	400.000	2,6	-1	-1	1	0	52
118	N02_AIII-1	UFW programme, leak detection and repair, Prijedor	1.600.000	2,6	-1	-1	1	0	52
119	S09_AIII-1	UFW programme, leak detection and repair, Rudo	200.000	2,1	-1	-1	0	1	52
120	N21_AIII-1	UFW programme, leak detection and repair, Modrica	400.000	2,1	-1	-1	1	0	52

Table 5.7: Ranking of Measures in WATER SUPPLY (excluding Emergency Measures); Rank 121 until 149

MEASURES				RENTABILITY	PRE-REQ.	TIME TO EFFECT	APPRECIATION		FINAL PRIORITY
No.	Code	Description	Investment costs (in DEM)	(Cost-effectiveness) [-]	PR	TE	ADMIN. AA	SOCIAL SA	
121	S13_AI-2	rehabilitation of pump station and pressure line, Ljubinje	420.000	3,1	-1	2	0	0	50
122	N17_AI-2	supply of pumping equipment, Srbac	150.000	3,1	-1	2	0	0	50
123	N11_AII-1	expansion of distribution network, Sipovo	500.000	3,1	0	1	0	0	50
124	N09_AII-1	extension of distribution network, Knezevo	200.000	3,1	0	1	0	0	50
125	S17_AI-2	repairs on water supply system, Kalinovik	430.000	2,1	0	2	0	0	50
126	N16_AII-1	construction of p.s. + force main/rehabilitation of reservoir, Prnjavor	300.000	4,2	-1	1	0	0	50
127	N08_AII-2	construction of reservoir, Kotor Varos	800.000	4,2	-1	1	0	0	50
128	N03_AII-1	study and design of the extension of the w.s.s., Novi Grad	250.000	0,0	0	1	1	0	48
129	N17_AII-1	construction of reservoir, Srbac	800.000	3,1	-1	1	0	0	46
130	N07_AII-1	construction of reservoir, Celinac	850.000	3,1	-1	1	0	0	46
131	N08_AII-1	expansion of source works Bijelo Polje, Kotor Varos	3.200.000	3,7	-1	0	0	0	45
132	N15_AIII-1	UFW programme, leak detection and repair, Teslic	600.000	3,1	0	-1	0	0	43
133	N04_AIII-1	UFW programme, leak detection and repair, Kozarska Dubica	400.000	2,6	0	-1	0	0	42
134	N19_AIII-1	UFW programme, leak detection and repair, Srpski Brod	600.000	2,5	0	-1	0	0	42
135	N20_AIII-1	UFW programme, leak detection and repair, Vukosavlje	200.000	3,1	-1	-1	0	0	41
136	N07_AIII-1	UFW programme, leak detection and repair, Celinac	200.000	3,1	-1	-1	0	0	41
137	S18_AIII-1	UFW programme, leak detection and repair, Trnovo	200.000	2,1	0	-1	0	0	41
138	N18_AIII-1	UFW programme, leak detection and repair, Derventa	600.000	2,1	0	-1	0	0	41
139	N10_AIII-1	UAF programme, leak detection and repair, Mrkonjic Grad	600.000	2,1	0	-1	0	0	41
140	S04_AIII-1	UFW programme, leak detection and repair, Srpsko Gorazde	200.000	1,7	0	-1	0	0	40
141	N12_AIII-1	UFW programme, leak detection and repair, Kljuc	200.000	1,7	0	-1	0	0	40
142	N16_AIII-1	UFW programme, leak detection and repair, Prnjavor	400.000	2,1	-1	-1	0	0	40
143	N08_AIII-1	UFW programme, leak detection and repair, Kotor Varos	200.000	2,1	-1	-1	0	0	40
144	S17_AIII-1	UFW programme, leak detection and repair, Kalinovik	200.000	1,3	0	-1	0	0	39
145	N20_AII-1	new source works Vucicevica Vrelo, Vukosavlje	1.500.000	1,3	-1	0	0	0	39
146	N11_AIII-1	UFW programme, leak detection and repair, Sipovo	600.000	1,3	0	-1	0	0	39
147	N09_AIII-1	UFW programme, leak detection and repair, Knezevo	600.000	1,3	0	-1	0	0	39
148	S13_AIII-1	UFW programme, leak detection and repair, Ljubinje	400.000	1,7	-1	-1	0	0	39
149	N17_AIII-1	UFW programme, leak detection and repair, Srbac	800.000	1,3	-1	-1	0	0	38

5.2.4 Scenario 3: Ranking of Municipalities

In Table 5.8 and Table 5.9, the total of all measures combined to a macro-project water supply within a municipality are ranked according to the PRIMAVERA prioritisation. A description of the measures are given in Volume II in the respective chapter (municipality).

The total costs are estimated up to DEM 103.81 Mill. (including emergency measures).

A detailed description of each measure is given in Volume II (Part I and Part II) in the respective chapter (municipality). Each measure is combined with the code of the municipality and the number of the measure.

5.2.5 Development Programme

In the sector for water supply, measures have been identified which can improve the situation further and bring it beyond the target level, i.e. anticipating the long-term development requirements in the urban area. These type of measures are included in the programme but have not been ranked, also because they clearly have a lower priority than the other measures. They are presented in a separate list in Volume II and may be regarded as projects needed to be implemented during the coming five years.

The total costs of the development programme are estimated up to DEM 38.21 Mill.

Table 5.8: Ranking of Municipalities in WATER SUPPLY (including Emergency Measures); Rank 1 - 25

	MEASURES			103.810.000	RENTABILITY	PRE-	TIME TO	APPRECIATION		
				Investment costs	(cost-effectiveness)	REQ.	EFFECT	ADMIN.	SOCIAL	FINAL
No.	Code	Description		[in DEM]	[-]	PR	TE	AA	SA	PRIORITY
1	S23	Water Supply.	Srebrenica	3.620.000	7,5	0	-1	1	2	81
2	S03	Water Supply.	Ilidza	5.130.000	7,0	0	-1	1	2	80
3	S01	Water Supply.	Pale	5.380.000	6,6	-1	-1	1	2	77
4	S21	Water Supply.	Bratunac	3.530.000	6,3	-1	-1	1	2	77
5	N23	Water Supply.	Bijeljina	2.650.000	5,4	-1	-1	1	2	76
6	S10	Water Supply.	Cajnice	1.860.000	5,3	-1	-1	1	2	76
7	S02	Water Supply.	Novo Sarajevo	1.860.000	6,3	0	-1	1	1	72
8	S06	Water Supply.	Sokolac	2.900.000	6,3	-1	-1	1	1	69
9	S24	Water Supply.	Milici	1.400.000	5,8	-1	-1	1	1	68
10	N01	Water Supply.	Banja Luka	5.750.000	5,7	-1	-1	1	1	68
11	S14	Water Supply.	Bileca	2.300.000	5,3	-1	-1	1	1	68
12	S08	Water Supply.	Visegrad	2.560.000	5,3-	-1	-1	1	1	68
13	N25	Water Supply.	Lopare	4.050.000	5,2	-1	-1	0	2	68
14	S19	Water Supply.	Ugljevik	400.000	4,9	-1	-1	1	1	67
15	S12	Water Supply.	Nevesinje	1.180.000	4,4	-1	-1	1	1	67
16	S15	Water Supply.	Gacko	965.000	4,4	-1	-1	1	1	67
17	N26	Water Supply.	Sekovici	570.000	3,6	-1	-1	0	2	65
18	S07	Water Supply.	Rogatica	1.450.000	7,1	0	-1	0	1	64
19	N03	Water Supply.	Novi Grad	980.000	6,0	0	-1	1	0	62
20	N24	Water Supply.	Brcko	3.200.000	5,7	0	-1	1	0	61
21	N14	Water Supply.	Doboj	1.350.000	4,7	0	-1	1	0	59
22	N05	Water Supply.	Gradiska	2.300.000	6,4	-1	-1	1	0	59
23	S20	Water Supply.	Zvornik	7.300.000	5,9	-1	-1	1	0	58
24	S22	Water Supply.	Vlasenica	750.000	5,4	-1	-1	1	0	57
25	S05	Water Supply.	Han Pijesak	2.450.000	5,3	-1	-1	1	0	57

Table 5.9: Ranking of Municipalities in WATER SUPPLY (including Emergency Measures); Rank 26 - 50

	MEASURES		103.810.000	RENTABILITY	PRE- REQ.	TIME TO EFFECT	APPRECIATION		FINAL PRIORITY
			Investment costs	(cost-effectiveness)			ADMIN.	SOCIAL	
No.	Code	Description	[in DEM]	[-]	PR	TE	AA	SA	
26	N22	Water Supply, Samac	1.000.000	3,7	0	-1	1	0	57
27	N02	Water Supply, Prijedor	5.000.000	4,7	-1	-1	1	0	56
28	N06	Water Supply, Laktasi	1.000.000	4,7	-1	-1	0	1	56
29	S16	Water Supply, Srbinje	1.120.000	4,6	-1	-1	1	0	56
30	N21	Water Supply, Modrica	1.550.000	4,4	-1	-1	1	0	56
31	S11	Water Supply, Trebinje	3.130.000	4,0	-1	-1	1	0	55
32	S09	Water Supply, Rudo	250.000	3,1	-1	-1	0	1	53
33	N18	Water Supply, Derventa	2.350.000	5,6	0	-1	0	0	49
34	N12	Water Supply, Kljuc	1.725.000	5,4	0	-1	0	0	49
35	N04	Water Supply, Kozarska Dubica	1.350.000	5,3	0	-1	0	0	48
36	N19	Water Supply, Srpski Brod	2.150.000	5,1	0	-1	0	0	48
37	N15	Water Supply, Teslic	1.600.000	4,9	0	-1	0	0	47
38	N20	Water Supply, Vukosavlje	1.950.000	6,4	-1	-1	0	0	47
39	S18	Water Supply, Trnovo	770.000	4,2	0	-1	0	0	46
40	N08	Water Supply, Kotor Varos	4.250.000	5,2	-1	-1	0	0	45
41	N16	Water Supply, Prnjavor	850.000	5,2	-1	-1	0	0	45
42	N09	Water Supply, Knezevo	980.000	3,4	0	-1	0	0	44
43	N10	Water Supply, Mrkonjic Grad	750.000	3,3	0	-1	0	0	44
44	S04	Water Supply, Srpsko Gorazde	300.000	3,3	0	-1	0	0	44
45	N07	Water Supply, Celinac	1.050.000	4,6	-1	-1	0	0	44
46	N17	Water Supply, Srbac	2.150.000	4,1	-1	-1	0	0	43
47	S17	Water Supply, Kalinovik	630.000	2,6	0	-1	0	0	42
48	N11	Water Supply, Sipovo	1.100.000	2,3	0	-1	0	0	41
49	S13	Water Supply, Ljubinje	820.000	2,3	-1	-1	0	0	40
50	N13	Water Supply, Petrovac	100.000	study	0	1	0	0	

ANNEX VII: Examples of templates prepared for collecting and calculating data

WATER SUPPLY SYSTEM QUESTIONNAIRE

No.	ITEM	PRE-WAR	PRESENT	REMARKS
1.1	**SOURCE OF WATER**			
1.1.1	groundwater well			
1.1.2	groundwater spring			
1.1.3	river bank well			
1.1.4	surface water			
1.1.5	mixture of source			
1.2	**Total population**			
1.3	**CAPACITY OF SOURCE (liter per second)**			
1.3.1	Source 1. Wells			
1.3.2	Source 2. Source			
1.3.3	Source 3. Drinking water treatment plant			
1.3.4	Source 4.			
1.4	**USE OF SOURCE (liter per second)**			
1.4.1	Source 1.			
1.4.2	Source 2.			
1.4.3	Source 3.			
1.4.4	Source 4.			
1.5	**QUALITY OF SOURCE**			
1.5.1	Danger to public health			

WATER SUPPLY SYSTEM QUESTIONNAIRE

No.	ITEM	PRE-WAR	PRESENT	REMARKS
2	WATER SUPPLY NETWORK			
2.1	Coverage population			
2.1.1	Supply per capita and day			
2.2	Delivery of municipal tapwater to industries			
2.2.1	industry 1-			
2.2.2	industry 2-			
2.2.3	industry 3-			
2.2.4	industry 4-			
2.2.5	industry 5-			
2.2.6	industry 6-			
2.2.7	industry 7-			
2.2.8	industry 8-			
2.2.9	industry 9-			
2.2.10	industry 10-			
2.2.11	industry 11-			
2.2.12	industry 12-			
2.2.13	industry 13-			
2.2.14	industry 14-			
2.2.15	industry 15-			
2.2.16	industry 16-			
2.2.17	industry 17 - Others			
2.3	Use of other water sources by industries			
2.3.1	industry 1 -			
2.3.2	industry 3 -			
2.3.3	industry 4 -			
2.3.4	industry 5 -			
2.3.5	industry 6 -			
2.3.6	industry 7 -			

WATER SUPPLY SYSTEM QUESTIONNAIRE

No.	ITEM	PRE-WAR	PRESENT	REMARKS				
2.4	Length of pipes		to be replaced due to	material of pipes to be replaced AC=asbestos cement, PVC, Co=concrete, HPDE, Ot=others				
				AC	Co	PVC	HDPE	Others
2.4.1 2.4.2 2.4.3 2.4.4 2.4.5	- diameter 80-100 mm - diameter 100-200 mm - diameter 200-400 mm - diameter > 400 mm high pressure lines (>10 bar) - diameter	km	%					
2.5	Distribution loss							
2.6	Operation of the system							
2.7 2.7.1 2.7.2 2.7.3 2.7.4	Water metering - meters at source - meters at pumping station - meters at end users - meters at reservoirs			All water meters are damaged.				

WATER SUPPLY SYSTEM QUESTIONNAIRE

No.	ITEM			PRE-WAR		PRESENT	REMARKS
3.	PUMPING STATIONS						
3.1	Pump No	Type	Power KW	Capacity (l/s)	dH (m)	to be replaced	
3.1.1	1.	centrifugal					For pumps that are not necessary to be replaced, it is necessary to procure material for maintenance : operating stages, sealing rings, bearings and etc.
3.1.2	2						
3.1.3							
3.1.4							
3.1.5							
3.1.6							
3.1.7							
3.1.8							
3.1.9							
3.1.10							
3.1.11							
3.1.12							
3.1.13							
3.1.14							
3.2	Power available to the system						
4	WATER HAMMER MEASURES - buffer tank - valve - others: i.e.						

No.	ITEM			REMARKS
5	**DISINFECTION**			
5.1	Disinfection at source?			
5.2	Disinfection at pumping station?			
5.3	Disinfection in network?			
5.4	Chemicals available?			gas chlorine, alum sulph. etc
5.5	Power available?			
6	**POLLUTION**			**TYPE OF POLLUTION**
6.1	At source?			bacteriological
6.2	At pumping station?			
6.3	In the network?			
6.4	Type of pollution: e.g. oil, chemicals, bacteria			

WATER SUPPLY SYSTEM QUESTIONNAIRE

No	ITEM	PRE-WAR	PRESENT	REMARKS
7	**PURIFICATION**		**IN USE?**	
7.1	Type of purification, if any - aeration - slow sand filter - coagulation, flocc., sedim. - rapid sand filtration			
7.2	power available for purification.			
8	**RESERVOIRS**			**Height over ground level?**
	No. Volume Material			
8.1	1. reservoir I high zone			
8.2	2. reservoir I high zone			
8.3	3. reservoir I high zone			
8.4	4. reservoir II high zone			
8.5	5. reservoir II high zone			
8.6	6. reservoir II high zone			

WATER SUPPLY SYSTEM QUESTIONNAIRE

No.	ITEM	PRE-WAR	PRESENT	REMARKS
9	**ORGANIZATION /COSTS/ TARIFFS**			
9.1	Number of staff - water supply system			
9.2	Number of staff - water purification plant			
9.3	ANNUAL RUNNING COSTS -personnel -energy -materials / maintenance -equipment/vehicles -other			
9.4	ANNUAL CAPITAL COSTS - depreciation and reserves for replacement and extension			
9.5	ANNUAL TARIFFS - households - industry			

WATER SUPPLY SYSTEM QUESTIONNAIRE

No.	ITEM	PRE-WAR	PRESENT	REMARKS:		
10	INVESTMENTS					
10.1	Planned investments before the war	DESCRIPTION		PRIORITY	COSTS (DEM)	
10.1.1	- construction 2nd phase of water treatment plant for (Q=600 l/s)			high	13 500 000	
10.1.2	- construction of transport pipeline	- I phase dn 1000mm,L= 7 000m		urgent	24 200 000	
10.1.3	- construction of transport pipeline	- II phase dn 700mm,L=29 000 m		medium	21 500 000	
10.1.4	- extension of reservoir space	- V=40 000 m^3		urgent	36 000 000	
10.1.5	- construction of water intake Lijevce polje			low	247 000 000	
10.1.6	- construction of system for monitoring and remote control			medium	8 250 000	
10.1.7	- construction of treatment plant for waste water of rapid filters washing			low	4 500 000	
10.1.8	- performing of researching works at source			medium	55 500 000	
10.2	Rehabilitation/reconstruction investments		DESCRIPTION	PRIORITY	COSTS (DEM)	
10.2.1	- replacement of pumps 51 and 52 at water intake and procurement of reserve parts for other pumps			urgent	1 500 000	
10.2.2	- replacement of distributive pipelines, only emergency works			urgent	2 250 000	

This sheet is an eaxample to show how it can be filled up

Definition and Ranking of Measures (Scenarios)

Chapter 5

5. Definition and Ranking of Measures (Scenarios)

5.1 Identification of Measures and Scenarios

5.1.1 Identified Focus Points

As mentioned in Chapter 3, general objectives for the year 2001 and related focus points/problems for the year 1996 have been formulated within each sector. The classification of each focus point (see Table 3.6) in gravities „0" (target situation) until „4" (emergency phase) with separate values within each focus point allows a detailed analysis and verification of the present service level in the sectors of water supply, sanitation and solid waste for each municipality.

When comparing the current situation with the general objectives, 339 **focus points are identified** in total and can be described as follows:

Water Supply

Within the 50 municipalities of the RS there are 34 focus points for **water consumption (A1)**, 17 focus points for the **quality of the water (A2)**, 32 focus points for the **coverage of the water supply network (A3)**, 49 focus points on **water losses (A4)** and 44 focus points on the **operation hours of the water supply system (A5)**. Altogether 176 focus points have been identified in the sector Water Supply.

Sanitation

For the Sanitation sector a total of 66 focus points have been identified of which 45 focus points relate to **damaged sewer systems (B1)**, 5 focus points related **to waste water treatment plants or pumping stations (B2)** and 16 focus points for **potential public health risks (B3)**.

Solid Waste

For the Solid Waste sector there are two focus points possible within each municipality, i.e. **waste collection (C1)** and **status of waste disposal sites (C2)**, which means that the number of focus points within this sector for the whole RS (50 municipalities) can be not higher than 100. When comparing the data collected in the field survey with the objectives, it appeared that there are 97 (!) focus points, which implies that especially in this sector the problems are quite severe.

In conclusion all identified focus points in **water supply** (A1 until A5), **sanitation** (B1 until B3) and **solid waste** (C1, C2) and their related gravity are summarised in Table 5.1 on the following page.

Table 5.1 *Gravity of all focus points*

Sector	No.	Municipality	A: Water Supply					B: Sanitation			C: Solid Waste	
			A 1	A 2	A 3	A 4	**A 5	B 1	B 2	B 3	C 1	C 2
North	1	Banja Luka	3	0	2	3	0	1	0	1	3	2
North	2	Prijedor	2	0	1	3	0	1	0	0	3	2
North	3	Novi Grad	1	0	3	2	2	1	0	0	4	2
North	4	Kozarska Dubica	1	0	3	2	2	1	0	0	2	2
North	5	Gradiska	1	3	2	2	2	1	0	0	3	4
North	6	Laktasi	2	0	1	2	2	1	0	0	2	2
North	7	Celinac	2	0	1	2	2	1	4	0	2	2
North	8	Kotor Varos	3	0	1	2	2	2	0	0	4	2
North	9	Knezevo	0	2	2	3	0	2	0	0	4	3
North	10	Mrkonjic Grad	0	0	0	3	1	2	0	0	4	2
North	11	Sipovo	0	0	2	3	0	3	0	0	4	2
North	12	Kljuc	1	0	4	3	1	2	0	1	4	4
North	13	Petrovac	4	-	-	-	-	0	0	0	4	4
North	14	Doboj	2	0	0	3	1	2	0	0	2	2
North	15	Teslic	0	1	0	2	1	2	0	0	2	3
North	16	Prnjavor	2	3	0	2	1	2	0	0	2	2
North	17	Srbac	3	2	0	3	2	1	0	0	1	3
North	18	Derventa	3	0	0	2	2	2	0	0	4	4
North	19	Srpski Brod	0	3	0	2	1	2	4	0	2	2
North	20	Vukosavlje	3	3	1	1	1	0	0	0	4	4
North	21	Modrica	1	0	1	2	1	1	4	0	2	4
North	22	Samac	0	0	0	2	1	2	0	0	2	4
North	23	Bijeljina	0	0	0	2	2	0	0	3	4	4
North	24	Brcko	3	1	0	3	1	2	0	0	4	4
North	25	Lopare	3	2	2	2	3	2	0	3	4	3
North	26	Sekovici	3	0	0	2	1	3	0	2	2	4
South	1	Pale	4	0	2	3	1	2	0	4	4	2
South	2	Novo Sarajevo	1	2	2	2	1	2	0	3	4	2
South	3	Ilidza	4	2	2	2	3	2	0	2	2	4
South	4	Srpsko Gorazde	0	0	4	3	0	0	0	0	3	4
South	5	Han Pijesak	3	0	2	3	1	2	0	0	0	2
South	6	Sokolac	3	0	3	2	1	2	0	0	0	2
South	7	Rogatica	3	3	0	2	1	1	0	0	4	2
South	8	Visegrad	2	0	1	3	2	2	0	1	3	4
South	9	Rudo	2	0	0	1	1	1	0	0	2	4
South	10	Cajnice	2	2	2	3	1	2	0	1	3	2
South	11	Trebinje	0	0	0	3	1	2	4	1	3	2
South	12	Nevesinje	0	0	2	2	1	1	0	1	2	3
South	13	Ljubinje	1	0	1	3	1	0	0	0	4	2
South	14	Bileca	2	3	2	3	1	2	0	2	2	2
South	15	Gacko	2	0	1	2	1	2	0	0	2	4
South	16	Srbinje	3	0	2	3	1	2	0	0	2	4
South	17	Kalinovik	1	0	1	2	1	3	0	0	4	2
South	18	Trnovo	2	0	1	2	1	2	0	0	4	2
South	19	Ugljevik	2	0	0	2	1	1	0	0	2	2
South	20	Zvornik	3	2	0	2	1	2	0	0	3	3
South	21	Bratunac	3	1	1	3	1	2	0	2	4	2
South	22	Vlasenica	1	0	0	2	1	2	0	0	0	2
South	23	Srebrenica	4	4	2	2	3	2	0	1	4	2
South	24	Milici	1	0	2	2	1	1	2	1	4	2

5.1.2 Elaboration of Questionnaires

As mentioned in the introduction, much of the pre-war data is not relevant any longer and in many cases technical documentation is not available. An intensive field survey for data collection has been carried out within six weeks during August 1996 and September 1996. The data collection was based on interviews with the local representatives of municipal authorities. Where necessary, additional information has been sampled from the authorities and used for the elaboration of measures. Where data was obviously erroneous or did not fit with expected figures when checked, further information was obtained from the municipality (or the municipality was revisited by the surveyor). In this way, the data collected reflects the shortcomings existing in the different sectors and the measures proposed are representative to rectify the deficiencies in the systems. However, due to the limited time for the field survey, a detailed verification of the collected data was not executed. However the gathered data gives in general detailed information about the present service level and the shortcomings.

5.1.3 Definition of Measures

5.1.3.1 General

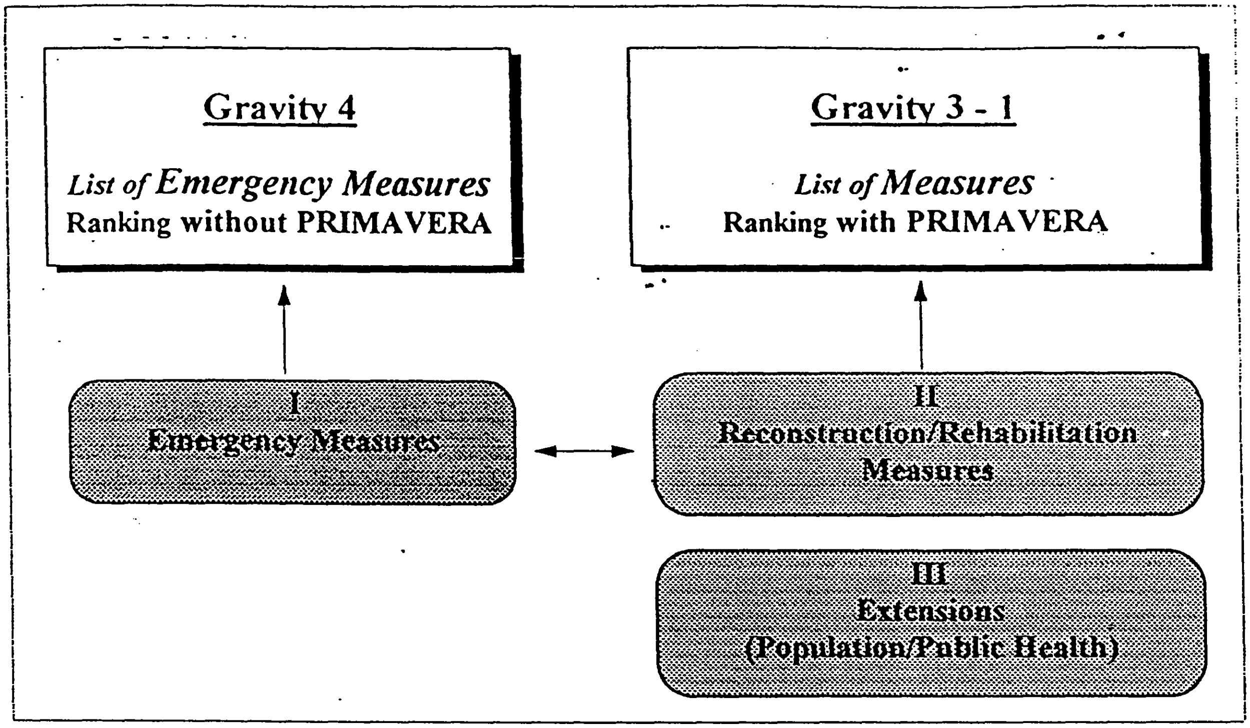
As described in Chapter 4, focus points (and the related gravity) have been identified and have been analysed in each sector. To improve the present service level **economic and practical (feasible) measures** should be proposed accordingly. In order to get a priority list and to facilitate the decision making process for financing, the proposed measures will be ranked by PRIMAVERA.

In accordance with the present classification/gravity, the measures can be distinguished in general between (see Figure 5.1):

- **I: Emergency Measures**
- **II: Reconstruction and Rehabilitation Measures**
- **III: Extensions**

The meaning of the several measures will be discussed in the next chapters.

Figure 5.1 Definition of measures



Based on this methodology, all proposed measures are summarised and are described in detail in „project-sheets" for each sector (water supply, sanitation and solid waste) and each municipality in Volume II (measures).

Each measure is described by the following items:

- **code of the measure (i.e. linked with code of municipality)**
- **title of the measure (headline)**
- **justification of the measure (short description)**
- **technical specifications**
- **costs of investment**
- **time of execution**
- **focus point**
- **gravity**
- **scope (population)**

5.1.3.2 Emergency Measures

As mentioned in Chapter 3.4, an **emergency phase** is identified in case of gravity „4" within any focus point. The proposed measure (emergency measure) must solve this critical situation, i.e. bringing the gravity from „4" to a lower number. Emergency measures are all equally important and thus they need not to ranked. Emergency measures focus mainly on short-term objectives and will be mainly related to the prevention of health risks.

The characteristics of all emergency measures can be described as follows:

- **Emergency measures should be executed immediately**
- **Emergency measures should be implemented within a short time (in general less than six months)**
- **Emergency measures should be economic and practical**
- **Emergency measures should fit into any proposed mid and long-term development programmes**

As described in Figure 5.1, emergency measures could also be a reconstruction/rehabilitation measure of existing facilities or/and any kind of extension of present systems.

5.1.3.3 Reconstruction and Rehabilitation Measures

As mentioned in Chapter 3.4 a **reconstruction and rehabilitation phase** is identified in case of gravity „3" (serious problem), gravity „2" (moderate problem) and gravity „1" (slight problem) within any focus point. The proposed measure must solve this situation, i.e. bringing the gravity to a lower number. Implementation of the reconstruction and rehabilitation measures aims mainly to achieve the pre-war service level. These measures are not equally important and thus they will ranked by PRIMAVERA within each sector separately. In Table 3.7 the related prerequisites, administrative and social appreciation evaluation factors were given.

The characteristics of reconstruction and rehabilitation measures can be described as follows:

- **To achieve a high effectiveness the measures should be implemented within the 3-year period (short and medium term measures)**
- **Measures should be economical and practical**
- **Measures should fit into a long-term development programme and for instance bring it beyond the target level**

5.1.3.4 Extensions

The sudden increase of the number of inhabitants (presence of refugees) has lead to significant problems for several municipalities and thus the present infrastructure is not able to meet even the most basic needs in the sectors of water supply, sanitation and solid waste. Especially collection and transport of solid waste has more or less collapsed in all municipalities of the post-war RS and the disposal has become a major problem. Reliability and quality of the urban services are characterised by significant operational inefficiencies and this has resulted in huge number of uncontrolled temporary sites within urban areas and the adjacent environs. Septic tanks are widely in use and were not maintained. Sewer systems were not cleaned during the war. Water supply networks are not continuously able to meet the water demand and with a sufficient pressure and quality.

As shown in Figure 5.1 in any case of potential public health risk or large increase of population (presence of refugees) **measures for extension** or **construction of new facilities** are necessary. These measures are not equally important and thus they will ranked by PRIMAVERA within each sector separately. All measures can be characterised as mentioned in Chapter 5.1.3.3.

For 25 out of the 50 municipalities. Master Plans for Water Supply were made during the past year by Zavod za Vodoprivredu and IMG. The projects formulated in these master plans were also screened on their effectiveness to improve the present situation and a selection of appropriate measures was thus made.

5.1.4 Definition of Scenarios

5.1.4.1 Scenario 1: Listing of Emergency Measures

The effects of the war, especially the massive migration of population have resulted in major problems in the supply of water, sanitation services and solid waste management. Based on focus points, emergency measures for water supply (see Chapter 5.2.2), sanitation (see Chapter 5.3.2) and solid waste (see Chapter 5.4.2) have been identified.

> ➲ **Scenario 1 describes emergency measures within each sector which should be executed immediately.** As mentioned in Chapter 5.1.2.2. emergency measure are all equally important and thus they will not ranked by PRIMAVERA.

In accordance with the different nature of each sector, the proposed emergency measures related with cost of investment and time of implementation have been listed for each sector separately, i.e. emergency measures for water supply are not comparable or equivalent with emergency measures from another sector (e.g. solid waste). Most of the emergency measures are proposed for the sector solid waste.

5.1.4.2 Scenario 2: Ranking of Measures

Apart from the emergency measures, all proposed measures concerning rehabilitation/reconstruction and extensions have been ranked by the multi-criteria computer program **PRIMAVERA**. Because of the different nature of each sector, the ranking has been executed in each sector separately, i.e. water supply projects are not comparable with solid waste projects. For the ranking, costs of investment (annual costs), time to effect, gravity, effectiveness of the measure, scope (population) and support aspects (e.g. war damages) are taken into account (see Chapter 3).

> ➲ The result is a **priority list** of all measures within the related sector (clustering of measures) and funds can be given for particular measures in the different sectors or to particular municipalities. Each measure describes a „**micro-project**" (see also chapter 5.1.4.3) and can be executed individually, i.e. is in general not linked with another measure.

Due to lack of maintenance and lack of governmental funds during the war, measures have been proposed for **procurement of spare parts and tools** (basic equipment) for each municipality in the sectors of water supply and is combined into a nation-wide programme. These measures are not comparable with measures for construction works and are not linked with a focus point. However, spare parts and tools are essential for the daily operation and maintenance. These measures are necessary and are not ranked with PRIMAVERA.

Cleaning and inspection of the sewer system is to be set-up as a nation-wide effort. Measures for **cleaning and inspection** are not linked with a focus point. To get a clear picture about the condition of a sewer system, cleaning and inspection must be carried out at first. These measures are necessary and are not ranked with PRIMAVERA.

5.1.4.3 Scenario 3: Ranking of Municipalities

To improve the current situation and to reach the target situation within a municipality and within a sector (e.g. water supply), all proposed measures should be implemented. The total of all emergency measures, reconstruction/rehabilitation measures and measures for extension per sector are combined to one project and are ranked by PRIMAVERA. Costs of investment (annual costs), time to effect, gravity, effectiveness of the measure, scope (population) and support aspects (e.g. war damage) are taken into account (see Chapter 3).

➲ The result is a **priority list** of municipalities for each sector (clustering on geographical basis) and funds can be given selectively for a municipality. The total of measures are combined to a „**macro-project**" (see also Chapter 5.1.4.2).

5.2 Water Supply

5.2.1 Description of Adopted Key-Parameters

The present situation concerning the water supply services in the various towns in the RS has been described in Section 4.2 of this report. For the assessment of the seriousness of the situation in each of the towns, five parameters - or focus points - have been distinguished as follows:

A1 **water available for consumption**
A2 **quality of the water**
A3 **coverage with water supply networks**
A4 **water losses**
A5 **operation of the water supply systems**

For each focus point the seriousness - or gravity - of the situation was defined as shown in Table 3.6. and labelled with numbers. By applying this standardised definition of gravities in all municipalities, a comparison between the several municipalities is possible.

As mentioned in Chapter 3.4, gravity „0" is defined as the target situation to be achieved in the year 2001. It must be realised that in some cases, the achievement of this target would mean an improvement when compared to the pre-war situation. In terms of gravity, some parameters would have been rated with a „1" or „2" before the war.

In the assessment of the current situation and the definition of the effectiveness of proposed water supply measures, the parameters have been applied as follows:

A1 **water available for consumption**

To assess the current situation in terms of availability of water the quantities available for the population have been used. This means that the present unaccounted-for-water (UFW) water percentages have been subtracted from the quantities supplied into the network. As mentioned in

Chapter 3.5, the present number of inhabitants who have access to the system has been used. To achieve the targeted situation the desired UFW figure (less than 25 %) and coverage level (more than 90 %) have been taken into account.

Additionally the following points have been considered:

- **in case the population has increased drastically due to the influx of refugees, the post-war population is taken into account (because of uncertainties regarding demographic developments).**
- **UNHCR priority target areas for return of refugees**
- **for industrial water consumption the pre-war levels have been used.**

A2 quality of the water

Initially one level of gravity was defined: gravity '4' representing bacteriological unsafe water. While making the assessments it was considered appropriate to define a variation in gravities in order to distinguish between immediate dangers (i.e. the water is certainly polluted; gravity „4") and risk (i.e. a possibility that the water may become polluted, gravity „3" until „1").

A3 coverage with water supply networks

The target of more than 90 % coverage was applied to all urban areas. In cases with a coverage lower than 90 %, extensions of the water supply systems have been proposed. In a few cases this target was not applied where it involved settlements with a rural character. Examples are *Srpsko Gorazde* and *Petrovac*, which are villages that became capitals of newly formed municipalities after the war. The settlements are hardly urbanised and the need for piped water supply systems are therefore less urgent.

A4 water losses

Water losses in the network is only a part of the total unaccounted-for-water (UFW). To reduce physical water leakage, technical intervention is necessary. The need for a concentrated effort to reduce leakage is apparent and applies to virtually all towns. Other components of UFW - such as low billing rates - and administrative errors require non-technical measures. The non-technical measures are not included in the programme. However, upgrading of the systems by leakage surveys and rehabilitation is the first action to be taken and should be seen as a nation-wide effort. A decreasing of UFW means in general an increasing of availability of water and will solve in many cases the problems of water supply in several municipalities. Therefore a leak reduction programme for the entire RS with a total amount of DEM 23.8 Mill has been proposed (see Volume II, part IV).

A5 operation of the water supply systems

The target is to maintain continuous pressure in the distribution network, mainly to prevent ground water entering into the pipes. A good operation of the supply system also implies that water can be supplied in sufficient quantities during peak-demand hours. This means that sufficient storage capacity in the system is required.

For the daily operation and maintenance basic equipment (spare parts and tools) is essential. In many of the towns much of the equipment, transportation, tools and spare parts have been destroyed or was removed during the war. The remaining equipment is generally in a very poor condition. Therefore a programme for procurement of equipment and tools for the entire RS with a total amount of DEM 5.11 Mill (Level 1) and DEM 6.49 Mill. (level 2) has been proposed (see Volume II, Part IV).

5.2.2 Scenario 1: Listing of Emergency Measures

In the following Table 5.2, all Emergency Measures in the sector for Water Supply are summarised. As mentioned in Chapter 5.1.3.2, emergency measures are all equally important and should be executed. They are not ranked by PRIMAVERA.

Table 5.2 Emergency Measures for Water Supply

Code	Municipality	Description	Costs of Investment [in Mill. DEM]
N-12	Kljuc	Expansion of Water Supply System	1.50
N-13	Petrovac	Feasibility Study	0.10
S-01	Pale	Construction of Pipeline	3.70
S-03	Ilidza	Construction of Transmission Mains	2.19
S-04	Srpsko Gorazde	Feasibility Study on Extension of Network	0.10
S-23	Srebrenica	Emergency Measures	2.15
		Total:	**9.74**

The total costs of all emergency measures are estimated up to DEM 9.74 Mill. A description of each measure is given in Volume II in the respective chapter (municipality).

5.2.3 Scenario 2: Ranking of Measures

In the following Tables 5.3 until 5.7, all measures concerning reconstruction/rehabilitation, extension and the UFW-programme for water supply are summarised (in total 149 measures) and are ranked according to the PRIMAVERA prioritisation. In Chapter 3.6, the prerequisites, administrative and social appreciation evaluation factors are given.

The total costs are estimated up to DEM 94.07 Mill. (excluding emergency measures).

A detailed description of each measure is given in Volume II (Part I and Part II) in the respective chapter (municipality). Each measure is combined with the code of the municipality and the number of the measure.

Table 5.3: Ranking of Measures in WATER SUPPLY (excluding Emergency Measures); Rank 1 until 30

MEASURES				RENTABILITY	PRE-REQ.	TIME TO EFFECT	APPRECIATION ADMIN	APPRECIATION SOCIAL	FINAL PRIORITY
No.	Code	Description	Investment costs [in DEM]	(Cost-effectiveness) [-]	PR	TE	AA	SA	
1	S03_AI-2	spare parts for pumping equipment, Ilidza	25.000	6,9	0	2	1	2	87
2	S23_AI-2	repair of existing reservoirs, Srebrenica	900.000	6,1	0	2	1	2	86
3	S23_AI-3	repair of the distribution network, Srebrenica	170.000	6,1	0	1	1	2	84
4	S21_AI-2	pumping and chlorination equipment, Bratunac	130.000	6,1	-1	2	1	2	84
5	S03_AII-1	extension of distribution network Dobrinja I, Ilidza	65.000	6,1	0	1	1	2	84
6	S01_AI-2	replacement of distribution pipelines, Pale	220.000	5,9	-1	2	1	2	84
7	S03_AI-3	completion reservoir G.Kotorac and distribution system Kasindo, Ilidza	2.650.000	5,6	0	1	1	2	83
8	S02_AI-3	rehabilitation of source works and treatment plant Tilava, Novo Sarnjevo	530.000	5,8	0	2	1	1	83
9	N23_AI-2	transformer station and supply of pumps, Bijeljina	250.000	5,4	-1	2	1	2	83
10	S07_AI-4	protection of sources + installation of chlorination equipment, Rogatica	800.000	6,9	0	2	0	1	82
11	S01_AII-1	completion of w.s.s.Pribanj, Pale	460.000	6,1	-1	1	1	2	81
12	S10_AI-3	rehabilitation source works, Cajnice	150.000	4,2	-1	2	1	2	81
13	S10_AII-1	completion of reservoirs Novi Kasarne and Braha, Cajnice	560.000	5,4	-1	1	1	2	80
14	S10_AII-2	extension of distribution network, Cajnice	700.000	5,4	-1	1	1	2	80
15	S07_AI-3	rehabilitation of transmission main Seljani-Podluni, Rogatica	400.000	6,3	0	2	0	1	80
16	N03_AI-2	rehabilitation of production wells, Novi Grad	330.000	6,1	0	2	1	0	80
17	S02_AI-2	spare parts for pumping stations, Novo Sarajevo	100.000	4,2	0	2	1	1	79
18	S10_AI-2	supply of pumping equipment, Cajnice	50.000	3,1	-1	2	1	2	79
19	S21_AII-1	expansion of source capacity Bjelovac, Bratunac	1.500.000	5,6	-1	0	1	2	78
20	S02_AII-1	extension distribution network Dobrinja IV and D.Mladice, Novo Sarajevo	830.000	5,4	0	1	1	1	78
21	N01_AI-2	supply and installation of pumping equipment, Banja Luka	1.500.000	5,4	-1	2	1	1	78
22	S01_AII-2	construction reservoir Pale I, Pale	800.000	3,7	-1	1	1	2	78
23	S14_AI-2	rehabilitation of water intake works and treatment plant, Bileca	700.000	4,9	-1	2	1	1	77
24	S06_AII-1	extension of source capacity Biostica, Sokolac	800.000	6,9	-1	1	1	1	77
25	N23_AII-1	construction of reservoir, Bijeljina	1.800.000	4,2	-1	0	1	2	76
26	S23_AIII-1	UFW programme, leak detection and repair, Srebrenica	400.000	3,7	0	-1	1	2	76
27	S21_AII-2	replacement and expansion of distribution system, Bratunac	1.300.000	3,7	-1	0	1	2	76
28	S07_AI-2	spare parts for pumping station Grad, Rogatica	50.000	4.9	0	2	0	1	75
29	N14_AI-2	reconstruction of w.s.s., Doboj	350.000	4,9	0	2	1	0	75
30	N24_AII-1	construction of new wells, Brcko	400.000	6,9	0	1	1	0	75