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NEPAL
WATER SUPPLY AND SANITATION SECTOR STUDY

REPORT

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WATER SUPPLY AND SANITATION

SECTOR STUDY

REPORT

Pre-Investment Planning Unit, Division of Environmental Health, WHO
Public Utilities Projects Division - IBRD/IDA

1977

CURRENCY EQUIVALENTS

March 1977

1 US dollar	=	12.54 Nepalese Rupees (Rs)
1 Rupee	=	0.08 US dollars
1 million Rs	=	79,745 US dollars
1 Rupee	=	100 Paisa

Note: The current exchange rate dates from 9 October 1975. The previous rate was US\$ 1.00 = Rs 10.56. All relevant data in this report have been converted at the new exchange rate, unless otherwise stated.

MEASURES AND EQUIVALENTS

l	=	Litre (1 litre = 0.26 US gallons)
l/cd	=	Litre per capita per day
m ³	=	Cubic metre or 1,000 litres (1,000 litres = 264 US gallons)
l/sec	=	Litre per second (0.035 cubic feet per second)
mm	=	Millimetre (0.03937 inch)
m	=	Metre (3.28 feet)
km	=	Kilometre (0.62 miles)
ha	=	Hectare (10,000 square metres or 2.47 acres)

ABBREVIATIONS

HMG	-	His Majesty's Government of Nepal
MWP	-	Ministry of Water and Power
MHP	-	Ministry of Home and Panchayat
MH	-	Ministry of Health
NPC	-	National Planning Commission
WSSB	-	Water Supply and Sewerage Board
DWSS	-	Department of Water Supplies and Sewerage
LDD	-	Remote Area and Local Development Department
DHS	-	Department of Health Services
NP	-	Nagar Panchayat (Town Council)
GP	-	Gram Panchayat (Village Council)
CDO	-	Chief District Officer
EI	-	Engineering Institute
IM	-	Institute of Medicine
NTD	-	National Trade Limited
NTC	-	National Transport Corporation
WHO	-	World Health Organization
WHO/	-	World Health Organization/South East
SEARO		Asia Regional Office
IBRD	-	International Bank for Reconstruction and Development
UNICEF/	-	United Nations International Children's Emergency Fund/
SCARO		South East Central Asia Regional Office
UNDP	-	United Nations Development Programme

CALENDAR & FISCAL YEAR

July 16 to July 15

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I. SUMMARY AND MAIN RECOMMENDATIONS

Introduction

1.01 This report contains the analysis and conclusions of a WHO/IBRD Cooperative Programme mission that visited Nepal from 22 September to 10 October 1975^{1/}. A draft of this report was discussed with the Government during 27 - 30 April 1976 and served to establish Government's final position as regards the main recommendations, to review and update factual information and to determine potential follow-up.

Population and Economy

1.02 Nepal belongs to the Least Developed Countries with 1975 per capita income estimated at US\$ 110. The country is handicapped by being landlocked and 80% mountainous. The 1975 population is approximately 12.6 million. Annual growth of GDP has been about 2.5%, similar to population growth. Close to 12 million live from agriculture in some 28 000 scattered communities administered by over 3 900 village councils (gram panchayats). Poor transport and communication facilities render many remote areas virtually inaccessible. Increasing food deficits in the hilly regions have induced seasonal and permanent migration to the valleys, towns and Southern Terai plains. 50% of the urban population of over 600 000 is concentrated in Kathmandu Valley. There are 16 officially established towns (nager panchayats) and another 8 communities with some urban characteristics (more than 10 000 inhabitants).

Water Resources

1.03 Water resources are often plentiful but have hardly been explored. There is much variety by geographic areas (Annex 5). Four major rivers, all tributaries of the Ganges in India, and five secondary perennial rivers plus a large number of seasonal rivers constitute the main sources. Springs and small streams provide for community needs in the high mountains and the midlands. In some parts of Western Nepal, surface and groundwater are insufficient for people and cattle during the dry season so that there is a need to impound rain water. Systematic groundwater exploration has only been undertaken in parts of Kathmandu Valley and the Terai. Preliminary observations show that shallow groundwater can be found all over the densely populated central and southern parts of the Terai. Concerted action is needed to survey and identify water resources for judicious and economical use of all water needs in the country.

Sector Organization

1.04 Responsibility for water supply/sewerage is divided between the Ministry of Water and Power (MWP) and the Ministry of Home and Panchayat (MHP). In addition the Ministry of Health is concerned with urban waste disposal and rural sanitation including the installation of pilot latrines. Delineation of responsibility between the various organizations is not always precise.

1.05 Within MWP, the Department of Water Supplies and Sewerage (DWSS) is responsible for design, construction and supervision of water supplies in urban communities, zonal and district headquarters and rural communities with initial population over 3 000, and for providing sewerage facilities in the urban centres. The Department also operates and maintains 38 schemes which local town or village Councils did not take over as intended because of lack of funds and expertise.

^{1/} Participated in the mission's work:
E. Becher, D. Sieber, WHO/PIP Geneva;
S. Radojicic, UNICEF/SCARO;
I. Iheme, UNDP trainee;
N. Saravanapavanathan, H.S. Suphi, WHO Country Engineers.

1.06 Also under MWP, the Water Supply and Sewerage Board (WSSB) is responsible for the construction and operation of water supply and sewerage projects supported by IBRD/IDA in Kathmandu Valley and the town of Pokhara. The Board seeks corporate autonomy on a national basis by developing the financial viability of its existing and future urban schemes.

1.07 Within MHP, the Remote Area and Local Development Department (LDD) is responsible through the evolving district administration and planning network, for assisting small communities with initial population under 3 000 in public works including water supply and wherever possible, sanitation. Village Councils are in charge of operation and maintenance.

Rural Service Levels

1.08 Probably close to 600 000 or 5% of the rural people have access to safe water often at a considerable distance requiring steep climbs. Of these, one third are served by now over 100 public schemes, mostly simple gravity systems with a few standpipes. More than half of these schemes have been built since 1972 with UNICEF/WHO support. Rural sanitation is in its early stages in selected areas as part of integrated development projects. Many communities draw their water from contaminated sources.

Urban Service Situation

1.09 Over 500 000 or 85% of the urban population has access to safe water mostly through public standpipes. The supply systems, however, are inadequate because of deficiencies in source, storage and/or distribution. Waterborne sanitation is a recent innovation. A small combined sewerage system serves part of the old city of Kathmandu. Elsewhere, waterborne sanitation is limited to septic tanks serving hospitals, government buildings, hotels and a few new private houses. Most of the urban areas are served by surface drains which also receive domestic waste water. Solid waste removal exists in organized form only for parts of Kathmandu. Defecation and dumping of solid wastes into water courses cause local water pollution problems.

Public Health

1.10 The public health status related to water supply and sanitation gives rise to concern, even though only spot records from hospitals are available to highlight the widespread incidence of parasitic diseases. Dysentery, gastroenteritis, hookworm and roundworm infestation are common throughout the country. There is also a noticeable incidence of cholera. Malaria after reaching a low in 1972, is again on the rise. Preventive public health measures in the form of regular water quality control are, due to lack of facilities and trained staff, presently undertaken only in the capital and in Pokhara. The public is ill informed of the potential dangers to health from insanitary living conditions.

Water Charges

1.11 Rural standpipe users do not pay charges, but contributions in the form of labour, materials or cash may be raised within the community as and when required. The Water Tax Act (1966) sets uniform tariffs and connection fees for all systems owned and operated by Government through DWSS. The Town Council Act (1962) empowers the Councils which operate systems to charge their own rates. As separate accounts for revenue and expenditure are not maintained, it is not possible to assess the financial situation. The supply systems managed by WSSB for Greater Kathmandu, Bhaktapur and Pokhara operate commercially with encouraging results. The Board's tariff schedule in Kathmandu is Rs 9 per month for the smallest unmetered connections compared to Rs 5 elsewhere and as applied by DWSS. The Board also charges Government Rs 100 per month for each public standpipe.

Sector Finance

1.12 Close to Rs 100 million (US\$ 8 million) in current terms were spent on water supply development over the 1970-1975 Fourth Plan in about equal proportion from internal and external sources. There has been little capital outlay for sanitation or sewerage. The share of rural schemes in total expenditure had risen to two thirds by mid 1976, partly because of the creation of LDD in 1972 and additional support through UNICEF. The lion's share of external finance for urban schemes has come from IBRD/IDA, smaller contributions being made by India and the Federal Republic of Germany including a sewerage/sanitation component. Compared to budget allocations, there has been a considerable degree of under-spending by DWSS on both rural and urban schemes, indication that finance has not been the foremost constraint in sector development.

Planning

1.13 The National Planning Commission (NPC) is in charge of development plan formulation and for the allocation of required funds between the sector agencies. The Fifth Plan (1975-1980) sector allocation amounts to between Rs 217 and 248 million (US\$ 17 to 20 million) depending on whether a 4% or 5% annual GDP growth is assumed. This allocation corresponds to about 3.5% of planned spending in the public sector compared to 1.5% in the previous plan. In terms of planned expenditure for social services, the sector obtains 15% compared to 12% during the previous plan. Actual GDP growth has, however, been less than half the target rate. About 500 000 people, in about equal proportion in urban and rural areas, obtained new or improved service during 1970-1975. Even the lower alternative Fifth Plan allocation is unlikely to be effectively spent.

Sector Targets

1.14 The drinking water and sewerage master plan project for Greater Kathmandu and Pokhara under WSSB and 19 carry over projects from the previous plan for which DWSS is in charge take up a substantial part of the total resources earmarked for the sector. Between 72 and 90 new drinking water projects for urban communities under DWSS and 525 rural schemes constitute the remainder of the programme. Sector targets are expressed in terms of additional drinking water to be made available per day from all projects. By implication, it is expected to extend new or improved service to about one million people in 1980, whereas population will grow by 1,7 million. The total number of people not served will consequently increase, unless the current programme is accelerated or expanded.

Principal Constraints

1.15 The principal constraints pervading the sector and likely to impede full implementation of the current plan, not to mention an accelerated programme, stem from institutional fragmentation, staff shortages and maldistribution, difficulties in obtaining materials and delivering them in a timely manner to project sites, and insufficient cooperation on the part of many local councils who are unwilling to take over responsibility for schemes and so free some of the scarce manpower at central agency level for planning, design and construction supervision.

The main recommendations may be summarized as follows:

Organization

1.16 The mission had recommended a reduction in the number of agencies active in the sector and had outlined alternatives for functional amalgamation in the draft report discussed with Government in April 1976. The sector agencies concerned held a series of meetings on the question of future sector organization during the summer of 1976 and agreed to continue with the present set up. It was felt that towards the end of the Fifth Plan, a joint evaluation of the performance of sector agencies could be carried out to serve as a guide for possible institutional reform.

1.17 It is recommended that this evaluation exercise should be undertaken jointly with WHO and UNICEF during 1979 so that Government decisions on sector reform can be prepared in time for the beginning of the next planning cycle in July 1980.

1.18 Meanwhile, coordination between sector agencies and between these and external assistance agencies should be strengthened by holding regular programme review meetings. Also, steps to improve the internal functional efficiency of agencies should be taken: in DWSS by setting up an investigation and design section, starting in-service training for junior engineers, introducing better financial and management procedures and improving stores management. In LDD, by setting up a separate water supply section, strengthening the field organization and establishing better recording procedures. WSSB's planned transformation within the current Five-Year Plan into a financially autonomous corporation with regional centres would be an important step forward in the development of the sector.

Planning

1.19 In line with the deferred decision on a future organizational structure, the work programmes of the existing agencies should continue to the end of the current plan period. It is however, recommended that the programme be expanded by giving more emphasis to groundwater exploration and development in the Terai as outlined in detail in Annex 5, which summarizes the UNICEF hydrogeologist's contribution to the sector mission. Implementation of this programme will mainly fall upon LDD with cooperation from DWSS. It is estimated that 800 000 more people could be supplied from this sub-programme as it expands up to 1980. Preliminary estimates of the funds required suggest a figure of Rs 40 million (US\$ 3 million). While not in Government's priority area for sector development, the suggested programme would be a relatively cheap way to catch up with population growth.

1.20 Government wants a study to be made to define desirable medium range goals for the sector and it is therefore recommended that this task be undertaken by WHO/SEARO, with possible backstopping from the Cooperative Programme in follow-up to the WHO project formulation exercise and to the Cooperative Programme sector mission. This would include studying the implications of the WHO regional water supply and sanitation targets for 1980 as revised by the World Health Assembly in 1976 and as they relate to Nepal.

Financing

1.21 A study should be made of the level and structure of tariffs required to make schemes presently run by DWSS on behalf of Panchayats self supporting. New schemes should be subjected to strict financial and socio-economic analysis in addition to technical feasibility. Possibilities for cross subsidization formulas should be explored with regard to the ability of the poorer community strata to pay for service.

Manpower Development

1.22 Since the shortage of trained manpower is the most important factor inhibiting sector development, it is recommended that joint training programmes be undertaken by the sector agencies, in collaboration with Nepalese Training Engineering Institutes supported by WHO and educators; bilaterals for managerial and financial administrative staff, planners, design engineers, overseers and draughtsmen. Refresher and short in-service training courses should be organized with external expertise. A few fellowships for specialized post-graduate training are required. The proportion of permanent staff positions needs to be increased to attract new personnel. Both DWSS and LDD face difficulties in assigning suitable professional and sub-professional staff to construction sites in remote areas. Staff working in the field should be offered extra allowances and experienced overseers should be offered field appointments at the level of assistant engineers. A concentrated training effort is required to enable Local Councils to take over completed water supply schemes from DWSS. There is a dearth of qualified health educators; auxiliary health work including basic health education at the peripheral health facilities or in schools is hardly carried out. Additional training assistance is required to build up the cadre of health workers.

Procurement

1.23 It is recommended that the three sector agencies convene a series of meetings of persons in charge of materials and equipment procurement to establish a common streamlined procurement policy designed to overcome the current cumbersome and costly project-wise approach which is additionally hampered by import quota restrictions, causing long delays in the execution of projects. The National Trading and Transport Corporations should be consulted. Field and research studies to explore the possibilities of substituting local materials for conventional imported ones should find more systematic support.

Public Health

1.24 It is recommended that the Department of Health Services in the Ministry of Health be assisted in launching sanitation and health education programmes which provide, as a first step, latrines in schools and health posts, encourage people to build latrines with local material and inform them about the dangers of contaminating water supplies, better source protection, and the hygienic levels that can be attained when water becomes available in quantities exceeding mere subsistence needs; this programme component should be added to the ongoing health sector programme 1975-1980.

1.25 There is a clear need for more regular and frequent bacteriological tests and for water quality surveillance in general for all water supply systems.

II. COUNTRY AND SECTOR BACKGROUND

Geography and Climate

2.01 The Kingdom of Nepal, a landlocked, mountainous (80% of the area) country, lies on the Southern slopes of the Himalayas, wedged in between India in the South and China to the North; its area is 140 000 km². Climatic conditions vary widely, in relation to the elevation of the country, from tropical (in the Southern Terai plains) to tundra climate (over 3 500). Rainfall is between 1 000 and 1 500 mm/year, and occurs mostly during the monsoon season (June - September).

Water Resources

2.02 Water resources are often plentiful but hardly explored. There is a considerable degree of variety by geographic areas (Annex 5). Four major rivers, all tributaries of the Ganges in India, and five secondary perennial rivers plus a large number of seasonal rivers present the main sources. Springs and small streams provide for community needs in the high mountains and the midlands. In some parts of Western Nepal, surface and groundwater are insufficient for people and cattle during the dry season so that there is a need to collect rain water. Systematic groundwater exploration has only been undertaken in parts of Kathmandu Valley and the Terai. Preliminary observations show that shallow groundwater can be found all over the central and Southern parts of the Terai which are also densely populated.

Population

2.03 The 1975 population is approximately 12.6 million, of which 11.9 million live in rural areas, in about 4 000 Gram Panchayat (rural local council) areas, each constituted of several wards (up to 9). It is estimated that there are about 28 000 villages and clusters of houses. While 60% of the rural population continue to live in the hilly regions on only 35% of the cultivated land, there has been an increase in migration to the Southern plains, both seasonal and permanent, following the reduction of the incidence of malaria. HMG is promoting these movements by resettlement schemes. The urban population of 630 000 lives in 16 established towns plus 8 communities with urban characteristics (more than 10 000 inhabitants). Approximately 50% of the urban population lives in Kathmandu Valley; major towns outside the capital area are Biratnagar (45 000), Birganj (15 000), Pokhara (36 000), Nepalganj (25 000) and Dharan (22 000). Urban growth is about 6% per year, while the overall growth rate is 2.5%/year (2.7% in the Terai and 0.9% in the mountains).

Economy

2.04 The economy is dominated by agriculture, which accounts for over two-thirds of GNP. In the hills and mountains, small sized family holdings (average 0.8 ha) prevail with precarious subsistence farming and animal husbandry, while in the low-lands there is good development potential for raising food crops and cashcrops on irrigated land. Industry is only beginning, a 60 000 tons/year cement plant is the major venture; tourism has become a source of income and employment, stimulating the hotel industry, related services and artisan trade. There is good potential to develop and export hydroelectric power, but so far no major projects have been undertaken. 80% of external trade is with India, and third country imports and exports must all go through the congested port of Calcutta, causing severe losses to the national economy. GNP in 1973-1976 is estimated at close to Rs 17.5 million (US\$ 1.4 million) implying a per capita income of US\$ 110. Annual growth has been about 2.5%; equal to population growth. Inflation rates are similar to India, with 16 to 25% in 1973 and 1974, but down to less than 10% in 1975 and since.

Infrastructure

2.05 The modern transport system, some 2 000 km of all-weather roads, mostly in the East-West sense, contrasts with some 10 000 km of porter trails. The country remains fragmented in the absence of a national network of tele-and postal communication facilities. Railway connections exist with India in Birganj and Ianakpur (narrow gauge). Air service assures most connections with abroad and between regional centres. The emphasis has shifted to develop North-South routes between the hills and the Terai to stimulate exchange between the complementary regional economies.

Administration

2.06 The country has a unitary system of administration and is divided into 4 development regions, 14 zonal administrations and 75 districts further subdivided into 3 916 rural units (Gram Panchayat) and 16 urban ones (Nagar Panchayat). With the new policy of decentralization the focal point for classic administration functions and development planning is the District Administration Office headed by the Chief District Officer (CDO). He carries out the decisions of the District Council (Panchayat) on decentralized matters such as district development plans and annual budget estimates and reports to the Ministry of Home and Panchayat on all central affairs delegated to him. Functions of existing district offices of central ministries are to be merged into the District Secretariat to form its various divisions. Ministries and departments are to transfer funds required for district-level projects to the district secretariat with two Divisions, for Development and Law and Order. The former consists of three basic units, namely public works; development and social services; and procurement, stores and supply. The regional administration is more concerned with supervision, control and evaluation than with executive functions. There will be four Regional Development Centres to harmonize and screen district plans and report quarterly to the Ministry of Home and Panchayat on performance (Annex 14).

Planning

2.07 Four five year plans have been implemented, and the Fifth Plan has actually started, in July 1975. Since 1972, the National Planning Commission (NPC) has been charged with plan formulation, implementation, evaluation, resource budgeting and economic research within guidelines drawn-up by the National Development Council under the Chairmanship of HM the King. Past investments went mainly into basic transport infrastructure and institution building. Social improvements favoured the more accessible parts of the country.

2.08 The Fifth Plan (1975-1980) foresees public sector outlays of Rs 6.17 billion (US\$ 494 million) under the minimum programme assuming average annual growth of 4%. Under the maximum programme, based on a 5% annual growth, total outlays would rise to Rs 7.55 billion (US\$ 604 million). Sector allocations are distributed in terms of total public outlays as follows: 30% for agriculture, 21% for industry and power, 24% for transport, and 24% for social services. The latter item includes drinking water and sanitation for which in absolute amounts between Rs 217 million (minimum programme) and Rs 248 million (maximum programme) have been earmarked. This corresponds to about 3.5% of the public sector outlays and to almost 15% of the expenditure planned for social services. The comparatively high priority of the sector becomes apparent when comparing those shares with those at the outset of the previous plan in 1970: 1,5% and 12% respectively. External assistance is expected to amount to 45% of total development spending, compared to over 50% during the last plan. For lack of absorptive capacity, staff shortages, and material delays, a high proportion of projects has been carried over into the current plan, estimated at 30 - 50% of total volume.

Public Health and Education

2.09 Main health problems are the high infant mortality, widespread filth-borne diseases and resurgence of malaria. The incidence of parasitic, water-borne and other common diseases is explained in Annex 6. Dysentery, gastroenteritis, hookworms and roundworms are common throughout the country. There is noticeable incidence of cholera also. To secure basic health services, a para-medical corps and health post network is being established. Primary education reaches now some 35% of school age population. Higher education increased rapidly, with little focus yet on technical or vocational training. There is no adult literacy training (present literacy rate 12%). This complicates health education efforts.

III. SECTOR DEVELOPMENT ANALYSIS

SERVICE LEVELS

3.01 Annex 7 shows the Government agencies active in the sector and summarizes present service levels as estimated by the mission.

Urban Water Supply

3.02 All urban areas have piped water supplies serving about 85% of the population according to mission estimates. There are approximately 20 000 house connections (of which 5 000 are metered) serving 25% of the urban population. The rest of the people have access to the piped system through standposts, but a considerable number still use traditional sources (privately constructed tubewells and dugwells, rivers and other surface or groundwater sources), because of greater convenience.

3.03 All urban systems operate on an intermittent basis, due to shortage of storage and distribution capacity, or to insufficient sources, or both and also because there is a great amount of unaccounted-for-water (estimated to reach up to 75% of production in some cases (due to leakage, wastage and illegal connections). Treatment is provided only in the Kathmandu Valley for the system serving the capital and Lalitpur. Considering these service conditions, no supply can be called entirely safe.

3.04 The water supplies of the established towns situated in the Terai fall into two categories: surface water supplies (Dharan, Hetauda and Butwal) and groundwater supplies (Biratnagar, Rajbiraj, Birganj, Bhairawa and Nepalganj). The towns of the first group lie at the foot of the hills and are supplied from perennial streams; in each case the water intake has been located as to obtain gravity supplies with minimum danger of catchment pollution; the quantity of the water of all supplies is limited. Adequate alternative river sources would be available, but water would have to be pumped from river intakes and require full treatment. Towns of the second group receive water from underground sources and are situated near the Indian border; these systems have proved inadequate both in terms of source and service reservoir capacity.

3.05 Of the remaining towns, Kathmandu is supplied from fully treated surface sources. There is at present an adequate amount of water going into this system, but due to leakage and wastage on a massive scale, supply is by zones and must be restricted to four to six hours per day. For Lalitpur, the main source are three springs which during the dry season produce only 26 litres per capita per day. A small scheme was added in 1971, pumping and treating water from Bagmati river; this increased the supply by a further 15 litres per capita per day. The quantity now available is therefore only enough for a supply by standposts. Bhaktapur's source is a perennial stream with a minimum reliable yield of 72 litres per capita per day. As the stream is also used for irrigation purposes, there exists a continuous dispute about water allocation. The source for Pokhara is inadequate during the dry season and liable to pollution in its catchment area; the same is true for Tansen. In Illam a new water supply scheme was completed by the end of 1973.

Rural Water Supply

3.06 Less than 5% of the rural population has at present access to safe water. By now over 100 public systems were constructed by the Department of Water Supplies and Sewerage (DWSS)^{1/}, the Local Development Department (LDD) and the Government of India (through the Indian

^{1/} And its predecessor the Water Supply and Irrigation Department

Cooperation Mission (ICM)). The rest of the rural people take water from springs, rivers or tubewells (privately constructed) or dugwells. Even though some of the springs in the higher mountain areas might be considered safe, water taken from these sources is subject to secondary contamination. Also, because of long walking distances and sometimes excessive climbs, people use only the absolute minimum amount of water necessary for subsistence (including for domestic animals).

3.07 At various times, attempts were made to start rural water supply projects in the Terai. Smaller communities were to have shallow tubewells equipped with handpumps, while larger ones would be supplied from deep wells with motor pumps and water would be pipe distributed; wherever possible artesian groundwater would be used. LDD has started a pilot project in Bara district where health posts have recently been provided under a separate WHO/UNICEF supported project. Arrangements are underway to undertake a physical survey of the villages in Bara district, and subsequently in other districts to put on record the existing dugwells which can be capped and to establish where new tubewells could be sunk with hand-augers to replace existing dilapidated dugwells.

Sewerage and Sewage Disposal

3.08 Waterborne sanitation is a recent innovation in Nepal. There are no sewerage systems except for a small combined system serving part of the old city of Kathmandu. Elsewhere waterborne sanitation is limited to septic tanks serving hospitals, government buildings and a few recently constructed modern houses. Most of the urban areas are served by some form of drains. These are predominantly surface drains into which are also connected domestic waste water drains and, in some cases, hand flushed latrines. These drains vary from open earth channels to covered brick culverts. Water supplies in all towns except Kathmandu are inadequate to permit the general introduction of waterborne sanitation and it will be necessary to improve the water supplies before sewerage systems can operate.

Solid Waste Removal

3.09 There is at present no organized solid waste collection and disposal service in the country, except in Kathmandu where the Ministry of Health is in charge and employs a number of sweepers who dump the refuse along the banks of the river. A pilot scheme which had been organized in seven wards of Kathmandu City and which according to reports worked well for some time had to be abandoned due mainly to lack of funds^{1/}.

Water Quality Surveillance

3.10 Only the water supply system of Kathmandu is regularly tested for chemical quality of water by WSSB who operates a laboratory at the main treatment plant of Kathmandu. It occasionally carries out bacteriological tests but their frequency is determined by the availability of the chemicals needed for those tests. The WSSB also carries out approximately 150 chemical tests per year of water supplies operated by DWSS. The WSSB project for greater Kathmandu and Pokhara includes a central laboratory to be established in 1977. cursory surveillance of water quality is also carried out by the Department of Health, when epidemic cases have been reported or are suspected. No data could be obtained on the frequency and the results of these analyses. There is a clear need for more regular and frequent bacteriological tests and for water quality surveillance in general for all water supply systems.

^{1/} A new project covering Kathmandu Valley is under discussion with the Federal Republic of Germany. The Ministry of Public Works appears to be interested in establishing a special board for implementing and operating such a scheme.

SECTOR ORGANIZATION

General

3.11 Organizational changes have been fairly frequent in the sector over recent years. These have, however, not produced more coherence in programme formulation. This task has yet to be accomplished by the National Planning Commission, which lacks resources and expertise to gear the divergent tendencies of sector agencies into a unified sectoral policy. The situation has however improved in respect of task distribution among sector agencies. Also when comparing the present Fifth Plan (1975-1980) with earlier Plan documents, the broad objectives, targets by community categories and the required range of resources have been spelled out in more detail, at least for urban areas and for district headquarters in the rural areas.

3.12 The three national agencies operative in the sector are the:

- (i) Department of Water Supplies and Sewerage (DWSS)
- (ii) Water Supply and Sewerage Board (WSSB)
both in the Ministry of Water & Power;
- (iii) Remote Area and Local Development Department (LDD)
in the Ministry of Home and Panchayat.

DWSS carries the most diversified mandate as to size and location of systems, LDD has potential responsibility for the largest number of schemes, while WSSB has the most precise tasks and relatively ample resources.

Department of Water Supplies and Sewerage (DWSS)

3.13 DWSS is in charge of:

- design, construction and supervision of systems in urban areas except the capital area and Pokhara, accounting for over 300 000 people of which over 70% are actually served mostly by public standposts; the 1980 target is to offer access to the total population;
- similar responsibility for Zonal and District headquarters and some 1 350 medium sized village communities in the 3 000 - 10 000 people range with total population of close to 6 million. Actually served are hardly more than 100 000 or 2%. The 1975-1980 programme target is to serve another 600 to 700 000 people;
- operation and maintenance of urban and rural water supply systems not taken over by the panchayats - at present there are 38 such systems.

DWSS's responsibility includes sewerage but for lack of financial and staff resources only "preliminary works in local sanitation through simple sewerage systems will be undertaken in certain areas"^{1/} (of 5 000 - 10 000 population range).

^{1/} Fifth Plan quotation.

Remote Area and Local Development Department (LDD)

3.14 LDD was created in 1971 to assist small communities up to 3 000 people in public works including water supply and eventually sanitation. The population living in over 2 550 established communities or in scattered, isolated clusters exceeds 6 million. LDD, an expanding agency in the ongoing process of placing more responsibility at the regional and village council level, sees its future role in central coordination and local assistance by strengthening its network of field offices. A separate rural community water supply section has recently been established and a number of district civil engineers have been appointed in accordance with the district administration plan. Though not explicitly in charge of rural sanitation, the Department has recognized the need of complementary services to water supply and other developmental activities in rural areas and is actively pursuing a programme of providing sanitation facilities to selected districts for which it attempts to enlist the cooperative support of the Ministry of Health. LDD's water supply activities are intimately related to WHO and UNICEF assistance.

Water Supply and Sewerage Board (WSSB)

3.15 WSSB was formed in 1973 to act as the executing agency for water supply and sewerage of the World Bank/IDA Project for Kathmandu, Lalitpur, Bhaktapur, Kirtipur, Bode and Thimi, together with several village supplies around these towns, and of Pokhara 200 km West outside Kathmandu Valley. The total population coming under the jurisdiction of the Board is approximately 420 000, of which some 80% are served by water and less than 15% by sewerage/waste removal facilities. The 1975-1980 programme consists of source development, rehabilitation works, operational improvements and supply network extension, and some work is foreseen in sewerage. WSSB works increasingly along commercial lines. Tariffs and charges provide an increasing share of revenue. Staff is recruited at salaries exceeding by 15 - 20% the normal civil service pay scales. The Board seeks corporate autonomy based on the financial viability of the works it operates.

Other Agencies

3.16 Also, if only indirectly, involved in sector activities are the following institutions:

- Department of Irrigation, Ministry of Agriculture;
- Department of Electricity, Ministry of Water and Power;
- Department of Health Services, Ministry of Health.

The Department of Irrigation will have to be brought more prominently into the picture as and when groundwater exploration in the Terai region will be undertaken systematically to supply drinking water. The Department of Electricity is in charge of hydro-electric power schemes to which community water supply facilities can be attached. In addition, the direction and pace of urban and village electrification have an important bearing on the choice of suitable water source and treatment facilities. The Department of Health Services, potentially the appropriate agency for water quality control and sanitary surveillance, is presently not equipped to play an active role in the sector. The expanding network of basic health services through the establishment of health centres and health posts with basic sanitary facilities attached to them will enhance the role of this Department.

RECENT PERFORMANCE

3.17 The sector programme 1970-1975 became adversely affected by the economic crisis after 1973. Material shortages developed and considerable cost overruns had to be absorbed. The information collected to establish planned versus actual results for 1970-1975 is incomplete. It is therefore not possible to provide a clear-cut status. The following achievements appear to have been made:

3.18 Against an original Fourth Plan allocation of Rs 38 million in 1969 prices concerning mostly DWSS, eventual allocations in current prices amounted to close to Rs 100 million including external aid. Actual expenditure under this allocation has been close to Rs 50 million, of which 56% went into rural schemes as planned^{1/}. The low implementation ratio is also reflected when comparing plan and results in terms of numbers of projects. Excluding 11 projects carried over from the Third Plan, close to 40 projects seem to have been completed by DWSS, of which 7 urban schemes for about 90 000 people and 30 - 33 rural schemes for about 100 000 people. To complete the record, one should add to the urban category the system improvements for close to 230 000 people in Kathmandu Valley and Pokhara under the IDA project/WSSB, and to the rural category the 45 schemes for 60 000 people built by LDD with UNICEF/WHO support. The number of carry-over projects into the current plan is for DWSS 19 rural for about 70 000 people, and 12 urban projects for close to 200 000 people, and for LDD about 100 schemes that were surveyed in a preliminary fashion. No projects were carried out in the field of sewerage and sanitation.

DWSS

3.19 Among the sector agencies, DWSS is most seriously affected by staff vacancies, which amount to about 30 out of over 120 sanctioned professional posts. The gap is most dramatic for overseers. The staff being employed by DWSS is given in Annex 8. DWSS has two sets of cadres, namely regular and development. The regular cadre comprises the permanent staff of the department, while the development cadre is intended to supplement the permanent staff to meet additional requirements. Increasingly, DWSS is sub-contracting work to local consultants, who are engineers from other Government agencies.

3.20 It has been the policy of Government that water supply projects constructed by DWSS, either directly or in conjunction with other agencies, should be handed over to the Panchayats for operation and maintenance. This policy has proved only marginally successful, difficulties having arisen in both implementation and operation. The Panchayats have been reluctant to take over water supply schemes because these are not financially viable, in that income does not meet the operating costs. If these supplies are operated by the Panchayat the deficit is to be met from Panchayats' own funds whereas, if DWSS operates the supplies the deficit is met by Central Government.

3.21 In Dharan the supply, which was completed in 1971 and which is operated by the Nagar Panchayat, is falling into poor maintenance. In Biratnager, the Panchayat is unable to obtain the required funds to employ the necessary staff to operate and maintain the supply or to carry out urgently needed extensions and improvement. Generally, maintenance has been limited to the repair of major leaks and clearing out of intakes.

3.22 DWSS imports practically all construction materials not locally available from India. Materials such as pipes, reinforcing steel, cement etc., are subject to a quota. The department has been unable to establish an unallocated store for the purposes of advance buying and is therefore obliged to call for tenders for the supply of materials project wise. This procedure combined with quota restrictions has proved to be most cumbersome and accounts for long delays in the execution of projects.

^{1/} Annex 11, Table 2.

3.23 DWSS has been constructing urban water supplies through contracts, and contractors have generally demonstrated a degree of reluctance in undertaking work in the less accessible parts of the country.

LDD

3.24 As regards LDD, less than 20% of its activity since the department was established has been in water supply. The organization and staff chart of LDD is shown in Annex 8, Table 4. The major obstacle, apart from staff shortage at headquarters and at regional level (especially for semi skilled people), has been materials and logistics. The staff problem was partly overcome by employing US Peace Corps and German Volunteers as overseers on rural water supply projects after a brief training period in which WHO sanitary engineers and bilateral agencies such as the Swiss Technical Assistance Agency (SATA) participated by providing instruction material and trainers and UNICEF, cash grants. The programme of LDD has been most prominently carried, however, by UNICEF which has made available practically all pipes, fittings and taps required for the rural schemes and assisted in getting men and materials to project sites, and by WHO which provided technical assistance.

WSSB

3.25 The initial institutional building phase of WSSB has come to a close. About US\$ 5 million had been spent by mid 1976 out of the US\$ 7.8 million World Bank/IDA credit^{1/}. Annex 9 shows the financial results. Performance has been broadly in line with expectations. A revised tariff structure including a charge on public standpipes payable by the Government has been introduced (see Annex 10). The average water rate has been increased from Rs 0.39 to 0.50/m³. A sewerage charge of 50% of the water rate for those connected to the actual sewer system is planned. More well-to-do people and business appear to be prepared to accept higher tariffs if service could in turn be improved by lengthening the hours of supply from an average of 4 hours per day at present.

3.26 Major contracts are out to tender including the sewerage component of the works. Training programmes for engineers to run additional urban systems and for skilled and semi-skilled personnel such as overseers, plumbers and fitters are underway.

CURRENT PLAN AND TARGETS

Overview

3.27 The National Planning Commission (NPC) is in charge of formulating development plans and of allocating the required funds among the sector agencies. It is hoped to obtain 45% of the overall planned outlay from external sources. No breakdown by sector of the expected external contributions appears to have been made. An Aid Nepal Consultative Group was recently established by IBRD, and interested donors met with Nepalese authorities for the first time in December 1976. A number of potential projects for urban and rural water supply and sanitation were submitted, including solid waste disposal for Kathmandu Valley which appears to have been taken up by the Federal Republic of Germany.

^{1/} An additional World Bank/IDA credit for US\$ 12 million is being considered for further water supply and sewerage works to serve the Kathmandu Valley, Pokhara, Biratnagar and Birganj.

Sector Programme and Targets

3.28 The Fifth Plan allocations for water supply and sanitation amount to between Rs 217 and 248 million (US\$ 17 to 20 million) depending on GDP target growth as stated above. This allocation represents about 3.5% of planned spending in the public sector compared to 1.5% for the previous plan as shown in Annex 11, Table 1. In terms of planned outlays for social services only, the sector obtains 15% compared to 12% during the previous plan.

3.29 The programme funds are allocated among the sector agencies as is shown below:

	Minimum Programme		Maximum Programme	
	Rs million	%	Rs million	%
DWSS	101	47	121	49
WSSB	96	44	107	43
LDD	20	9	20	8
TOTAL	217	100	248	100

3.30 In terms of targets, the Fifth Plan just states that a total of 14.6 million gallons of additional drinking water per day would be available from the various projects and it is implied that service would increase in line with population growth.

3.31 Four categories of communities are distinguished and the following targets for water and sanitation spelled out:

- (i) supply approximately 20-30 gallons of drinking water per capita per day in communities with more than 10 000 people and as far as possible provide sewerage facilities in these areas. Provide private connections and levy taxes so as to attain self-sufficiency.
- (ii) Provide 15 to 20 gallons of drinking water per capita per day in communities with 5 000 - 10 000 people. Preliminary sanitation works will be undertaken in certain areas.
- (iii) Provide approximately 10 gallons of water per capita per day in communities with 3 000 - 5 000 inhabitants. Only public water taps should be installed and no charges are foreseen.
- (iv) For communities with less than 3 000 people 5 - 7 gallons of water per capita per day will be provided. Such projects should have priority for which local labour and locally available construction materials can be utilised and which are capable of attracting maximum cooperation of the people.

Project Outlays

3.32 DWSS is in charge of implementing 19 carry over projects from the previous plan and between 72 and 90 new projects according to the minimum and maximum programme alternatives. As shown in Annex 11, Tables 4 and 5 DWSS projects range from very small rural to urban communities with per capita costs ranging from Rs 135 for rural to over Rs 300 for urban type schemes.

3.33 A sum of Rs 58 million is proposed for expenditure by the Board on Kathmandu, Lalitpur and Pokhara water supplies by 1980; other major urban centres will be taken up later dates by the Board as feasibility studies are completed and the needed funds are mobilized. The Board has also plans to expend a similar amount in providing sewerage and sewage disposal facilities for Kathmandu within the same period. A large part of the said expenditure will be met from

the IDA/IBRD soft loans. Total capital expenditure on 13 larger urban water supplies which would be needed to meet the requirements to the end of 1987, is estimated (see Annex 11, Table 6) at Rs 230 million at 1972 prices. If it is decided to start construction work now with the objective to provide all the 16 established urban communities with adequate water supplies by the end of 1986, then an average annual capital expenditure of about Rs 20 million (at 1972 prices) would be needed.

3.34 In accordance with the proposals for the Fifth Five Year Plan about 400 000 urban population will be provided with adequate safe water by 1980, in addition to about 250 000 population within Greater Kathmandu which will be adequately supplied by the Board.

3.35 LDD's small community programme relies in addition to the budgetary allocation shown above on contributions from the local people themselves, contributions from the Panchayats and on UNICEF support as follows:

- (i) under the regular programme, 175 schemes for 165 000 people at a cost of Rs 25 million (including UNICEF assistance of US\$ 1.42 million);
- (ii) under additional programmes, 350 schemes for close to 200 000 people at a cost of Rs 29 million (including UNICEF, and various bilateral assistance over US\$ 2 million). The implied per capita cost is close to Rs 150.

Population to be served by 1980

3.36 With the suggested programme, slightly more than 1 million people would obtain new or improved water supplies by 1980, whereas total population will have grown by 1.7 million, from 12.6 million in 1975 to 14.3 million in 1980, as shown in Annex 12. Consequently, the population without access to safe water now estimated at 11,4 million or 91% will grow to around 12 million representing 84% of the 1980 population.

3.37 In terms of urban/rural water service levels as well as sanitation levels in the light of the revised 1980 targets for the South East Asian region adopted by the World Health Assembly in 1976, the following picture emerges:

Water Supply

- (i) the target of serving 90% of the urban population by 1980 appears to be in reach although not in the desirable proportion of two thirds served by house connexions and the rest by public standpipes. The inverse relationship prevails in Nepal and is likely to prevail for some time to come.
- (ii) The target of serving 35% of the rural population is far out of reach and contrasts with a current service level of 5% to be increased to 8 - 10% with the current programme under the most optimistic assumptions.

Sanitation

- (iii) The target of serving 95% of the urban population, of which roughly one third by public sewerage and two thirds by household systems, contrasts with a present service level of about 45%, of which one fourth at most connected to the public sewerage system and three fourth using pit privies, toilets connected to septic tanks and bucked privies. The low priority presently given to sanitation is unlikely to change the situation. It may well deteriorate as a result of urban immigration.
- (iv) The target of bringing sanitary excreta disposal to 25% of the rural population is equally far out of reach given the extremely low actual level and the absence of a systematic programme.

IV. CONSTRAINTS AND RECOMMENDED ACTION

4.01 The principal constraints pervading the sector and likely to impede full implementation of the current plan, not to mention an expanded programme, stem from institutional fragmentation, staff shortages and maldistribution, from the lack of financial resources and operational expertise at the local council level, ~~and~~ from procurement problems.

4.02 It is interesting to note the order of priority of different constraints as considered by DWSS and LDD respectively^{1/}:

Constraints	DWSS	LDD
Manpower	1	1
Institutional structure	8	2
Procurement	2	5
Management	3	3
Planning	4	4
Execution of Projects	5	6
Operation	6	9
Maintenance	7	7
Finance	9	8

ORGANIZATION

Constraints

4.03 The net result of the institutional changes since 1971 is that there exist to-day three sector agencies whose areas of jurisdiction partly overlap, whose staff resources are not shared, who go separate ways for staff development and training, face parallel problems of procurement, and have tended to follow their respective programmes of work supported by external assistance from various sources without sufficient concern for mechanisms assuring sectoral linkage and coordination.

4.04 The current state of affairs is transitional: it is planned to transform WSSB in due course into a Corporation with four regional centres in charge of potentially viable urban systems (and possibly surrounding rural areas according to the merits of the case). Urban schemes would be taken over gradually as their financial and operational situation improved through tariff increases and training programmes. The central functions of the Corporation would include overall planning and control, project development, and enable cross subsidizations if and when required.

4.05 The situation is more complex as regards the rural sub-sector, although some tendencies emerge. HMG policy of strengthening the panchayat system through implementing the district plan is becoming more clear cut. The 1976 merger of the previous Ministries of Panchayat and Home Affairs into one Ministry has of course provided additional impetus in this respect, as this Ministry is the executing agency of the District Plan. In the future, projects are to be formulated and carried through at the district level except for national interest projects. Water supply and sanitation responsibility will be transferred to the district administration, while the central offices of LDD and DWSS would provide backstopping only, with the latter in charge of developing services for district headquarter communities. In line with this orientation, LDD has recently appointed engineering staff

^{1/} Report on Urban Water Supply
WHO/SEARO, op.cit., page 28

at district level and established a separate water supply section at central level for technical guidance.

Recommendations

4.06 The sector mission previously advocated "an early decision" on future organization, outlined various alternatives of merging sector agencies and recommended that the re-organization be completed within a two-year span. The sector agencies concerned held a series of meetings on this question in 1976 and agreed to continue with the present set up. It was felt, however, that towards the end of the present plan, a joint evaluation of the performance of sector agencies might be carried out to serve as a guide for possible sector reform with a view to making better use of manpower resources, and attracting more financial resources for a more ambitious programme.

4.07 It is recommended to undertake this evaluation exercise jointly with WHO and UNICEF and possibly IBRD during 1979 so that HMG decisions on sector reform could be implemented before the next Five-Year Plan starts in July 1980.

4.08 Meanwhile, coordination among sector agencies as well as between these and external assistance agencies should be strengthened by holding regular programme review meetings.

4.09 Also, steps to improve the internal functional efficiency within agencies should be taken: in DWSS by setting up an investigation and design section, by starting in-service training for junior engineers, better financial and management procedures and improving stores management. In LDD, setting up a separate water supply section, and strengthening the field organization are underway; progress reporting and financial recording procedures need to be improved to better inform and guide management. In WSSB, the planned transformation within the current five-year plan into a financially autonomous corporation with regional centres will be an important step forward in the development of the sector, but requires preparatory training of managerial, administrative and technical staff particularly in view of the planned take over of a number of existing urban systems whose current operations leave much to be desired. Each agency should build up an evaluation component inside the organization to better identify strengths and weaknesses in the light of programme objectives.

PLANNING

Constraints

4.10 Actual planning by sector agencies is foremost in terms of number of projects to be implemented. Lacking is an overall view of determining sector wide and sub-sector target levels expressed as percentages of populations to be served. The National Planning Commission is not yet equipped to perform this role. Also, present planning except in WSSB does not include thorough analysis of the socio-economic aspects and financial viability of contemplated schemes which are mostly evaluated in technical terms only. Finally, little has been done to date to foster groundwater development for community water supply in the comparatively densely populated Terai with a high share of the small communities in the country^{1/} and with the highest rate population growth compared to other areas^{2/}.

Recommendations

4.11 In line with the deferred decision on future organizational structure of the sector, the work programmes of the existing agencies should continue to the end of the current plan

^{1/} Annex 12, Table 2

^{2/} Since 1952 population increased country wide about 30%, in Kathmandu Valley 43%, and in the Terai by 68% (due to internal migration).

period. It is however, recommended that the programme be expanded by giving more emphasis to groundwater exploration and development in the Terai as outlined in detail in Annex 5, which summarizes the UNICEF hydrogeologist's contribution to the sector mission. Implementation of this programme will mainly concern LDD with cooperation from DWSS. It is estimated that 800 000 more people could be supplied with safe water from this sub-programme as it expands up to 1980. Preliminary estimates of the funds required suggest a figure of Rs 40 million (US\$ 3 million). The suggested programme would be a relatively cheap way to keep service development in phase with population growth, i.e. to avoid slippage.

4.12 The Government wants a study to be made of the desirable medium range goals for the sector and it is therefore recommended that this task be undertaken by WHO/SEARO with possible backstopping from the WHO/IBRD Cooperative Programme as a follow up to the WHO project formulation exercise for the sector in 1975 and the present sector study. This should include studying the implications for Nepal of the WHO regional water supply and sanitation targets for 1980 and beyond as revised by the World Health Assembly in 1976. The National Planning Commission should guide this activity with the aim of formulating and costing appropriate sector targets for the next Five Year Plan.

FINANCING

Recommendation

4.13 A study should be made of the level and structure of tariffs required to make schemes presently run by DWSS on behalf of Panchayats self supporting. New schemes should be subjected to strict financial and socio-economic analysis in addition to technical feasibility.

MANPOWER DEVELOPMENT

Constraints

4.14 Shortage of trained manpower is the most important factor inhibiting sector development. As summarized in Annex 8, Table 1 technical and administrative staff shortages vary among sector agencies. DWSS and LDD have found it most difficult to assign professional and sub-professional staff to construction sites in remote areas. Neither Department has been able to attract the needed cadre for lack of permanent posts, particularly in the sub-professional grades. WSSB's current shortage is foremost felt at the managerial level (finance and administration) and also at the overseer level.

4.15 There are no facilities for training engineers to degree level in Nepal. Other technical personnel is trained in insufficient numbers (Annex 13). Efforts to recruit overseers from India on contracts have not been successful. It is estimated that graduates returning each year from abroad, mainly India, number about 50 civil engineers and 20 each mechanical and electrical engineers. A general constraint facing staff in Government service is the virtual absence of career incentives (particularly for overseers), and allowances for persons working in rough and remote field conditions are equally lacking.

Recommendations

4.16 It is recommended that joint training programmes be undertaken by the sector agencies, in collaboration with the Nepal Engineering Institute and with the Centre for Economic Development and Administration of Tribhuvan University and supported by WHO and bilaterals for managerial, financial and administration staff, planners design engineers, overseers and draftsmen. Refresher and short in-service courses should be organized with external expertise. A few fellowships for specialized post graduate training are required.

4.17 The proportion of permanent staff positions needs to be increased in DWSS and LDD to attract competent staff. Staff working in the field should be offered extra allowances and experienced overseers should be offered field appointments at the level of assistant engineers.

4.18 A concentrated training effort is required to enable Panchayats to take over completed water supply schemes from DWSS.

PROCUREMENT AND LOCAL PRODUCTION OF MATERIALS

Recommendations

4.19 In view of the procurement difficulties faced in parallel by the agencies particularly DWSS and LDD, meetings should be held of the persons in charge of logistics to establish a common policy and harmonize practices designed to overcome the current cumbersome and costly project wise approach which is additionally hampered by import quota restrictions, causing long delays in the execution of projects. The National Trading and Transport Corporations should be consulted. The concurrence of the National Trading Ltd. would be required for imports handled by this organization (e.g. cement), in view of its own regional network structure, and given its flexibility to store floats of material according to inventory management principles, not hindered by government budget procedures. NTL would welcome this role, if sector agencies would disclose their likely input requirements some time in advance. The National Transport Corporation practices a policy of price equalization for many basic goods throughout the country, and this policy should be extended to include sector input requirements to the extent feasible. The rural programme is mainly affected by the actual procedures. The basic proposition is that long lead times for ordering, shipment and internal transport to project sites do not matter much, as long as a minimum float of materials is kept in stores (preferable in each region).

4.20 Field and research studies to explore the possibilities of substituting local materials for conventional imported ones should find more systematic support. The Government has already issued licences to two companies for the local manufacture of PVC, HDPE and other plastic pipes (1st year capacity 260 M/T). UNICEF seems to be ready to assist the supply of raw material for the manufacture of plastic pipes. Since cement is now manufactured in the country (though in short supply), concrete pipes could be produced without any heavy financial investment. These could be of use both for water and sewage. For larger sizes (600 mm and above), pre-stressed concrete pipes could be considered, as they could be manufactured in the same factory as the ordinary ones. In view of the high cost of cast iron pipes, and considering the transport expenses, even smaller sizes of pre-stressed concrete pipes might work out to be cheaper. The only material to be imported for the RCC pipe being steel, it might be more economical for Nepal to use these pipes. This should be studied in detail. The manufacture of handpumps and GI specially needed for water supply could also be undertaken after making an assessment of the demand. UNIDO might assist the Government in such studies.

PUBLIC HEALTH

Recommendations

4.21 The Department of Health Services in the Ministry of Health needs to be assisted in launching sanitation and health education programmes which provide, as a first step, latrines in schools and health posts, encourage people to build latrines with local material, inform them about the dangers of contaminating water supplies, better source protection, and the hygienic levels that can be attained when water becomes available in quantities exceeding mere subsistence needs; this programme component should be added to the ongoing health sector programme. Additional training assistance is required to build up the cadre of health workers.

4.22 There is a clear need for more regular and frequent bacteriological tests and for water quality surveillance in general for all water supply systems.

NEPAL
WATER SUPPLY AND SANITATION
SECTOR STUDY

Annex 1

ORIGINAL TERMS OF REFERENCE

17 September 1975

A. BACKGROUND

A reconnaissance visit to Nepal was undertaken by Mr Paul Bierstein, Consultant, WHO/IBRD Cooperative Programme, from 20 to 25 March 1975.

The report of this visit provides information on the Government agencies responsible for the sector and information on the present status of the sector.

A sector study on water supply and sanitation in Nepal was completed in 1973 as a component of a UNDP/WHO-assisted project. Other more recent reports on urban and rural water supply issued by the WHO Regional Office for South-East Asia are available and listed in the report of Mr Bierstein's visit.

Feasibility studies for projects of water supply and sewerage were carried out under the project mentioned above and portions of the water supply and sewerage in the Kathmandu Valley and water supply in Pokhara are now under construction, financed in part by IDA Credit 470-NEP. The same project prepared pre-feasibility studies for the urban communities of Birgunj, Biratnagar, Surkhet and Dhankuta.

Since 1963 assistance has been provided by WHO and UNICEF on a rural water supply programmes. This assistance is proposed to be continued until at least 1980.

B. SCOPE OF STUDY

The study will be national in scope, covering water supply and sewerage in urban areas and water supply and excreta disposal in rural areas. It will follow, in general, the guidelines for sector work in the water supply and waste disposal sector as developed cooperatively by the World Bank and WHO and dated 9 November 1973.

In view of the recent reports on the sector the primary objective of the study will be to review and up-date the 1973 sector study, in particular its recommendations on sector organization and the future investment programme.

C. SECTOR ISSUES

The following issues have been identified during the course of the reconnaissance visit and in previous reporting:

1. National policies and goals for the sector and its sub-sectors have not been clearly indicated. The Third Five-Year Plan (1966-1970) states "..... drinking water supply systems will be developed in all the important urban areas. Priority will be given to areas without easy access to drinking water." The Planning Commission states that a tentative target for water supply to the combined urban and rural population for the up coming Fifth Five-Year Plan (1975-1980) is to increase the percentage served from 7.25% to 12.25%. The study should propose desirable Government policies and realistic goals for medium and long-term programmes.

2. Recent changes have been made in institutional arrangements and responsibilities within the sector. A Water Supply and Sewerage Development Board was established in 1973 with the responsibility for Kathmandu Valley and other, as yet, unspecified areas. It is proposed that the Board should ultimately be transformed into a Water Supply and Sewerage Corporation as recommended in the 1973 sector study. There is also a proposal to create administrative centres in the five towns for which pre-feasibility studies were made under the UNDP/WHO-assisted project, for decentralizing authority for water supply and sewerage. A Department of Water Supply and Sewerage was established in 1972 under the Ministry of Water and Power with responsibility for water supplies in communities of over 3 000 population and sewerage in urban centres. In 1971 the Remote Area and Local Development Department was established under the Ministry of Panchayat with responsibility for water supplies for communities of under 3 000 population. The study should consider the following:
- (a) the effectiveness of present institutional arrangements in terms of programme performance, optional utilization of limited technical and other manpower and division of responsibilities.
 - (b) The need for institutional changes in relation to national goals, proposed investment programmes and maximum utilization of existing manpower.
 - (c) Decentralization to provide effective support for construction of facilities and their subsequent operation and maintenance. This should include a time table for transition, manpower needs, etc.
3. It is probable that the major constraint to achieving national goals will be that of manpower. Present indications are that, in the medium term, shortfalls will be less in the professional than in the sub-professional categories. The basic need, especially for the rural water supply programme, is for overseers. Although Government planning proposes that the requirements for overseers will be met by the end of the Fifth Five-Year Plan in 1980, there is some doubt as to whether the training facilities will be able to cope with the expanded training programme. The study should make an evaluation of Government planning for manpower development, present proposals for the most effective utilization of existing manpower, review the projections of manpower requirements over the medium term and make specific recommendations for training programmes to meet projected needs with indications of external assistance requirements.
4. Sectoral investment programmes for the Fifth Five-Year Plan (1975-1980) are now being processed by the Government. These programmes should be studied in relation to national sectoral goals, their priorities and the constraints to their successful achievement. Recommendations should be made as to possible modifications of the programmes.
5. Operation and maintenance of existing and future water supply and sewerage systems will require studies of institutional, organizational, manpower, logistic and training aspects. The emphasis placed by Government on the rural water supply programme requires careful considerations of a practical decentralized institutional arrangement for providing maximum support to local bodies in the operation and maintenance of these supplies.

6. Future water supply development, especially in the foothills and the terai will be based on groundwater.
The study should indicate to what extent groundwater exploration has been carried out and the present plans for future work. Recommendations should be made as to the best means for groundwater exploration and development.
The following alternatives inter alia should be examined:
 - (a) A Government Groundwater Unit with its own rigs to serve all departments.
 - (b) Each Government Department to have its own Units.
 - (c) Use of contract drillers (Local or Indian).
7. The Government has no national standards for drinking water quality. The study should consider the need for such standards, possibly adapted from the WHO International Standards, taking into account suitable standards for remote areas.
The establishment of surveillance mechanisms for drinking water quality also needs study.
8. Other problem areas include designs of sector facilities for communities where pilgrimages or tourism contribute to large population fluctuations and the potential for water pollution.
9. The mission would identify those areas where external agencies might assist the sectoral programmes by either technical or financial assistance.
10. If time permits, the mission should, in connexion with the second-stage UNDP-assisted project for urban water supply and sewerage outline further feasibility studies to be undertaken in a third stage.
11. To collect national data on community water supply and waste disposal from the Member Governments, a questionnaire has been developed by WHO. This questionnaire is being completed by the Government of Nepal annually so that progress or shortfall may be assessed immediately. This should be checked and updated by the Mission.
12. A report on hydrogeological aspects has been prepared by Dr A.I. Moller, WHO Hydrogeologist-consultant, during September-October 1974. This report has been under process in the WHO Regional Office for South-East Asia. However, a draft can be made available on request.

D. COMPOSITION OF MISSION

The full mission is expected to be composed of the following:

Dr E. Becher, WHO/IBRD Cooperative Programme (Mission Leader);

Mr D. Sieber, WHO/IBRD Cooperative Programme;

Two UNICEF designated representatives will also participate in the mission^{1/};

Mr Iheme, UNDP Trainee at WHO, Geneva, from the African Development Bank will join the mission.

^{1/} S. Radojicic (UNICEF/SCARO) participated in the mission.

E. COLLABORATION EXPECTED FROM GOVERNMENT

The cooperating agency for the study will be the National Planning Commission assisted by the Remote Area and Local Development Department of the Ministry of Panchayat^{1/}. This latter agency as well as the Water Supply and Sewerage Department will each provide one or more English-speaking professional staff members to join the study team on a full-time basis.

A tentative itinerary of field visits to representative urban and rural areas will be prepared by the operative agencies in collaboration with Messrs N. Saravanapavanathan and H. Suphi, WHO Sanitary Engineers.

F. COLLABORATION FROM WHO/IBRD IN THE FIELD

The WHO, IBRD and UNICEF Representatives in Nepal will provide their good offices to facilitate the work of the study team.

G. TIMETABLE AND REPORT OF THE MISSION

The mission is expected to carry out its field work in Nepal from 22 September to 9 October 1975.

A meeting of representatives of government agencies with responsibilities in the sector is expected to be convened by the Planning Commission on or about 23 September 1975.

A similar meeting for the purpose of presenting the findings of the study team, together with preliminary conclusions and recommendations is expected to be convened by the Planning Commission on or about 9 October 1975.

The draft report on the sector study will be prepared by WHO and should be completed about 30 November 1975.

^{1/} The mission reported to Mr A.B. Rajhbandari, Secretary of the Ministry of Water and Power. The Water Supply and Sewerage Department was designated as cooperating agency.

NEPAL

Annex 2

WATER SUPPLY AND SANITATION

SECTOR STUDY

AMENDED TERMS OF REFERENCE

1. The original terms of reference (Annex 1) for the sector mission's work became partly superseded as a result of the following events:

- a) when the sector mission arrived in Nepal on 22 September 1975, it learned that in follow-up of the Country Health Programme work of 1974 a Project Formulation Exercise concerning water supply and sanitation needs of Nepal had just been concluded in a collaborative effort between the national sector agencies and WHO staff in accordance with Terms of Reference drawn up by a Steering Committee consisting of the chief executives of the three water agencies and covering essentially the same ground as the Terms of Reference's for the sector mission.
- b) Over a period of 6 weeks (17 July - 28 August 1975) 7 staff members from the national sector agencies and 3 WHO staff had collaborated full time and a number of national staff part time on the exercise.
- c) The outcome of this project formulation as approved by the Steering Committee had just become available in a document entitled Project Formulation for Development of Water Supply and Excreta Disposal, in the form of a detailed plan to implement the 5th National Plan's Objectives within its five year time frame, consisting of 49 recommendations, identifying activities required for implementation as well as scheduling them.

2. In view of the above it appeared inappropriate for the sector mission to carry out its work as originally intended. At the opening meeting with Government it was agreed that the results of the project formulation exercise could facilitate the mission's task in the field of analysis and should be used as a working basis in designing an action programme for the sector.

3. The general guidance given to the mission by the Secretary of the Ministry of Water and Power and with the concurrence of the other Ministries involved (Panchayat, Health, National Planning Commission, and Finance) stipulated that:

"The sector study shall keep as its objective to recommend to the Ministry of Water and Power, HMG, the desirable medium range goals and the institutional changes necessary to achieve them. The study may also indicate to the planners the priority that may be advantageously followed in executing these goals. In doing so it may examine the present shortcomings in the existing organization, financial system and formulation of projects themselves. The study should not necessarily be limited to the framework of the present Five Year Plan and organization. However, it has to be realistic about the financial and manpower constraints persisting beyond the Plan period."

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Annex 3

WATER SUPPLY AND SANITATION

SECTOR STUDY

PERSONS MET

Sector Agencies

Mr A.B. Rajhbandari	Secretary	Ministry of Water & Power ^{1/}
Mr S.B. Shahi	Secretary	Ministry of Home and Panchayat
Mr H.J. Malla	Chief Engineer	Water Supply & Sewerage Department, Ministry of Water & Power
Mr T.D. Bhattarai	Director General	Remote Area & Local Dev. Department, Ministry of Home and Panchayat
Mr N.D. Joshi	Director General of Health Services	Ministry of Health
Mr R.M. Shrestha	Project in-charge	Water Supply & Sewerage Board, Ministry of Water & Power
Mr S.N. Sharma	Deputy Chief Engineer	Department of Water Supply & Sewerage, Ministry of Water & Power
Mr A.K. Ranjitkar	Civil Engineer	Department of Water Supply & Sewerage, Ministry of Water & Power
Mr M.M. Singh	Senior Accountant	Department of Water Supply & Sewerage, Ministry of Water & Power
Mr R. Rimal	Sanitary Engineer	Department of Water Supply & Sewerage, Ministry of Water & Power
Mr S.B. Rai	Deputy Director	Remote Area & Local Dev. Department, Ministry of Home and Panchayat
Mr L.M. Singh	Assistant Engineer	Remote Area & Local Dev. Department, Ministry of Home and Panchayat
Mr B.P. Shah	Acting Senior Engineer of Tech- nical Section	Remote Area & Local Dev. Department, Ministry of Home and Panchayat
Mr M.M. Joshi	Senior Engineer	Water Supply & Sewerage Board
Mr R.L. Shrestha	Chief Accountant	Water Supply & Sewerage Board
Mr G. Amatya	Sanitary Engineer	Water Supply & Sewerage Board
Mr E.G. Felts	Manager-Engineer	Water Supply & Sewerage Board
Mr B.A. Collins	Distribution Expert	Water Supply & Sewerage Board
Mr H.G. Charles	Distribution Expert	Water Supply & Sewerage Board
Mr R. Shrestha	Sanitary Engineer	Water Supply & Sewerage Board
Mr R.L. Yoshi	Sanitary Engineer	Department of Health, Ministry of Health
Mr J. Poudyal	Laboratory Services	Department of Health, Ministry of Health

^{1/} Mr Rajhbandari is now Secretary, Ministry of Forests, and has been succeeded by Mr K.D. Adhikary.

Mr C.K. Sharma	Chief Geologist	Ministry of Food, Agriculture & Irrigation, Groundwater Section
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Other Government Agencies/Institutions (all in Kathmandu)

Mr R.S. Rana	Member	National Planning Commission
Mr M.P. Upadhyaya	Joint Secretary	National Planning Commission
Mrs C. Pande	Under Secretary	National Planning Commission
Mr N.K. Joshi	Deputy Director	Central Bureau of Statistics
Mr M. Rana	Deputy Director General	National Trade Corporation Ltd
Mr B.D. Adhikari	Director	National Trade Corporation Ltd
Mr R.P. Sharma	General Manager	Nepal Industrial Development Corporation
Mr B.B. Pradhan	Chief Economic Adviser	Nepal Rastra Bank
Mr B.P. Risal	Chief, Family Budget Survey	Nepal Rastra Bank
Mr P.P. Shah	Executive Chairman	Nepal Electricity Corporation
Mr S.K. Malla	Chief Engineer	Department of Electricity, Ministry of Water & Power
Mr M.N. Bhattarai	Works Manager	National Construction Company Nepal (NCCN)
Mr G.B. Pradhan	Director	Centre for Economic Development & Administration (CEDA)
Mr D.S. Pearson	Chief Adviser	Industrial Services Centre

United Nations Personnel

Dr A.R. Mills	WHO Representative	Kathmandu
Mr D. Thomas	IBRD Representative	Kathmandu
Mr H. Kuloy	UNICEF Representative	Kathmandu
Mr M. Kulesa	UNDP Representative	Kathmandu
Mr N. Saravanapavananthan	WHO Sanitary Engineer	Kathmandu
Mr H.S. Suphi	WHO Sanitary Engineer	Kathmandu
Mr G. Temple	UNICEF	Kathmandu
Mr C.H. Chung	IBRD Staff (Washington)	Rural Development Project Mission
Mr C.P.R. Nottidge	IBRD Staff (Washington)	Rural Development Project Mission
Mr R.J. Wakefield	Financial Adviser	Asian Development Bank
Mr M. Thaineua	Assistant Director	Health Services, SEARO, Delhi
Mr A.K. Roy	Regional Adviser	EHE, SEARO, Delhi
Mr P. Hornby	Operational Research Specialist	SEARO, Delhi

Mr R.K. Stoelzel	Chief	Water Supply Section, UNICEF, South Central Asia Regional Office (SCARO), Delhi
Mr G. Cahn-Hidalgo	Chief	Supply Division, UNICEF, Geneva
Mr D.T. Halliday	Procurement Officer	UNICEF, Geneva
Mr P. Bayer	Procurement Officer	UNICEF, Geneva
Mr P. Chiles		World Food Programme, Kathmandu

Bilateral Agencies and Projects

Mr M. Chardrasekaran	Engineer	Indian Cooperation Mission, Kathmandu
Mr J.M. McGill	Manager	Engineering - Science Inc., Kathmandu
Mr C. Grader	Director	USAID, Kathmandu
Mr W. Olden	Office of Health	USAID, Kathmandu
Mr M. Boppre	Chargé d'Affaires	Embassy, Federal Republic of Germany, Kathmandu
Mr M. Kohl	Civil Engineer	Bhaktapur Development Project, (German Agency for Technical Cooperation)
Mr H. Biemann	Technician	Bhaktapur Development Project, (German Agency for Technical Cooperation)
Mr A. Schild	Director	Swiss Association for Technical Assistance (SATA), Kathmandu
Mr L. Ruesch	Administrator	Swiss Association for Technical Assistance (SATA), Kathmandu
Mr A. Bachmann	Sanitary Engineer	Swiss Association for Technical Assistance (SATA), Kathmandu
Mr K. Schranz	Sanitary Engineer	Swiss Association for Technical Assistance (SATA), Kathmandu

NEPAL

WATER SUPPLY AND SANITATION

SECTOR STUDY

LIST OF DOCUMENTS

National Planning and Development (incl. Sector Studies)

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WATER SUPPLY AND SANITATION
SECTOR STUDY

WATER RESOURCES AND GROUNDWATER DEVELOPMENT IN NEPAL^{1/}

Introduction

The assessment of water resources and groundwater development has been based upon data collected from the Departments of Water Supplies and Sewerage (DWSS), and Remote Area and Local Development (LDD); the Ground Water Section (GWS) of the Ministry of Food and Agriculture; UNICEF and WHO personnel in Kathmandu, and from various reports and studies (see list of documents). It also reflects personal impressions which the writer received during his field trip to Kathmandu, Pokhara, Butwal and Bhairawa.

1. Surface Water

Rivers represent the main source of water in Nepal, all are tributaries of the Ganges River in India and they flow generally in a north-south direction.

The four main rivers are the Mahakali, the Karnali, the Sapta Gandaki (Narayani) and the Sapa Kosi. They all spring from the high Himalayas and because of snow and glaciers, they are perennial. The Kankai Mai, the Kamla, the Bagmati, the Rapti and the Babai are some of the secondary rivers originating from the middle hills. Their discharge greatly varies with high floods during the monsoon (July-September), they never dry out completely. A large number of small rivers springing from the Churia Hills and Terai are mainly seasonal. According to data obtained in the Department of Irrigation, Hydrology and Meteorology, Ministry of Food and Agriculture, in 1972, there were 41 regular gauging stations and 39 partial-record stations for flow discharge measurements. As for water supply, the following facts are important:

- (i) the streams of the High Himalayas are mainly fed from melting snow, and therefore they are more or less clear during the whole year and can be used for water supply in the areas where groundwater cannot be developed (needed: simple water treatment, and/or disinfection);
- (ii) the rivers from the middle hills are mainly rainfed and therefore they carry a high load of solids during the monsoon and immediately afterwards which rather complicates their utilization for water supply; therefore they should be considered a source only where no other water is available;
- (iii) the rivers originating from the Churia Hills and Terai are seasonal and muddy, and therefore inadequate as a source for water supply.

2. Groundwater

2.1 The Mountain Areas

They cover more than three quarters of the Nepalese territory and include all mountains from the Churia Hills in the south (bordering on the Indo-Gangetic plain) to the High Himalayas in the north. With the exception of a few river and tectonic valleys (filled by Miocene-Pliocene, Quaternary slightly consolidated and unconsolidated deposits saturated with underground

^{1/} Abridged version of contribution to sector study by S. Radojicic, UNICEF.

water), the whole complex consists of geologically consolidated formations (solid rocks) which contain groundwater only within fissured formations. The complex is mainly composed of metamorphic rocks (gneiss, various schists, crystalline limestone and dolomite, quartzite, phyllite and slates) followed by sedimentary formations (sandstone, shale and in a less degree, conglomerate and limestone), and finally igneous rocks (granite facies dominating). These rocks are of very poor primary porosity and only the secondary porosity caused by the post-genetic processes and movements is of practical importance as far as groundwater accumulation is concerned. It means that faults, fractures, joints and slip places represent the only ways for the water percolation, movement and drainage. As to some specific hydrogeological and other closely related features, this complex can be separated into 4 zones: High Himalayas, Midlands, Mahabharat Range and Churia Hills.

2.1.1 High Himalayas

Their elevation ranges from 3 000 m up to 8 848 (Mount Everest). The climate is alpine (tundra) with short and cool summers and severe dry winters. In areas higher than 5 000 m (snow line), the temperature is below freezing throughout the year and there is abundant snowfall. Precipitation figures vary from 500 - 1 000 mm in the west to 500 - 2 500 mm in the centre and east.

Geologically, the area is built up of granite, gneiss, migmatite and various schists with lenses and beds of marble and crystalline dolomite (cherty) in the southern belt of the zone. Because of intensive tectonic movements, rocks are folded, faulted and fissured, so that, apart from streams, springs represent the main water sources, draining the fissured and local aquifers formed in the weathering cover (characteristically mechanical weathering). As they are richly fed by snowfall, their average discharge is 25 - 30 l/sec. There are no data on seasonal variation but often they might be perennial, provided there is forest conservation.

Water from small streams is also quite clean and can be used for water supply. The quality of spring and stream water is believed to be suitable, since there is practically no pollution. Generally, settlements are scarce in this zone (because of severe climatic conditions, there are practically no villages above 3 000 m) and located below the water sources so that gravity supply systems seem appropriate.

2.1.2 Midland Zone

Between the High Himalayas in the north and the Mahabharat Range in the South, lies a 30 km wide belt of low-lying hills, rivers and tectonic valleys, with an average altitude of 2 000 m. In the valleys which open Southwards, the climate is moist, sub-tropical, and in the higher areas (over 2 000 m) it is temperate. Rainfall ranges from 1 000 to 4 500 mm, with 1 000 to 2 500 mm occurring in the farwestern and eastern parts, 2 000 to 4 000 mm in the western and central parts and the maximum around Pokhara (4 500 mm).

Because of favourable conditions and intensive soil development, about 60% of the total population lives in this zone. There are also favourable geological compositions, with soft formations subject to mechanic and chemical disintegration (the first one being more expressed). With the exception of river and tectonic valleys, the whole zone is composed of more or less metamorphosed rocks, the degree of metamorphism decreasing going from the North towards the South. In the northern part are various schists and gneiss with lenses and strata of crystalline limestone and dolomite. In the central part are phyllites with chlorite schist, quartzite, limestone and dolomite and in the southern belt are slates with lenses and beds of (cherty) dolomite. The southern boundary between the Midland zone and the Mahabharat Range in western

Nepal is not well defined, with numerous interrupted synclinales in the Tansen area stretching West-Eastwards. This zone also coincides with the major fault zones. It can be noticed that numerous rivers in the basins of Karnali, Narayani and Sapta Kosi have eastern or western courses following the weak points. Kathmandu, Pokhara, Dang and Surkhet are typical tectonic valleys located in this zone.

The main water sources which can be developed for the community water supply are numerous streams, springs which drain fissured aquifers, and porous water-bearing formations in river and structured valleys where groundwater can be exploited by dug and tube wells.

Most of the rivers and streams are perennial and they are mainly rain-fed. During the monsoon and immediately after it, their water becomes very turbid which rather complicates their utilization for water supply (settling tanks and other treatments are required). As most settlements are located at the top of the hills or in the upper parts of their slopes, because of more favourable climatic conditions and better soil stability, areas lacking suitable springs would have to be supplied from surface sources by use of centrifugal pumps or hydraulic rams with heads varying between 30 and 300 m. If pumps and rams are to be avoided, long-distance pipe lines are required (e.g. Tansen and Bandipur). In some parts of western Nepal, during the dry season both surface and groundwater are insufficient for people and cattle, so that there is need to impound rain water.

Because of the insufficient porosity of most of the metamorphic complex, the springs of this zone are connected with fault zones and lines. As they are mainly fed by percolation of rainfalls, it must be assumed that their discharge varies greatly (no measurements have been carried out). It is therefore important to differentiate between perennial and seasonal (intermittent), and primary and secondary springs, especially since water supply of a large number of settlements is based upon spring tapping. As for the groundwater in the river and structured valleys, extensive explorations have only been made in Kathmandu Valley.

In other valleys no explorations have been made so far. The Quaternary deposits may, however contain groundwater in sufficient quantity and quality, and could be developed by shallow and deep wells. The lithological composition of water bearing formations can be guessed by comparison with the composition of nearby mountains from which they originate. Larger river and structured valleys are Dang, Surkhet, Pokhara, Mariphant, Banepa and Panchkhal.

2.1.3 Mahabharat Range

This is the first high hill range facing the Indo-Gangetic plain. This range is meteorologically of great importance, because it blocks the hot dusty winds from the Indo-Gangetic plain from entering the Midland area and entraps most of the clouds coming from the South-eastern side of India, causing heavy precipitation in the Terai region.

Summer rainfall is dominant and most of the winter precipitation is in the form of snow. In the central and eastern parts rainfall ranges from 2 000 to 3 000 mm, and in West and far West from 1 500 to 2 000 mm. Geologically, the zone is of similar composition as the midland, only that the soft members of the metamorphic complex are rather less prominent (schist, phyllite and slate). In the eastern part of the range dominate granite, gneiss and quartzite, in the middle and western parts cherty dolomite with some slates, and in the far Western part granite and gneiss. The eastern and far western parts of the zone are composed of very hard rocks and are higher in altitude, steeper and consequently less populated. In the middle and western parts there are more villages which have the same supply problems as those in the Midland with somewhat more favourable conditions in areas where dolomite is found.

Thick forests cover large parts of this range, and numerous springs can be found, particularly on the northern slopes where most of the villages are located; southern slopes are much steeper, because of the above mentioned dislocations.

There are no data on the discharge of springs, their variations and water quality.

2.1.4 Churia Hills

They represent the most southern belt of the mountainous complex. Humid tropical climate prevails at lower (300 m) and moist sub-tropical climate at higher altitudes (1 500 m). Rainfall varies from 1 500 to 2 500 mm, with a maximum of 3 500 mm in the Butwal area.

The hill slopes are steep in the South and gentle in the North. Northern slopes bear vegetation and some springs, whereas the southern face is dry. Geologically the Churia Hills correspond to the Miocene-Pleistocene basin composed of gravel, sand and clay beds dipping Northwards. Being porous and exposed, no groundwater is retained in this area (fast drainage). Water availability is very limited, hence, there are not many villages in this area except in "dun valley" (inner Terai) which are filled with recent and Quaternary loose deposits (gravel, sand, clay), saturated with groundwater at the depth of 9 to 12 m. Water is fresh and fit for consumption and can be developed by hand dug and drilled tube wells. The maximum depth of the Quaternary deposits is estimated to be about 300 m in the central part of the "duns". A great many villages are situated in Rapti dun (East) and Deokhuri (West). People use dug wells for tapping and shallow water but they are not properly designed (no proper lining and concrete slab on the top), and easily contaminated both from the sides and the top as shown by the increase of chloride and nitrate content and bacteria. Waterborne diseases are therefore common. It is recommended to test the second layer of groundwater for exploitation or improve the existing wells.

The groundwater table fluctuates from the surface to 12 m. Its development might be difficult in peripheral parts because of very coarse deposits (cobble, bolder). There percussion drilling methods are more appropriate. Streams cannot be used for water supply as they are not perennial.

2.1.5 The Terai Region

The Terai climate is tropical with very hot summers (50 C) and mild winters. The summer rainfall comes from the East and varies from 1 800 mm in the East to 900 mm in the West. In the winter some rainfall comes from the West, so that the western part of the Terai gets more rain than the eastern one. Hence, the total rainfall is nearly equal within the whole area (1 500 to 2 000 mm). Regional surface and subsurface explorations in the Terai suggest that the alluvial material originates from nearby mountains.

The Terai region can be hydrogeologically separated into three zones: the northern Bhabhar zone, the middle or marshy (artesian) zone, and the southern zone - flat lands.

Bhabhar Zone: is a phreatic aquifer composed of very coarse, loose deposits (boulder, pebble, gravel) saturated with groundwater whose water table is at a different depth: at the northern end of the zone it is at the depth from 7 to 90 m, in the central part of the zone at the depth from 5 to 15 m and at the southern edge of the zone immediately below the ground surface or at the ground surface itself. The southern border of the zone is clearly marked by a line of numerous springs.

Location	Static Water Level/ft	Pumping Discharge gph	Drawdown ft	Well Depth ft
Kalaiya	14	45 600	23	360
Parwanipur	15	45 000	18	420
Jitpur	15	40 200	33	200
Pachaule	13	46 800	14	350
Chainpur	16	47 000	13.5	330
Ramporatokni	28	48 000	13.5	390
Parsoni	24	48 000	13.5	390
Khutwa	22	48 000	13	390
Chosimi	11	43 500	20	230
Barewa	22	42 000	18	430
Biratnagar	21	54 725	11	252
Shivnagar	11	56 409	10	240
Chainpur	20	58 000	12	320
Salimpur	30	41 946	16	324
Lakshmipur	9	62 696	10	350
Kaurera	14	54 405	10	330
Bishanpur	24	35 000	18	340
Khutanne	14	52 000	12	330
Simra	7	61 186	10	-
Average	17.2	48 970	15.4	

^{1/} After C.K. Sharma, "A Glimpse of Groundwater Resources of Nepal", Lajimpat, Kathmandu 1970.

The middle zone, marshy or artesian zone, contains two systems of aquifers: the deep confined aquifer system consists of numerous individual aquifers composed of gravel and sand. In some areas, this system starts even at the depth of 30 m, but on the whole the depth does not exceed 60 m. As a rule, wells tapping this aquifer system are of very large discharge and suitable not only for water supply of large communities, but for large scale irrigation schemes also.

The phreatic aquifer is immediately below the ground surface. It is composed of sand, silt and clay and it is very suitable for water supply of small communities by shallow tube wells equipped with hand pumps.

The southern zone, mostly called southern flat zone, stretches along the Nepal-Indian border. It also contains two aquifer systems: the deep aquifer with subartesian conditions and the shallow, phreatic aquifer. The aquifer mainly consists of fine sand, silt and clay. Generally they are poor in water. To secure the water supply of large communities, numerous individual aquifers could be tapped by deep wells. As for small settlements it might be sufficient if only the top, phreatic aquifer is tapped by shallow tube wells equipped with hand pumps.

As there are comparatively few big towns in the Terai for which the large quantity of water needed would have to be provided by deep wells, there remains open the question of the numerous small rural communities whose requirements for water could usually be met by providing a water source with a discharge of few litres per second only. These communities may be provided with water in three ways:

- (i) by using the existing exploratory wells (about 200) and small diameter research wells (about 200). Most of them are overflowing and close to settlements so all that is needed is to construct pipelines from the well to the respective community. Where there was a well used for observation purposes only it can also be used for water supply providing certain modifications are made to still enable measurements of pressure and discharge as well as water sampling. Some of the test wells are in the phreatic aquifer while others penetrate into the confined ones where subartesian conditions prevail. They can be used by providing either hand or diesel pumps, according to the size of the settlement to be served.
- (ii) By improving the large number of dug wells. According to information obtained there exist quite a few dug wells properly lined, so that only a concrete slab drainage for waste water and a hand pump would have to be installed. A sanitary and technical survey should be made to decide which wells could be improved successfully. No improvement of open dug wells is recommended as it is rather complicated and costs almost as much as the drilling of a new shallow tube well.
- (iii) By drilling new shallow tube wells in most of the Terai except in the Bhabhar zone where special heavy equipment is required for the construction of wells. The preliminary observations show that shallow groundwater can be found all over the central and southern parts of the Terai which are also most densely populated; similar conditions exist also in the central parts of the Dun Valleys (Inner Terai). The water bearing formation are usually soft and light rigs can be used for drilling. Judging from the depth to the water table, most of the wells should be 10 to 20 m deep, exceptionally 30 m. The upper 5 to 6 m of the aquifer should not be tapped, due to sanitary reasons (this part should be protected). Considering the seasonal

fluctuations of the water table and the additional use of the aquifer for a large number of minor irrigation schemes, the average depth of the wells should be 15 m. They should be provided with hand pumps whose cylinders are inside the wells. This will increase the price of each well, i.e., the per capita cost, but a continuous water production even under the most unfavourable hydrogeological conditions will thus be assured.

3. Drilling Methods and Equipment Required

For small diameter shallow well drilling, light drill rigs will be the most suitable ones. As mentioned, settlements in the Terai are rather compact, but because of the lack of roads, it will be difficult to transport the rigs to the well locations in the centre of the settlements. The rigs should therefore be easily transportable, even by ox cart or porters. For long distance transport of rigs, four wheel drive pick-ups for 6 persons, 1 to 2 ton capacity, and loading space for materials should be suitable. All engines should be diesel driven.

As for drilling equipment, rotary rigs are more difficult to handle and more expensive than other types of rigs. Drillings mud must be used which means that bentonite of good quality must be provided and a constant control of the quality of fluid is necessary; also well development is more complicated, since the removal of the mud cake might prove difficult. A skilled and well trained drilling crew is therefore indispensable. Few such people or training facilities exist at present in Nepal.

It is therefore recommended to use cable tool type rigs, continuous auger drilling and jet drill rigs. The advantages of using these types are lower cost, easier operation and maintenance and less skill of drilling staff (can be more easily trained). The cost of a complete rig is as follows:

- (i) cable tool rig US\$ 15 000
- (ii) jet boring rig US\$ 15 000
- (iii) continuous auger drilling US\$ 12 000.

There are even cheaper rigs (e.g. Phillipine Fadrig rig US\$ 2 500), but the ones suggested above are of such a capacity that they can meet the requirements for well drilling in the whole of the Terai and Inner Terai, with the exception of areas where the aquifer is composed of boulders and pebbles. In this last case, the heavy duty cable tool rigs should be used. Fortunately, there are few settlements in these areas so that the small number of wells required can be done by the Ground Water Section, Ministry of Food and Agriculture, which has this type of rig and the experienced drilling crews. For drilling these wells, it is also possible to use local contractors or contractors from India.

4. Well Design, Construction and Cost

Each tube well equipped with a hand pump should meet the water requirements for 200 to 500 people, according to the density of population. The walking distance to the wells should not exceed 100 to 150 m if possible.

The public wells should provide for the continuous exploitation within a long period and the maintenance should be as simple as possible (well clearance, pump repair, etc.). In contrast to the experience to date, it is recommended, therefore, to drill large diameter wells (final diameter 6 inches) and to install 4 inch PVC casings and screens (chemically very resistant, hard enough for shallow wells and cheapest and lightest), filter packing and a protection for the upper part of the wells (up to the depth of 5 to 6 m, according to the local conditions) by bentonite or grout. At the surface, a concrete slab, a drain and a pit for the waste water disposal, 5 to 10 m from the well, according to the permeability of the top layer), must be

constructed.

Generally, most of the future tube wells will tap the phreatic aquifer which is composed of silt, various grained sands and, in some areas, finer gravel. With regard to the filter pack suggested, it can be assumed that for screen slots of 0.5, 1.0 and 1.5 mm, filter packings with fractions of 0.5-1, 1-2 and 2-3 mm respectively, will meet the requirements. As for the choice of the screen size a team of experts should be employed, whose task, besides other things, would be to study all the existing hydrogeological documentation and to make additional investigations where data are lacking. For the well development, in addition to the above mentioned equipment, a light compressor should also be provided. According to K. Jagtiani^{1/} a well 50 ft deep, of 4 inch diameter, drilled by jet boring equipment and equipped with a pitcher pump, will cost Rs 500. Providing a well serves 200 inhabitants, the per capita cost would be Rs 2.50/cap. This cost does not include the platform, drain and soaking pit.

According to A. Moller^{1/} a well 60 ft deep, with a diameter of 4 inches and a casing/screen diameter of 3 inches, drilled by a direct, rotary rig, would cost Rs 3 800. To this price has to be added the installation of a hand pump (with a cylinder and raising main inside the well) and the construction of the concrete foundation, Rs 2 200. The total price of the well would be Rs 6 000, i.e. a per capita cost of Rs 30 per capita.

According to the same author, the price of lining of an existing dug well with concrete rings costs Rs 2 400. Adding to this the price of a hand pump and the construction of the concrete slab (Rs 2 200), the total cost of improvement of an existing dug well would be Rs 4 600, the per capita cost being Rs 23 per capita.

According to G. Stern and K. Anderson^{1/} the price of a shallow tube well to be used for irrigation is Rs 3 500. If a pump set is installed (as suggested by A. Moller at Rs 2 200) the total price of the well would be Rs 5 700 or Rs 28.5 per capita.

The highest price of a well 15 m deep is obtained if the local unit price for the drilling (Table 2 below) and casing/screen (Table 3 below) is applied:

- drilling 6 inch diameter 15 m à Rs 410	Rs 6 150.0
- 4-inch steel casing, 11 m à Rs 196.8	Rs 2 164.8
- 4-inch steel slotted pipe 4 m à Rs 393.6	Rs 1 574.4
- gravel packing Rs 250 per well	Rs 250.0
- hand pump set with cylinder in the well	Rs 1 500.0
- pump installation	Rs 200.0
	Rs 11 839.2
	or 59.2 per capita

^{1/} See List of Documents, Annex 4

Well Depth (m)	Drilling dia. (inch)	Unit Price (Rs/Ft)	Type of Drilling
10	2	30	Hand auger + machine
20	2	40	Hand auger + machine
10	4	60	Hand auger + machine
20	4	80	Hand auger + machine
50	4	100	Machine
100	4	160	Machine
10	6	100	Hand auger + machine
20	6	150	Machine
50	6	160	Machine
100	6	200	Machine
50	10	200	Machine
100	10	250	Machine

Steel casing pipe (made in India)		Slotted iron pipe coated with brass (India made)	
Diameter (inch)	Unit Price (Rs/Ft) ^{1/}	Diameter (inch)	Unit Price ^{1/} (Rs/Ft)
2	20	2	40
4	60	4	120
6	140	6	280
8	200	8	400
10	250	10	500

^{1/} Transport and all taxes included

5. Study of the cost of a well

The price is for a well 15 m deep, diameter 6 or 8 inches, drilled by a cable tool rig, with an installed 4 inch PVC casing and screen and a hand pump set with a cylinder and raising main into the well.

It is supposed that a drilling crew may finish 5 wells/month, i.e. 40 wells/year.

1.	<u>Equipment</u>	<u>Rs</u>
a.	One cable tool rig (Dando-150) mounted on a trailer with all accessories required to a depth of 100 Ft US\$ 20 100 Depreciation time for rig : 10 years Annual rate: US\$ 2 010 The rate per one well : 2 010 : 40 = US\$ 50.25 With the rate of exchange 1 US\$ = Rs 10.56 The rate per well comes to	536.-
b.	One pick-up, 4 wheel drive, diesel suitable for transport of 6 passengers and 1 ton of load US\$ 1 500 The rate per one well : 1 500 : 40 = US\$ 37.5	396.-
c.	One tractor with bulldozer blade and operational attachment (it will serve 3 drilling units) US\$ 8 000 (see under d)	
d.	One light compressor 1.50 cfm mounted on a trailer (it will serve 3 drilling units) US\$ 5 000 Depreciation time for items c. and d. is 5 years. Annual rate for c. and d. : Rs 13 000 : 5 = US\$ 2 600 The rate per one drilling unit 2 600 : 3 = US\$ 867 The rate per one well 867 : 40 = US\$ 21.7	229.-
	<u>TOTAL under Item 1</u>	<u>1 161.-</u>
2.	<u>Personnel</u>	
a.	One hydrogeologist (to serve 3 drilling units); annual gross salary 12 x 600 = Rs 7 200 The annual rate per one drilling unit	2 400.-
b.	One drilling superintendant (will serve 3 drilling units) annual gross salary 12 x 450 = Rs 5 400 The annual rate per one drilling unit	1 800.-
c.	One diesel mechanic (for 3 drilling units) annual gross salary 12 x 450 = Rs 5 400 The annual rate per one drilling unit	1 800.-
d.	One driller, annual gross salary 12 x 350	4 200.-
e.	One assistant driller, annual gross salary 12 x 250	3 000.-
f.	Two skilled labourers for drilling, annual gross salary 2 x 12 x 150	3 600.-

2.	<u>Personnel</u> (cont'd)		<u>Rs</u>
g.	One driver (for pick-up), annual gross salary 12 x 200		2 400.-
h.	One driver for tractor (for 3 drilling units), annual gross salary for one drilling unit 12 x 200 : 3 ...		800.-
i.	One driver helper (for tractor and for 3 drilling units), annual gross salary for one drilling unit 12 x 150 : 3		600.-
j.	One mason, for 3 drilling units, annual gross salary for one drilling unit 12 x 350 : 3		1 400.-
		<u>Personnel TOTAL</u>	<u>22 000.-</u>
	The rate per one well 22 000 : 40		550.-
3.	<u>Well Casing and Screen</u> (PVC without custom duties)		
a.	4 inch PVC casing, 11 m à 63.36 (US\$ 6)		697.-
b.	4 inch PVC screen, 4 m à 168.96 (US\$ 16)		676.-
c.	One bottom plug 21.12 (US\$ 2)		21.-
		<u>TOTAL under Item 3</u>	<u>1 394.-</u>
4.	<u>Gravel Packing</u>		
	250. per well		250.-
5.	<u>Diesel, oil, etc.</u>		
	300. per well		300.-
		<u>Well Construction TOTAL : (1-5)</u>	<u>3 655.-</u>
6.	<u>Well protection</u> (concrete slab, drain, pit)		250.-
7.	<u>Hand pump set</u>		
a.	Hand pump body.....	US\$ 48	
b.	Galvanized iron pipe, 13 m a US\$ 4.4	US\$ 57.2	
c.	Steel rod 13 m a US\$ 1.2	US\$ 15.6	
d.	Brass cylinder	US\$ 54.	
e.	Reducing brush barrel	US\$ 8.4	
f.	Barrel nipple	US\$ 2.4	
g.	Brass foot valve	US\$ 4.8	
		<u>US\$ 190.4</u>	
		<u>TOTAL under Item 7</u>	<u>2 011.-</u>
	<u>TOTAL Well cost, Items 1 to 7</u>		<u>5 916.-</u>
	<u>The per capita cost 5 916 : 200 = Rs 29.6.-</u>		

It should be emphasized that the above is a rough estimation only. The actual price of a well and the most effective and suitable drilling equipment will have to be studied during the first phase of a project for the Terai.

6. Government Agencies involved in the Water Resources Exploration and Exploitation

At present there are three Government organizations sharing the responsibility for the Water Supply and Sanitation Sector. They are: the Water Supply and Sewerage Board (WSSB), the Department of Water Supplies and Sewerage (DWSS) and the Remote Area and Local Development Department (LDD). Related activities are carried out by the Nepal Resettlement Corporation which is responsible for a programme of moving people into new areas.

The other organizations related to activities concerning the sector are the Ground Water Section within the Irrigation, Hydrology and Meteorology Department under the Ministry of Food and Agriculture and the Bureau of Mines and Geological Survey under the Ministry of Industry and Commerce.

7. Contractor Services available in Nepal

The Nepal International Drilling Co.

The Nepal International Drilling Co., was established in 1974. It has two drilling rigs bought from the Nepal Resettlement Co. It has one foreign engineer and drillers. Up to now they have drilled only a few wells for hotels in Kathmandu.

The N.B. Tube Wells & Co. (Nepal) Ltd.

The N.B. Tube Wells & Co (Nepal) Ltd., is an Indian company. It has 4 rigs, but they are not stationed continuously in Nepal. Whenever a contract is concluded the rigs are brought from India. In the period 1967 to 1972, this Company drilled 60 wells for the Ground Water Section i.e. for the Ground Water Exploration Project in the Terai Region. They were exploratory wells, but the Company could also make large diameter productive wells.

M/H Hindustan Tube Well Co., Patna, India

The M/H Hindustan Tube Well Co., is a contractor usually engaged by DWSS for the drilling of deep productive wells. This Company is able to make complete determination of water sources in terms of quality and quantity.

In addition to the above mentioned, in the Terai and especially on its border, there are numerous Indian private contractors which offer their services for sinking shallow wells and installing hand pumps, under very favourable conditions and guarantees.

OUTLINE OF AN ACTION PROGRAMME

8. Considering the existing institutional, technical and staff constraints in the country, a programme to serve the whole Terai (about 6 million people by about 1985) will require careful preparation. It appears feasible to serve some 800 000 people by 1980 if the programme is launched as soon as possible along the broad lines of action outlined below. Preliminary costing of the additional outlay required under the current plan period has produced a figure of Rs 25 - 40 million (US\$ 2 - 3 million) or between Rs 30 - 50 per capita.

9. Studies have shown that rich groundwater aquifers exist practically everywhere in the Terai except in the Bhabar area where conditions are difficult and the water table is as low as 300 to 350 ft below the ground level. There is usually a shallow top layer (3 to 20

meters) which may be subject to contamination by infiltration of sullage water, excreta, or fertilizers. The deeper layers are often artesian in character, with both free-flowing or pumped wells possible for exploitation. Groundwater exploitation should start in those areas where sufficient data are available (about 60% of the Terai region). In the rest of the area studies should be accelerated, combined in each case with a pilot drilling programme, to study the most feasible and economic method.

10. LDD would be the agency in charge of the scheme the phases of which are indicated at the end of this section. But cooperation with DWSS is required, also in view of some larger communities that could be served. For villages with over 3 000 people and reasonable access facilities, 1 or 2 wells, with a relative high yield should be drilled as a source for a small piped scheme; water should be distributed within the village by standposts plus house connections to those willing to pay for them. These wells should possibly be of the artesian type which means that drilling has to go down to the deeper layers; where free-flow is not possible, small pumps would be installed driven by diesel or electric motors. The population of the communities should participate in the programme by contributing the required labour. This type of groundwater development should preferably be combined with agricultural development schemes, which means that wells should be big enough to also contribute water for irrigation. The testing done in several zones of the Terai shows that this is possible.

11. Smaller communities and those with difficult access will be better served by shallow tubewells with handpumps. It will be necessary to change the method of construction used so far (which causes damage during construction and therefore small yield, contamination, and short life for the well). It is felt that with the hydrogeological data available, it is not necessary to test what type of rigs would be suitable. A decision can be taken without much difficulty. Experience in the Terai areas of India will also be of great assistance.

12. Considering the soil and depth to which the handpumps and tubewells are to be bored in the Terai, the communication difficulties, shortage of personnel and high cost of fuel, hand boring of tubewells should prevail. Experience has shown that proper maintenance of the rigs in such areas is difficult. Spare parts and fuel would need recurring expenditure of foreign exchange. There is surplus labour in Nepal and a labour-oriented project will be more beneficial to the country. Light jeeps with trailers will help in communication. Where necessary even bullock carts could be used. In the Indian Terai area, all the tube wells for handpumps and even large tube wells for power driven pumps have been bored manually.

13. To support the shallow tube well programme it is necessary to choose a handpump suitable for Nepal. At present, one model is produced at Birganj, but it is not self-priming (cost about US\$ 10). It should be feasible to introduce a self-priming model and produce it at the same factory for an equally low cost.

14. LDD could order with the assistance of UNICEF, some small drilling rigs of the types quoted. These rigs could bore at least 12 tube wells in a year. UNICEF or a bilateral agency could supply the necessary personnel for the first two to three years of the operation of these rigs with the main objective to train local people. Drilling should then start in those areas where sufficient data are already available. The Irrigation Department of the Ministry of Agriculture should consider water supply as part of their agriculture development programmes. Considering the extremely high yields of some of the artesian wells, it should be possible to use them also for drinking water which in most cases constitutes a very small percentage of total water needs.

15. Tube well construction with handpumps could be tried on a community basis. A suitable maintenance unit would have to be established. They should be shown how to construct the wells in such a manner that contamination is not possible.

16. A preventive sanitation programme should go hand in hand with the tube well programme by showing how to construct latrines far enough away from the wells, how to use the pump, how to protect themselves from secondary contamination (by using only clean containers), and also how to take care of personal hygiene.

WATER SUPPLY AND SANITATION
SECTOR STUDY

PUBLIC HEALTH STATUS

1. In the absence of country wide statistical surveillance, the situation and identification or primary concerns in the area of public health can be summarized as follows based upon recent hospital records covering Kathmandu (Table 1 below), sample observations reported by field staff (Table 2) and mission field visits and interviews.
2. Public health as a policy concern became more prominent in the course and as a result of the Country Health Programming exercise conducted during 1973-1974 with the assistance of WHO. Out of the exercise grew a set of objectives and detailed programmes which have become incorporated in the Fifth Plan 1975-1980. Water supply and sanitation defects were singled out as one of the outstanding public health problems and a Project formulation exercise for the sub-sector was undertaken from 18 July to 16 September 1975^{1/}.
3. The existing network of public health facilities is in no position, not even in Kathmandu where available services are clustered, to undertake except for relief efforts any measures improving upon the presently precarious environmental state.
4. Out of the 75 districts, 30 have no hospital and 10 not even a health centre. The ratio of doctors to population varies from 1 : 20 000 in the centre region to 1 : 100 000 in the western region. The country wide average for dentists is 1 : 145 000, for nurses 1 : 34 000, for auxiliary health workers 1 : 20 000, for sanitarians 1 : 1.4 million, and for health educators 1 : 690 000. Laboratory facilities to perform all the necessary tests for the detection of diseases as well as water quality surveillance exist only in Kathmandu.
5. National standards for drinking water do not yet exist. Most of the systems constructed to date have never been tested. WSSB has laboratory facilities of its own and carries out chemical analysis of the Kathmandu water supply as well as of other systems operated by DWSS. The Laboratory of the Department of Health Services in the Ministry of Health carries out a few surveillance tests of the Kathmandu water supply.
6. The task of monitoring water quality control has not been entrusted by Government to any one single authority, on a sector wide basis. It falls upon each agency to concern itself with maintaining satisfactory quality or establishing the acceptability of new source developments.
7. The most widespread infectuous water related, water borne and parasitic diseases are gastroenteritis, infatible diarrhoea, enteric group of fevers (Typhoid etc), dysenteries, hookworm and other worm infestations, malaria and filaria. Cholera is also still widespread. Hospital records for January - October 1975 from Bir Hospital in Kathmandu disclose that about 64% of all cases analysed suffered from infective or parasitic diseases, with a comparatively high incidence of hookworms, which are considered to divert up to one third of a patient's food intake.
8. Malaria had reached a low in 1972, but due to reduced alertness and neglect in spraying houses with insecticide and unimproved environmental sanitation, the disease is again on the rise. According to the local press (The Rising Nepal, 5 October 1975), the number of cases has risen from 2 372 in 1972 to 8 379 in 1973, and some 13 500 in 1974. Cases reported by August 1975 numbered 5 500.

^{1/} See Annex 2.

9. The main obstacles to the success of the eradication programme have been the high and rising cost of insecticides, lack of trained manpower, and the deficient network of campaign management. Presently, areas occupied by 6.4 million people are susceptible to malaria, and the Nepal Malaria Eradication Organization has under control areas occupied by 5.2 million people. The rest of the areas where malaria outbreaks are possible are covered by the integrated health programme. The resurgence of malaria ties up human and financial resources that could otherwise be made available for new areas of public health concern.
10. The effects of ill health and exposure to communicable diseases are exacerbated by widespread nutritional deficiencies particularly in the hilly and mountainous areas.
11. The low level of environmental sanitation in urban communities, including the capital presents the foremost concern in the present context. Public or private sanitary latrines or solid waste disposal have not yet become accepted features of community life. They do not have priority in present planning either. The role of health education is impaired by the existing conditions of communications and media development, particularly by low rates of literacy and acceptability of modern concepts. In the Department of Health there is a Division of Health Education, the activities of which are directed towards informing the public of the potential dangers to health from insanitary living conditions. A call for people's participation in urban sanitation has never been made.
12. The medium term programme for public health as outlined in the present Five Year Plan 1975 - 1980 emphasizes the establishment of basic health services; local health posts serving between 5 000 - 25 000 people according to area constitute the core institution. They would deliver the following services: family and mother/child health, health education, nutritional advice, smallpox surveillance and vaccination, malaria surveillance and therapy, tuberculosis and leprosy control, immunization, first aid field services, recordings of births and deaths, and statistical institutional services. By the end of 1980, the current number of 250 health posts should have grown to 810, of which 597 will be situated in remote and hilly regions and 213 in the Terai.
13. Environmental sanitation - latrine construction and waste disposal - has also been included as one of the tasks to be performed by and through the health post. Junior Auxiliary Health Workers to be attached to each health post constitute the key personnel for sanitation activities.
14. Though many responsibilities have been outlined for the auxiliary health worker and and extensive operations manual been drafted for their guidance, we feel that the following activities should be added because of their preventive nature:
- (a) to encourage people to build latrines; for this a set of simple descriptions should be handed out depicting how to construct latrines cheaply with local material;
 - (b) to inform people about the dangers of contaminating water supplies, about better source protection, and about the hygienic requirements that can be fulfilled once water is made available in quantities greater than just meeting subsistence needs.
15. The above outlined functions can be aptly demonstrated only if the health post itself is equipped with a sanitary water supply and latrine facilities, with a septic tank as a final disposal unit.
16. Similarly, in order to spread sanitary habits rapidly at relatively low cost, all schools should be equipped with water supply and latrines. 64% of children of primary school age are planned to be in school by 1980.

17. Both these programmes are considered to be the only two feasible large scale sector wide sanitation efforts for the current Five Year Plan period, in view of the demand on resources and the potential capacity of health institutions. The actual execution would fall upon the various agencies in charge of establishing the specific community facilities. Where other public buildings are being given priority at the local level, water supply and simple sanitation units should be attached to these. The same applies to envisaged external assistance programmes, even on a pilot basis. As cases in point, the World Bank Rural Development Project under active consideration for two districts (Nuwakot and Rasuwa) as well as the envisaged noted project by UNICEF for water supply in 6 Gurkha districts should be complemented by basic sanitation units as the most convincing attempt at practical health education through demonstration and actual use.

WATER SUPPLY AND SANITATION
SECTOR STUDY

SECTOR INSTITUTIONS AND PRESENT SERVICE LEVELS

A. WATER SUPPLY

	Agency in Charge 1/	Estimated 1975 Population 1000's	No of Administrative Communities (Councils)	No of Communities actually served	House connexions				Standposts			Total Population with access to safe water, incl private systems and springs		Total Population without access	
					Total No	Of which No metered	Population served 1000's	% of Total	No	Pop. with access 1000's	% of Total	1000's	%	1000's	%
URBAN															
Capital area (Kathmandu, Lalitpur, Bhaktapur)	WSSB	265	3	3	16 600	5 000	130	49	1 150	100	38	230	87	35	13
Pokhara	WSSB	36	1	1	900	-	10	28	200	20	56	30	84	6	16
Other established towns	DWSS	143	8	8	1 350	-	10	7	185	105	73	115	80	28	20
	NP	89	4	4	1 350	-	10	11	230	70	79	80	90	9	10
Other urban areas	DWSS	96	4	4	2/	-	-	-	3/	41	88	41	88	11	12
	WSSB		4	4		-	44	44							
Sub-Total		629	24	24	20 000	5 000	160	25	3/	380	61	540	86	89	14
RURAL															
Communities 3 000 - 10 000 pop.	DWSS	6 445	1 346	26	1 500	-	20	2/	3/	115	2	400	3	6 000	97
	GP			21		-									
	WSSB			11		-									
Communities with < 3 000 pop.	LDD + GP	5 500 ^{4/}	2 561	45	-	-	-	-	3/	60	1	200	1.5	5 300	98
Sub-Total		11 945	3 907	103	1 500	-	20	2/		175	2	600	5	11 300	95
TOTAL		12 574	3 931	127	21 700	5 000	180	1.4	3/	555	4.4	1 140	9	11 400	91
<p>Notes: 1/ WSSB - Water Supply and Sewerage Board DWSS - Department of Water Supplies and Sewerage NP - Nagar Panchayat (Town Council) GP - Gram Panchayat (Village Council) LDD - Remote Area and Local Development Department</p> <p>2/ Negligible 3/ Not available 4/ Includes 1.5 - 2 million people living scattered and isolated in mountain and hill regions.</p>															

B. SANITATION

The few pertinent data can be summarized as follows:

- 50 000 people in the Capital Area served by sewerage (WSSB);
- 1 400 septic tanks in the urban areas mainly for Government buildings, hospitals, hotels, schools, etc;
- less than 20 000 people use sanitary latrines in the urban area and hardly any are in use in the rural areas;
- drainage systems for about 250 000 urban population;
- solid waste removal in organized form only for parts of Kathmandu, under Ministry of Health.

WATER SUPPLY AND SANITATION
SECTOR STUDY

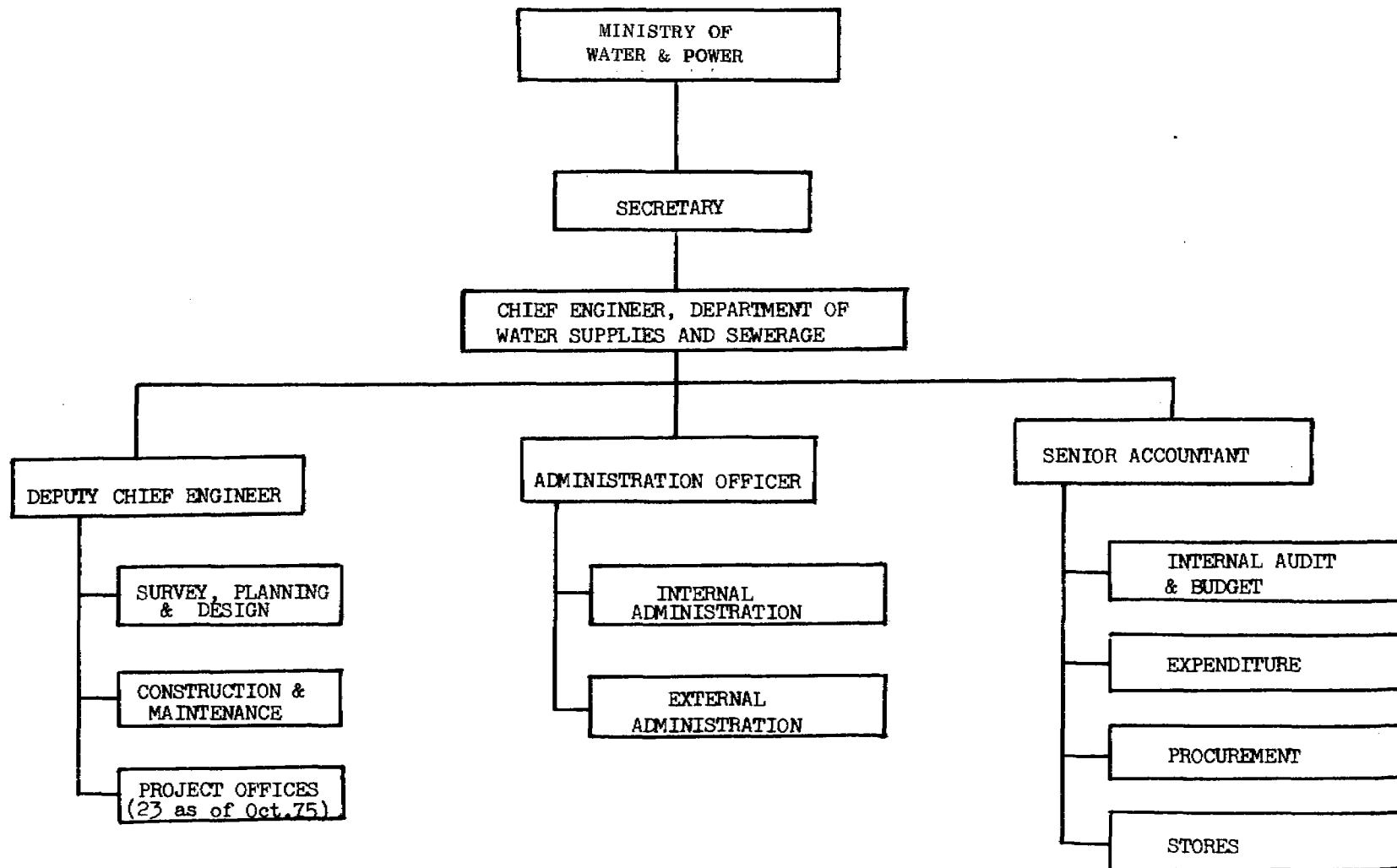
DISTRIBUTION OF STAFF AMONG SECTOR AGENCIES^{1/}
IN TOTALS AND PERCENTAGES

Agency	Professional Staff 1976		
	Established Posts	Filled Posts	
		No	%
<u>DWSS</u>	<u>121</u>	<u>92</u>	<u>33</u>
Engineers	37	31	42
Overseers	64	46 ^{3/}	27
Administrators	20	15	39
<u>LDD</u> ^{2/}	<u>167</u>	<u>152</u>	<u>54</u>
Engineers	36	24	33
Overseers	114	114 ^{4/}	67
Administrators	17	14	37
<u>WSSB</u>	<u>54</u>	<u>38</u>	<u>13</u>
Engineers	22	18	25
Overseers	20	11	6
Administrators	12	9	25
<u>TOTAL</u>	<u>342</u>	<u>282</u>	<u>100</u>
Engineers	95	73	100
Overseers	198	171	100
Administrators	49	38	100

Notes: ^{1/} not including operation and maintenance tasks entrusted to local councils;
^{2/} includes all professional staff for public works. For water supply only:
5 Engineers, 96 Overseers (under training) and approximately 5 Administrators;
^{3/} of which 24 under training;
^{4/} of which 96 under training.

DEPARTMENT OF WATER SUPPLIES AND SEWERAGE (DWSS)

ORGANIZATION AND STAFFING CHART



Source: DWSS

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TECHNICAL MANPOWER SITUATION IN THE DEPARTMENT OF WATER SUPPLIES AND SEWERAGE (DWSS)

	Engineers			Overseers
	Class I	Class II	Class III ^{1/}	
A. Department				
a) Chief Engineer	1	-	-	-
b) Survey, planning & design Section	-	1	10	25
c) Inspection, construction & maintenance		1	2	-
B. Pool (Project Offices)				
Dadheldhura	-	-	-	-
Dailekh	-	-	1	-
Salyan	-	-	1	1
Lung	-	-	-	1
Baglung	-	-	1	1
Rigma	-	-	-	1
Balkot	-	-	1	-
Beshishahar	-	-	-	1
Bharatpur	-	-	1	1
Chautara	-	-	1	-
Falate	-	-	1	-
Namdu	-	-	-	-
Bhojpur	-	-	1	1
Maheudra Nagar	-	-	1	1
Hितादा	-	-	-	1
Zanakpur	-	-	-	1
Madi	-	-	-	1
Ramechhap	-	-	-	1
Ilam	-	-	1	1
Pashupati	-	-	-	1
Butawal	-	-	1	1
Rajbiraj	-	-	1	1
Birendra Nagar	-	-	1	1
	1	2	25	42
In Foreign Training	-	-	2	3
GRAND TOTAL	1	2	27	45

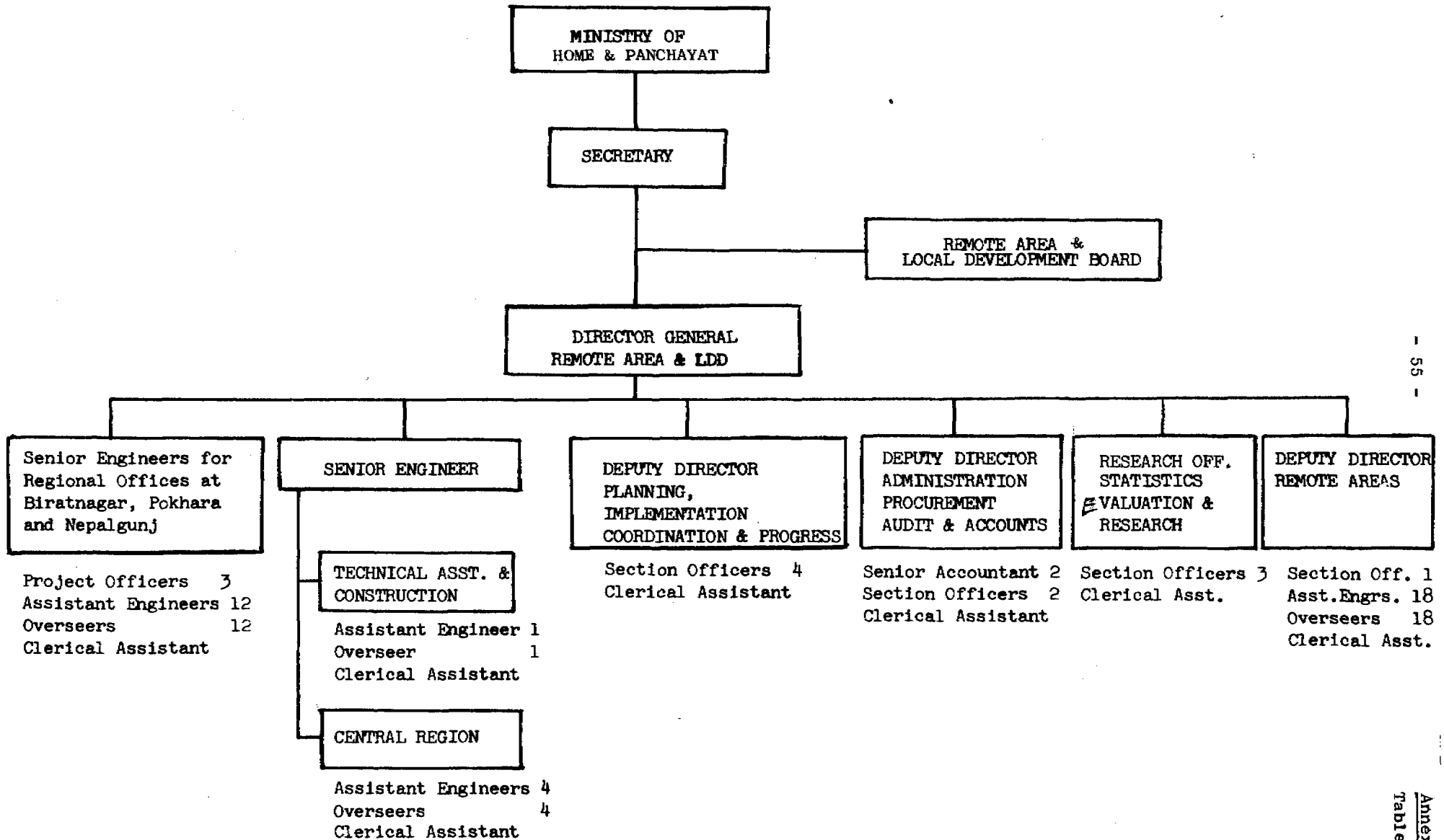
Source: DWSS

Note: ^{1/} Gazetted Classes I, II etc. Overseers and lower grade professionals are classified in non-gazetted classes.

REMOTE AREA AND LOCAL DEVELOPMENT DEPARTMENT (LDD)

Annex 8
Table 4

Organization and Staffing Chart



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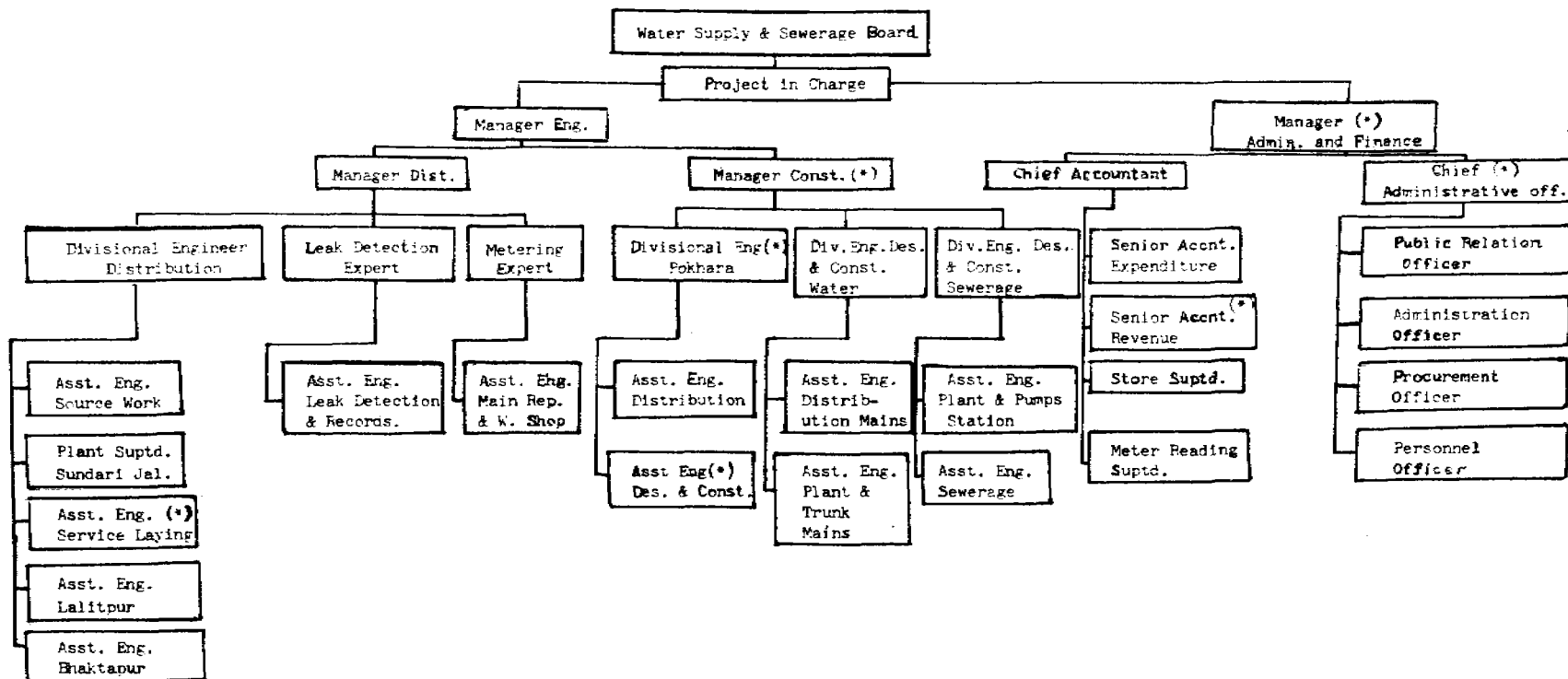
Source: LDD

Notes: Vacancies: Engineers 7, Overseers (not available); A special Water Supply Section was created beginning 1977.

Annex 8
Table 4

WATER SUPPLY AND SEWERAGE BOARD (WSSB)
ORGANIZATION AND PROFESSIONAL STAFF CHART
 (including vacant posts^{1/})

Annex 8
Table 5



^{1/} Vacant posts indicated by (*);
 (4 Engineers, 5 Overseers and 3 Senior Administrative Staff)

Source: WSSB

NEPAL
WATER SUPPLY AND SANITATION
SECTOR STUDY

Annex 9
Table 1

WATER SUPPLY AND SEWERAGE BOARD

CONSOLIDATED SUMMARY INCOME AND EXPENDITURE STATEMENTS
Current Rs 000's unless otherwise stated

<u>Year to July 15</u>	<u>Actuals</u> <u>1972</u>	<u>Estimates</u> <u>1973</u>	<u>Estimates</u> <u>1974</u>	<u>Actuals</u> <u>1975</u>
Number of connections	14 666	16 454	18 001	17 500 ^{1/}
Volume Produced m ³ /000s	7 080	7 300	7 830	12 045 ^{1/}
Volume Sold m ³ /000s	3 540	3 650	3 915	3 650
Unaccounted for %	50	50	50	70
Average Water Charge Rs/m ³	0.36	0.38	0.39	0.50
Population - Total 000s	340	350	359	301
Population - Served 000s	323	330	345	265
Consumption l/cd	30	30	31	38
<u>OPERATING REVENUE</u>				
Billings	1 271	1 375	1 514	1 582
Additional Fee	136	103	112	308 ^{2/}
TOTAL OPERATING REVENUES	1 407	1 478	1 626	1 890
<u>OPERATING EXPENSE</u>				
Labour	467	484	645	1 200 ^{3/}
Chemicals	85	93	170	100 ^{3/}
Power	31	33	56	100 ^{3/}
Administration and General	105	114	119	168
Repairs and Maintenance	263	275	288	300 ^{3/}
Bad Debts Provision	25	10	74	53
TOTAL OPERATING EXPENSE	976	1 009	1 352	1 921
Income Before Depreciation	431	469	274	(31)
Depreciation	1 194	1 255	1 097	1 147
Income Before Interest	(763)	(786)	(823)	(1 178)
Interest Not Capitalized	-	-	-	-
Net Income	(763)	(786)	(823)	(1 178)
Average Net Assets	31 368	32 039	32 952	33 000
Rate of Return %	-	-	-	-
Operating Ratio Before Depreciation %	69	68	83	102

Notes: 1/ Based on average daily production capacity multiplied by 365.
2/ Includes 209 for overdues.
3/ Provisional.

Source: Data - covering water supply operations only - for 1972, 1973 and 1974 are taken from Nepal Water Supply and Sewerage Project, World Bank Report 270a - Nep, 1974, Annex 12.

WATER SUPPLY AND SEWERAGE BOARD

CONSOLIDATED BALANCE SHEETS

Current (Rs 000's)

Year to July 15	Actuals 1972	Estimate 1973	Estimate 1974	Actuals 1975
ASSETS				
Fixed Assets				
Gross in Operation	46 898	47 719	51 077	35 126
Less: Depreciation	<u>14 142</u>	<u>15 447</u>	<u>16 594</u>	<u>1 147</u>
Net in Operation	32 756	32 272	34 483	33 979
Work in Progress	-	<u>1 058</u>	<u>2 936</u>	<u>12 124</u>
Sub-total	32 756	33 330	37 419	46 103
Current Assets				
Inventories	1 511	1 553	1 778	1 853
Net Accounts Receivable	228	298	399	1 004
Cash	-	-	<u>1 188</u>	<u>1 278</u>
Sub-total	1 739	1 851	3 365	4 135
TOTAL	34 495	35 181	40 784	51 637^{1/}
EQUITY AND LIABILITIES				
Equity				
Accumulated Surplus	(2 843)	(3 679)	(4 552)	(4 817)
Contribution	<u>37 338</u>	<u>38 860</u>	<u>42 496</u>	<u>47 927</u>
Sub-total	34 495	35 181	37 944	43 110
Debt				
Long Term Gross	-	-	2 600	8 232
Less: Current Maturities	-	-	-	-
Long Term Net	-	-	2 600	8 232
Current Liabilities				
Accounts Payable	-	-	240	295
Current Maturities	-	-	-	-
Sub-total	-	-	240	295
TOTAL	34 495	35 181	40 784	51 637
Debt as a % of Fixed Assets	-	-	7	18
Current Ratio (times)	-	-	14	14
Receivable as a % of Revenue	-	-	25	53

Notes: 1/ Incl. 1 399 for "Advance unleared"

Source: Data for 1972, 1973 and 1974 are taken from World Bank Report op.cit., Annex 14. 1975 data have been submitted to the mission by WSSB.

WATER SUPPLY AND SEWERAGE BOARD
STATEMENT OF CASH COLLECTION 1974-1975
(Rs '000)

Annex 9
page 3

Month ^{1/}	Kathmandu				Lalitpur				Bhaktapur				Pokhara			
	Water Charge (1)	Overdue incl. fines (2)	Other (3)	Total (4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
July	126	12	-	138	7	0.4	0.7	8.1	1	0.1	0.1	1.2	2	0.1	0.1	2.2
Aug	140	21	-	161	5	0.6	0.5	6.1	5	0.2	0.3	5.5	10	0.2	2	12.2
Sept	100	13	-	113	5	0.4	0.8	6.2	3	0.2	0.1	3.3	3	0.2	2	5.2
Oct	79	8	1	88	3	0.4	0.7	4.1	2	0.2	0.2	2.4	2	0.2	0.1	2.3
Nov	103	12	3	118	5	0.9	0.5	6.4	3	0.2	0.1	3.3	4	1	0.3	5.3
Dec	120	35	3	158	4	0.6	1	5.6	3	0.3	0.2	3.5	2	3	0.8	5.8
Jan	112	17	11	140	5	1	2	8	4	0.3	0.4	4.7	3	0.5	0.5	4.0
Feb	109	13	2	124	5	0.5	1	6.5	3	0.2	0.1	3.3	4	0.9	0.2	5.1
Mar	137	17	2	156	9	1	2	12	4	0.6	0.1	4.7	3	0.8	0.1	3.9
Apr	130	16	2	148	6	0.8	3	9.8	5	0.3	4	9.3	2	0.3	0.1	2.4
May	121	12	6	139	8	0.5	1	9.5	6	0.4	1	7.4	3	0.4	0.1	3.5
June	145	14	5	164	7	1	0.8	8.8	7	0.3	0.7	8.0	7	0.4	0.1	7.5
1974/75	1 422	190	35	1 647	69	8.1	14.0	91.10	46	3.3	7.3	56.60	45	8.0	6.4	59.40

Grand Total of 4 towns: (1) Water Charges 1 582.0
(2) Overdues 209.4
(3) Other 62.7
Total 1 854.1

Note: ^{1/} Nepalese months beginning 16th

Source: WSSB. Data rounded, totals may not add up completely.

WATER SUPPLY AND SANITATION
SECTOR STUDY

WATER SUPPLY AND SEWERAGE BOARD

WATER TARIFF

1. METERED SUPPLY ^{1/}

a. Rate of charge

≤ 10 000 l/month Rs. 0.50 per 1000 litres

> 10 000 l/month Rs. 0.80 per additional 1000 litres

b. Minimum charge

Monthly charges		
Connection Size	Kathmandu Rs.	Bhaktapur/Lalitpur/Pokhara Rs.
1/2"	5.00	3.00
3/4"	20.00	20.00
1"	40.00	40.00
1.1/2"	120.00	120.00
2"	200.00	200.00
3"	600.00	600.00
4"	1 200.00	1 200.00

2. UNMETERED SUPPLY

Monthly charges				
Connection Size	Kathmandu		Bhaktapur/Lalitpur/Pokhara ^{2/}	
	First tap	Other taps	First tap	Other taps
1/2"	9.00	3.00	5.00	3.00
3/4"	30.00	6.00	30.00	6.00
1"	60.00	12.00	60.00	12.00
1.1/2"	170.00	30.00	170.00	30.00
2"	340.00	50.00	340.00	50.00
3"	930.00	100.00	930.00	100.00
4"	1 930.00	235.00	1 930.00	235.00

3. PUBLIC STANDPIPES

Payable by H.M. Government, Rs 100 each per month.

- Notes:
- 1/ Only Kathmandu has some metered connections at present.
 - 2/ These are the same rates as applied by DWSS country wide except for second etc. taps for 1/2 inch connections where DWSS charges Rs 1 instead of Rs 3.

Source: WSSB

DEPARTMENT OF WATER SUPPLIES AND SEWERAGE

Annex 10

WATER TARIFF

Table 2

1. METERED SUPPLY -- not provided.

2. UNMETERED SUPPLY

Monthly Charges (Rupees)

Size of Connection	Until 14 January 1975		Since 14 January 1975		After 14 April 1975	
	First tap	Each Subsequent tap	First tap	Each Subsequent tap	First tap	Each Subsequent tap
½"	3.00	1.00	3.00	1.00	5.00	1.00
¾"	6.75	1.00	30.00	6.00	30.00	6.00
1"	12.00	1.50	60.00	12.00	60.00	12.00
1½"	27.00	1.50	170.00	30.00	170.00	30.00
2"	48.00	4.00	340.00	50.00	340.00	50.00
3"	108.00	4.00	930.00	100.00	930.00	100.00
4"	192.00	6.00	1930.00	235.00	1930.00	235.00

Source: DWSS

NEPAL
WATER SUPPLY AND SANITATION
SECTOR STUDY

Annex 11
Table 1

DEVELOPMENT PLAN ALLOCATIONS IN THE PUBLIC SECTOR BY AREAS OF ACTIVITY

In Rs million and percent (in parentheses)

	Plan I 1956-1961	Plan II 1962-1965	Plan III 1965-1970	Plan IV 1970-1975	Plan V 1975-1980 Min. Progr ^{1/}
1. Transport & Communication	124 (37.6%)	144 (23.0%)	615 (35.4%)	1 050 (40.8%)	1 431 (23.2%)
2. Agriculture	95 (28.7%)	117 (19.6%)	378 (21.6%)	663 (25.7%)	1 851 (30.0%)
3. Industry & Power	55 (16.6%)	193 (32.1%)	385 (22.1%)	470 (18.3%)	1 234 (20.0%)
4. Social Services	44 (13.3%)	115 (19.1%)	293 (16.8%)	324 (12.7%)	1 468 (23.8%)
<u>of which water & sanitation</u>	n.a	n.a	31 ^{2/}	38	217
5. Miscellaneous	13 (3.8%)	32 (5.2%)	70 (4.1%)	63 (2.5%)	186 (3.0%)
TOTAL	330 (100%)	600 (100%)	1 741 (100%)	2 570 ^{1/} (100%)	6 170 (100%)

Notes: 1/ Assuming 4% annual GDP growth rate.
2/ Of which 8,7 million for rural supplies.
3/ Original allocation, including Rs 9 million as Government contribution towards the Master Plan Studies for Kathmandu Valley and Pokhara, and Rs 16 million for improvements of urban water supplies. Allocations from the budget were increased during the plan to a total approaching Rs 100 million to match external assistance commitments of close to US\$ 8.5 million.

Source: Fourth Plan and Fifth Plan summaries

FOURTH PLAN ALLOCATION AND EXPENDITURE FOR WATER SUPPLY

Current Rs million

Fiscal Year	Allocation				Expenditure			
	Urban DWSS ^{1/} only	Rural		Total	Urban DWSS only	Rural		Total
		DWSS	LDD ^{2/}			DWSS	LDD	
1970-1971	7.9	3.6		11.5	3.0	1.3		4.3
1971-1972	6.0	4.0	0.6	10.6	3.1	3.1	0.2	6.4
1972-1973	10.5	4.4	2.6	17.5	5.0	3.7	1.9	10.6
1973-1974	3.1	22.4	2.5	28.0	2.1	7.1	3.2	12.4
1974-1975	7.8 ^{3/}	10.4	5.3	23.5	4.3 ^{3/}	7.4	5.3	17.0
TOTAL	35.3	44.8	11.0	91.1	17.5	22.6	10.6	50.7

Notes: 1/ Department of Water Supplies and Sewerage (incl. allocation for WSSB)
 2/ Remote Area and Local Development Department
 3/ Excludes expenditure of US\$ 103 000 (by HMG and West Germany) on Bhaktapur water supply and sewerage construction.

Source: Report on Urban Water Supply, Sewerage and Excreta Disposal, Nepal, WHO/SEARO, 20 May 1976 (Draft)

THE FIFTH PLAN FRAMEWORK, 1975 - 1980^{1/}

	Five-Year totals in Rs million under	
	Minimum Programme with annual GDP growth target of 4%	Maximum Programme with annual GDP growth target of 5%
<u>1. Total Development Outlay</u>	<u>9 197</u>	<u>11 404</u>
of which :		
- Public sector	6 170	7 545
- Panchayats	931	1 187
- Private sector	2 096	2 672
<u>2. Public Sector Resources</u>	<u>6 170</u>	<u>7 545</u>
of which from :		
- Domestic resources	3 994	4 150
- External assistance	2 776	3 395
<u>3. Total Investment</u>	<u>7 963</u>	<u>9 895</u>
of which in :		
- Public sector	4 936	6 036
- Private sector	2 096	2 672
- Panchayat sector	931	1 187

Note: ^{1/} Base year GDP 1974-1975 was estimated at Rs 14.3 million

Source: Fifth Plan, National Planning Commission, 1975

DEPARTMENT OF WATER SUPPLIES AND SEWERAGE

Annex 11

PROPOSED IMPLEMENTATION SCHEDULE FOR 1975 - 1980 (5TH FIVE YEAR PLAN)

Table 4

URBAN SCHEMES FEASIBILITY STUDIES, ENGINEERING DESIGN, TENDER DOCUMENTS (CONSTRUCTION AFTER 1980)

Priority	District	Community	Estimated 1975 Pop. (000)	Present Supply Situation				Standposts No.	Industry	Development	Population Growth	Remarks & Observations
				Production	Population served (000)	Consumption (theoretical) l/ cap.d.	House Connc.					
				mld			No.					
1	Banke Far Western Region	Nepalganj	27.5	1.08	23.5	46	2/	2/	small only	main trading centres for western hill & mountain regions connected to Indian rail- head.	4%	Very bad supply situation breakdowns in electricity and diesel supply; sewerage design should start, but construction can be delayed. Malaria area - good surface drainage necessary.
+ 1	Korang Eastern Region	Biratnagar	49.7	2.03	45.1	45	600	60	jute industry (ADE assistance sugar & small others	very good development potential; good commun- ications.	2.5%	Very large migrant pop. (40 - 50 000); old supply (1964); only 7 hours/d supply, 2000 applicants for house connections; sewerage and drainage needed, feasibility study exists.
1	Makwanpur Central Region	Hetauda	25.0	1.35	16.2	83	350	20	Timber Corp. slaughter house industrial estates (own supply)	to develop into one of the major industrial centres good comm- unications.	11.0%	Old supply (1965); tremendous population growth due to excellent development potential, only 10 h/d supply, high leakage and wastage, no sewerage, limited drainage system.
2	Dhanusha Central Region	Janakpur	17.2	1.35	14.3	94	150	40	Cigarette factory (being expanded) own supply from tube- wells		4.8%	Sources are estimated to be adequate; distribution system needs extension. 500 000 pilgrims/year visit local temples.

Annex 11
Table 4 (cont'd)

Priority	District	Community	Estimated 1975 Pop. (000)	Present Supply Situation				Standposts No.	Industry	Development	Population Growth	Remarks & Observations
				Production mld	Population served (000)	Consumption (theoretical) l/ 1/cap.d.	House Connec. No.					
2	Farsa Central Region	Birganj	14.0	1.35	13.0	104	520	60	important industrial town (most factories have own supply)	main entry point from India	1.0%	Feasibility study exists (some capital works recommended)
2	Rupandahi Western Region	Bhairawa	23.5	0.90	17.3	52	270	25	sugar factory (own supply)	possible tourist potential	8.0%	Problems at the source (wells); new well has been sunk, but has not been developed at time of study (1973).
3	Rupandahi Western Region	Butwal	17.4	2.03	12.9	157	60	40	no industry		8.0%	Newly constructed supply (1975)
+ 3	Palpa Western Region	Tansen	7.0	0.38	6.4	59	90	40	no industry		2.3%	New supply has been constructed (1975)
+ 3	Ilam Eastern Region	Ilam	8.5	0.16	7.3	22	2/	2/			3.9%	Insufficient information.
3	Septan Eastern Region	Rajbiraaj	9.2	1.35	7.8	173	2/	2/			4.1%	Insufficient information.
3	Jhapa Eastern Region	Bhadrapur	8.8	0.64	10.0	64	2/	2/			4.1%	Insufficient information.
+ 3	Sunsari Eastern Region	Dharan	23.9	1.92	20.5	94	660	130	small industry only; estate planned		3.9%	Treatment plant not operated adequately; high percentage of wastage
		TOTAL (12)	231.7	14.54	194.3	75	2700	415				

1/ Includes leakage and wastage

2/ Number not known

Source: DWSS

NEPAL
WATER SUPPLY AND SANITATION
SECTOR STUDY

Annex 11
Table 5

DEPARTMENT OF WATER SUPPLIES AND SEWERAGE

PROPOSED IMPLEMENTATION SCHEDULE FOR 1975-1980 (5TH FIVE YEAR PLAN)

RURAL SCHEMES NEW SUPPLIES ONLY

No	District	Locality	Estimated 1975 Pop. 1000's ^{1/}	Preliminary study by	Design by	Project Office established by	Contained in workplan of 1975/76	Project carried over from 4th FYP since 1970	Project carried over from 1974/75	Estimated Construction cost Rs 1000's	Survey and design to be carried out (year)	Construction to be carried out in			
												1976/77	1977/78	1978/79	1979/80
1	Dandhelhura	Dandhelhura	4	DIWI ^{2/}	WSSD	WSSD				1000		+			
2	Archan	Ririkot	7	DIWI	WSSD	WSSD		+		1860		+			
3	Dallekh	Dallekh	3	DIWI	WSSD	WSSD		+		210		+			
4	Phyntan	Lung	4	WSSD	WSSD	WSSD		+		425		+			
5	Arghekhanchhi	Balkot	6	WSSD	WSSD	WSSD		+		1900		+			
6	Gulmi	Riha	3	WSSD	WSSD	WSSD		+		1325		+			
7	Baglung	Baglung	5	DIWI	WSSD	WSSD	+		+	750		+			
8	Lamjung	Beshishahar	2	WSSD	WSSD	WSSD				305		+			
9	Chitwan	Bharatpur	18 ^{2/}	WSSD	WSSD	WSSD				7235		+			
10	Kapilbasta	Tulijama	9	WSSD	WSSD	WSSD				1360		+			
11	Kavrepalanchok	Palante	2	WSSD	WSSD	WSSD		+		340		+			
12	Sindupalanchok	Chentara	2	WSSD	WSSD	WSSD					1975/76	+			
13	Dolkha	Nandu	1	WSSD	WSSD	WSSD		+		255		+			
14	Bojpur	Bojpur	5	WSSD	WSSD	WSSD		+			1975/76	+			
15	Bara	Kalaja	3	WSSD							1975/76	+			
16	Rantahat	Gaur	5				+		+		1975/76	+			
17	Dhankuta	Chuliban	8	WSSD	WSSD	WSSD				2830		+			
18	Taplejung	Taplejung	2				+				1976/77		+		
19	Panchthar	Phidim	2				+	+			1976/77		+		
20	Jhapa	Chandragachi	3				+				1976/77		+		
21	Sankhuwasaba	Khandbari					+				1977/78			+	
22	Sunsari	Inarwa	6				+				1975/76	+			
23	Solukhumbu	Phaplu					+				1977/78			+	
24	Khotan]	Diktel					+				1977/78			+	
25	Udaypur	Gaighat					+				1975/77			+	
26	Siraha	Siraha	3				+		+		1977/78			+	
27	Dolkha	Charikot					+				1977/78			+	
28	Mahottari	Yalesquare	5				+		+		1975/76			+	
29	Sarlahi	Malangwa	3				+		+		1975/76			+	
30	Nuwakot	Bidur					+		+		1977/78			+	
31	Dhading	Sunaula B.					+		+		1977/78			+	
32	Rasuwa	Dhanche					+		+		1975/76			+	
33	Dolpa	Dulve					+				1973/79			+	
34	Gorkha	Gorkha	2				+				1978/79			+	
35	Hanang	Chame					+				1973/79			+	
36	Parlat	Kusma	3				+				1978/79			+	
37	Nawal Parasi	Parasi	3				+				1977/78			+	

- ^{1/} Where no population figure appears, the community has probably less than 1500 population
^{2/} More than one village
^{3/} Consulting Engineers

Source: DWSS

Annex 11
Table 5 (cont'd)

No	District	Locality	Estimated 1975 Pop. 1000's ^{1/}	Prefeasibility study by	Design Finished by	Project Office established by	Contained in workplan of 1975/76	Project carried over from 4th FYP since 1970	Project carried over from 1974/75	Estimated Construction cost Rs 1000's	Survey and design to be carried out (year)	Construction to be carried out in			
												1976/77	1977/78	1978/79	1979/80
38	Gulmi	Tanghas	3				+		+		1975/76				
39	Argakhanchi	Narayani					+		+		1975/76				
40	Mustang	Thomsom	2								1978/79				+
41	Rukum	Musikot	6	DIWI							1976/77		+		
42	Rolpa	Libang	3				+				1977/78			+	
43	Titrikot	Depalgaon									1978/79				+
44	Mugu	Mugu	2								1978/79				+
45	Hunla	Simikot									1978/79				+
46	Bardia	Gularia					+				1977/78			+	
47	Bajura	Bajura	2	DIWI							1976/77		+		
48	Bajhang	Chainpur	3								1978/79				+
49	Achan	Mangalsen	6	DIWI							1975/76	+			
50	Darchula	Darchula	2				+				1977/78			+	
51	Dangdeukhuri	Kailabas	4	DIWI	WSSD					170	1975/76	+		+	
52	Ramechhap	Ramechhap	2	DIWI							1975/76	+			
53		Sivuva	4	DIWI							1976/77		+		
54		Syuchatar									1977/78			+	
55	Lalitpur	Lubhu	3								Pass to WSSB				
56		Dhadkhikot									1977/78			+	
57		Hatmate									1977/78				
58		Gilung									1977/78			+	
59		Yang Jakot									1978/79				+
60		Karendanda									1978/79				+
61		Darsing									1978/79				+
62		Malla									1978/79				+
63		Rupakot									1978/79				+
64	Chitwan	Narayankat	3								1976/77				
65	Udaipur	Udaipur	3								1976/77			+	
66		Sakphara									1978/79				+
67		Chujendanda									1978/79				+
68		Chukiharigaon									1978/79				+
69		Netrakali									1978/79				+
70	Surketh	Birendra Nagar	5								1976/77			+	
71	Dankuta	Dankuta	12								1976/77			+	

1/ see overleaf.

INVESTMENT COST OF URBAN WATER SUPPLIES

Urban Centre	1987 Projected Population	Capital Cost Estimate (1000 Rs) at 1972 Prices
Greater Kathmandu and Bhaktapur	359 000	130 018
Biratnager	67 000	9 444
Nepalgunj	35 000	7 710
Dharan	37 000	14 710
Pokhara	45 000	14 860
Bhairawa	50 000	12 690
Hetauda	50 000	15 300
Janakpur	31 000	5 000
Butwal	40 000	10 190
Birgunj	25 000	5 000
Tansen	10 000	4 360
TOTAL	749 000	229 282

Based on the above estimates, per capita cost urban water supplies would be Rs 310 on average and Rs 360 for Greater Kathmandu and Bhaktapur.

Source: Water Supplies and Sanitation in Nepal, Sector Study 1973 by Binnie and Partners, Tables 4.3 and 5.1

WATER SUPPLY AND SANITATION
SECTOR STUDY

POPULATION GROWTH AND DISTRIBUTION

Year	End-Year Population (in Thousands)		
	Urban ^{1/}	Rural	Total
1970	532	10 854	11 386
1971	560	11 087	11 647
1972	588	11 325	11 913
1973	619	11 569	12 188
1974	650	11 818	12 468
1975	684	12 071	12 755
1976	719	12 330	13 049
1977	756	12 594	13 350
1978	795	12 864	13 659
1979	836	13 139	13 975
1980	879	13 420	14 299

^{1/} In the Nepalese Constitution communities are classified into Nagar (Urban) or Gram (Rural). To qualify for the status of Nagar Panchayat (Municipality), the population should be 10 000 or more and should have motorable roads and water and electricity supply systems. However, one or more of these facilities may not be available. There are 16 municipalities and 8 additional communities with more than 10 000 inhabitants each.

Source: UN Population Statistics

Area	Population	Identifiable compact communities with population greater than				
		7 000	7 000 to 3 500	3 500 to 2 500	2 500 to 1 500	1 500 to 300
Terai	4 211 000	9	12	14	14	5 130
Midlands	6 246 000	7	14	33	45	530
Hills	1 099 000	nil	1	8	36	582
Total	11 556 000	16	27	55	95	6 242

Source: Binnie and Partners Sector Study, 1973

Table 3 a		VITAL STATISTICS				
	Census 1971	Nepal Health Survey 1966				
Crude birth rate	40/1 000				
Crude death rate	20/1 000	27/1 000				
Infant Mortality rate	183/1 000	130-208/1 000				
Natural increase rate	2.07% per annum					

Table 3 b		POPULATION PROJECTIONS, 1975 - 2000				
	1975	1980	1985	1990	1995	2000
Total Population (in thousand)	12 574	14 230	16 267	18 747	21 746	25 408
Crude Birth Rate (per 1 000)	44.0	44.7	44.9	44.3	43.7	43.5
Crude Death Rate (per 1 000)	20.4	18.9	17.3	15.3	13.4	11.5
Growth Rate (% per annum)	2.36	2.58	2.76	2.90	3.03	3.19
Life Expectancy at Birth (in years)						
Males	42.1	44.1	46.3	48.8	51.5	54.5
Females	45.2	47.7	50.2	53.2	56.2	59.2

Estimates of International Bank for Reconstruction and Development Mission to Nepal, 1973

NEPAL

Annex 13

WATER SUPPLY AND SANITATION
SECTOR STUDY

TECHNICAL PERSONNEL TRAINED IN NEPAL INSTITUTIONS, 1972 - 1975^{1/}

Campus and Course		1972	1973	1974	1975	Total
1. <u>Nepal Engineering Institute Campus as</u>						
Civil Engineering Overseers	Intake	120	144	144	144	552
	Output	45	78	80	130	333
Draftsman/Arch/Ce	Intake		18		24	42
	Output			10		10
Plumber/Pipe Fitter	Intake		16	16	16	48
	Output			14	14	28
Brick layer	Intake	14	10	32	32	88
	Output	10	8	28	28	74
Carpenter	Intake	16	16	32	32	96
	Output	12	14	28	28	82
2. <u>Thapathali Campus</u>	(Mainly Electrical & Mechanical)					
3. <u>Balaju Centre</u>	(Mainly General Mechanics)					
4. <u>Biratnagar Centre</u>	(Mainly Mechanics - Semi Skilled)					
5. <u>Cottage Industry Centre</u>	(General Mechanics, electrician and furniture makers)					
6. <u>Butwal centre</u>						
Brick layers	Intake	3	3	3	3	12
	Output	3	3	3	3	12
	(others include electricians, mechanics etc.)					

Source: WHO/SEARO report on urban water supply, etc., May 1976 (Draft)
Appendix XVII

Note: 1/ Centre for Economic Development and Administration (CEDA)

To these institutions should be added the Centre for Economic Development and Administration at Tribhuvan University near Kathmandu. CEDA has since its establishment in 1969 conducted over 55 seminars, workshops and colloquia involving 1 400 participants, mostly civil servants at middle and upper management levels. The Centre has also completed a series of research and consultancy studies for the National Planning Commission, various Ministries and public enterprises. It also has conducted a development study of the Far Western Region of Nepal.

WATER SUPPLY AND SANITATION
SECTOR STUDY

POLITICAL ADMINISTRATION

DISTRICT ADMINISTRATION AND PLAN

1. There are 75 District Councils with Chief District Officers (CDO) appointed by HMG as executive heads. District Development Officers (DDO's) assist them and act as secretaries of the District Council. The lion's share of field administrative work is handled by the districts to the virtual exclusion of the zonal level. In relation to the Village Council level, Village Development Officers (VDO) have been appointed but are not yet enough in number so that on average one VDO would have to look after a whole group of villages. District Councils are facing difficulties in exerting their role versus the Village Councils.
2. Staff of District Councils is appointed and administered by the Ministry of Home and Panchayat although increasing authority relating to personnel matters is being delegated to CDO's. The typical staffing pattern of a district level office is shown in the chart below.
3. Among other duties, District Councils are to provide for sanitation and health services, drainage and drinking water schemes..., to execute all district level development projects initiated by HMG..., to formulate projects for the district after coordinating the programmes of the Village Councils and the Town Councils..., to supervise and inspect the activities of these bodies and to give them directives^{1/}.
4. There are three categories of offices operating at the district level:
 - the office of the Chief District Officer (CDO) as the field office of the Ministry of Home and Panchayat;
 - the office of the District Council exercising any autonomous functions granted by the Local Administration Act;
 - the host of Central Departments' field offices operating at the district level under the authority from the Centre.
5. Some of the present weaknesses to be overcome are:
 - the remote control to be exercised by the respective Departments tends to be ineffective.
 - There is little de facto cooperation between field offices of several Departments, leading to duplication of efforts.
 - Effective supervision and control of the Chief District Officer over various programmes funded and/or staffed by the Centre has yet to be established, as a precondition to district-wide coordinated development planning.
 - The CDO is not given any credit for the success of projects so he is often not willing to take on the responsibility of helping projects along by removing obstacles to implementation.
 - The funds available to the District Councils for local development are marginal in comparison to the funds available to Departmental field offices; thus impairing the role of the CDO in programming development work.
 - The role of the CDO versus the District Council is not clarified in the Local Administration Act. Thus there is a tendency on the part of CDO's to keep themselves aloof from the activities of the District Council.

^{1/} District Councils may implement and operate schemes which are too large for, or which affect more than, one village community.

- Similarly, the duties and responsibilities between CDO's and the Zonal Commissioners are not clearly defined. There have been frequent cases of the zonal office acting at cross purposes with the CDO by merely demonstrating their authority. This has weakened the district administration in the eyes of the local people and confused them. CDO's have had to face conflicting orders from the Ministry of Home and Panchayat and Zonal Commissioners.
- There is no career development plan yet for district officials involving selections, rotational assignments, training and incentives.
- The principle of uniform and equal treatment as regards staffing of all district offices irrespective of district size, population, workload has proved to be the outstanding administrative problem to date. A staffing system in line with the potential importance of various districts needs to be developed.

6. The solution to these manifold problems will be facilitated by accelerating the evolution towards an integrated district organization comprising almost all district local development offices under the unified command of the Chief District Officer under the advisory role and guidance of the District Council^{1/}.

REGIONAL ADMINISTRATION

7. A programme for setting up development administration activities (as distinct from law and order administration) at the regional level is to be implemented during the current 1975-1980 Five Year Plan.

8. The actual establishment of this specialized functional administrative network, a new feature in Nepal's public service structure, is taking longer than originally assumed. By 1976, four Regional Development Centre Offices comprising several existing zones (which would gradually disappear) should have been working, namely:

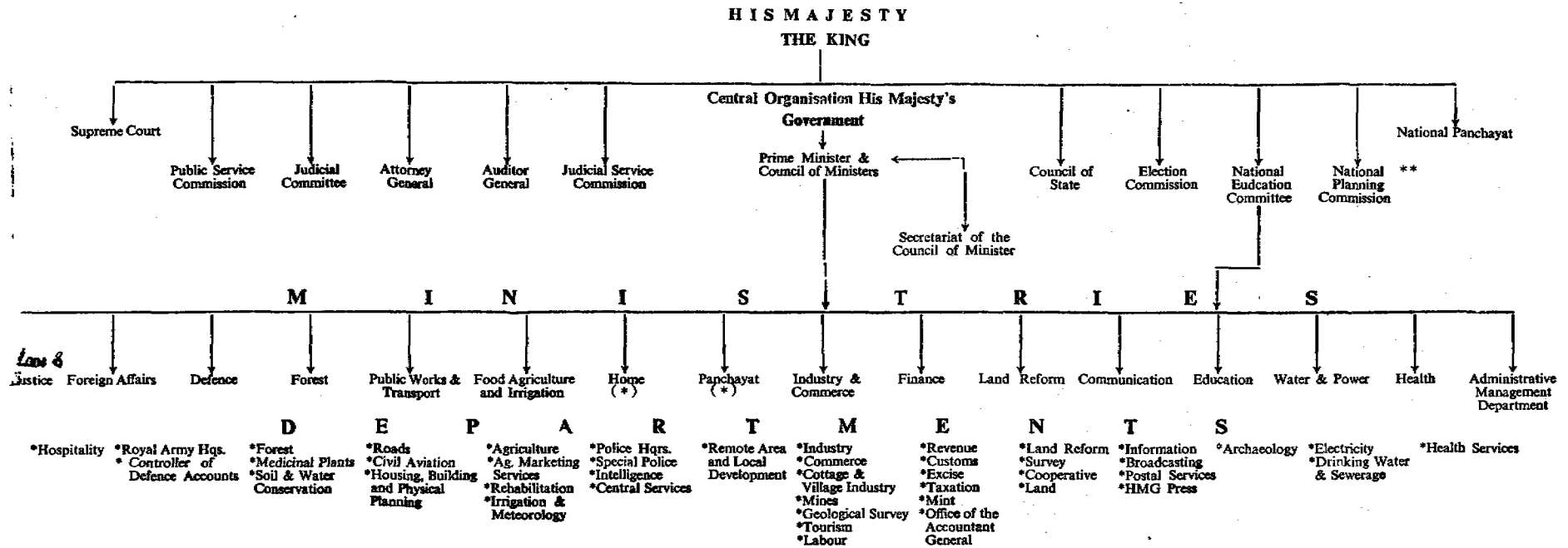
- | | |
|--|--|
| (a) <u>Eastern Region:</u> | Development Centre: Dhankuta |
| Comprising Mechi
Kosi and
Sagarmatha Zones | |
| (b) <u>Central Region:</u> | Development Centre: Kathmandu
Hetauda |
| Comprising Janakpur
Bagmati and
Narayani Zones | |
| (c) <u>Western Region</u> | Development Centre: Pokhara |
| Comprising Gandaki
Lumbini and
Dhaulagiri Zones | |
| (d) <u>Far-Western Region:</u> | Development Centre: Surkhet |
| Comprising Rapti
Karnali
Bheri
Sati and
Mahakali Zones | |

^{1/} Public Administration in Nepal, op.cit., p.105 ff.

9. The regional administrative structure is conditional upon two processes of administrative evolution, viz., the handing over of developmental powers and duties in terms of programmes, appropriations and staff from the Centre to the Region, and the convergence of district level activities for review and guidance by the Region. None of these processes is yet in full swing, as many obstacles have to be overcome, such as finding suitable staff for a complex task which falls outside traditional civil service and career patterns, residential difficulties for lack of social, health and communication facilities in the outlying regions, and lack of enthusiasm on the part of the traditional administration to give up established prerogatives.

10. However, the Fifth Year Plan Budget allocates funds by regions, thus providing an impetus towards implementation of the policy through the annual programmes to be drafted by the various Departments and to be approved by the National Planning Commission.

11. The planned regionalization of a host of activities such as agriculture, irrigation, resettlement, education, housing and physical planning, transport, land reform, cooperatives, health, industry, commerce, tourism, labour power, drinking water supply and forest programmes practically in a parallel fashion over a 2 year span is overtaxing administrative capabilities. It is therefore realistic to anticipate considerable delay in the actual ability of Regional Development Centres to perform the functions entrusted to them. With particular regard to sector activities it can safely be assumed that the regional set-up will not become fully functioning before the beginning of the next Five Year plan period 1980-1985. The integrative function of the regional offices both in terms of blending various departmental activities and of harmonizing and balancing district level activities would appear to be the most difficult task to perform in due course.



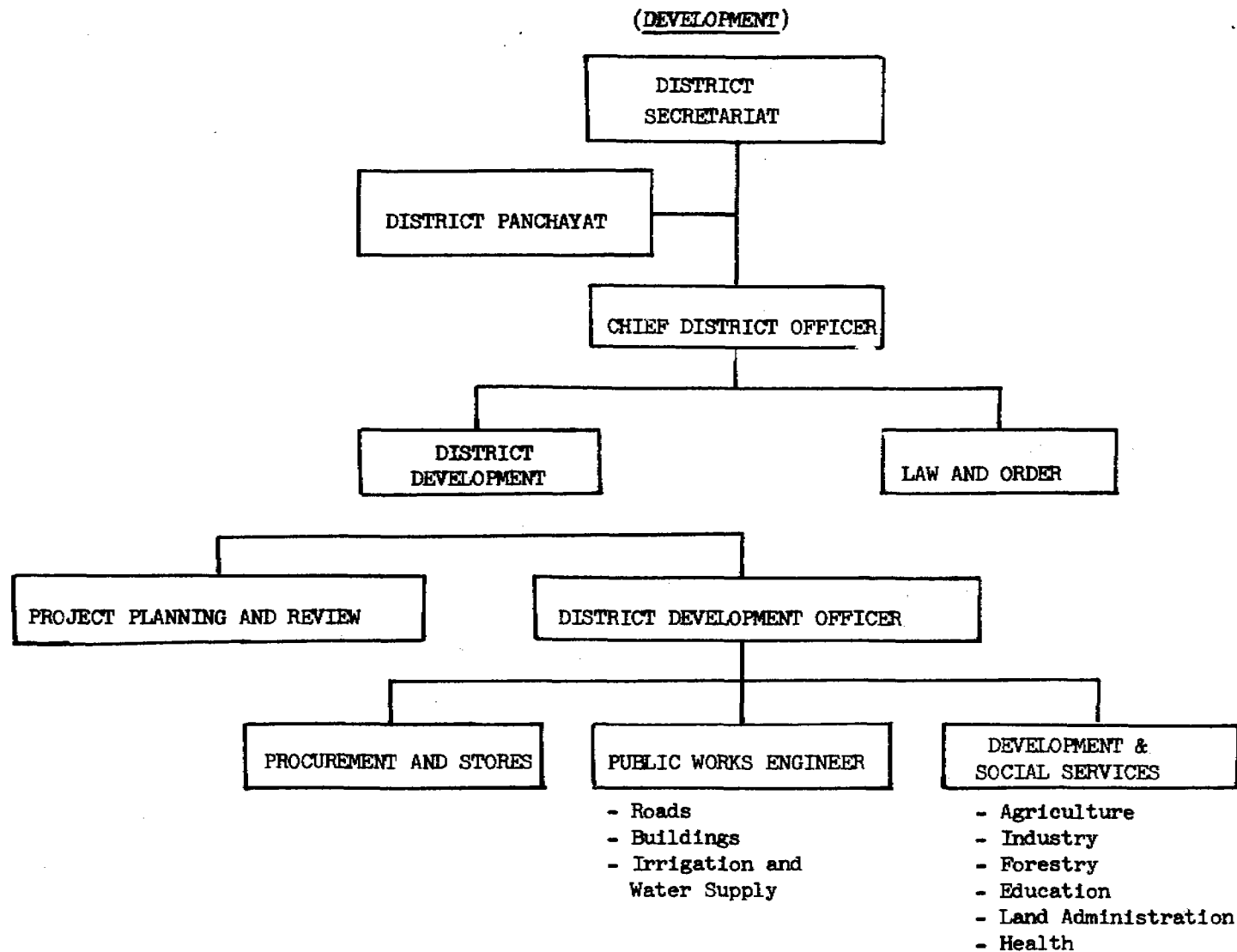
Source: Public Administration in Nepal op.cit., Appendix

(*) Merged into one Ministry in 1976

** Central Bureau
of Statistics

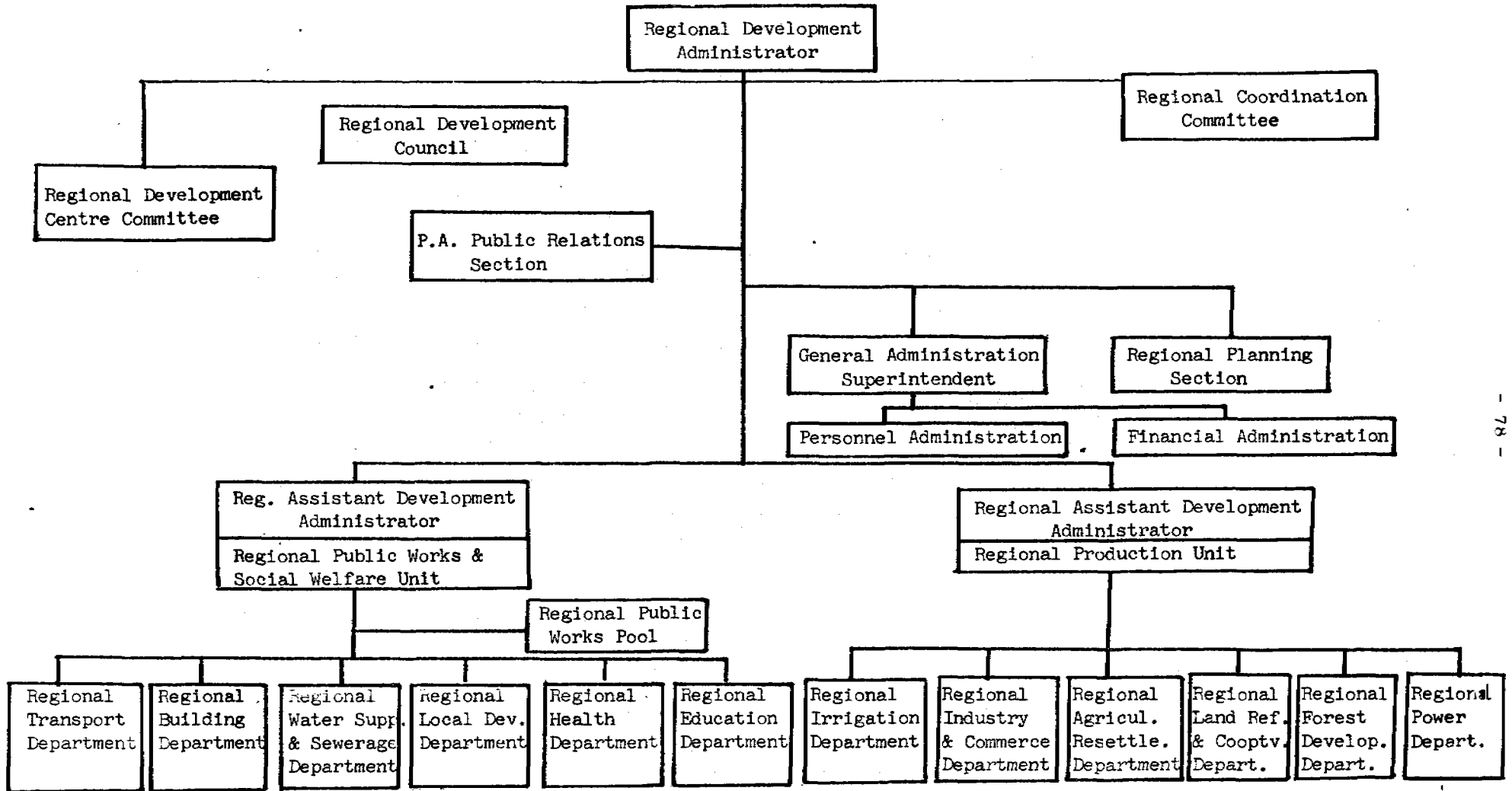
DISTRICT ORGANIZATIONAL CHART

Annex 14
Table 2



Source: District Administration Plan, 1974 - page 61

ORGANIGRAM OF REGIONAL DEVELOPMENT CENTRE



- 78 -

Source: District Administration Plan, 1974 - page 61

WATER SUPPLY AND SANITATION
SECTOR STUDY

LEGAL PROVISIONS^{1/}

The present laws which concern the provision of water supply and sanitation facilities, and the rules and regulations framed thereunder are:

- (i) The Water Tax Act (1966), which governs the rate and method of collection of charges for water connections made from water supplies owned and operated by the Government;
- (ii) The Nagar Panchayat Act (1962), and the Gram Panchayat Act (1962) which define, amongst other things, the powers and duties of the Panchayats to provide water supply, sewerage and other sanitation facilities and collect revenues;
- (iii) The Development Board Act (1956) and the Corporation Act (1964) which provide for and regulate the formation and operation of the types of organization which might be considered suitable to provide water supply and sewerage services;
- (iv) The Nepal Civil Service Act (1956) and the associated Civil Service Regulations (1965);
- (v) The Administrative Procedure Regulations Act (1956) and the following associated Rules and Regulations:
 - Government Funds Expenditure (Procedure) Rules, (1960);
 - Government Fund Management Rules (1960);
 - Revenue Officer (Remittance and Deposit) Rules, (1960);
 - Government Income and Expenditure (Management) Procedure' Rules, (1960); and
 - Fiscal Administration Regulations (1969);
- (vi) The Government Funds (Collection and Clearance) Act, (1968);
- (vii) The Revenue and Government Contract Rates (1965).

^{1/} Source: WHO/SEARO report on urban water supplies, etc., May 1976 (Draft)

NEPAL

Annex 16

WATER SUPPLY AND SANITATION
SECTOR STUDY

EXTERNAL ASSISTANCE

1. Involved in direct or indirect assistance to the water supply and sanitation sector are:

Multilateral

- United Nations Development Programme;
- World Health Organization;
- United Nations Childrens Fund (UNICEF);
- World Bank/International Development Agency;
- Asian Development Bank;

Bilateral

- Indian Co-operation Mission;
- Indian Gurkha Resettlement;
- Overseas Development Ministry - U.K.;
- British Gurkha Resettlement Programme;
- U.S. AID and Peace Corps;
- German Agency for Technical Co-operation (GTZ) and German Volunteer Service;
- Swiss Association for Technical Assistance (SATA).

Some of the more important external contributions are briefly described below.
All contributions except from I.D.A. have been grants.

WHO

2. WHO's regular annual budget for the sector over 1975-1977 is around US\$ 0.8 million. Two staff Sanitary Engineers assist LDD and more recently DWSS in their Water Supply and Sanitation Programmes.

UNDP

3. UNDP has shown significant interest in sector as well as in environmental health projects. Recently the WHO/UNDP project on Development of Water Supply and Sewerage in Greater Kathmandu and Bhaktapur was completed. UNDP has finalised its Second Country Programme for 1977-1981 with an Indicative Planning Figure of US\$ 31 million. Agriculture, forestry and irrigation get top priority, with nearly 40% of resources. Other areas receiving high priority include education, health, social services and planning. Project proposals indirectly relevant to the sector include US\$ 2.7 million for the malaria programme, US\$ 0.41 million for basic health services, whereas an earlier allocation of US\$ 2.125 million for water supply and sewerage system design in major towns including a suggested tariff study has been reallocated to other priority areas.

An ongoing UNDP project for the training of supervisors and skilled personnel for public works includes training facilities at the Engineering Institute in Kathmandu for plumbing, masonry, electricity. It is proposed to extend the programme to regional centres of training at Surket, Pokhara, Dhankuta, and Biratnagar for semi-skilled and skilled workers, overseers, supervisors and instructors for all basic engineering. UNDP is likely to spend US\$ 1.2 million on this programme in 1977-1980. The ongoing programme with ILO collaboration costs US\$ 0.6 million for 1975-1977.

UNICEF

4. During 1971-1975, UNICEF assistance to basic health services has been about US\$ 0.3 million and for rural water supply schemes, US\$ 0.5 million, mainly in the form of pipes etc., cement and transport services. The proposed five-year plan for 1975-1980 over US\$ 5.0 million includes health services in 6 districts (US\$ 1 million), nutrition and child care (US\$ 0.7 million) and US\$ 1 million for rural water supplies to provide equipment, materials, transport and cash (e.g. for training) for up to 175 projects in 25 districts.

World Bank/IDA

5. After the earlier US\$ 7.8 million soft loan an additional World Bank/IDA credit for US\$ 12 million is being considered for further water supply and sewerage works to serve the Kathmandu Valley, Pokhara, Biratnagar and Birganj. Another soft loan of US\$ 7.0 million is for an integrated rural development project in two hill districts including 100 village water supplies and 13 health centres.

Asian Development Bank

6. The Bank financed a groundwater exploration project in the Lumbini zone of the Terai region, amounting to US\$ 100 000 and recently approved a soft loan of US\$ 6 million for irrigation including groundwater investigations, sinking of wells and pumps installations in selected areas of 13 Terai districts.

Peace Corps US and German Volunteer Service

7. These agencies have been providing volunteers as development workers in the rural areas. 18 volunteers were recently assigned to work on water supply schemes of LDD, fulfilling the role of overseers.

Indian Co-operation Mission

8. The Mission completed about 25 water supply projects over the last 15 years, mainly in the Terai, for an amount of Rs 10.9 million. Discussions are underway for negotiating further assistance, both financial and technical, for the sector.

German Agency for Technical Cooperation (GTZ)

9. GTZ is in charge of the Bhaktapur Development Project, a multi-sectoral urban renewal scheme which includes water supply, waste water disposal and solid waste removal for a total of Rs 15 million of which two thirds are borne by the German Government. The Federal Republic has offered assistance for an organized refuse disposal system in Kathmandu Valley and GTZ has subcontracted master plan studies for this project.

Indian Gurkha and British Gurkha Resettlement Schemes

10. Assistance consists of infrastructural improvements including water supply in villages to which ex-service men return.

Overseas Development Agency, U.K.

11. ODA provides managerial assistance (posts of managers, engineering and financial administration) and technical assistance (leak detection and meter replacement/installation) to WSSB.

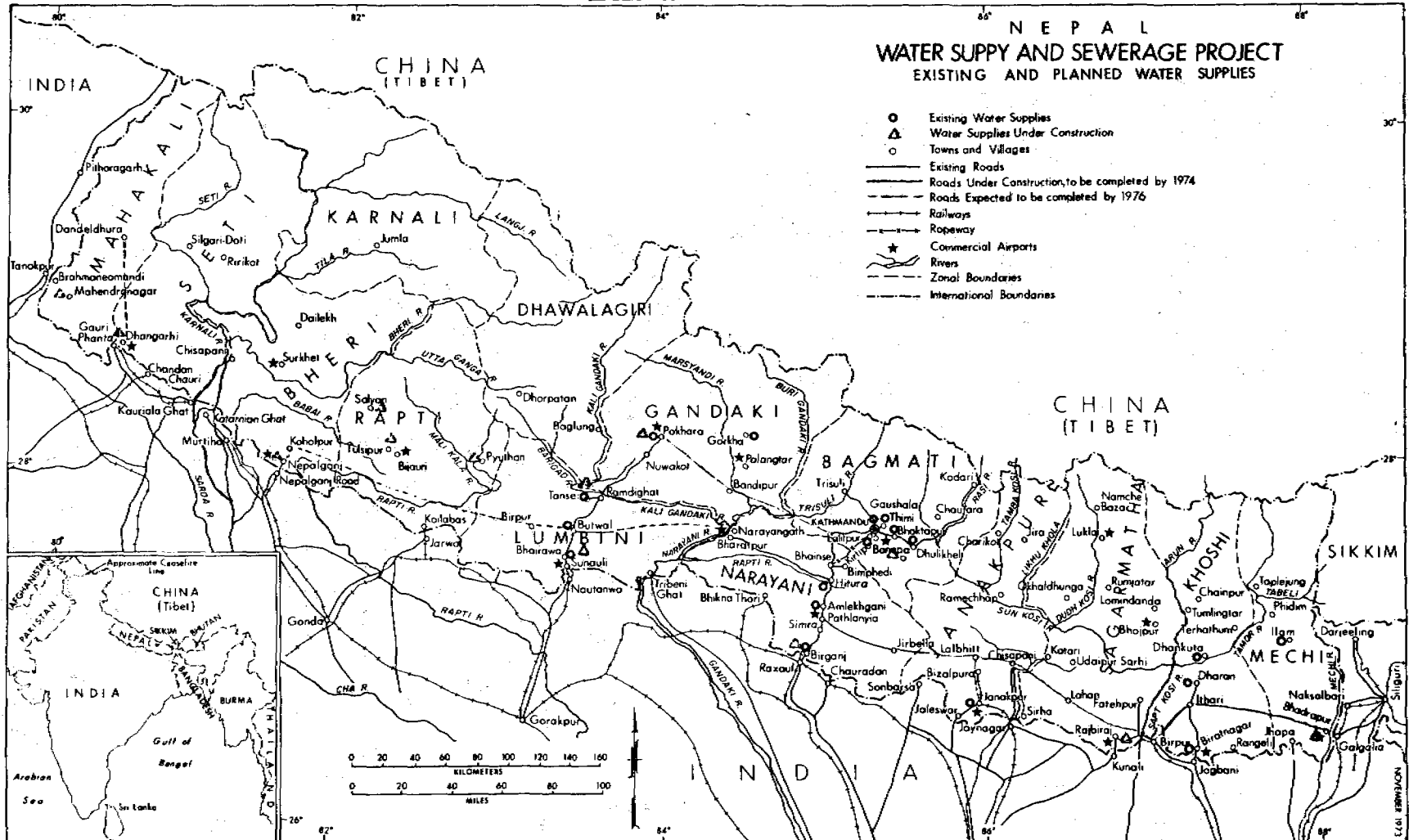
USAID

12 The equivalent of US\$ 24 million in Indian Rupees have been earmarked over the next few years for rural development and partly for basic health assistance to serve the rural poor, as well as for training of Peace Corps Volunteers, and possibly of sanitarians.

Swiss Association for Technical Assistance (SATA)

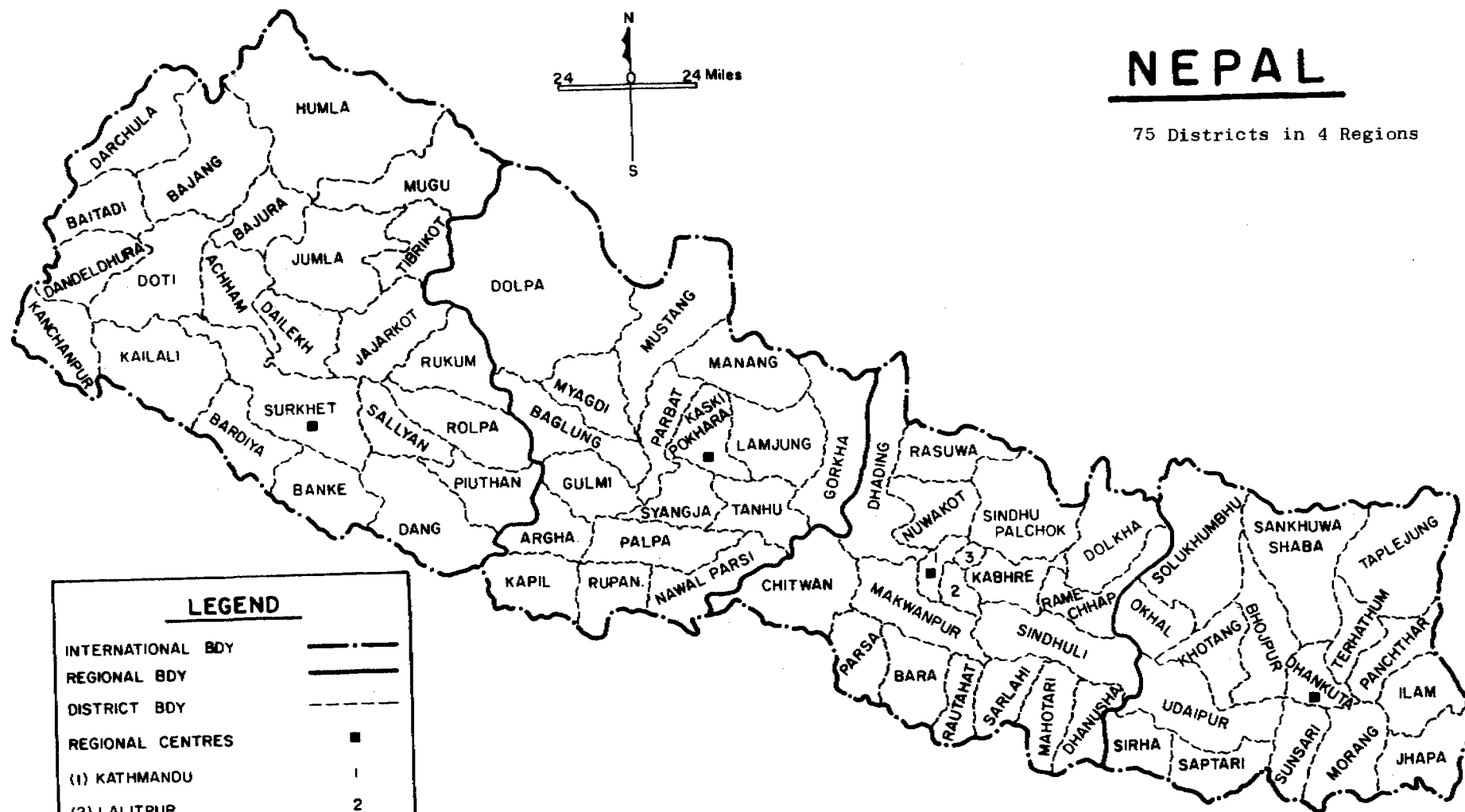
13 SATA was instrumental in an integrated hill development project and has since engaged in applied research and prototype development of such devices as mini-turbines, hydraulic rams, solar pumps and water heaters, wind pumps and water filtration with local material. Its resident engineers participate in the training programme for overseers volunteers under the LDD/UNICEF programme.

NEPAL
WATER SUPPLY AND SANITATION
SECTOR STUDY
MAP OF NEPAL



NEPAL

75 Districts in 4 Regions

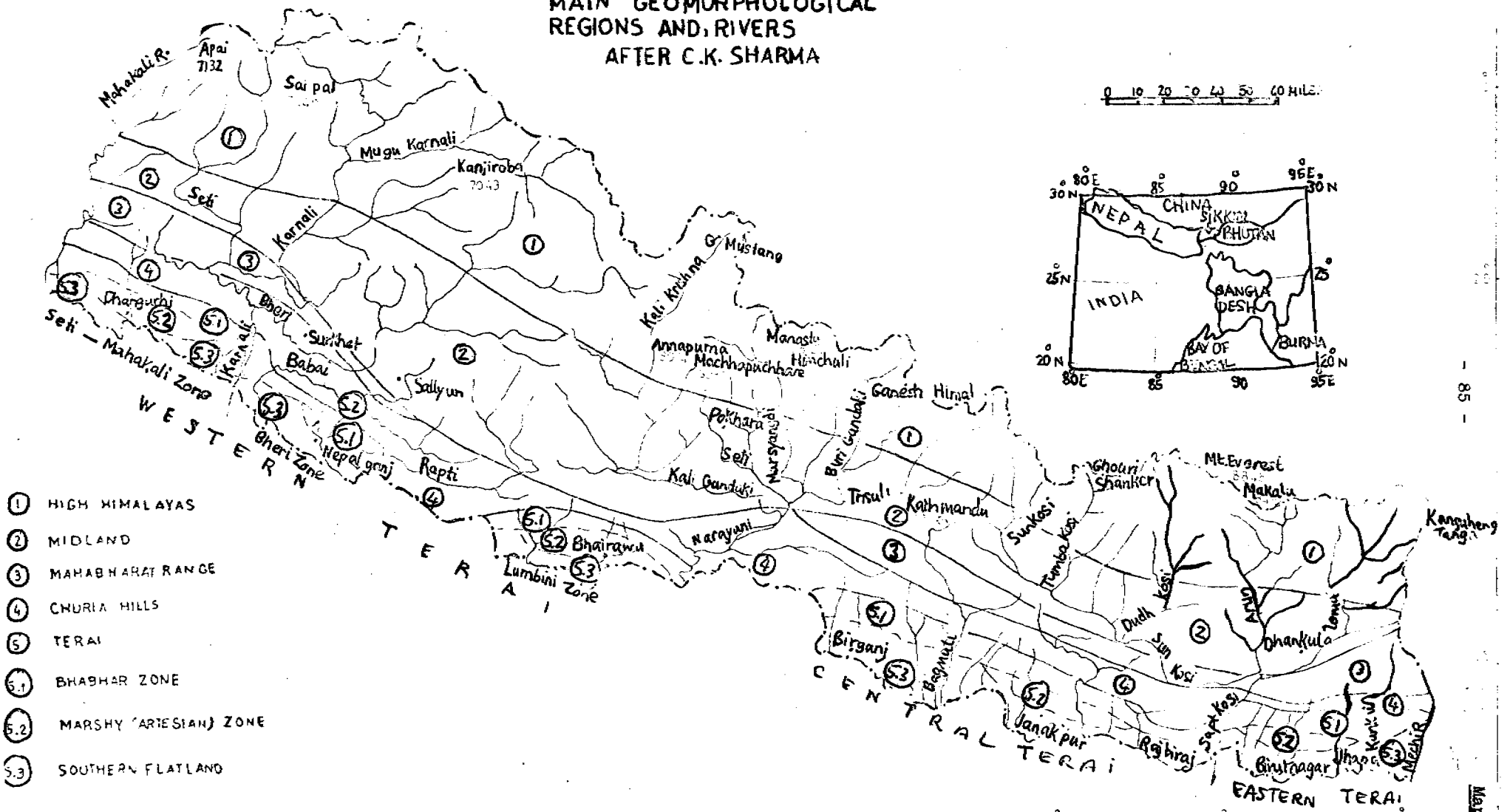
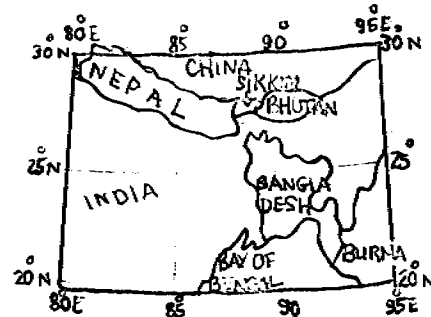


LEGEND	
INTERNATIONAL BDY	— · — · —
REGIONAL BDY	=====
DISTRICT BDY	-----
REGIONAL CENTRES	■
(1) KATHMANDU	1
(2) LALITPUR	2
(3) BHAKTAPUR	3

N E P A L

MAIN GEOMORPHOLOGICAL REGIONS AND RIVERS AFTER C.K. SHARMA

0 10 20 30 40 50 60 MILES



- ① HIGH HIMALAYAS
- ② MIDLAND
- ③ MAHABHARAT RANGE
- ④ CHURIA HILLS
- ⑤ TERAI
- ⑤.1 BHAGHAR ZONE
- ⑤.2 MARSHY (ARTESIAN) ZONE
- ⑤.3 SOUTHERN FLATLAND