THE REPUBLIC OF UGANDA

UGANDA WATER ACTION PLAN

WATER RESOURCES DEVELOPMENT AND MANAGEMENT

MANAGEMENT ASPECTS

ANNEX REPORT - VOLUME 3 (DOC. 012)

MINISTRY OF NATURAL RESOURCES

DIRECTORATE OF WATER DEVELOPMENT

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ANNEX 12

LAND AND WATER MANAGEMENT STUDY

1 INTRODUCTION

1.1 Background

A first phase of "Water Action Plan for Water Resources Development and Management" (WATER ACTION PLAN PHASE I) was prepared February to May 1993. The major components were:

- draft water resources policy
- draft rapid water resources assessment
- draft institutional & management study
- international study

In the period from June to November 1993 follow-up work was carried out during the "Consolidation Phase I" which also comprised preparatory activities for Phase II. These activities were preliminary data collection and information gathering in five districts selected as pilot areas for studies to be undertaken under Phase II. The Consolidation Phase I activities were undertaken by the project counterpart staff.

The Project Document entitled "Water Action Plan for Water Resources Development and Management" (WATER ACTION PLAN PHASE II) describes the second phase of the project to develop a Water Action Plan for Uganda. The work on the Phase II started in November 1993. The second phase will produce among other items:

- an outline proposal for appropriate local water resources management levels based on district studies
- an outline proposal for management procedures providing the administrative machinery at national and district level with guidelines for sustainable water resources management

District studies which would support such proposals are carried out in each of five selected pilot districts comprising Arua, Mbarara, Mukono, Mbale and Moroto. These studies comprise reconnaissance level evaluations of sociologic and economic conditions which combines to give the background for assessments of water uses and demands. The water uses and demands are compared to available water resources in terms of quantity and quality.

An unequal distribution of demands and resources leads to the identification of a number

of water resources issues and cases which require management strategies and capabilities at different levels (national level, district level, community level). Based on the existing institutional and judicial framework, management potentials and constraints are evaluated.

1.2 The Land and Water Management Study Report

The aim of the present report is to present an assessment of the impacts of land management practice on water resources in Uganda - in particular the possible negative effects of erosion, and propose appropriate management tools in order to ameliorate the situation.

Consequently the severity of erosion will primarily be evaluated in relation to its impact on the water resources rather than in relation to its negative effect on soil fertility and reduced crop yield, which usually is the case.

It is outside the scope of this study to give a detailed assessment of the impact of soil erosion on the water resources for each district in Uganda, and there are no data to justify such a detailed assessment. Instead it has been aimed at dividing the country into a number of zones according to the negative impact of land processes, primarily soil erosion, on the water resources, in order to indicate in which areas they are important factors in relation to the quality and quantity of water resources. The areas assessed to be most severely affected by soil erosion was visited during the study and therefore a more detailed description of the interactions between land management practice and water resources are given for these areas. As the focus is on rainfed agriculture and soil erosion, the impact of other important land use practices, e.g. irrigation and utilization of wetlands, on the water resources is only discussed briefly.

Chapter 2 comprises a short account of the general land use and water resources interacting.

Chapter 3 contain a short description of the land use practice and physical characteristics of each zone and assess the extent of erosion and its effect on the water resources and how that influence the utilization.

Chapter 4 propose ways and means, technically, legally and institutionally to ameliorate the situation and ensure an more integrated land and water resources management

Chapter 5 contain a list of proposed actions to be included in the Water Action Plan.

2 INTERACTIONS BETWEEN LAND USE PRACTICE AND WATER RESOURCES

The water available in various water bodies (streams/rivers, groundwater reservoirs, lakes/reservoirs, wetlands etc.) originates from rainfall running off or infiltrating through the soil surface, on which a particular land use is practised. This land use practice will control:

- to which of the water bodies the rainfall will be directed
- when and at what velocity the rainfall is directed to the water body
- the condition (quality) of the water entering the water body

Hence, it is obvious that water management necessarily has a strong link to land management to the extent that land management measures affect the quantity and quality of the water resources.

Poor agricultural practice, such as cultivation on steep slopes which are not suitable for crop production and overgrazing may lead to increased surface runoff and soil erosion and thus have a negative effect on the water resources in terms of quantity and quality, e.g.:

- transport of soil/sediment to water reservoirs, intakes and pipelines, causing siltation, increased turbidity and technical difficulties
- transport of nutrients and chemicals, resulting in pollution and eutrophication of surface water
- poor soil structure and decreasing infiltration rates resulting in reduced groundwater recharge and reduced flow during dry seasons
- increased peak flow during months with heavy rains

An assessment of the extent to which the present land use practice causes such effects on the water resources of Uganda is given in the next chapter.

3 ASSESSMENT OF SOIL EROSION IMPACT ON WATER RESOURCES

3.1 Availability of data

The present water resources situation in Uganda with respect to sediment loads and siltation as well as the relation to actual land-use practices, is virtually unknown due to lack of quantitative data. Sediment measurements in rivers are not carried out presently, but some few measurements were taken during the period 1971-72 (HYDROMET, 1975). At two sites, Namatala and Waki, sediment load was related to discharge and estimated from monthly mean discharges for one year as 13,000 and 5,000 tons/year, respectively. This corresponds to 98 and 10 tons/km^2, which are considered as moderate and low values, respectively. However, only a total number of 22 sediment concentration analyses were carried out, which is far too few to use for assessments. In a UNEP study (UNEP, 1987) a Soil Erosion Hazard map was compiled using GIS technology. The map was based on rainfall erosivity (Fournier's index), soil erodibility (based on soil texture and other soil properties available), slope, land use pressure and population density. This type of mapping where factors are multiplied as in the Universal Soil Loss Equation (USLE), can only give some very rough estimates, and for assessments it should be supported by field observations and/or measurements. The study did not include any evaluation of the impact of soil erosion on the water resources of Uganda. Broadly the Erosion Hazard Map from the UNEP study corresponds with the erosion zone classification shown in Fig. 3.1 and Table 3.1.

Some few data from soil erosion plots exist, but these can only be used locally to make a relative comparison of various conservation measures' effectiveness in controlling erosion.

Furthermore, most of the assessments of the extent and severity of erosion found in the literature are made in relation to agricultural impact, i.e. loss of soil fertility and reduced crop yield. Still, there are a lot of statements on detrimental impacts of erosion on water bodies. Muddy rivers have been reported round Mt. Elgon, severe erosion in Kigezi area, silting of rivers in Kumi and silting of Lake Wamala.

However, during the study tours it was experienced that there often seems to be an overstatement of the extent of erosion as well as its impact. Seasonal (non-perennial) rivers are perceived as man-made gullies and thus erosion is assessed to be severe, although the rivers probably have existed for decades or centuries, and will continue to be there as a natural element of the geomorphology of the area. Most of the valley dams visited, described as silted, were in poor condition due to lack of maintenance, and the deposition often mainly consisted of partially decomposed plant residues rather than deposited sediments brought by surface runoff. In cases where it was stated that the dams had dried up it was due to the fact that water from the dam was used downstream for irrigation and in one case a valley tank was simply poorly designed, not allowing very much water to

enter the tank. Droughts and increase in the number of cattle that are being watered may be other reasons for the drying up of valley dams/tanks. In Kabale the drainage of wetlands and subsequent establishment of grassland, and to some degree cultivation, was blamed for having caused declining rainfall. Such statements are important parts of people's perception of siltation problems, but there is an urgent need for quantitative data in order to make a proper assessment of the extent and causes of these land processes and their impact on the water resources.

3.2 Method used for the assessment

The following assessment of soil erosion impact on water resources is based on visits to the areas where erosion is most severe. The following areas were visited: Kabale, Kasese, Mbarara, Masaka, Mbale and Kapchorwa. These areas will be covered in more detail than the other areas in the description below. Some observations were made as well in Tororo, Iganga, Mukono, Mpigi, Ntungamo and Bushenyi. For areas not visited, the assessment is based on physical characteristics which influence the soil erosion (listed according to ranking):

- topography
- land use, which is subdivided into
    - percentage of area cultivated
    - livestock density
    - vegetation cover
- soil erodibility
- population density
- rainfall erosivity (only partially included as no proper data existed)

During the Rapid Water Resources Assessment, WAP Phase I, 24 selected catchments were analyzed as to their surface runoff characteristics. The calculated runoff coefficients from these catchments are compared with the assessment of the extent of erosion, because in most cases there will be a positive correlation between runoff coefficient and erosion rates. This was supported by information gained during visits of study teams to the five pilot districts, as well as existing reports.

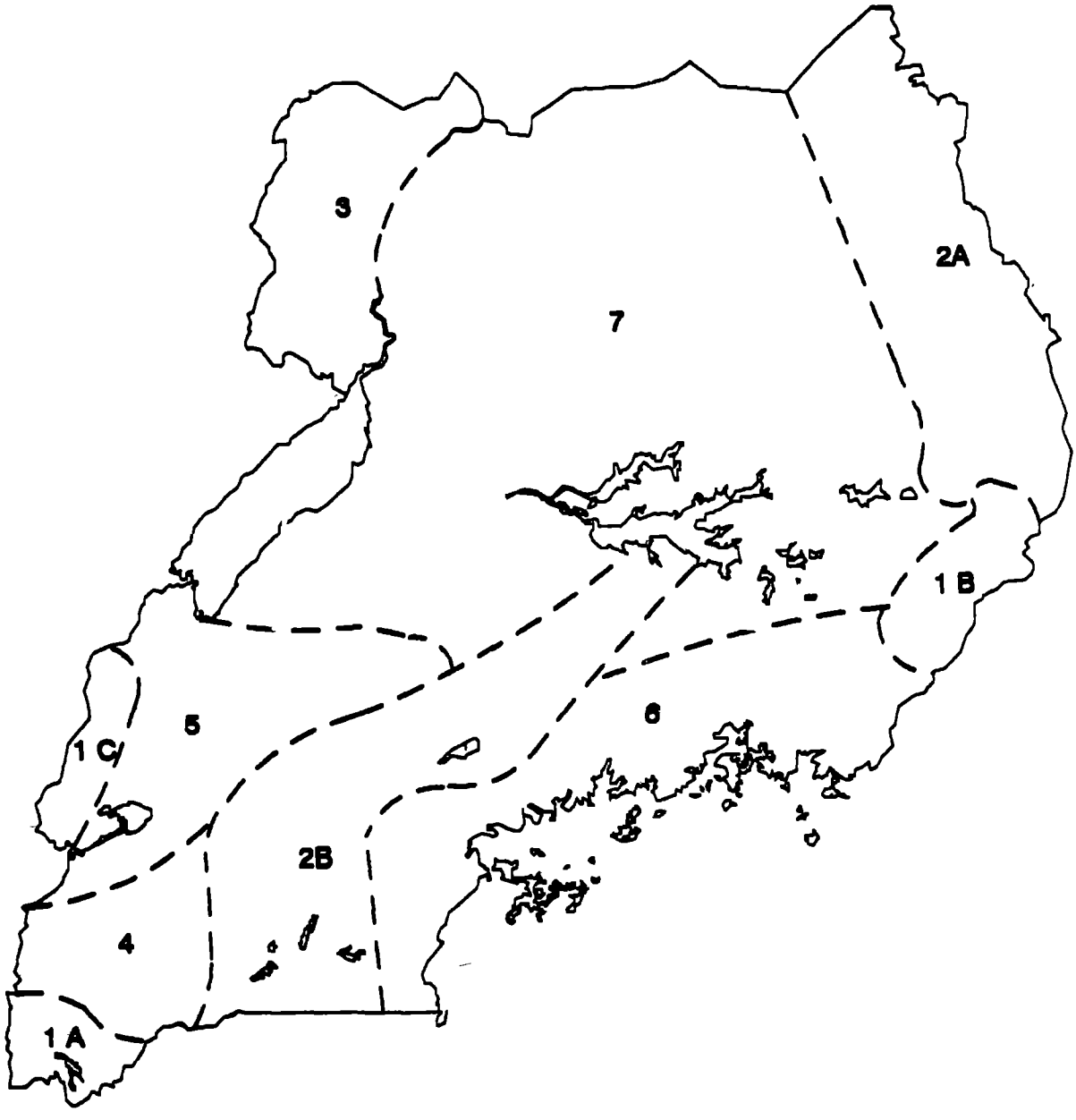

Figure 3.1 - Main erosion zones in Uganda according to severity and impact on the water resources

Table 3.1 - Regional description of the extent of soil erosion and the impact on water resources (the table continues)

Area	The extent of soil erosion	Main causes of soil erosion	Main impacts on water resources
1A. The south-western mountainous area (Kabale, Kisoro and parts of Rukungiri)	Very high	- Cultivation on steep slopes - High land use pressure - Annual crop cultivation	- Siltation of rivers, lakes and water systems - Reduction in sub-surface water quantity
1B. Mt. Elgon and surrounding foothills (Mbale, Kapchorwa)	High	- Cultivation on steep slopes - High land use pressure - Cultivation on river banks - Forest encroachment	- Siltation of rivers, lakes and water systems - Reduction in subsurface water quantity
1C. The Ruwenzoris (Parts of Kasese, Bundibugo, Kabarole)	High	- Cultivation on steep slopes - Medium Livestock density - Bushfire and burning of crop residues	- Siltation of rives, lake and water systems - Reduction in sub-surface water quantity
2A. The north-eastern pastoral area - Karamoja (Moroto, Kotido)	Medium to high	- High intensity storms - High soil erodibility - Steep slopes - Poor vegetation cover / bushfires - Overgrazing	- Siltation of valley dams and tanks - Faecal contamination of water for domestic use
2B. The south-western pastoral area (Mbarara, parts of Masaka, Mubembe and Rakai, Mpigi, Luwero, Mukono)	Medium High in specific areas	- Overstocking - Poor vegetation cover in the dry season / bushfires - Highly degraded soils	- Siltation of valley dams and tanks - Siltation of rivers - Faecal contamination of water for domestic use
3. The West Nile area (Arua, Nebbi)	Low to medium High in specific areas	- Cultivation on steep slopes - High population pressure - Deforestation	- Siltation of rivers - Pollution of water sources
4. The south western highlands (Bushenyi, Ntungamo, parts of Rukungiri and Mbarara)	Low Medium in specific areas	- High land use pressure - High population pressure	- Potential siltation of rivers - Faecal contamination of water for domestic use
5. The western highlands (Kabarole, Kibale, Mubembe and parts of Kiboga)	Low Medium in specific areas	- Cultivation on slopes	- Potential siltation of rivers - Faecal contamination of water for domestic use
6. The south and south-eastern lake area (Mpigi, Jinja, Iganga, Tororo, parts of Kamuli, Pallisa, Mukono, Luwero and Masaka)	Low	- High land use pressure - High population pressure	- Few, possible siltation of rivers and possible pollution from fertilizers and agrochemicals

Area	The extent of soil erosion	Main causes of soil erosion	Main impacts on water resources
7. The north-central area (Kitgum, Gulu, Moyo, Masindi, Luwero, Lira, Soroti, Kumi, Pallisa, Kamuli, Kiboga)	Low	- Poor vegetation cover - High rainfall erosivity	- Very few

Table 3.2 - Physical and population characteristics of the various erosion zones.

Area	Topography Elevation (m)	Percentage cultivable area cultivated	Livestock density Cattle km^{-2}	vegetation cover	Soil erodibility	Population density Persons km^{-2}
1A. South-western mountainous region	1500 - 3600	73 - 80	15.1 - 27.9	High altitude and medium altitude forests Annual crop on cultivated areas	Humic Ferralitic soils, loamy LOW - MODERATE	> 200
1B. Mt. Elgon and the surrounding foothills	1200 - 4200	41 - 122	10.4 - 27.0	High montane and moist forest Perennial crops (banana, coffee) dominantly cultivated	Humic Ferralitic soils interspersed with Ferisols. Sandy clays loams. LOW	> 200
1C. The Ruwenzoris	1200 - 4200	24- 59	14.6 - 25.8	High montane grassland (moors) Annual crops upslope and perennial crops downslope	-do-	50 - 149
2A. North-eastern pastoral area - Karamoja	900 - 1500	Negligible	17.4 - 19.8	Dry Acacia savanna with Hyparrhenia spp on low lands, shrub and thicket at higher altitude	Vertisols and Vertisols complexes with Ferruginous soils HIGH	< 50
2B. South-western pastoral area	1200 - 1500	17 - 36	40.0 - 98.5	Grass savanna dominated by Hyparrhenia spp & Acacia spp	Ferralitic soils. Sandy loams. LOW	50 - 99
3. West Nile area	610 - 1500	23 - 28	4.1 - 21.8	Moist to dry Acacia savanna Perennial crops at high altitudes, annuals (Tobacco) at low	Ferralitic soil. Sandy loams to the North, sandy clay loams to the South LOW HIGH (in minor parts)	50 - 149

Area	Topography Elevation (m)	Percentage cultivable area cultivated	Livestock density Cattle km^{-2}	vegetation cover	Soil erodibility	Population density Persons km^{-2}
4. South-western highland	1200 - 1800	46 - 52	16.8 - 50.1	Perennial crops (banana, coffee, tea) dominate cultivated land interspersed with pastureland and swamp vegetation Tropical Forest and thickets to the North West	Ferralitic soils, consisting both sandy loams and sandy loams LOW	150 - 199
5. Western highlands	100 - 1800	46 - 59	3.8 - 14.6	Sparse banana/coffee system Uncultivated areas dominated by Elephant grass and moist semi-deciduous forests	-do-	50 - 99
6. South and South-eastern lake area	900 - 1200	66 - 69	20.2 - 35.4	Banana/coffee system is dominant interspersed with annual crops and some pasture areas	Ferralitic soils mixed with Ferrisols Sandy Clay loams, but mainly sandy loams to East. LOW	150 - >200
7. North-central region	600 - 100	10 - 50	0.2 - 25.5	Sparse annual crops Dominant wooded savanna with Hyparrhenia .	Mainly Ferralitic soils. Sandy loam LOW - MODERATE	Northern < 50 Central 50 - 99

3.3 Regional description of soil erosion impact on water resources

3.3.1 General

By using the method described above, the country is roughly classified into a number of areas; each of them is assumed to be relatively homogeneous in relation to their erosion risk (see Fig. 3.1 and Table 3.1).

Slope steepness, vegetation cover / land management and rainfall are normally the three most important parameters determining soil erosion and Uganda is no exception. Thus the most severe erosion is experienced in the 3 mountainous areas, Mt. Elgon and surrounding foothills, the Ruwenzoris, and the south-western mountainous region (Kabale and Kisoro districts). Intensive cultivation on steep slopes with no or only few and inadequate soil and water conservation measures has resulted in extensive erosion in parts of these areas. Accelerated erosion (where the soil removed by erosion exceeds the soil formed by weathering of the bedrock) is taking place in major parts of all three mountainous areas, - thus the situation will worsen if no measures are undertaken.

Next to these mountainous areas there are the two major semi-arid regions, namely the north-eastern pastoral area in Karamoja (Area 2A) and the south-western pastoral area (Area 2B). The low amount of rainfall and overgrazing caused by the large number of cattle result in poor vegetation cover, especially towards the end of the dry season - leaving the ground exposed to erosion by rainfall and surface runoff.

In the remaining part of Uganda the impact of soil erosion on water resources is not severe, although in certain specific areas there might be a significant impact e.g. in hilly areas in Arua with high population density.

3.3.2 Assessment of the various regions

1A. South-western mountainous region

This area covers Kabale and Kisoro districts and part of Rukungiri district. Most of the following description applies in particular to Kabale district. However, the districts are very similar in terms of physical characteristics and land use practice. The terrain slopes greatly in all three districts and the whole area is heavily cultivated with an average population density of 250-300 persons/km^2. Expect from the Impenetrable Forest there is very little forest left in the area. The soils in the western part of Kabale and parts of Kisoro originates from volcanic material and are less prone to erosion than the soils in the remaining part of the area.

Kabale District is very hilly and consists mainly of rounded top ridges which quickly steepen to 10-30 % on the middle parts and then often decline to 5-10° on the lower parts.

In the steepest parts of the district the average slope steepness is between 30-40 %. With such a topography the area is prone to erosion and 50 % of the area is estimated to be too steep to be cultivated without risking serious accelerated erosion.

Due to the very high population density (up to 880 per km^2 in some areas) almost every plot of land, right from the hill top to the valley bottom, is cultivated despite the steepness of the slope. Annual crops are dominant and cultivation is continuous, mainly with two crops a year, thus leaving the soil bare at the onset of each of the two rainy seasons. It is estimated that only 20 % is covered with perennial crops, mainly bananas.

Due to the potential for accelerated erosion, terracing became an enforced practice under by-laws established in 1945 and during the subsequent 5-10 years most of the area was terraced. However, most of the conservation practices were neglected when the by-laws were no longer enforced. Most of the structures exist today but they are often inefficient and unstable as they mostly are left without vegetation. Furthermore, many of them are being removed in order to increase the arable area and to make use of the relatively fertile soil from the bunds which have been left fallow for a long period. Cattle encroaching the plots when searching for grass and crop residues have also contributed to this destruction. Burning of plant residues, which is a common practice, has further aggravated the problem.

Kabale District is ranked first among districts most severely affected by soil erosion in the 1993 Annual Report from the Soil Conservation Section within the Ministry of Agriculture, Animal Industry and Fisheries. According to the report more than 80 % of the district was experiencing erosion.

This is very much in accordance with the observations made during the visit to the district. Sheet erosion was observed almost all over the areas visited and rill erosion could be seen in most areas, and especially in the most steep areas, e.g. the areas around Lake Bunyonyi and in Rwamucucu, Bubaale, Kitumba, Muko and Maziba sub-counties. In the V-shaped valleys that run down between spurs of side ridges huge amounts of water collect during heavy rainstorms and they have created gullies that often continue all the way down to the water courses. Due to the prevailing unstable convex slopes, landslides were seen at several locations where these slopes were heavily cultivated.

The most pronounced impact of soil erosion on the water resources in terms of quality is siltation and increased turbidity of water bodies. This was especially obvious at the rivers/streams in Rwamucucu sub-county where not only silt and sand but also gravel and even larger stones, branches and small banana trees were deposited. In Lake Bunyonyi large amounts of sediment are definitely deposited as well, but due to the great depth of the lake this siltation is only evident in areas with relatively shallow water.

During heavy rains the gravity scheme at Kiyoora, which uses surface water, has to be

closed as the water carries too much sediment resulting in very high turbidity.

Siltation was also apparent at the dam upstream of the mini-hydro power station at Maziba, but not to such an extent that desilting of the dam had been necessary. However, the turbines are normally stopped every third month for removal of silt and sediment to decrease wear on the turbine wheels.

Despite the severe erosion in the district most of the rural water supply is not seriously affected as about 40 % originates from protected springs. However, several protected springs are said to have been closed or moved due to siltation, but the two closed springs visited were established in technically unsuitable low lying areas next to river banks. Faecal contamination from both humans and animals was reported to be a problem at some of the unprotected springs, and surface runoff played a major role. Unfortunately, no analysis was undertaken of streams and non-protected springs, which makes it difficult to assess the impact of soil erosion on these water sources quantitatively. Regarding contamination caused by transport of artificial fertilizers and agrochemicals this is not considered to be a problem in the area, as almost none of the small-scale farmers use either of these inputs, mainly because they cannot afford to buy them.

The accelerated erosion taking place in the district is having a negative effect on the water quantity from the springs as the increased surface runoff allow less water to infiltrate. Reduction of the soil cover depth and reduced infiltration capacity caused by poor soil structure, will further aggravate the situation. As an abundant number of springs is not yet utilized there will still be sufficient water for domestic use, but at extra cost when e.g. gravity schemes are no longer able to cover the demand for which they were designed and water therefore have to be obtained from additional sources.

1B.-Mt. Elgon and the surrounding foothills

On and around Mt. Elgon the situation is less serious than in Kabale, as perennial crops, which are prevailing here, provide a better ground cover. Further more, the soils which originate from volcanic material, still have a relatively high hydraulic conductivity and low erodibility. The calculated runoff coefficient for the analyzed catchments in this area varies between 24 and 43%, which is much more than the average for Uganda as a whole.

Due to the high population density (280 persons per km^2 in Mbale), the area is almost 100 % cultivated. On the slopes bananas, often intercropped with coffee, is dominating and intercropped maize and beans are the most common annual crops. In the lowland, where it is much drier, annual crops like millet, sweet potatoes, cassava and cotton are grown. Burning of residues is not common like e.g. in the Ruwenzoris. Cattle are common, but normally each household has one or two cattle and zero grazing is becoming normal, so their effect on the extent of soil erosion is not significant. Cultivation on and close to the river banks is contributing significantly to the sediment load originating from the lower

parts of the area.

Due to the high rainfall (1500 - 2000 mm/year) many perennial rivers originate from Mt. Elgon, draining to Lake Kyoga and Lake Opeta and some of the rivers originating from the Kenyan side of the mountain drain to Lake Victoria. Many of these rivers carry a high sediment load, especially during the rainy season and cause severe technical problems downstream. At the intakes at River Manafwa (serving Mbale Town) and River Malaba (serving Tororo) silt has to be removed daily. At the intake at River Manafwa silt is removed twice a day while at the intake at River Malaba up to 1 metre of silt has to be removed daily. At the Doho rice scheme, which uses water from river Manafwa, the main canal and the intake structures have to be desilted every third week. Therefore it has been necessary to introduce an irrigation fee in order to pay for the maintenance of the canals and hydraulic structures. In the mountains, springs are the most common source for domestic use, so the population is not very much affected by the high turbidity in the rivers/streams. On the other hand, almost the whole of Mbale town is supplied from surface water. Thus, the high siltation rates result in high costs in order to desilt intakes and to treat the water. Generally, contamination of water with pesticides and fertilizers is negligible, as only 2-5 % of the farmers use these inputs in plant production. However, pesticides are normally used in the cotton fields. The large swamp areas exist between Mt. Elgon and Lake Opeta and Lake Kyoga has a major impact of the water quality as well as the flow regime downstream, as these areas act as a kind of filter, absorbing nutrients, chemicals, etc. and a lot of sedimentation of sediment takes place as well. However, draining of these swamp areas and subsequent cultivation of paddy rice, vegetables etc. reduce this filtering effect considerable, and use of chemicals in connection with the cultivation may in some cases have a harmful effect on the water quality.

1C. The Ruwenzoris

In the Ruwenzoris, geological erosion, a natural phenomena, is taking place. However, cultivation on the often very steep slopes has accelerated this process. Fortunately, the population density is not yet very high and the soil still has a good physical structure, but the area is very prone to soil erosion and an increase in soil erosion will inevitably take place as the population and cultivated area increases. This is emphasized by the fact that the runoff coefficients from analyzed catchments in this area vary between 50 and 85%. As for Mt. Elgon very few soil and water conservation measures have been implemented despite the steep slopes on which cultivation takes place. Furthermore, bushfires are rampant, even burning of residues within banana plantations takes place. The burning normally occurs prior to the rainy season, thereby leaving the soil totally bare at the onset of the heavy rains.

Sheet and rill erosion are the most common types of soil erosion, but gullies also exist where huge amounts of water collect. The soil erosion results in high sediment load in the numerous rivers originating from the Ruwenzoris. There were frequent problems with

siltation of the reservoir tank and the pipes at the gravity scheme serving Kilembe and part of Kasese, and during the heavy rains in April and May parts of Kilembe and Kasese towns experience severe floods, leaving areas submerged for several days and huge amount of sediment remains on roads, around houses, etc. From time to time bulldozers removes large boulders left by the floods. Also, Lake Albert receives a considerable amount of silt from the Ruwenzoris via Semliki river. The Mubuko Hydropower Station is often closed weekly to clear the intake from silt.

Certain by-laws, e.g. prohibiting burning of bush and dry vegetation and regulations on ploughing along contours, exist but are not enforced. However, the Agriculture Department in Kasese, is taking initiatives to try to enforce these by-laws through the RC system. This might take a lot of time and education before it will be possible, as many traditional beliefs persist, e.g. that burning makes rain, etc.

2A. The north-eastern pastoral area - Karamoja

This area is probably the region in which most gullies can be seen. The area is semi-arid with an unreliable rainfall pattern. The yearly rainfall varies between 300 and 1200 mm. The long dry period between September and March and overgrazing do not allow for establishment of a proper plant cover, and the ground appears bare with few trees scattered around. The soils in the lower part of the area are black cotton soils (Vertisols). These soils swell during wet periods which reduces the infiltration capacity to almost zero and they become very muddy, making them extremely erodible. Furthermore the rains are unreliable and heavy in this area. During heavy rains large amounts of runoff collect on the slopes, due to poor infiltration and poor vegetation cover, incise the highly erodible soil, and can create gullies with a depth of up to 2 to 5 metres. The main effect on the water sources is the siltation of valley dams and tanks, which are the main water source for cattle. However, in many cases the poor state of these valley dams, of which most were constructed by the government more than 25 years ago, is due to reluctance by the cattle keepers to maintain the dams, and a major part of the soil and sediment brought to the dams/tanks probably originate from erosion caused by cattle tracks close to the sites. The increase in the number of cattle since the construction of the dams is probably another cause of the drying up of some of the dams/tanks, as they were not designed for that high amount of cattle. There are only a few permanent streams (the runoff coefficients for this area is almost zero) and the main supply for domestic use in the driest areas is ponds, dams and valley tanks. There are a relatively high number of boreholes but during the dry season the Karimojongs migrate with their cattle and drink water from the same sources as the cattle during this period, namely ponds, dams and valley tanks. Faecal contamination from the livestock thus becomes a health risk. The potential for springs as well as shallow wells is low in this area.

2B. South-western pastoral area

In the south-western pastoral area, the low amount of rainfall and overgrazing caused by

the high number of cattle, especially in Mbarara, result in poor vegetation cover, especially towards the end of the dry season leaving the ground exposed to erosion by both rainfall and surface runoff. Burning of the grass has further aggravated the situation. The topography varies considerably within this area. The steepest hills (slopes approximately 20 %) are found in the southern part of Mbarara in the northern part of the area, whereas the remaining part the of the area is undulating.

Sheet erosion is the most common type of erosion although some few gullies were observed in the V-shaped valleys that run down between spurs of side ridges. The southern part of the area drains to the Kagera River, and this contributes to the extremely high turbidity of this river. Due to the shortage of water during the dry seasons, valley dams and valley tanks serve as water sources for both humans and animals in the driest part of the area, and faecal contamination is widespread. Siltation of these dams and tanks is reported to be common, but in many cases lack of maintenance is the main reason for the poor condition of these valley tanks. Lake Wamala in the north-eastern part of the area is slowly drying up, but the hydrological conditions is as likely as siltation to be the cause of this as the lake was originally a swampy area. Siltation is causing a lot of problems at the intake for Mbarara Town at the Rwizi river. In Mbarara springs and open wells are the most common source for domestic use, but in the drier part of Mbarara, which belong to this pastoral area, valley tanks are important for domestic use and human and cattle normally drink from the same source, which create a serious health risk. However, in Mbarara, streams/rivers cover 20 % of the domestic use, so erosion has a major impact on the quality of the water for these people. High turbidity and faecal contamination are the main problems.

3. The West Nile area

The topography in the West Nile area, comprising Arua and Nebbi districts, is mostly gently undulating with altitudes ranging from 1500 m in the south-west to 700 m in the north-east. The average population density is not high for the area as a whole, but locally the population density is very high, e.g. around Arua Town where it is more than 300 persons per km^2. Thus, almost all land is cultivated in these areas, whereas the lowland along the Albert Nile is sparsely populated, but people migrate to this area during the second rain. Most crops are annual, although banana plantations exist at higher altitudes. In the most densely populated areas, the intensive growing of annual crops without any conservation measures, combined with heavy rains and moderately erodible soils, has caused considerable erosion. Serious deforestation is taking place in some areas, due to the need for huge amounts of fuelwood for tobacco curing as well as for many thousands of refugees from Sudan. This has caused soil erosion in the newly cleared areas. Thus, the turbidity is high in the rivers originating from these areas during heavy rains. The erosion will affect the water for domestic use as 25 to 45 % originates from rivers and streams..

4. The south-western highlands

The south-western highlands, consisting mainly of Bushenyi, Ntungamo and parts of Rukungiri and Mbarara are undulating to hilly. Most of the area is covered with perennial crops, with bananas as the most important food crop and coffee and tea being important cash crops. Annual crops, mainly finger millet, sweet potatoes and beans, are grown as well. There is a relatively high number of cattle in the area and they are kept in the lowland. Furthermore, the high rainfall in this area, provide a good plant cover. Soil erosion is generally not severe, due to a good ground cover provided by the perennial crops and soils with a relative high organic matter content. However, due to the differences in topography within the area, soil loss might be considerable in some parts of the area. Possible pollution of water sources will have a significant impact on the domestic water use as streams and rivers supply between 25 and 40 % of the population within the area.

5. The western highlands

This area is very similar to the south-western highlands (Area 5). However, both the population density and the cattle density is considerably lower in this area. Generally soil erosion is not severe but the area includes some rather steep areas where soil erosion may be significant, and siltation of the Kafu river has been reported. Open springs/wells are the main water source for domestic water use, while water from streams and rivers accounts for 25-30 % of domestic supply in Kabarole and Kiboga districts.

6. The south and south-eastern lake area

In this area, along Lake Victoria, the population density is relatively high, and most of the area is cultivated. However, the area is dominated by perennial crops with a good ground cover, which protect the soil against the rain, and enhance infiltration. Furthermore, there are only few cattle in the area. A considerable portion of the area is covered by swamps, which act as a filter for sediments and nutrients. Pesticide dependent crops are grown in most of the area, cotton in the eastern part, coffee in the central and western part of the area and some tea and sugar cane estates exist in the central part of the area. This might locally result in some contamination of the surface water, although this contamination generally might be minor compared to the pollution from industrial sources.

7. The north-central area

This large area, which covers the north and central regions is flat (slopes < 2 %) and relatively sparsely populated. The population density is particularly low in the northern districts and only about 20 % of the land is cultivated. Around Lake Kyoga, the population density is higher, but still less than 50 % of the land is cultivated. There are only few cattle in the whole area except in Luwero. Annual crops are grown in the area north of Lake Kyoga while perennial crops are prevailing south of the lake. Rainfall varies from

1000 mm/year around the lake to 1500 mm/year in Gulu, being bimodal south of the lake and monomodal in the north.

Little soil erosion will occur in this area, with the exception of the north-western corner, covering Moyo and part of Gulu. The shallow soils, prevailing in this area, are relatively prone to erosion, and this area also experiences heavy rains from time to time. Also in the steeper part of the area some soil erosion may be experienced locally. Generally, soil erosion is not considered to be a threat to the water sources in this area and the major part of soil washed into the rivers and streams probably originates from bank erosion and cultivation close to the water bodies.

4 TOOLS FOR INTEGRATED LAND AND WATER RESOURCES MANAGEMENT

4.1 Cross-sectoral collaboration and institutional strengthening

In the districts visited, where soil erosion was found to be severe, e.g. Kabale, only few soil conservation measures are practised, no comprehensive extension on soil and water conservation issues is undertaken and there is no linking of the land and water management plans and practice. This is, among other things, due to:

- limited cross-sectoral collaboration
- lack of awareness among officers and extension workers about the interactions between land use practice and water resources
- lack of awareness among farmers about the importance of soil conservation measures and the negative effects of soil erosion on the water resources
- severe logistic constraints within most of the departments

4.1.1 Cross-sectoral collaboration

In order to establish a proper management of water resources at the lowest appropriate level it is important to ensure that the organisational system allows initiatives to be taken at the lowest level, and that responsibilities and duties are clearly defined, both for user groups and within the Government system. The relevant committees for integrated land use planning and water management could be:

- on the local level, Users Committees are established to ensure that no misuse or damage of the source takes place. These committees could act as a local environmental committee as well, ensuring that appropriate land use is practised upstream of the source. The User Committee could also, together with the RC 1, act as an enforcement authority, if needed.
- on the district level, a cross-sectoral coordinating unit could be the District Health and Environmental Committee, which is one of the compulsory committees under the decentralization statute. The committee should include technical staff from the water, agriculture and forest departments, NGOs working in the district as well as political representatives from the District Resistance Council (DRC).

This committee should be responsible for awareness raising among farmers and coordination of proposals and requests from local groups, technical evaluation of proposals and

organization of training and information to groups to enable these to implement proper land use and agricultural practice. It is important that spontaneous conservation practices and indigenous environmental knowledge is recognized. Bottom-up communication is very important in the planning of e.g. soil and water conservation measures. Some measures might be preferred by researchers and officers from a technical point but when it comes to implementation by the farmers, economical considerations, availability of e.g. grasses and tree species and how time-consuming the measures are, becomes very important factors.

Establishment of non-cultivated strips along rivers/streams (see Section 4.2.2) and planning of major water schemes are obvious issues where a cross-sectoral unit should provide guidelines for local groups of farmers. Similarly, when a water source has been identified and approved by the DWO to be suitable for a major gravity scheme, the local authorities and users group, as well as the agronomist and forester should be involved in the evaluation of the suitability of the catchment area of the possible scheme. The work should result in a plan for proper land management to be implemented as part of the scheme, in order to protect the source in terms of water quality and quantity. The plan must include a specification of the responsibilities, authority and economic frames for the local Users Committee.

4.1.2 Training needs and awareness raising

One can not expect a subsistence farmer to protect water sources, - which he in some cases might not even use himself, unless he can see that he is benefitting e.g. through better crop yield. In order for the local farmers to be able to manage local resources properly and benefit effectively as well, farmers need to be trained, both with respect to particular farming techniques, but also with respect to the organization of the local committees.

Thus, it is very important to have well-trained staff, extension workers as well as officers, who can give well qualified suggestions e.g. on how to combine soil and water conservation measures with measures to improve or at least maintain the soil fertility, - otherwise the farmers soon loose interest. During the visit to Kabale and other districts it was felt that the knowledge among officers and extension staff on these issues is inadequate. Therefore, there is a need for additional training of staff. Since 1989 it has been the aim to place a graduate Soil and Water Conservation Officer in each district. However, this has been possible only in few districts due to lack of funding and lack of qualified personnel. Therefore an already employed Agricultural Officer or Ass. Agricultural Officer, often with little specialization in Soil and Water conservation has been transferred to such a position.

The IDA-financed Agricultural Extension Programme (AEP) being implemented in 10 pilot districts includes monthly training (1-5 days) of extension workers by the subject matter

specialists (e.g. on soil and water conservation). If this training shall be proper and effective it is very important that the officers carrying out this training are well-qualified. However, the AEP has allocated some funds which enable officers to go for additional training.

The AEP extension approach, where the extension workers meet with groups of farmers rather than individual farmers, will probably enable a more effective extension strategy, as it will be possible for the extension worker to reach a larger number of farmers, and the farmers will be able to support and discuss with each other. For each group, at least one or two demonstration plots should be established e.g. at the fields of the group leader, whc act as a contact farmer to the extension worker. The demonstration plots could be used during field days for practical oriented "learning by doing" training of the farmers. The proper management of these demonstration plots will result in an increased crop yield and thus the demonstration plots can be used as a strong tool to convince other neighbouring farmers about the benefits of sound agricultural practice. Thus, it is also important that the farmer keeps records of the yield from the plots. During the visit to the Uganda Soil Conservation and Agroforestry Pilot Project (USCAPP) in Mbarara District, it was evident that a considerable increase in crop yields in the banana plantations of the contact farmers, had created a lot of interest among the neighbouring farmers. Data, whether recording of crop yields from different types of land management or records of soil loss and/or sediment load are strong and necessary tools in awareness raising and training.

It is also important that experience gained from research stations, universities, etc. is passed on and utilised by the district staff, and that some kind of collaboration is established (see Section 4.3). The training should to some extent be coordinated with the other departments, so that cross-sectoral training of farmers could take place.

4.1.3 Logistic constraints

Joint extension activities between departments could also help overcoming some of the constraints regarding transport, as vehicles can be shared by staff going to the field together.

However, with the limited possibilities of funding for the government sector, it can be foreseen that logistic constraints may hinder the possible adaption and implementation of more integrated land and water management. Thus, it might be relevant to establish a donor financed Soil and Water Conservation Projects in the areas which are most severely affected by soil erosion. Such projects would be able to provide some logistic inputs and assist in additional training of farmers and government staff.

4.2 Possible management tools

4.2.1 Technical tools

On the flat areas it is believed that the sediment transport to the water sources in many cases primarily originates from erosion close to the sources. Thus, it is expected that non-cultivated zones (see below) will be able to reduce the existing erosion and associated siltation problems in these areas considerably. Sound agricultural practice like mulching of residues instead of burning, use of manure, compost, etc. will ensure a good soil structure and thereby a good infiltration.

In the most mountainous areas, especially Kabale, the slopes are often so steep that they should be left non-cultivated although this is not very realistic with the present population density and growth rate. Even comprehensive soil and water conservation measures will not be able to reduce the erosion rates sufficiently. On the less steep slopes (slope < 25%), contour ploughing/cultivation, planting of grasses on bunds along contours and sound agricultural practices aiming at maintaining a high organic matter content would in most cases reduce the soil erosion significantly. Tree planting of upper catchment areas, and the introduction of agroforestry practice on steep slopes should be promoted. However, the tree species should be carefully selected. In areas where water is scarce or areas which are catchments for water supply schemes tree species with a high water consumption, e.g. Eucalyptus should be avoided. In order to avoid encroachment on Forest Reserves and sensitive upper catchment areas, it is important that individuals establish woodlots to cover their own need. This will also minimize the time used for collection of firewood. However, in the area where each individual only have a little piece of land, it becomes difficult to allocate land for this purposes. During the field studies it was observed that a few of the protected water intakes were surrounded by a hedgerow of *Euphorbia tirucalli*. The carcinogen, 4-deoxyphorbol, has been found not only in the euphorbia itself, but also in extract from nearby soils, vegetables and drinking water. This illustrates the need for careful selection of tree species.

Of Uganda's total land surface area of 202,000 km^2 about 80% is considered to be suitable for agricultural production. Despite the fact that only 25% of this area (for Uganda as an average) is actually cultivated, certain areas, like Mbale and Tororo in the South-east and Kabale, Kisoro and Rukingiri in the South-west, are almost 100% utilized, while under-utilized high farming potential areas with low population densities exist in Kabarole, Kasese, Mubende, Hoima, Masindi and parts of Lira, Apac and Gulu districts. This imbalance has resulted in an undesirable situation. On one hand the potential productive capacity has not been fully exploited in land-surplus areas and on the other has the fertility of the soils has been exhausted and severe erosion has taken place in the land scarcity areas due to over-cultivation. This situation is precarious as the high population pressure in the above-mentioned areas causes accelerated environmental degradation and creates poverty as only little land is available per person.

Thus, a national soil and land suitability survey should be carried out, so that the necessary data can be available for proper land use planning on national and district and local level. However, a more even utilization of the farming potential areas will be difficult in the short-term as the present uneven distribution has many social, cultural and ethnic reasons.

In order to secure a better assessment of the extent and severity of soil erosion and transport of sediment to water sources it is necessary that a comprehensive collection of data is initiated. Thus, collection and analyses of sediment load at selected streams and rivers should be an integrated part of the proposed rehabilitation of the hydrometric network. Also, in order to assess the effectiveness of soil and water conservation measures, measurements of soil loss from plots with various soil and water conservation measures should be carried out. The experiments at the ICRAF research station in Kabale is one of the few places where such measurements are carried out presently.

There is a need for restoration of many of the valley tanks and dams, of which most were constructed by the government between 1957 and 1970. However, before this can take place it is necessary to clarify the user right and who shall be responsible for the future maintenance.

In connection with the restoration of the valley dams and tanks, the watering methods should be improved in order to minimize the future maintenance and ensure less health risk to the humans using the water for drinking purposes. The tanks should be fenced so that cattle do not have direct access. Instead the cattle should be watered downstream the tank or dam via a pipeline. Grass strips should be established upstream the dams, acting as a kind of filter for the sediment. However, long periods of drought and interference by cattle might hinder such grass strips to be established and act as an effective filter. An increase of the number of dams and tanks would decrease the water scarcity during the dry period. The reduced number of cattle per water point will also reduce the problems with cattle tracks, acting as initiators of rill and gully erosion.

4.7 2 Legal tools

By-laws can be a means to ensure proper land and water management, but have the disadvantage that they are likely to be neglected when not enforced unless the farmers do realize the importance and benefits. Hence, if by-laws should be used as a tool it is important that:

- awareness is raised about the importance and benefits of the by-laws
- local enforcement takes place

Cross-sectoral collaboration among extension staff as well as involvement of local people

and authorities are equally important. Non-cultivated zones along river banks could be an example of a possible issue for a by-law which could be implemented through cross-sectoral collaboration. During discussion with the DWOs in Kabale as well as the other districts visited, the importance of a 3 to 6 metres non-cultivated zone along river banks was emphasized. For the DWO alone, it might be difficult to go out and convince the farmer who may only own one ha, to leave e.g. 6 meter of his field along the adjacent stream uncultivated. The farmer might think that a major part of his land now will become non-productive. But if the DAO can advise the farmer to grow Napier grass which could serve as fodder for his cows and serve as feed security during dry periods, the farmer might realise that apart from getting more clean water he can also improve his livestock practice and thereby raise his income. The combined effort of the DWO and DAO make it much easier to convince the farmer about the importance as well as benefit from such a non-cultivated zone.

Pollution of water sources caused by the single individual farmer will be almost impossible to avoid and control, but pollution from point sources should be controlled. For example cattle dips must be constructed with due consideration of the discharge of wastewater and there should be regular monitoring of the water quality of drainage water from major rice schemes.

There is also an urgent need for a policy and guidelines to lay the basis for environmentally sound management and maximum sustainable utilisation of wetlands. On national level such a policy is already in the final stage of development and it is expected that it soon will be translated into law. But there is a need to develop an institutional framework for implementation of the wetland policy at the district level. It is especially important that the right to and allocation of land is specified. Regarding irrigation it should be considered whether permission should be obtained to extract water for irrigation purposes, - especially in areas where scarcity of water might become a problem.

In order to encourage farmers to improve soil fertility and to ensure proper protection of the natural resources, inclusive of water bodies through implementation of soil and water conservation measures this requires that he or she has security of permanent ownership to the land. Thus a more clearly defined landownership, than is the case in many areas presently, is needed.

4.3 On-going soil and water conservation projects and proposed guidelines

4.3.1 Existing soil and water conservation activities

During the visits to the selected districts very little soil and water conservation and soil improvement activities were observed. In Kabale bunds exists, but this is mainly remains from the colonial time. Most of them have not been maintained and today they mainly act as demarcation of the fields and are most often inefficient as soil conservation measures. In Mbale few conservation measures were found, often in areas where a mission is located, which has promoted the establishment of the measures. Essentially no practical results in the field of agroforestry was observed. However the International Centre for Research in Agroforestry (ICRAF) has for the last six years carried out on-station trials at three agricultural research stations in Kabale, Bushenyi and Mpigi, under the AFRENA programme (Agroforestry Research Networks for Africa). Recently, some on-farm trials have been initiated in Kabale in order to see the effect of these measures when carried out by farmers, and how they pursue them.

The Farm Forestry Project (FFP), which was a part of the multi-donor financed Forestry Rehabilitation project was established in 1988. The objective was that individual farmers, especially women should establish private nurseries and woodlots. However, the number of individual farmers who established nurseries with assistance from FFP was quite small, among other things due to the fact that the duration of the project only lasted from few months to three years in the various districts. Generally eucalyptus woodlots were planted in order to sell the wood. Thus the woodlot did not have the objective of solving the problems of shortages of firewood, which in many districts has resulted in encroachment on forest reserves and forest on communal land. Such a short duration does not leave any possibility for institutional development and often leave confused staff behind. The former CARE Farm Forestry project manager concluded, that "The Farm Forestry Project spread itself too thin and too fast".

The SIDA financed Uganda Soil Conservation and Agroforestry Pilot Project (USCAPP) was established in two Sub-counties in Mbarara District in 1992 aiming at generating experience on how soil and water conservation and agroforestry activities can best be carried out in Uganda, and of course also aiming at improving the conditions with regard to land management in the project area. The project is solely implemented by the district staff, mainly from the Agriculture and Forestry Departments, supported by a National Soil Conservation Officer and an expatriate who act as a short-term consultant few months a year. With the limited knowledge on the use of soil and water conservation measures and agroforestry in Uganda and how the farmers pursue these activities, it is suitable that pilot projects like this are started, rather than the wide but very scattered approach used in the Farm Forestry Project. Despite the fact that the project is only two years old positive results in terms of improved crop and increased crop yield could be observed at the three contact farmers visited. In this relatively dry area, it is the mainly the conservation of water that is the most likely reason for the increased yields. The farmers confirmed that neighbouring farmers had paid a lot of interest when realising the increased yields and had started to take up the technology.

The most comprehensive soil and water conservation project carried out presently in Uganda is probably the Mount Elgon Conservation and Development Project. The main aim of the project is to secure:

- conservation and rehabilitation of Mount Elgon Forest Park
- sustainable development of the communities surrounding the forest, thus reducing the pressure of encroaching on forest land
- the quantity and quality of water flow to all areas affected by the forest

The project was started in 1988 and is now entering the third phase. The activities includes education and extension through awareness campaigns, production of support material and training of farmers, extension workers and community leaders; proper management practice such as soil and water conservation and agroforestry and "zero grazing" of improved livestock; reforestation of encroached areas. Furthermore an erosion hazard map of Mount Elgon has been produced to ensure a proper land use planning. The project is working within the framework of the government system and there is a close cooperation between the project and the involved Government Departments. The project seems to have strengthened the capability of the staff involved, but the process of farmers adapting a more sustainable agriculture has been difficult and slow. However, the approach of a long-term project working within the government system seems to be right and all persons from the various departments met, expressed their positive attitude towards the project.

4.3.2 Proposed guidelines for any future soil and water conservation projects

During planning of any future soil and water conservation projects it is proposed that the main development objective should be that farmers in the project areas should be able to practice a diversified and sustainable agriculture that will increase or at least maintain the present crop yield and ensure protection of the natural resources, inclusive of the water bodies in the area. The main project strategy should be a combination of a participatory approach and institutional and community development

The main criteria for a successful and sustainable institutional development is that the project is integrated in the already existing government system, so that the staff attached to the project, are persons already employed within the government system. Only a few expatriates plus some few administrative staff should be directly employed by the project. The projects shall focus on the improvement of linkages between the local farmers/villagers, extension staff and district headquarters staff. As there is no doubt that most agricultural as well as forestry field staff lack training in soil and water conservation and agroforestry, any new soil and water conservation projects must include a heavy element of training, including training in communicating with and motivating farmers.

Participation of personnel from the Water Department shall ensure the necessary linkage of land management and protection of water resources. This linkage is often missing in soil conservation projects.

During the focus on soil and water conservation activities and participatory approach, there should be emphasis on the farmers willingness to take up the soil and water conservation activities and aim at a "bottom-up" approach where their already existing knowledge is used. Awareness raising should also be an important component especially during the first years. It is proposed that the projects should be long-term projects with phases of a duration of 4-5 years.

5 PROPOSED LAND MANAGEMENT RELATED SET OF ACTIONS

Below is listed a number of activities that could be used as tools to reduce some of the negative impact of land management practice on the water resources, and which could be part of the set of actions to be included in the Water Action Plan:

- establish measurements of sediment load in connection with the rehabilitation of the hydrometric network
- establishment of non-cultivated zones along streams/rivers - if necessary through by-laws
- include watershed protection issues in the activities of the District Health and Environmental Committee on district level and Users Committees on local level
- establishment of cross-sectoral collaboration at national, district and local level,
- identify soil and water conservation projects in the districts which are most severely affected by soil erosion
- establishment of a national policy and legislation on the reclamation and utilization of wetlands/swamps
- promote more cross-sectoral courses in the education system
- undertake a national soil and land suitability survey
- strengthening of the extension service on soil and water conservation at district level.

ANNEX 13

GUIDELINES FOR DISTRICT MANAGEMENT OF WATER RESOURCES

ANNEX 13

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1 INTRODUCTION

The Water Resources Statute, the Water Supply and Sewerage Statute and their subsidiary Regulations specify the roles and responsibilities of the Directorate of Water Development and the district administrations in regards to water resources management and water supply services. These provisions are in accordance with the Local Governments (Resistance Councils) Statute, 1993 regarding decentralization.

Decentralization has resulted in the districts being responsible for water supply services, subject to supervision and approval by the central government (DWD), while the central government is responsible for water resources. Water resources management, however, requires actions and decisions to be taken at the district and local levels as well as at the national level. Therefore, the district administrations also have a role to play in regards to water resources management.

These guidelines are intended to assist the district administrations in having an understanding of the issues involved and in the role that they can play. They are a summary of existing regulations and procedures, but not a substitute for them. The districts should be conversant with relevant legislation, regulations and management procedures.

2 WATER RESOURCES MANAGEMENT ISSUES

At the district and community levels the following water resources issues may be in need of management action. The problems arising from the issues will vary in severity from one district to another.

- competition between various users for the right to use the same water source, such as a river or stream. The various uses, for example, could be irrigation, town water supply, fish ponds, and livestock watering.
- excessive use of a water resource or a wetland that may cause environmental and pollution problems
- soil erosion caused by over-grazing or cultivation of steep slopes, which in turn creates water quality problems
- wastewater discharges and industrial pollution which may cause water quality problems
- pollution of groundwater by inadequate sanitation facilities
- management, operation and maintenance of rural and urban water supplies

3 DISTRICT WATER RESOURCES MANAGEMENT FUNCTIONS

The district administrations will need to carry out the following functions in order to deal with the above issues.

3.1 Policy making, planning and coordination

- establish a district management structure for water resources
- define district priorities for water resources management activities in light of severity of problems, expressed needs and financial resources available
- in accordance with national policies and with the approval of DWD, make by-laws and regulations regarding the management of wetlands, hill slopes, cattle watering, fish ponds, irrigation schemes and other water resources
- establish a data base of water resources, sources and use
- integrate district extension services so that water resources and environment activities and messages are coordinated
- support lower levels of government, especially the sub-counties and Village Resistance Councils, in taking responsibility for monitoring and managing water resources in their areas
- promote the role of women in water resources management.

3.2 Regulation of water extraction

- identify large water users that will require permits as per regulations, and inform DWD
- administer the procedures required at district level for regulation of water extraction, as described in "Management Procedures" issued by DWD

3.3 Regulation of wastewater discharge

- identify wastewater dischargers requiring permits as per regulations, and inform DWD
- receive applications, inform the relevant RC 1 and RC 3, and forward applications to DWD

3.4 Monitoring

- observe, where possible, the performance of water extraction and wastewater discharge permit holders, and report infringements to DWD

3.5 Mediation

- mediate disputes concerning use of water resources that cannot be settled by lower level RC Courts or by Chiefs and Elders

3.6 Training and information

- train the district extension staff, such as those in community development, agriculture, forestry, fisheries and livestock in an integrated approach to water resources and related land management, and in spreading integrated environmental messages to the public

3.7 Rural and urban water supply

- promote rural water supply systems that are owned, operated and maintained by the users, so that the district does not have any operational responsibilities for these facilities

- ensure that town water supply systems, after rehabilitation, are operated and maintained by town councils or community groups, so that the district does not have any operational responsibilities for these systems

4 STRUCTURAL NEEDS FOR DISTRICT MANAGEMENT OF WATER RESOURCES

Water resources management will need to be placed within the committee and departmental structure of the district administration. Water resources management is a part of overall environmental management, so these activities should be administratively linked.

The District Resistance Council can determine its own committee and departmental structures. It is proposed that the DRC consider forming an Environment and Natural Resources Committee and a department that reports to it. Such a structure will take care of the needs for environment and water management. The department can include units for environmental planning, water resources and water supply, and forestry.

The Chairman of the committee would be a DRC member, and the Secretary would be the head of the department.

The district will be able to save resources such as staff, transport and office facilities if it integrated the extension staff in the district as much as possible, and enabled them to spread a coordinated and uniform environmental message. Such an arrangement would mean that the district will not need to employ extra extension staff to deal with water resources and environmental issues, but instead will ensure that the necessary functions were carried out by existing extension staff in other departments.

It is proposed that the district integrates its extension activities and staff through the Technical Planning sub-committee of the District Development Committee, and that the Deputy District Executive Secretary be given responsibility for the success of this approach. Assistance can be expected from external/national sources in planning and training activities in order to promote the integrated extension approach.

5 RELATION BETWEEN THE DISTRICT AND DIRECTORATE OF WATER DEVELOPMENT

5.1 Water resources management

Water resources is still a central government responsibility according to the Local Government Statute, 1993. Therefore, DWD will formulate management procedures for such functions as regulation of water extraction and wastewater discharge, and will require the assistance of the district administration in carrying out these functions as well as the function of national monitoring of surface water and groundwater quantity and quality. It is the intention in the future to further decentralize some of these functions, such as allocating water extraction permits.

DWD will liaise with the district administration regarding water resources management through the District Executive Secretary. The Inspection and Support Services Department will be the contact point in DWD, and will call on the services of the other DWD departments (Rural Water, Urban and Institutional Water, Water Resources) as required.

District policies, by-laws and regulations regarding water resources will be forwarded to DWD for approval so as to ensure that national laws, policies, regulations, and procedures are being followed.

Costs incurred by the district in carrying out the specific functions required for water extraction and wastewater discharge permits will be covered through an arrangement with DWD involving the retention of the Water Extraction Application Fee by the district.

5.2 Water supply services

According to the Local Government Statute, 1993, water supply services are a district responsibility, but subject to the approval and supervision of the central government, the central government agency in this case being DWD.

DWD's role in approval and supervision will be handled through the Inspection and Support Services Department, which will call on the technical services of other departments when necessary.

The approval role will be confined to reviewing the district's annual work plan regarding water supply activities and ensuring that national policies, priorities and standards are being followed.

The supervising role will take the form of inspection visits that can offer technical advice and assistance where possible in regards to development of water supply services. The inspection visits will be on an irregular basis, and in the meantime assistance can be requested by the district.

DWD will retain responsibility for national and external funded water supply projects. Implementation will take place through district staff in relevant departments concerned with water, health and community development.

ANNEX 14

BACKGROUND FOR REGULATIONS

ANNEX 14

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1 INTRODUCTION

Uganda is currently in a process of reviewing, updating and supplementing existing water legislation. Some of the proposed Acts and subsequent regulations will need to reflect the principles of the Water Action Plan to cater for consistent and unambiguous management of water resources.

The relevant regulations in the context of the WAP have been identified as regulations on extraction of surface and groundwater, and on wastewater discharge, all being related to the draft Water Resource Statute.

The present Annex report contains the background for and discussion of the outline regulations and management procedures on these subjects. The synthesis of this background information and discussion is presented as recommendations for regulations and management procedures in Annex reports nos. 15 and 16 of this Volume.

2 REGULATION OF WATER EXTRACTION

2.1 Regulation needs

An essential aspect of water resources management is allocation, at a sustainable level, of available water resources for different uses and, especially, prioritization between different uses in case of scarce resources. In order to execute rational management it is necessary to possess knowledge on available resources and the extent of present and possible future exploitation of these resources. This can only be obtained if extractors of water provide information on their extraction to the authorities responsible for management of the resources, hence the need for regulation of water extraction.

For reasons of administrative capacity constraints, it is clear that a requirement for all water users, irrespective of the quantity of water extracted, to apply for and obtain a water extraction permit is not feasible, nor is it necessary from a point of view of water resources management.

One of the guiding principles behind the WAP is that management structures should only be developed in response to a perceived and expressed demand from those affected. Hence, if small scale water extraction does not affect other users' possible use of the same resource, there is no need for regulation of water extraction. The criteria for when water extraction is likely to impact the availability or the quality of the resource being exploited, and hence be subject to a water extraction permit, for administrative reasons has to be defined rigorously.

It is suggested that the criteria applied should be the amount of water extracted. However, the amount of water extracted may be impossible to assess in many cases, since meters are generally installed only in large extraction facilities. Instead, an indirect and more operational measure of the quantities of water extracted may be applied, being the potentially extracted amount of water with the type of extraction facility installed.

2.2 Criteria for levels of water extraction regulation

The proposed threshold levels for rendering a water extraction permit mandatory to a water user, before water can legally be extracted, are determined in order to cope only with the big extractors.

In some paragraphs figures for certain threshold levels have been omitted because the basis for determining values has been deemed insufficient. For instance, the level for irrigation schemes requiring an extraction permit has been indicated by "Irrigation schemes > .. ha". In these cases the threshold values will have to be set by the Director of Water Development.

By applying the proposed thresholds it is estimated that the vast majority of all water

extractions will be exempted from regulation. Having accomplished this, the available resources and capacities within the regulating authorities can be designated to regulate and control the big water extractors more comprehensively than would have been possible if all water extractions were subject to regulation. A basic principle applied in the outline of regulations has been to ascertain that proposed regulations can be enforced within the existing capacities of the regulating authorities, or capacities likely to be available in the short term. If the necessary enforcement capacity is deemed insufficient, regulation should be simplified or abandoned. This is in accordance with the principles laid down in the water policy for Uganda proposed as part of the Water Action Plan work.

The overlying principle is that water extraction serving only domestic purposes, as defined in the Water Resources Statute, is exempted from regulation.

In the case of groundwater resources, the lower limit for requirement of permits is proposed to be boreholes mounted with handpumps. If a motorized pump allowing water to be drawn from the source is installed, an extraction permit should be mandatory.

In the case of surface water extraction one additional criteria for regulation is proposed: if motorized pumps or gravity diversions allowing water to be drawn from a surface water source are arranged, but the extraction capacity is less than 5 l/s, an extraction permit should not be mandatory. The water extractors should have an obligation to register their extraction with DWD on prescribed forms. Irrigation schemes and fish ponds for subsistence purposes shall not be subject to regulation. Irrigation schemes and fish ponds which are not serving solely subsistence purposes, but are less than .. ha (irrigation schemes) and .. ha (fish ponds) should be subject to registration.

The purpose of the registration is to provide the necessary background information to DWD for continued supervision of sustainable use of the resources and to enable DWD to decide whether regulation becomes necessary. If scarcity of water resources becomes a problem (for instance, due to the cumulative effect of a large number of small scale extractors previously not needing an extraction permit) in a certain area, there should be a provision for requiring a permit even for small scale extractors, and also to cancel existing permits, within the affected area.

The sensitive problem of cancelling water extraction permits might be reduced by making all permits time-limited. This would allow for a more dynamic and up-to-date planning of development of water resources: conditions for renewal of water permits can more easily take account of recent development in demands and availability of water resources in terms of quantity and quality.

The principle of no regulation of water extraction for domestic use overrules the other criteria mentioned above. For instance, a borehole with a motorized pump supplying water to a single or few houses, or even to a local community, should not be regulated, if the water is used only for domestic purposes. This may seem a possible significant impact on the resource being exempted from regulation. However, assuming a domestic water

consumption of 100 l/cap/d, this implies that up to approx. 4000 people may be connected to a borehole and yet extract an amount of water less than 5 l/s, which is proposed as the lower limit for regulation of surface water extraction. In cases where so many people are served by the same motorized extraction, it is most likely that the water will also be used for other purposes than domestic ones, and the extraction will then be subject to regulation.

Surface water extraction with a capacity of more than 5 l/s, and irrigation schemes larger than .. ha and fish ponds, or aggregations of fish ponds owned by one individual or agency, larger than .. ha, should be subject to obtaining a permit.

An overview of the above proposals for levels of water extraction regulation are provided in Table 2.1 below.

Table 2.1 - Criteria for levels of water extraction regulation

DEGREE OF CONTROL	GROUNDWATER	SURFACE WATER
No regulation	Domestic use as defined in Water Resource Statute Extraction by manual means	Domestic use as defined in Water Resource Statute Extraction by manual means
Registration required		Extraction of water by motorized pump or by gravity diversion with a capacity < 5 l/s Non-subsistence irrigation schemes < .. ha Non-subsistence fish ponds < .. ha
Permit required	Extraction by mechanical, electrical or other equipment, except for domestic use	Extraction of water by motorized pump or by gravity diversion with a capacity > 5 l/s Irrigation schemes > .. ha Fish ponds > .. ha

2.3 Management levels

Another of the guiding principles behind the WAP is that management of water resources should take place at the lowest appropriate level. In the context of water extraction permit administration, the district studies carried out as part of the WAP Phase II indicate that this level at present is the national level due to inadequate managerial capacity at the district level. However, the water extractors who are subject to registration but not to obtaining a permit may be administered at the district level. The duties at the district level will be to examine periodically the possible combined effect of the registered water extractors that do not have a permit, and to assess, with assistance from DWD if necessary, whether the effect on the water resources warrants a local regulation of these water extractions.

Application of the principle of management at the lowest appropriate level implies

promotion of community involvement through a consultation and hearing procedure at a very decentralised level (as far down as RC 3 or RC 1). The management procedures must allow for local influence on the procedure of granting a water extraction permit.

As a consequence, the proposed management procedures will inevitably impose an additional burden on the district administration. The duties will principally consist of operating an objection procedure, hearing objections, consulting District Officials and synthesising comments and objections for onward transmission to DWD. The best way to reduce the weight of this burden is to levy an administrative charge to finance directly the costs of administering the application. The size of this charge should cover the administrative costs at both district and national level.

From a long-term perspective, extraction of water that may be foreseen to affect only water sources within a single river basin should be subject to regulation at the district level while extraction of water that may be foreseen to affect water resources shared by more than one river basin should continuously be administered at the national level. It is proposed that DWD set an upper limit for extraction from each river basin and allows district administrations to regulate water extraction within such limits. The districts may then further allocate a certain amount of water for smaller administrative units, i.e. the appropriate RC level, and leave it to the RC unit how to share the combined allocated water resources between individual extractors as described below.

2.4 Principles for local regulation of water extraction

The proposed principles for selecting water users requiring permits for surface extraction aims at reducing the number of cases where permits shall be issued by central government to cover only the really significant water extractions. The large number of smaller extractions will never call for any regulations as their impact on the water resource is not significant. There will however, in certain situations, be a need for applying regulations to some of these non-permit holders.

This will for example be the case, if the number of medium size water users (motorized extraction or gravity diversion up to 5 l/s) of a particular surface water resource increases resulting in a combined extraction exceeding the capacity of the resource.

Other examples are clusters of small scale farmers irrigating up to .. ha or clusters of fish farmers in the range up to .. ha of fish ponds, which do not need permits, but due to their combined extraction exhaust the common resource and thereby exclude other (possibly more valuable) uses of the resource.

Following the management procedures proposed in Annex 4, this kind of users will be required to register the details of their extraction, and therefore information about them will be available in the district as well as with DWD.

It is proposed that in such situations, local regulations are imposed for the particular resource trough district by-laws, using the possibility of DWD to delegate water resources management functions. The by-laws may further delegate the distribution of extraction rights among the actual users (within a total extraction limit for the water resource) to even lower levels such as sub-counties or parishes. To cover the administrative costs of this kind of regulation, the involved users may be obliged to pay a water extraction fee to the district.

The initiation of such regulations may arise from private water users claiming reduced water availability or from routine hydrological analyses made by the district or DWD.

Under the decentralization the districts will, to a large extent, decide themselves which management functions they will prioritize within their administration. They should however be encouraged to take over the above mentioned functions under guidelines from DWD.

2.5 Monitoring compliance with water extraction permits

Since it is proposed that the drillers should be obliged to ascertain that water users hold an extraction permit before installing a pump in a borehole, the enforcement of the regulations on groundwater extraction may be rather simple. DWD will do spot checks to see if the installations at a borehole is in accordance with the permit. If not, DWD should be empowered to cancel the licence of the driller.

For surface water extractions the monitoring is also simple: For motorised installations DWD (or the District Officer) has to do spot checks with registered users and users holding an extraction permit to see if the extraction capacity is within prescribed limits. For fish ponds and irrigation schemes the monitoring will take place by calculating the surface area of the installations.

3 REGULATION OF WASTEWATER DISCHARGES

3.1 Regulation needs

From an environmental point of view, based on the available information on present industrial activities in Uganda discharging effluents to the aquatic environment (N.Droruga, 1990: Report on the Purification of Industrial Waste Water - Uganda; Danida, 1993: Rapid Water Resources Assessment, Uganda Water Action Plan, Phase I), it is suggested that the emphasis should be put on regulating the following municipal and industrial sectors:

- urban wastewater treatment plants
- sugar factories
- textile industries
- breweries
- leather tanning industries
- oil and soap industries
- meat, fish and milk processing industries

Mining and oil exploitation industries will need a separate regulation of wastewater discharges, and preparation of such regulation is ongoing.

According to available information, the first three mentioned industrial sectors (sugar factories, textile industries and breweries) are responsible for more than 95% of the national industrial discharge of BOD. The tanning industry produces some of the most heavily polluted wastewater in the country. A treatment plant already exists on the only operating factory, but according to Droruga (1990) it is probably not working adequately. Oil and soap industries are ranked the fourth most polluting industrial sector in terms of BOD. The wastewater quantities from meat, fish and milk processing industries are in many cases rather low, but the number of operating units is considerable.

Other industries, e.g. battery factories, garages and gas stations discharging hazardous substances, might become subject to effluent regulations, but no discharge figures for such industries have been available and it is considered that this kind of wastewater discharges does not at present constitute a major environmental problem in Uganda - though the situation may change with intensified industrial development.

The mentioned highest priority industries (at least breweries and sugar factories) are probably those most economically viable and thus most capable of affording wastewater

treatment costs.

It must be emphasized that only installations discharging effluents directly to a recipient are covered by the regulations outlined in this report. Installations discharging to a sewer system should be subject to regulation by the body responsible for treatment of the sewage. In some cases, industries may be required to apply pretreatment of wastewater in order to avoid contamination of treatment processes in the treatment plant. However, since the sewage treatment plant will discharge effluents directly to a recipient, the plant will be subject to regulation according to the present outlines.

3.2 Principles of setting standards/guidelines

Basically, two different approaches to setting effluent standards/guidelines could be taken:

- requiring uniform quality from any type of effluent; thus paying no attention to the type and use of the receiving water body

- adjusting on a case-by-case basis the allowed amount of pollutants discharged according to the natural characteristics, projected quality objectives and planned use of the receiving water body

Standards/guidelines developed according to the first approach must necessarily be very restrictive in order to effectively protect the environment, since they must take into account the most critical situations and locations. Thus, this approach might lead to unnecessary treatment costs in some cases. The major advantage of this approach is its rather simple administrative implications.

The second approach allows for a more flexible administration of environmental management and optimization of treatment efforts and costs because the level of treatment may be tuned to the actual receptive capacity of the receiving waters assessed on a case-by-case basis. The problem of this approach is the difficulty of practical application: knowledge of the receptive capacity requires studies of the hydraulic, dispersive, physico-chemical and biological conditions prevailing in the water body in question, and also plans for future development in the area should be taken into account.

Based on the above, it is suggested that the future granting of wastewater discharge permits be based on a combination of fixed discharge limits (permitted discharge related to production or raw material; maximum concentrations and flow) and assessment of assimilative capacity of the receiving waters. As a general rule fixed limits should be applied, but for certain areas stricter or more lenient standards may be applied, based on a case-by-case environmental assessment of the individual recipient.

If, however, the applicant for a wastewater discharge permit can produce, to the satisfaction of the responsible authorities, scientifically sound evidence in the form of an

EIA that the planned wastewater discharge is not likely to adversely affect the receiving waters, or prevent other existing or planned uses of the waters, there should be an option for the responsible authority to accept more lenient wastewater effluent quality. But the responsibility for and costs incurred by carrying out the EIA should rest solely with the applicant.

Hence, rather than a straight approval or refusal of a technical proposal, the process of issuing a wastewater discharge permit will take the form of a negotiated agreement between DWD and the applicant on the specific conditions for the permit. As a basis for this negotiation, it is recommended to set up a Working Group with representatives from authorities, industry and the NWSC having the objective to work out an "Advisory Code of Practice for the Discharge of Wastewater". This would be a technical code of practice covering most aspects of wastewater pollution in a Ugandan context. All applications for a permit would be judged, in the first instance, against the provisions of the Advisory Code. This would make it very much easier to undertake negotiations for a permit between DWD and the applicant.

Both public as well as private installations should be obliged to comply with standards (ref. Sec. 38 in Water Resource Statute). For instance, municipal sewage treatment plants operated by NWSC or any other authority should be subject to compliance with effluent standards.

3.3 Types of contaminants included in standards/guidelines

Generally, discharge control of a wide range of substances are needed in order to protect the aquatic environment and human health, i.a. degradable organic material, nutrients, toxic compounds, bio-accumulating compounds and carcinogens. In principle, all polluting discharges should be subject to identical discharge limitations regarding the list of substances discharged. This does not mean, however, that control for the entire set of parameters needs to be performed for each polluting discharge.

For instance, breweries discharge effluent with a high content of organic matter and no other significant pollutants; hence standards limiting the BOD-discharge may be relevant for breweries. Tanneries, on the other hand, typically discharge effluent with a high content of i.a. organic matter, sulphides and chromium. Thus, for this type of industry discharge standards covering a wider range of constituents might be applied. In Table 3.1 a suggestion is made for relevant pollutants to be monitored for different industrial sub-sectors.

Table 3.1 - Characteristic pollutants for various wastewater effluent.

INDUSTRIAL SECTOR	CHARACTERISTIC POLLUTANTS
Urban sewerage treatment plants	TSS, BOD, nitrogen, phosphorus, faecal coliforms + various, depending on connected industries
Sugar industries	TSS, BOD
Textile industries	TSS, BOD, pH, oil & grease, chromium, phenols, sulphides
Breweries	TSS, BOD.
Leather tanning industries	TSS, BOD, sulphides, chromium, nitrogen, oil & grease, faecal coliforms
Oil and soap industries	TSS, BOD, pH, oil & grease
Meat, fish and milk processing industries	TSS, BOD, oil & grease, pH, faecal coliforms, (phosphorus)

TSS: Total suspended solids
BOD: Biochemical oxygen demand

3.4 Time perspective of implementation of standards/guidelines

Development and implementation of standards/guidelines and monitoring for the pollutants listed in Table 3.1 should be the target in the long term. However, a less ambitious and more simple target might be reasonable in a short term perspective, taking into account present administrative and analytical capacities and capabilities. This approach finds support by a World Bank paper (World Bank Environment Mission, November 1993, Aide-Memoire), which states that "...enforcement capabilities at ministerial and local levels are unlikely to substantially improve over the next years. Any promulgations of new or stricter regulations (to complement incentive structures) have to be done with this in mind".

It is recommended that highest priority should be given to the development of standards/guidelines for BOD, as this is the main characteristic pollutant of most wastewater effluents presently discharged. However, since tuning of treatment processes and plants to meet required effluent standards are most adequately dealt with in the planning and design phase, development of standards for other substances (ref. Table 3.1) than BOD - as well as the time scale of their implementation - should preferably take place soon and announced as early as possible, in order to avoid unnecessary investments in treatment facilities that will prove inadequate to meet tomorrow's effluent standards.

Both new and existing installations should be obliged to comply with the standards. However, existing installations may need a few years period of adjustment during which they will have to bring their effluent quality to comply with the standards.

For Kampala, the discharge of wastewater into Murchison Bay, where also the water

intake for the city of Kampala is located, constitutes a special problem. This situation may warrant reduction in discharges of nutrients - giving rise to excessive growth of toxic algae and water hyacinth with its well known side effects - and hazardous substances, in order to protect the drinking water quality.

3.5 Suggested effluent standards/guidelines

In accordance with the above principle of a stepwise development and implementation of standards, two scenarios are outlined: 1) the ideal Ugandan situation from a long term perspective, and 2) the first step to take to approach the ideal situation in the short term.

For the characteristic pollutants from specific industrial sectors, the World Bank has issued guidelines prescribing effluent standards (World Bank, 1988: Environmental Guidelines). These standards are mandatory for projects receiving funding from the World Bank, so they might be taken as a target to be achieved for Uganda in the long term. Examples of these standards for relevant industries, in a present Ugandan context, are given in Table 3.2 below.

Table 3.2 - World Bank effluent standards for relevant Ugandan industrial sectors.

INDUSTRIAL SECTOR	POLLUTANT[1]	UNIT	WB STANDARD
Sugar industries	TSS BOD_5	kg/t product do.	0.09-0.11 0.18-0.30
Textile industries	TSS BOD_5 COD Chromium Phenol Sulphides	kg/t product do. do. do. do. do.	11-22 5-8 60-85 0.04-0.12 0.04-0.12 0.08-0.24
Breweries	not available	not available	not available
Leather tanning industries	TSS BOD_5 Oil & grease Chromium Sulphides Kjeldahl-N Faecal coliforms	kg/t raw hides do. do. do. do. do. counts/100 ml	1.2-3.6 1.0-3.2 0.48-1.3 0.04-0.12 0.004-0.012 0.20-0.64 400
Oil and soap industries	TSS BOD COD	mg/l effluent do. do.	500 100 1000
Meat processing industries[2]	TSS BOD_5 Oil & grease Faecal coliforms	kg/t product do. do. counts/100 ml	0.38-0.44 0.28-0.34 0.20-0.26 400
Slaughterhouses	TSS BOD_5 Oil & grease Faecal coliforms	kg/t live weight do. do. counts/100 ml	0.20-0.25 0.12-0.21 0.06-0.08 400
Fish processing industries[3]	TSS BOD_5 Oil & grease	kg/t live weight do. do.	2.2-4.0 2.2-11 0.27-2.8

INDUSTRIAL SECTOR	POLLUTANT[1]	UNIT	WB STANDARD
Dairy products industries	TSS BOD_5	kg/t product do.	0.08-1.21 0.06-0.97

1: For all kind of industries, the standard for pH of the wastewater is 6-9.
2: Slaughterhouses not included.
3: For shellfish processing the following limits apply: TSS 22-41; BOD_5 41-52; oil & grease 0.62-4.6.

As an initial estimate of reasonable standards for discharge from urban wastewater treatment plants, the following is proposed:

Table 3.3 - Tentative suggestion for effluent standards for urban wastewater treatment plants.

TIME PERSPECTIVE	POLLUTANT	CONCENTRATION (mg/l)
First step	BOD	15-30
Long term	Total N	10-15
	Total P	1-2

This proposal is based on typical achievable effluent quality for a municipal wastewater treatment plant with mechanical and biological treatment (BOD), and more advanced treatment, such as chemical treatment and denitrification (nitrogen and phosphorus). Furthermore, forced to comply with the BOD standard, urban wastewater treatment authorities will need to force a number of industries to apply pre-treatment for e.g. hazardous substances that might otherwise inhibit the bacteriological treatment processes. Besides, removal of BOD itself through biological treatment contributes, though only moderately, to removal (approx. 30%) of nutrients.

3.6 Monitoring of wastewater discharges

Monitoring compliance with a wastewater discharge permit requires analytical laboratory capacity and capabilities which presently in Uganda are inadequate. The project proposed under phase I of the Water Action Plan: "Rehabilitation of Water Resources Monitoring and Assessment Services in Uganda" is expected to develop the necessary framework in terms of a reference laboratory for analysis of water samples. However, sampling, handling and analysis of wastewater effluents are not envisaged in the above project. Since the analytical and management requirements for wastewater effluent compliance control resemble those of water resources in general, and since both tasks might be expected to rest within DWD, it is recommended to incorporate development of management procedures and training of inspection staff for wastewater discharge control, and necessary investment costs (vehicles, equipment, etc.), in the above project.

The industries discharging wastewater to a recipient should be obliged to monitor effluent quality themselves according to terms prescribed and laid down in the wastewater

discharge permit.

If the industry has its own laboratory or plans to establish one (the breweries are known to have labs, but generally construction of private labs is not likely in a foreseeable future, given the present economic circumstances), it should be allowed to carry out the monitoring control in that laboratory provided it satisfies the quality criteria stipulated in the permit.

To reduce the risk of manipulation of monitoring results, the responsible authority should put as a clause in the wastewater discharge permit that inspectors be allowed entrance to the relevant premises without prior notice in order to take control samples for analysis in an independent laboratory. If the deviation between self-monitoring and control is significant, steps to impose legal sanctions should be taken.

The frequency of control visits to individual dischargers should reflect the frequency of the self-monitoring, which in turn should reflect the size and variation of flow and expected influence on the aquatic environment. Daily to weekly sampling, preferably flow-proportional but depending on availability of equipment, might be relevant self-monitoring frequencies while control monitoring might typically take place at monthly intervals.

4 OTHER REGULATIONS

In Chapters 2 and 3, principles for regulations of water extractions and direct wastewater discharges to surface waters have been outlined. However, besides the regulation of direct water uses and discharges, there is a need for regulation of other social activities which may affect the water resources negatively. These types of regulations have not been elaborated in details and it has not been defined from which administrative level they should be governed. However, the proposed brief contents are outlined in the following.

4.1 Regulations concerning streams and rivers

There will be a need for regulations defining the allowed range and extent of activities that may take place in the vicinity of streams and rivers.

4.1.2 Land use regulations

In some areas in Uganda the cultivation pressure is very high, resulting in exploitation of land to the edges of streams and rivers (e.g. Mbale and Kabale). Such practises increase the load of sediment entering the water ways, thus possibly creating siltation problems. The regulation should contain definitions of the minimum distance for cultivation near rivers and streams as well as guidelines for tree planting or other soil erosion preventing measures.

4.1.3 Activities affecting hydrological regime

A number of activities which can affect the hydrological regime will have to be regulated through conditional permits based on impact assessments. Examples are:

- any diversion which may change the natural direction or meandering of streams and rivers (e.g. with the purpose to obtain land)
- any construction of works which can obstruct or change the natural flow of rivers and streams (e.g. bridges, piers, dams etc.)

4.2 Activities affecting groundwater levels

Large scale diversion of groundwater should be regulated through conditional permits based on impact assessments. The regulations shall further define the level of such diversions which can be exempted from permit application, e.g. by defining maximum amounts in m^3/d. Examples are pumping of groundwater in connection with:

- construction of buildings
- drainage of roads
- exploitation of gravel, sand and other natural resources

4.3 Activities polluting groundwater

4.3.1 Dumping of solid waste

The dumping of solid wastes may contaminate groundwater by seepage of various organic and inorganic substances. It is therefore necessary to regulate dumping of waste by permits based on impact assessments, the siting and design of larger dump sites. The regulation should contain i.a:

- Approved design of dump sites for various types of wastes
- Minimum distances to groundwater extraction points

4.3.2 Discharge of wastewater to the ground

To avoid contamination of groundwater from uncontrolled seepage of wastewater discharged directly on the ground, regulations will be needed to define:

- Approved design of septic tanks and soak pits for different purposes
- Minimum distances of seepage installations to e.g. groundwater extraction points

4.4 Underground storage tanks

To avoid contamination of groundwater from uncontrolled seepage of oil (or other chemicals) stored in underground tanks, regulations will be needed to define:

- Approved design of storage tanks for different purposes
- Maximum age of storage tanks
- Minimum distances to groundwater extraction points

4.5 Mining, oil exploitation

Exploitation of minerals and oil are large scale activities which often may include production of polluting wastewater or piling of solid waste which can contaminate groundwater or surface water resources by rain water wash out of contaminants. The handling of wastewater, drainage water, oil, seepage from stockpiles etc. will have to be regulated individually according to the nature of the activities. It is proposed that such regulations derive from the environmental impact assessment which will be mandatory, and are incorporated in the conditions for operating licences.

4.6 Transport of oil products and other hazardous substances

To minimize the risk of accidental spills of oil or chemicals during transportation as well as to minimize the effects of possible spills through abatement measures, regulations are needed containing i.a.:

- approved design of transport equipment
- approved transport procedures
- contingency plans defining alert and abatement procedures in connection with accidental pollution.

5 COMBINATION OF REGULATORY AND ECONOMIC MEASURES

5.1 Water as an economic good

In addition to pure legislative and regulative means of controlling and adjusting behaviour as to use of water resources, economic measures may be introduced. Economic measures may provide incentives to behave rationally to support sound water resources management and conservation. This chapter provides the background for a selection of a combination of regulatory and economic measures.

Economic measures should be based on the principle of water as an economic good, which is a key element in the Water Action Plan. The economic value of water is obtained from calculating its value where it achieves the greatest economic benefits. Underlying this principle is the implicit assumption that water is a scarce commodity, with limited supplies and predictable demand, and that it should be subject to economic analysis, and be treated like other factors of production. Secondly, the principle implies that water users should pay the full costs of water. The objective of making people pay the full costs of water is to encourage them to make the most efficient use of the resource, and to avoid wasting or polluting it. Thus such payment would be a regulating factor in the use of the resource.

The full cost of water is comprising three elements; direct costs, opportunity costs and environmental costs.

5.1.1 Direct costs

Direct costs are those costs associated with developing water resources and supplying water to the ultimate users. They consist of investment and operating costs, and in the past they have often been considered the main/only costs incurred in the provision of water.

5.1.2 Opportunity costs

Opportunity costs are those economic costs incurred if the water is not used for its most valuable use. In those situations where water resources are abundant both for all present uses and for all possible foreseeable future demands, water has no opportunity cost. Where there is competition for water due to limited water resources, using water to meet one need pre-empts its use to meet other needs. Where the water is not used for its most valuable purpose, there is an opportunity cost equivalent to the difference between the most beneficial value, in both present and future uses, and the value in the actual use. The opportunity cost principle is especially useful in relating present water demands to anticipated future demands, and should be applied to prevent allocation of scarce water resources to present low value uses when the same water will be required in the future for high value uses.

5.1.3 Environmental costs

Environmental costs in relation to water resources are those costs incurred by users to restore polluted water to an acceptable environmental standard to enable it to be reused, or to prevent harmful impact on other natural resources, people, livestock, fish and flora and fauna. Further, environmental costs are incurred when the environment is deprived of water being extracted for consumptive purposes. Ensuing changes in hydrological regimes will mean that ecological changes also will occur.

In pragmatic terms environmental costs may be comparable to for instance the cost of wastewater treatment prior to discharging the water into either surface or groundwater. The cost of changing industrial technologies to reduce the extent of water pollution can be considered in the same way.

5.2 Costs and water supply

The sum of direct cost, opportunity cost and environmental cost is here termed the full cost. The decision on whether beneficiaries should pay the full cost of water has to be balanced against the social importance of the water and is ultimately a political decision. In Uganda, pricing policies are generally only reflecting the direct cost and in many instances beneficiaries are only paying a small proportion of the direct cost. This is for instance the case in many rural water supplies where donors are granting all capital costs of source development, while the beneficiaries contribute operation and maintenance cost (in cash or kind)

5.2.1 National Water and Sewerage Corporation pricing

Water supply

National Water and Sewerage Corporation (NWSC) is responsible for the provision of water supplies and wastewater disposal services in nine of the largest towns. It is expected to operate on a self financing basis, and receives no Government subsidy for operating costs. It has uniform tariff rates throughout all nine towns. Tariffs, which were increased by 60% in April, 1994, are for metered supplies (amounts in USh/m3)

Residential	616
Institutions and Government	760
Minor Industrial and Commercial	1,056
Major Industrial and Commercial	(1,056 for the first 500 m3/month
	(1,264 for 501-1,500 m3/month
	(1,424 for over 1,500 m3/month

Sewerage

NWSC also provides sewerage in all nine towns. Sewerage tariffs are based on water

tariffs, and for those connected to the sewerage system residential users pay a surcharge of 75% of the water tariff, and all other users such as industries, commercial users etc. pay 100% of the water tariff. NWSC is currently unable to distinguish between the costs of water supply and the costs of wastewater collection, treatment and disposal. The fixed percentage charge for wastewater disposal does not give incentives for reduction of the concentrations of pollutants in the wastewater.

It is difficult to assess whether the water supply and sewerage pricing policy and set tariffs cater for the total direct cost. Although NWSC is operating at a self financing basis, part of the capital costs of rehabilitation and extension of works are provided by donor agencies and international development banks from where, for instance, soft loans are provided.

5.2.2 Pricing policy for Rural Towns Water and Sanitation Programme

The Directorate of Water Development is responsible for implementing the Rural Towns Water and Sanitation Programme, (RTWSP), which is planned to provide up to 60 small towns and rural growth centres with a treated water supply and improved sanitation. The principle that the provision of services should be demand driven with beneficiaries paying for their water is a key element. Operation and maintenance costs are to be paid for by the beneficiaries, and they will make a contribution to the capital costs, equivalent to one year's operation and maintenance. The remaining capital costs would be provided in the form of a subsidy either from foreign aid or from Government. The communities themselves will then devise a pricing system providing finance for the direct cost of operation, maintenance and replacement.

5.2.3 Rural water supply pricing policy

It is government policy that the communities in the rural areas themselves should be responsible for financing operation and maintenance of water supplies, and this policy is being implemented in a number of donor assisted rural water supply schemes. Low income levels inhibit the ability of many communities to contribute towards the capital costs of scheme construction.

5.2.4 Livestock water supplies

The cost of water systems for livestock owners who keep their livestock exclusively on their own land, such as privately owned ranches, whether from pumped supplies from groundwater, from rivers, lakes, etc or by gravity, are paid by the owners. They also pay the full costs of any dams or reservoirs created for dry season water supplies.

Other cattle owners are nomadic pastoralists in the arid and semi-arid areas, who use public land for pasture, and seek free public water supplies. For them dry season water

supply is commonly a major constraint to raising livestock. Previous policy of the Government was to pay the full costs of construction of communal dams. The present policy is to require livestock owners to pay 50% of the capital costs. Livestock owners are required to form water committees not only to collect the contribution to capital costs but also to manage the dams and reservoirs, and ensure their maintenance.

5.2.5 Irrigation

There are three categories of irrigation schemes, Government managed schemes, private sector sugar estates and smallholder rice farmers using swamp or valley bottom land.

Although in the past Government paid for all the capital costs and most if not all of the recurrent costs of the nine Government schemes, it is now trying to reduce the financial burden of these schemes. Seven of the schemes are either to be sold or to be handed over to farmers associations, and on the other two schemes, farmers are now expected to provide all annual maintenance costs, either in cash or in kind. Farmers committees have been established to ensure that all farmers contribute.

The direct costs of irrigating the sugar estates are fully met by their private owners.

Smallholder rice and vegetable farmers use limited quantities of water from swamps to supplement rainfall. The water is presently a free commodity.

5.2.6 Regulatory and economic measures within water supply

Human requirements for water can to a certain degree be controlled either by regulations or by economic measures. The regulatory control of surface and groundwater quantity can be exerted through a permit system. Under such system those wanting to extract water will have to apply for a permit to do so. A full regulatory control of all extractions would require a highly developed administrative system including appropriate enforcement capacities. Such a system is not considered feasible in the Ugandan context neither in the short term nor in the long term.

A national strategy aims at designing tariff systems, fees and charges in such a way as to provide incentives for conservation and minimization of wastage. The structure of the economic measures can be designed in such a way that they influence the users habits regarding consumption and use. To gain control through such measures would require a calculation of the full cost (direct cost, opportunity cost and environmental cost) and charging this to the consumer.

Water supply, which is satisfying basic needs, may be less sensitive to price controls than other types of commodities. At the lower levels of use, rural dwellers may well be drawing the minimum amounts for subsistence. They will be unlikely to cut down on water

use, but will rather have to allocate a larger amount of any cash incomes to acquire water.

Economic measures will also have to be differentiated for various groups of users. In the case of the rural dweller it may well be the overall best policy to encourage use of more water as a means of enhancing hygienic practices. In the case of larger urban consumers and industrial use, economic measures may be designed to avoid wasteful practices by graduated tariffs. However, industrial tariffs will have to consider the water as a production factor, the price of which will influence the competitiveness and viability of the production. Thus, pricing structures will have to consider the characteristics of different consumer groups and will have to include social considerations as well.

The control of the use (extraction) of water will have to be exerted through a combination of regulatory means and economic measures as none of these alone would be adequate. Presently, only economic measures are used as discussed above. These measures are basically taking into account recovery of direct cost (NWSC tariffs) and do also include social considerations (for instance within rural water supply). They are not considered to have a planned regulating effect on the water use.

It is recommended that charges in connection with water extraction permits will comprise two elements:

- a flat rate to cover the costs of the administrative procedures associated with handling water extraction permits

- an annual charge for water extraction

The annual charge could be designed in a way as to reflect any scarcity in particular areas. The revenue should be an income for administering the permit system and will be used to cover i.a. the costs of monitoring compliance with the given permits and impacts on the water resources.

5.3 Cost and wastewater discharge

5.3.1 Regulatory and economic measures within wastewater management

Wastewater discharge can theoretically be controlled by two completely different mechanisms. One option is to introduce a full regulatory control developing, implementing and enforcing laws, by-laws and rules for all types of wastewater discharges. The other completely opposite option is to have no regulatory control and let economic measures control the situation.

Applied in the Ugandan context, the first option would require implementation and enforcement capacities far beyond presently available resources. This approach, often termed "command and control" also requires a very high degree of awareness of what is

allowed and what is not at all levels of society. It is not conceivable that such awareness can be attained either in the short or long term.

The second option where economic measures take over the control requires that the full cost (direct cost, opportunity cost and environmental cost) is known or can be calculated, and that such costs can be charged and collected from the polluter. Direct costs are the costs easiest calculated, being based on well known and understood economic principles. Opportunity costs being the difference in value of the water in its most beneficial use and the planned use is more difficult to define and calculate. The environmental costs being the cost of avoiding undesirable effects on the ecosystem as such, or the cost of total prevention or clean-up is in most cases impossible to estimate even roughly.

From the discussion above, it will appear that none of the two options are feasible in the present context. This means that a suitable combination of regulatory and economic measures has to be defined as the basis for control of wastewater discharge. Such a combination has to take into account the degree of regulatory control and enforcement that is feasible. At the same time one should define appropriate economic measures that encourages reduction of concentrations of pollutants in wastewater discharges and enhances environmental conservation.

Appropriately designed economic measures mean a set of charges structured in such a way that the polluter will see an economic advantage in reducing the amount of pollutants at the source.

5.3.2 Structure of charges

The present structure of charges for sewerage does not provide any incentive to reduce amounts of pollutants discharged, since the fees (where such fees are charged, at present only in towns serviced by NWSC) are calculated as a percentage of the water supply fee. Thus, there is no relation between fees charged and the amount and quality of effluent discharged.

It is recommended that a system of charges providing incentives to reduce contents of pollutants in wastewater effluent, either by more efficient use of raw materials (cleaner technology) or by treatment of effluents, should be established. This could be achieved by imposing a charge, the size of which should depend on the amount of discharged pollutants. There are two alternative systems for determining such charges:

- to charge for the entire amount of pollutants
- to charge a fine for the amount of pollutants exceeding a wastewater discharge permit and nothing for pollutants discharged within the permitted amounts

It is recommended that the first system should be applied. This would allow the charge to

reflect the type and the quantity of pollutants being discharged. It would clearly indicate that all polluting effluents are harmful, and it would meet the principle of "polluter pays".

The disadvantage of the second system, which may be easier to administer, is that there is no incentive to reduce the discharge of pollutants allowable within the permit. The discharge permit would be set at what is considered an acceptable level of pollution, and compliance with it would imply that the pollutants discharged has no harmful effects.

The charge for a wastewater discharge permit would be in the form of a fee paid annually. The fee would be comprising two elements:

- a flat rate to cover the costs of the administrative procedures associated with handling wastewater discharge permits

- a variable charge related to the type and quantity of pollutants being discharged. This charge would among others cover the costs of monitoring compliance with the given permits

The scale of variable charges would be designed to impose a very severe penalty for wastewater discharges with excessive pollution. It would provide a clear incentive to industries and institutions producing pollutants to reduce them by applying a progressive tariff system. The charges will reflect the direct cost of applying an appropriately high technology.

Charges according to this system would only be applied for discharges within the maximum allowable level of pollutants according to the permit. If the discharge exceeds the permit, legal sanctions and penalties would be applied instead.

The above mentioned charging system will ensure that the authority responsible for the administration of the charging system is not financially constrained. It will, however, not take account of the opportunity costs and environmental costs of water pollution.

The largest single wastewater discharge entity is NWSC. It is envisaged that NWSC is treated in the same way as any other polluter. The requirements to effluent quality from NWSC treatment plants will have to confirm to set standards. It will then be a NWSC responsibility to make sure that standards are reached and set requirements to industries within the NWSC service area.

It is extremely important that the revenue from collected charges for these services is an income for the authority that administers the permit system. If the revenue simply is passed to the Treasury there will be no incentive to pursue cost recovery and the efficiency of the administrative and monitoring system will decrease.

It is assessed that the above structure of charges combined with the regulatory control exerted through the permit system and accompanying enforcement will provide a suitable

combination of regulatory control and economic measures.

5.3.2 Economic impact on existing types of industries

The charges reflecting the costs of an appropriately advanced treatment technology will have to be paid by for instance single industries discharging directly into receiving waters. The cost to the industries should not introduce undue financial hardship to the industries with the danger of reducing the profitability and competitiveness significantly. The approach summarized below has been followed in order to check the economic impact of compliance with the regulations/charges.

- a reconnaissance survey of key industries in Kampala and Jinja has been carried out leading to estimates of, among others, water consumption and wastewater production
- the direct costs of appropriately advanced treatment technology at relevant production levels have been estimated very roughly
- based on water consumption and present levels of NWSC sewage charges, costs that would be borne by key industries are estimated on a model basis
- comparison of costs incurred if connected to a NWSC system and costs of compliance (appropriately advanced treatment technology applied at the production facility) are made

Reconnaissance survey

Some of the main producers of industrial effluent were visited and interviews conducted. Summaries of information collected are given in Appendix 5.1 to 5.7. The industry types comprised among others, breweries, textile industry, sugar works, oil and soap factory and leather tanning industry.

Estimates of direct costs

An appropriately advanced treatment technology was selected for each individual industry type. A typical production capacity was selected and the corresponding capital cost of construction of treatment facilities were estimated roughly. Fairly wide ranges of capital costs were found depending on assumptions about the composition of the wastewater. Costs were based on European prices with appropriate corrections for the Ugandan environment. Annual operation and maintenance costs for the wastewater treatment facilities were estimated to be 10% of the capital cost. The treatment technologies chosen were estimated to be adequate to meet the proposed short term goal of reducing BOD. The costs and the typical parameters used for the model calculations are given below.

Table 5.1 - Parameters for model calculation. Parameters correspond to typical values for Ugandan industries.

INDUSTRY TYPE	PRODUCTION CAPACITY	TREATMENT PROCESSES	CAPITAL COST USHS MILLION
Brewery	30,000 m3/yr	Aerated equalization. + medium activated sludge + extended aeration	250 - 1,000
Textile	31 mill. m/yr	Settling + Chemical precipitation + activated sludge	750 - 2,250
Sugar refinery	50,000 t/yr	Anaerobic + medium activated sludge + low loaded act. sludge	1,250 - 7,000
Leather tanning	300,000 m2/yr	Sulphide oxidation + low loaded activated sludge	250-350
Oil and soap	50,000 t/yr	Oil separation + biological activated sludge	100 - 500

Comparison of direct costs

A comparison has been made between the cost of individual treatment at the production facility, and charges that the same model industry would pay if it was connected to a NWSC sewerage system. The comparison is based on a calculation of the net present value (NPV) in the two cases. The comparison has been made over a period of 15 years corresponding to an assumed lifetime of the treatment installations. The discount rate used for the calculations is 6%. The main parameters and the results of the calculations are given below.

Table 5.2 - Comparison of cost of individual treatment and sewerage system charges based on model assumptions.

INDUSTRY	WATER CONSUMPTION M3/YEAR	ANNUAL SEWERAGE CHARGE USHS MILL.	CAPITAL COST OF TREATMENT USHS MILL.	O & M COST USHS MILL.	NPV OF ANNUAL CHARGE USHS MILL.	NPV OF TREATMENT USHS MILL.
Brewery	200,000	284	250-1,000	25-100	2,760	490-1,970
Textile	4.5 mill.	6408	750-2,250	75-225	62,220	1,480-4,430
Sugar refinery	1.4 mill.	1993	1,250-7,000	125-700	19,350	2,460-13,800
Leather tanning	75,000	106	250-350	25-35	1,030	490-690
Oil & soap	336,000	478	100-500	10-50	4,640	200-980

The model calculations show that the cost of individual treatment is comparable in size to the charge that would have to be paid had the industry been connected to a NWSC sewerage system. The comparison makes it likely that typical Ugandan industries will be able to bear the cost of introducing appropriately advanced treatment technology able to meet the BOD requirements proposed for inclusion in the waste water discharge regulation.

ANNEX 15

OUTLINE REGULATIONS AND MANAGEMENT PROCEDURES FOR WATER EXTRACTION

ANNEX 15

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1 Introduction

1.1 By the proposed outline regulations it is ascertained that only the most significant water extractions will be subject to regulation. It is estimated that the vast majority of all water extractions will be exempted from regulation according to the criteria set up. A guiding principle for the present work has been to develop management procedures only in response to a perceived and expressed demand. Hence, if small scale water extraction does not affect other users' possible use of the same resource, there is no need for regulation. Reduction of scope of regulation has also been necessary in order to match the present economic, regulatory and managerial capacity with the extent of the burdens and tasks imposed by the regulations. It has been a basic principle to simplify or avoid regulation in cases where regulatory and enforcement capacity have been deemed insufficient.

1.2 Due to the ongoing work of privatization of drilling operations in Uganda, and with a view to reducing the administrative burden of water resources management imposed on DWD, it is proposed to licence drilling contractors. This implies that part of the job of regulating water resources is delegated to non-governmental institutions, in this case private contractors. The requirements from the responsible authorities to the contractors, in order to ensure proper management on this aspect of water resources, are therefore outlined in this Annex as Chapter 3.

1.3 The proposals given here mainly address the short term situation, where district capacity is assessed as being rather limited and regulation therefore is proposed to take place at the national level. At the long term it is the intention to decentralize the administration of water extraction permits to the district level.

1.4 In some paragraphs figures for certain threshold levels have been omitted because the basis for determining values has been deemed insufficient. For instance, the level for irrigation schemes requiring an extraction permit has been indicated by "Irrigation schemes > .. ha". In these cases the threshold values will have to be set by the Director of Water Development.

1.5 The background discussion of principles and guidelines for regulation of water extraction and wastewater discharge is presented in Annex 14.

2 Criteria for levels of regulatory control of water extraction

2.1 Two levels for regulation of groundwater extraction, and three for surface water

regulation are envisaged. These depend on the degree of anticipated impact on the water resources (see also Table 2.1).

Table 2.1 - Criteria for levels of water extraction regulation

DEGREE OF CONTROL	GROUNDWATER	SURFACE WATER
No regulation	Domestic use as defined in Water Resource Statute Extraction by manual means	Domestic use as defined in Water Resource Statute Extraction by manual means
Registration required		Extraction of water by motorized pump or by gravity diversion with a capacity < 5 l/s Non-subsistence irrigation schemes < .. ha Non-subsistence fish ponds < .. ha
Permit required	Extraction by motorized pump, except for domestic use as defined in Water Resource Statute	Extraction of water by motorized pump or by gravity diversion with a capacity > 5 l/s Irrigation schemes > .. ha Fish ponds > .. ha

NOTE: The Director of Water Development will review limiting values at regular intervals.

2.2 **No regulation**: According to the proposed Water Resources Statute, everyone has the right to extract water for domestic purposes from a source to which one has lawful access. For extraction for other purposes, if no motorized pumps are installed or gravity diversions established, no obligation to obtain an extraction permit or to register the extraction is imposed.

2.3 **Obligation to register (only surface water extraction)**: If motorized pumps or gravity diversions allowing water to be drawn from a surface water source are arranged, but the extraction capacity is less than 5 litres per second, then the extraction is subject to registration, and to the imposition of standard conditions for a water extraction. Also non-subsistence irrigation schemes less than .. ha and non-subsistence fish ponds less than .. ha should be obliged to register.

2.4 **Obligation to obtain a water extraction permit**: In the case of:

- surface water extraction installations capable of extracting more than 5 litres per second,

- installation for non-subsistence purposes of motorized pumps allowing water to be drawn from a groundwater source,

- non-subsistence irrigation schemes larger than .. ha, or

- non-subsistence fish ponds, or aggregations of fish ponds owned by one individual or agency, larger than .. ha

a water extraction permit is required which specifies the conditions for extraction.

3 Drilling licences

3.1 It is proposed that any mechanised drilling operation shall be carried out by a licensed driller according to a set of regulations. Thus, the establishment of a borehole will not require a specific drilling permit.

A licence for a drilling contractor shall, besides contractual matters, liabilities, safety rules, etc., state a number of responsibilities relating to water resources management, to be undertaken by the operator/licensee as follows:

- extraction from an installation established by him shall be legal, e.g. the client shall hold an extraction permit, if a permit is mandatory according to the Regulations, before installation of a motorised pump on a borehole

- prior to the commencement of any drilling operation the District Water Officer shall be notified in writing by the operator about drilling sites and the time period for the drilling operation

- within 3 months of the completion of the drilling operation, relevant borehole data (specified by DWD) shall be forwarded by the operator to DWD with a copy to the District Water Officer

3.2 Furthermore the operator shall secure through proper siting of the borehole that:

- future water extraction from the borehole is not likely to affect the yield of other existing boreholes

- the borehole is not likely to be contaminated by faecal or hazardous substances e.g. by observing minimum distances to latrines, underground fuel tanks, etc.

- the borehole or drilling operations do not interfere with existing technical installations

- the owner of the land has given his consent to the drilling operations and access to the site can be done in a legal manner

4 Standard conditions for all water extraction

4.1 These are described in Part V of the Draft Water Resources Statute and apply to all persons/syndicates extracting water, irrespective of whether or not they hold a water extraction permit. The conditions state that a person/syndicate extracting water:

(a) must not cause or allow any water to be polluted

(b) must prevent damage to the source from which the water is taken, or to which water is discharged after use

(c) will take precautions to ensure that no activities on land where water is used result in the accumulation, in any source of water, of any substance whatsoever which may render water less fit for any beneficial purpose for which it may reasonably be used

(d) will observe any conditions prescribed by regulations made under the Statute

(e) will observe any special conditions attached to that water permit

Furthermore, it should not be allowed, through extraction of water or construction of hydraulic works, impounding dams or valley tanks, to significantly affect downstream users' availability of water (amounts, levels, distribution in time), unless a compensation can be agreed on.

5 Procedure for registration of water extraction

5.1 It will be the duty of a person or agency extracting surface water, where such operations are not exempted from regulation as defined above and are not subject to regulation by an extraction permit, to register the extraction with the District Water Officer on prescribed forms within 1 year of the coming into force of the Regulations, or in the case of extractions started after the coming into force of the Regulations, within 1 month after commencement of extraction.

5.2 The District Water Officer will forward a copy of the registration to DWD for inclusion of the information into the national database on water extractions.

5.3 The registration of water extraction shall not be subject to payment of any fee.

them for comment

8.9 The DES will note the objections and the comments received on the application and forward it to the Director of Water Development for his consideration.

8.10 Upon receipt of the application from the DES, the Director of Water Development will consult with relevant national Ministries i.e. fisheries, environment, agriculture, health etc on the application. If necessary the Director will undertake a detailed technical evaluation of the application. If necessary the Director may form an Ad Hoc committee of technical advisers to assist him in the processing of application(s).

8.11 The Director shall ensure that the requirement (or otherwise) for an Environmental Impact Assessment is communicated as early as possible by the National Environmental Management Authority. In the event that an EIA is needed, this should be immediately communicated by the Director to the DES and the applicant.

8.12 On the basis of his evaluation and the comments and objections received, the Director will then determine the application attaching (where appropriate) standard and specific conditions. Where a permit is refused, clear grounds for refusal must be specified. Time limits attached to the permit shall be clearly specified.

8.13 Arrangements for monitoring by DWD or the permit-holder of water extraction/usage in connection with the permit will be specified on the permit.

8.14 The Director will compute the annual charges for water payable by the permit-holder, and their regular payment shall be a condition of the permit.

8.15 Charges for water abstraction are as follows:

- Bulk Supply UShs. .. per m3 per annum
- Commercial UShs. .. per m3 per annum
- Agriculture UShs. .. per m3 per annum
- Industrial UShs. .. per m3 per annum

8.16 Charges for water shall be established by the Water Policy Committee and reviewed periodically.

8.17 The Director shall inform the DES on his decision on the application and this shall be communicated to the applicant.

8.18 All decisions on applications for permits will be communicated to the Water Policy Committee for information.

9 The appeals procedure

9.1 The applicant may appeal against a decision by the DWD to refuse a permit or to grant a permit subject to specific conditions.

9.2 Any person who has previously made an appeal against an application may appeal against a decision by the Director to grant a permit (with or without specific conditions).

9.3 Appeals should be made within 30 days of receipt of the Director's decision, on prescribed forms.

9.4 Appeals will be submitted to the Minister of Natural Resources whose decision will be final. The Minister may normally consult any person or agency, but will usually seek assistance in determining the appeal from the Water Policy Committee.

9.5 The decision by the Minister on the Appeal must be communicated to the appellant within 3 months of the receipt of the Appeal, unless otherwise agreed to.

10 Failure to apply for a permit, to comply with conditions or to register extraction

10.1 In cases where a person or agency fails to apply for a permit to extract water which are covered by the Regulations, the Director of Water Development may require that the activity in question ceases and works be dismantled, or that the person or agency applies for a permit.

10.2 In cases where a person or agency fails to comply with all or any of the conditions of a permit, then the Director may cancel the permit.

10.3 In cases where a person or agency fails to register water extraction which are covered by the Regulations, the Director of Water Development may require that the

activity in question ceases and works be dismantled.

11 Summary of administrative procedures

11.1 In order to provide an overview of and the proper context for the regulations outlined in the previous chapters, the main actions involved in the administrative procedures of processing water extraction applications are summarized and distributed at local, district and national levels in the table below.

Table 11.1 - Summary of administrative procedures of water extraction regulation

TIME	LOCAL LEVEL	DISTRICT LEVEL	NATIONAL LEVEL
Week -0	Comments from RC 1 and RC 3 obtained by the applicant		
Week 0-1		Application received by DES Application forwarded by DES to DWD Notice of application prepared by DES and advertised in local and national press	
Week 1-2			Application registered by DWD Copy forwarded to NEMA
Week 6		Hearing of objections	
Week 7		Application with district objections and comments from DES to DWD	
Week 8-9			Application circulated to relevant institutions
Week 10-11			DWD undertakes technical evaluation and determines the application. Notification of DES, WPC and NEMA
Week 12		DES notifies applicant of decision	

12 Outline of guidelines for local water extraction regulation

12.1 Local regulation of water extractions can be applied to all water users which are extracting water below the levels where an extraction permit is required.

12.2 Local regulation of water extractions should be applied where:

- The (combined) extraction of one or a group of legal non-regulated water extractions are not sustainable considering the water resource availability or such a situation can be foreseen to occur in the future if no regulations are incurred

- The (combined) extraction of one or a group of legal non-regulated water extractions for low value purposes affects or can be foreseen to affect a possible higher value extraction

12.3 A file of all water extractions registered in the district (including boreholes and surface water extractions) shall be kept by the District Water Officer.

12.4 The need for local regulation shall be assessed by the District Water Officer (possibly supervised by DWD) once a year by comparing actual water extractions with resource availability. Such an analysis shall furthermore be made in cases where individuals, institutions or other parties claim reduced water availability due to extraction from other users.

12.5 The District Water Officer drafts a by-law which states:

a) Which water resource(s) is covered by the by-law including well defined geographical boundaries within which the local regulation is in force.

b) The maximum allowed combined extraction of the water resource to be regulated.

c) Any possible special conditions for extractions.

d) The procedures for distributing water rights within the regulated area.

e) The procedures for monitoring the actual extractions.

f) Levels of possible extraction fees.

g) Procedures for legal enforcement

re c) There may be special conditions included in the regulation e.g. definition of sites excluded from extraction.

re d) Depending on the geographical distribution of the involved water extractions, distribution of individual water rights can be further delegated to the appropriate

lower administrative level. Thus, if the extractions are scattered over many sub-district boundaries, a system of local extraction permits issued by the district can be chosen. If, however, all involved extractions are located within sub-district units (RC 4, RC 3, RC 2) the power of distribution of the water rights can be handed over to the appropriate RC-Council.

12.6 The draft by-law shall be forwarded for comments to the relevant sub-district RC-councils as well as the relevant departments of the district administration and DWD. Finally, before the draft by-law is submitted for approval by the District Council, it shall be forwarded again to DWD for checking/approval consistency with national legislation and policies.

12.7 The District Water Officer shall secure that the extractions under regulation are regularly monitored (spot inspections), and that violations of the by-law are properly legally handled.

Moreover, he shall make a yearly assessment of the status of the regulated water resources and include this in his annual report to DWD.

ANNEX 16

OUTLINE REGULATIONS AND MANAGEMENT PROCEDURES FOR WASTEWATER DISCHARGE

ANNEX 16

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1 Introduction

1.1 Regulations to govern wastewater discharge will principally concern discharges from urban sewerage operations and from industrial and mining operations outside towns. As the majority of existing and future industries capable of discharging noxious wastewater are likely to be situated in towns and connected to sewer systems, wastewater from these will be subject to control under the proposed Sewerage Regulations under the Draft Water Supply and Sewerage Statute. However, discharge from a sewer system to a recipient will be subject to control as outlined below.

1.2 Since processing of wastewater discharge applications by nature involves complex technical issues, it will inevitably be a complex and timely procedure. Therefore, it is proposed to reduce the scope of wastewater discharge regulations and concentrate the available resources, human as well as financial, on regulation of a limited range of polluting activities. By this approach it is estimated that only a limited number of discharges of wastewater will be subject to regulation.

1.3 Due to the present level of water quality management capacity, and to the fact that BOD is a characteristic pollutant of the majority of existing polluting industries in Uganda, the approach has been taken to regulate activities contributing most to BOD pollution through wastewater discharge. According to available information, approx. 10 individual industries within the identified list of activities contribute more than 95% of the total industrial BOD discharge. Wastewater treatment and control for BOD is rather simple and may thus provide an opportunity to develop capacity.

1.4 Administrative and technical capacity to handle the issues involved in wastewater discharge regulation is limited, as are the analytical facilities. For these reasons it is proposed that the procedures for regulation are as simple as possible. Similarly it is proposed that the scope of its application is, in the first instance, unambitious. Because of the issues involved it is important to expand the application of the Regulations gradually as competence, experience and administrative and technical capacity and understanding by the general public become available.

1.5 Some of the activities requiring to obtain a permit for wastewater discharge are defined according to size of production. For these activities no threshold production figures have been given. The appropriate figures in a Ugandan context have to be set by the Director of Water Development.

2 Limitations

2.1 The regulations shall govern wastewater discharged directly into any natural recipient, comprising surface and groundwater bodies, wetlands and top soil. Wastewater discharged into a sewer system is not covered by these regulations.

2.2 The Regulations shall govern the wastewater discharges of defined operations already in existence and those of proposed future operations.

2.3 A permit will therefore be required by defined operations already in existence in order to continue to operate, and by proposed operations in order to initiate operation.

2.4 The economic and social consequences of regulating the activities of existing operations will be taken fully into account in determining applications for permits.

3 Application

3.1 The following activities will require to obtain a permit for wastewater discharge:

- Urban wastewater treatment plants
- Sugar factories
- Textile factories, producing not less than ..
- Breweries
- Leather tanning factories, producing not less than ..
- Oil and soap factories, producing not less than ..
- Meat, fish and milk processing factories, producing not less than ..

3.2 Any other class of activity may require to obtain a permit, if so determined by the Water Policy Committee.

4 Establishment of wastewater discharge standards

4.1 The Director shall develop, circulate and agree with the operators of the categories of operation set out in para.3.1 above, an "Advisory Code of Practice for the Discharge of Wastewater, under the Regulations for Wastewater Discharge". This Code of Practice will be used in the determination of applications made under the Regulations. The Code of Practice shall be published and made available to all applicants for a permit to discharge wastewater to the recipient.

4.2 The Director shall form an Ad Hoc Committee comprising concerned experts from the public sector and the private sector to advise him periodically on the determination of applications under the Regulations and to advise him, where appropriate, on the interpretation of the "Advisory Code of Practice for the Discharge of Wastewater under the Regulations for Wastewater Discharge" in determining applications.

5 Procedure for applying for a permit

5.1 It will be the duty of those carrying out the activities for the categories of operation defined in para.3.1 above to apply for a wastewater discharge permit in order to continue to discharge wastewater, from the date of coming into force of the Regulations or to initiate discharge after that date.

5.2 Application shall be made (on prescribed forms) to the Director of Water Development (DWD) for a permit to discharge wastewater directly to a recipient.

- Name and address of the applicant
- Whether applicant is an individual or corporate body
- Numbers of employees
- Site map at 1:50,000 scale showing location of operations, arrangements for discharge (pipe/channel/spillway etc.) and location of entry to proposed recipient
- Detailed description and drawings of the existing/proposed operations
- Estimates of quantities/qualities of characteristic pollutants to be discharged to the recipient
- Detailed description and drawings of proposed wastewater discharge treatment arrangements
- A statement of how the proposed arrangements for discharge of wastewater to the recipient conform and/or differ from the provisions of the "Advisory Code of Practice for the Discharge of Wastewater under the Regulations for Wastewater Discharge" described in para.4.2.
- Certificate from a chartered engineer confirming that the information supplied with the application is correct

5.3 All categories of operation described in para.3.1 above which are already in operation on the day of the coming into force of the Regulations will be required to submit an application for a permit within one year of the coming into force of the Regulations. If an application is not received within one year, then continued operations after that date will be construed as a contravention of the Regulations.

5.4 Applications must be made and determined for all categories of operation described

in para.3.1 above and which are not already in operation on the day of coming into force of the Regulations, before wastewater discharge can be made to the recipient. Any changes in the operations likely to increase the amount of pollutants discharged require a new permit.

5.5 On the submission of an application, the applicant will be required to pay an administrative charge set by the Director of Water Development. The purpose of the charge is to cover the costs of processing the application. The charge will be paid to the account of the Director of Water Development. The application will not be registered for determination if not accompanied by the administrative charge mentioned above.

5.6 On the submission of an application, the applicant will submit a signed statement which confirms that he has read and is aware of the contents of the "Advisory Code of Practice for the Discharge of Wastewater under the Regulations for Wastewater Discharge", referred to in para.4.1 above.

6 Register of applications

6.1 A Register of Applications received and decisions made shall be kept by the Director of Water Development, and shall be available, on request, to the general public for inspection.

7 The determination of applications for permits

7.1 In accordance with the provisions of the Draft Regulations, applications will be determined by the Director of Water Development (DWD) who is required to consult with all relevant authorities. The Director's decision can be appealed to the Minister of Natural Resources.

7.2 All applications for a permit will be submitted to the Director of Water Resources through the District Executive Secretary (DES) in the concerned District. All applications should be accompanied by a statement from the DES that the local community in the area has been informed (through the appropriate RC 1 and RC 3 offices) of the receipt of the application and of their rights of appeal against the application.

7.3 On receipt of the application, the Director of Water Development shall issue a Notice that an application to obtain a permit to discharge wastewater to the recipient has been received, and that a copy of the application will be available for inspection in his office and in the office of the appropriate District Executive Secretary. This Notice shall state

the proposed category of operation and the location and volume of the proposed discharge. A copy of the Notice shall be published in the Uganda Gazette and in a newspaper circulating at national level.

7.4 Members of the public will be given a period of 30 days from the date of issue of the Notice within which to lodge, with the Director of Water Development, objections to the granting of a permit. The Director, or his representative, shall hear objections in person, if necessary.

7.5 On receipt of the application, the Director of Water Development will forward the application to the National Environmental Management Authority (NEMA) for comment. The Authority will decide and inform the Director whether an Environmental Impact Assessment (EIA) is required, and will provide an appropriate Terms of Reference for such an EIA.

7.6 If an EIA is required then the Director will immediately inform the applicant in writing that the application cannot be determined until the completion and submission of an EIA by the applicant on the basis of the Terms of Reference.

7.7 The Director of Water Development will consult with the Ad Hoc Committee (see para.4.3 above), NEMA and any other appropriate person/agency on the technical, economic and environmental aspects of the application.

7.8 The Director of Water Development will communicate the findings of the Ad Hoc Committee, NEMA and others on the application to the applicant.

7.9 The process of determination of the application will necessarily include considerable consultation and negotiation between the applicant and the Director of Water Development. As it may be difficult to predict the precise absorptive capacity of the recipient and the precise constitution of the wastewater discharge, the determination of an application and the subsequent issue of a permit may be contingent on a number of technical conditions negotiated between the Director of Water Development and the applicant. These negotiations are likely to concern the extent and nature of wastewater treatment arrangements to be provided by the applicant.

7.10 Negotiations between the Director of Water Development and the applicant shall take full account of the economic and social consequences of the granting (with or without conditions) or refusal of the application.

7.11 On the basis of objections received, comments received from the Ad Hoc Committee, negotiations held with the applicant and the decision of NEMA on the EIA, the Director of Water Development will determine the application. The conditions and decisions imposed by NEMA are binding on the Director when finally determining the application.

7.12 Standard and specific (negotiated) conditions may be attached to the granting of any application. Clear time limits attached to the permit will be specified. Grounds for refusal or approval of any application should be clearly stated. All types of objections received during the application procedure, and the way they have influenced the decision, should be clearly stated.

7.13 Charges for wastewater disposal will be levied on the applicant. The rates charged will be set so as to provide incentives to reduce the amount of polluted discharge water to the recipient, and will reflect the costs of proper treatment of the wastewater in question. A progressive fee will be imposed on discharges within the permit, while a heavy fine will be imposed for pollutants discharged beyond the permit.

7.14 Proposed charges for each application will be referred to the Water Policy Committee for comment before the issue of a permit.

7.15 The Director will inform NEMA and the District Executive Secretary on his determination of the application and this shall be communicated to the applicant.

7.16 All decisions on applications for permits will be communicated to the Water Policy Committee for information.

8 The appeals procedure

8.1 The applicant may appeal against a decision by the Director of Water Development to refuse a permit or to grant a permit subject to specific conditions.

8.2 Any person or agency who has previously made an appeal against the granting of a permit may appeal against a decision by the Director to grant a permit (with or without specific conditions).

8.3 Appeals should be made within 30 days of receipt of the Director's decision, on prescribed forms.

8.4 Appeals will be submitted to the Minister of Natural Resources whose decision will be final. The Minister may normally consult any person or agency, but will usually seek assistance in determining the appeal from the Water Policy Committee.

8.5 The decision by the Minister on the Appeal must be communicated to the appellant within 3 months of the receipt of the Appeal, if not otherwise agreed to.

9 Failure to apply for a permit or failure to comply with conditions

9.1 In cases where a person or agency fails to apply for a permit to discharge wastewater into the recipient as required in para.3.1 above, then the Director of Water Development may require that the activity in question ceases, or that the person or agency applies for a permit.

9.2 In cases where a person or agency fails to comply with all or any of the conditions of a permit, then the Director may cancel the permit. He may also require that the operations licensed cease until such time as the permit conditions are complied with.

9.3 Provision is made in the Draft Water Statute for the imposition of fines and custodial sentences for failure to apply for a permit and failure to comply with the conditions of a permit.

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