



28th WEDC Conference

Kolkata (Calcutta), India, 2002

SUSTAINABLE ENVIRONMENTAL SANITATION AND WATER SERVICES

## Wastewater management in Zimbabwe

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ZIMBABWE IS CURRENTLY undergoing water and environmental management reforms. This process involved the changing of regulations and institutions governing access to water, and the setting up of a national water authority which will oversee the establishment of catchment and sub-catchment councils. This new set-up will ensure that water will be managed as a tradable commodity. There are also changes to the way the environment is managed with the Environmental Management Act (EMA) coming into effect soon. This will provide for sustainable management of natural resources and protection of the environment; prevention of pollution and environmental degradation; the preparation of a national plan and other plans for the management of the environment and the establishment of an Environment Management Agency and Environment Fund. This Act aims to streamline the management of various aspects of environmental pollution by bringing the enforcement of legislation under one ministry. New regulations have also been promulgated to control the discharge of effluent and waste into water bodies. Such discharges now require permits which are classified as blue, green, yellow and red, depending on the degree of risk to the environment.

### Methodology

This study looked critically at the current reforms in terms of their implications for the development of sustainable wastewater management practices. First it looked at the position or absence of wastewater management as a crucial component in these reforms. It also looked at the basis and intentions of the new regulations and how different categories of local authorities are going to be affected and how they are likely to respond. Of concern was the technological responses and how these would impact on financial sustainability especially in smaller local authorities.

### Regulatory aspects

#### The Water Act 1998 (Chapter 20:24)

Before the enactment of the new Environmental Management Act, the Public Health Act, The Water Act (Chapter 20:24), the Water Pollution Control Act (1976), the Natural Resources Act (Chapter 20:13), and the Urban Councils Act (Chapter 29:15) have been the governing statutes in as far as water pollution and wastewater management are concerned. The Water Act was very prominent on water pollution issues providing for the protection of the environment and the prevention and control of water pollution. The function of fixing water quality standards and related issues are now being repealed and transferred to the new

Environmental Management Act. The Water Act and the Zimbabwe National Water Authority (ZINWA) Act (Chapter 20:25) set up a national water authority, ZINWA. ZINWA and the relevant catchment councils are tasked with the preparation of outline water development plans for every river system. The outline plans include the maximum permissible levels of pollution within the catchment area concerned, subject to quality standards prescribed by the new EMA. Sections 68 – 71 dealing with enforcement, permits, pollution remediation, and delegation of certain powers to local authorities have now been repealed and now appear in the EMA.

#### Environmental management act

The Environmental Management Act repeals and replaces the Natural Resources Act [Chapter 20:13]; the Atmospheric Pollution Prevention Act [Chapter 20:03], the Hazardous Substances and Articles Act [Chapter 15:05] and the Noxious Weeds Act [Chapter 19:07]. The Act is in addition to and not in substitution for any other law which is not in conflict or inconsistent to it. In case of conflict, the EMA takes precedence. It establishes three bodies; the National Environment Council, the Environmental Management Agency, and the Environmental Management Board. The National Environment Council has a duty to advise on policy formulation and directions on the implementation of the Act. The Council also recommends to all appropriate authorities regarding the harmonisation of functions related to the environment. It is also the duty of the Council to review and recommend incentives for the protection of the environment (clauses 7 and 8). Environment Management Agency is a secretariat/administrative body that advises the Minister of Environment on any matter pertaining to planning, development, exploitation and management of the environment. In particular, the Agency develops guidelines for the preparation of a national plan and local environmental action plans. Furthermore, the Agency regulates, monitor review and approve any environmental impact assessments; regulate and monitor the management and utilisation of ecologically fragile ecosystems; and undertake any works deemed necessary or desirable for the protection of the environment where it appears to be in the public interest or where in its opinion an appropriate authority has neglected to do so (clauses 9 and 10).

Part IX provides for the establishment of a Standards and Enforcement Committee (clause 56) as part of the Environmental Management Board. Clause 59 prohibits water pollution while clause 62 prohibits discharge of effluent

without a licence and gives power to the Board to cancel an effluent discharge licence if the holder of the licence contravenes any provisions of the Act. The Standards Enforcement Committee is empowered to set air quality standards, standards of waste, standards of pesticides and toxic substances, standards of noise emission, and standards of noxious smells. For the purpose of promoting and facilitating the co-ordination of strategies relating to the environment, the Minister of Environment shall prepare a National Environmental Plan (clause 90) The public at large may make objections or representation in connection with the plan (clause 92). Every local authority will be required to prepare its own environmental action plan (clause 98).

Clause 60 stipulates that every owner or operator of a trade or industrial undertaking shall discharge any effluent or other pollutants originating from the trade or industrial undertaking only into existing sewerage system and the local authority operating or supervising such sewerage system shall issue, at a prescribed fee, the necessary licence for the discharge. The applicant shall, prior to being granted a licence to discharge effluent into the environment, install an appropriate plant for the treatment of such effluents before they are discharged into the environment. Every application for an effluent discharge licence shall be on the prescribed form and accompanied by the prescribed fee. The Board shall maintain a register of all effluent discharge licences issued under the Act. The register shall be a public document and may be inspected at any reasonable hour by any person on the payment of the prescribed fee.

### Waste and effluent disposal regulations

New Zimbabwe effluent regulations were promulgated in 2000 - Statutory Instrument (S.I.) 274 of 2000, Water (Waste and Effluent Disposal) Regulations, 2000. Essen-

tially this provided for the re-establishment of a water quality watchdog, the Water Pollution Control Unit, under the new Water Act, CAP 20:24 of 1998. This organisation is currently under ZINWA, which is a major player in the water sector in Zimbabwe. As activities of ZINWA also need monitoring, this set-up might need to be revised. This organisation should be under the Department of Water Development, or more appropriately, under the Ministry of Environment and Tourism. The new regulations introduced fees and penalties for waste and effluent disposal and classified permits into blue, green, yellow and red categories, respectively, in ascending order of potential risk posed to the receiving environment. Selected effluent standards from these regulations are shown in Table 1. Most councils will not be able to meet these standards, forcing them to go for irrigation or just paying the penalties.

An assessment of annual payments for a small town of 100,000PE, assuming 100 l/cap.d wastewater production, is given in Table 2. The regulations are not clear on what disposal is and on whether irrigation using effluent is a form of disposal that would require a permit. The permit fees and penalties were based on the construction of new biological nutrient removal (BNR) systems and these costs have since been overtaken by inflation which is currently above 100% (year on year). Some councils will prefer to pay the penalties as it can be cheaper, also considering that funds for capital projects are very expensive and often not available. The total annual cost for a red permit for 100,000PE equates to a loan repayment for a principal amount of ZWD3.25m at 16% government interest rate over 25 years. The actual construction costs are far too high as discussed later for the Redcliff plant. There is a need for a framework to predict realistic construction costs and a reference to a stable currency might be required. Where councils cannot meet

Table 1. Selected effluent discharge standards in Zimbabwe

Parameter	Blue		Green	Yellow	Red
	Sensitive	Normal			
Ammonia (N), mg/l	≤0.5	≤0.5	≤1.0	≤1.5	≤0.3
Nitrite-nitrogen, mg/l	≤3	≤3	≤5	≤8	≤10
Nitrogen Total (N), mg/l	≤10	≤10	≤20	≤30	≤50
Boron (B), mg/l	≤0.5	≤0.5	≤1.0	≤1.5	≤2
BOD, mg/l	≤15	≤30	≤50	≤100	≤120
COD, mg/l	≤30	≤60	≤90	≤150	≤200
Conductivity (µS/cm)	≤200	≤1000	≤2000	≤3000	≤3500
DO % saturation	≥75	≥60	≥50	≥30	≥15
FC (#/100 ml)	≤1000	≤1000	>1000	>1500	≤2000
Helminth eggs (#/100 ml)	≤1000	≤1000	>1000	>1000	≤2000
Iron (Fe), mg/l	≤0.3	≤1	≤2	≤5	≤8
Lead (Pb), mg/l	≤0.05	≤0.05	≤0.1	≤0.2	≤0.5
Oxygen absorbed, mg/l	≤5	≤10	≤15	≤25	≤40
PH (pH units)	6.0 - 7.5	6 - 9	9 - 10	10 - 12	12 - 14
Total-PO <sub>4</sub> (P), mg/l	≤0.5	≤0.5	≤1.5	≤3	≤5
Potassium (K), mg/l	*	*	*	*	<500
TDS, mg/l	≤100	≤500	≤1500	≤2000	≥3000
Temperature deg. C	<25	<35	<40	≤40	≤45
Total heavy metals, mg/l	≤1.0	≤2.0	≤4	≤10	≤20
TSS, mg/l	≤10	≤25	≤50	≤100	≤150
Turbidity (NTU)	≤5	≤5			

Source: S.i. 274 of 2000

**Table 2. Cost implications of S.I. 274 of 2000 (all costs in ZWD)**

Permit Type	New or, renewal \$/yr	Annual monitoring fee, \$/yr	Environmental waste fee for liquid waste	Solid waste fee, \$/yr	Total annual cost, \$
			Unit cost, \$/1000 m <sup>3</sup>	Annual cost, \$/yr	
<b>Blue</b>	8,000	7,500	nil	nil	15,000
<b>Green</b>	11,750	11,250	30.00	109,500	22,500
<b>Yellow</b>	15,500	15,000	67.50	246,375	30,000
<b>Red</b>	23,000	22,500	120.00	438,000	45,000

regulations, a permit will not be issued. Discharge without a permit attracts a fine of up to ZWD500,000 and/or imprisonment according to EMA. It is important that these regulations be regularly revised and updated to reflect current technology and thinking.

### Trade effluent control

Industrial, commercial and residential properties not connected to municipal sewers are not required to pay sewerage charges. This should act as an incentive for these properties to handle wastewater within their premises with possibilities for reuse and recycling. Connected industrial and commercial properties pay the fixed monthly charge for each toilet fitment multiplied by the number of fitments on the property. Effluent charges are applicable to hotels, boarding houses, hostels, crèches, clubs, shops, offices, warehouses, filling and service stations, factories and other commercial and industrial buildings or properties. In terms of Section 180(1)(c), (d), and (e) of the Urban Councils Act 1995 (Chapter 29:15) councils are empowered to regulate discharges into public sewers. Larger councils like Harare have trade effluent regulations and carry out regular surveillance of industrial premises (Jarawaza, 1997). In clause 173, councils are allowed to request for pre-treatment of industrial effluents if it is deemed necessary. Clause (1)(d) specifically forbids stormwater entry into municipal sewers, thereby outlawing combined sewer systems in Zimbabwe.

### Technological implications

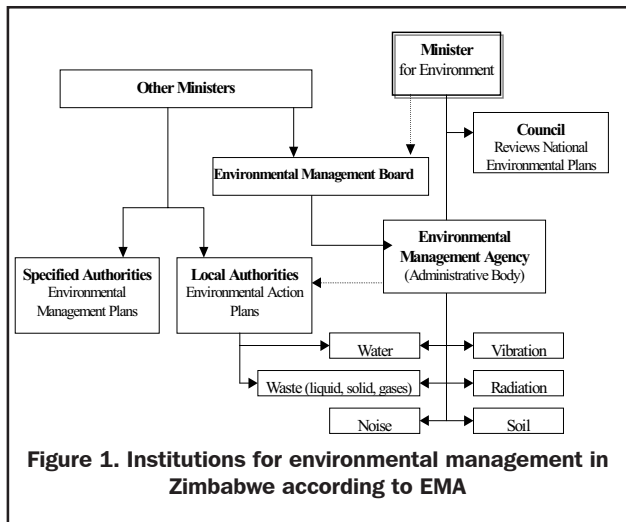
Councils are going to respond to the new effluent and waste disposal regulations differently depending on their sizes. Although they were consulted on regulations development, very few understood what exactly was going on and they are now starting to cry foul at the implementation stage. Most council engineers do not have a good wastewater treatment background. The new standards can only be met by using biological nutrient removal (BNR) systems and these are very costly to construct and maintain, especially for smaller local authorities that cannot achieve economies of scale. The adoption of sophisticated technologies in poor communities has serious financial implications. For example the construction of a new 2,000 m<sup>3</sup>/d biological nutrient removal (BNR) treatment works at Redcliff at a cost of

ZWD50m would mean an additional cost per household of ZWD4,080/annum on average for the 2,000 households that will be connected. For the average household earning about ZWD15,000/annum this would mean about 27% of income only to cover this investment cost. Besides this, there are other municipal and service charges to be met from the household income. Clearly there is something seriously wrong here. Literature figures are 5% of household income for water and sanitation given by Franceys (1999) and 3% for sanitation only given by Franceys *et al* (1992), Cairncross (1992) and Cairncross and Feachem (1983). Many professionals now realise that a greater part of our communities cannot afford expensive technologies and a revolutionary approach to our technology choice is urgently necessary.

The "polluter pays principle" in the EMA shall ensure that the person contributing the greater amount of pollution shall bear the largest burden in paying for cleaning the environment. In addition, fiscal, economic or social incentives for promoting the protection and management of the environment and the conservation and sustainable utilisation of natural resources can be determined in accordance with the EMA. Measures can also be determined for preventing the unsustainable use of natural resources and controlling the generation of pollutants. This is likely to lead to reuse of nutrients and the adoption of cleaner production approaches (pollution prevention and minimisation) to wastewater management. Local authorities can regulate the quality of effluent reaching sewage treatment works. This will give them flexibility in terms of technology choice especially if they manage to eliminate industrial toxins in sewer systems. Toxins hinder effective biological treatment.

### Institutional aspects

The new EMA revolutionises the institutional aspects of pollution control, resulting in the institutional structure shown in Fig 1 below. In this Act "waste" includes domestic, commercial or industrial material, whether in a liquid, solid, gaseous or radioactive form, which is discharged, emitted or deposited into the environment in such volume, composition or manner as to cause pollution. This definition covers a spectrum of functions falling under different sector ministries. The EMA, therefore proposes wider



consultations with relevant ministries, association agency or authority considered to have responsibilities relating the standards concerned. The central role of the ministry for the environment is reinforced through a statutory mandate to ensure, through monitoring, that all relevant players actually carry out their mandates in a co-ordinated manner. This unified approach will remove current duplications, achieve better co-ordination and channelling of efforts, and resources will no longer be wasted (Mtetwa, 1997).

In previous water pollution legislation, institutional settings were more focused on water supply. Wastewater was left to be managed by local councils that do not have sufficient muscle and authority to manage it commercially as their tariffs are strictly controlled by their parent ministry. On the other hand, the water supply function was delegated to catchment councils which are semi-autonomous bodies whose activities are directly controlled by stakeholders who fully appreciate the value of water. The price of water is going to rise considerably whilst that of wastewater treatment services will not be reflected in charges. The Pollution Control Unit (PCU) is currently under ZINWA, an arrangement queried earlier on. The regulations that introduced PCU are also more focused on penalising those who contravene discharge standards. Although the PCU was also established to carry out educational campaigns, it is doubtful that it has the technical and financial capacity to do so.

## Discussions and conclusions

The new effluent regulations will not be enough to control effluent discharges. Applying these regulations for more polluted catchments like Lake Chivero (Moyo, 1997) will still result in unacceptable loads of nutrients to the Lake. There is need for standards based on receiving environment condition. This is included in the new EMA but not reflected in the effluent regulations. The penalties should be of a progressive nature by pegging them to a stable currency. The positive aspect of the EMA is that it will promote source control, reuse, and recycling of effluents; issues necessary in sustainable management of the environment.

An important aspect still missing in all these reforms is the regulation of effluent reuse, not only after central sewage treatment, but also at a much localised scale. Discharge to land is still controlled by archaic regulations, GN 638/72, issued under the Public Health Act in 1972. These must be revised to safeguard public health and protect against adverse environmental impacts. Adequate staff and resources are necessary for organisations charged with the responsibility for assessing, implementing, operating and monitoring effluent reuse schemes and enforcing compliance with regulations. These should be backed by educational and awareness campaigns and should address the following issues:

- Agricultural regulations:* the type of irrigation technology to be applied, applicable crop restrictions, and applicable loading rates to avoid ponding and minimise salination effects.
- Wastewater regulations:* health standards for reuse and protection of the underground water resources taking into consideration a limited areal zone where water may be affected.
- Farmer protection:* farmers guidelines on how to handle, manage and utilise wastewater effluents in agriculture in a way that health risks are minimal to the workers, their families and the consumers of effluent irrigated crops.

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