

# Water Pollution Management Programme

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## **1.0 INTRODUCTION**

Environmental degradation in Trinidad and Tobago has historical roots that are not too dissimilar from those in the rest of the world attributed largely to economic growth and the development and growth of human population. Between the islands themselves, different patterns of development have resulted in differences in environmental degradation, for whereas in Trinidad the main thrust has been heavy industrial development, in Tobago it has been tourism development. Generally the country passed through a long period of agricultural development, typical of the region, moving into exploitation of petroleum resources and later heavy industrialization. Trinidad and Tobago experiences much of the full range of environmental problems, from widespread pollution of its waterways and nearshore waters to air pollution, chemical spills, illegal dumping, deforestation, fisheries and wildlife depletion.

The Environmental Management Act No. 3 of 2000 (the 'Act') separately describes the approach to pollution management in all environmental media (i.e. air, water and land). The Environmental Management Authority (the 'Authority') has chosen water pollution management as the area that requires immediate attention. The following discussion on the state of water quality in Trinidad and Tobago has guided this choice.

## **1.1 FRESHWATER**

### **1.1.1 Watershed Status**

Land use within a catchment affects the amount of water infiltrating to groundwater, the rate of run-off and erosion, and the amounts of agricultural chemicals, sediment and nutrients reaching water bodies. Urban centers and industry produce wastes that can pollute surface and sub-surface waters. Rivers carry pollutants from catchments to the sea. In turn, water availability and quality affect land use and land degradation.

In Trinidad and Tobago like all developing countries natural rivers and creeks have been confined in concrete channels, wetlands have been drained and filled, and asphalt streets, parking lots and buildings, have covered flood plains. As a result of economic development and population increase there has been a concomitant loss of natural functions that are critical to the health of ecosystems and the availability of good quality surface water. While these incremental changes may seem insignificant if viewed separately their cumulative impact over time and throughout a watershed can be significant.

The condition of watersheds and their freshwater resources is extremely varied. Many of the Northern Range rivers, especially those draining to the north in the eastern part of the Northern range are pristine, not prone to flooding even though arising in high rainfall areas, and support a rich biota. In contrast, many south flowing rivers of the Northern Range, especially those in the western part of the range, reflect the serious deforestation, which has taken place over the past two centuries. Discharge after heavy rain is rapid, causing flooding in valleys and plain, and the necessity in built areas, to canalize rivers at considerable capital cost, as for example in the Maraval and Diego Martin Valleys, is increasing.

Combined storm inflows from adjacent watersheds in both Northern and Central Ranges cause serious annual flooding and damage in heavily populated low lying areas. This results in costly flood control measures being undertaken from time to time, particularly embankments and river mouth dredging.

A number of studies have been commissioned in the past to assess watershed degradation, land use and watershed management. The main factors responsible for watershed degradation have been linked to:

- Indiscriminate clearing and degradation of forests for housing and urban development, shifting cultivation and squatting;
- Loss of forest and protective vegetation cover by forest and bush fires;
- Quarrying operations and road construction on steep slopes; and
- Cultivation on steep slopes, without application of appropriate soil conservation measures.

Erosion status map of 1960's indicated that 15% of the soils in Tobago have lost their entire topsoil and another 42% of the soils lost more than half their topsoil. The most severely eroded are Hillborough East and the Louis d'Or in Tobago. In Trinidad only 1% of the soils has lost the entire topsoil, while only less than 10% of the soils lost more than half of their topsoils. Heavily eroded watersheds are all located on the south facing slopes of the Northern Range, the only exception being the Poole basin. Since the above situation prevailed in the 1960's and since that time the population has increased and land use has changed dramatically in a number of watersheds, it implies that the actual erosion status have declined further from the one presented on the map.

A recent attempt to rank basins in the northwest Trinidad and of Tobago according to their degree of degradation revealed that Maraval, St Ann's and Diego Martin basins in Trinidad need priority attention while Courland and Hillsborough in Tobago were selected for priority treatment.

The effects of soil erosion and watershed degradation in Trinidad and Tobago cannot be assessed quantitatively since data on changes in soil productivity, changes in sedimentation rates of rivers and reservoirs and data on changes in the hydrological response of the watersheds to rainfall are very scarce.

### **1.1.2 Ground Water**

There are significant sources of groundwater available and utilized in Trinidad, especially in northern Trinidad. The more important aquifers lead from the southern side of the Northern Range into the gravel deposits in the floors of valleys and in the Caroni plain. Many of these are successfully exploited. There are many perennial springs in Northern Range valleys and a few scattered artesian upflows on the Caroni plain as, for example, in Orange Grove and Santa Rosa. Ground water reservoirs are also to be found in coarse sand beds along the flanks of the Central Range and several of these are currently exploited. There are also a few scattered perennial artesian outflows in and around the Central Range as well as fine sand beds in south Trinidad, which have been exploited.

Minor aquifers exist in the southwestern part of Tobago but these have not been exploited over the years, as are those, in Trinidad. Persistent but minor upwelling of freshwater occurs in the western reef at Buccoo Reef.

The natural groundwater quality of the major aquifers in Trinidad is generally within the limits set by the WHO for potable use. In some well fields near limestone lenses the water can be hard and well fields in the main Central Sands and the Southern aquifers have high iron contents. Aquifers close to the coast (e.g. El Socorro wells) experience seawater intrusion due to over-abstraction. Apart from seawater intrusion it can be concluded that groundwater quality in the main aquifers in Trinidad are still of a good quality. Minor aquifers exist in southwestern Tobago but these have not been exploited over the years as those in Trinidad.

Groundwater is inextricably linked to the surface environment therefore its quality is affected by point and non-point sources of pollution. Although the natural groundwater quality of the major aquifers in Trinidad are generally good most of the aquifers are very vulnerable as there are no thick overlying clay layers to protect the aquifer from infiltration of contaminants. Therefore major types of pollution threatening aquifers are:

- **Leachate from landfills.** The three main landfills in Trinidad are located adjacent to productive aquifers. Monitoring for landfill leachates at one landfill site have shown no major contamination of the subsurface waters.
- **Leakage from service station underground storage tanks (UST).** There are over 1000 UST in Trinidad and Tobago containing fuel, 90% of them are made of single wall steel construction at different stages of corrosion. Although there are plans to upgrade and replace all UST many have the potential to leak and contaminate local groundwater supplies. Recent hydrocarbon tests done on subsurface samples near UST at three service stations in Trinidad have indicated significant contamination at two sites. One of the contaminated sites was located above a productive aquifer.
- **Leachate from septic tanks and pit privates.** Improperly designed and maintained septic tanks and pit privates can allow untreated sanitary wastewater to enter and contaminate local ground water supplies.
- **Infiltration of nutrients and pesticides.** The over application of fertilizers and pesticides on agricultural lands can percolate through the subsurface and contaminate local ground water supplies.
- **Industrial and farm effluent discharges (including mining).** High strength industrial and livestock effluent if discharged directly onto open lands can infiltrate the soil and affect the quality of ground water supplies.

It should be stated that groundwater quality monitoring in Trinidad and Tobago has been limited and that the present monitoring techniques have to be revised to allow for the detection of micro-pollutants (i.e polychlorinated biphenyls, polyaromatic hydrocarbons, pesticides, benzene, toluene, ethylbenzene, xylene, methyl tert butyl ether, etc.)

### **1.1.3 River Water Quality**

Natural variation from place to place, seasonal changes, and the composition of rock and soil type through which water travels can all affect the quality of riverine water. Water in coming into contact with soil mineral dissolves certain chemical constituents, which in turn can influence the suitability of these waters for various uses (e.g. water containing high levels of iron can affect palatability and potability, high levels of calcium and magnesium can cause water hardness).

The quality of the surface water resources of Trinidad and Tobago is in many places deteriorating due to high levels of suspended solids, organic matter, high bacterial counts and the presence of chemical pollutants. The main causes are uncontrolled point source discharges, in particular industrial (including mining) and domestic. The high erosion rates in upstream area and the indiscriminate removal of vegetative cover contribute to the high turbidity and suspended solids loads in certain watersheds. The increasing pressure on the water resources due to population and socio-economic activities will result in an even higher rate of pollution, if no corrective measures are instituted.

Relevant scientific information available to provide a quantitative assessment of water quality in Trinidad and Tobago is generally lacking. This is because monitoring of water quality parameters has generally been given low priority, the technical base weak, there is lack of coordination between agencies and key indicators particularly biological are limited. Although some monitoring data exist there has never been any national compilation from which to estimate state or trends, there has been little interpretation of existing data and archiving poor.

Recognizing the above limitation a recent study was done by Phillip (1998) who carried out a biological and water quality survey in many of the rivers in Trinidad and Tobago over a two-year period. Using the information generated from the survey a water quality index was formulated which classified the sampling sites into three classes; pristine, perturbed and polluted. The study concluded that all the polluted sites were found in Trinidad and mainly concentrated in the western and southwestern part of the island. None of the sites along the north coast of Trinidad were polluted and no polluted sites were found in Tobago.

The Caroni River Basin represents the only area in Trinidad and Tobago where numerous studies have been done on surface water quality monitoring, this is no doubt related to its size (representing 22% of the entire surface area of Trinidad) but also because it provides potable water for over 40 % of the population. The Caroni River, the largest in Trinidad, originates from the confluence of the rivers Aripo and Cumuto in the central area between the Northern and Central Ranges. Approximately 40km in length it receives flow from many tributaries and discharges into the Gulf of Paria via the Caroni Swamp.

Located on the banks of the Caroni River is the Caroni Arena Water Treatment Plant (CAWTP) which was commissioned in 1981 and produces approximately 272,760m<sup>3</sup>/day or 40% of the country's potable water supply. Since the CAWTP abstracts water directly from the Caroni River, the quality of waters in the tributaries upstream of the plant as well as the waters in the Caroni River has been the focus of numerous studies. Even before the plant was built it was identified from various studies that the quality of water upstream of the proposed site was susceptible to agricultural, domestic and industrial wastes. Eighteen years after being built the CAWTP has managed to supply the country's potable needs but at a very high (approximately TT\$6.0x10<sup>6</sup> for alum in 1988), this cost will continue to escalate if activities taking place in areas upstream of the CAWTP are not brought under strict control.

A review of existing information on riverine water quality revealed that the most serious factors affecting water quality are related to:

- **Direct discharges of industrial effluent (including mining).** Many of the rivers that cross the East/West Corridor and those that drain the western part of Trinidad are affected by industrial pollution, these include Ciperó (cane sugar production and refining, service stations), Guaracara (oil refining, service stations), Couva (petrochemicals, sugar cane production, service stations, agro-processing), Guayamare (rum distilling, service station), Caroni (rum distilling, quarrying, service stations, agro-processing, manufacturing of paints, other chemicals and metal fabricated products), Santa Cruz/San Juan (quarrying, agro-processing, service stations), Maracas/St. Joseph (quarrying, service stations, agro-processing including brewing, chemicals), Tacarigua (service stations, agro-processing, chemicals and metal fabricated products) Mausica (service stations, agro-processing), Arima (service stations, agro-processing, quarrying, chemicals), Guanapo (quarrying), El Mamo (quarrying), North Oropouche (quarrying). (Refer to Map 4.1). In Tobago industrial activity is concentrated mainly in the southwest where there are only a few major rivers; the Steele River receives agro-processing wastewater (See Fig.4.2).
- **Direct and indirect discharge of sewage effluent (including seepage from septic tanks and pit privates).** Many of the rivers that drain urban centers of Trinidad as well as those in the southwestern part of Tobago are susceptible to pollution by non-functional sewerage treatment plant (Refer Fig. 4.3) and improperly designed septic tanks.
- **Oil production.** As many of the main on-land oil fields are located in the southern part of Trinidad, oil exploration and production activities have left many of these rivers and their tributaries polluted by oil (Refer to Fig. 4.1).
- **Deforestation.** Many of the rivers that drain the foothills of the Northern Range are affected by high sediment load as a result of denuded vegetation in the upper catchment area. The rivers Diego Martin, Maraval, Maracas/St Joseph, Tacarigua, and Arima are all testimony to this during periods of high rainfall.
- **Direct and indirect discharges farm wastes.** Many river systems in agricultural areas of Trinidad and Tobago receive inputs of livestock wastes that are easily biodegraded, however large volumes of high strength waste especially in the dry season have presented serious problems as is the case in the Poole, Erin, Arima and Cunupia Rivers for Trinidad and Hillsborough River in Tobago.

- **Dumping of domestic refuse and other solid wastes.** This takes place throughout all rivers in Trinidad and Tobago.
- **Agricultural and domestic chemicals.** There have been a number of reported fish kills in rivers of Trinidad and Tobago attributed to the indiscriminate use of pesticides, fertilizers and domestic chemicals. In Trinidad the rivers Maraval, St. Anns, Santa Cruz/San Juan, Caroni and Arima, and in Tobago the Argyle River have all experienced fish kills in the past.

Apart from the above sources of pollution affecting inland water bodies, leachates from landfills and leaks from underground storage tanks can also affect the quality of subsurface and surface water.

#### **1.1.4 Wetlands**

Limited water quality assessment has been carried out mainly in the larger wetland areas namely Caroni, Nariva and South Oropuche. Alterations of the hydrological regimes continue to be the major factor affecting the quality of water in these areas as evidenced by increasing salinity due to drying out and saltwater intrusion. An overall assessment of water quality in wetland areas can hardly be done as there has been no systematic and sustained studies that look at effects of various water quality parameters on the health of wetland systems. To be able to assess ecotoxicological risks there is need to conduct research in monitoring macro-chemistry and other micro-pollutants in surface water, sediment and biota in all major wetlands of Trinidad and Tobago.

A recent study has concluded that the main factors threatening wetlands in Trinidad and Tobago are drying out and salinization. Evidence of this has been showcased in parts of Caroni, Nariva, South Oropuche swamps where drainage works have decreased the freshwater storage capacity (especially in the dry season) and at the same time increased the accessibility of saltwater intrusion. Other contributory factors to wetland deterioration are sedimentation runoff, nutrient inputs and discharging of high strength industrial effluents.

## **1.2 COASTAL AND MARINE WATER QUALITY**

Water quality in Trinidad and Tobago is impacted by activities both on land and in the marine areas. Most of the contaminants investigated focused on the macro-pollutants such as hydrocarbons and heavy metals with little information regarding other pollutants.

### **1.2.1 Pollutants**

In Trinidad, evidence of petroleum hydrocarbon contamination exists in all coastal waters from natural oil seeps or petroleum mining operations. On the south and north coasts as in the waters around Tobago, contamination is believed to result from shipping activities, ballast discharge and oil spills from tanker traffic. In the coastal waters of the Gulf of Paria there are varying degrees of contamination from petroleum hydrocarbons and heavy metals. The higher concentrations of petroleum hydrocarbon (200 to >500µg/g dry wt. Chrysene equiv.) are evident in the vicinity of runoff from drilling or refinery operations.

The concentrations of heavy metals are even higher in the wet season, suggesting that during this time runoff from land is a greater source of heavy metal contamination than offshore fields. On the east coast of Trinidad which has a more recent history of oil exploration and production than the west, most of the oil-related activities are offshore and it is, therefore, not surprising that there is little evidence of petroleum hydrocarbon contamination from land-based sources.

### **1.2.2 Salinity**

Water quality is much influenced by the Orinoco River which displays marked seasonality of discharge as indicated by surface salinities in the wet and dry seasons. Peak discharge takes place between August and October, but shows some variability in timing as well as in volume. In most years at these times salinities in the Columbus Channel and in the nearshore waters at Icacos and Cedros fall to approximately one tenth, and in the Gulf of Paria to about one half that of oceanic seawater. Along the east coast there is also considerable dilution and mixing. At Galera salinities may fall to three-quarters that of oceanic seawater. The effects in Tobago are not as severe but at Crown Point salinity may fall by one or two parts per thousand.

Associated with this seasonal dilution of nearshore waters from riverine discharge are stratification in the water column and a significant increase in turbidity due to suspended sediments, both organic and inorganic, some of which originated several hundreds of kilometres upriver. This drastically reduces light penetration and in extreme instances light may disappear at the comparatively shallow depth of 35 metres. Occasionally, organic flocculations may completely coat the substratum in sheltered places and cause dieback of coral communities, as happened at Buccoo Reef in the early 1970s.

A notable feature of Orinoco discharge is floating vegetation torn from along the riverbanks far inland. This phenomenon is thought to be responsible for colonization of the southwestern peninsula by both plants and animals.

### **1.2.3 Temperature**

The temperature regime is extreme stable with average sea surface temperatures ranging from 26.5°C (dry season) to 28°C (wet season). Nearshore and in sheltered places temperatures may be higher.

### **1.2.4 Effects of Human Settlement and Economic Development**

Domestic wastewater discharges continues to be a serious and chronic problem. Discharged wastewater finds its way into the marine environment where it can have negative public health effects, largely through its bacterial content. Solid wastes are managed by sanitary land filling with minimal recycling. There is a serious potential problem at the Beetham dump, situated close to the sea where seepage may be transported to the coast via the adjoining wetlands. There is at present no toxic waste disposal site in the country and any toxic waste irresponsibly dumped on land is likely to find its way into the sea, via runoff, where it may have adverse effects on marine biota. Agricultural and industrial pollution are constant features of the economic development of the country.

In the first half of the century agricultural pollution was largely associated with the sugar industry and the main areas affected were the Caroni, Couva and Cipro rivers, coastal mangroves and the nearshore environment. More recently there has been indirect evidence of the buildup of industrial pollution pressures associated with a wide range of industrial activities, ranging from the petrochemical industry to light manufacturing. The appearance of lesions, deformities and tumours in marine fish, and dieback of coral and seagrass communities in the Gulf of Paria, may be evidence of the effect of these pollutants on the biota.

## **2.0 BACKGROUND**

The Act sets out a systematic sequence of requirement for effective management of pollution in all environmental media. In the water medium the requirements of the Act, as defined in Section 52, are mandatory on the Authority and can be summarised as follows:

- Ascertain the extent, character and sources of water pollution in Trinidad and Tobago;
- Develop a rule which lists water pollutants defining them by their quantity, condition or concentration; and
- Develop and implement a programme for the management of water pollution, which shall include registration of significant sources of water pollutants.

Section 53 (1) of the Act may require the Authority to grant permits as part of water pollution control programme.

The four documents listed below provided useful background information in addressing the above requirements of the Act.

- (i) **UMA Environmental, (1997). Technical Background Paper for Parameters in Water Effluents. Prepared for the EMA with assistance from the Caribbean Industrial Research Institute (CARIRI), October 1, 1997.**

In 1997 the Authority contracted UMA Environmental to conduct a study entitled *Technical Background Paper for Parameters in Water Effluents*. The objective of this study was to provide recommendations and the supporting rationale for limits on pollutants in industrial effluent in Trinidad and Tobago. The study report included the following:

- An overview of the industrial and environmental profile for Trinidad and Tobago, including an assessment of the quantity and character of liquid effluents;
- A discussion of pollution prevention opportunities and control technologies;
- A cost/benefit analysis of implementing standards; and
- Recommendations for effluent limits and monitoring and reporting requirements.

The study was also to be used by the Authority to contribute to the deliberations of the Trinidad and Tobago Bureau of Standards (TTBS), Specifications Committee on Liquid Effluent from Industrial Processes into the Environment.

(ii) **TTS 547:1998. Trinidad and Tobago Standard. Specification for the Effluent from Industrial Processes Discharged into the Environment. Published by Trinidad and Tobago Bureau of Standards (TTBS).**

On March 5, 1998 the above captioned Trinidad and Tobago Standard was declared. This standard was accomplished after lengthy deliberation by the above mentioned committee made up of experts from the scientific, industrial, academic, engineering and NGO community. The standard although voluntary states the maximum permissible limits for discharge of parameters in industrial effluents into four categories of receiving environment:

1. Inland surface waters;
2. Coastal near-shore;
3. Marine offshore; and
4. Environmentally sensitive areas.

(iii) **TTS 417:1993. Trinidad and Tobago Standard. Specification for the Liquid Effluent from Domestic Wastewater Treatment Plants into the Environment. Published by the Trinidad and Tobago Bureau of Standards (TTBS).**

On April 20, 1993 the above captioned Trinidad and Tobago Standard was declared. This standard was accomplished after lengthy deliberation by the above mentioned committee made up of experts from the scientific, industrial, academic, engineering and NGO community. The standard though compulsory states the maximum permissible limits for parameters in domestic wastewater effluent into six classes or points of discharge:

1. Groundwater;
2. Inland surface waters (excluding waters close to or in classes 5&6);
3. Inshore areas of the sea (excluding waters close to or in classes 5&6);
4. Offshore areas of sea (excluding waters close to or in classes 5&6);
5. Environmentally sensitive areas; and
6. Recreational waters, irrigation use waters, waters that are sources of food or potable water and other waters that impact on human health.

(iv) **Pollutant Inventory Study**

The Pollutant Inventory Study for Trinidad and Tobago was developed for the Authority by Eco-Engineering Consultants and submitted in May 1998. The primary objective of this study was to conduct a detailed assessment of existing significant sources of pollutants in all environmental media in Trinidad and Tobago. It seeks to address the first aspect of water pollution management as stated in the Act Section **52 (1) a** *...ascertain the extent of water pollution and significant sources of water pollution.*

### **3.0 SCOPE**

This document addresses the above requirements by referring to the Authority's previous and proposed work on a pollutant inventory, designating a register of water pollutants and developing a programme for the management of water pollution in general. It should be pointed out here that although the country has over 100 pieces of legislation relating to environmental protection it has not been achieved the level of environmental conscious in conducting daily activities. This is due mainly to petty fines, unsustained public awareness programmes, absence of subsidiary legislation, overlapping responsibilities of government agencies and lack of environmental standards to enforce against. It is hoped that the new regime of water pollution management programme as contained in this documented along with its supporting legal and institutional framework will change the culture to one of environmental awareness and compliance.

### **4.0 POLLUTANT INVENTORY**

As discussed above, the Authority conducted the Pollutant Inventory Study (PIS) during 1997 in order to meet the requirements of Section 52 (1) of the Act. The PIS did however, rely substantially on existing data and the use of simple models to derive the data therein. This was necessary because many industries did not do regular monitoring of their discharges or were not amenable to releasing their results. There is neither existing legislation nor widespread culture in Trinidad and Tobago that would require them to do either. In cases where monitoring data was released it was on the condition that it would not be published and distributed such that it could be linked to the source.

The PIS therefore, when supported by the monitoring and reporting legislation to be developed as part of the water pollution management programme, provides the basis for an evolutionary approach to development of a comprehensive pollutant inventory.

### **5.0 REGISTER OF WATER POLLUTANTS**

According to the Section 52 (2) of the Act the Authority shall cause a register or list of water pollutants to be developed which shall contain data identifying the quantity, condition or concentration of each pollutant.

In the Act pollution is defined as follows:

*The creation or existence of any deviation from natural conditions within the environment, which based on technical scientific or medical evidence as determined to cause or to be likely to cause harm to human health and the environment...*

Water pollutant means:

*Any pollutant released into or which otherwise has an impact on the surface water, sea, groundwater, wetlands or marine area within the environment.*

There is significant technical, scientific and medical evidence developed internationally that demonstrates the cause and effect relationship between pollution and harm to human health and the environment. Although there has been a number of studies done in the past to identify and assess pollution problems in different parts of the country, very little scientific evidence has been gathered on pollution/harm relationships specific to Trinidad and Tobago. The lack of national water quality standards for water bodies or segments of water bodies also poses somewhat of a constraint when attempting to develop a register of water pollutants specific to Trinidad and Tobago. To develop such a register that specifies conditions and concentrations of water pollutants that would cause harm to human health and the environment would require an elaborate system of environmental quality monitoring over a fairly long time series involving complex scientific analysis.

To address this deficiency the Authority will designate a register of water pollutants based on the reports listed in Section 2.0 of this document, international water quality guidelines and standards, and the Authority's expert opinion. This register is presented in Table I and represents the concentration or condition at which a water quality parameter or substance is considered a pollutant. It is the intention of the Authority to update and adjust this register from time to time.

The underlying principle in deriving Table I was that where multiple sources of information were utilised for determining the condition or concentration for a particular parameter or substances the source with the most stringent value was chosen. This would ensure that the water pollutant has the most sensitive definition after considering all technical, scientific and medical information available to safeguard human health and the environment. In ordinary terms any person discharging industrial, domestic or agricultural wastes containing parameter(s) or substance(s) that exceed the concentrations or conditions specified in Table I, will be termed a source of water pollutants.

### **5.1 Guidelines Establishing Procedures for Sampling, Preservation and Analysis of Water Pollutants as identified in the Register of Water Pollutants**

All methods of sample collection, preservation and analysis shall be in accordance with those prescribed in "Standards Methods for the Examination of Water and Wastewater 19<sup>th</sup> Ed. 1995, published by the American Public Health Association (APHA), American Water Works Association (AWWA) and Water Environment Federation (WEF)", or any subsequent edition, or other generally accepted procedure approved by the Authority.

**Table I. Register of Water Pollutants**

<b>No.</b>	<b>Parameters or Substances</b>	<b>Quantity, Condition or Concentration at which substance or parameter is defined as a pollutant <sup>a</sup></b>
1.	Temperature	Maximum variation of 3 °C from ambient
2.	Hydrogen ion (pH)	Less than 6 or greater than 9
3.	Dissolved Oxygen Content (DO)	<4
4.	Turbidity	Maximum variation of 5 NTU from ambient
5.	Five day Biological Oxygen Demand (BOD <sub>5</sub> at 20°C)	>10
6.	Chemical Oxygen Demand (COD)	>60
7.	Total Suspended Solids (TSS)	>15
8.	Total Oil and Grease (TO&G) or n-Hexane Extractable Material (HEM)	>10
9.	Ammoniacal Nitrogen (as NH <sub>3</sub> -N)	>0.01
10.	Total Phosphorus (as P)	>0.1
11.	Total Nitrogen	>0.4
12.	Sulphate (as SO <sub>4</sub> )	>200
13.	Sulphide (as H <sub>2</sub> S)	>0.2
14.	Total Residual Chlorine (as Cl <sub>2</sub> )	>0.2
15.	Total Fluoride (F)	1.5
16.	Dissolved Hexavalent Chromium (Cr <sup>6+</sup> )	>0.05
17.	Total Chromium (Cr)	>0.1
18.	Dissolved Iron (Fe)	>1.0
19.	Total Petroleum Hydrocarbons (TPH)	>10.0
20.	Total Nickel (Ni)	>0.5
21.	Total Copper (Cu)	>0.01
22.	Total Zinc (Zn)	>0.1
23.	Total Arsenic (As)	>0.01
24.	Total Cadmium (Cd)	>0.01
25.	Total Mercury (Hg)	>0.005
26.	Total Lead (Pb)	>0.05
27.	Total Cyanide (as CN <sup>-</sup> )	>0.01
28.	Phenolic Compounds (as phenol)	>0.1
29.	Radioactivity	NIAA
30.	Toxicity	NATE
31.	Benzene	>0.005
32.	Toluene	>0.002
33.	Ethylbenzene	>0.002
34.	Xylenes	>0.3
35.	Faecal Coliforms	>100
36.	Solid Waste	No solid debris

<sup>a</sup> all units are in milligrams per litre (mg/L) except for temperature (°C), pH (pH units), turbidity (NTU), faecal coliforms (counts per 100ml), radioactivity (Bq/L) and toxicity (toxic units).

NIAA- no increase above ambient

NATE- no acute toxic effects

> greater than

< less than

To ensure that proper procedures are adhered to during sampling and analysis for any of the water pollutants listed in the register of water pollutants the following guidelines are provided:

### **5.1.1 Method and Manner of Sampling**

Two major points must be considered when sampling for water pollutants:

- sample locations (must be at a point that is representative of the particular discharge); and
- type of sample to collect (grab or composite). E.g. grab samples must be collected for pH, temperature, dissolved oxygen, chlorine, oil and grease, faecal coliforms and cyanide.

Appendix I (Table I) gives a general outline of the key points of consideration when establishing any sampling programme.

### **5.1.2 Sample Preservation**

Sample preservation procedures, container materials, and maximum allowable holding times for each parameter listed in the Register of Water Pollutants is contained in Appendix I (Table II).

### **5.1.3 Sample Analysis**

Test methods for the analysis of each parameter listed in the Register of Water Pollutants is presented in Appendix I (Tables III, IV, V and VI). References for these methods are also listed. These references give a full description of the approved methods. Under certain circumstances, the Authority may propose or approve additional test procedures for nation-wide use.

## **6.0 WATER POLLUTION MANAGEMENT PROGRAMME**

As stated earlier, the Act requires that the Authority develop and implement a programme for the management of water pollution.

The Act defines a programme to include:

- a) the particular objective to be achieved by a course of action;*
- b) the policies to be developed or implemented and the procedures to be followed, in achieving that objective; and*
- c) the allocation of resources and personnel directed toward giving effect to that course of action;*

### **6.1 Background**

The starting point for the development of the Water Pollution Management Programme (the 'Programme') began with an Environmental Quality Workshop held with personnel from the US based Environmental Law Institute and the Authority's staff. This was followed by discussions with a legal expert from the United States Environmental Protection Agency and lengthy in-house debates.

During the above deliberations it was recognized that there are many elements involved in managing water pollution, some of which were outside the mandate of the Authority and is the responsibility of other governmental agencies. Some of these programmes include the management of ship-generated wastes, water conservation, wetland protection, coastal zone management, groundwater quality, etc.

While the Authority may contribute to the development of such programmes it was felt that a focused approach that is practical, implementable and consistent with the Act should be developed. The following sections describe the Authority's approach to water pollution management.

### **6.2 Objective**

The Programme overall objective is to control, reduce and prevent water pollution from point and non-point sources discharges into the waters of Trinidad and Tobago. The benefit to be derived for meeting this long-term objective would be the preservation and maintenance of good quality water that would support present and future generations. To accomplish this a number of sub-programmes will have to be developed under the Programme.

### **6.3 Policy**

The key principle of pollution control as stated in the National Environmental Policy (the 'Policy') is that the cost of pollution prevention or of minimising environmental damage due to pollution will be borne by those responsible for pollution (i.e. the Polluter Pay Principle). The Policy goes further to state that pollution control will be enforced through a system of permits, which will set pollution limits or performance standards for air, noise, water, waste and hazardous substances.

The following guidelines on water pollution policy will be considered to achieve the objective of the Programme:

- (i) The achievement of water quality objectives is in the public interest and the achievement of these objectives should not represent an unreasonable barrier to economic or social development;
- (ii) Existing water uses and the level of water quality necessary to protect existing water uses shall, as a minimum, be maintained and protected;  
Major Water Uses in Trinidad and Tobago are:
  - Raw water for drinking water supply;
  - Recreational water quality and aesthetics;
  - Freshwater and marine aquatic life;
  - Agricultural water use (livestock watering and irrigation);
  - Industrial water supplies;
  - Ceremonial and religious; and
  - Commerce and navigation.
- (iii) The water use classification and criteria listed in Appendix II will be adopted as guidance on water quality management in Trinidad and Tobago;
- (iv) No further water quality degradation, which would interfere with or become injurious to existing water uses, shall be permitted;
- (v) For waters with multiple uses the criteria must support the most sensitive use;
- (vi) Waters whose existing quality is less than the quality specified in the water quality guidelines (Appendix III) shall be improved to comply with these, wherever possible. ***It should be noted that these Guidelines should not be regarded as blanket values for national environmental quality. Variations in natural environmental conditions across Trinidad and Tobago will affect environmental quality and many of the guidelines reported here will need to be modified according to site-specific conditions. Site-specific environmental quality objectives derived using these guidelines may therefore differ from the above recommendations. For environments in which water is of superior quality to these guideline concentrations, no deterioration of existing water quality would be permitted. Such considerations should form part of the rationale for site-specific environmental quality objectives to be developed by the Authority in collaboration with other governmental agencies;***

- (vii) Waters whose existing quality exceeds levels necessary to support propagation of fish, shellfish, and wildlife and recreation in and on the water shall be maintained and protected unless and until it is found after full opportunity for public participation and intergovernmental co-ordination, that allowing lower water quality is necessary to accommodate an important economic or social development in the area in which the waters are located, subject to the provision that in no event, however, may degradation of water quality interfere with or become injurious to existing uses;
- (viii) Before any new point source or non-point source of pollution lowers the water quality in any area, the person responsible for such pollution shall establish and use at least the most cost-effective and reasonable environmental management practices to address such pollution;
- (ix) To the extent practicable, all new point sources of pollution shall not discharge into near-shore or fresh surface waters;
- (x) All sewage and waste shall receive the degree of treatment necessary to protect the beneficial uses of waters of the Republic of Trinidad and Tobago before discharge;
- (xi) In no event shall there be a degradation of water quality which shall cause the water quality in any area to fall below that necessary to protect the uses of the water for the propagation of aquatic life and for recreation in and on the water and to protect human health;
- (xii) Outstanding national resource waters designated as Environmentally Sensitive Areas (ESA) or waters on which Environmentally Sensitive Species (ESS) depend shall be protected in a pristine state;
- (xiii) All waste water from industrial or commercial facilities that are located close to a public sewerage system should be disposed into that system, subject to such quality and flow conditions as the owner of the sewerage system may apply;
- (xiv) There shall be no direct or indirect discharge of sewage or other waste into any planned or intended ground or surface source of public drinking water;
- (xv) No new industrial or commercial facilities will be permitted in any Class I Groundwater area;
- (xvi) In cases where the water quality falls below of what is necessary to protect human health, the person that caused the pollution shall pay for any cost necessary to inform the public of the risks involved, in order to protect human health;

- (xvii) Where more than one person is responsible for causing a level of a substance in a water body to exceed a water quality standard or guideline, those persons may agree amongst themselves on the manner to reduce individual contributions to meet the standard or guideline; if they cannot agree within a reasonable time frame amongst themselves, the Authority may require a reduction to be achieved by each person based on what is assumed, by the Authority, to be reasonable in the circumstances;
- (xviii) The Authority shall apply a precautionary approach, whenever necessary, to ensure that future developments are not endangered or in case the water body requires a high degree of protection;
- (xix) A point source or a non-point source of a water pollutant should not, in isolation or combination with any other source(s) of that pollutant, cause a condition to exceed the water quality guidelines mentioned above;
- (xx) In order to meet the water quality guidelines in receiving waters mentioned in Appendix III, the concentration or condition of a parameter or substance in a point source discharge shall not exceed that water quality limits contained in Table II, or shall not exceed, after approval by the Authority any stated concentration (mg/l) calculated by using:
  - a) the relevant modelling protocol contained in Dilution Models for Effluent Discharges (U.S. Environmental Protection Agency, Office of Resources & Development. EPA/600/R-94/086), or other equivalent model approved by the Authority;
  - b) background concentration(s); and/or
  - c) discharge volume and density; and any other relevant data or criteria as specified in the models listed in paragraph (a).
- (xxi) Dilution of wastes or sewerage in order to meet any water quality standard or guideline shall not be permitted; and
- (xxii) Transfer of wastewater discharges from a point source to a non-point source as well as transfer of pollution from one medium to another shall not be permitted.

## **6.4 Procedures**

In order to achieve the overall objective of the Programme the following sub-programmes will be developed and implemented simultaneously/sequentially:

- 6.4.1** Water Pollutant Registration
- 6.4.2** Water Pollution Permitting
- 6.4.3** Best Management Practices
- 6.4.4** National Water Quality Standards
- 6.4.5** Monitor and Control Environmental Incidents
- 6.4.6** Watershed Management Programme
- 6.4.7** Non-Point Source Pollution Control Programme
- 6.4.8** Inter-Governmental Approach to Remedy Abandoned and Malfunctioning Sewage Treatment Plants
- 6.4.9** Laboratory Registration and Certification Programme

The Authority has other programmes that will assist in preventing and reducing water pollution these include:

- the development of market based instruments in the environmental code;
- the national environmental information system;
- the public awareness/education campaign;
- the designation of environmentally sensitive areas and species; and
- the issuance of certificates of environmental clearance.

This document seeks to address all the sub-programmes identified above with special emphasis on Water Pollutant Registration and Water Pollution Permitting System as legislated for in the Water Pollution Rules 2001 (Appendix IV).

### **6.4.1 Water Pollutant Registration**

Section 52(3) of the Act mandates the Authority to make procedures for the registration and further characterisation of significant sources of any ongoing and intermittent releases of water pollutants into the environment. Aside from meeting this legislative requirement, this provision would allow the Authority to build on the existing pollutant inventory, provide the public with information affecting their health and livelihood and assess the effectiveness of its Programme. The procedures for registration of sources will include the making of a rule under Section 26(a) of the Act requiring that persons, who release water pollutants, register with the Authority. The information from the registration process will also be inputted into the water polluters' register. The following are some of the specific benefits of implementing such a system:

#### **Benefits to the government: -**

- Who are the sources of water pollutants in the country
- What and how much pollutants are being discharged
- What is the geographical distribution of the sources of water pollutants (identifying "hot spots", prioritizing action)
- Monitor progress on pollution reduction plans and track trends over time
- Plan for possible emergencies from the kinds of discharges that could occur under emergency circumstances

**Benefits to the public: -**

- Access to information would enable informed participation in environmental decision making
- Well informed communities can take measures to protect themselves from any chemical related risk

**Benefits to the water pollutant source: -**

- Data reported on can stimulate the use of more efficient processes thereby reducing effluent quality and at the same time increase profits
- Comparison of data within facilities and sectors can spur opportunities for cleaner production
- Information shared with the public can build trust and confidence and lead to better public image

**6.4.1.1 Who Must Register****Inclusion**

Any entity engaged in activities, which release water pollutants outside the conditions or levels as identified in Table I must register with the Authority as a source of water pollutants. These include any person who is involved in the following activities:

- The construction, installation, modification or operation of any sewerage facility or any extension or addition thereto;
- The construction, installation or operation of any industrial, commercial, institutional or agricultural establishment or any extension or modification thereof or addition thereto, the operation of which would cause the discharge of wastes into surface and ground water or would otherwise alter their physical, chemical and biological properties in any manner not already lawfully authorised.

**Exemptions**

- Discharges authorised by a component governmental entity into sewerage facilities owned and/or operated by such competent governmental entity;
- Discharges from households except where such households contain industrial or commercial facilities; and
- Operational discharges from motor vehicles.

**6.4.1.2 Registration Information**

The information required for registration is described in Form A along with instructions (Appendix V for Forms A, B and C).

The types of information include:

- Application type;
- Stage of activity;
- Age of facility;
- Name, mailing address, facility contact, and facility location;
- Brief description of the nature of business including products, raw materials and processes;
- Number of employees at facility;

- Discharge characteristics;
- Improvements; and
- Other pertinent information.

#### **6.4.1.3 When to apply**

Persons discharging water pollutants are required to register as a source of water pollutants within 45 working days of the Rules becoming law. Persons proposing to discharge water pollutants must register within 45 working days before actual discharge. Registered entities must renew their registration every three- (3) years. Persons with a valid permit are not required to renew their registration.

#### **6.4.1.4 Registration Process**

The registration process begins with entities discharging water pollutants submitting an application form and payment of a prescribed fee (see section Appendix VI for Fee Determination). Once the form has been completed a determination will be made whether the applicant requires a registration certificate or not or whether more information is needed. This requirement will be communicated to the applicant via an acknowledgment form letter (Form B, Appendix V). After receiving the acknowledgment notice if the applicant is determined to be a source of water pollutants a registration certificate (Form C, Appendix V) would be issued which is valid for three years.

The process of registration as a source of water pollutants begins with application submission and payment by the applicant, checking for completeness and referencing, technical evaluation, mailing out acknowledgement notices and certificates, archiving, analysing and maintaining a water polluters register and database (see Figure 1).

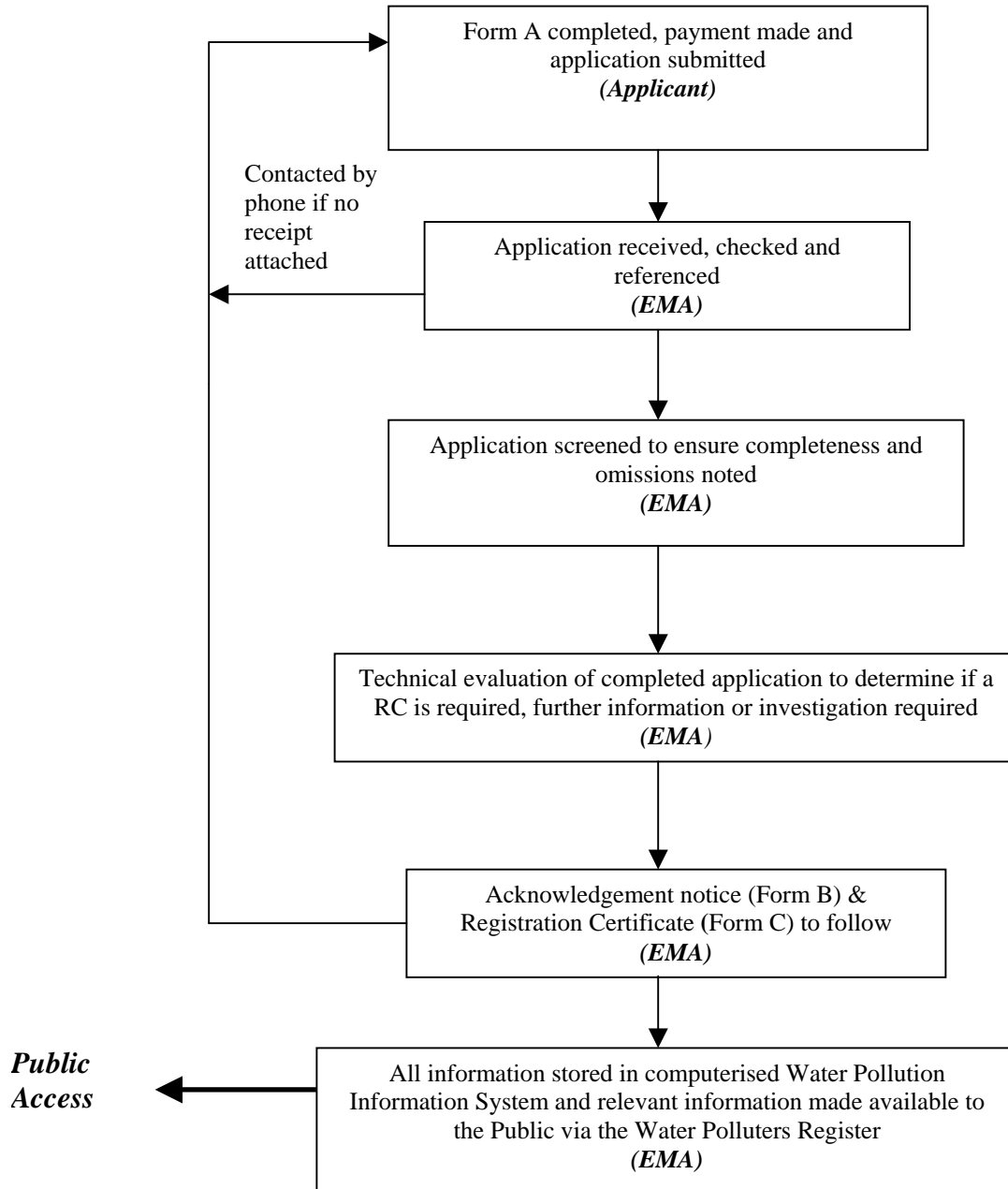
#### **6.4.1.5 Water Polluters Register**

A water polluters register will be developed and maintained by the Authority for public disclosure and will include particulars of or relating to:

- Every source application and permit application
- Every registration certificate and permit
- Discharge characterisation of every registee or permittee
- Status of all permits
- All enforcement proceedings (variation notices, enforcement, revocations, appeals, convictions and other such matters)
- Every refusal to grant or deny a source registration or permit
- Inspection reports
- Ministerial directions
- Other relevant information

It is the intention of the Authority to set up the register so that the public will have access either electronically (EMA's Web site) or through printed media.

**Figure 1. Process of Registration as a Source of Water Pollutants**



#### **6.4.1.6 Rights and Obligations**

Registration as a source of water pollutants is only a record that a polluting entity exists. Although facilities cannot operate without it, it does not by itself represent any endorsement, licence or permit to operate by the Authority.

Registration is not transferable to new owners or locations.

Facilities that have undergone modifications that result in substantial alterations of their original application information are required to re-register with the Authority.

Falsification of application information or failure to comply with other requirements of the registration process may result in cancellation of registration status, a fine may also be imposed.

#### **6.4.2 Water Pollution Permitting**

As mentioned earlier, TTBS has already produced voluntary standards for discharge of effluent from industrial processes and domestic wastewater treatment plants into the environment. The Authority's investigation of the environment to date indicates that the majority of the entities currently discharging water pollutants **do not comply** with these Standards. In many instances any attempt to immediately meet these standards by existing pollution sources would result in an onerous burden on the financial and human resources and have widespread negative effects on the economy.

Recognising that a healthy economy and a healthy environment are defining elements of sustainable development, the Authority plans to use a flexible approach to achieve compliance with discharge standards. To accomplish this water pollution permit system will be developed and will be used to control and reduce point source discharges.

*A permit is typically a license for a facility to discharge a specified amount of a pollutant into a receiving water body under certain conditions.*

As a measure of practicality not all sources of water pollutants will be required to obtain a water pollution permit at this time. To achieve this all water pollutant sources whose effluent quality are outside the conditions or levels specified in Table II (i.e Schedule II of the Rules) will be notified by the Authority to apply for a water pollution permit and be phased into compliance through performance targets. The Authority has determined that this approach although permitting water pollutants at a higher levels to be discharged into the environment in the first instance will ensure that the internal resources will not be overwhelmed and at the same time offer an incentive to the regulatory community to achieve environmental objectives below Table II.

**Table 2. MAXIMUM PERMISSIBLE LEVEL OR CONDITION OF WATER POLLUTANTS DISCHARGED INTO THE ENVIRONMENT**

No.	Water Pollutants Parameters or Substances	Level or Condition			
		Inland Surface Water	Coastal Nearshore	Marine Offshore	Environmentally Sensitive Areas /Groundwater
1	Temperature	35	40	45	NIAA
2	Hydrogen ion (pH)	6-9	6-9	6-9	6-9
3	Five day Biological Oxygen Demand (BOD <sub>5</sub> at 20°C)	30	50	100	10
4	Chemical Oxygen Demand (COD)	250	250	250	60
5	Total Suspended Solids (TSS)	50	150	200	15
6	Total Oil and Grease (TO&G) or n-Hexane Extractable Material (HEM)	10	15	100	No discharge
7	Ammoniacal Nitrogen (as NH <sub>3</sub> -N)	10	10	10	0.01
8	Total Phosphorus (as P)	5	5	5	0.1
9	Sulphide (as H <sub>2</sub> S)	1	1	1	0.2
10	Chloride (as Cl <sup>-</sup> )	250	NIAA	NIAA	NIAA
11	Total Residual Chlorine (as Cl <sub>2</sub> )	1	1	2	0.2
12	Dissolved Hexavalent Chromium (Cr <sup>6+</sup> )	0.1	0.1	0.1	0.05
13	Total Chromium (Cr)	0.5	0.5	0.5	0.1
14	Dissolved Iron (Fe)	3.5	3.5	3.5	1.0
15	Total Petroleum Hydrocarbons (TPH)	25	40	80	No discharge
16	Total Nickel (Ni)	0.5	0.5	0.5	0.5
17	Total Copper (Cu)	0.5	0.5	0.5	0.01
18	Total Zinc (Zn)	2	2	2	0.1
19	Total Arsenic (As)	0.1	0.1	0.1	0.01
20	Total Cadmium (Cd)	0.1	0.1	0.1	0.01
21	Total Mercury (Hg)	0.01	0.01	0.01	0.005
22	Total Lead (Pb)	0.1	0.1	0.1	0.05
23	Total Cyanide (as CN <sup>-</sup> )	0.1	0.1	0.1	0.01
24	Phenolic Compounds (as phenol)	0.5	0.5	0.5	0.1
25	Radioactivity	NIAA	NIAA	NIAA	NIAA
26	Toxicity	NATE	NATE	NATE	NATE
27	Faecal Coliforms	400	400	400	100
28	Solid Waste	NSD	NSD	NSD	NSD

<sup>a</sup> all units are in milligrams per litre (mg/L) except for temperature (°C), pH (pH units), faecal coliforms (counts per 100ml), radioactivity (Bq/L) and toxicity (toxic units).

NIAA – no increase above ambient

NATE – no acute toxic effects

NSD – no solid debris

The limits in Table II have been derived by due consideration of the information contained in the Standards (TTS 417:1993 and TTS 547: 1998), international effluent limitations guidelines as contained in the UMA Environmental (1997), as well as the Authority's best professional judgement. The underlying principle in deriving Table II was setting the minimum level of treatment for all point source discharges based on currently available treatment technologies while allowing the discharger to use any available control technique to meet the limitations (i.e. technology-based).

It should be pointed out here that in the absence of promulgated water quality standards these limits may not be fully protective of the receiving waters (i.e. they are not water quality-based). The Authority recognises the need for water quality-based effluent limits as this affords overall environmental protection but the lack of either numeric or narrative standards for water bodies and the need for water use classification negates this. Once the mechanism has been instituted that would allow for the development of water quality standards for water bodies or segments thereof then the Authority will be in a better position to develop permit limits that are more protective of human and environmental health.

The use of voluntary or mandatory compliance with national standards (i.e. TTS 417:1993 and TTS 547:1998) was seen as an alternative strategy to control and reduce water pollution from point sources, but as mentioned previously will cause severe economic hardship and have no beneficial results. However, the water permitting system has far greater flexibility in controlling point source discharges through the use of effluent limitations, compliance responsibilities and best management practices, and has been fairly successful in countries that have adopted such programs.

Like the water pollutant registration system a number of specific benefits can be realised from implementing a water pollution permitting system:

**Benefits to the government: -**

- Who are the significant point source dischargers in the country
- What and how much water pollutants being discharged
- What is the geographical distribution of the permitted sources
- Monitor progress on pollution reduction plans and track trends over time
- Plan for possible emergencies from the kinds of discharges that could occur under emergency circumstances

**Benefits to the public: -**

- Access to information would enable informed participation in environmental decision making
- Well informed communities can take measures to protect themselves from any chemical related risk
- Reduced levels of water pollutants in the environment and improvement in the quality of life

**Benefits to permitted entity: -**

- Data reported on can stimulate the use of more efficient processes thereby reducing effluent quality and at the same time increase profits
- Comparison of data within facilities and sectors can spur opportunities for cleaner production
- Information shared with the public can build trust and confidence and lead to better public image

**6.4.2.1 Who will be required to get a permit**

**Inclusions**

Any entity who release water pollutants other than the conditions or levels specified in Table II may be notified by the Authority to get a permit. This includes any person who is involved in the following activities:

- The construction, installation, modification or operation of any sewerage facility or any extension or addition thereto;
- The construction, installation or operation of any industrial, commercial, institutional or agricultural establishment or any extension or modification thereof or addition thereto, the operation of which would cause the discharge of wastes into water or would otherwise alter their physical, chemical and biological properties in any manner not already lawfully authorised.

**Exemptions**

- None

**6.4.2.2 Variances to Permit Requirements**

A variance is any mechanism or provision, which allows modification to or waiver of the general applicable effluent limitations requirements or time deadlines of the Programme. To address unique permitting situations, the Programme regulations will allow permit writers to grant variances under certain prescribed conditions. These variances may apply to either technology-based permit requirements as well as variance from the prescribed preservation techniques, container materials, maximum-holding times for samples, sample collection and analysis technique, and monitoring frequency. Whichever situation it addresses, an application for a variance usually involves very specific data that has to be provided by the applicant before the variance is granted. The burden of proof lies with the entity requesting the variance.

A permittee may apply for a variance (less stringent) from effluent limits as specified in the permit. In order for the request to be granted the applicant must demonstrate that such effluent limits will not interfere with attainment or maintenance of water quality to protect public water supplies, or with protection and propagation of a balanced indigenous community of biota and wildlife and will allow recreational activities in and on the water. Also the modified requirement will not result in quantities of pollutants that may reasonably be anticipated to pose an unacceptable risk to human health or the environment, cause acute or chronic toxicity, or promote synergistic properties.

Alternatively the Authority may tighten the limits in a previous permit after analysing the effect of the discharge on the receiving water, as the discharge limits may not be sufficiently stringent to meet the water quality standards.

Applications for variances may be made by letter to the Authority. Sufficient data should be provided to support the claim. Such data will be technically reviewed and recommendations for action on the variance application. After review the Authority may grant a variance applicable to the specific change to the applicant. A decision to approve or deny a variance will be made within 90 days of receipt of the application by the Authority.

#### **6.4.2.3 Permit Application**

There are three types permit application forms specific to the particular activity is question (Appendix V, Forms E, F & G).

The types of information include:

- Application Type
- Stage of Activity
- Name of facility
- Facility Contact
- Corporate Data
- Confidentiality request
- Topographic map showing the location of the facility, existing or proposed intake and discharge structures, treatment and disposal facilities as well as surface water bodies
- Improvements
- Intake and Discharge Characteristics
- Certification
- Other Relevant Data

#### **6.4.2.4 When to apply**

On notification by the Authority persons are required to fill out and submit a completed application within 30 working days of notice along with a prescribed fee (Appendix VI for Permit Fees).

#### **6.4.2.5 Water Polluters Register**

The information contained in the permit application form as well as from the registration process will be used by the Authority to maintain the register (see section 6.4.1.5).

The public will have access to the register either electronically (EMA's Web site) or through printed media.

#### **6.4.2.6 Overview of the Permitting Process**

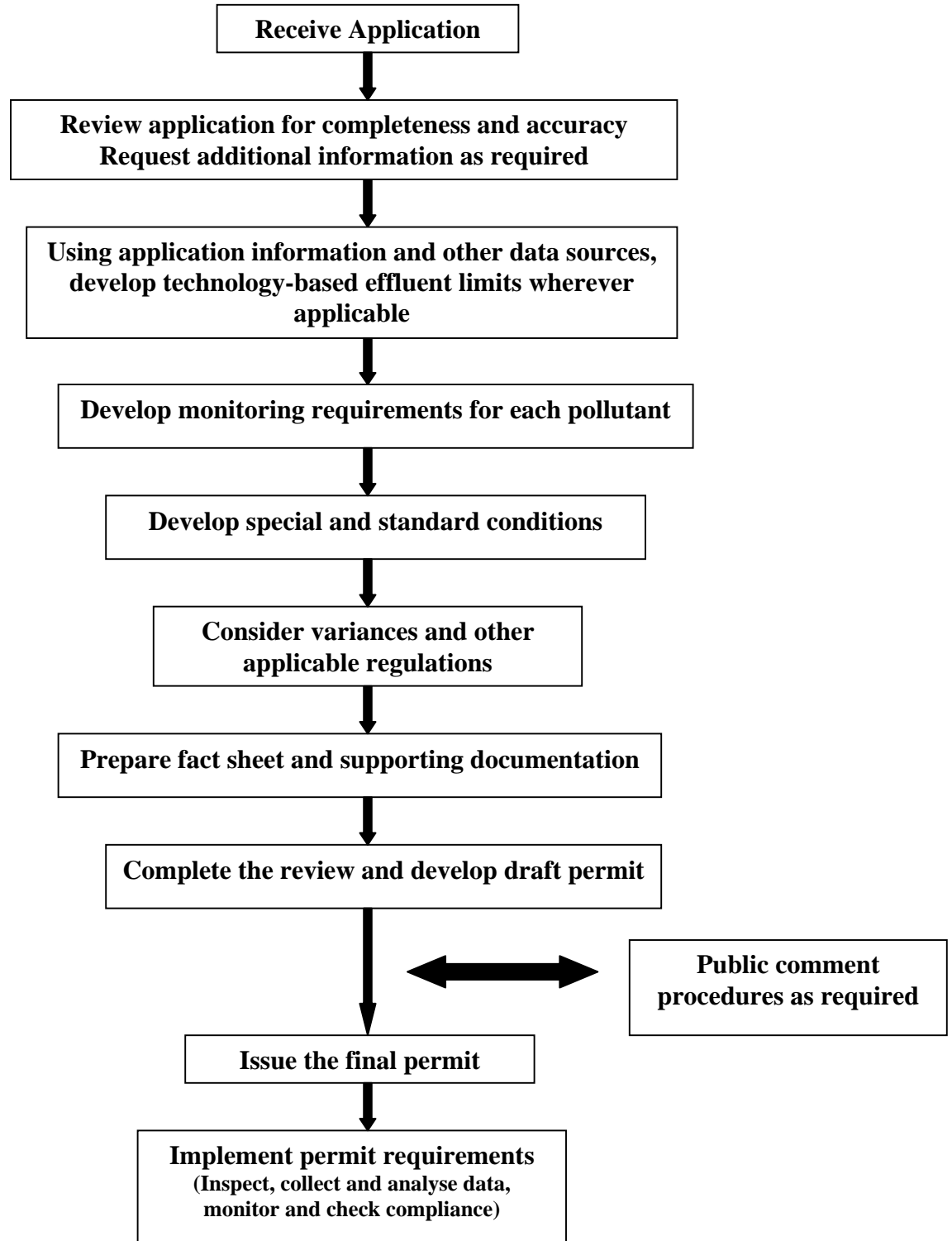
While the limits and conditions in an individual permit are unique to the permittee, the process used to develop the limits and conditions, and issue the permit, will generally follow the steps outlined in Fig.2. It is envisaged that for the first rounds of permits issued by the Authority the conditions would be based on the permit writer's best professional judgement as it is envisaged that many facilities would not have significant monitoring datasets and detailed engineering analysis to satisfy strict effluent limitations..

The permitting process begins when an application is submitted by the owner/operator of a facility. After receiving the application the permit writer reviews the application for completeness and accuracy. When the application is determined to be complete, the permit writer begins to develop the draft permit and the justification for the permit conditions (also referred to as the fact sheet or statement of basis) based, in part, on the application data.

Using the information supplied by the permittee and any other pertinent data, the permit writer develops a permit which would normally contains five main sections:

- Cover page – typically contains the name and location of the permittee, a statement authorising the discharge and the specific locations for which a discharge is authorised;
- Effluent limits - the primary mechanism for controlling discharges of pollutants;
- Monitoring and reporting requirements - used to characterise the effluent stream, evaluate wastewater treatment efficiency, and determine compliance with permit conditions;
- Special conditions - conditions developed to supplement discharges e.g. best management practices, additional monitoring activities, stream surveys etc.; and
- Standard conditions – pre-established conditions that apply to all permits and delineate the legal, administrative and procedural requirements of the permit.

**Figure 2. Major Steps Involved in Developing and Issuing Permits**



Under certain circumstances as to be determined by the authority the public will have an opportunity to participate in the permitting process. At such time a public notice will be issued announcing the permit and interested parties may submit comments regarding the draft permit. Based on the comments, the Authority then finalises the permit, with careful attention to documenting the process and decisions for the administrative record.

Permits may be issued on sectorial or watershed basis in order not to overwhelm the resources of the Authority. Priority will be exercised where economic sectors have a high pollution impact or where watersheds due to their valued importance as public water supply have been identified. Once determined individuals operating in such economic sectors and watersheds will be notified by the Authority (registered or not) to apply for a permit thereby initiating the permitting process.

Failure to come to an agreement with the Authority can result in permit denial and continued non-compliance to conditions stated in a permit can result in a permit being revoked.

The following lists the type of information that may be contained in a permit:

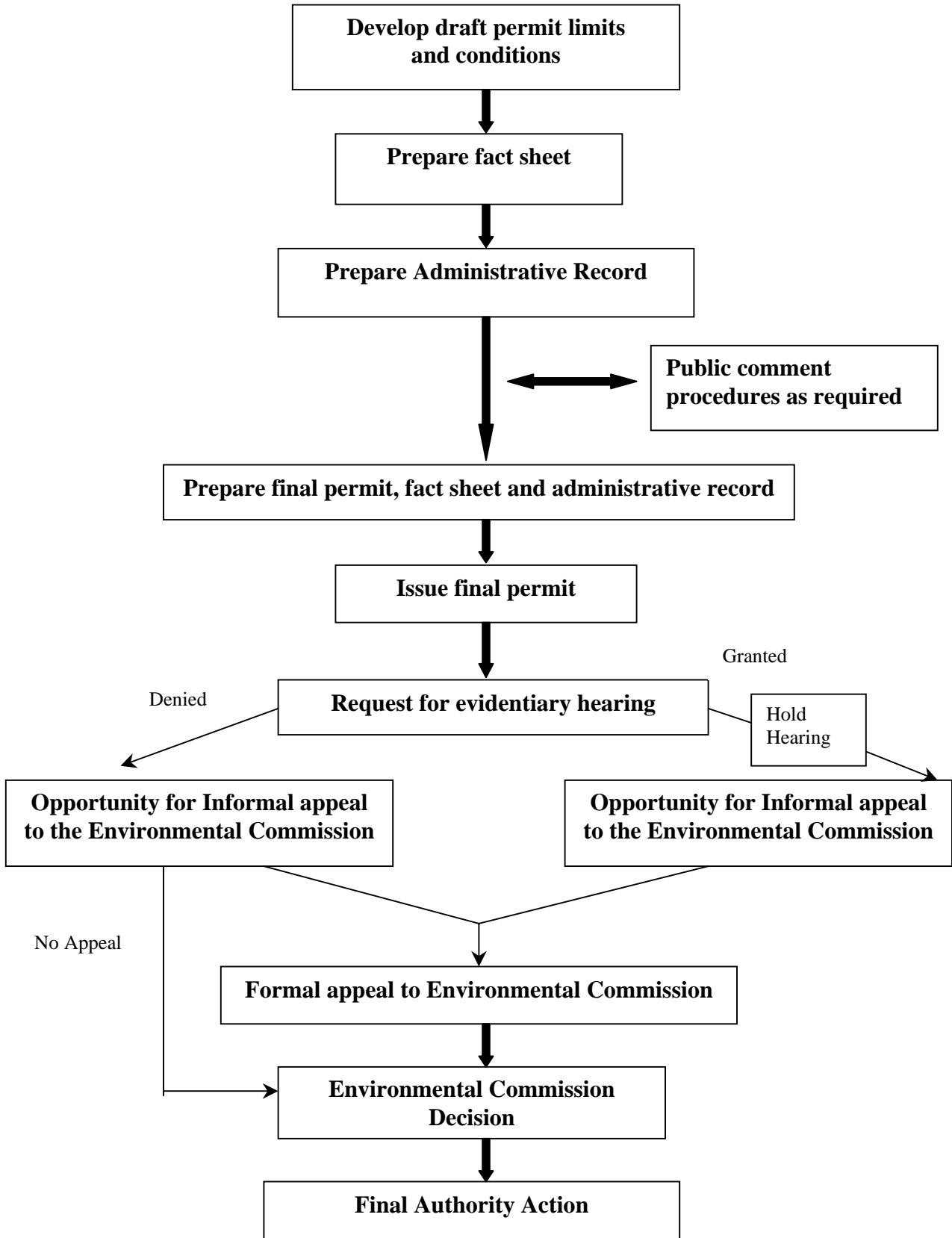
- Number of years for which permit is valid ( maximum of 5yrs.) and conditions for renewal, withdrawal, reissue or modification;
- Permits are non-transferable to new owners or similar facilities without approval of the Authority;
- Specify site-specific discharge limits or conditions;
- Negotiation of partial and phased compliance standards;
- Standard and site-specific compliance monitoring and reporting requirements;
- Special conditions (BMP plans, river surveys, storm water management, etc.)
- Consent to inspections and review of monitoring data;
- Statement about enforcement for non-compliance;
- Requirement to report violations and anticipated non-compliance as well as mitigate damage caused;
- Specify conditions for revocation of permits (consistent non-compliance to agreed conditions, falsifying reporting information, etc.); and
- Other relevant information.

#### **6.4.2.7 Permitting Administrative Process**

The administrative process associated with the issuance of a permit includes the following and the steps are outlined in Figure 3:

- Documenting all permit decisions;
- Providing public notice as required, conducting hearings (if appropriate) and responding to comments; and
- Defending the permit and modifying it (if necessary) after issuance.

**Figure 3. Permit Administrative Process**



## **6.4.2.8 Analysis of Various Permit Fee Models**

### **6.4.2.8.1 Introduction**

Research has revealed the use of several mechanisms to calculate permitting fees with respect to the discharge of liquid effluents. Permitting is more a feature of the legal environmental regime of the United States and research activities were centred on the different mechanisms employed by various states.

In terms of the needs of Trinidad and Tobago, certain basic parameters were established and these are as follows:

1. The system should be relatively simple and easy to administer.
2. The permitting system should generate adequate revenue to cover the costs of the permit programme.
3. It should be equitable both in terms of ability to pay and actual levels of pollution.
4. Permitting fees should not only reflect the cost of granting the permit but also the impact on the environment. Basically, there should be consideration of the polluter pay principle so as to achieve ultimately a more responsible attitude towards the discharge of liquid effluents.

Several permitting models have been noted and these will be briefly described taking into account their relative advantages/disadvantages within the perspective of the requirements of the EMA.

In developing an appropriate permitting model, two main points must be noted. First, there is no real analysis on the number of permits that may be issued based on the information as to the number of commercial enterprises. Using WASA list of commercial consumers to generate such data is suspect on two levels. This list is not an accurate indicator of actual discharge rather of consumption and the two cannot be equated and the list also is not an appropriate reflection of the liquid effluent profile of a particular waste stream. Second, there is little data on the actual pollution load of the wastewater stream of commercial entities in Trinidad and Tobago.

### **6.4.2.8.2 Permit Fees Models**

#### **MODEL 1 – ACTUAL COST MODEL**

This method of permitting takes into consideration the actual cost of the overall permitting programme and develops an hourly rate for performing the permitting activity. The actual fees are primarily derived on the basis of an estimation of the actual number of hours it takes to take a given permit through the complete permit issuance process.

This method achieves a high degree of cost recovery, as the permitting is re-imbursed its full cost. Further, this method achieves some level of equity, in that the bigger operations with more complex operations are required to pay more for their permits.

However, this method do not reflect the fact that smaller and simpler operations that generate significant pollutants may benefit from a faster permitting process without the cost of the permit reflecting the environmental impact of the release of the pollutants. An even more serious concern is the fact that the hourly rate may not adequately reflect the true learning curve in acquiring permitting expertise and therefore the first wave of entities being permitted may be required to pay an inequitable amount of the administrative costs.

#### MODEL 2 - THE EGALITARIAN APPROACH

This model suggests an identification of the total permitting cost on a yearly basis and an estimate of the number of permits that the EMA anticipate will be issued. The total permitting cost is divided by the anticipated number of permits and the resulting figure is deemed to be the permitting cost.

This is a simple model that will be quite easy to administer. However, it suffers from several inherent deficiencies such as the failure to distinguish between ability to pay; lack of consideration of pollution profile and load profile; and impact of pollutant on the environment.

#### MODEL 3 - THE EQUITBLE/EGALITARIAN APPROACH

This model is somewhat popular and is based on model 2 above. The major distinction is that permits are divided into three categories based on gross revenue and described as minor, medium and major. Thus, commercial entities are placed in a particularly category as determined by the EMA and the cost of the permit is based on such placement. Again, an estimate must be developed as to the number of permits to be issued in each category on a yearly basis and an apportionment done to ensure full recovery of the overall costs of the permitting programme.

While this model makes some attempt at ensuring equity by not imposing on low-income level permittees an unreasonable permitting cost, this model fails to consider pollution load. It is conceivable that a low income permittee can generate pollutants that are extremely harmful to the environment and yet pay permitting fees at a lower level than that paid by a high income permittee who may release more benign pollutants into the environment.

#### MODEL 4 – EQUITABLE/POLLUTION LOAD/EGALITARIAN APPROACH

This is a variation of models 2 and 3. The only deviation is to develop a formula that would not only consider revenue stream as a means of ensuring equity but also actual level of pollutants discharged. The adding of new variables can make it more complex to administer.

#### MODEL 5 – VOLUME INTAKE/DISCHARGE

This model operates at two levels. First, one can simply look at the volume of water being purchased by a consumer and then base a permit fee on that basis. The variation to this is to look at the discharge end and simply base the permitting fee on discharge volume.

The advantages of this model are mainly the fact that it would be easy to identify the number of permittees based on WASA report of its commercial customers. This is particularly so if the fees are to be based on water purchases. This system would be simple to administer and have some equity due to the fact that the larger dischargers or purchasers would pay more.

However, despite the advantages of the model, it is not equitable in reality due to the situation of having people pay either on consumption or discharge. Large consumers like soft drink factories would pay more for permits, similarly large volume dischargers with low pollutant loads would be penalised. This model in no way contemplates the imposition of permitting fees in relation to actual pollution load. Further, the ability to impose punitive measures would be lost as this can only be based on actual misconduct.

#### MODEL 6 - THE POLLUTION LOAD APPROACH

The pollution load model is perhaps the most suitable one for ensuring that the environmental imperatives are satisfied together with the cost recovery requirement of the permitting agency. Basically, this model operates on several levels.

Essentially, the Fees paid are based on those pollutants included in the permit; the environmental harm caused by the pollutants discharged; the quantity of the pollutants discharged and the quality of the water receiving the discharge. This method of setting permit fees is big in Wisconsin and the state has been effective in achieving full recovery of its cost.

In Wisconsin the limits of permits are said to be the measure of both the environmental harm and quality of the receiving water, and that by inverting the limit established in the permit, as in  $1/\text{limit}$ , we accurately reflect the statutory requirement. To illustrate this consider a 30 mg/l limit versus a 5 mg/l limit -  $1/30 = \$0.03/\text{pound}$  versus  $1/5 = \$0.20/\text{pound}$ , you can see that the lower the limit the higher the fee rate. Wisconsin permits also require compliance monitoring and reporting which gives an indication of the quantity of pollutants discharge. It may be in Trinidad and Tobago that some permittees would not be required to perform monitoring activities to ensure compliance. However, due to the fact that pollution load would be based on pre-estimates, it may be that voluntary monitoring would be pursued.

The law sets the amount of money that the program is to collect. The fees are based on the pollutants in the wastewater and where the wastewater is discharged. Fees collected under the program are deposited in the State's General Fund. The department calculates the total pounds of substances discharged during the year using discharge monitoring and reporting data. By March 1 of each following year, the department will provide the results of these calculations to each discharger for review and correction, and to allow the discharger to deduct substances in the influent. Corrections must be returned to the department by April 1.

The discharge fees are based on calculated discharge pounds, the fee rate in dollars per pound, and an adjustment factor. The fee rate is the inverse of the permit limit for the discharge of a substance. For example, if the BOD5 limit is 30 mg/l then the fee rate is 1/30 or \$0.033 per pound. The adjustment factor is needed to collect the required amount, and applies to all discharges.

FORMULA - average daily flow x average daily concentration x 8.34 = pounds per day x discharge days in a month = pounds per month x fee rate (inverse of permit limit for a parameter at that outfall) x adjustment factor.

EXAMPLE - 1.0 mgd x 30 mg/l x 8.34 = 250.2 (lbs/day) x 30 (days) = 7506 (lbs/month) x 0.033 = \$247.70 (month) x adjustment factor = monthly fee. This formula would need to be done for every month.

The annual wastewater fee is the greater of the total of discharge fees or the base fee. The base fee \$250 for dischargers with a minor permit, or \$500 for dischargers with a major permit. The Environmental Fee Statement, mailed to each discharger around the first of June, documents the fee calculation. Payment is required within 30 days.

This Wisconsin model is quite useful as it provides equity in the sense that the polluter pays according to discharge load and is not penalised for merely being a company with a high gross revenue stream. In addition by considering where discharge is taking place, measures can be taken to protect more sensitive water zones. Finally, basing a model on load based pollution ensures full implementation of the polluter pay principle.

**6.4.2.8.3 Analysis**

It is proposed to assess the merits/demerits of the various permit fees models using the following point scale:

- Cost Recovery - 30
- Equity - 30
- Simplicity - 15
- Punitive - 25

Marks	Actual Cost Recovery	Egalitarian Approach	Equitable/Egalitarian Approach	Equitable/Pollution/Egalitarian Approach	Volume Intake/Discharge	Pollution Load Approach
Cost Recovery	25	20	20	20	20	20
Equity	20	00	15	25	10	27
Simplicity	12	12	08	06	13	08
Punitive	15	15	15	15	10	17
Total	72	47	58	66	53	72

The above analysis is entirely subjective and it is the Authority’s expert opinion that Model 6 (i.e. the pollution load approach) is perhaps the most equitable and will be used as the basis for determining water pollution fees.

#### **6.4.2.9 Rules and Public Participation**

According to Section (26 a, b, c, d, and j) of the Act the Minister may make rules for negative resolution of parliament for:

- procedures for registration of sources of water pollutants;
- quantity, condition or concentration of water pollutants;
- procedures and standards for permits;
- the form and manner for applying for a permit and revoking, suspending, varying or cancelling a condition in that permit; and
- procedures and standards for the periodic or continual monitoring of pollutants releases in conjunction with any process, activity, vehicle or premises.

Sections (27 and 28) of the Act mandates the Minister and the Authority in developing the rules above make provision for public participation through the public comment procedure.

Once the Rules are finalized by the Authority the public will be notified through the printed media about the major issues and concerns, and reasons for such action. The public will have not less than 30 days from the date of the notice to submit written comments about the proposed action. If the Authority determines that there is sufficient public interest it may hold a public hearing for discussion of the proposed action and receive verbal comments.

Following the public comment procedure and/ or public hearing the proposed Programme and Rules will be revised as the Authority sees fit and published in the Gazette to be laid in parliament.

Only reasonable arguments with supporting factual material will be considered in the public comment procedure. However, the Authority may find it good practice to inform all parties who provide public comments that their comments have been received and are being considered.

Only permits that the Authority considers, as being in the interest of the public will follow the public comment procedure as stated above.

#### **6.4.2.10 Resources**

The office with responsibility for managing the Programme will recruit and train staff and procure equipment in order to implement the procedures associated with the water pollutant registration and permitting process.

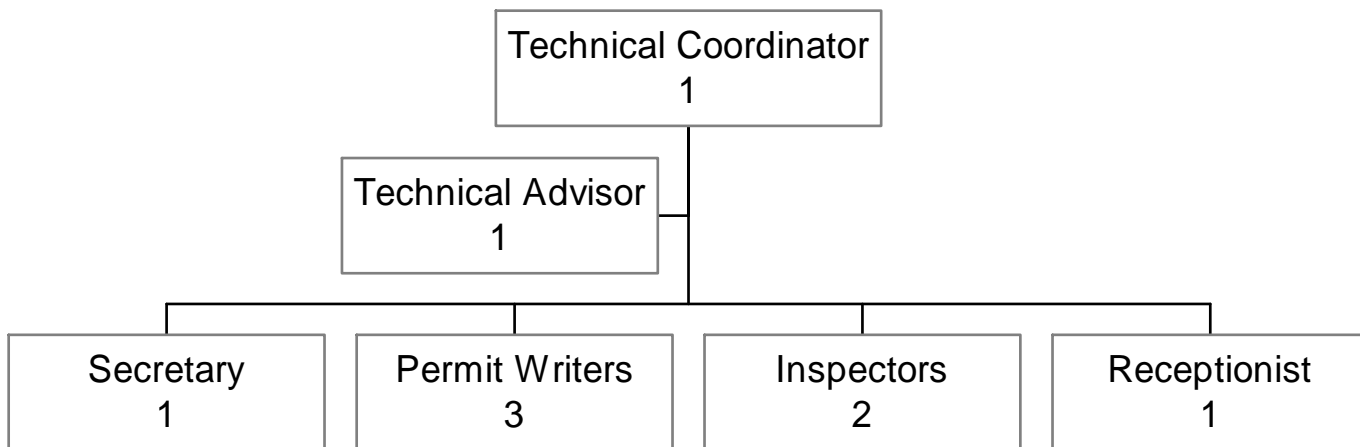
##### **6.4.2.10.1 Human Resources**

The Table 3 lists the human resources along with their main responsibilities for managing the water pollutant registration and permitting process. It is intended that the Authority will discharge its functions with little support from other participating agencies and Figure 4 shows an organisational chart structure for managing the water pollutant registration and permitting system.

**Table 3. Resource and Responsibility Requirements for the Water Pollutant Registration and Permitting System**

<b>Resources</b>	<b>Responsibilities</b>
Technical Co-ordinator	<ul style="list-style-type: none"> <li>▪ Manage division</li> <li>▪ Refine the permitting process</li> <li>▪ Issue registration certificates</li> <li>▪ Issue permits</li> </ul>
Technical Advisor	<ul style="list-style-type: none"> <li>▪ Assist small industry in designing compliance programmes.</li> <li>▪ Assist permit writers in negotiations</li> <li>▪ Identify project for financial assistance</li> <li>▪ Assist in permit appeals</li> </ul>
Permit Writers	<ul style="list-style-type: none"> <li>▪ Review permit application</li> <li>▪ Develop draft permit limits and conditions</li> <li>▪ Negotiate and modify permit conditions</li> <li>▪ Prepare administrative record</li> <li>▪ Assist in inspections, enforcement and permit appeals</li> </ul>
Inspectors	<ul style="list-style-type: none"> <li>▪ Verify application information.</li> <li>▪ Check compliance with permit requirements</li> <li>▪ Compliance/non-compliance reports</li> <li>▪ Assist in enforcement proceedings</li> </ul>
Data Processors (external)	<ul style="list-style-type: none"> <li>▪ Input permit application data and other data in the permit information database</li> <li>▪ Update and maintain register</li> </ul>
Secretary	<ul style="list-style-type: none"> <li>▪ Distribute forms</li> <li>▪ Provide information to the public</li> <li>▪ Assist in information follow up Provide secretarial support to above staff</li> <li>▪ Assist in information follow up</li> </ul>
Sector Consultant (external)	<ul style="list-style-type: none"> <li>▪ Provide technical assistance to the public</li> <li>▪ Assist in reviewing and developing permit limits and conditions</li> <li>▪ Assist in preparing administrative record</li> <li>▪ Assist in inspections, enforcement and permit appeals</li> </ul>
IT Consultant (external)	<ul style="list-style-type: none"> <li>• Design and maintain register</li> <li>• Design and maintain the permit information database</li> <li>• Provide all information support to the permitting process</li> </ul>

Figure 4. Organisational Structure for the Water Pollutant Registration and Permitting System



### 6.4.3 Best Management Practices (BMPs)

Best management practices (BMP) are inherently pollution prevention (P2) practices and in many situations can be considered one and the same thing. Traditionally, BMPs have focused on good housekeeping measures and good management techniques intended to avoid contact between pollutants and water media as a result of leaks, spills, and improper waste disposal. However, BMPs now include the universe of pollution prevention encompassing production modifications, operational changes, material substitution, materials and water conservation, and other related measures. The concept of BMP and P2 is really one of source reduction and waste minimisation that is reflected in the preferred environmental waste management strategy as depicted in Figure 5. Although BMPs does not necessarily target a single media, its applicability to the overall Water Pollution Management Programme and its supplement control in water pollution permits is of major importance. In order to provide guidance to the permitting process in the development of BMPs the following sections have been extracted from the USEPA (1993) document entitled “Guidance Manual for Developing Best Management Practices (BMP)”.

#### 6.4.3.1 BMP Applicability

According to Rule 16, 2(g) of the WPR2000 permittees shall at all times carry out and maintain best management practices and as such will have to develop BMPs as part of the water pollution permitting system in order to control and reduce releases. BMP may apply to an entire site or be appropriate for discrete areas of a particular activity. Many of the same environmental controls promoted as part of a BMP plan may currently be used by certain facilities in Storm Water Pollution Prevention (SWPP) plans, Spill Prevention Control and Countermeasure (SPCC) plans, Occupational Safety and Health Administration (OSHA) safety programmes, fire protection programmes, insurance policy requirements or standard operating procedures. Additionally, where facilities have developed P2 programmes, controls such as source reduction and recycling/reuse may be similar to those for use in a BMP plan. The following basic questions can be used to establish the scope of BMP plans:

- What activities and materials at the facility are best addressed by BMPs?;
- How do BMPs work?; and
- What are the types of BMPs?

#### What Activities and Materials at a Facility are Best Addressed by BMPs?

The following examples have been found to be amenable to control by BMPs:

- **Material Storage Areas** for toxic, hazardous, raw materials, intermediates, final products or byproducts.
- **Loading and Unloading Operations** involving the transfer of materials by different handling methods to and from vehicles, including in-plant transfers.
- **Facility Runoff** generated principally from rainfall on a facility site.
- **Sludge and Waste Storage and Disposal Areas** including landfills, pits, ponds, and lagoons.
- **Production Process** including operational changes, re-engineering process, material substitution, materials and water conservation

**Figure 5. Environmental Waste Management Hierachy**



### How Do BMPs Work?

- **BMPs are practices or procedures.** They include methods to prevent toxic and other substances from reaching receiving waters. They are most effective when organised into a comprehensive facility BMP plan
- **BMPs are qualitative.** They are designed to address the quality of a facility's practices and may ultimately affect the ability of the facility to meet environmental compliance objectives.
- **BMPs are flexible.** Many different practices can be used to achieve similar environmental protective results.

### What are the Types of BMPs?

BMPs may be divided into general applicable to a wide range of facility operations, and facility specific (process specific) tailored to the requirements of an individual site.

General BMPs (or baseline practices) are widely practised measures that are independent of chemical compound, source of pollutant or industrial category and are typically low cost and easily implemented. Common general BMPs include good housekeeping, preventative maintenance, inspections, security, employee training and recordkeeping and reporting.

Facility-specific BMPs are measures used to control releases associated with individually identified toxic and hazardous substances and /or one or more particular ancillary source. They are often developed when a facility notes a history of problem releases of toxic chemicals or when a facility's personnel believe that actual or suspected pollutant discharge problems should be addressed. Facility-specific BMPs may include many different practices such as source reduction and onsite recycle/reuse.

#### 6.4.3.2 Components of BMP Plans

The elements of a good BMP plan can be separated into three phases:

1. **Planning** includes demonstrating management support for the BMP plan and identifying and evaluating areas of the facility to be addressed;
2. **Development and Implementation** to ensure that its implementation will prevent or minimise the generation and the potential for release of pollutants from the facility; and
3. **Evaluation/Re-evaluation** consists of an assessment of the components of a BMP plan and review of plan components periodically or as a result of factors such as environmental releases and /or changes at the facility.

Suggested elements of a general BMP plan is shown below

### **Planning Phase**

BMP committee

- BMP policy statement
- Release identification and assessment

### **Development Phase**

- Good housekeeping,
- Preventative maintenance,
- Inspections,
- Security,
- Employee training and
- Recordkeeping and reporting.

### **Evaluation and Re-evaluation**

- Evaluate plan implementation benefits
- Periodically or as needed, repeat bullet items 1-9

#### **6.4.3.2.1 Planning Phase**

##### **BMP Committee**

A BMP committee is comprised of interested staff within the facility's organisation that represent the company's interest in all phases of plan development, implementation, oversight and plan evaluation. It may function similarly to other committees that exist at a facility (e.g. SPCC committee) and may include the same employees.

The BMP committee's role is to assist a facility in managing all aspects of the BMP plan and shoulder the responsibilities of the following elements:

- Develop the scope of the BMP plan
- Make recommendations to management in support of the BMP policy
- Review any existing accidental spill control plans to evaluate existing BMPs
- Identify toxic and hazardous as well as other releases
- Identify areas with potential for release to the environment
- Conduct assessments to prioritise substances and areas of concern
- Determine and select appropriate BMPs
- Set standard operating procedures for implementing of BMPs
- Oversee the implementation of the BMPs
- Establish procedures for recordkeeping and reporting
- Co-ordinate facility environmental release response, cleanup and regulatory agency notification procedures
- Establish BMP training for facility and contractor personnel
- Evaluate the effectiveness of the BMP plan in preventing and mitigating releases of pollutants
- Periodically review the BMP plan to evaluate the need to update and/or modify the BMP plan.

## **BMP Policy Statement**

A BMP policy statement describes the objectives of the BMP programme in clear, concise language and establishes the company policies relating to BMPs. The policy statement provides two major functions:

1. It demonstrates and reinforces management's support of the BMP plan; and
2. It describes the intent and goals of the BMP plan

The first step in creating a BMP policy statement is determining the appropriate author (e.g. general manager, chief executive officer, managing director, plant manager, etc.). The next step is to craft the specific language which may include references to the company's commitment to being a good environment citizen, expected improvements in plant safety and potential cost savings. Regardless of personal style all policy should indicate the company's support of BMPs to improve overall facility management and introduce the intent of the BMP plan.

## **Release Identification and Assessment**

Release identification is the systematic cataloguing of areas at a facility with ongoing or potential releases to the environment. Release assessment is used to determine the impacts on human health and the environment of any on-going or potential releases identified.

The release identification and assessment process can provide a focus for the range of BMPs being considered on those activities and areas of a facility where risks (considering the potential for release and the hazard posed) are the greatest. In some cases, the assessment may be performed based on experience and knowledge of the substances and circumstances involved. In other cases, more detailed analyses may be necessary to provide the correct focus, and release assessments may then rely on some techniques of risk assessment (e.g. pathway analysis, toxicity, relative risk).

Identifying and assessing the risk of pollutant release for the purpose of a BMP plan can best be accomplished in accordance with a five-step procedure:

- **Reviewing existing materials and plans as a source of information to ensure consistency and to eliminate duplication.** Such information may be contained in preparedness, prevention and contingency (PPC) plans, spill control and countermeasures (SCC) plans, storm water pollution prevention (SWPP) plans, etc.
- **Characterising actual and potential pollutant sources that might be subject to release.** This step may be conducted through assembling a description of facility operations and chemical usage and then verifying information through inspections. A site map or maps covering the entire facility is very useful in this evaluation along with an inventory of raw materials, products and by products.
- **Evaluating potential pollutants based on hazards they present to human health and the environment.** Information may be available from facility safety personnel as well as a variety of technical resource materials.

- **Identifying pathways through which pollutants identified at the site might reach environmental and human receptors.** Identifying pathways of current releases can be accomplished based on visual observation however, potential releases require sound engineering judgement in determining, point of release, direction and rate of flow towards receptors and identifying means of controlling releases. The analyst must consider all pathways carefully in combination with the materials inventory to identify possible release mechanisms and receptor media.
- **Prioritising potential releases.** Using the information from the previous steps along with best professional judgement one can rank actual and potential sources as high medium and or low priority. From these priorities a BMP plan that places the greatest emphasis on BMPs for the sources that present the greatest risk to human health and the environment can then be developed.

#### 6.4.3.2.2 Development Phase

After the BMP policy statement and committee have been established and the release potential identification and assessment has defined those areas of the facility that will be targeted for BMPs, the committee can begin determining the most appropriate BMPs to control environmental releases. The BMP plan should consist of both facility specific BMPs and general BMPs.

All BMP plans should consist of six basic components:

- **Good housekeeping:** A programme by which the facility is kept in a clean and orderly fashion.
- **Preventative maintenance:** A programme focused on preventing releases caused by equipment problems, rather than repair of equipment after problems occur
- **Inspections:** A programme established to oversee facility operations to detect and identify actual or potential problems
- **Security:** A programme designed to prevent accidental or intentional entry that might result in vandalism, theft, sabotage or other improper or illegal use of the facility
- **Employee training:** A programme developed to instil in all employees an understanding of the BMP plan
- **Recordkeeping and reporting:** A programme designed to maintain relevant information and foster communication.

#### 6.4.3.2.3 Evaluation and Re-evaluation

##### Plan Evaluation

Planning, development and implementation of the BMP plan require the dedication of important resources by company management. The benefits derived serve to justify the costs and commitments made to the BMP plan. To illustrate the plan's benefits it may be appropriate and even necessary in some cases to measure the plan's effectiveness.

An evaluation can be performed by considering a number of variables, including:

- **Benefits to employees.** This can be measured in terms of health and safety, productivity and morale. Comparison before and after plan implementation can be used to determine the BMP plan effectiveness (e.g. time off due to injury or illness from exposure to chemicals or production records of workers).

- **Benefits to the environment.** Discharge monitoring report records may show reductions in the quantity or variability of pollutants in the discharges as well as reduced releases resulting from spills, volatilisation and losses to storm water runoff.
- **Reduced expenditure.** Cost consideration can be tracked through expense records including chemical usage, energy usage, and water usage and employee records. The development of production records on product per unit cost before and after plan implementation may show a significant drop, thereby demonstrating the effectiveness of the plan.

### **Plan Reevaluation**

The operations at any one facility are expected to be dynamic and therefore subject to periodic change and as such the BMP plan must reflect these changes. At a minimum the BMP plan should be revisited annually to ensure that it fulfils its stated objectives and remains applicable. This time dated approach allows for the consideration of new perspectives gained through the implementation of the BMP plan, as well as the reflection of new directives, emerging technologies and other such factors.

In some case it may be appropriate to evaluate the plan due to the following changed conditions:

- Restructuring of the facility management
- Substantial growth
- Significant changes in the nature or quantity of pollutants discharged
- Process or treatment modification
- New permit requirements
- New legislation related to BMPs (e.g. new OSHA standards)
- Unexpected releases to the environment.

### **6.4.4 National Water Quality Standards**

A water quality standard defines the water quality goals of a water body, or portions thereof, by designating the use or uses to be made of the water, by setting the criteria necessary to protect the uses and by establishing anti-degradation policies and implementation procedures that serve to maintain and protect water quality.

National water quality standards are necessary to protect public health or welfare, enhance the quality of water as well as:

- Include provisions for the restoration and maintaining chemical, physical and biological integrity of the nations waters;
- Provide wherever attainable, water quality for the protection and propagation of fish, shellfish, wildlife and recreation in and on the water; and
- Consider the use and value of the country's water for public water supplies, propagation of fish and wildlife, recreation, agriculture, industrial purposes and navigation.

#### **6.4.4.1 Water Quality Standard**

A water quality standard is comprised of three parts:

- Use classification;
- Numeric and /or narrative water quality criteria; and
- Antidegradation policy

The first part in developing any national water quality standard is specifying a classification system for water bodies or segments thereof based on the expected beneficial uses of those water bodies. These uses have already been identified in the policy and include public water supply, recreation in and on, propagation of fish, shellfish and wildlife, agricultural, industrial, navigation, etc. The second part in developing water quality standards is setting the water quality criteria deemed necessary to support the designated uses of each water body or segment thereof. These criteria may be numeric or narrative. The third part of the water quality standard is the antidegradation policy, which ensures protection of water quality for a particular water body where the quality exceeds levels necessary to protect fish and wildlife propagation and recreation on or in the water. This also includes special protection of waters designated as outstanding natural resource waters.

#### **6.4.4.2 Establishing Water Quality Criteria**

Water quality criteria set ambient levels of individual pollutants or parameters (numeric), or describe conditions of a water body that if met will generally protect the designated use of the water (narrative). Water quality criteria are developed to protect aquatic life, human health and in some cases wildlife from deleterious effects of pollutants. A water quality criteria normally consists of three components:

- Magnitude – the level of pollutant expressed as a concentration that is allowable
- Duration – the period of time (averaging period) over which the instream concentration is averaged for comparison with criteria concentrations
- Frequency – How often criteria can be exceeded.

The development of national numeric water quality criteria for the protection of aquatic life and human health is a very complex process that relies on information from many scientific disciplines (e.g. aquatic toxicology, chemical specific risk analysis, human exposure considerations, bioaccumulation studies, ambient monitoring, etc.).

Once a decision is made that a national criterion is needed for a particular material, all available information is collected and reviewed for acceptability. If enough data has been generated then they are used to derive acute and chronic criterion for the particular material for freshwater and saltwater bodies.

Appendix II identifies a water use classification and criteria for Trinidad and Tobago (recommendation based on Fiji's experience) while, Appendix III identifies water quality guidelines for Trinidad and Tobago according to water classes (recommendation based on Fiji's experience). The information presented in appendices II & III is for guidance only and has to be supported by structured scientific assessments as mentioned previously.

## 6.4.5 Monitor and Control Environmental Incidents

The Authority already investigates environmental incidents and is developing programmes to avoid such incidents in the future.

## 6.4.6 Watershed Management Programme

### 6.4.6.1 Background

A watershed approach is a strategy for effectively protecting and restoring aquatic ecosystems and protecting human health. This strategy has as its premise that many water quality and ecosystem problems are best solved at the watershed level rather than at the individual waterbody or discharger level. Major features of a Watershed Protection Approach are: targeting priority problems, promoting a high level of stakeholder involvement, integrated solutions that make use of the expertise and authority of multiple agencies, and measuring success through monitoring and other data gathering.

The watershed approach is a coordinating framework for environmental management that focuses public and private sector efforts to address the highest priority problems within hydrologically-defined geographic areas, taking into consideration both ground and surface water flow.

### 6.4.6.2 Guiding Principles

Although watershed approaches may vary in terms of specific objectives, priorities, elements, timing, and resources, all should be based on the following guiding principles.

- **Partnerships** -- Those people most affected by management decisions are involved throughout and shape key decisions. This ensures that environmental objectives are well integrated with those for economic stability and other social and cultural goals. It also provides that the people who depend upon the natural resources within the watersheds are well informed of and participate in planning and implementation activities.
- **Geographic Focus** -- Activities are directed within specific geographic areas, typically the areas that drain to surface water bodies or that recharge or overlay ground waters or a combination of both.
- **Sound Management Techniques based on Strong Science and Data** -- Collectively, watershed stakeholders employ sound scientific data, tools, and techniques in an iterative decision making process. This includes:
  - (i) assessment and characterization of the natural resources and the communities that depend upon them;
  - (ii) goal setting and identification of environmental objectives based on the condition or vulnerability of resources and the needs of the aquatic ecosystem and the people within the community;
  - (iii) identification of priority problems;
  - (iv) development of specific management options and action plans;
  - (v) implementation; and
  - (vi) evaluation of effectiveness and revision of plans, as needed.

### 6.4.6.3 Benefits

Operating and coordinating programs on a watershed basis makes good sense:

- Environmental - working together on environmental health concerns e.g. drinking water protection, pollution control, fish and wildlife habitat protection and other aquatic resource protection programs, managers from all levels of government can better understand the cumulative impacts of various human activities and determine the most critical problems within each watershed;
- Financial - cost savings can be realised by leveraging and building upon the financial resources and the willingness of the people with interests in the watershed to take action. Through improved communication and co-ordination the watershed approach can reduce costly duplication of efforts and conflicting actions;
- Social and Administrative - the watershed approach strengthens teamwork between the public and private sectors to achieve the greatest environmental improvements with the resources available. This emphasis gives those people who depend on the aquatic resources for their health, livelihood or quality of life a meaningful role in the management of the resources.

### 6.4.6.4 Implementation

In implementing the watershed approach four key elements are involved which reflect and provide the operating structure for the guiding principles described above. They are:

- Stakeholder Involvement  
(providing structure for the *Partnership* principle)
- Geographic Management Units  
(providing structure for the *Geographic Focus* principle)
- Co-ordinated Management Activities  
(providing structure for the *Sound Management* principle)
- Management Schedule  
(providing further structure for the *Sound Management* principle)

### Stakeholder Involvement

Broad involvement is critical. In many cases, the solutions to natural resource problems depend on voluntary actions on the part of the people who live, work and play in the watershed. Besides improving co-ordination among their own agencies, the watershed approach calls upon local government entities, sources of watershed impacts, users of watershed resources, environmental groups, and the public in the watershed management process to help them better understand the problems, identify and buy into goals, select priorities, and choose and implement solutions.

### Geographic Management Units

The entire jurisdiction is divided into geographic management units. Ideally, these units are determined on the basis of hydrologic connections, as described under the geographic focus principle. Other factors such as political boundaries are often factored into decisions about geographic management units, as well.

The size of the management unit is an important consideration because, depending on scale different parties may take different roles.

For example, for large river basins different government agencies are likely to lead watershed-planning efforts, while local government, conservation districts, and watershed councils may take the lead in developing and implementing solutions in smaller watersheds.

### **Co-ordinated Management Activities**

Government agencies have responsibility for many of the management activities described in the guiding principles. Ideally, the various agencies with responsibilities for wetlands protection, drinking water source protection, waste management, point and nonpoint source pollution control, air pollution, pesticide management and other programs such as water supply, agriculture and transportation (in any given jurisdiction, these might be several different agencies) would jointly compare their lists of high priority areas, meet with each other and other stakeholders, and look for opportunities to leverage their limited resources to meet common goals. Watershed approaches should not be viewed as an additional layer of oversight; rather watershed approaches should constitute improvements in coordination of current programs, processes and procedures to increase efficiency and efficacy.

The activities listed below are just some of the project areas that can support watershed approaches.

#### *1. Assessment and Characterization of Aquatic Resources, Problems, their Causes and Sources*

Ideally, monitoring parameters would be determined by water quality standards and other watershed goals and indicators, which are specified according to the needs and conditions of the area. A strong monitoring program should include:

- An inventory of key existing information on resources, including priority ground water, sources of drinking water, habitat, wetlands and riparian acreage, function and/or restoration sites.
- A monitoring design that confirms or updates existing information or fills gaps and can report trends.
- Reference conditions for biological monitoring programs to provide baseline data for water quality assessments and development of biological and nutrient criteria.
- Data collected using comparable methods to allow aggregation of data at various scales and stored so as to be readily accessible to others.
- Geographic references so that monitored waters can be mapped using a Geographical Information System (GIS), allowing information to be aggregated on a watershed basis.
- Key information on condition of waters (e.g., impaired, in need of special protection, endangered species present, threatened sources of drinking water) and causes of impairment are reported in the Annual State of Environment Report.
- Collaborative efforts on existing and planned monitoring activities with other public and private institutions to share information when goals are similar.

## 2. Goal Setting

In the process of identifying goals, water quality standards provide a legal baseline or starting point. These goals clearly identify the uses to be made of the waters, for example the protection and propagation of wetlands. Water quality standards also include the appropriate chemical, physical and biological criteria to characterize and protect the uses and an antidegradation policy to preserve the uses and water improvements attained in the waters of their watersheds. Actions by government agencies that support watershed efforts include:

- Reviewing, and if appropriate, revising water quality standards within the watershed framework, consulting the other stakeholders involved in the watershed.
- Adopting precisely defined uses given the chemical, physical and biological characteristics of the waterbody.
- Expanding the suite of tools applicable to the development and implementation of their water quality standards and management programs. The expanded suite should include tools to address multiple stressors and their cumulative impacts, including criteria to protect human health, aquatic life, wildlife and sediment dwelling organisms; methodologies for sediment and whole effluent toxicity testing; and assessment methods for establishing Total Maximum Daily Loads (TMDLs) or waste load allocations, and evaluating ecological risk, nutrient enrichment and habitat.

## 3. Problem Prioritization and Resource Targeting

Staff in the various water-related programs should work with other stakeholders to jointly set priorities for the particular suite of water resources concerns present in each identified management unit. Deliberations should consider:

- Drinking water source protection for both ground and surface water sources;
- Wetlands and riparian area protection and other ecological values;
- Nonpoint source pollution control;
- Point source pollution control;
- Living resource needs; and
- Other issues, such as waste and pesticide management, air pollution affects on water resources, and water supply, as appropriate.

The watershed approach should take into consideration the findings of and priorities established under pre-existing initiatives.

## 4. Management Option Development and Watershed (or Basin) Plans

Each watershed partnership should develop management options and set forth a watershed or basin management plan that should:

- Establish environmental objectives that are consistent with all applicable state regulations, including water quality standards and drinking water maximum contamination levels and health advisories.
- Identify environmental indicators compatible or complementary to national indicators that can be used to monitor and report on attainment of the environmental objectives.
- Identify specific implementation actions, including voluntary, mandatory, and educational efforts that will attain and maintain the goals.
- Set forth milestones, assign responsibility, specify who will implement actions, and identify existing and potential sources of funding for implementation.

### *5. Implementation*

Due to the participatory nature of watershed approaches, responsibility for implementation of watershed plans will fall to various parties relative to their particular interests, expertise and authorities. To the maximum extent possible they should consider the full range of tools available to them in programs as diverse as water quality protection, pesticide management, waste management, air pollution control, as well as natural resources protection, agriculture programs, water supply, transportation and other related programs. For example, under water quality and natural resource protection programs they may:

- Support watershed approaches to water quality permitting, nonpoint source pollution control, habitat protection and other water resource protection and restoration activities using Total Maximum Daily Load analyses.
- Issue water permits in accordance with the state regulations.
- Tailor nonpoint source management program to respond to watershed needs and ground water connections.
- Direct activities toward reducing wetland impacts from land and water-based activities.
- Direct state activities toward protection of high priority surface and ground water.
- As authorized, monitor, verify implementation, and, when necessary, enforce management actions.

### *6. Monitoring and Evaluation*

To evaluate the effectiveness, the watershed management cycle should include monitoring to ascertain both the environmental and socioeconomic impacts of implemented watershed plans. Progress should be reported and results of monitoring help guide decisions about continued implementation.

### **Management Schedule**

A schedule for carrying out co-ordinated management activities within each of the management units helps organise the work state agencies needs to undertake. The schedule would lay out a long-term program for maintaining, restoring, and protecting water resources and provide other interested parties an opportunity to plan for their involvement.

To most effectively create an orderly system for focusing and co-ordinating watershed management activities on a continuous basis, the schedule should contain two features:

1. A sequence for addressing watersheds that balances workloads from year to year; and
2. A specified length of time planned for each major management activity (e.g. assessment, management option development, and implementation).

The schedule should reflect the magnitude of activities to be carried out within any particular watershed or basin, which depends largely on the range and severity of problems found within that management unit. For example, some watersheds may require minimal actions to maintain high environmental quality, whereas others may require substantial effort to restore environmental quality.

Reorganising workloads to take a watershed approach may take a considerable amount of time.

During the early phases of reorientation (before the entire jurisdiction is covered by the watershed schedule), existing program activities to address high priority restoration, remediation and/or protection concerns, such as wellhead protection, may need to proceed in some places independently of the watershed schedule. Ideally, however, over time all relevant programs would be carried out within a jurisdiction-wide watershed approach.

#### **6.4.7 Non-Point Source Pollution Control Programme**

Non-point source (NPS) pollution, unlike point source pollution (industrial and sewage treatment facilities), comes from many diffuse sources. NPS pollution is caused by rainfall moving over and through the ground. As the runoff moves, it picks up and carries away natural and human-made pollutants, finally depositing them into ponds, rivers, wetlands, coastal waters, and even into underground sources of drinking water.

Atmospheric deposition and hydromodification are also sources NPS pollution.

Pollutants from NPS pollution include:

- Excess fertilizers, herbicides, and insecticides from agricultural lands and residential areas;
- Oil, grease, and toxic chemicals from urban runoff and energy production;
- Sediment from improperly managed construction sites, crop and forest lands, and eroding streambanks;
- Bacteria and nutrients from livestock, pet wastes, and faulty septic systems;

Developing legislation that ensures state lands are properly managed during land farming, mining, logging as well as developing legislation that protect watershed and groundwater resources can prevent and control NPS pollution. However this can be a time consuming process that can be better handled locally, such as by zoning or erosion control ordinances or through encouraging individuals to play an active role by practising conservation and by changing certain everyday habits.

The preferred option to address NPS pollution control in the Programme will be to communicate effectively to individuals via the public awareness/education programme on examples of what you can do to prevent NPS pollution. The following are some examples according to areas of concern;

##### **Urban Stormwater Runoff**

- Keep litter, pet wastes, leaves, and debris out of street gutters and storm drains--these outlets drain directly to streams, rivers, and wetlands.
- Apply lawn and garden chemicals sparingly and according to directions.
- Properly dispose of household hazardous wastes. Many common household products, (paint thinners, moth balls, drain and oven cleaners, etc.) contain toxic ingredients. When improperly used or discarded, these products are a threat to public health and the environment. Do not pour hazardous products down any drain or toilet. Do not discard with regular household trash. Learn about natural and less toxic alternatives and use them whenever possible. Contact Solid Waste Management Office for information regarding hazardous waste collection in your area.

- Recycle all used motor oil by taking it to a service station or local recycling center. Motor oil contains toxic chemicals that are harmful to humans and animals. Do not dump used motor oil down storm drains or on the ground.
- Control soil erosion on your property by planting ground cover and stabilising erosion-prone areas.
- Limit the amount of impenetrable surfaces in your landscape. Use permeable paving surfaces such as wood decks, bricks, and concrete lattice to let water soak into the ground.
- Encourage local government officials to develop construction erosion/sediment control ordinances in your community.

### **Mining**

- Become involved in local mining issues by voicing your concerns about proper drainage and reclamation projects in your area.

### **Forestry**

- Use proper logging and erosion control practices on your forestlands by ensuring proper construction, maintenance, and closure of logging roads and skid trails.
- Allow thick vegetation or buffer strips to grow along waterways to slow runoff and soak up pollutants. Plant trees, shrubs, and ground cover. They will absorb up to 14 times more rainwater than a grass lawn and don't require fertilizer.
- Report questionable logging practices to forestry division and other water quality agencies.

### **Agriculture**

- Manage animal waste to minimise contamination of surface water and ground water.
- Protect drinking water by using less pesticides and fertilizers.
- Reduce soil erosion by using conservation practices and other applicable best management practices.
- Use planned grazing systems on pastureland.
- Dispose of pesticides, containers, and tank rinsate in an approved manner.

## **6.4.8 Inter-Governmental Approach to Remedy Abandoned and Malfunctioning Sewage Treatment Plants**

As mentioned in the introduction section of this document point source discharges of sewage was identified as a major problem affecting surface water quality. While permits will be issued to persons owning and operating such facilities, the majority of sewage treatment plants (STP) including small package treatment plants are non-functional and some also have no identifiable owner/operator. The EMA recognises that the only solution to the problem of abandon and malfunctioning sewage treatment plants in the country is the construction of a few large-scale municipal wastewater treatment plants thereby removing the plethora of individual STP's. As conceded by all this would require a huge capital investment and the benefits to be derived would only be realized in the middle to long term.

While the above solution is ideal there is urgent need to address the situation in the short term. In this respect the Authority is cognisant of the steps taken by the Water and Sewerage Authority (WASA) in developing a model that identifies those private plants that are suitable for adoption by WASA. However it is envisaged that many of the existing plants that service small communities will not be eligible for adoption and as such some form of rationalisation seems as the only way forward.

Since capital expenditure is a prerequisite to both the adoption and rationalization process the Authority with the assistance of all stakeholder will try to identify and secure some loan facility or grant that small communities can access. Once available individual plants can be upgraded to an acceptable standard for adoption and maintenance by WASA, it is expected that sewerage rate would then be applied. The Authority sees this as the first step in dealing with a situation that if left unchecked has the potential of causing serious risk to human and environmental health.

#### **6.4.9 Laboratory Registration and Certification Programme**

In keeping with the Act (Sect. 34 (1) b) and the Programme there is need to develop a Laboratory Registration and Certification Programme. The objective of the programme is to ensure that laboratories are submitting reliable and consistent data to the Authority. It is envisaged that once permits are issued and monitoring data are being generated for compliance purposes there has to be a mechanism that ensures the integrity of data. To accomplish this a certification and registration programme for commercial and small-scale laboratories will be developed in collaboration with TTBS.

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