SUSTAINABLE WASTEWATER MANAGEMENT IN TRINIDAD AND TOBAGO

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1.0 INTRODUCTION

1.1 Background
Although sewers were introduced in Port of Spain since 1861, it was not until 1962 that the Government embarked on the first major island-wide sewerage project for Trinidad. This project involved the construction of three (3) major wastewater treatment plants (WWTPs) with associated lift stations and collection systems. The project was completed in 1965, the same year that the Water and Sewerage Authority (WASA) was established, and resulted in the sewering of the three (3) major population centres in Trinidad, the capital city of Port of Spain and environs, San Fernando and Arima.

Since then, as the population grew and the demand for housing rapidly increased, WASA was unable to expand wastewater systems to satisfy the increasing demand. Approvals were therefore given to private housing developers, government institutions (including schools), hotels and industry, to construct, operate and maintain their own wastewater systems.

These approvals were given with the intent that WASA would eventually adopt, operate, and maintain these systems and collect wastewater rates. However, the number of these wastewater systems was increasing at a rapid rate and due to the high Operations and Maintenance (O & M) costs, and low potential revenues, WASA was reluctant to adopt the plants and systems without extra financial assistance from the Government. Today, WASA owns and operates twelve (12) systems, while about twenty-four (24) fall under the jurisdiction of the Ministry of Housing and Settlements, its agencies and the Urban Development Company of Trinidad and Tobago (UDeCOTT). There are over one hundred and fifty (150) or so, others, which are privately owned. One should note that only persons who are connected to the systems owned by WASA pay wastewater rates. While the Government-owned systems were maintained to some level of functionality, the privately owned ones, especially those in housing developments, were not maintained and almost all are in a state of disrepair.

1.2 Water And Wastewater Operations
WASA is a regulated utility formed under the WASA Act #16 of 1965. Its main business relates to the water and wastewater sectors. The water aspect of the business relates to the finding, production, treatment, transmission and distribution of potable water. The wastewater aspect of the business involves the collection, transmission, treatment and disposal of wastewater. However, in addition to these core activities, WASA provides several other services such as:

- Approval of building and housing development plumbing plans
- Development of water and wastewater infrastructure
- Provision of geographic information for Trinidad and Tobago
- Repair of leaks and road restoration
Clearing of Sewer Chokes
Licensing of Water Abstractors

Like many of the other islands in the Caribbean, economic growth and development coupled with population increases have resulted in continual environmental degradation of our watersheds, water resources and coastal areas. The Authority believes that these units are all intrinsically linked to one another and as such, threats from land based activities such as widespread pollution of our waterways; indiscriminate dumping and destruction of our forests significantly contribute to the overall deterioration of in-stream water sources, coastal areas and oceans.

1.3 Paper highlights
On the topic of “Sustainable Wastewater Management in Trinidad and Tobago”, this paper addresses and analyses the present situation including the mandate from the government for WASA to “assume control” on a phased basis of the wastewater sector in accordance with the WASA Act of 1965. It also identifies and discusses the critical issues and strategies to achieving Sustainable Wastewater Management in Trinidad and Tobago. Some of the topics include:

1. Revenue and Funding
2. Manpower Training and Certification
3. Handling Trade Effluent
4. Occupational Health and Safety
5. Science and Technology
6. Adoption/Integration Measures
7. Onsite Wastewater Collection, Treatment and Disposal
8. Legal Aspects
9. Intersectoral Coordination (Stakeholders)
10. Public Education and Participation

Also highlighted is the construction of a new twenty (20) million gal/day activated sludge-extended aeration WWTP serving the capital city and environs.

2.0 WASTEWATER SITUATION ANALYSIS

2.1 WASA Wastewater Systems

WASA owns and operates twelve wastewater systems across Trinidad and Tobago. See Appendix I for the listing, design flows and actual flows.

2.2 Other Government Systems

There are twenty four (24) WWTPs and collection systems with eleven (11) associated lift stations that are owned by the Government Housing agencies. Appendix II summarizes the status of those facilities.
2.3 Privately Owned Systems
There are approximately one hundred and fifty eight (158) other non-WASA plants; fifty-six (56) wastewater treatment plants in housing developments, fifty-five (55) in various institutions owned by the government (incl. schools), eighteen (18) at industrial/commercial sites and nine (9) at various hotels. In addition to these treatment facilities, there are also approximately twenty (20) associated lift stations.

Most of these installations, especially those owned by private housing developers are in an advanced state of deterioration, offering little or no treatment and some have even been abandoned by their owners (developers) leaving the residents the responsibility for the O & M of their WWTP. Less than five of those developments actually have a regular maintenance programme in place. Numerous complaints have been received from residents and Resident Associations about raw sewage overflowing in the roads and backing up in their homes. Very often WASA has assisted in relieving these homeowners of their plight. The sustainable strategy that the developers needed to employ was to insert, as part of the deed document, a clause making mandatory, monthly maintenance fee contributions for a contractor to perform regular O & M at the plant, until the take over by WASA, and the subsequent issuance of wastewater bills. The adoption of these facilities by WASA will be subsequent to the adoption of the Government-owned facilities, and will depend on other variables such as integration possibilities, revenue potential, functionality, and so on.

2.4 Onsite Wastewater Systems
One of the more neglected areas in wastewater management is in the field of Onsite wastewater treatment and disposal. Even though the design and use of advanced onsite systems has taken place in other countries, the systems still being constructed in Trinidad and Tobago are of designs several decades old. Even the National Standard, TTS 16 80 400:1991, “CODE OF PRACTICE FOR THE DESIGN AND CONSTRUCTION OF SEPTIC TANKS AND ASSOCIATED SECONDARY TREATMENT AND DISPOSAL SYSTEMS” is about 13 years old at this time. A request was made in 2003 to have a review in 2004 of this standard. Septic tank designs have developed to be more effective, and drainfields have replaced soakaways to minimize impact to the groundwater. Synthetic materials now used for tanks and drainfields are not addressed in the standard.

Traditionally the “grey water” from showers, sinks, and baths was not captured and treated on site. Grey water was allowed to be discharged, untreated, into surface drains. WASA has reviewed this situation and has already implemented the policy that grey water must be treated onsite and not be discharged untreated into surface drains. In an effort to “make a sustainable impact as soon as possible” WASA has met with the Regional Health Corporations and agreed on the grey water handling issue, as well as utilization of newer more efficient septic tank designs, such as the exclusive use of double-compartmented tanks.
3.0 SUSTAINABLE DEVELOPMENT

3.1 Principles
Sustainable Development was popularized by the World Commission on Environment and Development (1987) as “development that meets the needs of the present without comprising the ability of future generations to meet their own needs”. More simply, its mutually reinforcing goals are economic growth, environmental protection and social justice.

3.2 Component Areas
The three components of Sustainable Development are social, environmental and economical.

3.2.1 Social: The main features are: (1) Population: Population concerns should be part of national sustainable development strategies. For example, the age structure of the population must be assessed to show future demands for environmental resources and infrastructure. (2) Human Health: Human health depends on a healthy environment – clean water, sanitary waste disposal, and an adequate supply of healthy food, healthful housing, and other buildings. (3) Communities: Peripheral urban areas to tend to suffer from high population densities and inadequate environmental infrastructure, while rural communities should be made more liveable and be protected from floods, etc.

3.2.2 Environmental: Two subject areas should be considered: (1) Environmental resources: Air, land and water resources must be managed more suitably. Resources pollution should be controlled, if not prevented, by pre-development impact assessments. The biodiversity of life in Caribbean island/ countries should be protected at all times. (2) Environmental health: The relationship between environmental quality and human health is direct and extremely important, as follows:

- Drinking water supply to homes, schools, etc.
- Liquid and solid waste management
- Food hygiene and sanitation
- Built environment (e.g. homes, offices, etc)
- Other environmental health factors (e.g. pollution, occupational health/safety, etc)

3.2.3 Economical: Prime economic considerations are: (1) Poverty: In view of the cost of environmental infrastructure and related services, all Caribbean countries and communities need to eradicate poverty and minimize hunger, illiteracy, unemployment, etc. (2) Consumption Patterns: The pattern of consumption and production in Caribbean countries must be more sustainable, and economies must grow and prosper while reducing the use of energy and materials, and waste production. (3) Financing: Very large investments are needed to implement the huge sustainable development programmes recommended by UNCED 92, including human resource development and public education.
3.3 Role of Major Groups
The role of four major groups should be considered as follows:

(a) **Public Sector:** All Caribbean governments should establish a Multi Sectoral National Commission for Sustainable Development to provide leadership and direction for the paradigm shift. National agencies and local authorities should be included.

(b) **Private Sector:** Important subgroups are: Business and Industry, Scientists and Technologists, Farmers and Fisherman, etc. These are all part of the problem and the solution.

(c) **Non-Government Organizations (NGOs):** Most Caribbean countries have environmental NGOs, and others representing Woman, Youth, Culture, etc. all of whom should participate in the new holistic approach.

(d) **General Public:** Because people are at the centre of socio-environmental causes and effects, they should be equipped and empowered to play a meaningful role in Sustainable Development.

4.0 SUSTAINABLE WASTEWATER MANAGEMENT

4.1 Critical Issues

4.1.1 Financial
The O & M of wastewater systems is costly. Daily maintenance is required at most facilities, especially the more mechanical types. The ideal situation occurs when the collections from billing exceeds the outlay for O & M and capital development. In this country even the potential revenue based on the current tariffs are too low in most cases. In addition, only about half of the revenue is actually collected. In the past WWTPs were constructed for each development that required one. The strategy of integration where possible, was not entertained. As a result, in most of the smaller developments the amount of revenue collected will not cover the O & M costs of the WWTP and collection system.

4.1.2 Adoption/Integration
The adoption of the non-WASA WWTPs has uncovered shortcomings in the entire process from the conceptualisation phase to the final approval stage. Lack of proper record keeping, inadequate designs, loss of drawings, questionable approvals, lack of inspections, legal issues, informal agreements that are now difficult to change, poor communication between stakeholders, apparent corruption at many levels are all issues that must be worked through for the process to be completed.

4.1.3 Inadequate Manpower
The current wastewater department is inadequate in the quantity and quality of its personnel. At present, wastewater is only a department not a division. There aren’t
enough well-trained, qualified personnel as managers. Many of the managers have been trained in disciplines other than environmental engineering/science. Many of the middle managers have not pursued a certificate in environmental studies available locally.

4.1.4 Occupational Health and Safety
In the past, boots and gloves and two or three road safety cones were considered the only safety equipment really necessary to go out and do work. With education and training, awareness has grown to the point where not only the manager but also the employee knows what safety equipment is necessary to perform certain jobs.

4.1.5 Trade Effluents
Until recently, commercial and industrial companies would discharge into the public sewers without WASA enquiring as to the quantity and quality of their wastes. As a result, wastes of all types would occasionally enter the pump stations and treatment plants of such a foul nature that it would jeopardize the health of the facility personnel, which has led to industrial action and down time for the employer. Plant treatment processes have also been affected causing substandard effluent to be discharged into the environment. Grease from fast food outlets is causing problems in the sewers in urban areas.

4.1.6 Science and Technology
Very little has been done in the past to foster improved processes and treatment through science and technology. There are very few Standard Operating Procedure Manuals. Developers have not been made to install “appropriate technology” systems that are more sustainable than the ones that may cost the least to purchase and install, but may have no parts available locally or have high O & M costs.

4.1.7 Legal issues
The adoption of the non-WASA facilities is fraught with legal issues. Land ownership and titles, outstanding rates and taxes, transfer details, rights-of-way are many of the issues that must be addressed.

4.1.8 Greater Port-of-Spain Sewerage System
The Facultative lagoons WWTP constructed in 1965 had reached the end of its useful life. Poorly treated effluent was being discharged into the Caroni Swamp and affecting the surrounding eco-system. In addition, one of the large rum distilleries was discharging directly into the system putting a strain on the treatment processes at the plant. Infiltration is also an issue that must be addressed.

4.1.9 Intersectoral Coordination
There are several different stakeholders involved in the wastewater sector. Until recently here has been little or no meaningful communication among most of them. Developments are being planned and approved without the key stakeholders meeting at the same table to discuss and address the potential ramifications that should be sorted out before progressing any further in the approval process.
4.1.10 Public Education and Participation
The public plays a very important part in this whole process. Entire private developments have malfunctioning WWTPs because the residents do not feel the need to put money towards hiring a contractor to operate and maintain their plant. The knowledge to use septic tanks correctly; to insist on public sewers in their neighbourhood; to require the most appropriate technology; to pay for the services received; all come with the better educated consumer.

4.2 Strategies

4.2.1 Financial
For wastewater management to be sustainable in the financial category, costs must be reduced and revenues must be increased. Integration of two or more plants into one larger plant to reduce the O & M costs must be pursued. An increase in the tariff rates is also required. The current wastewater rate is about half that of the water rate, on average. In developed countries, the rate is two or more times the water rate. Rates should reflect the true cost of collection, treatment and disposal of wastewater.

4.2.2 Adoption/Integration
Systems must be put in place by the various stakeholders to improve record keeping. Standardization and streamlining of the approval process and requirements need to be instituted.

4.2.3 Manpower
Existing personnel need to be adequately trained and gaps in the structure for appropriately qualified persons need to be filled. The Department structure needs to be upgraded to become a Division.

4.2.4 Occupational Health & Safety
Training and education continue to be important to teach good safety practices, but the requisite equipment is necessary if health and safety is to be seriously addressed.

4.2.5 Trade effluents
A trade effluent standard for discharge into all sewers is needed to help address the quality and quantity of trade waste currently entering the sewers.

4.2.6 Science and Technology
With the advent of the Internet, information can easily be accessed to research new technologies used in other parts of the world. Suppliers and users can be contacted and communicated with to discuss whether certain technologies would be applicable to a local situation.

4.2.7 Legal issues
A legal and regulatory team must be established to handle all the details of adoptions and any other legal issues associated with wastewater management.
4.2.8 Greater Port-of-Spain Sewerage system
A new treatment plant is needed to effectively treat the quality and quantity of waste from this country’s capital and environs. The waste from the rum distillery needs to be addressed as a separate issue. Infiltration needs also to be addressed.

4.2.9 Intersectoral Coordination
Communication is a key requisite to removing the current barriers between stakeholders. Approval teams are needed to address the planning and development of housing and other areas and the required infrastructure at a time when changes are easier to be made.

4.2.10 Public Education and Participation
Education programmes in schools, developments, and in communities are required to raise the level of knowledge and awareness of the general public. Standards will improve and operational costs will decrease when the public acts on the knowledge they have received, as the abuse of the systems will decrease and preventative maintenance programmes will be demanded and funded publicly and privately.

5.0 ACTION PLAN

5.1 Revenues and Funding
WASA, in conjunction with the Regulated Industries Commission (RIC) is going through the process to evaluate the current tariff structure with a view to ratifying charges so that they reflect the true cost of collection, treatment and disposal of wastewater.

5.2 Adoption/Integration Measures
Meetings on sustainable strategies have started with some of the various stakeholders to begin to streamline the approval process. The WASA approval process is currently under revue primarily to reduce the time taken to grant approvals to developers. More liaisons and teams are needed to truly streamline the entire approval process. This will lead to a greater opportunity for integration of developments thereby reducing the proliferation of WWTPs and their associated problems and costs. In addition, the development of a Wastewater Master Plan for the East West Corridor has started. Funding for this project is in the form of a grant from the French Government. Integration of WWTPs is one of the key objectives.

5.3 Manpower Training and Certification
Operator training courses have resumed after a period of several years. Managerial and supervisory classes have also commenced. Employees are being sent abroad on seminars, conferences, and facilities to learn from the owners and operators. The new divisional structure has been completed and is in the approval process. The new structure evidences gaps in the cadre of qualified manpower and steps are being taken to either hire the appropriate personnel or to hire a contractor to perform the necessary functions. For example, it has been decided to hire contractors to perform the O & M of several of the WWTPs that WASA is about to adopt. This will reduce the manpower requirement and allow for more rapid growth of the Division responsibilities. Work on a Certification
course has started. It is expected that the course will be a joint venture between WASA/CWWA and an international training group. Talks have started with an association in California, U.S.A.

5.4 Occupational Health & Safety
A Job Safety Analysis has been performed for all the wastewater positions in the Authority. Equipment is being purchased and training in the use of the equipment has commenced. Training on all the new equipment at the new WWTP for Port-of-Spain is scheduled to start within a couple weeks. A basic training course for all wastewater personnel will be formulated. Wastewater Health and Safety will be an integral part of the course.

5.5 Trade Effluents
A Trade Effluent Standard has been approved by WASA and is being implemented in the areas that contribute to the public sewers. A survey on all industries contributing their waste to the public sewers is almost complete. Letters requesting lab sample analyses have been sent to each of the industries that have been identified as potentially discharging non-domestic waste to the public sewer system.

A grease programme has started by identifying those businesses that can potentially discharge grease and oils to the public system. Those that have substandard systems will be required to upgrade to meet the Trade Effluent Standards of discharge to the public sewers for greases and oils.

5.6 Science and Technology
All wastewater processes are being investigated with a view to sustainable development. Standard Operating Procedures manuals are being compiled. New technology is being sought locally and internationally via the Internet and being recommended to developers. The upcoming more strict (draft) national water pollution rules are being used by WASA as the new standard for discharge to the environment. WWTPs now have to address the more restrictive tertiary treatment addressing nutrient removal. On lot systems now have to also treat grey water before discharge to the environment. Septic tank designs have improved.

5.7 Legislation and Standards
Standards are being updated continually. The plumbing code revision is almost complete. The new guidelines to developers for the design of water and wastewater systems is ready for public comment. An official request has been made to update the old on lot (septic tank) system standard. The trade effluent standards for discharge into public sewers has been approved. The next step is to have it accepted as a byelaw for all sewer systems especially as WASA will be adopting those systems in the future.

5.8 Greater Port-of-Spain Sewerage System
Work has begun on the new activated sludge-extended aeration WWTP for Port-of-Spain and its environs at a cost of over $200 million TT. The plant has a maximum capacity of 20mgd and will use the old WWTP lagoons as polishing ponds for its effluent. The
waste from the rum distillery is being specially handled at this plant. Work is expected to be totally completed in 2005, but liquid domestic waste will start to be handled as early as Summer 2004.

5.9 Intersectoral Coordination
Meetings have commenced with other wastewater sector stakeholders. Agreements have been made on specific directions and standards that must be followed. More meetings have been carded and liaisons continue to develop between WASA and other public agencies, NGOs, private companies, and citizens.

5.10 Public Education and Participation
The new wastewater structure includes a training and education officer with staff that will begin the process of training and educating both internal and external persons to WASA. Public education programmes will be set up for schools, businesses, and communities.

6.0 CONCLUSIONS
The paradigm shift to sustainable wastewater management in Trinidad and Tobago has commenced.

This purpose of this programme is to organize and strengthen the institutionalisation of wastewater management in the country. Many different tasks are needed if an effective wastewater management program is to be developed, and it is vital that the extent of roles and responsibilities of the stakeholders are fully appreciated.

The time is now that wastewater management is given its true sustainability by WASA, local developers, and the country at large.
APPENDIX I

LIST OF WASA FACILITIES
# LIST OF WASA FACILITIES

<table>
<thead>
<tr>
<th>Name</th>
<th>Process</th>
<th>Design Flow (m³/day)</th>
<th>Actual Flow 1999 (m³/day)</th>
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<td>Beetham Lagoons</td>
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<td>56,780</td>
<td>14300</td>
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<td>Arima Trickling Filter</td>
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<td>5000</td>
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<td>San Fernando Trickling Filter</td>
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<td>6000</td>
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<td>Chaguaramus Imhoff Tank &amp; Filter Bed</td>
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<td>WASA Head Office</td>
<td>Extended Aeration</td>
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<td>Trincity Activated Sludge</td>
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<td>1200</td>
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<tr>
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<td>Contact Stabilization</td>
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<td>Scarborough Extended Aeration</td>
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APPENDIX II

STATUS OF WASTEWATER FACILITIES
(NHA, LSA, SILWC, UDeCOTT)
## STATUS OF WASTEWATER FACILITIES (NHA, LSA, SILWC, UDeCOTT)

**MAY 2004**

<table>
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<tr>
<th>WWTP Installations Found To Meet The Basic Standard Requirements Note: No disinfection</th>
<th>WWTP Installations Requiring Corrective Repairs by WASA</th>
<th>WWTP Installations Requiring Corrective Repairs by Contractor</th>
<th>WWTP Installations Requiring Re-Engineering Works</th>
<th>WWTP Installations Under Refurbishment</th>
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<td>Old Valencia</td>
<td>Malabar Lift Station</td>
<td>Strikers Village</td>
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<td>New Valencia</td>
<td>Bon Air West</td>
<td>Orange Field Road Housing Development</td>
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<td>Frederick Settlement</td>
<td>Cantaro</td>
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