Water Quality Management Series

SUB-SERIES No MS 13.2

OPERATIONAL POLICY FOR THE DISPOSAL OF LAND-DERIVED WATER CONTAINING WASTE TO THE MARINE ENVIRONMENT OF SOUTH AFRICA

Department:
Water Affairs and Forestry

EDITION 1
2004

WATER QUALITY MANAGEMENT SERIES

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Department of Water Affairs and Forestry

EDITION 1
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FOREWORD

This operational policy for the disposal of land-derived water containing waste to the marine environment of South Africa outlines the Department of Water Affairs and Forestry's new thinking in relation to discharges to sea.

In line with international trends and our national objectives of efficient and effective management of the nation's resources, priority is given to a receiving water quality management approach. Previously the focus was on 'end-of-pipe' pollution control with little attention to the receiving environment, whereas this new approach focuses on the capacity of the receiving environment to assimilate waste and hence ensure water that is fit for use by all its other intended users.

In recent years, the discharge of land-derived water containing waste to the marine environment has been receiving increasing attention in many parts of the world due to the environmental sensitivity of the oceans and the cumulative impact of these discharges on the marine environment. In South Africa there are more than forty discharges of water containing waste formalised through authorisations issued in terms the Water Act, 1956 (Act 54 of 1956) and the National Water Act, 1998 (Act 36 of 1998). These discharges vary widely from surf zone and estuarine discharges of municipal sewage or industrial wastewater to discharges through well designed offshore marine outfalls fitted with hydraulically efficient diffusers operating in water depths of more than 20 metre.

The aim of this operational policy is to provide Basic Principles and Ground Rules as framework within which disposal practices for land-derived water containing waste could be evaluated when marine disposal is a possible alternative. It also provides a management framework within which such disposal needs to be conducted.

The Department of Water Affairs and Forestry would like to extend our sincere gratitude to all those who contributed to the development of this Operational policy and supporting documents.

EXECUTIVE SUMMARY

INTRODUCTION

In 1991 the Department of Water Affairs and Forestry published its *Water quality management policies and strategies in the RSA*. This was further elaborated in *Procedures to assess effluent discharge impacts*, published in 1995 and are currently being updated.

These policies and strategies changed the DWAF's approach to water quality management from the Uniform Effluent Standard approach (i.e. enforcing compliance to *General and Special Standard*) to the Receiving Water Quality Objectives approach (i.e. focusing on the fundamental water quality management goal, namely maintaining fitness for use). This change was necessary to counter the continuing deterioration of water quality and to meet the challenges of the future. The DWAF had recognised that without the necessary precaution, the Receiving Water Quality Objectives approach would inevitably lead to the deterioration of water resources to the point where they would be only marginally fit for their recognised uses. To counter the limitations of this new approach, and consistent with environmental policy worldwide, the DWAF decided to embody in its water quality management policy a hierarchy of decision making which contains elements of the Receiving Water Quality Objectives approach, as well as the precautionary principle of environmental protection through source reduction, minimisation, treatment, re-use, etc.

This hierarchy of decision-making can be summarised as follows:

1) Pollution Prevention, preventing waste production and pollution wherever possible.

2) Minimisation of pollution and waste at source, minimizing unavoidable waste through:

- Recycling
- Detoxification
- Neutralisation
- Treatment and re-use of waste streams
- Cleaner technologies and best management practices.

3) Responsible disposal, applying the precautionary approach:

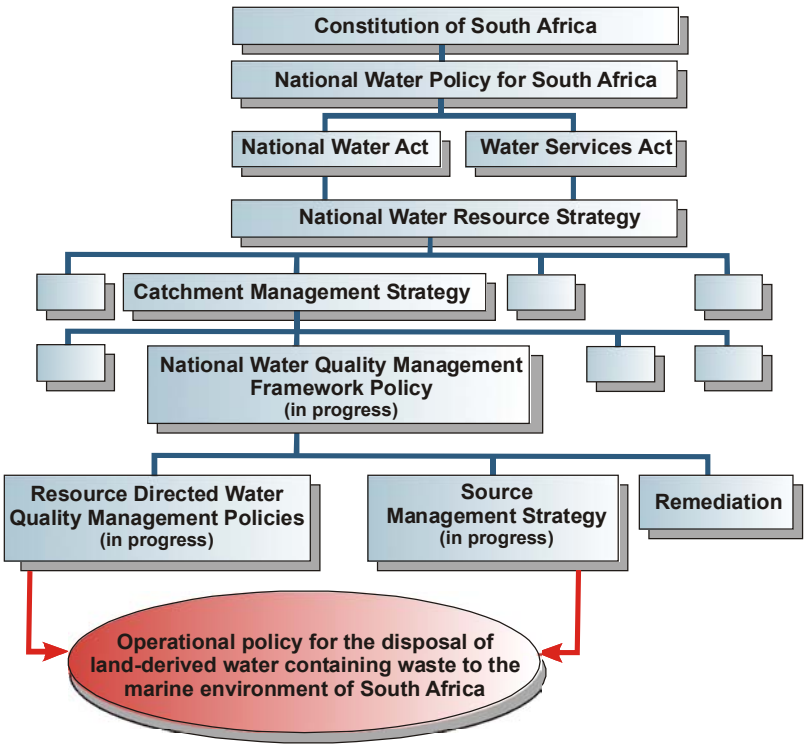
- Apply wastewater standards as a minimum requirement
- If wastewater standards are not sufficient, maintain fitness for use of the receiving water body in accordance with the Receiving Water Quality Objective approach
- Exemption from compliance to wastewater standards will only be considered in exceptional circumstances provided that the receiving water body remains fit for use in accordance with the Receiving Water Quality Objective approach.

Therefore, an application to dispose of wastewater to the environment must demonstrate that all reasonable efforts have been made, firstly to prevent waste, and secondly to minimise it. Only thereafter will minimum wastewater standards or standards based on the Receiving Water Quality Objective approach, whichever is strictest, be considered. Alternative options of managing wastewater must therefore be investigated. Disposal to the marine environment it is NOT the 'default' option in coastal areas.

In 1998, the National Water Act (Act 36 of 1998) (NWA) was promulgated to give legal status to the White Paper on a National Water Policy for South Africa (April 1997) and the Department's water quality management policies and strategies, amongst others.

To fulfil its legal obligation in terms of the management and control of land-derived wastewater under section 21 of the NWA, the DWAF commissioned this project to develop an *operational policy*, specifically focusing on the *disposal of land-derived water containing waste (or wastewater) to the marine environment of South Africa* (including estuaries, the surf zone and offshore marine waters), incorporating all relevant international and national principles, policies and legislation.

Within the context of existing strategies and policies of the DWAF, the overall context of this operational policy is illustrated in the figure below.



The overarching objectives of the strategies and policies indicated in the figure also apply to this operational policy. Although not explicitly repeated in this section, the objectives of these strategies and policies were taken into account in the development of the specific strategy, goal, basic principles and ground rules of this operational policy.

Land-derived wastewater discharges to the marine environment include point source discharges (i.e. discharges of which the volume and quality can be readily controlled) and non-point source (or diffuse) discharges (i.e. discharges of which the volume and quality are difficult to control). In the assessment of any wastewater discharge to the marine environment, both point and diffuse inputs must be taken into account.

Point source discharges of land-derived wastewater can be divided broadly into municipal wastewater and industrial wastewater discharges. Industrial wastewater includes discharging of seawater that is used for industrial purposes on land (e.g. coastal mining, fish processing industries and return flows from oceanariums), as well as contaminated (or polluted) stormwater run-off from an industrial premises (i.e. containing pollutants derived from the industrial process).

Diffuse discharges include urban stormwater run-off, agricultural and mining return flows, as well as contaminated groundwater seepage (these can discharge either directly into the marine environment or indirectly through river inflow). Although there are means of calculating and measuring the volumes and composition of diffuse wastewater inputs, controlling such properties, once the wastewater reaches the marine environment (or any other water resource), is extremely difficult. Such properties, therefore, are best managed and controlled at source, i.e. the point of origin.

Land-based treatment options to manage and control wastewater (i.e. treatment at source) are not within the scope of this operational policy. However, treatment requirements for marine disposal are specified, in particular, for municipal wastewater discharges. In the case of industrial wastewater, it is recommended that a *Code of Practice* be developed for industries in South Africa, addressing ways in which to eliminate or minimise the production of waste, based on best available techniques. This source directed approach to waste elimination and minimisation is considered to be of great value. In the case of diffuse wastewater (e.g. urban stormwater run-off, agricultural and mining return flows), land-based source management and control measures need to be developed at a catchment level, taking into account existing initiatives.

STRATEGIC VIEW

The Department of Water Affairs and Forestry's strategic view on the disposal of land-derived wastewater to the marine environment is as follows:

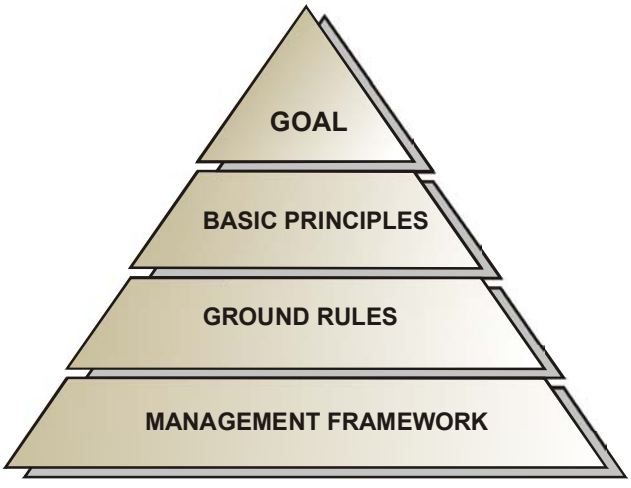
Taking into account the generally favourable, dynamic physical conditions along the South African coastline, responsible disposal of land-derived water containing waste (referred to as wastewater) to the marine environment is considered an option in South Africa, provided that all reasonable efforts have been made, first of all to prevent waste, and secondly, to minimise waste.

However:

- ***Because South Africa is a water scarce country, the loss of freshwater to the marine environment must be limited in terms of water conservation and demand management strategies.***
- ***According to the White Paper on a National Water Policy for South Africa, 'efforts to introduce source control will be strengthened, through standards and licensing and through changes in technologies and land use, with the final aim of getting as close as possible to a situation in which there is no discharge of pollutants into our water (including the marine environment)'.***

STRUCTURE OF THE OPERATIONAL POLICY

The structure of this operational policy for the disposal of land-derived wastewater to the marine environment of South Africa is illustrated below:



GOAL

The Goal of this operational policy for the disposal of land-derived wastewater to the marine environment of South Africa is as follows:

To achieve water quality that is 'fit for use' and that can maintain aquatic ecosystem health on a sustainable basis by protecting the country's water resources (including marine waters), in a manner allowing justifiable social and economic development. This will be achieved in accordance with the hierarchy of decision-making for water quality management, namely:

- ***Prevent waste***
- ***Minimise waste***
- ***Dispose responsibly.***

This goal will be achieved through enforcement of the Basic Principles, Ground Rules and Management Framework stipulated in this operational policy.

BASIC PRINCIPLES

Basic Principles provide the broad reference framework or direction within which to develop ground rules for the disposal of land-derived wastewater to the marine environment, as well as the management thereof. These principles were distilled from the broader international and national legislative context (refer to Appendix B in *Operational policy for the disposal of land-derived water containing waste to the marine environment of South Africa: Appendices* [RSA DWAF Water Quality Management Sub-Series 13.4]). The basic principles pertaining to the Operational policy for the disposal of land-derived wastewater to the marine environment of South Africa are listed below:

PRINCIPLE 1: POLLUTION PREVENTION, WASTE MINIMISATION AND PRECAUTIONARY APPROACH

The DWAF, in its water quality management policy describes a hierarchy of decision-making which applies to this operational policy and which strongly supports this principle. This hierarchy of decision-making is as follows:

1) <u>Pollution Prevention</u>, preventing waste production and pollution wherever possible.

2) <u>Minimisation of pollution and waste at source</u>, minimising unavoidable waste through:

- ***Recycling***
- ***Detoxification***
- ***Neutralisation***
- ***Treatment and re-use of waste streams***
- ***Cleaner technologies and best management practices.***

3) <u>Responsible disposal</u>, applying the precautionary approach:

- ***Apply wastewater standards as a minimum requirement***
- ***If wastewater standards are not sufficient, maintain fitness for use of the receiving water body in accordance with the Receiving Water Quality Objective approach***
- ***Exemption from compliance with wastewater standards will be considered only in exceptional circumstances provided that the receiving water body remains fit for use in accordance with the Receiving Water Quality Objective approach.***

PRINCIPLE 2: RECEIVING WATER QUALITY OBJECTIVES APPROACH

The requirements of the aquatic ecosystem, as well as the requirements of the beneficial uses of the water resource, will determine the objectives to be met (rather than following a uniform effluent standard approach as was the case with the General and Special Standard under the previous Water Act 54 of 1956). This principle applies to the marine environment as well.

PRINCIPLE 3: INTEGRATED ASSESSMENT APPROACH

The operational policy will adhere to the principles of Integrated Environmental Management, taking cognisance of concepts such as Strategic Environmental Assessment, and Environmental Impact Assessment and supporting the following underpinning principles:

- ***'Cradle-to-grave'***
- ***Strategic adaptive management (i.e. 'improving-by-learning' and 'thinking strategically whilst implementing locally')***
- ***Best Practice (to be developed by a regulator and obligatory implemented by the regulated community as a minimum for responsible source management)***
- ***Consistent Performance (i.e. all water users/impactors within the regulated community are required to ensure and strive for the same water quality goals at the same risk level)***
- ***Flexibility in approach (i.e. the regulator has the flexibility to consider the application of different alternatives and approaches, provided each of these is capable of meeting the desired objectives and requirements of the Source Management Strategy***
- ***Continuous improvement (encouraging continuous improvement in the actions and practices of both government and the regulated community).***

PRINCIPLE 4: POLLUTER PAYS PRINCIPLE

The responsibility for environmental costs incurred for rehabilitation of environmental damage, and the costs of preventive measures to reduce or prevent such damage, will be shifted to the impactors through, for example, the implementation of a waste discharge charge system.

PRINCIPLE 5: PARTICIPATORY APPROACH

Transparent stakeholder participation will be required, not only as part of the decision-making process (e.g. Environmental Impact Assessment process and setting of common environmental quality objectives), but also through ongoing transparent and open communication on status quo during design, construction and operations. Local management institutions (e.g. pipeline or catchment forums), for example, can be used for transparent stakeholder involvement throughout the process from application through to report back on monitoring results.

GROUND RULES

Ground Rules are derived within the broader context of the Basic Principles and provide more specific rules that will be applied by Government when considering licence applications to dispose of land-derived wastewater to the marine environment. For this operational policy, the Ground Rules are addressed under specific themes considered to be of particular importance in the disposal of land-derived wastewater to the marine environment (in alignment with the key components of the management framework), namely:

- Legislative Framework
- Management Institutions and Administrative Responsibilities
- Environmental Quality Objectives
- Activities and Associated Waste Loads
- Scientific and Engineering Assessment
- Monitoring and Contingency Plans.

GROUND RULES RELATED TO THE LEGISLATIVE FRAMEWORK:

1: Disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process must be licensed by the DWAF in terms of Section 21 (h). Also, a person who uses water must return any seepage, run-off or water containing waste which emanates from that use, to the water resource from which the water was taken, unless the responsible authority directs otherwise or the relevant authorisation provides otherwise (Section 22(2)(e)).

Principle supported: Integrated Assessment Approach

NOTE:

The National Water Act, 1998 is in the process of being amended in order to include a more suitable section dealing specifically with marine discharges. The amended sections will also be of relevance here.

In the context of this operational policy, currently only municipal wastewater and industrial wastewater discharges (i.e. point discharges) are required to be authorised by a licence under section 21 of the NWA. However, this does not exclude diffuse sources (such as urban stormwater) from being licensed in future.

Land-based activities within harbour areas that qualify as a water use under section 21 of the National Water Act 1998 are the responsibility of the DWAF and may require a licence. These include contaminated (or polluted) stormwater run-off from an industrial premise, as well as the disposal of polluted seawater that was used in an industrial process on land. In the case of commercial harbours, the National Ports Authority, as the landowner, is responsible for ensuring that developments and activities within its boundaries meet the requirements of national law, such as those required under the National Water Act.

2: The disposal of land-derived wastewater to the marine environment is subject to an Environmental Impact Assessment (EIA) under the Environmental Conservation Act 73 of 1989. The EIA process is administered by the Department of Environmental Affairs and Tourism (DEAT).

Principle supported: Integrated Assessment Approach

NOTE:

An EIA authorisation cannot replace a water use licence application, since the former does not address all the requirements of the National Water Act. For example the EIA process often excludes the legal validation (Stage 1) and pre-assessment (Stage 2) stages of the licence authorisation process under the National Water Act (refer to Section 6 of this document).

The granting of an authorisation under the EIA regulations does not necessarily mean that a water use licence will be granted (RSA DWAF, 2000). It is important that the applicant be aware of the overlap between the types of outputs required at certain stages of the water use licence and EIA processes and thus avoid duplication or unnecessary work. These overlaps are discussed in further detail in* Operational policy for the disposal of land-derived water containing waste to the marine environment of South Africa: Guidance on Implementation, Section 3 *(RSA DWAF Water Quality Management Sub-Series 13.3).

3: ***A licence issued for a water use, including the disposal of land-derived wastewater to the marine environment, is subject to review every 5 years (a provision of the National Water Act – sections 28 and 49). Revisions can also be motivated on grounds of negative impact on environment and non-compliance with licence conditions.***

Principle supported: Integrated Assessment Approach

4: ***Discharge of land-derived wastewater to any area declared a Marine Protected Area under the Marine Living Resources Act 18 of 1998 is prohibited***

Principle supported: Pollution Prevention, Waste Minimisation & Precautionary Approach

5: ***Any land-derived wastewater discharge to the marine environment may be subject to a waste discharge charge.***

Principle supported: Polluter Pays Principle

GROUND RULES RELATED TO MANAGEMENT INSTITUTIONS & ADMINISTRATIVE RESPONSIBILITIES:

6: ***The disposal of land-derived wastewater to the marine environment is currently governed by the DWAF under the National Water Act 36 of 1998. However, the DWAF will work in consultation with relevant local, provincial and national government departments (in particular the Department of Environmental Affairs and Tourism), as well as local management institutions (such as pipeline or catchment forums). This collaboration is required to ensure effective cooperative governance in the management of waste disposal to the marine environment of South Africa.***

Principle supported: Participatory Approach

7: ***Disposal of land-derived wastewater to the marine environment (offshore, surf zone or estuaries) must be managed through a local management institution. This can be an existing institution, such as a pipeline forum, monitoring committee, pipeline advisory committee, water quality committee or catchment forum. Representation must include government authorities (i.e. that hold jurisdiction), as well as non-government role players (e.g. industries, users of the marine environment and NGO's).***

Principle supported: Participatory Approach

GROUND RULES RELATED TO SENSITIVE AREAS:

8: ***Estuaries are classified as 'sensitive areas'. Disposal of municipal and industrial wastewater to these systems will therefore not be considered except in exceptional circumstances in which such inflows are required to improve or maintain the resource quality objectives (also taking into account effects of water quantity) or where the ecological functioning has been irreversibly modified to support commercial harbours. In the latter case, the resource quality objectives of other designated beneficial uses of the area, however, must be met as a minimum.***

Municipal and industrial wastewater discharges to estuaries, which were existing lawful water uses as on 31 May 2004, will be re-evaluated during the 5-yearly licence review process. Revisions can also be motivated on grounds of negative impact on environment and non-compliance with licence conditions

Principle supported: Pollution Prevention, Waste Minimisation & Precautionary Approach

9: ***The surf zone is classified as a 'sensitive area'. Disposal of municipal and industrial wastewater to the surf zone should therefore be avoided. Where legitimate motivation can be provided (e.g. in cases in which seawater used on land is returned to source), the environmental quality objectives for the study area must be met as a minimum. These include objectives pertaining to alteration of the natural salinity regime (in the case of freshwater discharges) and aesthetic impacts associated with the visibility of the discharge practice on land.***

Municipal and industrial wastewater discharges to the surf zone, which were existing lawful water uses as on 31 May 2004, will be re-evaluated during the 5-yearly licence review process. Revisions can also be motivated on grounds of negative impact on environment and non-compliance with licence conditions

Principle supported: Pollution Prevention, Waste Minimisation & Precautionary Approach

10: ***Discharges of land-derived wastewater to the offshore marine waters through a marine outfall may be considered as an option provided that the suitability of the areas to accommodate such activities is properly assessed***

Principle supported: Pollution Prevention, Waste Minimisation & Precautionary Approach

GROUND RULES RELATED TO ENVIRONMENTAL QUALITY OBJECTIVES:

11: ***Site-specific environmental quality objectives for the marine environment (excluding estuaries) must take into account the* South African Water Quality Guidelines for coastal marine waters *(RSA DWAF, 1995a) or any future updates thereof.***

Principle supported: Receiving Water Quality Objectives Approach

12: ***Where, in exceptional circumstances (as listed in Ground Rule 8), a discharge to an estuary is considered, resource quality objectives must be determined according to the methodology for estuaries developed by the Directorate: Resource Directed Measures (RSA DWAF, 2004 and future updates thereof). Estuaries are included in the definition of 'the water resource' in the National Water Act and objectives therefore must be determined in accordance with Chapter 3 of this Act.***

Principle supported: Receiving Water Quality Objectives Approach

13: ***Environmental quality objectives must be met within the area beyond the initial mixing zone.***

Principle supported: Pollution Prevention, Waste Minimisation & Precautionary Approach

GROUND RULES RELATED TO MUNICIPAL WASTEWATER:

14: ***South Africa is a water scarce country. Marine disposal of land-derived municipal wastewater (particularly freshwater) will therefore only be considered where it has been evaluated in terms of the Water Services Development Plan for a particular municipal area (required under the Water Services Act 108 of 1997, and which, in turn, forms part of the Integrated Development Plans required in terms of the Local Government Transition Act 209 of 1993). This requirement supports the concept of a 'Master Plan for water supply/demand and wastewater treatment'.***

Principles supported: Pollution Prevention, Waste Minimisation & Precautionary Approach
Integrated Assessment Approach

15: ***Municipal WWTW receiving industrial effluent (also referred to as trade effluent) will be subject to the Ground Rules for Industrial Wastewater (refer to Ground Rules 19 to 22). Service Providers or Local Authorities operating such treatment works will be required to prepare Industrial wastewater management plans (as part of the 'Master Plan'). It is also the responsibility of the Service Provider or Local Authority to investigate possible synergistic and/or cumulative effects which may occur as a result of the interaction between different (industrial) wastewater inputs.***

Principles supported: Pollution Prevention, Waste Minimisation & Precautionary Approach
Integrated Assessment Approach

16: ***The design, construction and management of collection systems (i.e. the land-based facilities at which the wastewater is collected prior to discharging to the marine environment) are outside the scope of this operational policy. The design, construction and management of such systems must comply with related policies and specifications of the DWAF.***

Principles supported: Pollution Prevention, Waste Minimisation & Precautionary Approach
Integrated Assessment Approach

17: ***In support of i) the DWAF's strategic view of 'enforcing source controls to get as close as possible to a situation in which there is no discharge of pollutants into our water' (referring to the Strategic view), ii) the hierarchy of decision-making (as reflected in Principle 1) and iii) international practice, primary treatment will be required as a minimum for disposal of municipal wastewater to the offshore marine environment. This minimum requirement will apply to all marine outfalls to be authorised after 31 May 2004. For marine outfalls that were already authorised by 31 May 2004, preliminary treatment will be accepted as a minimum requirement, provided that the receiving environment is suitable for this marine disposal and that the environmental (or resource) quality objectives are met. However, future expansions or upgrades to such existing marine outfalls will require primary treatment of the wastewater prior to discharge unless it can be proven that key socio-economic factors require otherwise. Nevertheless, environmental (or resource) quality objectives must still be met.***

As a minimum secondary treatment with disinfection will be required for disposal to the surf zone and estuaries. This applies to wastewater discharges to the surf zone and estuaries that existed as on 31 May 2004 and those to be authorised thereafter (where such discharges are allowed – refer to Ground Rules 8 and 9).

NOTE: The above set minimum requirements. Where such levels of treatment still do not meet the requirements of the receiving environment, as defined in terms of the environmental (or resource) quality objectives, higher levels of treatment will be required.

Principle supported: Pollution Prevention, Waste Minimisation & Precautionary Approach

18: ***The disposal of sludge arising from wastewater treatment facilities (e.g. primary, secondary and tertiary) must be in accordance with the Minimum Requirements for Waste Disposal by Landfill (DWAF, 1998) and the 'Sludge Guidelines' (1998 as amended in 2000) of the DWAF or any future updates of such policies or guidelines.***

Principles supported: Pollution Prevention, Waste Minimisation & Precautionary Approach
Integrated Assessment Approach

GROUND RULES RELATED TO INDUSTRIAL WASTEWATER:

19: ***The following is classified as ' industrial wastewater', requiring a licence, under Section 21 of the National Water Act for disposal to the marine environment:***

- ***Water used in an industrial process on land***
- ***Contaminated (or polluted) stormwater run-off originating from an industrial premises on land***
- ***Freshwater or seawater used as cooling water on land***
- ***Seawater used in an industrial process on land, e.g. seafood processing, coastal mining activities and return flows from oceanariums.***

Principle supported: Integrated Assessment Approach

20: ***An industry, discharging wastewater to a municipal WWTW or directly to the marine environment (or applying for a licence to do so), will be required to provide a detailed description of the waste stream in terms of both volume (quantity) and quality (i.e. listing all substances present and their concentrations and loads). Where industries discharge wastewater to a WWTW, the water services provider is responsible for obtaining this information from the industry concerned. The DWAF or local authority may also require a detailed inventory of the raw materials, as well as process material, used by an industry.***

Principle supported: Pollution Prevention, Waste Minimisation & Precautionary Approach

21: ***Industrial wastewater discharged to a municipal WWTW disposing to the marine environment will be subject to appropriate pre-treatment. It is the responsibility of the local authority operating the WWTW to ensure compliance in this regard.***

Principle supported: Pollution Prevention, Waste Minimisation & Precautionary Approach

22: ***Wastewater containing radioactive substances is governed by the Department of Minerals and Energy (in concurrence with the DEAT and DWAF) and must comply with policy developed in this regard.***

Principles supported: Pollution Prevention, Waste Minimisation & Precautionary Approach
Integrated Assessment Approach

GROUND RULES RELATED TO DIFFUSE WASTEWATER SOURCES:

23: ***Diffuse land-derived wastewater (such as urban stormwater run-off, agricultural return flows and contaminated groundwater seepage) discharged into the marine environment should not have any negative impact on the receiving environment, i.e. the environmental quality objectives must be met.***

Principles supported: Pollution Prevention, Waste Minimisation & Precautionary Approach
Integrated Assessment Approach

GROUND RULES RELATED TO SCIENTIFIC & ENGINEERING ASSESSMENT:

24: ***A licence application for the disposal of land-derived wastewater to the marine environment will only be considered where a holistic process has been followed for the disposal of land-derived wastewater to the marine environment. This implies that potential impacts on the receiving environment be investigated in both the near and far field, taking into account other anthropogenic activities and waste inputs so as to address possible synergistic and/or cumulative effects. Guidelines in this regard are provided in* Operational policy for the disposal of land-derived water containing waste to the marine environment of South Africa: Guidance on Implementation *(RSA DWAF Water Quality Management Sub-Series 13.3).***

Principle supported: Integrated Assessment Approach

25: ***A licence application for the disposal of land-derived wastewater to the marine environment will only be considered where a discharge system is designed, constructed and operated in accordance with recognised scientific, hydraulic and structural guidelines in order to meet environmental quality objectives.***

Principle supported: Pollution Prevention, Waste Minimisation & Precautionary Approach

26: ***Recognised numerical modelling techniques must be applied in the scientific and engineering assessment and design of a marine disposal system, as and where considered appropriate, according to recognised scientific and engineering guidelines.***

Principle supported: Pollution Prevention, Waste Minimisation & Precautionary Approach

27: ***A precautionary approach must be followed in the assessment and design of any marine disposal system in which the temporal and spatial coverage and accuracy of physical and chemical oceanographic data do not adequately describe site-specific conditions.***

Principle supported: Integrated Assessment Approach

GROUND RULES RELATED TO MONITORING & CONTINGENCY PLANS:

28: ***Any authority or industry responsible for the operation and management of a marine disposal system will be subject to the implementation of a monitoring programme.***

Principles supported: Pollution Prevention, Waste Minimisation & Precautionary Approach Integrated Assessment Approach & Participatory Approach

29: ***Authorities operating WWTW that receive industrial wastewater (also referred to as trade effluents) must ensure that monitoring programmes are implemented to record the individual flow and composition of such wastewater inputs prior to entering the wastewater reticulation system, as part of their industrial wastewater management plan.***

Principles supported: Pollution Prevention, Waste Minimisation & Precautionary Approach Integrated Assessment Approach & Participatory Approach

30: ***Any authority or industry responsible for the operation and management of a marine disposal system will be required to prepare contingency plans pertaining to maintenance shut downs, failure in operations or disasters.***

Principles supported: Pollution Prevention, Waste Minimisation & Precautionary Approach Integrated Assessment Approach & Participatory Approach

31: ***Any authority or industry responsible for the operation and management of a marine disposal system will be required to provide the DWAF with a regular evaluation of the performance of the marine disposal system.***

Principles supported: Pollution Prevention, Waste Minimisation & Precautionary Approach Integrated Assessment Approach & Participatory Approach

32: ***Where performance evaluations indicate non-compliance with the predetermined specifications (including the environmental quality objectives), the responsible authority or industry will be required to propose mitigating actions to ensure compliance (e.g. rehabilitation or alternative treatment options). The responsible authority and the industry operating the wastewater disposal system will be required to implement such actions at their own cost upon approval of the DWAF.***

Principle supported: Pollution Prevention, Waste Minimisation & Precautionary Approach and Polluter Pays Principle

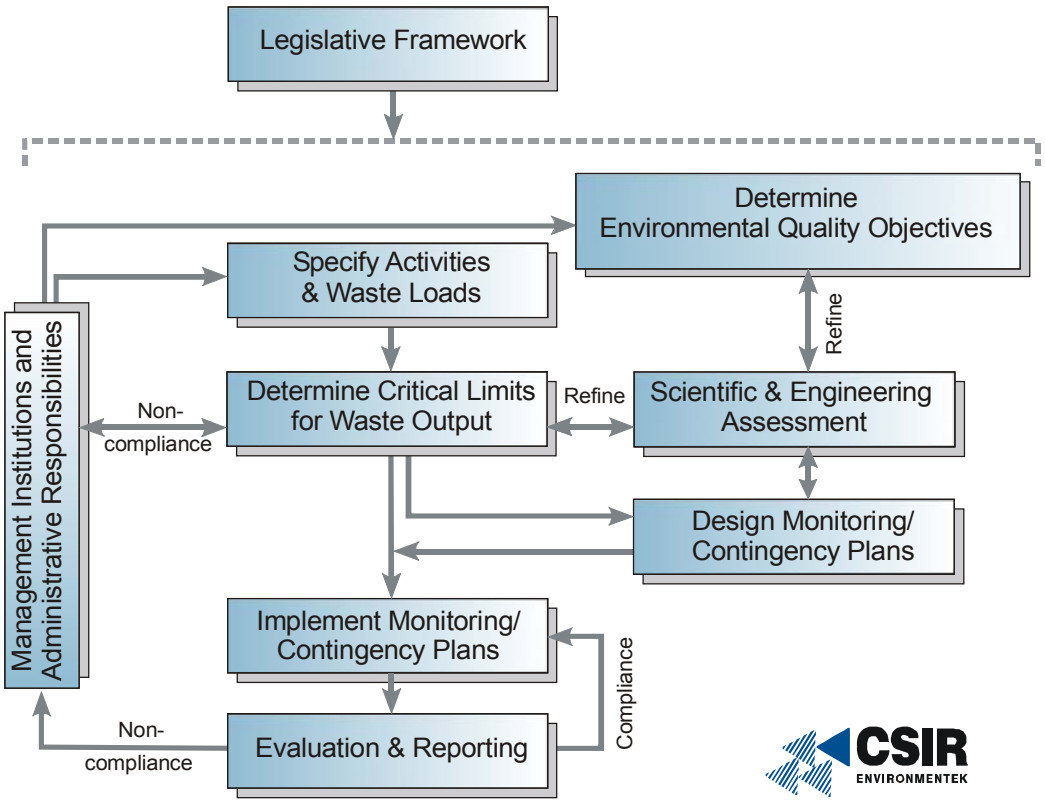
33: Decommissioning of a marine discharge structure must be addressed in the planning stages as part of the EIA process, supporting the cradle-to-grave principle. In the case of existing marine discharge structures (authorised prior to 31 May 2004), the authority, service provider or industry responsible for the operation and management of the marine discharge will be required to conduct decommissioning in an environmentally responsible manner. This may require an EIA. Negotiations should be conducted on a case-by-case basis, involving the DWAF, DEAT, the authority, service providers or industry responsible for the marine discharge and any other parties that may be affected by the decommissioning process.

Principles supported: Pollution Prevention, Waste Minimisation & Precautionary Approach
Integrated Assessment Approach

MANAGEMENT FRAMEWORK

The Management Framework provides the generic and structured approach within which the management and control of disposal of land-derived wastewater to the marine environment of South Africa needs to be conducted. Such a framework typically consists of the following components and is schematically illustrated in the figure below:

- Legislative Framework
- Management Institutions and Administrative Responsibilities
- Determination of Environmental Quality Objectives
- Specification of Activities and Associated Waste Loads (including determination of critical limits)
- Scientific and Engineering Assessment
- Monitoring and Contingency Plans (including evaluation and reporting).



APPROVAL

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- KZN Wildlife
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- Koeberg Power Station
- Earth Life Africa
- WWF, formerly known as the World Wildlife Fund
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- South African Local Government Association
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DOCUMENTS IN SERIES

Sub-Series MS13.1	Operational Policy for the disposal of land-derived water containing waste to the marine environment of South Africa: Inception Report
Sub-Series MS13.2	**Operational Policy for the disposal of land-derived water containing waste to the marine environment of South Africa**
Sub-Series MS13.3	Operational Policy for the disposal of land-derived water containing waste to the marine environment of South Africa: Guidance on Implementation:
Sub-Series MS13.4	Operational Policy for the disposal of land-derived water containing waste to the marine environment of South Africa: Appendices

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ACRONYMS

ANZECC	Australian and New Zealand Environment and Conservation Council
BAT	Best available technology
BOD	Biochemical oxygen demand
CEPA	Canadian Environmental Protection Act
COD	Chemical oxygen demand
CTD	Conductivity-Temperature-Depth
CWA	Clean Water Act (United States)
1-D	One-Dimensional
2-D	Two-Dimensional
3-D	Three-Dimensional
DBSA	Development Bank of South Africa
DEAT	Department of Environmental Affairs and Tourism
Defra	Department of Environment, Food and Rural Affairs (UK)
DPLG	Department of Provincial and Local Government
DWAF	Department of Water Affairs and Forestry
EC	European Community
e.p.	Equivalent population
EPA (Australia)	Environmental Protection Authority (Australia)
EPA	Environmental Protection Agency
GPS	Global Position System
GRP	Glass reinforced plastic
HDPE	High density polyethylene
IEM	Integrated Environmental Management
KZN	Kwazulu-Natal
LC_{50}	Concentration that is lethal to 50% of the test organisms
LPDE	Low density polyethylene
MATD	Minimum acceptable toxicant dilution
MDPE	Medium density polyethylene
MPa	Mega Pascal (unit)
NEMA	National Environmental Management Act 107 of 1998
NOAEC	No-observed-adverse-effect-concentration
NPDES	National Pollutant Discharge Elimination System
NTRPC	Natal Town And Regional Planning Commission
NWA	National Water Act 36 of 1998
NZWERF	New Zealand Water Environment Research Foundation
POTW	Public owned treatment works
PRO	Primary Responsible Officer
PVC	Polyvinal chloride
SADCO	South African Data Centre for Oceanology
SANCOR	South African National Committee for Oceanographic Research
SEPA	Scottish Environment Protection Agency
SS	Suspended solids
SUDS	Sustainable Urban Drainage System

UNEP	United Nations Environmental Programme
uPVC	unplasticised Polyvinal chloride
US-EPA	United States Environmental Protection Agency
WESSA	Wildlife and Environment Society of South Africa
WHO	World Health Organisation
WMS	Water Management System of DWAF
WRC	Water Research Commission
WRc	Water Research Centre
WWF	WWF - formerly know as the World Wildlife Fund
WWTW	Waste water treatment works
ZID	Zone of initial dilution

GLOSSARY OF TERMS

Advective transport	The transport of dissolved or suspended material in a horizontal plane by a current
Agglomeration	An area where the population and/or economic activities are sufficiently concentrated for urban wastewater to be collected and conducted to an urban wastewater treatment plant or to a final discharge point
Agricultural run-off	Irrigation tail-water, other field drainage, animal yard, feedlot, or dairy run-off, etc.
Anthropogenic	Having to do with man, or caused by humans
Aquifer	Underground layer of permeable rock, sand or gravel that conveys water
Aquaculture	Breeding and rearing of freshwater and marine (mariculture) organisms, such as fish, including the husbandry, management, nutrition, genetics and controlled propagation of all aquatic organisms for use by humans
Assimilative capacity	The ability of an ecosystem to absorb substances such as human waste and pollutants
Bathymetry	Measurement of the depths of water bodies (ocean, estuaries, dams)
Benchmark	Point of reference
Benthic organisms	Organisms living in or on sediments of aquatic habitats
Bioaccumulation	A process whereby chemical substances are accumulated by aquatic organisms, directly from water or through consumption of food containing such chemicals
Bioavailable	Able to be taken up by organisms
Biochemical oxygen demand (BOD)	A measurement of the amount of oxygen taken up by micro-organisms in oxidizing reducing material in the water sample. Normally measured over a 5 day period at 37 degrees C
Biodiversity	The variability among living organisms from all sources including, *inter alia*, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part. This includes diversity within species, between species and of ecosystems
Catchment	In relation to a watercourse or watercourses or part of a watercourse, this term means the area from which any rainfall will drain into the watercourse or watercourses or part of a watercourse, through surface flow to a common point or common points
Chemical oxygen demand (COD)	A measure of the amount of potassium dichromate needed to oxidise reducing material in the water sample. It is generally higher than the biochemical oxygen demand.
Coastal area	The part of the land affected by its proximity to the sea, and that part of the sea affected by its proximity to the land as the extent to which man's land-based activities have a measurable influence on water chemistry and marine ecology
Collecting system	A system of conduits that collects and conducts urban wastewater
Community	Assemblage of organisms characterised by a distinctive combination of species that occupy a common environment and interact with one another
Community composition	All taxa present in a community

Cumulative impact (or effect)	Cumulative impact is the impact on the environment which results from the incremental or combined effects of one or more developmental activities in a specified area over a particular time period, which may occur simultaneously, sequentially, or in an interactive manner.
Diffusive transport	When dissolved or suspended material 'flows' from one part within a medium with high concentrations to adjacent parts of the medium with low concentrations
Dilution	The reduction in concentration of a substance due to mixing with water
Dissolved oxygen (DO)	Oxygen dissolved in a liquid, the solubility depending upon temperature, partial pressure and salinity, expressed in milligrams/litre or milliliters/litre
Domestic wastewater	Wastewater arising from domestic and commercial activities and premises, which may contain sewage (as per General Authorisations - GG 20526 GN 1191 of 8 October 1999)
Echo-sounder	Device that determines depth by measuring the time taken for a pulse of high-frequency sound to reach the sea bed or a submerged object and for the echo to return.
Ecological integrity	Maintaining a diverse, healthy and productive natural system
Economic incentive	A motivating financial instrument, such as a tax concession or rebate, used to encourage a particular attitude or action
Ecosystem	A community of plants, animals and organisms interacting with each other and with the non-living (physical and chemical) components of their environment
Eddies	The movement of a stream of water in which the current doubles back on itself causing a type of 'whirlpool'. This is typically caused by promontories along a coastline or due to counteractions from driving forces such as wind shear and an ambient current
Effluent	Liquid fraction after a treatment process (i.e. preliminary, primary, secondary or tertiary) in a wastewater treatment works
Environmental impact	A positive or negative environmental change (biophysical, social and/or economic) caused by human action
Environmental quality objective	A statement of the quality requirement for a body of water to be suitable for a particular use (also referred to as Resource Quality Objective)
Environmental quality standard	The specified concentration of a substance that legally may not be exceeded so as to protect the receiving environment for a particular use
Equity	Treating all people with dignity, fairness and justice.
Equivalent population	The population that comprises the resident population, an allowance for holiday visitors and a conversion of industrial pollution loads to population terms, based on flow or biological load
Estuary	A partially or fully enclosed body of water which is open to the sea permanently or periodically, and within which the seawater can be diluted, to an extent that is measurable, with freshwater drained from land. The upstream boundary of an estuary is the extent of tidal influence.
Eulerian (current measurements)	Measuring current by means of a geographically fixed meter that measures the velocity of flow of the passing water
Eutrophication	Enrichment of water with nutrients causing abundant algal or plant growth often leading to subsequent deficiencies in dissolved oxygen

Far field	Within the context of ocean outfalls, the spatial/volumetric extent of the receiving water body in which the waste field is transported and dispersed after the initial dilution process
Habitat	A place, characterised by its physical properties and other life forms, where an organism or community occurs
Head works	The head works receives wastewater from a catchment and treats it to a specified standard prior to discharge.
Industrial wastewater	Wastewater arising from industrial activities and premises. Contaminated stormwater drainage from industrial premises is included in this definition
Initial dilution	The dilution of the wastewater plume generated by jet momentum and the buoyancy effects that occur between the outlet ports of a marine outfall's diffuser and the sea surface
Initial mixing zone	During the initial dilution process, ambient water is entrained by jet and buoyancy-induced turbulence and shear, causing dilution of the rising wastewater plume. When the density of the discharge plume approaches the density of the seawater, the initial dilution process will cease and, depending on stratification in the water column, this process may stop below the surface. The spatial/volumetric extent of the initial dilution process is referred to as the **initial mixing zone**. This process can be manipulated by the hydraulic design of the outfall system (discharge rate and diffuser configuration). Ambient processes will control the further mixing of the wastewater plume. However, these cannot be manipulated and the degree of mixing, when compared with the achievable initial dilutions, is almost insignificant. Only the physical location of the discharge structure can be optimised for achieving required dilutions at distant locations.
Land-based treatment	The treatment of wastewater at an inland site. Inland treatment, for example includes preliminary, primary, secondary or tertiary treatment of the wastewater prior to discharge.
Integrated Development Plan	A plan drawn up by local government to prioritise and co-ordinate development activities and investment, and to promote effective use of budgets
Interstitial water	Water that occurs naturally within the pores or spaces between sediment particles
Inter-tidal	Zone between high and low tide-marks
Lagrangian (current measurements)	Measuring currents by recording the path of a neutrally-buoyant float that follows the flowing water mass
Macroinvertebrates	Animals that have no backbone and are visible without magnification
Macrophytes	Macrophytes are (aquatic) plants that are large enough to be apparent to the unaided eye
Mariculture	Cultivation of marine plants and animals in natural and artificial environments
Marine discharge	Discharging wastewater to the marine environment either to an estuary or the surf zone or through a *marine outfall* (i.e. to the offshore marine environment)
Marine environment	Marine environment includes estuaries, coastal marine and near-shore zones, and open-ocean-deep-sea regions.

Marine outfall	A submarine pipeline originating on shore, which conveys wastewater from a head works to a submerged discharge location on or near the seabed beyond the surf zone (i.e. to the offshore marine environment). Also referred to in the literature as a long sea outfall/pipeline and ocean outfall/pipeline.
Measurement parameter	Within the context of this document, any parameter or variable that is measured to find out something about an ecosystem
Meiofauna	Animals ranging in size from approximately 0.1 mm to 1 mm that live within sediments
Municipal wastewater	Domestic wastewater or the mixture of domestic wastewater with industrial wastewater and/or urban stormwater run-off
Nearfield	Within the context of ocean outfalls this refers to the spatial/volumetric extent of the receiving water body in which the initial dilution process takes place.
Nearshore	Within the context of ocean outfalls, this is the zone in the sea in which wave action has a significant effect on water circulation and shoreline processes (erosion and accretion).
Non-point source pollution	Pollution originating from a number of diffuse sources often associated with run-off from agricultural and urban areas
Offshore	Within the context of ocean outfalls, this is the zone in the sea in which wave action has an insignificant effect on water circulation and shoreline processes (erosion and accretion)
Physiography	Description of the natural features of the seabed (physical geography)
Point-source pollution	Pollution discharged from a specific fixed location, such as a pipe or outfall structure
Pollution	The direct or indirect alteration of the physical, chemical or biological properties of the natural environment, including the marine environment, so as to make it less fit for any beneficial purpose for which it may reasonably be expected to be used, or to make it harmful or potentially harmful to the welfare, health or safety of human beings or to any aquatic or non-aquatic organisms
Precautionary principle	Avoiding risk through a cautious approach to development and environmental management
Preliminary treatment	Involves the removal from wastewater of 'litter' and solids by coarse and/or fine screens as well as the removal of 'grit' (particles sizes > 0.2 mm and with a specific gravity > 2.6) by settling or separation. The effect on the suspended solid concentrations and *BOD* in the sewage is insignificant.
Primary treatment	Involves the removal from wastewater of settleable organic and inorganic solids by sedimentation tanks. The solids, which settle as sludge, have to be disposed of or treated. Fats (oil and grease) are also skimmed from the top of the settling tank. During primary treatment > 40% of suspended solids and 20% of *BOD* are removed.

Reserve	The quantity and quality of water required: • to satisfy basic human needs by securing a basic water supply, as prescribed under the Water Services Act, 1997 (Act No. 108 of 1997), for people who are now or who will, in the reasonably near future, be relying upon, taking water from, or being supplied from the relevant water resource, and • to protect aquatic ecosystems in order to secure ecologically sustainable development and use of the relevant water resource.
Resource quality objectives	Management Objectives for a resource relating to quality of all the aspects of a water resource including: • the quantity, pattern, timing, water-level and assurance of instream flow; • the water quality, including the physical, chemical and biological characteristics of the water; • the character and condition of the instream and riparian habitat; and • the characteristics, condition and distribution of the aquatic biota. These objectives are set by the Department of Water Affairs and Forestry in terms of Chapter 3 of the NWA
Rhodamine-B dye	A fluorescent red basic xanthene dye used in the marine environment to determine transport and dispersion patterns
Risk-aversion	Active avoidance to possible exposure to loss of human life, or property damage as a result of hazardous events or coastal processes.
Seashore	The water and the land between the high- and low-water marks
Secondary dilution or dispersion	The further dilution that occurs after initial dilution when a wastewater plume is advected away from the discharge area
Secondary treatment	The separation of liquid and solids contained in primary treated wastewater by a stabilizing process, utilizing micro-organisms and oxygen (aerobic biological treatment by biofilters and/or aeration tanks). The liquid and solids are separated through settling and the sludge is disposed of or treated. Normally secondary treatment removes > 70% of suspended solids and BOD.
Side scan sonar	Sonar is the acronym for **so**und **n**avigation **a**nd **r**anging, a technique used for the detection and location of underwater objects by emitting acoustic waves, and by the interception of the reflected acoustic waves from underwater obstacles. A side scan sonar is a sonar system that transmits sound energy and analyses the echo (return signal) which bounces back from irregularities on the sea-floor, providing a black and white 'trace' of the sea-floor. Usually the side scan sonar (housed in a towfish) is towed behind a boat at a predetermined depth in deeper water or it can be mounted on the hull of the boat for use in shallow water.
Sludge	Residual sludge, whether treated or untreated, from urban wastewater treatment plants
Subtidal	The zone below the low-tide level, i.e. it is never exposed at low tide
Sustainability	In terms of water quality management (DWAF), this means: 'Fitness for use by other users and future generations' and the ability to assimilate waste means the ability to receive and process waste to such an extent that the water remains fit for use by its other intended users.

Surf zone	Also referred to as the 'breaker zone' where water depths are less than half the wavelength of the incoming waves with the result that the orbital pattern of the waves collapses and breakers are formed
Synergistic effect	When the effect of two chemicals acting together has a greater negative impact on an ecosystem than the impact of each chemical individually, or the sum of the individual impacts
Tertiary treatment	Involves the further treatment of secondary treated wastewater to remove nitrogen, phosphorus, ammonia, remaining suspended solids, organic compounds, heavy metals and dissolved solids by special treatment processes
Trade effluent	Term used for industrial wastewater discharged to a WWTW
Urban stormwater run-off	Stormwater run-off from paved areas, including parking lots, streets, residential subdivisions, of buildings, roofs, highways, etc.
Waste	Any solid material or material that is suspended, dissolved or transported in water (including sediment) in such volumes, composition or manner that, if spilled or deposited in the natural environment, will cause, or is reasonably likely to cause, a negative impact
Water containing waste	Water containing solid, suspended or dissolved material (including sediment) in such volumes, composition or manner that, if spilled or deposited in the natural environment, will cause, or is reasonably likely to cause, a negative impact
Wastewater	See *Water containing waste*

SECTION 1:
INTRODUCTION

1.1 HISTORICAL PERSPECTIVE

Previously, the disposal of land-derived water containing waste (to be referred to as *'wastewater'* for the purposes of this document), to the marine environment of South Africa was governed by the Water Act 54 of 1956, in particular section 21.

Section 21(1) of the Act required that:

- Water containing waste had to be purified or treated in accordance with requirements as prescribed by the Minister, in this case the *General and Special Standard* gazetted in 1984 (Government Notice No. 991 – 18 May 1984)

- Thereafter the purified or treated water had to be discharged in a manner and subject to requirements as may be prescribed by regulations issued under the Act:

    - If the water so used was derived from a public stream it had to be returned to that public stream at the place where such water was abstracted or at such other place as the Minister may indicate

    - If the water so used was seawater it had to be returned to the sea at the place of abstraction or at such other place as the Minister may indicate.

The Act allowed for the issuing of exemptions from the requirements specified in section 21(1). Such exemptions were also issued in terms of discharges to the marine environment. In coastal areas, freshwater discharges often did not comply with the quality standards for rivers. Such discharges were exempted from meeting the prescribed standards as well as from returning the water to the source of abstraction. These exemptions were granted for wastewater discharges to the:

- Offshore marine environment
- Surf zone
- Estuaries.

(The existing wastewater discharges to the marine environment of South Africa are listed in Appendix A in *Operational policy for the disposal of land-derived water containing waste to the marine environment of South Africa: Appendices* [RSA DWAF Water Quality Management Sub-Series 13.4].)

In the case of offshore marine outfalls, not only was exemption granted to discharge water to the sea (i.e. not necessarily to the place of abstraction), but there was also relaxation of the *General and Special Standard* (Government Notice No. 991 – 18 May 1984). In order to minimise the negative impact on the marine environment, the DWAF adopted a receiving water quality objectives and fitness for use approach. To assist in setting receiving water quality objectives for the marine environment, the *Water Quality Criteria for the South Africa coastal zone* were published in 1984 (Lusher, 1984). In 1995 this document was replaced by the *South African Water Quality Guidelines for Coastal Marine Waters* (RSA DWAF, 1995a).

In the case of wastewater discharges to the surf zone and estuaries, exemption was granted to discharge freshwater to the sea (i.e. not necessarily to the place of abstraction), provided that the wastewater was treated to the *General and Special Standard* (Government Notice No. 991 – 18 May 1984). However, *General and Special Standard* did not, for example, take into account potential negative impacts of 'freshwater' on these largely saline receiving environments.

Even though the design and planning of offshore marine outfalls did appropriate the Receiving Water Quality Objectives approach, this earlier approach was not applied to surf zone and estuarine discharges. Also, other options along the Pollution Prevention route, such as recycling, re-use or the application of waste reduction and minimization technologies at source, were not strictly enforced. Design criteria for existing marine outfalls also specify a minimum flow to obtain the desired dilution and dispersion. Such minimum flows would also have been seen as a limiting factor in applying waste minimisation and cleaner production.

In 1991 the Department of Water Affairs and Forestry (DWAF) published its *Water quality management policies and strategies in the RSA* (RSA DWAF, 1991). This was further elaborated in *Procedures to assess effluent discharge impacts*, published in 1995 (RSA DWAF 1995b) and are currently being updated (RSA DWAF, 2002a).

These policies and strategies changed the DWAF's approach to water quality management from the Uniform Effluent Standard approach (i.e. enforcing compliance to *General and Special Standard*) to the Receiving Water Quality Objectives approach (i.e. focusing on the fundamental water quality management goal, namely maintaining fitness for use). This change was necessary to counter the continuing deterioration of water quality and to meet the challenges of the future. The DWAF had recognised that without the necessary precaution, the Receiving Water Quality Objectives approach would inevitably lead to the deterioration of water resources to the point where they would be only marginally fit for their recognised uses. To counter the limitations of this new approach, and consistent with environmental policy worldwide, the DWAF decided to embody in its water quality management policy a hierarchy of decision making which contains elements of the Receiving Water Quality Objectives approach, as well as the precautionary principle of environmental protection through source reduction, minimisation, treatment, re-use, etc.

This hierarchy of decision making can be summarised as follows:

1) Pollution Prevention, preventing waste production and pollution wherever possible.

2) Minimisation of pollution and waste at source, minimizing unavoidable waste through:

   - Recycling
   - Detoxification
   - Neutralisation
   - Treatment and re-use of waste streams
   - Cleaner technologies and best management practices.

3) Responsible disposal, applying the precautionary approach:

   - Apply wastewater standards as a minimum requirement
   - If wastewater standards are not sufficient, maintain fitness for use of the receiving water body in accordance with the Receiving Water Quality Objective approach
   - Exemption from compliance to wastewater standards will only be considered in exceptional circumstances provided that the receiving water body remains fit for use in accordance with the Receiving Water Quality Objective approach.

Therefore, an application to dispose of wastewater to the environment must demonstrate that all reasonable efforts have been made, firstly to prevent waste, and secondly to minimise it. Only thereafter will minimum wastewater standards or standards based on the Receiving Water Quality Objective approach, whichever is strictest, be considered.

Alternative options of managing wastewater must therefore be investigated. Disposal to the marine environment is NOT the 'default' option in coastal areas. In evaluating wastewater disposal in coastal areas it should be considered that, for example:

- Real estate value in coastal areas is high which can have implications in terms of large surface areas required for treatment plants (e.g. maturation and oxidation ponds).
- The marine environment, particularly the surf zone and estuaries, constitutes ecologically sensitive areas in which disposal of freshwater or wastewater of an unacceptable quality can have negative impacts, causing overall degradation with economically, socially and ecologically negative affects.
- Coastal areas are popular holiday and tourist destinations that particularly require that water should be of a high quality to support, for example, recreational use.

1.2 THIS OPERATIONAL POLICY

In 1998, the National Water Act (Act 36 of 1998) (NWA) was promulgated to give legal status to the White Paper on a National Water Policy for South Africa (April 1997) and the DWAF's water quality management policies and strategies, amongst others. The NWA replaced the Water Act of 1956. Section 21 of the NWA specifies land-derived wastewater discharges as a water use for which a licence must be obtained from the DWAF. Of particular relevance are sections 21(f) and 21(h):

21(f) discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit

21(h) disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process

Discharges to estuaries, with estuaries being included in the definition of a water resource under the NWA, are covered under these sub-sections. However, although section 21(f) specifies '*discharging through a sea outfall'* as a water use, the '*sea*' (i.e. the surf zone and offshore marine environment) is currently not defined as a water resource under the NWA. To rectify this inconsistency, the DWAF is in the process of amending the NWA (Suzan Oelofse, Water Quality Management, DWAF, Pretoria, pers. comm.). In the interim, section 21(h) of the NWA covers the disposal of land-derived wastewater originating from industrial processes (including contaminated stormwater run-off from industrial premises) to the marine environment in that it specifies' *disposing in <u>any manner</u> of water which contains waste from, or which has been heated in, any industrial or power generation process*'.

Similar to the Water Act of 1956, section 22(e) of the NWA also requires that water be returned to its original source after use, unless the relevant authorisation not to do so has been granted:

22. (2)(e) …must return any seepage, run-off or water containing waste which emanates from that use, to the water resource from which the water was taken, unless the responsible authority directs otherwise or the relevant authorisation provides otherwise...

The National Water Resource Strategy (developed under the NWA) provides the framework for the protection, use, development, conservation, management and control of water resources of South Africa as a whole. In particular the strategy recognises that, although '*most water used in a non-consumptive manner is directly recycled for re-use or returned to the rivers for re-use elsewhere, there is further potential, particularly in coastal areas for re-use of water'* (RSA DWAF, 2002c).

To fulfil its legal obligation in terms of the management and control of land-derived wastewater under section 21 of the NWA, the DWAF commissioned this project to develop an *operational policy*, specifically focusing on the *disposal of land-derived water containing waste (or wastewater) to the*

marine environment of South Africa (including estuaries, the surf zone and offshore marine waters), incorporating all relevant international and national principles, policies and legislation,

The legislative framework for governance consists of several levels (Cloete & Wissink, 2000):

- *Principles*, stating society's values in relation to a specific issue, for example, the *Water Law Principles*
- *Policy* is a statement of intent by government in which it indicates how compliance to principles will be ensured, for example the *White paper on integrated pollution and waste management for South Africa (May 2000)*
- *Legislation* is the primary tool of Government for the implementation of policy, providing details on how policy objectives will be implemented and enforced, for example the *National Water Act 36 of 1998*
- *Regulations* provide the quantitative details relating to specific legislation, for example, the *General authorisation for water use*.
- *Best Practice Guidelines* is a general term that covers a wide range of activities, which may not be regulatory but which reflect the principles and support implementation of policy, for example, the *South African Water Quality Guidelines for Coastal Marine Waters*.

This operational policy for the disposal of land-derived wastewater to the marine environment falls within the category, **i.e. Best Practice Guidelines**.

International and national policies and legislation that were taken into account in the development of this operational policy include (refer to Appendix B in *Operational policy for the disposal of land-derived water containing waste to the marine environment of South Africa: Appendices* [RSA DWAF Water Quality Management Sub-Series 13.4]):

- Agenda 21
- Global Programme of Action for the Protection of the Marine Environment from Land-Based Activities (GPA)
- 1996 Protocols to the London Convention 1972, as amended
- White Paper: National Water Policy (November 1996)
- White Paper on Environmental Management Policy (July 1997)
- White Paper on Integrated Pollution and Waste Management for SA (May 2000)
- White Paper for Sustainable Coastal Development in South Africa (April 2000)
- The Constitution of the Republic of South Africa Act 108 of 1996
- National Water Act 36 of 1998
- Water Services Act 108 of 1997
- National Environmental Management Act 107 of 1998 (NEMA)
- Environment Conservation Act 73 of 1989
- Marine Living Resources Act 18 of 1998
- Health Act 63 of 1977
- Minerals Act 50 of 1991
- Hazardous Substances Act 15 of 1973
- National Environmental Management: Coastal Zone Bill (Draft 7).

Within the context of existing strategies and policies of the DWAF, the overall context of this operational policy is illustrated in Figure 1.1. The overarching objectives of the strategies and policies indicated in Figure 1.1 therefore also apply to this operational policy. Although not explicitly repeated

in this section, the objectives of these strategies and policies were taken into account in the development of the specific strategy, goal, basic principles and ground rules of this operational policy.

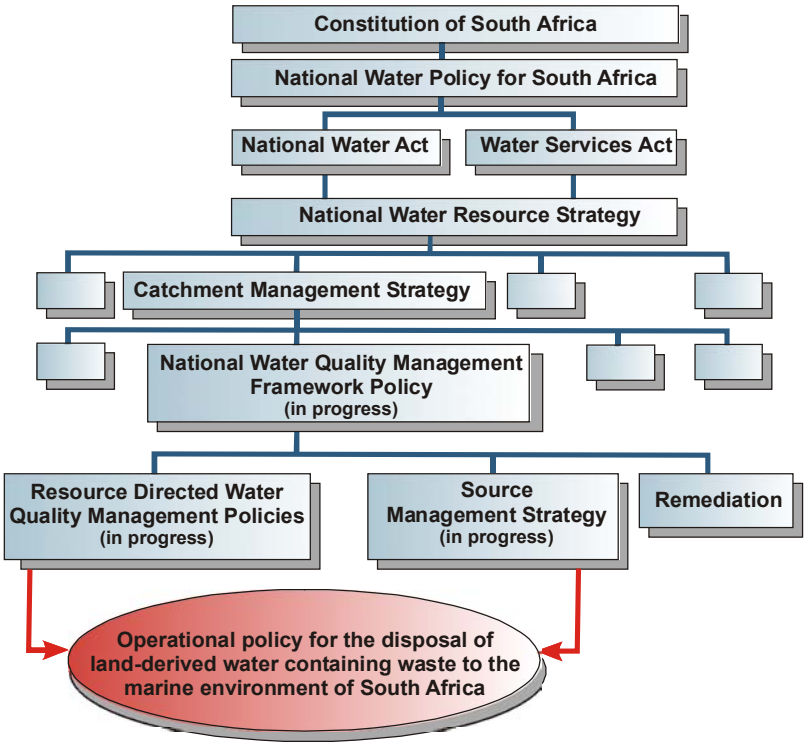


FIGURE 1.1: This operational policy within the context of existing strategies and operational policies within the DWAF

Land-derived wastewater discharges to the marine environment include point source discharges (i.e. discharges of which the volume and quality can be readily controlled) and non-point source (or diffuse) discharges (i.e. discharges of which the volume and quality are difficult to control). In the assessment of any wastewater discharge to the marine environment, both point and diffuse inputs must be taken into account.

Point source discharges of land-derived wastewater can be divided broadly into municipal wastewater and industrial wastewater discharges. Industrial wastewater includes discharging of seawater that is used for industrial purposes on land (e.g. coastal mining, fish processing industries and return flows from oceanariums), as well as contaminated (or polluted) stormwater run-off from an industrial premises (i.e. containing pollutants derived from the industrial process).

Diffuse discharges include urban stormwater run-off, agricultural and mining return flows, as well as contaminated groundwater seepage (these can discharge either directly into the marine environment or indirectly through river inflow). Although there are means of calculating and measuring the volumes and composition of diffuse wastewater inputs, controlling such properties, once the wastewater reaches the marine environment (or any other water resource), is extremely difficult. Such properties, therefore, are best managed and controlled at source, i.e. the point of origin.

Land-based treatment options to manage and control wastewater (i.e. treatment at source) are not within the scope of this operational policy. However, treatment requirements for marine disposal are specified, in particular, for municipal wastewater discharges. In the case of industrial wastewater, it is recommended that a *Code of Practice* be developed for industries in South Africa, addressing ways in which to eliminate or minimise the production of waste, based on best available techniques. This source directed approach to waste elimination and minimisation is considered to be of great value.

In the case of diffuse wastewater (e.g. urban stormwater run-off, agricultural and mining return flows), land-based source management and control measures need to be developed at a catchment level, taking into account existing initiatives.

1.3 CONTEXT: LARGER MARINE WASTE MANAGEMENT FRAMEWORK

In general, human developments and activities associated with waste disposal to the marine environment can be subdivided into four broad sub-categories:

- Wastewater originating from land-derived point sources, including municipal wastewater discharges and industrial effluent discharges.
- Water containing waste from diffuse, land-derived sources, including contaminated stormwater run-off (usually originating from urban and industrial areas), agricultural return flows and contaminated groundwater seepage. Pollutants from these activities may enter the marine environment via a river or they may be discharged directly into the marine environment.
- Pollution associated with shipping activities, including pollution from oil and garbage.
- Dumping at sea, including the dumping of waste matter and dredge spoil.

In South Africa, the legislative framework within which these activities are governed is still largely sectoral, (i.e. 'activity focused') as illustrated below:

SUB-CATEGORY	*KEY AUTHORITY RESPONSIBLE*	*KEY MANDATE*
Wastewater from land-derived point and diffuse sources	***Department of Water Affairs and Forestry***	***National Water Act 36 of 1998***
Pollution associated with shipping activities	*Department of Environmental Affairs & Tourism (prevention)*	*Prevention and Combating of Pollution at Sea by Oil Act 6 of 1981*
	Department of Transport (clean-up)	*Prevention and Combating of Pollution at Sea by Oil Act 6 of 1981* *Marine Pollution Intervention Act 64 of 1987*
Dumping at sea	*Department of Environmental Affairs & Tourism*	*Dumping at Sea Control Act 73 of 1980 (London Convention)*

The context of this operational policy within the larger marine pollution control and waste management is schematically illustrated in Figure 1.2.

Operational policies (relating to specific activities) are considered to be crucial building blocks in achieving an integrated and holistic pollution control and waste management system for South Africa. Although not within the scope of this project, it is envisaged that similar operational policies will be developed for other waste disposal activities to the marine environment. These would include activities associated with shipping traffic and dredge spoil dumping, which currently fall within the jurisdiction of the Department of Environmental Affairs and Tourism (DEAT). To facilitate effective cooperative governance, such policies should eventually be combined in an overarching operational policy for the disposal of waste to the marine environment of South Africa.

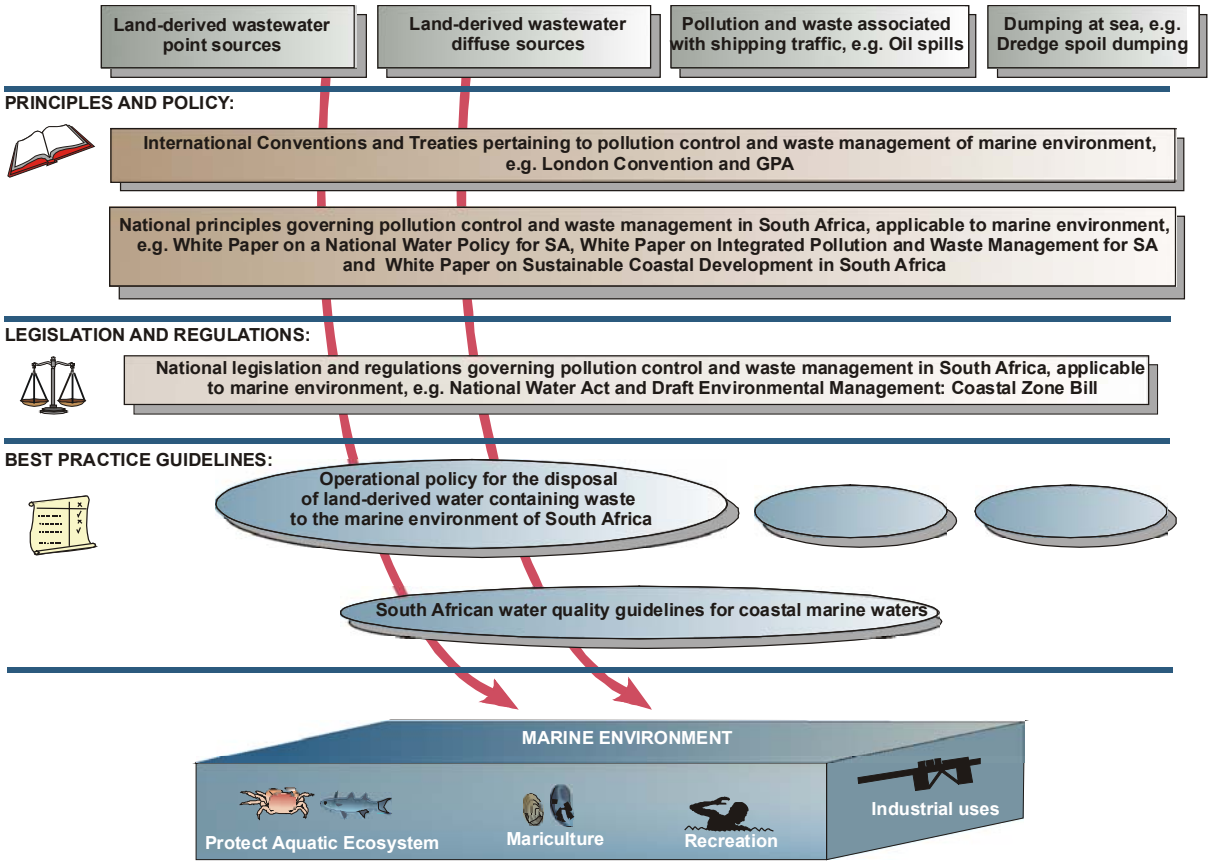


FIGURE 1.2: Context of the operational policy within the larger marine pollution control and waste management framework

1.4 APPROACH

The approach that was followed in deriving the operational policy for the disposal of land-derived wastewater to the marine environment was as follows:

- International and national policies and legislation, relevant to South Africa, were reviewed as a basis for this operational policy, as well as to ensure that the operational policy was strongly aligned with South Africa's overarching obligations and commitments (both international and national) in pollution control and waste management in the marine environment (refer to Appendix B in *Operational policy for the disposal of land-derived water containing waste to the marine environment of South Africa: Appendices* [RSA DWAF Water Quality Management Sub-Series 13.4.]).
- International trends in policy pertaining to the disposal of land-derived wastewater to the marine environment were evaluated and adopted where applicable in the SA context. (refer to Appendix C in *Operational policy for the disposal of land-derived water containing waste to the marine environment of South Africa: Appendices* [RSA DWAF Water Quality Management Sub-Series 13.4])
- Operational policy that were previously applied in South Africa, e.g. under the previous Water Act 56 of 1954 and the track record of the performance of marine disposal activities in South Africa over the past years were used as basis from which to work.

(refer to Appendix A in *Operational policy for the disposal of land-derived water containing waste to the marine environment of South Africa: Appendices* [RSA DWAF Water Quality Management Sub-Series 13.4])

- New and improved technological and scientific developments pertaining to the disposal of land-derived wastewater to the marine environment, both locally and internationally were considered and included where appropriate (as incorporated in *Operational policy on the disposal of land-derived water containing waste to the marine environment of South Africa: Guidance on Implementation* [RSA DWAF Water Quality Management Sub-Series 13.3]).

1.5 DOCUMENTATION

Documentation on the operational policy for the disposal of land-derived water containing waste to the marine environment of South Africa includes the following:

- ***Operational Policy for the disposal of land-derived water containing waste to the marine environment of South Africa: Inception report*** (RSA DWAF Water Quality Management Sub-Series MS13.1)

- ***Operational Policy for the disposal of land-derived water containing waste to the marine environment of South Africa*** (RSA DWAF Water Quality Management Sub-Series MS13.2) which is the main document containing the operational policy, including:

  - ***An Introduction***
  - ***Structure of Operational Policy***
  - ***Basic Principles for the disposal of land-derived wastewater to the marine environment***
  - ***Ground Rules for the disposal of land-derived wastewater to the marine environment***
  - ***Overview of the Management Framework for the disposal of land-derived wastewater to the marine environment.***

- ***Operational Policy for the disposal of land-derived water containing waste to the marine environment of South Africa: Guidance on Implementation*** (RSA DWAF Water Quality Management Sub-Series MS13.3). This document provides practical guidance on the implementation of the operational policy for the disposal of land-derived wastewater to the marine environment in the context of the management framework (applicable to both existing and proposed discharges). Although it was attempted to make this document accessible to less technically qualified people in order to provide them with an overview of the implementation processes, it is primarily aimed at the managers, scientists and engineers responsible for the technical implementation of the operational policy. The document structure follows the main components of the management framework and includes sections on:

  - ***Management Institutions and Administrative Responsibilities***
  - ***Legislative framework***
  - ***Environmental Quality Objectives***
  - ***Identification of Waste Activities and their Waste Loads***
  - ***Scientific and Engineering Assessments***
  - ***Monitoring***
  - ***Contingency Planning***
  - ***Recommendations for Future Implementation.***

- ***Operational Policy for the disposal of land-derived water containing waste to the marine environment of South Africa: Appendices*** (RSA WDAF Water Quality Management Sub-Series MS 13.4) which contain supplementary information that was collated as part of the project and which are considered to provide important background information for future updates or revisions of the operational policy. Appendices include:

  - ***An overview of the current situation in South Africa with regard to the disposal of land-derived wastewater to the marine environment (Appendix A)***
  - ***An overview of the legislative context (both national and international) that underpins this operational policy (Appendix B)***
  - ***An overview of international trends in the disposal of land-derived wastewater to the marine environment (Appendix C)***
  - ***A summary of the legislation pertaining to the management and control of marine water quality in South Africa, in general (Appendix D)***
  - ***Response to comments from Key Stakeholder Workshop - 12 August 2003, Stellenbosch (Appendix E).***
  - ***Response to comments from Key Stakeholder Workshop – 10 February 2004, Stellenbosch (Appendix F).***
  - ***External Reviews (Appendix G)***

SECTION 2:
STRUCTURE OF OPERATIONAL POLICY

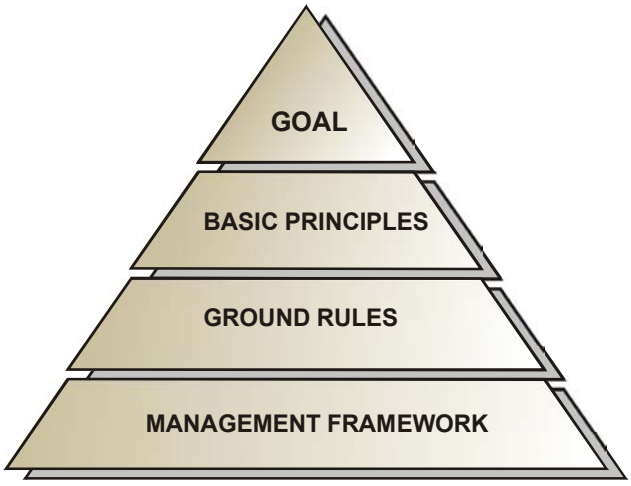
The Department of Water Affairs and Forestry's strategic view on the disposal of land-derived wastewater to the marine environment is as follows:

Taking into account the generally favourable, dynamic physical conditions along the South African coastline, responsible disposal of land-derived water containing waste (referred to as wastewater) to the marine environment is considered an option in South Africa, provided that all reasonable efforts have been made, first of all to prevent waste, and secondly, to minimise waste.

However:

- ***Because South Africa is a water scarce country, the loss of freshwater to the marine environment must be limited in terms of water conservation and demand management strategies.***
- ***According to the White Paper on a National Water Policy for South Africa, 'efforts to introduce source control will be strengthened, through standards and licensing and through changes in technologies and land use, with the final aim of getting as close as possible to a situation in which there is no discharge of pollutants into our water (including the marine environment)'.***

The structure of this operational policy for the disposal of land-derived wastewater to the marine environment of South Africa is illustrated below:



The **Goal** of this operational policy for the disposal of land-derived wastewater to the marine environment of South Africa is as follows:

To achieve water quality that is 'fit for use' and that can maintain aquatic ecosystem health on a sustainable basis by protecting the country's water resources (including marine waters), in a manner allowing justifiable social and economic development. This will be achieved in accordance with the hierarchy of decision making of water quality management , namely:

- ***Prevent waste***
- ***Minimise waste***
- ***Dispose responsibly.***

This goal will be achieved through enforcement of the Basic Principles, Ground Rules and Management Framework stipulated in this operational policy.

Basic Principles (Section 3) provide the broad framework or direction within which to develop ground rules on the disposal practices of land-derived wastewater to the marine environment, as well as the

management thereof. The basic principles were distilled from the broader international and national legislative context to give international and national credibility to the policy.
Ground Rules (Section 4), derived within the broader framework of the Basic Principles, provide more specific rules that will be applied by Government when, for example, considering new licence applications or reviewing existing licences to dispose of land-derived wastewater to the marine environment.

The **Management Framework** (Section 5) provides the generic and structured approach within which the management and control of disposal of land-derived wastewater to the marine environment of South Africa needs to be conducted. Such a framework typically consists of the following components (Figure 2.1):

- Legislative Framework
- Management Institutions and Administrative Responsibilities
- Determination Environmental Quality Objectives
- Specification Activities and Associated Waste Loads (including determination of critical limits)
- Scientific and Engineering Assessment
- Monitoring and Contingency Plans (including evaluation and reporting).

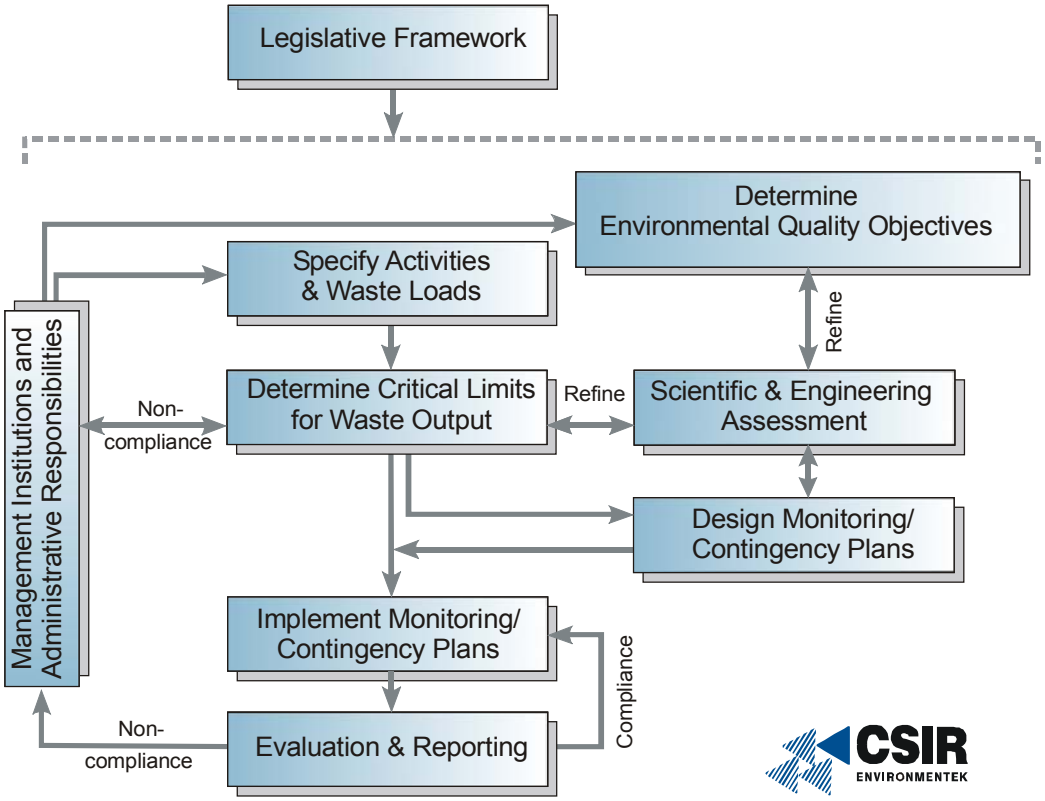


FIGURE 2.1: *A management framework for the implementation of the Operational policy for the disposal of land-derived wastewater to the marine environment of South Africa*

NOTE:

Globalisation is a reality, therefore even though South Africa may not always be able to afford First World approaches, we should strive for higher standards, i.e. 'stretching but not unrealistic'. Also, South Africa does export to countries, e.g. those forming part of the European Community and stricter First World requirements may become relevant, e.g. for mariculture activities.

SECTION 3:
BASIC PRINCIPLES

Basic Principles provide the broad reference framework or direction within which to develop ground rules for the disposal of land-derived wastewater to the marine environment, as well as the management thereof. These principles were distilled from the broader international and national legislative context (refer to Appendix B in *Operational policy for the disposal of land-derived water containing waste to the marine environment of South Africa: Appendices* [RSA DWAF Water Quality Management Sub-Series 13.4]). The basic principles pertaining to the Operational policy for the disposal of land-derived wastewater to the marine environment of South Africa are listed below:

PRINCIPLE 1: POLLUTION PREVENTION, WASTE MINIMISATION AND PRECAUTIONARY APPROACH

The DWAF, in its water quality management policy describes a hierarchy of decision-making which applies to this operational policy and which strongly supports this principle. This hierarchy of decision-making is as follows:

1) Pollution Prevention, preventing waste production and pollution wherever possible.

2) Minimisation of pollution and waste at source, minimising unavoidable waste through:

- ***Recycling***
- ***Detoxification***
- ***Neutralisation***
- ***Treatment and re-use of waste streams***
- ***Cleaner technologies and best management practices.***

3) Responsible disposal, applying the precautionary approach:

- ***Apply wastewater standards as a minimum requirement***
- ***If wastewater standards are not sufficient, maintain fitness for use of the receiving water body in accordance with the Receiving Water Quality Objective approach***
- ***Exemption from compliance with wastewater standards will be considered only in exceptional circumstances provided that the receiving water body remains fit for use in accordance with the Receiving Water Quality Objective approach.***

PRINCIPLE 2: RECEIVING WATER QUALITY OBJECTIVES APPROACH

The requirements of the aquatic ecosystem, as well as the requirements of the beneficial uses of the water resource, will determine the objectives to be met (rather than following a uniform effluent standard approach as was the case with the General and Special Standard under the previous Water Act 54 of 1956). This principle applies to the marine environment as well.

PRINCIPLE 3: INTEGRATED ASSESSMENT APPROACH

The operational policy will adhere to the principles of Integrated Environmental Management, taking cognisance of concepts such as Strategic Environmental Assessment, and Environmental Impact Assessment and supporting the following underpinning principles:

- ***'Cradle-to-grave'***
- ***Strategic adaptive management (i.e. 'improving-by-learning' and 'thinking strategically whilst implementing locally')***
- ***Best Practice (to be developed by a regulator and obligatory implemented by the regulated community as a minimum for responsible source management)***
- ***Consistent Performance (i.e. all water users/impactors within the regulated community are required to ensure and strive for the same water quality goals at the same risk level)***
- ***Flexibility in approach (i.e. the regulator has the flexibility to consider the application of different alternatives and approaches, provided each of these is capable of meeting the desired objectives and requirements of the Source Management Strategy***
- ***Continuous improvement (encouraging continuous improvement in the actions and practices of both government and the regulated community).***

PRINCIPLE 4: POLLUTER PAYS PRINCIPLE

The responsibility for environmental costs incurred for rehabilitation of environmental damage and the costs of preventive measures to reduce or prevent such damage will be shifted to the impactors through, for example, the implementation of a waste discharge charge system.

PRINCIPLE 5: PARTICIPATORY APPROACH

Transparent stakeholder participation will be required, not only as part of the decision-making process (e.g. Environmental Impact Assessment process and setting of common environmental quality objectives), but also through ongoing transparent and open communication on status quo during design, construction and operations. Local management institutions (e.g. pipeline or catchment forums), for example, can be used for transparent stakeholder involvement throughout the process from application through to report back on monitoring results.

SECTION 4:
GROUND RULES

Ground Rules are derived within the broader context of the Basic Principles and provide more specific rules that will be applied by Government when considering licence applications to dispose of land-derived wastewater to the marine environment. For this operational policy, the Ground Rules are addressed under specific themes considered to be of particular importance in the disposal of land-derived wastewater to the marine environment (in alignment with the key components of the management framework), namely:

- Legislative Framework
- Management institutions and Administrative Responsibilities
- Environmental Quality Objectives
- Activities and Associated Waste Loads
- Scientific and Engineering Assessment
- Monitoring and Contingency Plans.

4.1 LEGISLATIVE FRAMEWORK

For the disposal of land-derived wastewater to the marine environment there are a number of legal (or statutory) requirements that must be complied with. Ground Rules pertaining to these are listed below.

GROUND RULES RELATED TO THE LEGISLATIVE FRAMEWORK:

1: Disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process must be licensed by the DWAF in terms of Section 21 (h). Also, a person who uses water must return any seepage, run-off or water containing waste which emanates from that use, to the water resource from which the water was taken, unless the responsible authority directs otherwise or the relevant authorisation provides otherwise (Section 22(2)(e)).

Principle supported: Integrated Assessment Approach

The DWAF is in the process of amending the NWA in order to provide a more suitable section dealing with marine disposal. In the interim, water use licences to sea outfalls are issued under Section 21 (h) since this section deals with industrial wastewater and does not specifically refer to the water resource as point of discharge (most municipal wastewater in any event contains wastewater from industrial activities).

Section 22(2)(e) of the NWA requires that water from a water resource be returned to the resource unless the responsible authority directs otherwise or the relevant authorisation provides otherwise. Discharging freshwater to the marine environment (i.e. not returning freshwater to its original water resource) therefore requires authorisation. It is also important that Section 22(2)(e) be specifically addressed as part of the licence authorisation process, particularly where water requirements in terms of the Reserve could be affected (the Reserve is also dealt with under Chapter 3 of the NWA [RSA DWAF, 1999a]).

The following activities must be authorised by a licence under Section 21 of the National Water Act:

- *New applications to dispose of land-derived wastewater to the marine environment*
- *Existing discharges of land-derived wastewater to the marine environment that are not classified as an existing lawful water use in terms of Section 32 of the NWA*
- *Upgrade or extension of existing WWTW or industries discharging to the marine environment that were not approved in terms of the original authorisation.*

Where an exemption permit has expired and a licence application has been submitted to the DWAF, the discharge will still be seen as an existing lawful water use, provided that the conditions of the expired permit are still complied with.

NOTE:

In the context of this operational policy, currently only municipal wastewater and industrial wastewater discharges (i.e. point discharges) are required to be authorised by a licence under section 21 of the NWA. However, this does not exclude diffuse sources (such as urban stormwater) from being licensed in future.

Land-based activities within harbour areas that qualify as a water use under section 21 of the National Water Act 1998 are the responsibility of the DWAF and may require a licence. These include contaminated (or polluted) stormwater run-off from an industrial premises, as well as the disposal of polluted seawater that was used in an industrial process on land. In the case of commercial harbours, the National Ports Authority, as the landowner, is responsible for ensuring that developments and activities within its boundaries meet the requirements of national law, such as those required under the National Water Act.

2: The disposal of land-derived wastewater to the marine environment is subject to an Environmental Impact Assessment (EIA) under the Environment Conservation Act 73 of 1989. The EIA process is administered by the Department of Environmental Affairs and Tourism (DEAT).

Principle supported: Integrated Assessment Approach

The Environmental Impact Assessment must be performed in accordance with the EIA regulations under the Environment Conservation Act 73 of 1989. The EIA must investigate all alternatives, including recycling/re-use.

This applies to:

- *New proposal to dispose of land-derived wastewater to the marine environment*
- *Existing discharges of land-derived wastewater to the marine environment that are not classified as an existing \ lawful water use (and that have not been subject to an EIA)*
- *Upgrade or extension to existing WWTW or industries discharging to the marine environment that were not approved in terms of the original authorisation*
- *Change in effluent volume or composition (a licence is issued based on a specific effluent volume and composition, therefore for such changes the discharger legally must re-apply).*

Failure to comply with any conditions stipulated in the licence will be a violation of the law and is subject to prosecution. Where the potential impact of an existing lawful wastewater discharge has not been assessed properly or where there is reason to believe that such discharge has a negative impact on the receiving marine environment, the responsible authority or organisation will be requested to engage in specific studies, as would be required for a licence authorisation process. The extent of such investigations will depend on potential risks and the sensitivity of the receiving marine environment. An EIA as such will not necessarily be needed in such instances, unless it involves upgrades or extensions are involved. According to the EIA regulations, only independent, qualified consultants may undertake an EIA.

NOTE:

An EIA authorisation cannot replace a water use licence application, since the former does not address all the requirements of the National Water Act. For example the EIA process often excludes the legal validation (Stage 1) and pre-assessment (Stage 2) stages of the licence authorisation process under the National Water Act (refer to Section 6 of this document).

The granting of an authorisation under the EIA regulations does not necessarily mean that a water use licence will be granted (RSA DWAF, 2000). It is important that the applicant be aware of the overlap between the types of outputs required at certain stages of the water use licence and EIA processes and thus avoid duplication or unnecessary work. These overlaps are discussed in further detail in* Operational policy for the disposal of land-derived water containing waste to the marine environment of South Africa: Guidance on Implementation, Section 3 *(RSA DWAF Water Quality Management Sub-Series 13.3).

3: A licence issued for a water use, including for the disposal of land-derived wastewater to the marine environment, is subject to review every 5 years (a provision of the National Water Act – sections 28 and 49). Revisions can also be motivated on grounds of negative impact on environment and non-compliance with licence conditions.

Principle supported: Integrated Assessment Approach

The licence review process will form the primary mechanism through which the Basic Principles and Ground Rules will be phased in for existing lawful water uses. For example, where reduction in wastewater constituent concentrations is required to comply with Basic Principles and Ground Rules, this will be negotiated and a plan, with time frames, will become part of the individual licence conditions.

As part of the review process the following will be considered:

- *Compliance with all licence conditions*
- *Re-assessment of the water use activity's alignment with Policy pertaining to the disposal of land-derived wastewater to the marine environment, and in particular, whether such disposal could still be considered as the Best Practical Environmental Option, taking the hierarchy of decision making into account (refer to Basic Principle: Pollution Prevention and Waste Minimization)*
- *Review of monitoring reports to assess, for example, whether monitoring objectives that were defined as part of the monitoring programme (refer to Ground Rule 28) have been met.*
- *Based on the outcome of the above, the licence holder could be requested to conduct further investigations for confirmation. The extent of such investigations will depend on potential risks and sensitivity of the receiving marine environment. Unacceptable impacts or water demand in the catchment could lead to revision of decisions made during the initial licence authorisation process, possibly also requiring alternative treatment, i.e. the 'no go' option.*

For permits which were issued in terms of the Water Act 54 of 1956, no review is legally required unless there is a permit condition allowing amendment of the permit. This will be rectified by an amendment of the National Water Act, 1998 which is currently in progress.

4: Discharge of land-derived wastewater to any area declared a Marine Protected Area under the Marine Living Resources Act 18 of 1998 is prohibited.

Principle supported: Pollution Prevention, Waste Minimisation & Precautionary Approach

The Marine Living Resources Act prohibits, amongst other activities, the discharge of waste to any marine protected area, unless the Minister of Environmental Affairs provides permission to do so. However, the Minister may grant permission in cases in which such activity is to the benefit of the marine protected area, which is unlikely to be the case for a wastewater discharge.

For proposed discharges to the marine environment the boundaries of both existing and proposed Marine Protected Areas must be taken into account. Where the influence of discharge to the marine environment, classified as an existing lawful water use as on 31 May 2004, overlaps with the boundaries on a proposed Marine Protected Area, mitigating actions, if required, must be decided upon in consultation with the responsible authorities, in this case DEAT and DWAF.

5: Any land-derived wastewater discharge to the marine environment may be subject to a waste discharge charge.

Principle supported: Polluter Pays Principle

The DWAF is in the process of formulating a national strategy for a Waste Discharge Charge System, which forms part of the Pricing Strategy to be established in terms of Chapter 5 of the NWA (RSA DWAF, 2003b).

The aim of the Waste Discharge Charge System is to:

- *Promote the sustainable development and efficient use of water resources.*
- *Promote the internalisation of environmental costs by impactors*
- *Recover some of the costs of managing water quality*

A discharge for the purposes of the NWA is any waste stream that enters a water resource or marine environment. Discharges into municipal sewers are not regulated under the NWA, and are therefore not included in the Waste Discharge Charge System, but are instead regulated by the Water Services Act 108 of 1997. Discharge into municipal sewers is also regarded as a Schedule 1 water use in terms of the NWA.

Consult the DWAF website (www.dwaf.gov.za) for further details on the Waste Discharge Charge System.

4.2 MANAGEMENT INSTITUTIONS AND ADMINISTRATIVE RESPONSIBILITIES

Licensing of land-derived wastewater disposal to the marine environment is administered by the DWAF (as stipulated in Ground Rule 1). Although the DWAF is responsible for the overarching management and administration of the disposal of land-derived wastewater to the marine environment, a key element in the successful implementation of this operational policy is the establishment of local management institutions, representing all the role players in a designated area, which fulfil the role of 'local watchdogs' or 'custodians'. However, water services providers (operating WWTW) and industries still hold ultimate responsibility in terms of their individual licence conditions with the DWAF.

Where multiple developments and activities occur in a specific area, it is usually extremely difficult and financially uneconomical to manage marine environmental issues in isolation because of, for example, potential cumulative or synergistic effect on the receiving environment. Collaboration is often best achieved through a joint local management institution. Local management institutions are also considered the appropriate platform for facilitating the joint funding of studies (such as impact assessments and monitoring) for two or more developments/activities that may be responsible for pollution in a particular area. Although such institutions could be initiated from local level it is, however, crucial that these be coordinated from a national (or regional) level by the responsible government authorities, such as the DEAT and DWAF.

GROUND RULES RELATED TO MANAGEMENT INSTITUTIONS & ADMINISTRATIVE RESPONSIBILITIES:

6: The disposal of land-derived wastewater to the marine environment is currently governed by the DWAF under the National Water Act 36 of 1998. However, the DWAF will work in consultation with relevant local, provincial and national government departments (in particular the Department of Environmental Affairs and Tourism), as well as local management institutions (such as pipeline or catchment forums). This collaboration is required to ensure effective cooperative governance in the management of waste disposal to the marine environment of South Africa.

Principle supported: Participatory Approach

7: Disposal of land-derived wastewater to the marine environment (offshore, surf zone or estuaries) must be managed through a local management institution. This can be an existing institution, such as a pipeline forum, monitoring committee, pipeline advisory committee, water quality committee or catchment forum. Representation must include government authorities (i.e. that hold jurisdiction), as well as non-government role players (e.g. industries, users of the marine environment and NGO's).

Principle supported: Participatory Approach

Local management institutions, for example, play a leading role in identifying non-compliance, based on information provided by scientifically sound monitoring programmes. In the case of non-compliance, scientifically-sound monitoring data and information will provide the local management institution with an informed, scientific base from which to challenge the responsible authority (e.g. DWAF) to respond appropriately (e.g. prosecuting the offender) where such responsible authorities are reluctant to do so. Towards enforcing this ground rule, the DWAF requires the establishment of a local monitoring committee, as a licence condition for the disposal of land-derived wastewater to the marine environment.

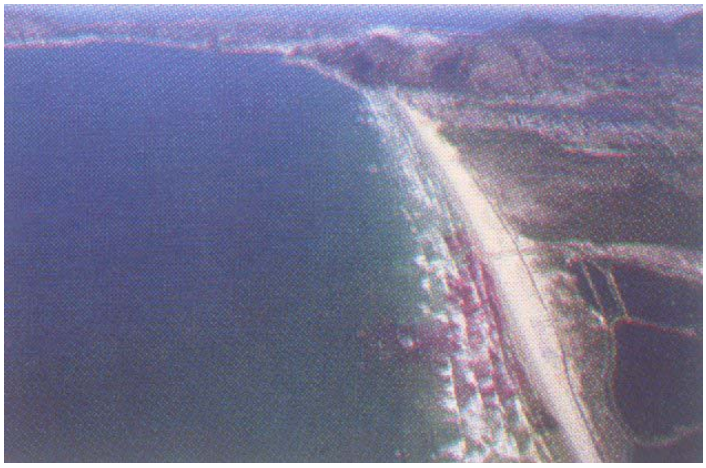
4.3 ENVIRONMENTAL QUALITY OBJECTIVES

4.3.1 Sensitive Areas

Although the technologies applied in the planning and design of wastewater discharges to the marine environment inherently highlight or 'flag' sensitive areas, the international trend currently is to explicitly identify zones or areas in the marine environment that can generically be defined as 'sensitive areas' with regard to the disposal of wastewater or even 'clean' freshwater (refer to Appendix B in *Operational policy for the disposal of land-derived water containing waste to the marine environment of South Africa* [RSA DWAF Water Quality Management Series 13.4]).

The marine environment can be subdivided roughly into three zones, each having distinctly different physical processes that influence their ability to assimilate wastewater, although the overall functioning is still strongly interdependent. These are the:

- Offshore environment
- Surf zone
- Estuaries.



Rhodamine-B dye test illustrating the 'trapping concept' of wastewater discharges to the surf zone

The offshore environment (typically defined as the zone beyond the surf zone or breaker zone) extends over a large area and usually has strong, more uniform water circulation characteristics that allow for effective transport and dispersion. In contrast, the physical processes in the surf zone and estuaries are often very complex and highly variable. Water exchange from these zones is also not very good, as illustrated by the transport and dispersion processes observed in the surf zone in False Bay, using Rhodamine-B dye as a tracer. These zones are therefore considered as being ecologically sensitive with very little assimilative capacity for anthropogenic inputs, such as land-derived wastewater. Estuaries are sheltered water bodies in which circulation patterns depend largely on the river inflow and the state of the mouth. Water exchange therefore ranges from 'very good' when river inflow is high and water is continuously flushed from the system to 'limited' or 'no' water exchange when the mouth is closed. This last exchange is particularly relevant to South Africa, where more than 75% of its estuaries are temporarily closed off to the sea. This high complexity in circulation patterns of the surf zone and estuaries largely reduces the accuracy with which transport and dispersion processes can be quantified, a key requirement in assessing the suitability of using the marine environment for the disposal of land-derived wastewater.

In the context of the above, although the offshore is considered to be a more appropriate environment for the disposal of wastewater, compared to the surf zone and estuaries, the suitability of a particular offshore environment largely depends on factors such as:

- Circulation characteristics, for example, strong currents enhance the achievable initial dilution, whereas rapid transport of the plume reduces the degree of decay of microbiological organisms between the discharge location and relevant beneficial use areas.

- Stratification in the water column, for example, strong stratification (e.g. presence of a thermocline) results in the inhibition of a rising buoyant effluent plume and subsequent reduced initial dilution.
- Proximity of depositional areas, i.e. areas where wave and flow generated bed shear stresses (turbulence) are reduced, resulting in particulate material (and associated pollutants) being deposited onto sediments.
- Presence of offshore reefs and islands, as well as marine protected areas (under the Marine Living Resource Act 18 of 1998), which are also considered to be 'sensitive areas'.
- Risk of damage, for example shipping routes where the outfall structure could be damaged by dropping or dragging anchors.

Inappropriate disposal of wastewater (e.g. when treatment systems malfunction, usually during the holiday season from overloading) or even disposing of 'clean' freshwater (e.g. tertiary treated wastewater) to sensitive systems such as estuaries and the surf zone can have serious ripple effects, both ecologically and socio-economically. Historically, disposal to the marine environment around the South African coast (particularly discharges to estuaries and the surf zone) was allowed not necessarily on the grounds that it was the best environmental option. Economic considerations were more frequently the driving factor behind decision rather than environmental or social considerations.

The surf zone and estuaries are thus classified as 'sensitive areas' in terms of the disposal of treated wastewater, while evidence of suitability must be provided for disposal to the offshore environment (further justification is provided in each of the Ground Rules).

GROUND RULES RELATED TO SENSITIVE AREAS:

8: Estuaries are classified as 'sensitive areas'. Disposal of municipal and industrial wastewater to these systems will therefore not be considered except in exceptional circumstances in which such inflows are required to improve or maintain the resource quality objectives (also taking into account effects of water quantity) or where the ecological functioning has been irreversibly modified to support commercial harbours. In the latter case, the resource quality objectives of other designated beneficial uses of the area, however, must be met as a minimum.

Municipal and industrial wastewater discharges to estuaries, which were existing lawful water uses as on 31 May 2004, will be re-evaluated during the 5-yearly licence review process. Revisions can also be motivated on grounds of negative impact on environment and non-compliance with licence conditions

Principle supported: Pollution Prevention, Waste Minimisation & Precautionary Approach

Estuaries are classified as sensitive areas for the following reasons:

- *Discharging freshwater into sheltered saline or semi-saline environments such as estuaries is likely to modify the natural salinity regime, with potentially negative impacts on the ecosystem. Significant changes in inflows to temporarily open/closed estuaries can also modify the natural frequency and occurrence of mouth opening (this is particularly relevant since more than 75% of South Africa's estuaries are naturally closed off from the sea at times).*
- *Because discharges to estuaries do not have a distinct 'initial dilution process' as encountered in offshore discharges (i.e. dilution generated by jet momentum and buoyancy effects that occur between the outlet ports and the sea surface), it is most likely that there will be a zone of non-compliance in the receiving environment, unless the constituent concentration in the wastewater is equal to the resource quality objectives (i.e. 'compliance at end of pipe').*
- *Estuaries are sheltered water bodies in which circulation patterns are largely dependent on the river inflow and the state of the mouth. The complex physical dynamics of estuaries largely reduce the accuracy with which transport and dispersion processes can be quantified, a key requirement in assessing the suitability of disposal of land-derived wastewater to the marine environment as an option.*
- *Estuaries are transition areas between rivers and the sea. These ecologically sensitive areas provide unique habitats for a diversity of biota, and in addition also act as nursery areas for numerous marine organisms.*
- *A large proportion of beneficial uses of the marine environment (e.g. recreation and mariculture) occur in estuaries. The high real estate value along the coast is often strongly linked to acceptable water quality of estuaries, which can also be severely compromised by inappropriate disposal of wastewater.*

9: The surf zone is classified as a 'sensitive area'. Disposal of municipal and industrial wastewater to the surf zone should therefore be avoided. Where legitimate motivation can be provided (e.g. in cases in which seawater used on land is returned to source), the environmental quality objectives for the study area must be met as a minimum. These include objectives pertaining to alteration of the natural salinity regime (in the case of freshwater discharges) and aesthetic impacts associated with the visibility of the discharge practice on land.

Municipal and industrial wastewater discharges to the surf zone, which were existing lawful water uses as on 31 May 2004, will be re-evaluated during the 5-yearly licence review process. Revisions can also be motivated on grounds of negative impact on environment and non-compliance with licence conditions

Principle supported: Pollution Prevention, Waste Minimisation & Precautionary Approach

The surf zone is classified as a sensitive area for the following reasons:

- *Discharging freshwater into sheltered saline environments such as the surf zone modifies the natural salinity regime, with potentially negative impacts on the ecosystem.*
- *Because discharges to the surf zone do not have a distinct 'initial dilution process' as encountered in offshore discharges (i.e. dilution generated by jet momentum and buoyancy effects that occur between the outlet ports and the sea surface), it is most likely that there will be a zone of non-compliance in the receiving environment, unless the constituent concentration in the wastewater is equal to the environmental quality objectives (i.e. 'compliance at end of pipe').*
- *The complex physical dynamics encountered in the surf zone largely reduce the accuracy with which transport and dispersion processes can be quantified, a key requirement in assessing the suitability of disposal of land-derived wastewater to the marine environment as an option.*
- *These ecologically sensitive areas are transition areas between the land and the sea, providing unique habitats for a diversity of biota.*
- *A large proportion of beneficial uses of the marine environment (e.g. recreation and mariculture) occur in the surf zone (i.e. beaches). The high real estate value along the coast is often strongly linked to acceptable aesthetics and water quality at beaches, which can be severely compromised by inappropriate disposal of wastewater.*
-

10: Discharges of land-derived wastewater to the offshore marine waters through a marine outfall may be considered as an option provided that the suitability of the areas to accommodate such activities is properly assessed.

Principle supported: Pollution Prevention, Waste Minimisation & Precautionary Approach

Suitability of the offshore marine environment (generally defined as the area beyond the surf zone, in which circulation patterns are usually more uniform) for the disposal land-derived wastewater through a marine outfall mainly depends on:

- *Circulation characteristics*
- *Stratification in the water column*
- *Morphology of the seabed (with specific reference to the proximity of depositional areas where pollutants/contaminants may accumulate)*
- *Presence of offshore reefs and islands, also considered sensitive areas.*
- *Risk of damage, e.g. if situated along shipping routes*
- *Proximity of other existing marine outfalls*

4.3.2 Environmental Quality Objectives

The receiving water quality objectives approach requires that the aquatic ecosystem of a water resource and the requirements of the beneficial uses of that water resource together determine the objectives that need to be adhered to (rather than following a uniform effluent standard approach as was the case with the General and Special Standard under the previous Water Act 54 of 1956). The receiving water quality objectives approach is also widely used internationally (refer to Appendix B in *Operational policy for the disposal of land-derived water containing waste to the marine environment of South Africa: Appendices* [RSA DWAF Water Quality Management Series 13.4]).

Estuaries are defined as water resources under the NWA. Under the NWA, resource directed measures are aimed at providing a water resource with the appropriate level of protection, so as to remain fit for use by other users in a sustainable way. Resource Directed Measures encompass a Classification system, Reserve and Resource Quality Objectives (the term used for environmental quality objectives in the case of estuaries). The Classification system, once developed, will assign a management class to each significant water resource. The class will be determined by reconciling the Reserve (basic human needs and ecological requirements) with other user requirements within a catchment context. Following the determination of the class, resource quality objectives will be set within the catchment. If the resource quality objectives are met, the resource should be conforming to the Management Class that was set. Resource Quality Objectives may include ecological, economic and social objectives.

Marine waters (other than estuaries) are not included in the definition of a water resource in the NWA. Therefore the Resource Directed Measures as specified in the National Water Act currently does not apply to such marine waters. Environmental quality objectives however do need to be set for the marine environment, based on the requirements of the site-specific marine ecosystems, as well as other designated beneficial uses (both existing and future) of the receiving environment. The identification and mapping of marine ecosystems and the beneficial uses of the receiving marine environment provide a sound basis from which to derive site-specific environmental quality objectives.

The following are also defined as beneficial uses of South Africa's marine waters:

- recreation
- mariculture and fisheries
- industrial uses (e.g. taking in cooling water and water for fish processing).

To assist in setting environmental quality objectives for marine ecosystems and their beneficial uses, the *South African Water Quality Guidelines for Coastal Marine Waters*, was published by the Department of Water Affairs and Forestry in 1995 (RSA DWAF, 1995a). The South African guidelines provide recommended target values (not standards) for a range of substances, but are not exhaustive. Therefore, in setting site-specific environmental quality objectives, it may be necessary to consult additional information obtained from published literature, best available international guidelines (e.g. ANZECC 2000a; ENVIRONMENT CANADA, 2002; US-EPA, 2002), as well as site-specific data.

Environmental quality objectives need to be specified as measurable values for specific water column, sediment, biological and/or microbiological parameters to provide a practical and effective means against which to evaluate potential impacts of wastewater discharges. Current practice in most other countries is to define what is referred to as 'List I' and 'List II' substances (refer to Appendix C in *Operational policy for the disposal of land-derived water containing waste to the marine environment of South Africa [RSA DWAF Water Quality Management Series 13.4]).* List I substances are regarded as being particularly hazardous because of their toxicity, persistence and bioaccumulation and need to be *eliminated* from wastewater discharges. List II substances, in contrast, are considered less hazardous but nevertheless have a deleterious effect on the aquatic environment.

List II substances must be *controlled*. List II substances, therefore, are typically those for which specific target values need to be determined. List I and List II substances are currently not available for South Africa and should be addressed in future revisions of the *South African Water Quality Guidelines for Coastal Marine Waters* (RSA DWAF, 1995a).

GROUND RULES RELATED TO ENVIRONMENTAL QUALITY OBJECTIVES:

11: Site-specific environmental quality objectives for the marine environment (excluding estuaries) must take into account the* South African Water Quality Guidelines for coastal marine waters *(RSA DWAF, 1995a) or any future updates thereof.

Principle supported: Receiving Water Quality Objectives Approach

The South African Water Quality Guidelines for Coastal Marine Waters *(DWAF, 1995a) provide recommended target values for a list of substances in relation to aquatic ecosystem requirements as well as for other beneficial uses. However, the information provided in these documents is not exhaustive and does not provide target values for ALL possible substances. Therefore, in setting environmental quality objectives for the marine environment, the information contained in the guideline documents should be supported by information from additional sources such as published literature, best available international guidelines and site-specific data.*

List I and List II substances are currently not available for South Africa and this lack should be addressed in future revisions of the South African Water Quality Guidelines for Coastal Marine Waters *(RSA DWAF, 1995a), List I substances are regarded as being particularly hazardous because of their toxicity, persistence and bioaccumulation and must be eliminated from wastewater discharges. List II substances, in contrast, are considered less hazardous but nevertheless have a deleterious effect on the aquatic environment. List II substances must be controlled. List II substances, therefore, are typically those for which specific environmental target values must be determined. Recommended lists are provided in* Operational policy for the disposal of land-derived water containing waste to the marine environment of South Africa: Guidance on Implementation *[RSA DWAF Water Quality Management Series 13.3]).*

12: Where, in exceptional circumstances (as listed in Ground Rule 8), a discharge to an estuary is considered, resource (environmental) quality objectives must be determined according to the methodology for estuaries developed by the Directorate: Resource Directed Measures (RSA DWAF, 2004 and any future updates thereof). Estuaries are included in the definition of 'the water resource' in the National Water Act and objectives therefore must be determined in accordance with Chapter 3 of this Act.

Principle supported: Receiving Water Quality Objectives Approach

13: Environmental quality objectives must be complied within the area beyond the initial mixing zone.

Principle supported: Pollution Prevention, Waste Minimisation & Precautionary Approach

The initial mixing zone is defined as the area in the water column in which the initial dilution process takes place whereby 'clean' seawater is entrained during the rise of the buoyant plume. The degree of dilution and the geometry of the rising plume depend on the buoyancy of the effluent, as well as the current profile and stratification in the water column.

Instances in which this rule may not be strictly applied include microbiological parameters that do not necessarily affect the health of aquatic ecosystems, but rather affect specific beneficial uses (e.g. recreation and mariculture) that may be at a distant location from the point of discharge. Microbiological parameters are also further subject to secondary dilution and decay while being transported away from the initial mixing zone.

4.4 ACTIVITIES AND ASSOCIATED WASTE LOADS

4.4.1 Municipal Wastewater

Being a semi-arid country, a key concern in South Africa is future water demand. A major constraint in the management of municipal wastewater, including that of towns and cities along the South African coast, is that the disposal of land-derived wastewater is currently not addressed within the context of future water demand and supply. Also, instead of planning the collection, treatment and disposal of wastewater in, for example, an entire metropolitan area in a holistic manner, wastewater treatment works (WWTW) are typically designed and operated in a fragmented manner. As a result, the wastewater discharges from these WWTW often have cumulative negative impacts on the receiving environment (e.g. rivers and their estuaries) which were not taken into account in either the design or operations of such WWTW.

Therefore, in the disposal of land-derived wastewater (particularly freshwater), issues of the following nature need to be taken into account:

- Water supply and future water demand
- Reserve requirements for rivers and estuaries (specified under the NWA)
- Groundwater resources
- Surface water resources
- Sanitation (including reticulation systems)
- Wastewater treatment and disposal
- Trade effluents
- Stormwater reticulation and disposal.

It is therefore crucial that wastewater disposal be managed within a 'Master Plan' for water. For example, where re-use of wastewater will be essential to meet future water demand, wastewater treatment and disposal systems must accommodate such requirements in their design criteria, even though the ultimate implementation of such criteria may be incremental. The development of treatment and disposal facilities for land-derived wastewater in the context of a holistic master plan, which includes water supply (taking into account future water demand), is a key requirement of the World Bank for all its projects pertaining to the installation, upgrading and rehabilitation of wastewater treatment in the world, such as in Mombasa, Kenya (Gibb Eastern Africa, 1997). In a particular area a WWTW, for example, may initially only implement preliminary treatment with a marine outfall. Thereafter treatment facilities can be gradually upgraded as dictated by financial resources and water demand. Also, because the marine outfall was initially designed to accommodate preliminary treated wastewater, plant failure at any later stage in the life cycle of the WWTW will not have a negative impact on the receiving marine environment because the disposal route (i.e. still the marine outfall) was designed for the 'worst case'.

In terms of achieving this 'Master Plan' concept, the Water Services Development Plans that need to be prepared by a water services provider (e.g. local municipality) under the Water Services Act 108 of 1997, as part of the Integrated Development Plans (in terms of the Local Government Transition Act 209 of 1993), can be extended to also include the disposal of land-derived wastewater.

The design of a marine disposal practice depends largely on the quantity and quality of the effluent. These, in turn, depend on the service population (including industrial wastewater discharges into WWTW) that are effectively linked to the collecting system and the degree of treatment of the wastewater prior to discharge. Although non-sewered treatment (i.e. no collecting system structure), such as French drains and septic tanks, may be acceptable options for smaller communities, these are usually not acceptable for larger service populations.

The risk of impact on water resources, associated with spillages and seepage, increases markedly with the increase in the number and density of non-sewered systems. Internationally it has become common practice to provide a collecting system to communities with a service population greater than about 2 000, including coastal communities (refer to Appendix C in *Operational policy for the disposal of land-derived water containing waste to the marine environment of South Africa: Appendices* [RSA DWAF Water Quality Management Sub-Series 13.4]). South African policy in this regard is dealt with in documents such as *Strategic Framework for Water Services* (RSA DWAF, 2003a) and *Managing the water quality effects of settlements* (RSA DWAF, 1999c; RSA DWAF, 2002b).

With regard to the level of treatment of municipal wastewater prior to discharge, the main objective applied internationally is to reduce waste loads, particularly those of suspended solids and biochemical oxygen demand. Municipal wastewater has characteristic loads of these two substances that are easy to measure and, by reducing these, it is also possible to markedly decrease the loads of other potentially harmful substances, e.g. nutrients and toxins such as trace metals. Treatment levels of municipal wastewater (sewage) can broadly be categorised into:

- Preliminary treatment
- Primary treatment
- Secondary treatment
- Tertiary treatment
- Disinfection.

The typical treatment process for domestic sewage is schematically illustrated in Figure 4.1.

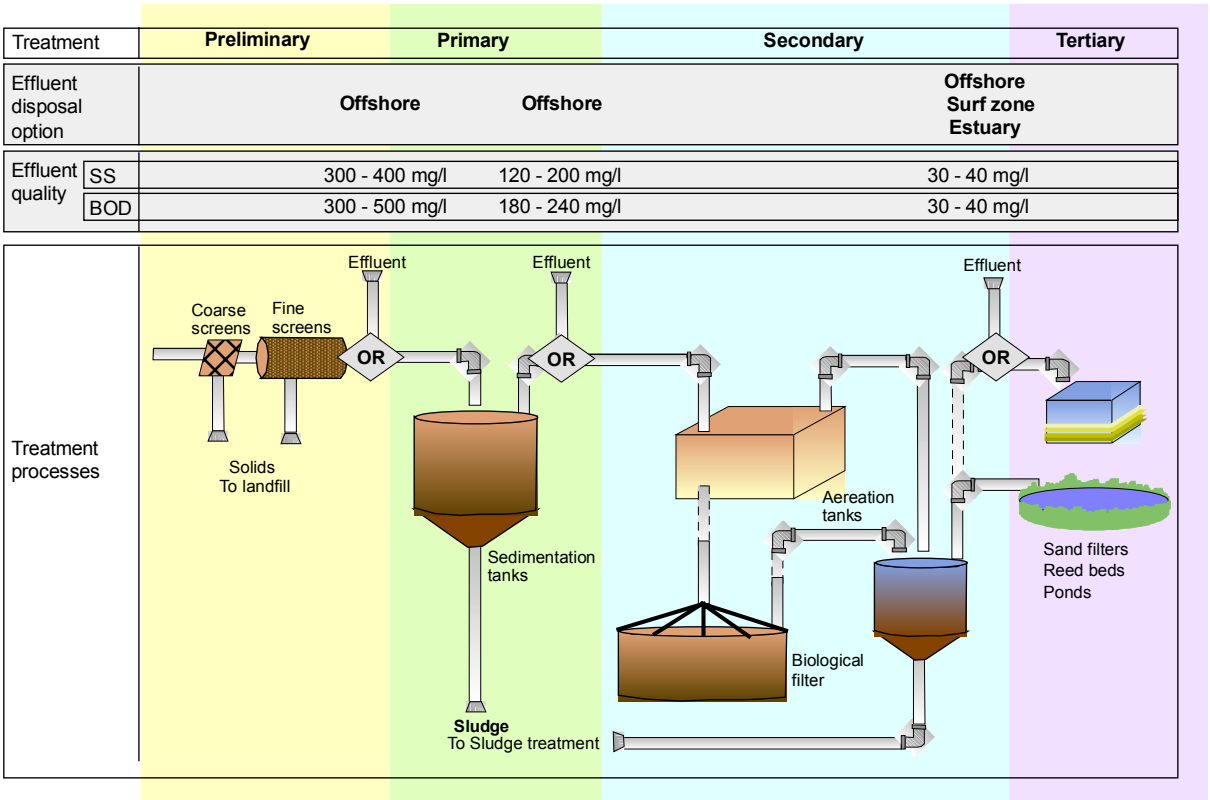


FIGURE 4.1: A schematic illustration of the different treatment processes for municipal wastewater

Most countries require primary treatment as a minimum for offshore marine outfalls. In the United States, Australia and the European Community this minimum rule applies only for service populations of between 50 000 and 150 000.

For larger service populations these countries require at least secondary treatment, in many instances including disinfection (refer to Appendix C in *Operational policy for the disposal of land-derived water containing waste to the marine environment of South Africa: Appendices* [RSA DWAF Water Quality Management Series 13.4]).

As an incentive to reduce waste loads in municipal wastewater, both the United States and Australia have introduced a charge system, similar to the Waste Discharge Charge System being developed by the DWAF (RSA DWAF, 2003b).

***GROUND RULES RELATED TO MUNICIPAL WASTEWATER**:*

14: South Africa is a water scarce country. Marine disposal of land-derived municipal wastewater (particularly freshwater) will therefore only be considered where it has been evaluated in terms of the Water Services Development Plan for a particular municipal area (required under the Water Services Act 108 of 1997, and which, in turn, forms part of the Integrated Development Plans required in terms of the Local Government Transition Act 209 of 1993). This requirement supports the concept of a 'Master Plan for water supply/demand and wastewater treatment'.

Principles supported: Pollution Prevention, Waste Minimisation & Precautionary Approach
Integrated Assessment Approach

It is crucial that wastewater disposal be managed within a 'Master Plan' for water, taking into account, for example:

- *Water supply and future water demand*
- *Reserve requirements for river and estuaries (under the NWA)*
- *Groundwater resources*
- *Surface water resources*
- *Sanitation (including reticulation systems)*
- *Wastewater treatment and disposal*
- *Trade effluents*
- *Stormwater reticulation and disposal.*

It is crucial that the upgrading of WWTW also be addressed as part of the holistic 'Master Plan' for water.

15: Municipal WWTW receiving industrial effluent (also referred to as trade effluent) will be subject to the Ground Rules for Industrial Wastewater (refer to Ground Rules 19 to 22). Service Providers or Local Authorities operating such treatment works will be required to prepare Industrial wastewater management plans (as part of the 'Master Plan'). It is also the responsibility of the Service Provider or Local Authority to investigate possible synergistic and/or cumulative effects which may occur as a result of the interaction between different (industrial) wastewater inputs.

Principles supported: Pollution Prevention, Waste Minimisation & Precautionary Approach
Integrated Assessment Approach

It is the responsibility of the Service Provider or Local Authority operating a WWTW to ensure that industrial wastewater discharges to the works adhere to the ground rules for Industrial Wastewater (refer to Section 4.4.2).

16: The design, construction and management of collection systems (i.e. the land-based facilities at which the wastewater is collected prior to discharging to the marine environment) are outside the scope of this operational policy. The design, construction and management of such systems must comply with related policies and specifications of the DWAF.

Principles supported: Pollution Prevention, Waste Minimisation & Precautionary Approach
Integrated Assessment Approach

Policy and specifications on sanitation, e.g. sewage collecting systems, are generic and not necessarily relevant only to wastewater that is disposed of to the marine environment. As a result, this operational policy is not prescriptive regarding collecting systems and refers to relevant policies and frameworks on sanitation.

In South Africa, guidelines on sanitation systems for settlements, for example, use population density, in terms of households per hectare, as a guideline. These guidelines are discussed in further detail in documents such as:

- *Strategic Framework for Water Services (RSA DWAF, 2003a)*
- *Managing the water quality effects of settlements (RSA DWAF, 1999c; RSA DWAF, 2002b).*

The DWAF (Groundwater Section) is also in the process of classifying South Africa's aquifers and the land-uses that will be permissible in such areas. It is envisaged that this process may also include specification for the permissibility, design and construction of sanitation systems in the proximity of certain types of aquifers (Manda Hinsch, DWAF, pers. comm.)

17: In support of i) the DWAF's strategic view of 'enforcing source controls to get as close as possible to a situation in which there is no discharge of pollutants into our water' (referring to the Strategic view), ii) the hierarchy of decision-making (as reflected in Principle 1) and iii) international practice, primary treatment will be required as a minimum for disposal of municipal wastewater to the offshore marine environment. This minimum requirement will apply to all marine outfalls to be authorised after 31 May 2004. For marine outfalls that were already authorised by 31 May 2004, preliminary treatment will be accepted as a minimum requirement, provided that the receiving environment is suitable for this marine disposal and that the environmental (or resource) quality objectives are met. However, future expansions or upgrades to such existing marine outfalls will require primary treatment of the wastewater prior to discharge unless it can be proven that key socio-economic factors require otherwise. Nevertheless, environmental (or resource) quality objectives must still be met.

As a minimum secondary treatment with disinfection will be required for disposal to the surf zone and estuaries. This applies to wastewater discharges to the surf zone and estuaries that existed in 31 May 2004 and those to be authorised thereafter (where such discharges are allowed – refer to Ground Rules 8 and 9).

NOTE: The above set minimum requirements. Where such levels of treatment still do not meet the requirements of the receiving environment, as defined in terms of the environmental (or resource) quality objectives, higher levels of treatment will be required.

Principle supported: Pollution Prevention, Waste Minimisation & Precautionary Approach

Government policy (White Paper on a National Water Policy for SA, 1997) is to strengthen source controls with the final aim of getting as close as possible to a situation in which there is zero discharge of wastewater to the environment. In the light of this, DWAF can therefore require or recommend more stringent levels of treatment based on, for example, the outcome of pre-assessments or detailed investigations, as part of the licence authorisation process.

Internationally, primary treatment, and even secondary treatment, is increasingly being put forward as the minimum for treatment levels for disposal to the offshore marine environment. For example, in the United States, Australia and the European Community, this minimum rule applies for service populations of between 50 000 and 150 000. For larger service populations these countries require at least secondary treatment, in many instances including disinfection.

18: The disposal of sludge arising from wastewater treatment facilities (e.g. primary, secondary and tertiary) must be in accordance with the Minimum Requirements for Waste Disposal by Landfill (DWAF, 1998) and the 'Sludge Guidelines' (1998 as amended in 2000) of the DWAF or any future updates of such policies or guidelines.

Principles supported: Pollution Prevention, Waste Minimisation & Precautionary Approach
Integrated Assessment Approach

4.4.2 Industrial Wastewater

Operational policies regarding the disposal of industrial wastewater to the environment (including the marine environment) are extensive and follow different approaches (refer to Appendix C in *Operational policy for the disposal of land-derived water containing waste to the marine environment of South Africa: Appendices* [RSA DWAF Water Quality Management Series 13.4]). Important aspects are highlighted below.

One approach is to identify specific industrial installations that are required to obtain authorisation to operate. For example, in the European Community the *Directive on integrated pollution prevention and control* (96/61/EC) provides a list of industrial installations and a set of common rules on permits (www.europa.eu.int/comm/environment/ippc). The permits have to be based on the concept of *Best Available Techniques* (BAT) and, realising that in many cases BAT entail quite radical environmental improvements which could jeopardise many jobs, the Directive grants listed installations an 11-year transition period. The Directive also identifies specific aspects that need to be taken into account when determining best available techniques.

Another approach towards eliminating or minimising wastewater from industrial installations is to regulate the operations and processes for specific industries, based on the concept of *Best Available Techniques*. For example, Canada sets specific standards, guidelines and an environmental code of practice for numerous industrial activities under the Canadian Environmental Protection Act, 1999.

With regard to disposal of industrial wastewater into WWTW, most countries require that pre-treatment be applied so as to prevent damage to equipment, that the treatment or re-use of sludge is not impeded and that there will be no adverse effect on the marine environment.

Section 21(h) of the NWA of South Africa states that '*disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process'* requires a licence from the DWAF (this includes stormwater run-off from industrial installations). South Africa's legislation, therefore, does not distinguish between different types of industries but rather subjects all industries to applying for authorisation for wastewater disposal, including disposal to the marine environment.

GROUND RULES RELATED TO INDUSTRIAL WASTEWATER:

19: The following is classified as ' industrial wastewater', requiring a licence, under Section 21 of the National Water Act for disposal to the marine environment:

- ***Water used in an industrial process on land***
- ***Contaminated (or polluted) stormwater run-off originating from an industrial premises on land***
- ***Freshwater or seawater used as cooling water on land***
- ***Seawater used in an industrial process on land, e.g. seafood processing, coastal mining activities and return flows from oceanariums.***

Principle supported: Integrated Assessment Approach

20: An industry, discharging wastewater to a municipal WWTW or directly to the marine environment (or applying for a licence to do so), will be required to provide a detailed description of the waste stream in terms of both volume (quantity) and quality (i.e. listing all substances present and their concentrations and loads). Where industries discharge wastewater to a WWTW, the water services provider is responsible for obtaining this information from the industry concerned. The DWAF or local authority may also require a detailed inventory of the raw materials, as well as process material, used by an industry.

Principle supported: Pollution Prevention, Waste Minimisation & Precautionary Approach

It will be the responsibility of an industry to supply a detailed description of their effluent to the DWAF. Such information is crucial to the licence authorisation process both in terms of evaluating potential impacts appropriately, and of evaluating alternative wastewater treatment options.

Toxicity testing will not be considered as a substitute where detailed description of the composition of the wastewater is not available. However, these tests are valuable techniques to be used as supplementary tools, for verifying impact assessment studies based on the detailed wastewater composition.

21: Industrial wastewater discharged to a municipal WWTW disposing to the marine environment will be subject to appropriate pre-treatment. It is the responsibility of the local authority operating the WWTW to ensure compliance in this regard.

Principle supported: Pollution Prevention, Waste Minimisation & Precautionary Approach

Appropriate pre-treatment is required to ensure that the:

- *WWTW and associated equipment are not damaged*
- *Operation of the WWTW and the treatment or re-use of sludge are not impeded*
- *Discharge from the WWTW does not adversely affect the marine environment.*

22: Wastewater containing radioactive substances is governed by the Department of Minerals and Energy (in concurrence with the DEAT and DWAF) and must comply with policy developed in this regard.

Principles supported: Pollution Prevention, Waste Minimisation & Precautionary Approach
Integrated Assessment Approach

The Department of Minerals and Energy is presently developing a national radioactive waste management policy and strategy in conjunction with the various role players in South Africa. Draft policy and strategy documents will soon be made available to the public for discussion (http://www.radwaste.co.za/regulation.htm).

4.4.3 Diffuse Wastewater Sources (including Urban Stormwater Run-off)

Diffuse wastewater sources include urban stormwater run-off, agricultural and mining return flows, as well as contaminated groundwater seepage (these can either directly discharge into the marine environment or indirectly through river inflow).

In the assessment of any municipal or industrial wastewater discharge to the marine environment, diffuse wastewater inputs must be taken into account. Although there are means of calculating and measuring the volumes and composition of diffuse wastewater inputs, controlling such properties, once the wastewater reaches the marine environment (or any other water resource), is extremely difficult. Such properties, therefore, are best managed and controlled at source, i.e. the point of origin.

Operational policies for the management and control of diffuse wastewater (e.g. urban stormwater run-off, agricultural and mining return flows) at source are not specific to the marine environment, but apply to any water resources, including rivers, groundwater and wetlands. Diffuse wastewater sources are therefore best dealt with on a catchment level, rather than per individual water resource component. It is, therefore, not within the scope of this operational policy to address specific measures to manage and control diffuse wastewater at source.

Regarding diffuse wastewater discharges, *urban stormwater run-off* is probably one of the most important concerns in coastal metropolitan areas. The vast volumes and run-off characteristics of urban stormwater make treatment prior to disposal extremely difficult and expensive. Mitigating treatment at source, i.e. preventing pollution rather than treatment, is usually a more cost-effective route to follow in the case of these non-point sources of pollution. An approach that appears to be effective in this regard is the establishment of Stormwater Management Programmes, as implemented for example in Scotland and the United States of America (refer to Appendix C in *Operational policy for the disposal of land-derived water containing waste to the marine environment of South Africa: Appendices* [RSA DWAF Water Quality Management Series 13.4]).

In 1987 the United States Congress amended the Clean Water Act (US-EPA, 2003a) to establish the section 319 Non-point Source Management Programme in recognition of the need for greater federal leadership to help focus non-point source management efforts. Section 319 requires that each State prepare a Non-point Source Management report (US-EPA, 1987). More specifically, stormwater discharges are also governed under section 402 of the Clean Water Act, as part of the NPDES programme (US-EPA, 2004).

Permitting of stormwater discharges in the United States of America:

The general rule is that the US-EPA does not require a permit for discharges composed entirely of stormwater except in the following cases:

- ***Discharges associated with industrial activities***
- ***Discharges from a municipal separate storm sewer system serving a population of 100 000 or more***
- ***Discharges for which the US-EPA or relevant State determines that the stormwater discharge contributes to a violation of a water quality standard or is a significant contributor of pollutants to the waters of the United States.***

An example of a permit for stormwater discharges in the USA is that of the Los Angeles County in California, formally known as the *Order for Waste Discharge Requirements for Municipal Stormwater and Urban Run-off Discharges within the County of Los Angeles* (United States, Los Angeles County, 1996). In general, the permit requires implementation of both the Stormwater Management Programme contained in the permit, and the elements of the Countywide Stormwater Management Plan or Watershed Management Area Plans.

Key objectives of a Stormwater Management Programme:

- ***Map stormwater reticulation systems, including discharge points into water resources***
- ***Identify and eliminate illicit connections and illicit discharges to the stormwater drainage system and facilitate the public's ability to report illicit connections and discharges.***
- ***Reduce stormwater impacts associated with development and redevelopment projects (i.e. ensure that stormwater management considerations are integrated into planning, permitting and construction of development projects).***
- ***Reduce stormwater quality impacts associated with public agency activities through:***
  - ***Procedures to prevent and respond to spills or leaks from sewage system operations***
  - ***Proper management, design and practices to prevent stormwater impacts from public construction projects***
  - ***Pollution prevention plans and best management practices for public vehicle maintenance/material storage facilities that may discharge pollutants into stormwater***
  - ***Procedures to minimize stormwater pollution associated with landscaping activities pools, and recreation areas***
  - ***Best management practices for catch basin and stormwater drainage maintenance***
  - ***Street sweeping and road maintenance programmes***
  - ***A programme to reduce pollutants from municipal parking lots***
  - ***Procedures to implement best management practices at municipal facilities or operated industrial facilities.***

- ***Increase public knowledge and understanding of the quality, quantity, sources and impacts of stormwater run-off and of actions that can be taken to prevent pollution through education and outreach programs targeting specific audience, such as residents, industrial facility operators, commercial businesses, school children and public agency employees.***
- ***Develop a stormwater quality monitoring programme that will:***
  - ***Track water quality status and trends***
  - ***Identify watershed-specific pollutants of concern***
  - ***Improve understanding of the relationship between land uses and pollutant loads***
  - ***Identify sources of pollutants and evaluate significant stormwater quality problems***
  - ***Evaluate the effectiveness of stormwater management programmes, including pollutant reductions achieved by best management practices***
  - ***Increase knowledge about the impacts of run-off on receiving waters.***
- ***Report and evaluate the effectiveness of implementing stormwater management programmes.***

The City of Norfolk (Virginia) also implements a Stormwater Management Programme as part of its NPDES permit requirements. Revenue for implementation of the programme is derived primarily from stormwater fees charged to residential and non-residential properties. Fees are based on the property's contribution to stormwater run-off. The run-off contribution is determined according to the amount of a property's impervious area (impenetrable surfaces such as concrete and asphalt that do not allow stormwater to infiltrate). Impervious surfaces adversely impact the volume, quality, and speed with which run-off and pollutants reach the stormwater system and local waterways (United States, Virginia, City of Norfolk, 2004).

The policy of the Scottish Environment Protection Agency's (SEPA) with regard to surface water run-off was designed to protect water quality from pollution caused by surface water run-off through active legislation (SEPA, 2001). In 1997, the Sustainable Urban Drainage Scottish Working Party was established and has been instrumental in changing attitudes towards sustainable urban drainage systems in Scotland. Positive results have been achieved through Sustainable Urban Drainage Systems (SUDS) which allow water to be treated prior to release in surface waters and also allow water to soak away into soil. The *Sustainable Urban Drainage Systems - Design Manual for Scotland and Northern Ireland* (Martin, 2000) provides a guide to the design the SUDS within the confines of existing legislation, and the SEPA considers this manual as its primary source of authoritative information. SEPA also promotes SUDS as the preferred solution for drainage of surface water run-off, including roof water, for all proposed developments.

Taking the above into account, operational policy for the management and control of urban stormwater needs to be set at catchment level, as such policies are not specific to urban stormwater run-off to the marine environment, but should apply to run-off to any watercourse, including rivers, groundwater and wetlands. Therefore, operational policy pertaining to stormwater will not be further addressed in this document. It is, however, proposed that an operational policy for the management and control of urban stormwater be developed, taking into account the international trends highlighted above, as well as existing national initiatives such as:

- *A framework for implementing non-point source management under the National Water Ac*t (RSA DWAF, 1999b)
- *Guidelines for human settlement planning and design - The Red Book* (CSIR, 2001)
- Set of documents on *Managing the Water Quality Effects of Settlements* (RSA DWAF, 1999c)
- *Towards a Strategy for a Waste Discharge Charge System* (RSA DWAF 2003b).

The *Framework for implementing non-point source management under the National Water Act* states that non-point source management is largely focused on land use, rather than water use, and should be conducted within the context of catchment management. The document proposes that a national non-point source strategy be put forward for South Africa as part of the national water resource strategy.

Guidelines for human settlement planning and design - The Red Book, also strongly reflect international trends in terms of stormwater management (CSIR, 2001). For example, the Stormwater Management Master Drainage Plans dealt with in detail in this manual are strongly aligned with the Stormwater Management Programmes applied in the United States. The Red Book also stresses that such plans be contemplated on a catchment-wide basis, irrespective of urban and other man-made boundaries.

Managing the Water Quality Effects of Settlements (RSA DWAF, 1999c; RSA DWAF, 2002b) provide the DWAF's strategy for managing waste streams from dense settlements, including the control and management of stormwater and should also be taken into account in the development of a proposed stormwater operational policy for South Africa.

The charges proposed in *Towards a Strategy for a Waste Discharge Charge System* (RSA DWAF, 2003b) also includes charges for diffuse sources of wastewater, which should also be taken into account in the development of an operational policy for urban stormwater run-off for South Africa.

GROUND RULES RELATED TO DIFFUSE WASTEWATER SOURCES:

23: Diffuse land-derived wastewater (such as urban stormwater run-off, agricultural return flows and contaminated groundwater seepage) discharged into the marine environment should not have any negative impact on the receiving environment, i.e. the environmental quality objectives must be met.

Principles supported: Pollution Prevention, Waste Minimisation & Precautionary Approach Integrated Assessment Approach

Although these activities are currently not licensed by DWAF, the Department may require local authorities that are, for example, responsible for stormwater management, to take measures to mitigate negative impact.

Input from diffuse wastewater discharges MUST be taken into account when conducting the scientific and engineering assessments for either an existing or new marine disposal facility. References to methods for calculating the volume and composition of, for example, urban stormwater inputs is provided in the Operational policy for the disposal of land-derived water containing waste to the marine environment of South Africa: Guidance on Implementation *(RSA DWAF Water Quality Management Sub-Series 13.3).*

4.5 SCIENTIFIC & ENGINEERING ASSESSMENT

The marine environment functions as an ecosystem with no clear boundaries between its different components, namely estuaries, surf zone and offshore waters. It is therefore important that, where the disposal of land-derived wastewater to the marine environment is considered, the interaction between these different components be taken into account. Also of crucial importance is the consideration of other waste inputs and anthropogenic activities in the area to ensure that synergistic and/or cumulative interactions are addressed.

The impact of any wastewater discharge depends on the quantity and quality of the wastewater, as well as prevailing physical and chemical oceanographic conditions of the receiving environment. Oceanographic conditions of the marine waters are highly variable, both spatially and temporally, and are determined by the bathymetry of the seabed, currents, winds, tides, waves and the ambient water and sediment chemistry. In order to set outfall design criteria, it is necessary to predict the dilution, transport and fate of substances contained in the wastewater (and subsequent compliance to resource quality objectives), taking into account site-specific oceanographic conditions. It is also important to consider other waste inputs in the area, from both point and diffuse sources. Such predictions and assessments are normally made with some form of predictive model tool.

Internationally, it has become a requirement to use numerical modelling techniques in the design and assessment of marine outfalls (SEPA, 2002; WRc, 1990, Gunnerson, 1988, US-EPA 2002).

Models vary greatly in type and complexity but it is essential that the model chosen be appropriate to the situation in which it is utilised. It is also important that the model be properly calibrated and validated in order to ensure that the model output is reliable and accurate.

A marine outfall is a controllable mechanism of which the design is such that the impact on the environment, as a result of discharge quality, can be manipulated through:

- Degree of treatment (through treatment processes)
- Flow rates (controlled by either a pressure or gravity head)
- Discharge depth and distance from specific beneficial use areas (determined by pipeline length and bathymetry)
- Dilution (diffuser).

GROUND RULES RELATED TO SCIENTIFIC & ENGINEERING ASSESSMENT:

24: A licence application for the disposal of land-derived wastewater to the marine environment will only be considered where a holistic process has been followed for the disposal of land-derived wastewater to the marine environment. This implies that potential impacts on the receiving environment be investigated in both the near and far field, taking into account other anthropogenic activities and waste inputs so as to address possible synergistic and/or cumulative effects. Guidelines in this regard are provided in* Operational policy for the disposal of land-derived water containing waste to the marine environment of South Africa: Guidance on Implementation *(RSA DWAF Water Quality Management Sub-Series 13.3).

Principle supported: Integrated Assessment Approach

Other waste inputs, for example, include diffuse wastewater inputs (e.g. urban stormwater inputs) and dredging activities (relevant to harbour areas). Thus, even though it is not within the mandate of the DWAF to develop operational policy, for example, dredge dumping that, in this case falls within the jurisdiction of the DEAT, such activities must be included as part of the holistic approach. This would also require that other responsible authorities and role players (in this case the DEAT and NPA) be represented on the local management institution.

Further guidance in this regard is provided in Operational policy for the disposal of land-derived water containing waste to the marine environment of South Africa: Guidance on Implementation *(RSA DWAF Water Quality Management Sub-Series 13.3).*

25: A licence application for the disposal of land-derived wastewater to the marine environment will only be considered where a discharge system is designed, constructed and operated in accordance with recognised scientific, hydraulic and structural guidelines in order to meet environmental quality objectives.

Principle supported: Pollution Prevention, Waste Minimisation & Precautionary Approach

Further guidance in this regard is provided in Operational policy for the disposal of land-derived water containing waste to the marine environment of South Africa: Guidance on Implementation *(RSA DWAF Water Quality Management Sub-Series 13.3).*

26: Recognised numerical modelling techniques must be applied in the scientific and engineering assessment and design of a marine disposal system, as and where considered appropriate, according to recognised scientific and engineering guidelines.

Principle supported: Pollution Prevention, Waste Minimisation & Precautionary Approach

In the application of numerical modelling techniques, the following must be complied with:

- *The model chosen be appropriate to the situation in which it is utilised*
- *The model must be calibrated and validated against a full data set adequately describing the site-specific physical and chemical oceanographic conditions*
- *Sensitivity analysis must be conducted to demonstrate the effect of key output parameters, based on the variation in input data and controlling assumptions.*
- *The reporting of model output must include a clear description of assumptions, summary of numerical output, confidence limits and sensitivity and implications and the dilution, transport and fate of relevant substances, in both the near and far field.*

Further guidance in this regard is provided in Operational policy for the disposal of land-derived water containing waste to the marine environment of South Africa: Guidance on Implementation *(RSA DWAF Water Quality Management Sub-Series 13.3).*

27: A precautionary approach must be followed in the assessment and design of any marine disposal system in which the temporal and spatial coverage and accuracy of physical and chemical oceanographic data do not adequately describe site-specific conditions.

Principle supported: Integrated Assessment Approach

In practice, due to time and financial constraints, it is often not possible to collect physical and chemical oceanographic data on spatial or temporal scales that would adequately describe site-specific conditions. The accuracy of prediction of near and far field dilutions, and subsequent compliance to environmental quality objectives largely depends on the adequacy of physical oceanographic data such as currents, stratification, wind, waves and tides (both statistical or real-time). Therefore, where data are not considered to be adequate, a conservative approach must be followed. Typically, this is achieved though, for example, a higher degree of treatment and/or by increasing discharge depth and/or distance from a specific beneficial use area (e.g. as determined by the pipeline length).

4.6 MONITORING & CONTINGENCY PLANS

Chapter 14 of the NWA clearly states that:

Monitoring, recording, assessing and disseminating information on water resources is critically important for achieving the objects of the Act. Part 1 of this Chapter places a duty on the Minister, as soon as it is practicable to do so, to establish national monitoring systems. The purpose of the systems will be to facilitate the continued and co-ordinated monitoring of various aspects of water resources by collecting relevant information and data, through established procedures and mechanisms, from a variety of sources including organs of state, water management institutions and ***water users****.*

Internationally, it is also recognised that monitoring and assessment are key requirements for effective control and management, including that of land-derived wastewater discharges to the marine environment (WRc, 1990; NZWERF, 2002; ANZECC 2000b; US-EPA, 2003b).

Although requirements pertaining to monitoring and assessment are discussed in more detail in *Operational policy for the disposal of land-derived water containing waste to the marine environment of South Africa: Guidance on Implementation* (RSA DWAF Water Quality Management Sub-Series 13.3), a few underpinning *Ground Rules* are listed below.

GROUND RULES RELATED TO MONITORING & CONTINGENCY PLANS:

28: Any authority or industry responsible for the operation and management of a marine disposal system will be subject to the implementation of a monitoring programme.

Principles supported: Pollution Prevention, Waste Minimisation & Precautionary Approach Integrated Assessment Approach & Participatory Approach

The presentation of data to the DWAF must be in a specified format and at a predetermined frequency. This is discussed in further detail in Operational policy for the disposal of land-derived water containing waste to the marine environment of South Africa: Guidance on Implementation *(RSA DWAF Water Quality Management Sub-Series 13.3).*

29: Authorities operating WWTW that receive industrial wastewater (also referred to as trade effluents) must ensure that monitoring programmes are implemented to record the individual flow and composition of such wastewater inputs prior to entering the wastewater reticulation system, as part of their industrial wastewater management plan.

Principles supported: Pollution Prevention, Waste Minimisation & Precautionary Approach Integrated Assessment Approach & Participatory Approach

Data on the individual flow and composition of waste streams must be reported to the DWAF on request.

30: Any authority or industry responsible for the operation and management of a marine disposal system will be required to prepare contingency plans pertaining to maintenance shutdowns, failure in operations or disasters.

Principles supported: Pollution Prevention, Waste Minimisation & Precautionary Approach Integrated Assessment Approach & Participatory Approach

Guidance on contingency planning for the disposal of land-derived wastewater to the marine environment is discussed in further detail in Operational policy for the disposal of land-derived water containing waste to the marine environment of South Africa: Guidance on Implementation *(RSA DWAF Water Quality Management Sub-Series 13.3).*

31: Any authority or industry responsible for the operation and management of a marine disposal system will be required to provide the DWAF with a regular evaluation of the performance of the marine disposal system.

Principles supported: Pollution Prevention, Waste Minimisation & Precautionary Approach Integrated Assessment Approach & Participatory Approach

Guidelines on the format and the frequency at which information on the performance of a marine disposal facility should be provided are discussed in further detail in Operational policy for the disposal of land-derived water containing waste to the marine environment of South Africa: Guidance on Implementation *(RSA DWAF Water Quality Management Sub-Series 13.3). Reporting may include the distribution of information to the wider community, for example through the World Wide Web.*

32: Where performance evaluations indicate non-compliance with the predetermined specifications (including the environmental quality objectives), the responsible authority or industry will be required to propose mitigating actions to ensure compliance (e.g. rehabilitation or alternative treatment options). The responsible authority and the industry operating the wastewater disposal system will be required to implement such actions at their own cost upon approval of the DWAF.

Principle supported: Pollution Prevention, Waste Minimisation & Precautionary Approach and Polluter Pays Principle

As a standard condition in licences, non-compliance must be reported to the Regional Director of the DWAF and actions taken to ensure compliance. The DWAF will work together with water users in order to improve compliance but directives could be issued to the licensee for non-compliance. Only after failure to react to such a directive, will prosecution follow. DWAF will work together with the Police Service and Public Prosecutor in order to prosecute a case of non-compliance or pollution. Evidence is needed for successful prosecution: samples must be taken in the presence of a witness and analysed in order to obtain evidence of a pollution incident. Once evidence is collected, the Police Service will take over the investigation.

33: Decommissioning of a marine discharge structure must be addressed in the planning stages as part of the EIA process, supporting the cradle-to-grave principle. In the case of existing marine discharge structures (authorised prior to 31 May 2004), the authority, service provider or industry responsible for the operation and management of the marine discharge will be required to conduct decommissioning in an environmentally responsible manner. This may require an EIA. Negotiations should be conducted on a case-by-case basis, involving the DWAF, DEAT, the authority, service providers or industry responsible for the marine discharge and any other parties that may be affected by the decommissioning process.

Principles supported: Pollution Prevention, Waste Minimisation & Precautionary Approach
Integrated Assessment Approach

SECTION 5:
MANAGEMENT FRAMEWORK

The **Management Framework** provides the generic and structured approach within which the management and control of disposal of land-derived wastewater to the marine environment of South Africa needs to be conducted. A flow chart illustrating the logical sequence of the above-mentioned components is schematically illustrated in Figure 2.1 (*page* 2-2). A brief overview of each of the components is provided below.

5.1 LEGISLATIVE FRAMEWORK

A management framework should be designed and implemented within the international and national legislative frameworks governing the particular activities and affected environmental domains. In the case of the disposal of land-derived wastewater to the marine environment, these requirements are provided for in the *Basic Principles and Ground Rules* of this operational policy.

Further discussion regarding legal requirements for the disposal of land-derived wastewater to the marine environment, is provided in *Operational policy for the disposal of land-derived water containing waste to the marine environment of South Africa: Guidance on Implementation, Section 2* (RSA DWAF Water Quality Management Sub-Series 13.3).

5.2 MANAGEMENT INSTITUTIONS AND ADMINISTRATIVE RESPONSIBILITIES

The disposal of land-derived wastewater to the marine environment is currently governed by the DWAF under the National Water Act 36 of 1998. The DWAF works in consultation with other government departments. In the context of this operational policy, water use authorisation, under section 21 of the NWA will be required for:

- New applications to dispose of land-derived wastewater to the marine environment
- Existing discharges of land-derived wastewater to the marine environment that are not considered to be existing lawful water use in terms of Section 32 of the NWA
- Upgrades, extensions of existing WWTW or industries discharging to the marine environment that were not approved in terms of the original authorisation
- Change in effluent volume or composition (a licence is issued based on a specific effluent volume and composition, therefore if these change, the discharger legally must re-apply).

Although the DWAF is responsible for the overarching management and administration of the disposal of land-derived wastewater to the marine environment, a key element in the successful implementation of this operational policy is the establishment of local management institutions, representing all the role-players in a designated area, and which fulfil the role of 'local watchdogs' or 'custodians'.

Further information on local management institutions is provided in *Operational policy for the disposal of land-derived water containing waste to the marine environment of South Africa: Guidance on Implementation, Section 3* (RSA DWAF Water Quality Management Sub-Series 13.3).

5.3 ENVIRONMENTAL QUALITY OBJECTIVES

The area within which this management framework is applied must be determined, taking into account the anticipated influence of the proposed discharge, both in the near and far fields (e.g. an entire bay or ecosystem).

Environmental quality objectives must be set in consultation with stakeholders. The identification and mapping of sensitive marine ecosystems and the beneficial uses in the affected areas provide the basis for the derivation of such site-specific environmental quality objectives.

In order for environmental quality objectives to be practical and effective management tools, they need to be set in terms of measurable target values or ranges for specific water column, sediment and biological parameters.

Guidance on procedures to be followed to determine the area boundaries, important ecosystems, beneficial uses and associated environmental quality objectives is provided in *Operational policy for the disposal of land-derived water containing waste to the marine environment of South Africa: Guidance on Implementation, Section 4* (RSA DWAF Water Quality Management Sub-Series 13.3).

5.4 ACTIVITIES AND ASSOCIATED WASTE LOADS

To ensure that possible cumulative and synergistic effects are taken into account, the waste loads of the activities under investigation, as well as those of existing waste inputs to the study area (both in terms of quantity and quality), need to be defined.

Guidance on determining the specification for different types of wastewater is provided in *Operational policy for the disposal of land-derived water containing waste to the marine environment of South Africa: Guidance on Implementation, Section 5* (RSA DWAF Water Quality Management Sub-Series 13.3).

5.5 SCIENTIFIC AND ENGINEERING ASSESSMENT

The objective of this component of the management framework is to refine the environmental quality objectives for a particular marine receiving environment and to establish whether a waste disposal practice can be designed that will comply with such environmental quality objectives. The following are required:

- Characterise the physical and biogeochemical processes and the ecological functioning of the receiving marine environment
- Conduct the hydraulic design of (offshore) outfall, based on preliminarily required dilution estimates and taking into account characteristics of waste loads (both in terms of volume and composition)
- Determine achievable near and far field dilution and deposition/re-suspension patterns, taking into account other anthropogenic influences in the study area, as well as possible synergistic or cumulative effects
- Assess for compliance with environmental quality objectives. Where compliance cannot be achieved, for example, through adjustment of the hydraulic design, either the critical limits for the waste load need to be reduced (e.g. through additional pre-treatment prior to discharge) or the environmental quality objectives need to be re-defined (only in extreme situations, e.g. in cases where the economic/social gains justify such environmental sacrifice).
- Define the structural design and construction considerations of a marine outfall to meet requirements as determined by the above.

Guidance on the procedures to be followed in the scientific and engineering assessment of land-derived wastewater disposal to the marine environment is provided in *Operational policy for the disposal of land-derived water containing waste to the marine environment of South Africa: Guidance on Implementation, Section 6* (RSA DWAF Water Quality Management Sub-Series 13.3). Where appropriate, a distinction is made between requirements for a pre-assessment and a detailed investigation as specified within the licence authorisation process, discussed in detail in *Section 3 of that document*.

5.6 MONITORING AND CONTINGENCY PLANS

Long-term monitoring plans need to be designed and implemented to enable the continuous evaluation of:

- The effectiveness of management strategies and actions to comply with the licence conditions and design criteria (Compliance monitoring and System Performance monitoring)

- The trends and status of changes in the environment in terms of the health of important ecosystems and designated beneficial uses in order to respond to and also to evaluate if the environmental responses that were predicted during the assessment process match the actual responses (Environmental monitoring).

Monitoring programmes typically become part of the licence issued by the DWAF for a particular discharge under Section 21 of the NWA. These monitoring programmes are designed and implemented at the cost of the licensee (following the Polluter Pays Principle).

To be useful from a management perspective, monitoring data must be evaluated against pre-determined objectives. Results need to be presented in clear format, providing the appointed management institution/s with the scientific and engineering information needed for effective decision making (i.e. facilitating effective adaptive management).

Contingency plans and mitigating actions are required to minimise the risks to the environment in the event of malfunctioning, both during construction and operation. Decommissioning of a wastewater disposal scheme is also addressed.

Guidance on procedures to be followed in the design and implementation of monitoring programmes and contingency plans is provided in *Operational policy for the disposal of land-derived water containing waste to the marine environment of South Africa: Guidance on Implementation in Section 7 and 8, respectively* (RSA DWAF Water Quality Management Sub-Series 13.3).

SECTION 6:
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