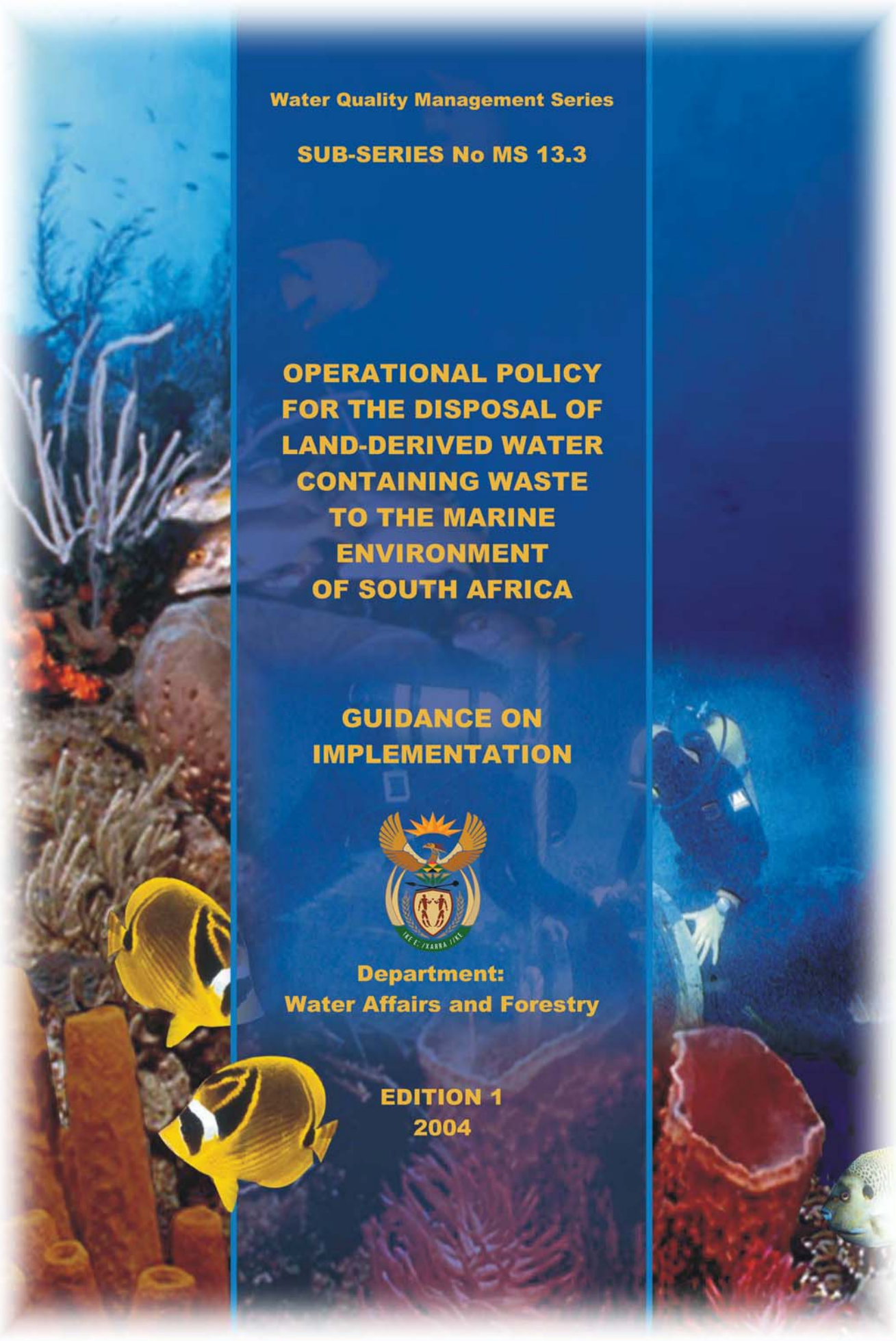

Water Quality Management Series

SUB-SERIES No MS 13.3

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

GUIDANCE ON IMPLEMENTATION

Department:
Water Affairs and Forestry

EDITION 1
2004

WATER QUALITY MANAGEMENT SERIES

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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

The Department of Water Affairs and Forestry (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) in order to fulfil its legal obligation in terms of the management and control of land-derived water and water containing waste (to be referred to as 'wastewater' for the purposes of this document).

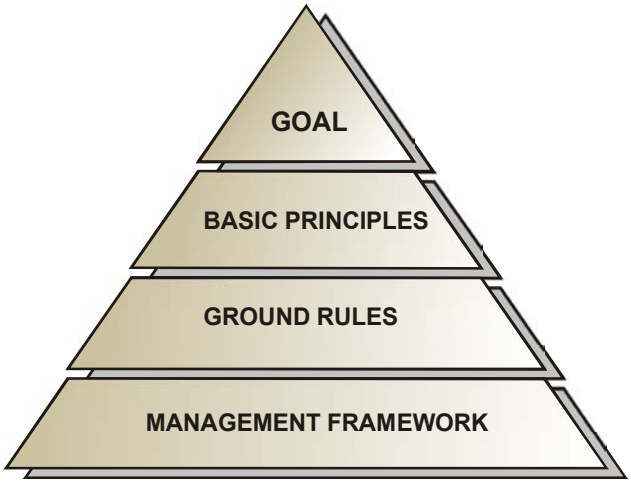
The Department of Water Affairs and Forestry's strategic view of the disposal of land-derived wastewater to the marine environment is as follows:

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 of 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 water quality management goals of the DWAF, namely:

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

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

Basic Principles 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 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 review existing licences to dispose of land-derived wastewater to the marine environment.

(The Basic Principles and Ground Rules are discussed in detail in the *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 13.2]).

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.

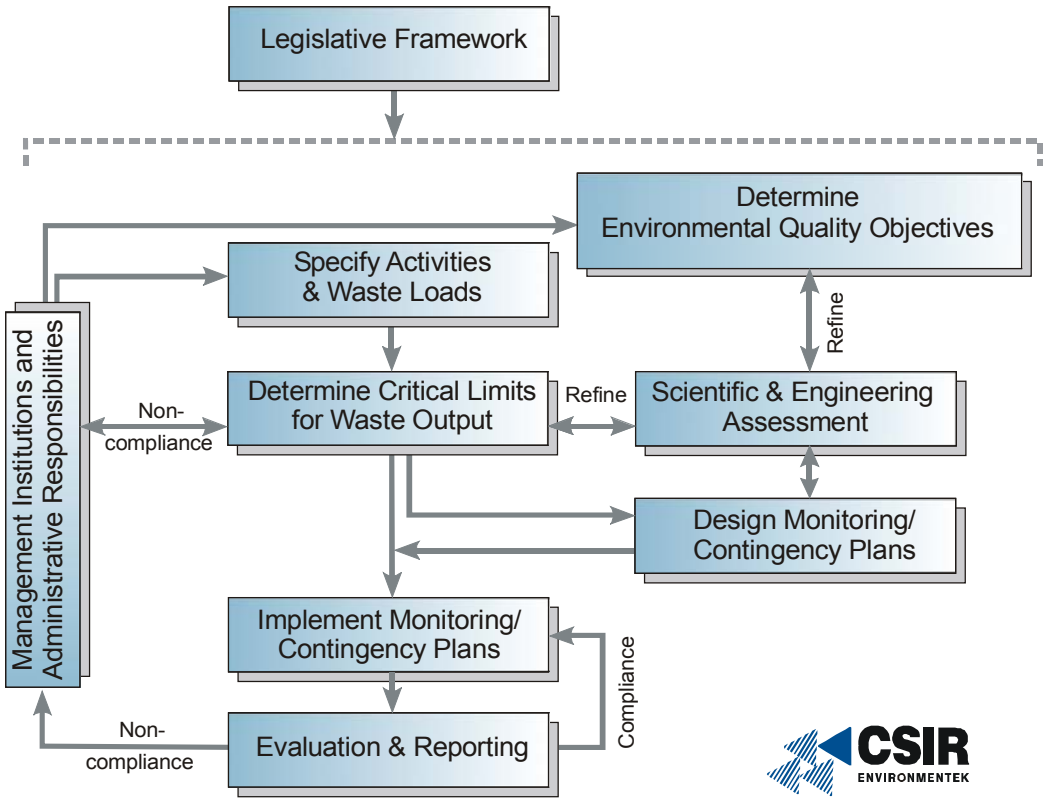
PURPOSE OF THIS DOCUMENT

The purpose of this document is to provide practical guidance to authorities, managers, engineers and scientists 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 an attempt was made to keep this document as user-friendly as possible so as also to provide the less experienced with an overview of the implementation processes, it is primarily aimed at managers, scientists and engineers who are responsible for the technical implementation of the operational policy.

Guidance on the implementation of the operational policy for the disposal of land-derived wastewater to the marine environment, provided in this document, is described within the context of the management framework.

OVERVIEW OF THE 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 the figure on the following page.



A brief overview of each of the components is provided below.

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 information on the legislative framework is provided in Section 2 of this Document.

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 management and administrative responsibilities is provided in Section 3 of this Document.

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.

Further guidance on procedures to be followed to determine the area boundaries, important ecosystems, beneficial uses and associated environmental quality objectives is provided in Section 4 of this Document

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.

Further guidance on determining the specification for different types of wastewater is provided in Section 5 of this Document

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.

Further guidance on the procedures to be followed in the scientific and engineering assessment is provided in Section 6 of this Document. Where appropriate, a distinction is made between requirements for a pre-assessment and a detailed investigation as specified within the authorisation process discussed in Section 3 of this document.

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 assess 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.

Further guidance on procedures to be followed in monitoring and contingency planning is provided is in Section 7 and 8 of this Document, respectively.

RECOMMENDATIONS FOR FUTURE IMPLEMENTATION

The following are recommended for future implementation:

- Operational policies (relating to specific activities) are considered crucial building blocks in achieving an integrated and holistic pollution control and waste management system for South Africa. It is recommended that such policies also be developed for other waste disposal activities to the marine environment. These include activities associated with shipping traffic and dredge spoil dumping, which currently fall within the jurisdiction of the 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.
- Operational policies need to be developed for the land-based management and control of diffuse wastewater sources (e.g. urban stormwater run-off, agricultural and mining return flows). These need to be dealt with on a catchment level, rather than per individual water resource component. International trends need to be taken into account as well as national initiatives.
- Where multiple developments and activities occur in a study area, it is usually extremely difficult and financially uneconomical to manage marine environmental issues in isolation because of, for example, their potential cumulative or synergistic effect on the receiving environment. Collaboration is often best achieved through a joint local management institution. It is, therefore, recommended that the DWAF and DEAT, jointly investigate an official route whereby local management institutions can be formally constituted to assist in the management and control of the quality of marine water resources in South Africa. Towards enforcing the involvement of local role players, the DWAF already requires the establishment of a local monitoring committee, as a licence condition for the disposal of land-derived wastewater to the marine environment.
- To incorporate new learning, both national and international, it is recommended that a review be undertaken of the *South African Water Quality Guidelines for Coastal Marine Waters* for the protection of the marine environment and other beneficial uses. These guidelines also need to include List I and List II substances (List I substances are regarded as particularly hazardous and need to be *eliminated* from wastewater discharges, while List II substances are regarded as less hazardous but nevertheless need to be *controlled*). List II substances are typically those for which specific target values need to be determined. It is also recommended that future updates of the *South African Water Quality Guidelines for Coastal Marine Waters* include sediment quality guidelines.
- It is recommended that South Africa regularly update the inventory of waste discharges to the marine environment, both in terms of volumes and loads. This information should be accessible to the public through the Internet. This publication has become general practice in many countries and provides a sound base from which to holistically assess effectiveness of an operational policy.
- It is recommended that a *Code of Practice* be developed for specific industries in South Africa, specifically addressing ways in which to eliminate or minimise the production of waste, based on best available techniques. This Code of practice should provide clear guidance to industries with regard to their environmental obligation by specifying environmentally sound technologies. This source directed approach to waste elimination and minimisation is considered to be of great value. Documentation available for use in other countries, such as Canada and New Zealand, could to a large extent be adopted for South Africa.
- In countries in which industries (and their waste loads) are not well-defined, prohibited or controlled, substance lists consist of individual substances, e.g. benzene. However, in countries, like Canada and New Zealand, in which industry types and their waste are well-defined, the prohibited or controlled lists also include certain waste stream types. To accommodate, for example synergistic effects from complex effluent, this is an approach that should be investigated for South Africa, once industry types and their waste are more clearly defined.

APPROVAL

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- WESSA

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- Mhlathuze Water
- Mgeni Water
- Buffalo City (East London)
- Nelson Mandela Metropole (Port Elizabeth)
- Coega Development Corporation
- Provincial Departments of Health
- City of Cape Town
- Fishing Industries
- Caltex Refinery, Milnerton
- Petro SA (formerly Mossgas)
- Saldanha Bay & St Helena Bay Water Quality Forum
- Orange River Interim Management Committee
- Alexcor, De Beers and Transhex
- District Municipality (Northern Cape)
- Koeberg Power Station
- Earth Life Africa
- WWF, formerly known as the World Wildlife Fund
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- Department of Provincial and Local Government (DPLG)
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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*