

# GUIDELINES FOR THE UTILISATION AND DISPOSAL OF WASTEWATER SLUDGE

Volume 4 of 5

Requirements for the beneficial use of sludge  
at high loading rates



**water & forestry**

Department  
Water Affairs & Forestry  
REPUBLIC OF SOUTH AFRICA



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Department  
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REPUBLIC OF SOUTH AFRICA



The Water Research Commission

## GUIDELINE VOLUMES

These Guidelines were developed to encourage the beneficial use of wastewater sludges. Rather than trying to develop a single guideline to address all the management options, a separate Guideline Volume deals with each of the management options. This Volume deals with the management, technical and legislative aspects associated with the beneficial use of sludge as well as the sludge characterisation and monitoring requirements for the beneficial use of sludge on land at high application rates.



**Volume 1:** Selection of management options



**Volume 2:** Requirements for the agricultural use of sludge



**Volume 3:** Requirements for the on-site and off-site disposal of sludge



**Volume 4:** Requirements for the beneficial use of sludge at high loading rates



**Volume 5:** Requirements for thermal sludge management practices and for commercial products containing sludge

### THESE VOLUMES ARE AVAILABLE FROM:

Water Research Commission

Private Bag X03

Gezina

0031

Tel: (012) 330 0340

Fax: (012) 331 2565

E-Mail: [info@wrc.org.za](mailto:info@wrc.org.za)

Webpage: [www.wrc.org.za](http://www.wrc.org.za)

The Department of Water Affairs and Forestry

Directorate: Resource Protection and Waste

Private Bag X 313

Pretoria

0001

Tel: (012) 336 7541 Toll free: 0800 200 200

Fax: (012) 323 0321

Webpage: [www.dwaf.gov.za](http://www.dwaf.gov.za)

DEAT: [www.sawic.org.za](http://www.sawic.org.za)

# **Guidelines for the Utilisation and Disposal of Wastewater Sludge**

## **Volume 4: Requirements for the beneficial use of sludge at high loading rates**

**Prepared for the  
Water Research Commission  
by**

**JE Herselman\* & P Moodley\*\***

**\*Golder Associates Africa**

**\*\* Zitholele Consulting**

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The publication of this report emanates from a project entitled: ***Development of the South African wastewater sludge disposal guidelines dealing with land and ocean disposal, beneficial use, use in commercial products and thermal treatment*** (WRC Project No. K5/1622)

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Traditional practices related to wastewater sludge management include dedicated land disposal, waste piling, landfill disposal and to a lesser degree use in agricultural practices. However due to varying reasons on-site land disposal and waste piling have become the standard management options for many wastewater treatment plants in South Africa today. With sludge production increasing on a daily basis, it has however become apparent that current practices are unsustainable with sludge management becoming a problem for many municipalities in South Africa. Innovative solutions need to be sought to create opportunities that provide a wide spectrum of options to the management of wastewater sludge.

Seeking innovative solutions requires a paradigm shift in our perception and understanding of wastewater sludge from a waste product to one of a resource. Such a shift creates an opportunity for local authorities and municipalities to generate a range of economic and social spin-offs to the benefit of their local communities thereby taking a small step towards achieving the goal of sustainable development.

Volumes 2, 3, 4 and 5 of the Sludge Guidelines Series aim to provide options and opportunities for this innovation and to encourage the beneficial use of wastewater sludge. Where wastewater sludge cannot be used as a resource, the guidelines also provide for its disposal in a responsible manner.

The potential benefits of the nutrients (nitrogen, potassium and phosphorus) and the high carbon content of sludge have been well demonstrated and have led to the beneficial utilization of sludge in many countries. Beneficial use of sludge as a soil conditioner is seen as an appropriate cost effective management option for South Africa both for the sludge user and wastewater industry. Generally, soils in South Africa are low in organic matter due to its rapid decomposition in the type of climate experienced. Land-use can cause further soil degradation (mining and industrial activities) and has contributed to a widespread deterioration of soil physical properties. The improvement of the physical properties of soil (water holding capacity, permeability etc.) as a result of an increase in organic carbon plays an important role in promoting the beneficial use of wastewater sludge on land in South Africa. Municipalities can particularly benefit from beneficial use, since it can serve as a source of income.

Volume 2 of the Sludge Guidelines focuses on the beneficial use of sludge in agricultural practices where sludge is added to soil at agronomic rates not exceeding an application rate of 10 tons dry mass per hectare per year. Volume 4 (this document) focuses on the beneficial use of sludge at high loading rates, *i.e.* exceeding 10 ton/ha/year.

The negative effects of high rate sludge application to land on environmental resources need to be managed, to ensure protection of human and animal health, water resources and land quality in general. This Guideline Volume has specifically been developed to maximise the responsible beneficial use of sludge applied at rates higher than agronomic, while still protecting the receiving environment.

The Guidelines were developed as a user friendly document for regulatory authorities, managers, practitioners and operators responsible for sludge management. The development of the Sludge Guidelines were also supported by an extensive stakeholder consultation process (two consultative workshops and a training workshop in each province) which included sector stakeholders, regulatory authorities, government departments, industry experts, professional service providers, and interested individuals whose inputs significantly enhanced the final product. In the interest of transparency, the scientific basis, assumptions, thought processes and stakeholder consultation were documented as separate documents available from the Water Research Commission (WRC).

The Sludge Guidelines are living publications, and will be reviewed periodically based on comments received on the current requirements and approaches. All users are urged to take a critical view regarding the Guidelines in terms of usefulness and appropriateness. It is believed that valuable feedback will ensure continual improvement. Comments should be directed to the Director: Resource Protection and Waste, Department of Water Affairs and Forestry, Private Bag X313, Pretoria, 0001.

**Ms Lindiwe Benedicta Hendricks (MP)**  
Minister of Water Affairs and Forestry

**Mr Marthinus Christoffel Johannes van Schalkwyk (MP)**  
Minister of Environmental Affairs and Tourism

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**The Reference Group responsible for this project consisted of the following persons:**

Dr HG Snyman	Water Research Commission (Chairman)
Mrs W Moolman	Department of Water Affairs and Forestry
Mr L Bredenhann	Department of Environmental Affairs and Tourism
Mrs K de Villiers	Department of Environmental Affairs and Tourism
Mr PN Gaydon	Umgeni Water
Dr AR Pitman	Johannesburg Water
Mr KS Fawcett/Mr RW Moollan	City of Cape Town
Mr JW Wilken	ERWAT
Mr FB Stevens	eThekweni Municipality: Water & Sanitation
Mr H Joubert	Phathamanzi Water Treatment
Mr JS Snyman	Tshwane Metro
Mr KP Taylor	Department of Agriculture

**Project team:**

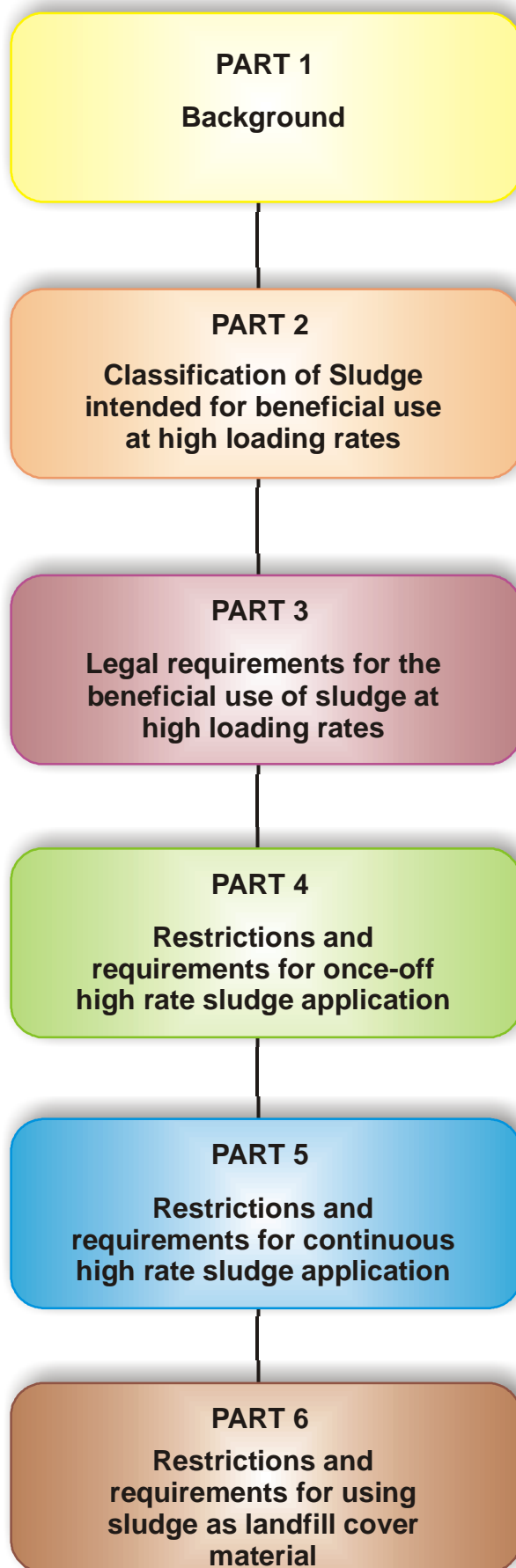
Mrs JE Herselman	Golder Associates Africa (Project leader)
Mrs P Moodley	Zitholele Consulting
Mrs LA Boyd	Golder Associates Africa
Ms W Mosupye	Zitholele Consulting
Dr AM van Niekerk	Golder Associates Africa
Mr M van Zyl	Golder Associates Africa
Mr T McClurg	CSIR
Dr L Dollar	CSIR
Dr G Tredoux	CSIR
Dr P Engelbrecht	CSIR
Dr D Baldwin	Environmental and Chemical Consultants
Mr CE Steyn	ARC-ISCW

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## STRUCTURE OF THIS GUIDELINE VOLUME





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## LIST OF ACRONYMS

DEAT	Department of Environmental Affairs and Tourism
DWAF	Department of Water Affairs and Forestry
ECA	Environment Conservation Act 73 of 1989
EEC	Estimated Environmental Concentration
EIA	Environmental Impact Assessment
MAR	Maximum application rate
NEMA	National Environmental Act, No. 107 of 1998
NWA	National Water Act 36 of 1998
PAR	Permissible application rate
RoD	Record of Decision
WWTP	Wastewater treatment plant
TMT	Total Maximum Threshold Value
MPL	Maximum Permissible Level
TCLP	Toxicity Characteristic Leaching Procedure
AE	Acceptable Exposure



## INTRODUCTION

These Guidelines were developed to encourage the beneficial use of wastewater sludge. Sludge has well known beneficial soil conditioning and fertilizing properties as well as potentially harmful substances and can therefore not be used as normal fertilizer. Volume 2 of the Sludge Guidelines covered the beneficial use of sludge in agricultural practices at agronomic rates, not exceeding 10 ton/ha/year. The fundamental premise of this volume (Volume 4) is that sludge can be used beneficially at high loading rates, provided that there is adequate management and control. These beneficial use options include once-off high rate sludge application to increase the organic content and nutrient status of degraded soils to sustain vegetative growth, continuous high rate applications on non-edible crops and the use of sludge as cover material on landfill.

High rate sludge application, especially practiced on a continuous basis, may have negative impacts on the environment. Therefore, the negative effects on environmental resources need to be managed and monitored to protect human and animal health, water resources and land quality in general. To achieve this, some of the principles of the Minimum Requirements<sup>1</sup> have been adopted for land application options. The Minimum Requirements are updated periodically and the reader would be referred to these documents, or any future updates of the documents, when necessary. However, Volume 3 and 4 of the Sludge Guidelines were developed recognising that the wastewater industry is not necessarily familiar with waste handling practices and legal requirements of the Minimum Requirements. Therefore, the basic principles of the Minimum Requirements, as adopted for sludge handling and disposal are included in these Volumes of the Sludge Guidelines to enable the wastewater industry to familiarise themselves with waste handling practices.

### PURPOSE OF THIS VOLUME

The purpose of this Volume is:

- To give guidance on how to select appropriate beneficial use options
- To create an understanding of the operational and legal requirements of the different beneficial use options; and
- To present guidelines for the monitoring of beneficial use sites.

### WHO SHOULD USE THIS VOLUME?

Volume 4 was developed to enable beneficial use of sludge at higher than agronomic rates without harming the receiving environment. Any person who effectively applies the Guidelines will comply with all the environmental requirements. This Guideline was developed for:

- **Wastewater treatment plant operators** – to implement acceptable good practice pertaining to the beneficial use of sludge at high application rates.

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<sup>1</sup> Department of Water Affairs and Forestry. Waste Management Series. Document 1: Minimum Requirements for the Handling, Classification and Disposal of Hazardous waste. Latest edition.

- **Wastewater treatment service providers** – to implement beneficial use of sludge at higher than agronomic rates as a sludge management strategy while managing the environmental impact.
- **Local authorities and town/city councils that own and operate wastewater treatment plants** – to design, operate and maintain a sustainable beneficial sludge use strategy that would not negatively impact on the receiving environment.
- **Landfill site owners/operators** – to manage the wastewater sludge accepted on the site as landfill cover material.
- **Wastewater engineers/scientists** – to design and develop improved treatment methods and monitoring protocols which will ensure sustainable beneficial use of sludge.
- **Technical advisors** – to encourage beneficial use of sludge and provide appropriate advice on management and monitoring requirements.
- **Legislators** – to assess compliance in cases where the Sludge Guideline Volumes have been referred to in a water use authorisation or waste disposal site permit.
- **Sludge users** – to effectively and responsibly utilise sludge in beneficial use options.
- **Educators** – to build capacity and create awareness.

### **PART 1** **Background**

- Approach followed to develop Volume 4
- Motivation for developing guidelines for beneficial use of sludge
- Description of beneficial use options

### **PART 2**

**Classification of Sludge  
intended for beneficial use  
at high loading rates**

### **PART 3**

**Legal requirements for the  
beneficial use of sludge at  
high loading rates**

### **PART 4**

**Restrictions and  
requirements for once-off  
high rate sludge application**

### **PART 5**

**Restrictions and  
requirements for continuous  
high rate sludge application**

### **PART 6**

**Restrictions and  
requirements for using  
sludge as landfill cover  
material**

## DEFINITIONS AND DESCRIPTION OF KEY TERMS

<b>Acceptable exposure:</b>	The concentration of a substance that will have minimal effect on the environment or human health.
<b>Agricultural land:</b>	Land on which a food crop, a feed crop, or a fibre crop is grown. This includes grazing land and forestry.
<b>Agronomic rate:</b>	The sludge application rate (dry-weight basis) designed (i) to provide the amount of nitrogen needed by the food crop, feed crop, fibre crop, cover crop, or vegetation grown on the land and (ii) to minimise the amount of nitrogen in the sewage sludge that passes below the root zone of the crop or vegetation grown on the land to the groundwater.
<b>Agricultural use:</b>	The use of sludge to produce agricultural products. It excludes the use of sludge for aquaculture and as an animal feed.
<b>Annual pollutant loading rate:</b>	The maximum amount of a pollutant that can be applied to an area of land during a 365-day period.
<b>Assimilative capacity:</b>	This represents the ability of the receiving environment to accept a substance without risk.
<b>Available metal content (Soil):</b>	Specific to Volume 2. Metal fraction extracted with ammonium nitrate in soil samples.
<b>Beneficial uses:</b>	Use of sludge with a defined benefit, such as a soil amendment.
<b>Bioavailability:</b>	Availability of a substance for uptake by a biological system.
<b>Biosolids:</b>	Stabilised Sludge. Organic solids derived from biological wastewater treatment processes that are in a state that they can be managed to sustainably utilise the nutrient, soil conditioning, energy, or other value.
<b>Bund wall:</b>	A properly engineered and constructed run-off interception device around a waste disposal site or down slope of a waste disposal site.
<b>Co-disposal (liquid with dry waste):</b>	The mixing of high moisture content or liquid waste with dry waste. This affects the water balance and is an acceptable practice on a site equipped with leachate management measures.
<b>Co-disposal (dewatered sludge with dry waste):</b>	The mixing of dewatered sludge with dry waste in a general landfill site or hazardous landfill site without affecting the water balance of the site.
<b>Composting:</b>	The biological decomposition of the organic constituents of sludge and other organic products under controlled conditions.
<b>Contaminate:</b>	The addition of foreign matter to a natural system. This does not necessarily result in pollution, unless the attenuation capacity of the natural system is exceeded.
<b>Controlled access:</b>	Where public or livestock access to sludge application areas is restricted or controlled, such as via fences or signage, for a period of time stipulated by this guideline.
<b>Cradle-to-grave:</b>	A policy of controlling a Hazardous Waste from its inception to its ultimate disposal.

<b>Cumulative pollutant loading rate:</b>	The maximum amount of a pollutant that can be applied to a unit area of land.
<b>Cut-off trench:</b>	A properly engineered and constructed trench to intercept and collect run-off.
<b>Dedicated land disposal:</b>	Sites that receive repeated applications of sludge for the sole purpose of final disposal.
<b>Delisting:</b>	If the estimated environmental concentration (EEC) is less than the Acceptable Exposure (AE) which is 10% of the LC <sub>50</sub> , the waste can be delisted, <i>i.e.</i> be moved to a lower Hazard Rating or even disposed of at a General Waste landfill with a leachate collection system.
<b>Dewatering:</b>	Dewatering processes reduce the water content of sludge to minimise the volumes for transport and improve handling characteristics. Typically, dewatered sludge can be handled as a solid rather than as liquid matter.
<b>Disinfection:</b>	A process that destroys, inactivates or reduces pathogenic microorganisms.
<b>Disposal:</b>	The discharge, deposit, injection, dumping, spilling, leaking, or placing of any solid waste or hazardous waste into the environment (land, surface water, ground water, and air).
<b>Disposal site:</b>	A site used for the accumulation of waste with the purpose of disposing or treatment of such waste. See also Waste Disposal Site.
<b>Domestic sewage:</b>	Waste and wastewater from humans or household operations that is discharged to, or otherwise enters a treatment works.
<b>Dose:</b>	In terms of monitoring exposure levels, the amount of a toxic substance taken into the body over a given period of time. See also LD <sub>50</sub>
<b>Domestic waste:</b>	Waste emanating, typically, from homes and offices. Although classified as a General Waste, this waste contains organic substances and small volumes of hazardous substances.
<b>Dose-response:</b>	How an organism's response to a toxic substance changes as its overall exposure to the substance changes. For example, a small dose of carbon monoxide may cause drowsiness; a large dose can be fatal.
<b>Drying:</b>	A process to reduce the water content further than a dewatering process. The solids content after a drying process is typically > 75%.
<b>Dry-weight (DW) basis:</b>	The method of measuring weight where, prior to being weighed, the material is dried at 105°C until reaching a constant mass ( <i>i.e.</i> , essentially 100 % solids content).
<b>Dump:</b>	A land site where wastes are discarded in a disorderly or haphazard fashion without regard to protecting the environment. Uncontrolled dumping is an indiscriminate and illegal form of waste disposal. Problems associated with dumps include multiplication of disease-carrying organisms and pests, fires, air and water pollution, unsightliness, loss of habitat, and personal injury.

<b><i>E. coli</i>:</b>	A group of bacteria normally found in the intestines of humans and animals. Most types of <i>e. coli</i> are harmless, but some active strains produce harmful toxins and can cause severe illness. In sanitary bacteriology, <i>Escherichia coli</i> is considered the primary indicator of recent faecal pollution.
<b>Ecotoxicity:</b>	Ecotoxicity is the potential to harm animals, plants, ecosystems or environmental processes.
<b>Emission:</b>	The release or discharge of a substance into the environment. Generally refers to the release of gases or particulates into the air.
<b>Emission Standards:</b>	Government standards that establish limits on discharges of pollutants into the environment (usually in reference to air).
<b>Environment:</b>	Associated cultural, social, soil, biotic, atmospheric, surface and groundwater aspects associated with the disposal site that could potentially be, impacted upon by the disposal.
<b>Environmental Impact Assessment (EIA):</b>	An investigation to determine the potential detrimental or beneficial impact on the surrounding communities, fauna, flora, water, soil and air arising from the development or presence of a waste disposal site.
<b>Estimated Environmental Concentration (EEC):</b>	The Estimated Environmental Concentration represents the concentration of a substance in the aquatic environment when introduced under worst case scenario conditions, i.e., directly into a body of water. It is used to indicate possible risk, by comparison with the minimum concentration estimated to adversely affect aquatic organisms or to produce unacceptable concentrations in biota, water or sediment.
<b>Faecal coliform:</b>	<i>Faecal coliforms</i> are the most commonly used bacterial indicator of faecal pollution. <i>Faecal coliforms</i> are bacteria that inhabit the digestive system of all warm-blooded animals, including humans.
<b>Hazard Rating:</b>	A system for classifying and ranking Hazardous waste according to the degree of hazard they present.
<b>Hazardous waste:</b>	Waste that may, by circumstances of use, quantity, concentration or inherent physical, chemical or infectious characteristics, cause ill health or increase mortality in humans, fauna and flora, or adversely affect the environment when improperly treated, stored, transported and disposed of.
<b>Helminth ova:</b>	The eggs of parasitic intestinal worms.
<b>Incineration:</b>	Incineration is both a form of treatment and a form of disposal. It is simply the controlled combustion of waste materials to a non-combustible residue or ash and exhaust gases, such as carbon dioxide and water.
<b>Integrated Environmental Management (IEM):</b>	A code of practice ensuring that environmental considerations are fully integrated into the management of all activities in order to achieve a desirable balance between conservation and development.
<b>Land application:</b>	The spraying or spreading of wastewater sludge onto the land surface; the injection of wastewater sludge below the land surface; or the incorporation of wastewater sludge into the soil so that the wastewater sludge can either condition the soil or fertilise crops or vegetation grown in the soil.

<b>Land disposal:</b>	Application of sludge where beneficial use is not an objective. Disposal will normally result in application rates that exceed agronomic nutrient requirements or cause significant contaminant accumulation in the soil.
<b>Landfill:</b>	To dispose of waste on land, whether by use of waste to fill in excavation or by creation of a landform above ground, where the term "fill" is used in the engineering sense.
<b>LC<sub>50</sub>:</b>	The median lethal dose is a statistical estimate of the amount of chemical, which will kill 50% of a given population of aquatic organisms under standard control conditions. The LC <sub>50</sub> is expressed in mg/l.
<b>LD<sub>50</sub>:</b>	The median lethal dose is a statistical estimate of the amount of chemical, which will kill 50% of a given population of animals (e.g. rats) under standard control conditions.
<b>Leachate:</b>	An aqueous solution with a high pollution potential, arising when water is permitted to percolate through decomposing waste.
<b>Liner:</b>	A layer of low permeability placed beneath a landfill and designed to direct leachate to a collection drain or sump, or to contain leachate. It may comprise natural materials, synthetic materials, or a combination thereof.
<b>Maximum available threshold (MAT):</b>	The maximum available (NH <sub>4</sub> NO <sub>3</sub> extractable) metal concentration allowed for soils receiving sludge.
<b>Maximum permissible level:</b>	The maximum total metal concentration allowed in soils at sludge disposal sites. Soil remediation would not be necessary except if this level is exceeded.
<b>Minimum Requirement:</b>	A standard by means of which environmentally acceptable waste disposal practices can be distinguished from environmentally unacceptable waste disposal practices.
<b>Monthly average:</b>	The arithmetic mean of all measurements taken during a given month.
<b>Most probable number (MPN):</b>	A unit that expresses the amount of bacteria per gram of total dry solids in wastewater sludge.
<b>Off-site:</b>	Sludge disposal site outside the boundaries of the wastewater treatment plant (WWTP).
<b>On-site:</b>	Sludge disposal site within the boundaries of the wastewater treatment plant (WWTP).
<b>Pathogenic organisms:</b>	Disease-causing organisms. This includes, but is not limited to, certain bacteria, protozoa, viruses, and viable helminth ova.
<b>pH:</b>	The logarithm of the reciprocal of the hydrogen ion concentration. The pH measures acidity/alkalinity and ranges from 0 to 14. A pH of 7 indicates the material is neutral. Moving a pH of 7 to 0, the pH indicates progressively more acid conditions. Moving from a pH of 7 to 14, the pH indicates progressively more alkaline conditions.



<b>Pollution:</b>	The direct or indirect alteration of the physical, chemical or biological properties of a (water) resource so as to make it less fit for any beneficial purpose for which it may reasonably be expected to be used; or harmful or potentially harmful to the welfare, health or safety of human beings; to any aquatic or non-aquatic organisms; to the resource quality; or to property.
<b>Primary treatment:</b>	Treatment of wastewater prior to other forms of treatment and involving settling and removal of suspended solids.
<b>Qualified person:</b>	A person is suitably qualified for a job as a result of one, or any combination of that person's formal qualifications, prior learning, relevant experience; or capacity to acquire, within a reasonable time, the ability to do the job.
<b>Receptor:</b>	Sensitive component of the ecosystem that reacts to or is influenced by environmental stressors.
<b>Recycle:</b>	The use, re-use, or reclamation of a material so that it re-enters the industrial process rather than becoming a waste.
<b>Rehabilitation:</b>	Restoring a waste site for a new industrial function, recreational use, or to a natural state.
<b>Remediation:</b>	The improvement of a contaminated site to prevent, minimize or mitigate damage to human health or the environment. Remediation involves the development and application of a planned approach that removes, destroys, contains or otherwise reduces the availability of contaminants to receptors of concern.
<b>Residue:</b>	A substance that is left over after a waste has been treated or destroyed.
<b>Responsible person:</b>	A person(s), who takes professional responsibility for ensuring that all or some of the facets of the handling and disposal of Hazardous Waste are properly directed, guided and executed, in a professionally justifiable manner.
<b>Restricted agricultural use:</b>	Use of sludge in agriculture is permitted but restrictions apply (crop restrictions, access restrictions etc).
<b>Risk:</b>	The scientific judgement of probability of harm. This basic and important concept has two dimensions: the consequences of an event or set of circumstances and the likelihood of particular consequences being realised. Both dimensions apply to environmental risk management with it generally being taken that only adverse consequences are relevant
<b>Risk assessment:</b>	The evaluation of the results of risk analysis against criteria or objectives to determine acceptability or tolerability of residual risk levels, or to determine risk management priorities (or the effectiveness or cost-effectiveness of alternative risk management options and strategies).
<b>Risk management:</b>	The systematic application of policies, procedures and practices to identify hazards, analysing the consequences and the likelihood associated with those hazards, estimating risk levels, assessing those risk levels against relevant criteria and objectives, and making decisions and acting to reduce risk levels to acceptable environmental and legal standards.
<b>Secondary Treatment:</b>	Treatment of wastewater that typically follows primary treatment and involves biological processes and settling tanks to remove organic material.

<b>Sludge-amended soil:</b>	Soil to which sludge has been added.
<b>Sludge:</b>	Solid, semi-solid, or liquid residue generated during the treatment of domestic sewage in a treatment works. Wastewater sludge includes, but is not limited to, domestic septage; scum or solids removed in primary, secondary, or advanced wastewater treatment processes; and material derived from wastewater sludge in a wastewater sludge incinerator. It does not include the grit and screenings generated during preliminary treatment of domestic wastewater in a treatment works.
<b>Soil organisms:</b>	A broad range of organisms, including microorganisms and various invertebrates living in or on the soil.
<b>Specific oxygen uptake rate (SOUR):</b>	The mass of oxygen consumed per unit time per unit mass of total solids (dry-weight basis).
<b>Stabilisation:</b>	The processing of sludge to reduce volatile organic matter, vector attraction, and the potential for putrefaction and offensive odours.
<b>Stabilised sludge:</b>	Organic solids derived from biological wastewater treatment processes that are in a state that they can be managed to utilise the nutrient, soil conditioning, energy, or other value.
<b>Sterilise:</b>	Make free from microorganisms.
<b>Supplier:</b>	A person or organisation that produces and supplies sludge for use. This includes a water business producing and treating sludge and processors involved in further treatment.
<b>Surface water interception mechanism:</b>	A mechanism placed between the disposal site and the surface water body to intercept possible run-off from the disposal site before it can reach the water body.
<b>Sustainability:</b>	Being able to meet the needs of present and future generations by the responsible use of resources.
<b>Sustainable use:</b>	The use of nutrients in sludge at or below the agronomic loading rate and/or use of the soil conditioning properties of sludge. Sustainable use involves protection of human health, the environment and soil functionality.
<b>Total investigative level (TIL):</b>	The total metal concentration in agricultural soils where further investigation is necessary before sludge application can commence.
<b>Total load capacity:</b>	The capacity of a landfill site to accept a certain substance or the amount of a substance, which can be safely disposed of at a certain site. The total load capacity is influenced by the concentration levels and mobility of the waste, and by the landfill practice and design.
<b>Total maximum threshold (TMT):</b>	The maximum total metal concentration allowed in agricultural soils receiving sludge.
<b>Total metal content:</b>	Metal fraction extracted using an <i>aqua regia</i> solution (HCl/HNO <sub>3</sub> solution).
<b>Total trigger value:</b>	The total metal concentration in soils at disposal sites indicating that additional management options should be implemented to reduce the impact on the soil.

<b>Toxic:</b>	Poisonous.
<b>Toxicity:</b>	An intrinsic property of a substance which can cause harm or a particular adverse effect to humans, animals or plants at some dose.
<b>Toxicity Characteristic Leaching Procedure (TCLP):</b>	A test developed by the USA Environmental Protection Agency to measure the ability of a substance to leach from the waste into the environment. It thus measures the risk posed by a substance to groundwater.
<b>Transporters:</b>	A person, organisation, industry or enterprise engaged in or offering to engage in the transportation of waste.
<b>Treatment:</b>	Treatment is used to remove, separate, concentrate or recover a hazardous or toxic component of a waste or to destroy or, at least, to reduce its toxicity in order to minimise its impact on the environment.
<b>Unrestricted agricultural use:</b>	Sludge is of such good quality that it can be used in agricultural practices without any restrictions.
<b>VAR:</b>	Vector Attraction Reduction.
<b>Vector attraction:</b>	The characteristic of wastewater sludge that attracts rodents, flies, mosquitoes, or other organisms capable of transporting infectious agents.
<b>Vectors:</b>	Any living organisms that are capable of transmitting pathogens from one organism to another, either: (i) mechanically by transporting the pathogen or (ii) biologically by playing a role in the lifecycle of the pathogen. Vectors include flies, mosquitoes or other insects, birds, rats and other vermin.
<b>Waste:</b>	An undesirable or superfluous by-product, emission, or residue of any process or activity, which has been discarded, accumulated or stored for the purpose of discarding or processing. It may be gaseous, liquid or solid or any combination thereof and may originate from a residential, commercial or industrial area.
<b>Waste disposal site:</b>	Any place at which more than 100kg of a Waste is stored for more than 90 days or a place at which a dedicated incinerator is located.
<b>Wastewater Sludge:</b>	The material recovered from predominantly domestic wastewater treatment plants. (Also see Sludge).
<b>Wastewater Treatment Plant (WWTP):</b>	Any device or system used to treat (including recycling and reclamation) either domestic wastewater or a combination of domestic wastewater and industrial waste of a liquid nature.
<b>Wet weight:</b>	Weight measured of material that has not been dried (see Dry-weight basis).