GUIDELINES FOR SEPTAGE
AND
BIOSOLIDS MANAGEMENT IN JAMAICA

Submitted to
Pan American Health Organisation (PAHO)
2-4 King Street
Kinston
Jamaica

Prepared by
Forrest & Associates
4 Chelsea Avenue
Kingston 10
Jamaica

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GLOSSARY

Application Site
The area over which the biosolids are applied.

Biosolids
Any product consisting totally or in part of organic matter that results from a wastewater treatment process (referred to as sewage sludge) or septic tank sludge.

Classification
The process of assigning biosolids into classes based on their quality.

Composting
The aerobic decomposition of organic constituents at elevated temperatures to produce a highly stable humus like material. Several composting techniques may be used.

Contaminants
Potentially toxic elements occurring in biosolids which may affect plant or animal growth or human health.

Digestion
Mesophilic anaerobic digestion typically at 30—35°C for 20—30 days.

Faecal sludge
Sludges of variable consistency collected from so-called on-site sanitation systems; viz. latrines, non-sewered public toilets, septic tanks, and aqua privies

Land Disposal
Application of biosolids where beneficial use is not an objective and normally at rates which exceed the nutrient requirements of crops/pastures or plants, or the requirement for organic matter.

Land Application
Spraying or spreading of biosolids on to the land surface or their injection below the land surface.

Landfill
A waste disposal area that has been approved for the purpose and licensed by the EPA.

Pathogens
Microorganisms such as bacteria and viruses, helminths (worms), and protozoan parasites such as Giardia, Entamaeta and Cryptosporidium, which can cause disease in humans and animals.
Public Toilet Sludge
Sludges collected from unsewered public toilets (usually of higher consistency than septage and biochemically less stabilised)

Septage
Septage, the informal term for hauled sewage, classifies all matter (liquids and solids) that is pumped out of septic tanks and holding tanks. Such tanks are found on residential, commercial and industrial properties. Septage is raw and untreated sewage, and must not be confused with sewage biosolids, which is the term applied to municipal sewage from a sewage treatment plant (STP) that meets specific standards.

Sludge
Sludge is residual waste or the byproduct of wastewater treatment processing.

Stabilisation
The processing of biosolids to reduce or eliminate the potential for putrefaction and which as a result reduces pathogens, vector attraction and potential to generate offensive odours.

Vectors
Insects and animals, such as flies, mosquitoes and rodents, which are attracted to the putrescible organic material in biosolids and which may spread pathogens.

Wastewater Treatment Plant
The processing facility that treats wastewater to render it acceptable for discharge to the environment and which as a result produces biosolids and minor residuals.

These guidelines have been produced as a working draft. Once the guidelines have been in operation for a period of time (TBD), the Central Board of Health’s Sub Committee on Septage and Portable Treatment Systems will seek comments from septage haulers, septage treatment operators and biosolids suppliers and users as well as from other interested parties, for possible revision of the guideline.
If you have any comments to make on this guideline, please forward them to:
Mr. Peter Knight
Director Environmental Health
Ministry of Health
2-4 King Street
Kingston
Comments may also be e-mailed to:
knightp@moh.gov.jm
EXPLANATORY NOTES TO GUIDELINES

The reader in examining these guidelines should be aware of the following.

1. At the time of the preparation of the guidelines a Policy for the management of septage and biosolids while contemplated had not been completed. Therefore although there is information regarding the land application of septage and or biosolids this is presented for completeness and does not represent a decision of the GOJ/MOH re land application as a disposal method for the country of Jamaica.

2. The Situational Analysis Report - Development of Guidelines, Standards and Regulations for the Management of Septage and Sludge (which informed the development of these guidelines) pointed to the inadequacy of locally generated data exist on septage and or sludge characteristics. The absence of which impacts adversely on the country’s ability to appropriately design treatment facility or utilise the land disposal option(s).

3. The guidelines have provided some numbers from Western Australia where climatic conditions are somewhat similar. However, these serve only as a guide and decisions regarding certain standards as noted in the document will have to be informed by local applied research. This responsibility should be given to a multidisciplinary cross sectoral team comprising representatives from the Ministry of Health, NEPA, WRA, SRC, UWI and the Ministry of Agriculture.

4. The guidelines are not intended to address industrial sludge.

5. The Ministry of Health will be responsible for permitting septage haulers.

6. The National Environment and Planning Agency remain responsible for the permitting of treatment and disposal facilities and the accompanying environmental standards. Guidelines related to these matters are not the subject of this document.

7. The disposal of biosolids in solid waste disposal facilities is the purview of the National Solid Waste Management Authority. Guidelines related to the operation of such sites have not been dealt with in this document.

June 3, 2005
1.0 INTRODUCTION

1.1 Background

The 2001 census reported that approximately 72.5% of households\(^1\) in Jamaica have on site systems for the disposal of excreta. These systems are emptied by cesspool operators however; the MOH has no regulations or guidelines to effectively manage the collection, transportation, treatment and disposal of septage in the country.

The Ministry of Health (MOH) with the support of the Pan American Health Organisation (PAHO) is currently working to regularise the management and disposal of septage and biosolids in Jamaica. In this regard, a consultant was contracted to develop in consultation with key stakeholders and interested parties guidelines, standards, and regulations for the management of septage and sludge in Jamaica.

The Scope of Work (SOW) for the project was as follows.

Specifically the consultant was required to:

1) Conduct a situational analysis to determine the present operational system and management of management of septage in Jamaica.

2) Collaborate with stakeholders in the regulatory agencies and private sector to develop a regulatory and monitoring system for operators and other persons involved in collecting, transporting, treating and disposing of domestic septage, industrial septage, sludge and temporary systems.

3) Review policies, guidelines, standards and regulations obtaining in other regional and international jurisdictions on septage management.

4) Develop drafting instructions to be sent to the Chief Parliamentary Council (CPC) for regulating domestic and industrial septage, industrial sludge, temporary treatment systems, licensing of cesspool servicing companies, and permit for transport operators.

5) Prepare guidelines and standards for the management of domestic and industrial septage, industrial sludge, temporary treatment systems, licensing of cesspool servicing companies, and permit for transport operators (this to include occupational health and safety standards).

6) Make presentation(s) on the guidelines to at least three public consultations.

\(^{1}\) Draft Report, The Collection, Transport and Disposal of Septic Tank and Absorption Pit Waste in Jamaica – Trans Caribbean Engineering & Management Consultants
This document contains the proposed guidelines which will govern the management of septage and biosolids in Jamaica.

1.2 Approach

The guidelines have been developed in keeping with the findings of the Situational Analysis Report. In that report, there was the recognition of the limited locally generated scientific information. Additionally, it was noted that bearing in mind the current reality, Jamaica should base its development of the regulatory framework on “an ethical model” that calls for a regulator to optimise the benefits of health and environmental protection while minimising costs within the constraints of technical feasibility.

In light of these findings, the guidelines and standards have been developed largely on the experience of the Environmental Agencies of The United States, Australia and Canada but adopted for the Jamaican situation. It is recommended that these standards be reviewed periodically as more locally generated data and experience becomes available.

1.3 Objective

The objective of these guidelines is to provide guidance on acceptable practices for the following.

- Transportation of septage;
- Treatment and disposal of septage;
- Land application of biosolids;
- Storage of biosolids;
- Vector control;
- Occupational health and safety; and
- Monitoring and Reporting

The guidelines acknowledge that septage and biosolids can be viewed as a resource, and that there can be significant benefits to their reuse as long as adequate procedures are put in place to eliminate and or minimise risks to public health and the environment.

These guidelines have been published as a working document. Key stakeholders will be consulted during their further development.

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2.0 SCOPE OF THE GUIDELINES

Septage is the informal term for hauled sewage, classifies all matter (liquids and solids) that is pumped out of septic tanks and holding tanks. Such tanks are found on residential, commercial and industrial properties. Septage is raw and untreated, and must not be confused with sewage biosolids, which is the term applied to solids derived from a sewage treatment plant (STP) that meets specific standards. These standards are currently being developed by the National Environment and Planning Agency (NEPA).

These guidelines address the transportation of septage, its treatment and disposal of biosolids.

Biosolids are organic solids derived from municipal sewage (sludge) and septage treatment processes. The term is generally used to refer to those solids that have been stabilised to enable beneficial reuse.

These guidelines do not apply to sludges and organic solid wastes produced from other industries such as piggeries, feedlots, wineries, and abattoirs, or to industries producing inorganic solid wastes.

These guidelines apply to the reuse of biosolids in direct land applications only. It proposes minimum criteria, procedures and approval processes that should be observed for direct application of biosolids in Jamaica.

It does not apply to the reuse of biosolids in compost.

This guideline has been developed for use by regulators, septage haulers, septage treatment plant operators, producers and users of biosolids.
3.0 HEALTH AND ENVIRONMENTAL ISSUES

Poor management of septage and biosolids could lead to harm to public health and to the environment. Infection by microorganisms is a major risk from human contact with partly treated products derived from wastewater depending on the treatment process and source of the material.

Biosolids as the by product of treated sewage and septage is of particular concern as it may contain bacteria, viruses, helminths (such as hookworm), protozoa (such as Giardia) and fungi. There are a number of recognised exposure pathways including inhalation, ingestion (especially through hand to mouth contact) and contact with broken skin. All persons handling septage and biosolids need to observe personal hygiene precautions.

Additionally, because of the diverse sources of wastewater, biosolids may also contain significant concentrations of chemical contaminants, including heavy metals and pesticides. Chemicals present in biosolids may become dissolved and move through soils if biosolids are used for agricultural purposes.

Where biosolids are used for agricultural purposes this may allow chemicals to pass into the food chain, which could have both health and economic implications. As some chemical compounds may remain in the environment for long periods of time, the frequency of applications to one site needs to be managed to prevent contaminant levels being built up to harmful levels.

Environmentally, when biosolids are disposed of in landfill sites issues of leachate treatment and disposal have to be considered. There are also environmental considerations for the acceptability of the effluent from septage treatment facilities which must meet the local environmental discharge standards. Issues of the potential to pollute surface and groundwater must also be part of any management of the waste stream.

This is also true for the application of biosolids on land and the existence of constraints that can limit the acceptability of application. Issues for consideration include the potential to pollute surface water and groundwater with nutrients or trace contaminants, the importation of exotic plant seeds and spores to sensitive areas and alteration of the pH of some soils, which may increase the mobility of some metals.

These guidelines have been developed to facilitate responsible and beneficial management of septage and biosolids and to minimise the risk of any adverse effects to human health, animal health and the environment.

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3 National Environment and Planning Agency Wastewater and Sludge Regulations
4.0 TRANSPORTATION OF SEPTAGE

4.1 Licensing of Septage Haulers

The haulers of septage should apply through the Public Health Department in their locale for a permit to transport septage. The applicant will be required to provide the following information:

(i) The names, address, and telephone number of the applicant and owner; individual;

(ii) The vehicle identification number and license plate number for the vehicle(s) which will be used to transport the tanks and tank identification number(s), if applicable;

(iii) The name, principal place of business, and telephone number of the septage hauler or septage transporting company that will appear on both sides of the vehicle or tank which will be used to transport the septage;

(iv) The anticipated service area(s); and

(v) The location of each site, facility, or wastewater treatment facility to which septage is proposed to be taken.

The application must be accompanied by a processing fee of (to be decided) dollars.

The application shall be accompanied by a statement signed by the operator or authorised agent of the septage disposal facility or sewage treatment plant, to which the applicant proposes to transport septage, which acknowledges the applicant's intent to use or dispose of septage at the facility and authorises such activity.

Each application shall be accompanied by a statement signed by the applicant stating that all vehicles and tanks proposed to be used to transport septage have met all applicable national motor vehicle requirements.

4.1.1 License Renewal

The license shall be granted for two years and will be subject to review before renewal. The renewal process will be carried out by the Public Health Department and will be granted based on the following determinations.

(a) All required reporting has been received;

(b) All applicable requirements of these rules have been met;

(c) All vehicles proposed to transport septage comply with all national motor vehicle requirements;

(d) The treatment facilities confirm use of its sites to dispose of septage; and
(e) The applicant has paid all fees and administrative, civil penalties owed to the department.

4.2 Permitting of Suppliers of Portable Toilets

The suppliers of portable toilet facilities should apply for a permit through the Public Health Department to provide this service. The applicant will be required to provide the following information:

(i) The names, address, and telephone number of the applicant and owner; individual;

(ii) The name, principal place of business, and telephone number of the units in operation.

(iii) The location of each site, facility, or wastewater treatment facility to which septage from the portable system is proposed to be taken.

(iv) Whenever a permit holder obtains an additional or replacement sanitary units, the permit holder shall notify the department in writing within 10 days.

The application must be accompanied by a processing fee of (to be decided) dollars

Portable toilet operators who transport waste from their toilets must apply for a septage haulage license.

4.3 Haulage Vehicles

4.3.1 Vehicle Identification

(a) A copy of the septage hauler license issued shall be retained in the vehicle at all times;

(b) Each septage hauler shall display in permanent and legible lettering the name, principal place of business, and telephone number of the septage hauler or transporting company on both sides of the vehicle or tank used to transport septage; and

(c) The department shall issue a permit plate that shall be mounted on the rear of the transporting unit.

(d) Whenever a license holder obtains an additional or replacement vehicle for transporting the tank(s), the license holder shall:

(i) Notify the department in writing within 10 days of using the vehicle to transport septage; and

(ii) Supply the vehicle identification number and license plate number for the vehicle.
4.3.2 Vehicle and Tank Maintenance

Any hauler who has been issued a license shall maintain all vehicles and tanks used to transport septage in accordance with the following:

(a) Each vehicle and tank shall be maintained so as not to create unreasonable malodors or public health hazards;

(b) Each tank shall be watertight;

(c) All piping, valves, and connections shall be accessible and capable of being cleaned;

(d) All inlet and outlet connections shall be constructed and maintained such that no material will leak, spill, or run out of the tank during transfer or transportation;

(e) Discharge outlets shall be designed to control the flow of discharge without spraying or flooding the receiving area;

(f) The tanker driver shall prior to transport on public roads ensure that septage will not leak, spill, or run out of the tank; and

(g) All vehicles used to transport the tanks shall be equipped, at all times, with spill control or absorbent materials and disinfectant materials such as lime.

4.4 Record Keeping

Each septage hauler license holder shall maintain the following information in the vehicle used to transport the septage whenever the vehicle is in transit to a site or treatment facility.

(i) The name, address, and phone number of the client(s) from where the septage was transported;

(ii) The volume of septage, in gallons, received from the client in (i) above and the treatment facility to which the septage is to be delivered;

(iii) Every septage hauler license holder shall maintain the following records of each load of septage transported:

   (a) The date received or picked up;
   (b) The name and address of the client(s);
   (c) The volume of the septage transported, in gallons;
   (d) The treatment facility to which the load was discharged; and
   (e) The date on which the load was discharged.

   (f) Records shall be retained for a minimum of seven years.
4.5 Accidental Release

In the event of an accidental release of septage, the license holder shall:

(i) Immediately take action to contain the septage, minimize the environmental impact, and begin clean-up procedures; and

(ii) Notify the Public Health Department and NEPA within 24 hours of the release with the following information:

(a) The date, time, and location of the spill;  
(b) The volume of septage spilled and the volume of septage recovered;  
(c) The final disposition of the septage that was not recovered;  
(d) The hauler's license and the name and telephone number of the driver involved in the incident;  
(e) The name and telephone number of the client(s); and  
(f) The actions taken to contain the spill, minimize the environmental impact and to clean up the area.

Septage shall be transported in ways that avoid public nuisance, particularly with respect to odour and spillages.

5.0 TREATMENT AND DISPOSAL OF SEPTAGE

The management, treatment and disposal of septage is dependent on its chemical and physical characteristics. Many different factors determine the physical properties of septage, including septic tank size, user habits, and pumping frequency.
The physical characteristics of septage make it difficult and objectionable to handle and treat. Septage has high levels of grease, grit and hair. Septage is anaerobic in nature and releases odorous gases. The material also contains parasites, viruses, and bacteria that can cause disease.

There are 3 main options for treatment and reuse of septage. These are:
- Land application;
- Treatment at Wastewater Treatment Plants (WWTP’s); and
- Treatment at independent septage treatment plants.

5.1 Permitting of Treatment and Disposal Facilities

Septage treatment facilities should apply through the NEPA for permit to establish a facility to treat and dispose of septage. The applicant must need the requirements as set out in the NRCA Permit and Licensing Regulations.

5.2 Classification of Biosolids

Biosolids are any product consisting totally or in part of organic matter that results from a wastewater treatment process (previously referred to as sewage sludge) or septic tank sludge.

The management and disposal of biosolids is dependent on its chemical and physical characteristics. The sources of the septage can be domestic, industrial or commercial and as a result the chemical properties of biosolids can vary significantly.

Biosolids are classified on the basis of chemical contaminants and pathogen indicators present in the material. It is possible to grade the biosolids and by so doing classify it use. The contamination grade is based on the concentration of the chemical contaminants. The pathogen grade is based on:
- Level of treatment to reduce pathogens
- Vector attraction
- Odour

Tables 4.1 and 4.2 provide contain contaminant acceptable concentration thresholds (C1, C2 and C3) and pathogen grades (P1, P2, P3 and P4).

Table 5.1 Biosolids Acceptance Concentration Thresholds

<table>
<thead>
<tr>
<th>Contaminant</th>
<th>Grade C1 mg/kg</th>
<th>Grade C2 mg/kg</th>
<th>Grade C3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arsenic</td>
<td>20</td>
<td>60</td>
<td>Untested or &gt;grade C2</td>
</tr>
<tr>
<td>Cadmium</td>
<td>3</td>
<td>20</td>
<td>Untested or &gt;grade C2</td>
</tr>
<tr>
<td>Chromium</td>
<td>100</td>
<td>500</td>
<td>Untested or &gt;grade C2</td>
</tr>
</tbody>
</table>

4 Source: Western Australian Guidelines for Biosolids Application, February 2002
### Guidelines for Septage and Biosolids Management in Jamaica

<table>
<thead>
<tr>
<th>Element</th>
<th>Value 1</th>
<th>Value 2</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copper</td>
<td>100</td>
<td>2500</td>
<td>Untested or &gt;grade C2</td>
</tr>
<tr>
<td>Lead</td>
<td>150</td>
<td>420</td>
<td>Untested or &gt;grade C2</td>
</tr>
<tr>
<td>Mercury</td>
<td>1</td>
<td>15</td>
<td>Untested or &gt;grade C2</td>
</tr>
<tr>
<td>Nickel</td>
<td>60</td>
<td>270</td>
<td>Untested or &gt;grade C2</td>
</tr>
<tr>
<td>Selenium</td>
<td>3</td>
<td>50</td>
<td>Untested or &gt;grade C2</td>
</tr>
<tr>
<td>Zinc</td>
<td>200</td>
<td>2500</td>
<td>Untested or &gt;grade C2</td>
</tr>
<tr>
<td>DDT/DDD/DDE</td>
<td>0.5 (total)</td>
<td>1 (total)</td>
<td>Untested or &gt;grade C2</td>
</tr>
<tr>
<td>Aldrin</td>
<td>0.02</td>
<td>0.5</td>
<td>Untested or &gt;grade C2</td>
</tr>
<tr>
<td>Dieldrin</td>
<td>0.02</td>
<td>0.5</td>
<td>Untested or &gt;grade C2</td>
</tr>
<tr>
<td>Chordane</td>
<td>0.02</td>
<td>0.5</td>
<td>Untested or &gt;grade C2</td>
</tr>
<tr>
<td>Heptachlor</td>
<td>0.02</td>
<td>0.5</td>
<td>Untested or &gt;grade C2</td>
</tr>
<tr>
<td>HCB</td>
<td>0.02</td>
<td>0.5</td>
<td>Untested or &gt;grade C2</td>
</tr>
<tr>
<td>Lindane</td>
<td>0.02</td>
<td>0.5</td>
<td>Untested or &gt;grade C2</td>
</tr>
<tr>
<td>PHC</td>
<td>0.02</td>
<td>0.5</td>
<td>Untested or &gt;grade C2</td>
</tr>
<tr>
<td>PCBs</td>
<td>0.3</td>
<td>0.5</td>
<td>Untested or &gt;grade C2</td>
</tr>
</tbody>
</table>

*All values mg/kg are dry weight*

### Table 5.2 Pathogen Grading Requirements

<table>
<thead>
<tr>
<th>Pathogen Grade</th>
<th>Maximum Pathogen Level</th>
<th>Treatment Method That Typically Achieve the Requisite Pathogen Level*</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>Salmonella &lt; 1 count per 50g of dry product AND Thermo-tolerant coliforms&lt; 100 counts per gram of dry product</td>
<td>Digested and composted in vessel at &gt; 55°C for a 3 day period Composted windrow and turned 5 times and maintained &gt; 55°C for a 15 day period</td>
</tr>
<tr>
<td>P2</td>
<td>Salmonella &lt; 10 count per 50g of dry product AND Thermo-tolerant coliforms&lt; 1000 counts per gram of dry product</td>
<td>Composted &gt; 53°C for a 5 day period Composted &gt; 55°C for a 3 day period Aerobic thermophilic digestion (55-60°C for a 10 day period) with volatile solids reduction &gt;38%</td>
</tr>
<tr>
<td>P3</td>
<td>Thermo-tolerant coliforms&lt; 2,000,000 counts per gram of dry product</td>
<td>Anaerobic digestion at 35°C for 20 days with volatile solids reduction &gt;38% Aerobic digestion at 20°C for 40 days with volatile solids reduction &gt;38%</td>
</tr>
</tbody>
</table>

*Source: Western Australian Guidelines for Biosolids Application, February 2002*
Aerobic composting at >40°C for 5 days

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>P4 Thermo-tolerant coliforms &gt; 2,000,000 counts per gram of dry product</td>
<td>Untreated or inadequately treated</td>
</tr>
</tbody>
</table>

* The list of treatments described not exhaustive

5.3 Reporting on Biosolids

Facilities which generate biosolids must report on the quantities of solids as specified by the NEPA Regulation.

(i) Persons who produce sewage sludge and/or intend to dispose of biosolids/sewage sludge must provide the information specified in NEPA Regulation.

(ii) Monitoring, sampling and analysis of biosolids is a requirement.

(iii) Any operator who produces sewage sludge must monitor, sample and analyse the sludge produced, keep records on the operation and performance of the treatment process and final product quality before it leaves the plant.

(iv) Testing of sewage sludge according to (parameters to be decided after discussion and inputs from interested parties).

(v) Every producer of biosolids that it is tested for the purpose of use in agriculture is tested according to (parameters to be decided after discussion and inputs from interested parties) not less than every six months or when any changes in the characteristics of the treated sludge occur as a result of changes in the treatment process or in the sewage being treated.

5.4 Storage of Biosolids

Biosolids are by products of septage treatment and sewage treatment facilities (sludge). Many of the potential environmental and health risks associated with biosolids are related to storage prior to final disposal whether in landfills or by land application. The risks include the potential for:

- Fly infestation
- Ground and surface water contamination
- Leaching of contaminants during heavy rainfall events and floods
- Public and occupational health risks from uncontrolled access.

The generator, suppliers and users of biosolids are to take the abovementioned risks into consideration when selecting and/or constructing a site for biosolids storage, and management of that site whilst product is stored there.

Factors that may influence the risk associated with biosolids storage include:

- the quantity to be stored;
- the biosolids quality;
• the proposed length of time to be stored; and
• the site vulnerability (e.g. nature of groundwater and surface water, slope of land, soil type, site vegetation).

A number of management controls may be employed to minimise the risks associated with biosolids storage. Ideally, each of the management controls below would be employed for all storage sites. However, in practice where potential risks are low, some of these measures may not be necessary. Judgment needs to be employed to ascertain the appropriate controls for storage at each site.

(i) Minimisation of storage time - ideally, biosolids will be spread upon arrival at the agricultural property. If for whatever reason this is not possible, the period of time that biosolids are stored on site prior to spreading should be minimised. If storage time is to be longer than 30 days, then the following controls will almost certainly be required.

(ii) Fencing and Signage
Biosolids should not be stored in locations where the public has ready access. The property owner must ensure that fencing is adequate around the premises to minimise the potential for unauthorised public access. In addition, the entry to the storage area must have appropriate weatherproof signage. As a minimum requirement, the sign must state that biosolids are being stored and used on site that contact with biosolids may be hazardous to human health, and that unauthorized access is not permitted.

(iii) Drainage
Biosolids stockpiles should be managed so that storm water is diverted away from the stockpile to minimise the potential for contaminant leaching. Ideally, the stockpile should be situated on flat, raised land. Construction of drainage channels should be installed where appropriate.

(iv) Lining
In general the use of lining should not be required as biosolids applications are not allowed in sensitive groundwater areas. However, it may be appropriate in situations where there is a risk of contaminating local groundwater.

(v) Covering
Covering of stockpiles is appropriate in fly breeding season to minimise the risk of fly infestation within the stockpile.

(vi) Monitoring
Stockpiles should be visually inspected on a regular basis to ensure the integrity of the stockpile itself, and/or the integrity of bunds and drainage channels.
6.0 LAND APPLICATION OF BIOSOLIDS

The benefits of biosolids reuse include soil improvement. In particular, biosolids can be used to build up organic matter in the sandy soils of the coastal plain, and in inland areas where top soils have been eroded. The organic matter helps stabilise soils, improve water retention and reduce soil erosion.
It can also be utilised as a complete or partial fertiliser substitute as biosolids contain nutrients found in conventional fertilisers, including nitrogen, phosphorus and trace elements, alleviating the need to dispose of biosolids at landfill sites.

However, the poor management of biosolids could lead to harm to public health and to the environment. Infection by microorganisms is a major risk from human contact with partly treated products derived from wastewater depending on the treatment process and source of the material.

Land application of biosolids is one of the methods of reuse of a potentially valuable resource but it must be effectively managed to eliminate the risk to human health and the environment.

6.1 Criteria for Land Application

A number of factors need to be considered when selecting appropriate sites for biosolids applications, as summarised below.

6.1.3 Soil Quality

An assessment of the soil quality prior to a restricted use biosolids application is required to ensure any biosolids application will not exceed acceptable contaminant levels in the soil. The total contaminants from the combined soil and applied biosolids may not exceed the maximum allowable soil contaminant concentrations listed in Table 5.1.

Table 6.1 Maximum Allowable Soil Contaminant Concentrations following Biosolids Application

<table>
<thead>
<tr>
<th>Contaminant</th>
<th>Maximum Allowable Soil Contaminant Concentration (mg/kg)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arsenic</td>
<td>20</td>
</tr>
<tr>
<td>Cadmium</td>
<td>1</td>
</tr>
<tr>
<td>Chromium</td>
<td>Total 100</td>
</tr>
<tr>
<td>Copper</td>
<td>100</td>
</tr>
<tr>
<td>Lead</td>
<td>150</td>
</tr>
<tr>
<td>Mercury</td>
<td>1</td>
</tr>
<tr>
<td>Nickel</td>
<td>60</td>
</tr>
<tr>
<td>Selenium</td>
<td>5</td>
</tr>
<tr>
<td>Zinc</td>
<td>200</td>
</tr>
<tr>
<td>DDT/DDD/DDDE</td>
<td>0.5</td>
</tr>
<tr>
<td>Aldrin</td>
<td>0.02</td>
</tr>
<tr>
<td>Dieldrin</td>
<td>0.02</td>
</tr>
<tr>
<td>Chordane</td>
<td>0.02</td>
</tr>
<tr>
<td>Heptachlor</td>
<td>0.02</td>
</tr>
<tr>
<td>HCB</td>
<td>0.02</td>
</tr>
</tbody>
</table>

6 Source: Western Australian Guidelines for Biosolids Application, February 2002
### Table 6.2 Soil Vulnerability Categories and Maximum Nutrient Loadings

<table>
<thead>
<tr>
<th>Vulnerability Category</th>
<th>Soil Description</th>
<th>Maximum P Loading (kg/ha/yr)</th>
<th>Maximum N Loading (kg/ha/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Coarse sandy soils/gravels draining to surface waters with moderate/high eutrophication risk</td>
<td>10</td>
<td>140</td>
</tr>
<tr>
<td>B</td>
<td>Coarse sandy soils/gravels draining to waters with low eutrophication risk</td>
<td>20</td>
<td>180</td>
</tr>
<tr>
<td>C</td>
<td>Loams/clay soils (Phosphorus Retention Index &gt; 10) draining to waters with moderate/high eutrophication risk</td>
<td>50</td>
<td>300</td>
</tr>
<tr>
<td>D</td>
<td>Loams/clay soils (Phosphorus Retention Index &gt; 10) draining to waters with low eutrophication risk</td>
<td>120</td>
<td>480</td>
</tr>
</tbody>
</table>

**Note:** Local data needed here. Should be regarded as interim numbers.

### 6.1.3 Soil pH

Biosolids should not be applied to sites with a soil pH less than 5.0 to minimise leaching of metals. Liming of soils may be used to provide buffer alkalinity in acidic soils.

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* Maximum Allowable Soil Contaminant Concentrations are measured in mg/kg dry weight of soil and are mean concentration values.

The existing soil should be sampled and the soil contaminant concentrations should be determined from the analysis of these soils. The results of the soil analysis are then used in the calculation of biosolids application rates. To calculate the available capacity of the existing soil to assimilate contaminants and also the Contaminant Limiting Biosolids Application Rate (CLBAR), see Section 12 on Beneficial Land Application and Appendix 4.

### 6.1.2 Soil Type

Four site vulnerability categories have been selected based on soil characteristics and nutrient risk to waters. Restrictions apply to highly permeable, very slowly permeable and water logged soils. These categories (Table 5.2) describe the ability of the site to assimilate nutrients. The category found in the table are not exhaustive but can be used as a guide.

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7 Source: Western Australian Guidelines for Biosolids Application, February 2002
6.1.4 Sensitive Land Areas and Water Resources

There are a number of sensitive areas, those in proximity to aquifers which are sources of public drinking water, water reserve and catchments, some protected areas where biosolids application would be inappropriate.

In addition, areas subject to water logging or areas prone to nuisance insects (e.g. stable fly), endemic diseases (e.g. hookworm), and other issues of public health concern may be subject to certain restrictions and additional conditions.

In all of these cases restriction need to be determined on a case by case basis.

6.1.5 Depth to Groundwater

Leaching of nitrogen and phosphorus is a major concern relating to water resource contamination. The potential risk of contamination to groundwater depends on a number of factors, including the geology of the soil and the distance to the water table.

To protect water quality, the Water Resources Authority (WRA) has adopted the following criteria (Table 5.3). They are based on the soil type, permeability and porosity.

**Table 6.3 Depth to Water Table Restrictions (WRA to be asked to provide some numbers)**

<table>
<thead>
<tr>
<th>Strata</th>
<th>Depth of Ground water</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Unacceptable</td>
</tr>
<tr>
<td>Clay</td>
<td></td>
</tr>
<tr>
<td>Sand</td>
<td></td>
</tr>
<tr>
<td>Karstic Limestone</td>
<td></td>
</tr>
<tr>
<td>Gravel and Hard Rock</td>
<td></td>
</tr>
<tr>
<td>Loam</td>
<td></td>
</tr>
</tbody>
</table>

6.1.6 Slope of Land

Run-off and seepage of nutrients can be a problem when applying biosolids to land. The greater the slope the greater the potential for run off and soil erosion. Slope recommendations are provided in Table 5.4.

**Table 6.4 Recommended Slope Limitations for Direct Land Application of Biosolids**

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8 Source: Western Australian Guidelines for Biosolids Application, February 2002
### Slope (%)

<table>
<thead>
<tr>
<th>Slope (%)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-3</td>
<td>Ideal: No concern for runoff or erosion</td>
</tr>
<tr>
<td>3-6</td>
<td>Acceptable: Slight risk of erosion</td>
</tr>
<tr>
<td>6-12</td>
<td>Acceptable if soil conservation practices are used to minimise erosion levels (e.g. contour banking)</td>
</tr>
<tr>
<td>12-15</td>
<td>No application of biosolids unless the site is maintained in grass vegetation with at least 80% ground cover</td>
</tr>
<tr>
<td>&gt;15</td>
<td>Unacceptable</td>
</tr>
</tbody>
</table>

#### 6.1.7 Re-Application

Biosolids may contain traces of heavy metals and pesticide residues. The contaminant grading criteria for direct land applications ensures that the amounts of these contaminants is limited to an acceptable level, however repeated applications could result in their accumulation, and for the soil to eventually become contaminated. For this reason, it is important to test the soil to determine the level of contaminants existing in the soil prior to either initial or repeat applications, and reduce the application rate if required.

#### 6.2 Application for Land Application

Disposal of biosolids by land application shall only be applied to land with a low potential for public exposure. This is land that the public uses infrequently which includes but is not limited to, agricultural lands, forests, and reclamation sites.

Applications for the land application of biosolids should be submitted to the Public Health Department within the parish. The following information should be supplied in the application.

(i) A map of the property, with topography, showing the drainage characteristics of property including locations of rivers other water courses; water supplies including individual and community wells within 500 feet of disposal area;

(ii) Soil types and their distribution in disposal area;

(iii) Percolation test results (optional as required by WRA);

(iv) Ground water levels; and

(v) An estimate of the maximum septage application in gallons per day

### 6.3 Locations of Land Disposal Sites
Written approval must be obtained from the Health Department for land disposal of biosolids at any given site.

Sandy soils overlaying an unconfined aquifer, which is used or may be used as a principal source of potable water shall not be utilised as land disposal sites for septage. An exception may be made when special studies by a soil hydrologist indicate acceptable separation distance between the point of septage application and the seasonal high water table can be achieved to prevent groundwater contamination.

Section 5.1 has other guidance re site selection criteria.

**6.4 Pathogen Control Management**
The following management practices must be complied with to control pathogens.

(i) Biosolids shall not be applied to any portion of a site that is within (to be discussed ..) feet of any river, or any permanent or intermittent water body.

(ii) Food crops with harvested parts that touch the land surface shall not be harvested for (to be discussed ..) months after septage application.

(iii) Food crops with harvested parts that develop above the land surface, feed crops, or fiber crops, shall not be harvested for (to be discussed ..) days after application of septage.

(iv) Food crops with harvested parts below the land surface shall not be harvested for (to be discussed ..) after application of biosolids and or septage.

(v) Animals shall not be allowed to graze on the land for 30 days after application of biosolids and or septage.

**6.5 Application Rate**
The annual application rate for biosolids applied to a land application site shall not exceed (to be decided) gallons per acre per year. The biosolids must be spread or injected as evenly as possible over the entire acreage where the crop or vegetation is grown.

**6.6 Record Keeping**
Persons involved in land application of biosolids shall maintain the following information seven years (to be decided) and that information shall be available for inspection by the Public Health Department, WRA or NEPA.

(i) The location of each site on which biosolids is applied;

(ii) The number of acres of each site on which biosolids is applied;
(iii) The crop or vegetation grown on each site; and

(iv) The rate in gallons per acre per year at which biosolids is applied to each site.

### 6.7 Biosolids Holding Facilities

It is necessary that all biosolids land disposal systems have an alternative method for the temporary holding of biosolids during periods of adverse weather. The holding tanks shall meet the following requirements.

(i) No overflow or leakage of biosolids may be allowed from the system onto the ground surface, into surface waters or the groundwater table;

(ii) Odors from such systems are to be controlled at all times; and

(iii) Biosolids is to be removed from the holding facility to the land disposal system as soon as weather and soil conditions permit.

### 6.8 Surface (Land) Application

Surface application is a frequently used biosolids, disposal method, but as with any surface application technique, some nitrogen (N) loss occurs through ammonia volatilization. Consideration should be given to intermediate holding facilities before application to the land. Storage is necessary just prior to or during periods of precipitation in order to prevent run off of contaminated water.

### 6.9 Subsurface Application

Subsurface applications techniques include plow furrow cover (PFC) and subsurface injection (SSI). Soil incorporation techniques offer better odor and vector control than surface spreading techniques. Additionally, the likelihood of inadvertent pathogen contamination to humans is greatly reduced. Disadvantages, include full incorporation of all nitrogen, since ammonia volatilization is eliminated, which reduces any nitrogen loading safety factor from ammonia loss in surface spreading.

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### 7.0 VECTOR CONTROL

A “vector” is an animal that could potentially play a role in transmitting pathogens from
Septage or biosolids to humans. Vectors could include flies, mosquitoes, fleas, rodents, birds or domestic animals.

Vector attraction reduction is necessary for any use of biosolids. It can be achieved through:

- reducing the moisture content of the biosolids;
- reducing the organic content of biosolids by either aerobic or anaerobic digestion;
- adding alkalis (e.g. lime)
- composting; or
- Incorporation or injection of biosolids into the soil.

Vectors can also be controlled by reducing the potential for physical contact (e.g. minimising the storage time, covering and bunding biosolids stockpiles). Methods proposed for this type of control need to be assessed on a case-by-case basis and are dependent on which vectors being controlled, seasonal conditions and the type of cover materials being used.

7.1 Vector Reduction Management

The following management practices must be met where applicable for compliance with vector reduction requirements.

(i) Septage shall be injected below the surface of the land and no significant amount of septage shall be present on the land surface within one hour after the septage is injected. Injection may be accomplished by any device(s) that places the septage beneath the soil surface in a narrow trench at a depth of no greater than 18 inches and promptly replaces the cover soil in the same action of trenching and placing septage.

(ii) Septage applied to the surface of the land shall be incorporated into the soil within six hours after septage application or the pH of domestic septage shall be raised to 12 or higher by alkali addition and, without the addition of more alkali, shall remain at 12 or higher for 30 minutes.

(iii) Septage is to be applied in a manner, which will prevent any ponding or standing of liquid on the land surface twenty-four (24) hours after application.

8.0 OCCUPATIONAL HEALTH AND SAFETY
Septage and biosolids are sourced from human waste, and therefore may contain harmful pathogens. For this reasons it is essential that the following minimum health and safety precautions are followed when handling or storing septage and or biosolids.

- The length of time that biosolids are stockpiled on a property should be minimised;
- Publicly accessible biosolids stockpiles should be fenced and signposted;
- Children should not be allowed access to biosolids, either during storage or application;
- Persons handling biosolids should wash their hands and scrub their nails with soap before eating, drinking, smoking, and at the end of the working day;
- Cuts and skin abrasions should be covered with waterproof dressings;
- Food and drink should not be consumed, and smoking should not occur, when handling biosolids;
- Suitable clothing covering hair, body, arms and legs, and boots, should be worn;
- Clothing and boots should be thoroughly washed prior to being worn again;
- Readily accessible showering facilities should be available to all persons handling biosolids;
- Eye protection and dust masks should be worn when applying biosolids to protect against airborne dust. For the same reason, persons applying biosolids should remain upwind of the application process; and
- All persons required to handle biosolids should be made aware of these basic health and safety requirements.
9.0 RESPONSIBILITIES

It is the responsibility of regulatory agencies to ensure that:

- the benefits of direct land applications of biosolids outweigh the potential adverse health or environmental effects; and

- compliance with relevant legislation is maintained.

It is the responsibility of the supplier to:

- conduct sampling of its biosolids product;

- ensure that biosolids are provided for purposes in keeping with the recommendations of this guideline;

- screen potential clients to ensure that they are in areas where direct land application of biosolids is suitable; and

- make potential clients aware of their responsibilities, and to provide them with sufficient knowledge to conduct the application in such a way that risks to public health and the environment are minimised.

It is the responsibility of the end-user to:

- obtain approval from the relevant regulatory agency to apply biosolids;

- store, apply and monitor the biosolids application in accordance with conditions set by any regulatory agency and with the recommendations of this guideline;

- provide appropriate signage; and

- notify adjacent land-holders of storage and application of biosolids on-site.