DOMESTIC WASTEWATER MANAGEMENT SERIES

LAND CAPABILITY ASSESSMENT FOR ONSITE DOMESTIC WASTEWATER MANAGEMENT

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1. INTRODUCTION

Residential developments generate wastewater that, if not properly managed, can harm public health, the environment and local amenity.

Centralised sewerage systems are the best way of dealing with wastewater in cities and towns.

It may be impractical, however, to provide centralised systems for small widely dispersed developments, such as rural residential developments.

2. OBJECTIVE AND SCOPE

For all proposed unsewered residential developments, a comprehensive land assessment should be undertaken prior to residential development proceeding. The overall objective of the land assessment process described in this bulletin is two-fold:

1. To assess the capability of the site to sustainably manage wastewater within allotment boundaries; and
2. To identify a management program that should be put in place to minimise the health and environmental impacts of on-site wastewater management.

This land capability assessment (LCA) procedure should be used to ensure that unsewered residential development only proceeds on land that has an acceptable capability for sustainable on-site wastewater management.

It is important that LCA for on-site domestic wastewater management be carried out as early as possible in the planning phase - the LCA procedure should be applied at the rezoning or subdivision stages of the planning process. However, (with appropriate changes to scale and data collection requirements), it could also be used to assess the capability of individual lots.

This bulletin forms part of the onsite wastewater management package that includes EPA Publication 891, *Septic Tanks Code of Practice* and the Certificates of Approval for EPA approved septic tank systems.

The bulletin should be read in conjunction with the Code of Practice.

This bulletin will assist local government staff, land capability assessors, developers and landowners by outlining a land assessment process. This process should be carried out prior to planning decisions being made about whether residential developments relying on on-site wastewater management systems should proceed.

The bulletin outlines an LCA procedure. However, it does not replace the complete set of technical information that will be needed to finalise an individual LCA; this information should be determined on a case-by-case basis.

EPA strongly encourages best practice environmental management (BPEM). Thus, innovative wastewater treatment and reuse approaches are acceptable if they can meet the environmental objectives set out in this bulletin.

3. OVERALL LAND ASSESSMENT PROCEDURE

An LCA for on-site management of domestic wastewater will allow:

- the identification of land areas that are most and least capable for on-site wastewater programs; and
- the development of a management regime corresponding to the site's capability, which will minimise the impact of on-site wastewater management and ensure its sustainability in the long term.

Figures 1 and 2 indicate how LCA should fit into the overall land development process.

Assessing land capability for on-site wastewater management can follow a four-stage process:

Stage 1. Develop appropriate LCA criteria;

Stage 2. Gather and collate land inventory information;

Stage 3. Assess land capability; and

Stage 4. Develop a management program.

Figure 3 provides a schematic view of the LCA process. It needs to be stressed that LCA does not indicate the social impact of a particular development, nor does it indicate whether a proposal will be suitable or economically feasible. The system is based upon environmental features alone.

3.1 Development of assessment criteria

The first stage in the LCA is the development of assessment criteria, typically including the following steps:

Identifying the site's key land features

The assessor should first identify the key land, water and climatic features of the site that may impose a constraint or limitation on a specific land use (in this case, residential development using on-site wastewater management). Generally, the features will be fixed over the project's life.

The council or land assessor may include any number of site features incorporating the soil, topographic and climatic aspects that are included within the land inventory to assist in the final appraisal of the site.

For practical purposes, the features selected need to be those which are easily identified and evaluated by a competent assessor. Features should not be excluded solely because they may take time or skill in identification. Proposed criteria should be discussed with the council to ensure that all relevant features are included.

Developing the Land Capability ratings

Having identified the features relevant to the particular development, council or the assessor should then develop a rating system for these features, which indicates progressively higher levels of constraint.

Each landform feature can be allocated a rating class between 1 and 5. The higher the rating, the higher the potential risk and the higher the management inputs needed to ensure that environmental degradation is minimised.

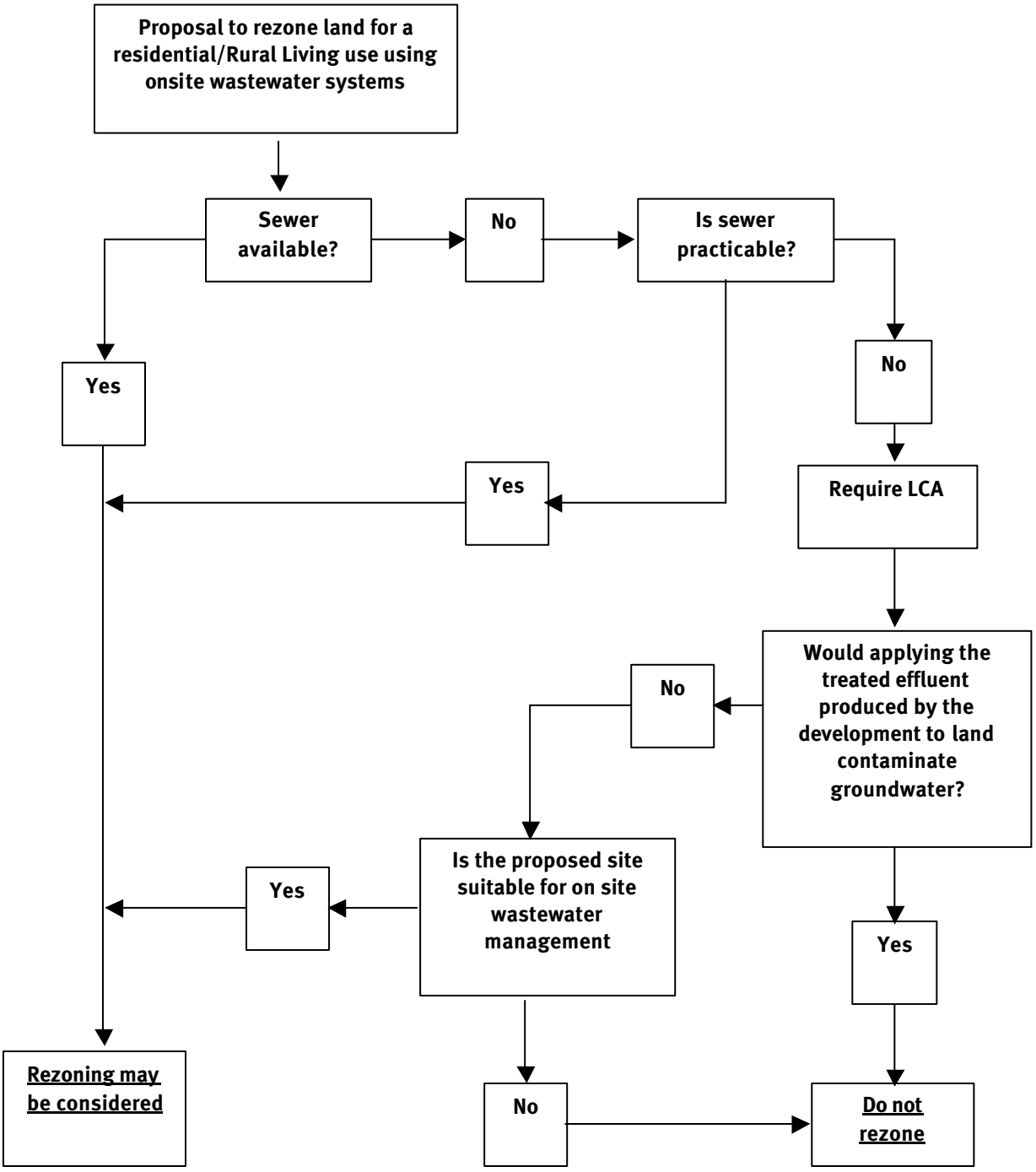

Figure 1:Rezoning to Allow an Unsewered Development: Role of LCA

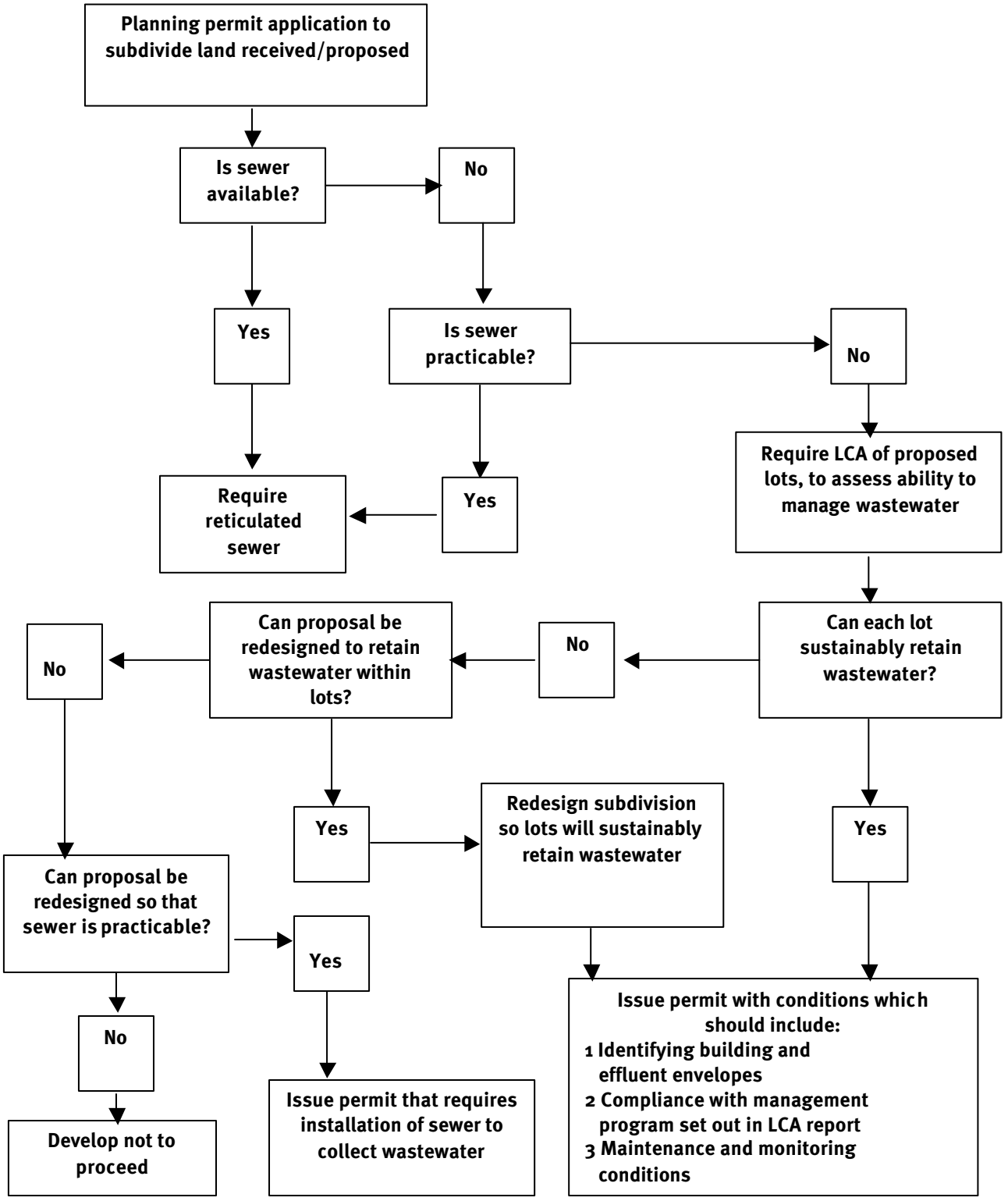

Figure 2: Applying for Planning Approval for an Unsewered Development – Role of LCA

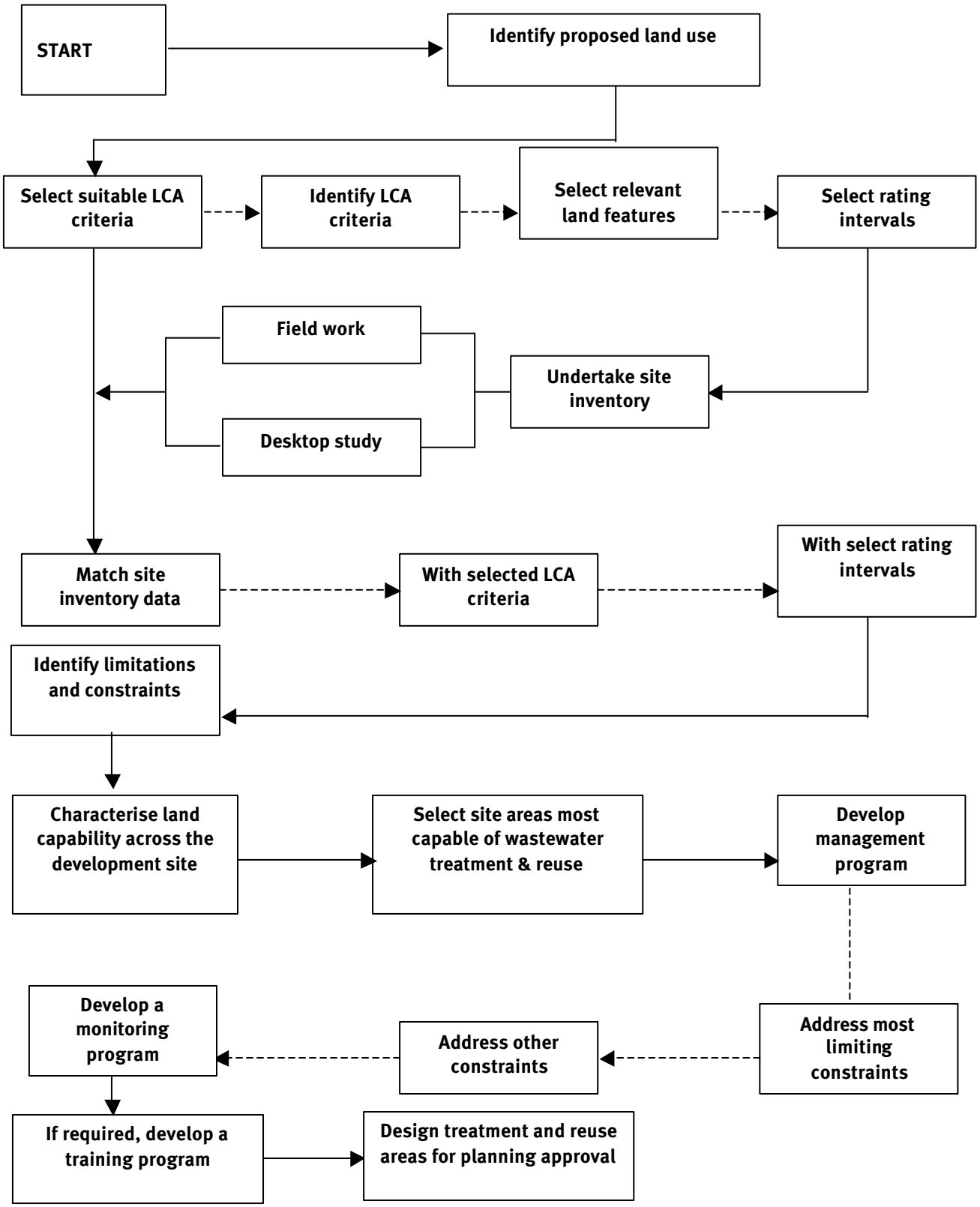

Figure 3: Land Capability Assessment Process

The Land Capability Assessment may be presented in the form of a two-way matrix table (below) with selected land (and environmental) features categorized into ratings.

The LCA table is essentially a systematic approach to land capability assessment. However it should not be seen as a "tick the box" catch-all method for developing a wastewater program.

The rating class ranges may vary, depending on the land management capacity of developers and property owners.

The allocation of ratings for each land feature can be made by the assessor or can rely on ratings previously accepted by the relevant council. However, the management inputs required as capability decreases are not linear. A rating outcome of "4" will require very considerable management input. The management input needed to redress the degree of constraint highlighted by a rating of 5 is not expected to be feasible.

An example of a LCA table is attached. Although this rating table may be used as a guide, it will not necessarily be applicable or relevant to any specific site.

Table 1: Land Capability Assessment Matrix

Land Feature Listing	Rating Category (Class)				
	1 (very good)	2 (good)	3 (Fair)	4 (poor)	5 (very poor)
A	Feature range	→			
B		Increasing	→		
C			Environmental	→	
D				Risk	→
Environmental Risk	Very Low	Low	Moderate	High	Very High

Land Capability Assessment For Domestic Wastewater Disposal And Reuse

The following is presented as an example of a LCA table. It may be used as a guide to assist with the capability rating of a land area that is to be used for domestic wastewater treatment and reuse. The LCA table summarises the LCA approach. It should not be seen as a 'tick the box' catch-all method for developing a wastewater program.

The list of land features should not be seen as obligatory or exhaustive - the extent of information required will vary from one site to another. The council may on balance be willing to accept professional judgement to offset the need and extent of on-site and laboratory assessment.

Example: LCA Assessment Table for Wastewater Management on Rural Residential Subdivisions.

Land features		Land Capability Class Rating				
		Very good (1)	Good (2)	Fair (3)	Poor (4)	Very poor (5)
General Characteristics						
Site drainage/runoff		Very slow	Slow	Moderate	Rapid	Very Rapid
Flood/inundation potential (yearly return exceedance)		Never		‹1 in 100	‹1 in 20	›1 in 20
Slope (%)		0 – 2	2 – 8	8 – 12	12 – 20	›20
Landslip				-	-	Present or past failure
Seasonal watertable depth (m) (incl perched watertables)		›5	5-2.5	2.5-2.0	2.0-1.5	‹1.5
Rainfall (mm/yr)		‹450	450-650	650-750	750-1000	›1000
Pan Evaporation (mm/yr)		›1500	1250-1500	1000-1250	-	‹1000
Soil profile characteristics	Structure*	High	Moderate	Weak	Massive	Single Grained
	Profile depth	›2m	1.5m-2m	-	1.5m-1.0m	‹1m
	Sodicity* ESP%	‹3	-	6 – 8	8 – 14	›14
	Percolation* (mm/hr)	50-75	20-50 75-150	15-20 150-300	- 300-500	‹15 ›500
	Stoniness (%)*	‹10		10-20	-	›20
	Emerson test* (dispersion/slaking)	4,6,8	5	7	2,3	1
	Salinity* (dS/m)	‹0.3	0.3-0.8	0.8-2	2-4	›4

* relevant to soil layer(s) associated with trench location.

Note: This table is an example only and does not include all relevant features that may relate to a specific site. Its use without site-specific information may result in rejection by the responsible authority.

3.2 On-site Assessment

Land Inventory

Having prepared the LCA table, the assessor needs to prepare an inventory of the information needed to allocate ratings for each of the features listed in the table. The preparation of this inventory will involve a number of steps including:

- desk top review;
- site visit;
- material collation; and
- information appraisal.

When preparing the inventory, the assessor will need to determine the level of detail, accuracy and the amount of data that should be collected. It is particularly important to consider the range and spread of results across the area rather than relying solely on a mean result. This is very relevant when assessing soil permeability information.

Inventory data should be presented without excessive detail but in a clear and concise manner to enable local government staff and other users of the LCA to readily understand the environmental restraints applying to the site. This does not mean sacrificing technical detail, in fact sound decision making will be aided by clear data presentation. The inventory should be scientifically based but needs also to be practically and realistically balanced.

Data presentation will be simplified by showing essential soil features and landform information on an appropriately scaled map. The experience and knowledge of the assessor is important in determining an appropriate scale that will result in a meaningful land capability assessment.

As the scale broadens, less information will be needed and the more generalised will be the outcome. Proposals for land to be rezoned or subdivided into a number of lots are often reviewed at the broad scale of 1:2500. Appraisal of a single lot may need to be at the more detailed scale of 1:100 to 1:500.

The final value of any assessment will depend on the quality of the data gathered. Inadequate, insufficient or inaccurate data, no matter how well-presented, cannot offer security of outcome to responsible planning authorities. A further benefit of an inventory is that it may provide information that would be helpful in considering issues other than on-site wastewater management. These could include issues associated with erodability and movement of sediment off-site.

The following table indicates the range of information that may be necessary for assessment of a domestic wastewater proposal.

Table 2: Examples of Information that can be Included in a Land Assessment

INVENTORY PARAMETER	INFORMATION
Topography	Slope, Rock outcrop, Landslip potential, flood return period, erosion, drainage lines
Soil Features	Profile depth, structure, permeability, dispersion character, soil salinity
Groundwater	Depth, Quality, seasonal fluctuation
Surface Waters	Proximity, category, use
Climate	Rainfall, evaporation, wind, temperature
Features	Location of existing and adjacent buildings, dams, roads, infrastructure.
Infrastructure availability	Water, sewer, power
Council requirements	Zoning, overlays, title details
Regulatory requirements	Water Authorities, CMA's, DSE, DOI, EPA

Reporting of soil profile characteristics is aimed to indicate the functionality of the soil for various management practices. However it should be remembered that although the identification and categorisation of soil features follows accepted classification criteria many characteristics are somewhat subjective and rely on experience and professional judgement.

In some instances the council may not require all aspects of a full land inventory to be obtained or reported. However it is recommended that assessors and council clarify the extent of data capture and subsequent reporting expected, prior to site features being investigated. The information required will need to be gathered at the agreed scale.

Land assessments can be 'open ended' and can involve considerable volumes of information and data. Councils need to be clear as to the extent and type of information they need which will allow them to assess a proposal properly.

The information needed for on-site domestic wastewater management will depend upon a number of factors and as such the extent of information sought and reported may vary with the type of development proposed. The more extensive the proposal and the more concentrated the development, the higher the potential risk of environmental degradation. As such there will be a need for more on-site information. For instance the environmental impact from a single un-sewered dwelling on a 100 hectare land parcel would generally be much less than that needed for a similar sized dwelling on a single hectare lot - that is 1 dwelling/km^2 compared to 100 dwellings/km^2.

The information made available to council needs to address all aspects that may have a reasonable bearing on the treatment and subsequent land

application of wastewater. The information needs to be rigorous and not gained from a cursory overview. However there is always a balance to be made so as to gather sufficient information that will allow for decisions to be appropriately made by Council – information should not be withheld if the adviser's professional judgement is that it could affect ongoing wastewater management practices.

Issues that may be considered in assessing the land capability and overall suitability of particular wastewater proposals are shown in the following tables.

Table 3: Issues that may be considered in LCAs

DESIRABLE CHARACTERISTICS	COMMENTS
1. Groundwater Protection Deep Non-contiguous with disposal areas	• Seasonal water tables should never rise to within 2m of the surface. • Seasonal water tables at greater depths may still have a potential to be contaminated depending upon soil and geological features.
2. Surface Waters Protection Well set back from water bodies Well setback from specific features Down slope from features	• Setbacks relating to disposal envelope areas should not be less than buffer distances unless approved by the responsible Authority. • In some instances a higher standard of treatment may allow for a reduced setback. • Surface waters may be affected by surface, subsurface and subsoil water flow.
3. Property Conformation & Service availability Large lots No reticulated potable water supply Low density development	• Disposal envelope potential should not be seen as directly relating to a specific Lot size. • Areas of 1 ha may prove difficult for appropriate location of disposal envelopes. • Incremental effects can have a serious impact on long-term non-sewered sustainability. • Reticulated household water supply should go hand in hand with reticulated sewerage services.
4. Climate Low rainfall High evaporation Good breeze Warm temperatures Low frosts	• Reliance on simple yearly averages may mask wide seasonal and monthly variations, which can limit land disposal methods. • Meteorological data is particularly limited and care needs to be taken when using information particularly in certain topographic situations. • Wastewater programs should not be based on the assumption that vegetation will immediately enhance evapo-transpiration.

DESIRABLE CHARACTERISTICS	COMMENTS
5. Topography Low slope Rough surface Very slow runoff No rock outcrop No erosion risk No land slip risk Non flood/inundation prone	• Wastewater should be restricted from moving off-site allowing the maximum period of time for soil amelioration and evapo-transpiration. • Sites should be selected so as to limit the movement of wastewater from disposal envelopes from both overland and within soil flow. • Disposal envelopes should be stable naturally and following the proposed hydraulic loadings. • Detailed assessment should be expected if the disposal envelope could be inundated or flooded at any time.
6. Buffer distances Maximising the distance from: - Water bodies - Neighbouring land - Buildings - Groundwater	• Various buffer distances should be set and maintained for separation between effluent disposal envelopes, and sensitive features. • Impact on distances will be affected by soil type, climate considerations and slope.
7. Soil Features Deep profiles Good structure Good porosity Low dispersion/low slaking Good permeability Non fill material Very low Salinity	• Indicates aspects of profile character that can greatly assist with the uptake of treated wastewater and enhance opportunities for the amelioration of residual biological material and the reuse of nutrients. • Where possible soil assessment should indicate constraining and limiting wastewater management factors and indicate remedial measures.

Table 4: Regulatory Issues to Consider when Preparing a Management Program During the LCA Process

Council Requirements Council Zoning provisions Specific Council Overlays Cadastral features Property situation Land Capability Assessment Site Plans	• Council zoning should reflect the Land Capability at an appropriate scale. • Further detailed site specific LCA should follow accepted criteria. • Details to Council should clearly address measures within general Overlays and should also highlight impacts on neighbouring lands. • Applications need to show disposal envelope areas at a scale that allows for on-ground identification.
Requirements of other Agencies Water Authorities (rural and/or urban) Catchment Management Authorities Department of Sustainability and Environment Department of Infrastructure EPA	• These Agencies may have specific interests to protect land areas in certain situations and these interests should be addressed. • Agencies should be made aware of development activities that may impact on their responsibility.

3.3 Land capability assessment

To complete the LCA, the assessor will assign a rating to each land feature. The features with the poorest rating are those that are the most constraining. As the land capability rating increases so does the associated risk and, with it, the degree of difficulty for satisfying environmental protection.

All land features associated with the particular land use are assessed together. The final overall LCA is that rating which relates to the most constraining feature(s). Part of a full appraisal may in some instances also include a water budget and/or a nutrient budget to ascertain wastewater application areas and to assist with site and vegetation selection. However, the appropriateness and the interpretation of results should be based upon professional judgement.

3.4 Management program

Although the LCA indicates the inherent capability of a site for on-site wastewater management, it should be comple mented by a management program showing how the land constraints (and the associated risks) identified in the LCA can be addressed. The LCA and the management program should be considered together when determining whether a proposed development is sustainable.

Thus, proponents should submit both the LCA and the corresponding management program to council, to support applications for proposed developments.

It will be for local government to overlay other considerations to finally ascertain the appropriateness, or otherwise, of the proposal being considered for a particular area. Councils should consider the practicability of the proposed management program for a range of landowners over time. It also needs to be appreciated that, as higher risk situations are identified, councils will also need to increase their involvement to ensure the management program is implemented.

Some generalised Land Capability class definitions are highlighted below. These definitions indicate the minimal management considerations that could be put in place for on-site domestic wastewater management.

Rating 1

The effluent envelope is suitable for on-site disposal of septic tank discharge. The limitations or environmental hazard from long-term use are considered very slight. Standard performance measures for design, installation and management should prove satisfactory.

Rating 2

The site has been identified as generally suitable for on-site effluent disposal but there is a slight associated environmental hazard expected. One or more la nd limitations are present, which may not be compatible with 'straight forward' conventional on-site disposal. The wastewater management program will require careful planning, adherence to specifications and adequate supervision.

Rating 3

The site has only a fair capability for on-site effluent disposal with a moderate associated environmental risk always present. Very careful site selection, preparation and specialised design will be required to address the identified land constraints. A management program should be delivered to the responsible authority with the development application and prior to earthworks commencing.

Buffering considerations to environmental features and to the proximity of nearby dwellings will be important in the design and siting of the development.

It is recommended that, in order to achieve BPEM, treatment systems, which can attain a higher level of treatment with basic monitoring, should be considered, as an alternative to standard conventional trench disposal.

Rating 4

Areas have a poor capability rating with a high associated environmental risk. Considerable difficulties are expected during siting and installation of the wastewater treatment system and during routine operation. A very high engineering input and close supervision would be needed to minimise the environmental impact.

Wastewater treatment systems capable of consistently producing a high quality secondary effluent (such as aerated wastewater treatment plants) together with an intense monitoring program should be investigated and adopted.

Rating 5

Areas have a very poor capability and there is a severe associated environmental risk. The areas are not generally considered suitable for disposal of septic tank effluent by conventional trench systems.

There will be a need for very high levels of engineering input and management at all stages of wastewater system installation. General management is unlikely to adequately address the identified land constraints and achieve a sustainable outcome. For closer development reticulated sewerage is usually the only acceptable option.

LCA Ratings from 3-5 indicate that a site has a limited capability for sustainable onsite wastewater management. It is the proponent's responsibility to demonstrate that appropriate engineering solutions and more intense management could overcome the site limitations. If the proponent fails to demonstrate this, development should not proceed.

FURTHER INFORMATION

EPA Victoria Information Centre
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Fax (03) 9695 2780

EPA Victoria Regional Offices

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7 Church Street, Traralgon 3844
Tel: (03) 5176 1744 Fax: (03) 5174 7851

North-East
24 Ely Street, Wangaratta 3677
Tel: (03) 5721 7277 Fax: (03) 5721 2121

North-West
43 Williamson Street, Bendigo 3550
Tel: (03) 5442 4393 Fax: (03) 5443 6555

South Metropolitan
45 Princess Highway, Dandenong 3175
Tel: (03) 9794 0677 Fax: (03) 9794 5188

South-West
State Government Offices
Cnr Lt Malop & Fenwick Streets, Geelong 3220
Tel: (03) 5226 4825 Fax: (03) 5226 4632

EPA Internet site
www.epa.vic.gov.au
Information about domestic wastewater treatment systems is listed under the "For Local Government" heading on this Website

Local Government Listings
Municipal Association of Victoria
Level 12, 60 Collins Street, Melbourne 3000
Tel: (03) 9667 5555

REFERENCES

The following references may assist in achieving best practice management of onsite wastewater systems:

Environment Protection Authority 1983 (revised 1991), *Guidelines for Wastewater Irrigation*, Publication 168, EPA Victoria.

Environment Protection Authority 1991, *Construction Techniques for Sediment Pollution Control*, EPA Publication 251, EPA Victoria

Environment Protection Authority 1997, *Code of Practice for Small Wastewater Treatment Plants*, EPA Publication 500, EPA Victoria

Environment Protection Authority 1998, *Development Approvals in Sewered and Unsewered Areas*, EPA Publication 629, EPA Victoria

Standards Australia 1998, AS/NZS 1546.1:1998 *Onsite domestic wastewater treatment units – Septic Tanks*, Standards Australia, Sydney

Standards Australia 2000, AS/NZS 1547:2000 *Onsite domestic wastewater management*, Standards Australia, Sydney

Standards Australia 2001a, AS/NZS 1546.2:1998 *Onsite domestic wastewater treatment units – Waterless composting toilets*, Standards Australia, Sydney

Standards Australia 2001b, AS/NZS 1546.3:1998 *Onsite domestic wastewater treatment units – Aerated wastewater treatment systems*, Standards Australia, Sydney

Environment Protection Authority 2002, *Guidelines for Environmental Management - Use of Reclaimed Water*, EPA Publication 464.1, EPA Victoria

Environment Protection Authority 2003, *Septic Tanks Code of Practice*, EPA Publication 891, EPA Victoria