

## What is required with an application for a Reedbed (second-stage wastewater treatment) system?

Reedbed systems are a second stage treatment for onsite wastewater systems – mostly for greywater systems. Before installation, an application for the approval of a reedbed system must be submitted to Alexandrina Council. Individual site or environmental considerations identified by the Environmental Health Officer when assessing the application may require the applicant to provide more details.

This guide specifies the information that must be provided with the application for assessment by Alexandrina Council, Environmental Health Officers for approval. Some treatment options have been provided.

### Location and site characteristics

- A plan showing detailed directions to locate the property.
- A scaled plan of the property and all nearby land and buildings and the land use of nearby properties.
- A site plan showing the location of the house / building, boundaries, recreation areas, reedbed area, disposal area of reedbed effluent and blackwater treatment and/ or disposal unit.
- Details of site characteristics, such as topography, proximity to any watercourses, bores, marine environment, etc.

### Treatment and disposal of all wastewater

A reedbed system is part of an overall property wastewater management system. The following information on the management of the whole system is required:

#### Method of black water (toilet waste) treatment and disposal

- Supporting information and engineering calculations should be provided.
- Options include:
- a septic tank (for a minimum of six persons) with effluent disposal by subsoil soakage, connection to an SA Water sewerage system, OR
- connection to an SA Water sewerage system or a private or a council scheme, OR
- a composting toilet or other type of blackwater treatment / disposal system approved for installation in SA.

### Greywater pre-treatment

For a domestic property, a tank with a minimum volume of 1620 litres is required for the greywater pre-treatment before reedbed disposal.

### Plumbing plan

The plan of the plumbing layout for the wastewater / greywater collection system must comply with *Australian Standard AS 3500.5*.

### Design & installation

#### Number of persons

The system must be designed for a minimum of six persons.

#### Reedbed surface area

Generally a surface area of 3m<sup>2</sup> -6m<sup>2</sup> per person is needed. Engineering data must be included to confirm the surface area size. The actual figure is dependent on the BOD, hydraulic flow, gravel void space and liquid depth of the bed.

#### Liquid depth

Reedbed water depth will be between 300-700 mm with at least 100 mm cover over the liquid.

#### Gravel substrate

The reedbed is to be constructed using a 20 mm gravel substrate. The gravel is to be washed prior to placing in the bed. Larger gravel/stones are required to minimise clogging around the inlet and outlet.

### **Total porosity**

The total porosity of the reedbed (void space of gravel where the wastewater lies) is usually calculated on a basis of 35- 50%.

### **Length to width ratio**

For the length to width ratio of the reedbed area, a ratio of between 3:1 and 5:1 is preferable.

### **Reed bed retention time**

A minimum detention time of 5 days is required.

### **Lining**

The lining of a reedbed should be impervious, durable and able to resist penetration by macrophyte roots. If using plastics, it is advisable to lay sand or geotextile under and over the plastic liner to prevent piercing by gravel, subsurface rock or tree roots. Alternative lining materials and installation methods must be supported with engineering specifications.

To minimise the chance of punctures, thin liners (i.e. 0.2mm or less) must not be planted with species such as *Phragmites* which have spear-like rhizomes. Rigid plastic modules must not be planted with *Typha*, a species with considerable expansive strength, due to the risk of rupture when the module becomes packed with growth. Acceptable liners include:

- a double layer of construction grade PVC liner (minimum 0.2mm thickness per layer)
- a suitable thickness of reinforced concrete.

### **Setbacks**

Distances for setbacks from watercourses, dams, bores, buildings or other similar features provided in the *Onsite Wastewater Management Systems Code* are to be considered when determining setbacks.

A lesser setback for lined beds may be considered where information, including calculations from a suitably qualified engineer is provided indicating that any installed lining will not be breached (eg. by lateral tree roots).

### **Inlet/outlet structure**

Inlet/ outlet structure details for discharge to subsurface must be provided.

### **Slope**

Any slope in the design is not to exceed 1% and may be zero.

### **Construction of collection sump**

The construction of the collection sump must not compromise the structure of the reed bed and must contain at a minimum of 50% of the daily flow or 500L, whichever is the greater. The sump must be constructed in accordance with the requirements for sumps in the Onsite Wastewater Systems Code

### **Plant species and planting layout**

#### **Suitable species**

Where possible, use only indigenous native Australian species. A list of appropriate species may be found on

page 4, but this is not comprehensive and is only intended as a guide. Many suitable natives are not commercially available, but may be harvested from

existing local wetlands provided a permit (public lands collection only) or permission from the local landholder is obtained.

Several introduced species used in reedbeds (e.g. *Elodea Canadensis*, *Salvinia molesta*, *Alternanthera*

*philoxeroides*, *Eichhornia crassipes* and *Lagarosiphon major*) have caused major stream clogging, and should be avoided. Check the national weeds database

([www.weeds.org.au/noxious.htm](http://www.weeds.org.au/noxious.htm)), consult with your local nursery, or phone the Animal and Plant Control Board before confirming species selection. *Typha* spp., *Phragmites* spp., and *Schoenoplectus* spp. are widespread, and have deep, vigorous root systems which generate essential aerobic conditions and encourage nitrification. *Schoenoplectus validus* and *Phragmites communis* are superior in removing nitrogen. *Typha* spp. Require less nutrients and do well in greywater only reedbeds.

*Bolboschoenus*

*caldwellii*, *Schoenoplectus pungens* and *Schoenus nitens* tolerate variable salinity. In

general, *Juncus*, *Baumea*, *Bolboschoenus*, *Cyperus*, *Isolepis*,

*Lepidosperma*, and *Schoenoplectus* species flower profusely, and are high nutrient assimilators.

#### **Seed versus seedlings**

Planting seedlings or clumps is easier than planting seed as rhizomes can be placed the correct way up to ensure successful establishment. Set rhizomes in the gravel deep enough to be in contact with subsurface water.

### **Planting density and layout**

Select 2-5 different species, grouping each species together. Shallower rooted species should be located near the inlet because of higher influent temperatures and nutrient levels. Deeper rooted species should be located toward the end of the reedbed. Planting a mix of annuals and perennials will ensure that nutrient assimilation occurs across all seasons. The planting density can range from 0.3m to 1.0m between the centres of each plant. Higher densities accelerate the development of a mature and completely functional reedbed, but also increase the cost. Rows should be 0.45m apart, planted perpendicular to the direction of flow and staggered 0.25m.

### **Establishment time**

A minimum establishment period of 6 weeks is required to allow new plants to settle and grow. Planting in spring provides the most successful results for seedlings, root rhizome stock or clumps.

### **Disposal of reedbed effluent (reclaimed water)**

#### **Effluent disinfection**

Surface irrigation for reedbed effluent for household systems requires adequate disinfection of the effluent in accordance with: Onsite Wastewater Management Systems Code. Other disinfection methods may be acceptable, depending on the proposed system, its design, installation and operation details provided in the application. For larger installations, reclaimed water reuse must be in compliance with the standards set out in the *South Australian Reclaimed Water Guidelines – Treated Effluent*.

#### **Effluent discharge to the irrigation area**

Pumped discharge to the irrigation area is required to achieve even pressure to all parts of the irrigation system.

#### **Disposal outlets**

The disposal area pipe work outlets should be protected from clogging. This may be achieved by the

installation of a self-cleaning filter. Backwash discharge from the filter must be forwarded to the primary chamber of the septic tank via a separate pipe work system.

#### **Effluent storage**

Any effluent storage details should be included in the application, such as the method of storage, tank type and size, and detention time.

#### **Irrigation /subsoil surface area**

Engineering assessment of soils should be supplied for the irrigation area (surface / sub surface disposal)The irrigation area is to be sized using 4.5 L/m<sup>2</sup> per day or to engineer's assessment and requirements. *The Australian Standard AS/NZS 1547:2000 - Onsite Domestic Wastewater Management* may be used as a guide to the design of alternative land disposal or irrigation systems.

#### **Surface water diversion**

Details showing adequate diversion of surface waters around the reedbed and the irrigation area are required.

### **Reedbed maintenance**

Where any property is vacant for extended periods, arrangements should be made to ensure plants within the reedbed are kept watered.

For further information please contact Environmental Health at Alexandrina Council (08) 8555 7000 or visit

[www.alexandrina.sa.gov.au](http://www.alexandrina.sa.gov.au)

## SA Reedbed Species Guidelines

The following native species are suitable for reedbed systems. The majority are commercially available within South Australia. Contact Urban Forests, telephone (08) 8278-0600 or visit:

[www.urbanforest.on.net/resources\\_growerslist.htm](http://www.urbanforest.on.net/resources_growerslist.htm) for details of native plant suppliers:

<i>Scientific name</i>	<i>Common name</i>	<i>* Natural distribution</i>	<i>Height</i>	<i>Commercially available?</i>	<i>Comments (nutr. = nutrient)</i>
<i>Baumea arthropophylla</i>	<b>Swamp Twig-rush</b>	LE, FR, SL, KI, SE	1-2m	Y	Submergent-emergent, high nutr. uptake
<i>Baumea articulata</i>	<b>Jointed Twig-rush</b>	FR, NL, SL, KI, SE	1-2m	N	High nutr. uptake
<i>Baumea juncea</i>	<b>Bare Twig-rush</b>	LE, EP, MU, YP, SL, KI, SE	0.3-1m	Y	Submergent-emergent, high nutr. uptake
<i>Bolboschoenus caldwellii</i>	<b>Salt Club-rush</b>	LE, FR, EP, NL, MU, SL, SE	0.3-0.9m	Y	Flowers profusely, high nutr. uptake, salt tolerant, deciduous
<i>Bolboschoenus medianus</i>	<b>Marsh Club-rush</b>	MU, SL, SE (rare in SA)	0.7-2m	Y	Occurs in swamp, deciduous
<i>Carex appressa</i>	<b>Tall Sedge</b>	FR, MU, SL, KI, SE	To 1m	Y	Grow in damp areas including standing water
<i>Carex bichenoviana</i>	<b>Notched Sedge</b>	SL	0.25-0.5m	Y	Aquatic-terrestrial, prefers moist conditions, tolerant to water level change
<i>Carex tereticaulis</i>	<b>Rush Sedge</b>	FR, EP, NL, SL, SE	1m+	Y	Aquatic-terrestrial, prefers moist conditions, tolerant to water level change
<i>Cyperus gymnocaulos</i>	<b>Spiny Flat-sedge</b>	NW, LE, GT, FR, EP, NL, MU	0.15-0.75m	Y	Flowers profusely, high nutr. uptake, prefers damp conditions
<i>Cyperus vaginatus</i>	<b>Stiff Flat-sedge</b>	NW, LE, GT, FR, EA, EP, NL, MU, YP, SL, KI	0.3-1.5m	Y	Wide spread, flowers profusely, high nutr. uptake, prefers wet conditions
<i>Eleocharis acuta</i>	<b>Common Spike-rush</b>	LE, GT, FR, EP, MU, SL, KI, SE	To 0.9m	Y	Prefers wet conditions
<i>Eleocharis sphacelata</i>	<b>Tall Spike-rush</b>	FR, MU, SL, KI, SE	To 2m	N	Prefers slow flowing to stagnant water, to water logged conditions
<i>Gahnia filum</i>	<b>Thatching Grass</b>	EP, YP, SL, SE	0.2-0.35m	Y	Prefers damp conditions
<i>Gahnia sieberiana</i>	<b>Red-fruit Saw-sedge</b>	SL, KI, SE	1-2.5m	Y	Prefers damp, shaded conditions, flower profusely, high nutr. uptake
<i>Isolepis inundata</i>	<b>Swamp Club-Rush</b>	FR, EP, MU, SL, KI, SE	0.1-0.3m	Y	
<i>Isolepis nodosa</i>	<b>Knobby Club-rush</b>	NU, FR, EP, MU, YP, SL, KI, SE	0.5-1.5m	Y	Prefers damp conditions, salt tolerant (coastal), flowers profusely, high nutr. uptake



<i>Scientific name</i>	<i>Common name</i>	<i>* Natural distribution</i>	<i>Height</i>	<i>Commercially available?</i>	<i>Comments (nutr. = nutrient)</i>
<i>Juncus bufonius</i>	<b>Toad Rush</b>	NW, GT, FR, EP, NL, MU, YP, SL, KI, SE	0.02-0.3m	Y	Widespread, cosmopolitan, prefers damp conditions, controls erosion, high nutr. uptake, excellent N fixator
<i>Juncus flavidus</i>	<b>Yellow Rush</b>	FR, EP, NL, YP, SE	0.35-1.2m	Y	Controls erosion, high nutr. uptake, excellent N fixator
<i>Juncus kraussii</i>	<b>Sea Rush</b>	LE, FR, EP, MU, YP, SL, KI, SE	1m	Y	Controls erosion, salt tolerant, high nutr. uptake, flowers profusely, excellent N fixator
<i>Juncus pallidus</i>	<b>Pale Rush</b>	NL, SL, KI, SE	0.5-2m	Y	Prefers seasonally wet conditions (tolerance to water level change), high nutr. uptake
<i>Juncus pauciflorus</i>	<b>Loose-flower Rush</b>	MU, SL, KI, SE	0.25-1m	Y	Control erosion, excellent N fixator
<i>Juncus sarophorus</i>		FR, MU, SL	0.7-1.2m	Y	Control erosion, excellent N fixator
<i>Juncus subsecundus</i>	<b>Finger Rush</b>	LE, FR, EP, NL, MU, SL, SE	0.2-0.9m	Y	Prefers damp conditions, compatible with many species, prefers SE regions
<i>Lepidosperma gladiatum</i>	<b>Sword Rush</b>	EP, YP, SL, KI, SE	1m+	Y	Flowers profusely, high nutr. uptake, prefers sandy conditions
<i>Phragmites australis</i>	<b>Common Reed</b>	LE, FR, NL, MU, SL, SE	1-3m	Y	Cosmopolitan, prefers wet conditions, good aerobic activity, medium salt tolerance, controls erosion, deciduous
<i>Schoenoplectus pungens</i>	<b>Spiky Club-rush</b>	LE, GT, FR, EP, MU, SL, SE	0.3-0.6m	Y	Salt tolerant, good aerobic activity, high nutr. uptake
<i>Schoenoplectus validus</i>	<b>River Club-rush</b>	LE, FR, EP, NL, MU, SL, KI, SE	2m+	Y	Cosmopolitan, good aerobic activity, high nutr. uptake
<i>Schoenus maschalinus</i>	<b>Leafy Bog-rush</b>	SL, KI, SE	2m	Y	Prefers damp to water logged conditions
<i>Triglochin striatum</i>	<b>Streaked Arrow Grass</b>	All	To 50cm	Y	Tolerates a range of salinities, prefers shallow water
<i>Typha domingensis</i>	<b>Narrow-leaf Bulrush</b>	NE, LE, FR, MU, RP, SL, KI, SE	2m	Y	Excellent for greywater systems (requires less nutrients), good aerobic activity, high nutr. uptake, deciduous
<i>Typha orientalis</i>	<b>Bulrush</b>	LE, FR, MU, SL, SE	2m	Y	Flowers profusely, high nutr. assimilator, excellent for greywater systems, good aerobic activity, deciduous

North-Western (NW), Lake Eyre (LE), Nullabor (NU), Gairdner-Torrens (GT), Eyre Peninsula (EP), Flinders Ranges (FR), Eastern (EA), Northern Lofty (NL), Murray (MU), Southern Lofty (SL), Kangaroo Island (KI), South-Eastern (SE) refer to South Australian botanical regions used by the State Herbarium. Visit <http://users.chariot.net.au/~littoral/biogeobotreg-0.htm> for a map of South Australia incorporating these regions.

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