Soil and Land
Conservation
Consulting

Site and Soil Assessment
for
On-site Effluent Disposal

Waste Transfer Station
Macs Reef Road
Wamboin
Palerang Council

February 2011

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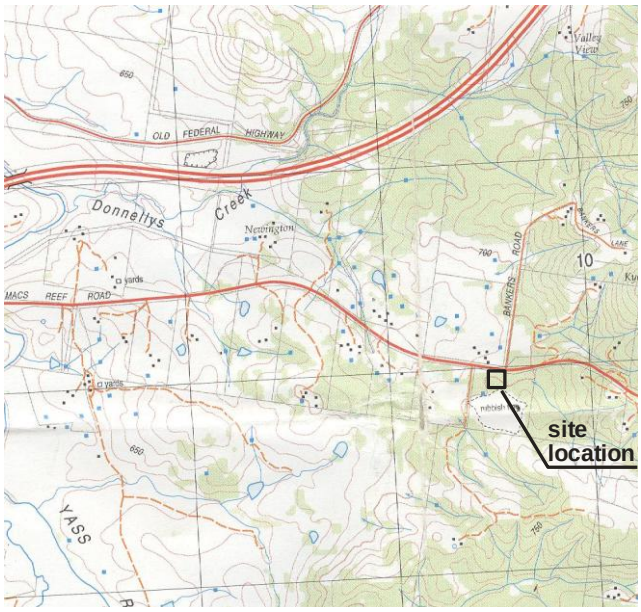
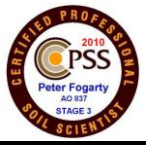
Soil survey and assessment for forestry, agriculture, urban development; land degradation assessment; catchment planning; soil conservation advice and planning; farm planning; land capability mapping
ABN 54 084 739 800

Contents

Project Definition	
Purpose	Provide direction for sustainable on-site effluent management for conversion of Macs Reef tip to a transfer station. Proposal entails having a toilet and wash basin to serve a single occupant plus occasional usage by one or two members of the public. The site is non powered site. The most suitable option is for a septic tank with effluent directed to an absorption bed.
Key References	*On-site Sewage Management for Single Households* (NSW Govt, 1998) ANZ Standard 1547:2000 *On-site Domestic Wastewater Management* *Yarrowlumla Council (former)* LEP 2002 Jenkins B (2000) Soil Landscapes of the Canberra 1:100,000 Sheet. DLWC.
Reporting	The report assesses the area in the vicinity of the transfer station to define land suited to effluent application. It excludes land with major physical constraints, particularly rock outcrop, shallow soils and poor drainage, and applies relevant drainage buffers. The assessment is presented in the pro forma required by, including management prescriptions, site plan and photograph, with supporting information in this report including assessment of design loading rate (DLR) and limitation assessment tables.
Location	 from Sutton 1:25,000 sheet
Terrain	Undulating hills and sideslopes developed on shale geology. Drains to Yass R via minor drainage lines, drainage depression runs to east of trench site, no buffers required..
Soils	See appendix 1for soil profile descriptions; shallow to moderately deep gravely dermosols comprising silty loam topsoil over clay loam subsoil. Limited extent of deeper soil, much of site has very shallow soil cover.

Site and Soil Evaluation

Site Evaluator Details	
Name **Company**	Peter Fogarty Soil and Land Conservation Consulting P/L
Phone **Fax**	0409129608 61614062
Date of Assessment	February 1, 2011
Signature **Date**	 

Site Information	
Local Government Area	Palerang Shire Council
Address/locality	Proposed transfer station, Macs Reef Rd, Wamboin
Owner	Palerang Council
Developer	Palerang Council
Block configuration **plans attached** **photo attached**	Area of approx 2ha yes yes
Intended water supply	Roofwater tank storage
Expected wastewater volume (litres/day)	Single occupant using toilet and washbasin, assume maximum effluent generation of 60l/day
Local experience	Trench systems work adequately where soil and site conditions are suitable, and assuming conservative trench design

Looking across land suited to effluent application, photo point location shown on fig 1

Site Assessment

Climate	Warm summers with large evaporative deficit, cool winters with small evaporative deficit; median summer monthly rainfall for Canberra airport 49mm; median monthly winter rainfall 38mm; mean monthly summer evap. 177mm, mean monthly winter evap 60mm.

Rainfall water balance attached **Land application area calculated** **Wet weather storage calculation attached**	Yes Yes n/a
Flood potential: **land application area above 1:20 yr flood** **land application area above 1:100 yr flood** **electrical components above 1:100 yr flood**	 Yes Yes Yes

Exposure	Adequate exposure due to elevated location
Slope	3-5%, generally flat planform
Landform	Gently graded hillslope ; avoids poorly drained and rocky land
Run-on	Significant upslope contributing area; diversion drain required as per management prescriptions
Seepage	None
Erosion Potential	Low due to good ground cover and gentle slopes
Site drainage	Freely drained, may be saturated for short period after extended periods of rainfall, lower lying areas prone to waterlogging excluded
Fill	None

Groundwater: **Horizontal distance to groundwater well used for domestic supply** **Groundwater vulnerability map category** **Bores in area and purpose**	 None known within 250m Moderate low None
Buffer distance from treatment system to: **perennial rivers and creeks** **drainage lines** **other sensitive environments** **boundary of premises** **swimming pools** **buildings**	 Not applicable to site Not applicable to site None 12m to lower boundary Not applicable to site >15m
Is there sufficient land area for: **application system including buffers** **reserve application system**	 Yes Yes, ample room within land designated as suitable
Surface rock and outcrop	Common patches of outcrop, area suited to trench generally free of rock

Soil Assessment

Depth to bedrock or hardpan	60cm in area designated for trench
Depth to high soil watertable	> 150cm
Hydraulic loading rate **soil texture** **soil structure** **permeability (from table 4.2A4 of AS1547:2000)** **recommended hydraulic loading for disposal system**	Loam upper layer to 10cm overlying clay loam subsoil Weak in topsoil, moderate in subsoil .5 to 1.5m/day in topsoil Subsoil absorption at 10mm/day
Coarse fragments	0
Bulk density	Estimate 1.4
pH	Surface 5, subsoil 6.5 (acid)
Electrical conductivity dS/m[1]	Topsoil .2, subsoil .3 (low)
Exchangeable sodium % [1]	Topsoil 3, subsoil 2 (low)
Cation exchange capacity (mequiv/100g) [1]	Topsoil 15, subsoil 9 (mod)
Phosphorous sorption capacity kg/ha[1]	2000 (moderate)
Geological features **discontinuities** **fractured rock**	 None None
Soil landscape reference [1]	Bywong, units 1, 2 and 3
Dispersiveness	Low in surface and subsoil (EAT 8, 3(1) respectively)
AS2870 Site Class	S (slightly reactive)

[1] extrapolated from Jenkins (2000) Soil Landscapes of the Canberra 1:100,000 sheet. DLWC

System Selection

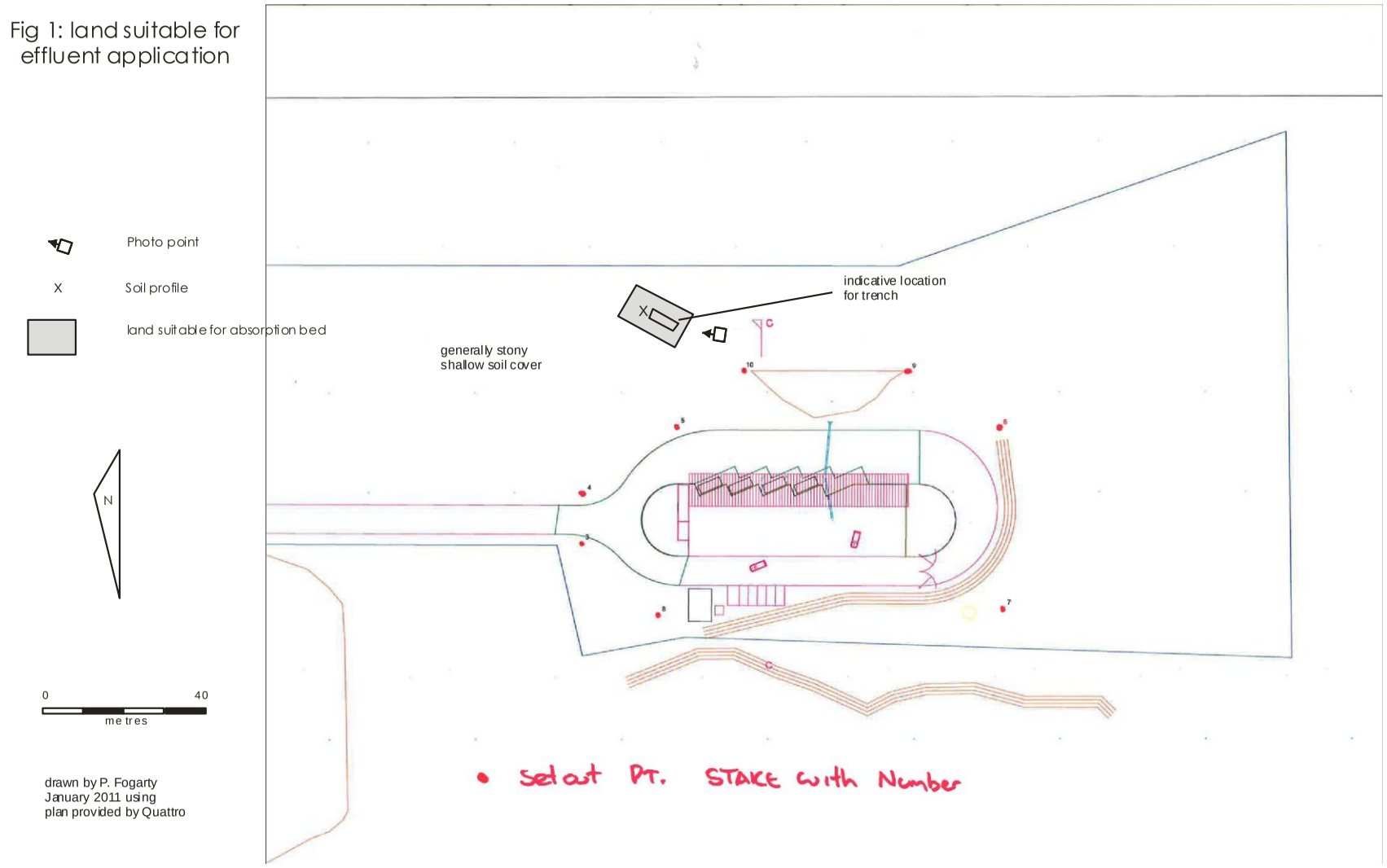
Consideration of connection to centralised sewerage system **distance** **potential for future connection** **potential for reticulated water**	 >5km none none
Type of land application system best suited **Justification**	Subsoil absorption trench with 10m length, .3m wetted depth, .6m wide and covered with .2m of topsoil (see management practices section) Soil is sufficiently permeable; not subject to drainage or water table limitations
Type of treatment system best suited **Justification**	Septic tank of 3000l These systems operate adequately on appropriate soil and site conditions, given good maintenance, and management practices as specified below

General Comments

Specific environmental constraints	None
Specific health constraints	None
Management prescriptions	The absorption trench will be located within the land shown as suitable in figure 1. There is flexibility with its precise location within this area. An absorption trench with a total base area of 6sq m is required. A trench with the following dimensions will achieve this result: width of .6m, length of 10m, wetted depth of .2m. The trench should be excavated parallel to the contour, so the floor has a grade of 2% down from the entry point to ensure an even spread of effluent along the length of the trench away from the entry point. The effluent can be delivered in a perforated pipe bedded level in clean, durable 20-40mm aggregate, or through a self supporting arch pipe (eg Relne drain). The excavation should have a total depth of .4m, comprised of 30cm wetted depth and 10cm of topsoil over the top. The soil cover should be mounded to achieve a raised cover of an additional 10cm Geotextile should be placed between the gravel in the trench and the topsoil. When excavating the trench, keep the topsoil (0-10cm) separate from the

	subsoil as the topsoil will be re-used over the trench. The excess subsoil should be used to construct a diversion drain around the high side of the trench to direct runoff from upslope around the trench site. All plumbing fittings should be AAA rated for water conservation. Vehicles should be excluded from the effluent disposal area in order to protect the trench surface from compaction. Building stockpiles should also be excluded. A septic tank size of 3000l is required, with at least two chambers to maximise settling efficiency. A tank of this size will provide around three days of treatment before discharging into the trench. The tank should be de-sludged every 10 years. This is crucial to ensure that the trench continues to operate effectively, and will therefore contribute to financial saving in extending trench life. Do not put the following things down the drain: fats and oils, paint and related fluids, particulates such as coffee fines, strong disinfectants and antibiotics as these will all reduce the effectiveness of the bacteria in the tank and clog the absorption trench.

Fig 1: land suitable for effluent application



Site and Soil Limitation Assessment

The following two limitation tables are a standardised guide to the site and soil characteristics which may limit the suitability of the site for effluent disposal and which would require attention through specific management practices. The tables have been reproduced from *On-site Sewage Management for Single Households* (tables 4 and 6, Anon, 1998). The italicised categories represent site and soil conditions of the land covered in this report. The tables show that the land designated for effluent application has slight to moderate limitations, but no severe limitations. Land with severe limitations, principally steep rocky land, land prone to waterlogging or within drainage buffers, has been excluded from the effluent application area.

Site limitation assessment

Site feature	Relevant system	Minor limitation	Moderate limitation	Major limitation	Restrictive feature
Flood potential	All land application systems	*> 1 in 20 yrs*		Frequent, below 1 in 20 yrs	Transport in wastewater off site
	All treatment systems	*components above 1 in 100 yrs*		Components below 1 in 100 yrs	Transport in wastewater off site, system failure
Exposure	All land application systems	*High sun and wind exposure*		Low sun and wind exposure	Poor evapo-transpiration
Slope %	Surface irrigation	0-6	6-12	>12	Runoff, erosion potential
	Sub-surface irrigation	0-10	10-20	>20	Runoff, erosion potential
	Absorption	*0-10*	10-20	>20	Runoff, erosion potential
Landform	All systems	*Hillcrests, convex sideslopes and plains*	Concave sideslopes and footslopes	Drainage plains and incised channels	Groundwater pollution hazard, resurfacing hazard
Run-on and seepage	All land application systems	*None-low*	Moderate	High, diversion not practical	Transport of wastewater off site
Erosion potential	All land application systems	*No sign of erosion potential*		Indications of erosion eg rils, mass failure	Soil degradation and off-site impact
Site drainage	All land application systems	*No visible signs of surface dampness*		Visible signs of surface dampness	Groundwater pollution hazard, resurfacing hazard
Fill	All systems	*No fill*	Fill present		Subsidence
Land area	All systems	*Area available*		Area not available	Health and pollution risk
Rock and rock outcrop	All land application systems	*<10%*	10-20%	>20%	Limits system performance
Geology	All land application systems	*None*		Major geological discontinuities, fractured or highly porous regolith	Groundwater pollution hazard

Soil limitation assessment

Soil feature	Relevant system	Minor limitation	Moderate limitation	Major limitation	Restrictive feature
Depth to bedrock	Surface and sub surface irrigation	> 1.0	.5-1.0	< *0.5*	Restricts plant growth
or hardpan (m)	Absorption	> 1.5	*1.0-1.5*	< 1.0	Groundwater pollution hazard
Depth to seasonal	Surface and sub surface irrigation	> 1.0	0.5-1.0	< 0.5	Groundwater pollution hazard
water table (m)	Absorption	*> 1.5*	1.0-1.5	< 1.0	Groundwater pollution hazard
Permeability[1]	Surface and sub surface irrigation	*2b, 3 and 4*	2a, *5*	1 and 6	Excessive runoff and waterlogging
Class	Absorption	3, 4		1, 2, 5, 6	Percolation
Coarse fragments %	All systems	*0-20*	20-45	>40	Restricts plant growth, affects trench installation
Bulk density (g/cc) SL L, CL C	All land application systems	 < 1.8 *< 1.6* < 1.4		 > 1.8 > 1.6 >1.4	restricts plant growth, indicator of permeability
pH	All land application systems	> 6.0	*4.5-6.0*	-	Reduces plant growth
Electrical conductivity (dS/m)	All land application systems	*<4*	4-8	>8	Restricts plant growth
Sodicity (ESP)	Irrigation 0-40cm; absorption 0-1.2mtr	*0-5*	5-10	> 10	Potential for structural degradation
CEC mequiv/100g	Irrigation systems	*> 15*	5-15	< 5	Nutrient leaching
P sorption kg/ha	All land application systems	> 6000	*2000-6000*	< 2000	Capacity to immobilise P
Aggregate stability	All land application systems	*Classes 3-8*	class 2	class1	Erosion hazard

[1] Estimated from ANZS 1547:2000

Permeability Estimation and Calculation of Absorption Trench Dimensions

Permeability has been estimated from table 4.2A1 from A/NZS 1547:2000. This table estimates permeability from soil properties, and prescribes a design loading rate (DLR) for effluent disposal. The latter is slower than permeability to account for the development of a clogging layer and a reduction of absorption capacity over time.

The soil properties encountered at this site were a subsoil comprising a moderately structured clay loam. Table 4.2A1 estimates the DLR for such a soil at 10mm/day. With an assumed effluent generation rate of 60l/day, an application surface of 60sq m is required (ANZS1547:2000 recommends against using trench sides in the calculation of trench dimensions to ensure a conservative design).

TABLE 4.2A1
RECOMMENDED DESIGN LOADING RATES FOR TRENCHES AND BEDS

Soil category	Soil texture	Structure	Indicative permeability (K_{sat}) (m/d) (see Note 6)	Design loading rate (DLR) (see Notes 1, 2 and 3)			Indicative drainage class (see Note 9)
				Primary-treated effluent (see Note 4)		Secondary-treated effluent (see Note 5)	
				Conservative rate (mm/d) (see Notes 4 & 7)	Maximum rate (mm/d) (see Notes 4 & 8)	(mm/d)	
1	Gravels and sands	Structure-less (Massive)	>3.0	20 (see Note 10)	35 (see Note 10)	50 (see Note 10)	Rapidly drained
2	Sandy loams	Weakly structured	> 3.0	20	35	50	Well drained
		Massive	1.4 – 3.0	15	25	50	
3	Loams	High/ moderate structured	1.5 – 3.0	15	25	50	Moderately well drained
		Weakly structured or massive	0.5 – 1.5	10	15	30	
4	Clay loams	High/ moderate structured	0.5 – 1.5	10	10	30	Imperfectly drained
		Weakly structured	0.12 – 0.5	6	10	20	
		Massive	0.06 – 0.12	4	5	10	
5	Light clays	Strongly structured	0.12 – 0.5	5	8	12	Poorly drained
		Moderately structured	0.06 – 0.12	(see Note 11)	5	10	
		Weakly structured or massive	< 0.06	(see Note 11)	(see Note 11)	8	
6	Medium to heavy clays	Strongly structured	0.06 – 0.5	(see Note 11)	(see Note 11)	(see Note 11)	Very poorly drained
		Moderately structured	< 0.06	(see Note 11)	(see Note 11)	(see Note 11)	
		Weakly structured or massive	< 0.06	(see Note 11)	(see Note 11)	(see Note 11)	

NOTES TO TABLE 4.2A1:

1 The DLR in mm/day is to be used to size the horizontal bottom area of conventional trench and bed systems. (Refer to Paragraph 4.2A7.3.1 for comment on the relationship between bottom area and sidewall absorption mechanisms.)

2 Where loading rates of 10 mm/day or lower are required, it is critical that there is an even effluent loading over the design area.

3 The Design Loading Rates in Table 4.2A1 are based upon the best available information at the time of preparation of this Standard.

4 Primary-treated effluent is the discharge from conventional septic tanks and improved septic tanks (such as two-stage units and/or tanks fitted with solids-control filters). It includes all-waste, greywater and blackwater effluents.

5 Secondary-treated effluent has a quality equal to or better than 20 g/m^3 BOD_5 and 30 g/m^3 SS and typically is the effluent discharged from processes such as AWTS, sand filters, or wetlands.

6 The values of indicative permeability as K_{sat} are based on the movement of water, and not effluent, through the soil. They are estimates only and shall be used with caution in the determination of soil category and DLR.

7 Conservative Design Loading Rates must be used for beds (see Paragraph 4.2A7.2), for systems to be installed on steep sites and where other site and soil limitations are present. Conservative Design Loading Rates must always be used for primary-treated blackwater effluent.

8 Maximum Design Loading Rates may only be used where site and soil limitations are absent and where there is evidence that these rates can be effectively maintained without harm to the environment or without potential for failure of the system. Maximum Design Loading Rates may also be used for primary-treated greywater effluent and for improved primary effluent from modified septic tanks. (Refer to Clause 4.3.5.2.1.)

9 Indicative drainage classes listed are based on the assumption that drainage of water out of the soil is governed only by the indicative permeability and that external factors play no role.

10 The treatment capacity of the soil and not the hydraulic capacity of the soil or the growth of the clogging layer govern the effluent loading rate in Category 1 soil. Category 1 soils require special design and distribution techniques to help achieve even distribution of effluent over the full design surface (see Paragraph 4.5A4.2) for recommended discharge method). These soils have low nutrient retention capacities, often allowing accession of nutrients to groundwater.

11 To enable utilization of such soils for on-site wastewater disposal alternative systems (including ETA/ETS systems), special design requirements and distribution techniques and/or soil modification procedures will be necessary. For any alternative system designed for these soils, the effluent absorption rate shall be based upon soil permeability testing. Specialist soils advice and special design techniques will be required for clay dominated soils having dispersive (sodic) or shrink/swell behaviour. Such soils shall be treated as Category 6 soils. In some situations, these soils will preclude the use of an absorption only system design.

If $K_{sat} < 0.06$ m/d, a full water balance for the disposal area (including effective rainfall, run-off, evapo-transporation, (see Appendix 4.2D), can be used to calculate trench/bed size.

Appendix 1: Soil Profile Description

Soil classification	Depth (cm)	Properties
Brown dermosol	0-8	A1 dark brown silty loam, whole coloured, 20% gravel, moderate fine angular blocky structure; slightly moist firm consistence, high content fine roots, gradual boundary to
	8-60	B2 grey brown clay loam, 10% gravel, dry very firm consistence, non plastic, moderate fine blocky structure; grades to weathered shale.