Assessing A20 permit applications for onsite wastewater management systems

Training for Council Officers

Avoiding Mistakes

Avoiding mistakes

- There are many mistakes made in the preparation of LCAs
- There are many mistakes made in the assessment of LCAs as part of the permit application process
- The Auditor General of Victoria has identified the shortcomings of LCA preparation and assessment (*Protecting our environment and community from failing septic tanks, Auditor General Victoria 2006*)
- Similar issues and concerns continue to be identified in VCAT

Avoiding mistakes

- An important part of the A20 permit application assessment process is the identification of errors and omissions and the reduction, and hopefully elimination, of mistakes
- Assessment of LCAs is complex and challenging
- Council staff often haven't had experience in the preparation of LCAs themselves, yet are required to assess the work of Land Capability Assessors
- It is important that Council staff are well trained, competent and confident in their work

Assessing A20 permit applications

- It is important to be systematic and thorough in making an assessment
- Staffing shortages and limited availability of time and resources put staff under pressure
- The quality of LCAs is highly variable; some are of high quality, others less so
- It is equally important to not have "the wool pulled over one's eyes"
- This session identifies and offers an opportunity for discussion of some of the pitfalls

Red flag situations

- Cautionary situations are outlined in Table 34 of EDRS
  - Inadequate land capability to manage wastewater
  - Small lot size
  - Close proximity to receiving environment
  - High sensitivity of receiving environment
- Also see Appendix 3 of EDRS – Permit application assessment checklist and OWMS assessment checklist (appended following Section 2 of these notes)

Other areas where things "slip through the net"

- In this session we will raise for discussion a number of areas where errors, omissions or or mistakes are commonly found
- If you have had a similar experience and would like to share it, please do not hesitate to contribute

Not considering all wastewater

- Where a composting toilet is proposed
- Common with tiny houses
- May “neglect” to consider all other wastewater e.g. kitchen and greywater
- These need to be provided for as part of the application

Not considering all wastewater

- Separate occupancy dwellings
- Bedrooms that aren’t bedrooms (second lounge room / media room, rumpus room, study, library, sewing room etc.)
- It is reasonable that some rooms do not serve the function of bedrooms, but use must be justified and consideration given to potential use as bedrooms, particularly if occupancy changes

Soil not representative of site

- Site not visited by land capability assessor
- Soil information is generic, mapped information, not site specific
- Borehole data from another site is used
- Borehole data from location of dwelling, not land application area, is used
- Especially common when soils data for building foundations is collected and used for LCA
- Data presented is Engineering data

Inappropriate designs based on topsoil

- DLRs and DIRs used in design should be based on the limiting layer within 0.6 meters of the point of application
  - 0.6 m for surface irrigation
  - 0.7 - 0.75 m for subsurface irrigation
  - ~1.0 m for beds (beds 0.4 m deep)
  - ~1.2 m for trenches (trenches 0.6 m deep)
- Unless the topsoil is >0.6 m deep, no designs should be based on DLRs or DIRs for the topsoil

Soil structure and DLR / DIR

- DLRs and DIRs vary according to soil texture and soil structure
- Soil structure can only be determined if a test pit is dug (rather than augered)
- An augured soil sample will not show structure, it will be destroyed by augering, so the structure cannot be determined
- Hence no allowance for higher DLR or DIR can be made on the basis of structure if soil texture is determined from an augered sample

Failure to recognise the significance of mottling

- Mottling indicates that the soil at the depth of the mottling is saturated for part of the time, hence mottling represents a limiting layer
- Land application systems should be installed a minimum of 0.6 m above any limiting layer
- Therefore, if a soil shows mottling, Consideration should be given to raising the point of application of the land application system (of any type) above the level of saturation to avoid placing effluent into saturated soil

Irrigation line spacing

"The LAA is provided by SSI within the sandy loam soils including the adoption of reduced lateral spacings from 1 metre to 0.5 metre effectively doubling the size of the wastewater field. This increase of subsurface lateral pipes also benefits the system operation ensuring treatment tank pumps operate effectively."

Does the halving of lateral spacing effectively double the size of the irrigation field?

In what way does the halving of lateral spacing ensure treatment tank pumps operate effectively?

Capacity of pumps in approved AWTS

- There is no guarantee that the pumps which are part of an approved AWTS will work in all circumstances, especially if the required field is correctly sized for low permeability soils (and as a result, large)
- The demands on pumps are commonly too high to ensure even distribution without dividing the field into smaller zones using an indexing (sequencing) valve

Irrigation system layout

- Problems with layout as shown in Figure M1 in AS/NZS1547:2012
- How is such a system going to work?

Irrigation system layout

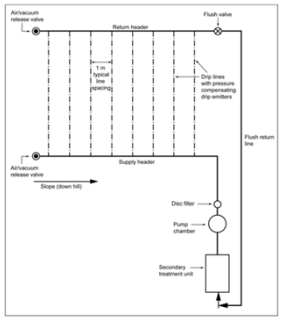
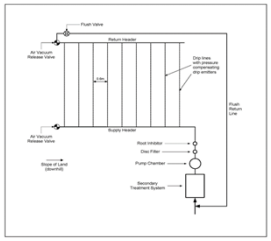


FIGURE M1 DRIP IRRIGATION SYSTEM – EXAMPLE LAYOUT OF COMPONENTS



Revised Figure M1 Page 167 AS/NZS1547:2012 to ensure even pressure in lines for effective distribution and flushing

Mound sizing

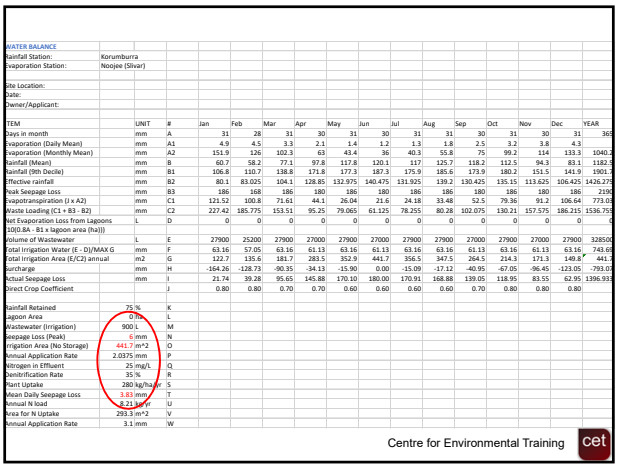
- Mounds are significantly undersized if sizing is based solely on DLR (basal loading rate) outlined in AS/NZS1547:2012
- Design needs to use appropriate sand loading rate (40mm/day) to size distribution bed
- Needs to also consider Linear Loading Rate (EDRS Table 64) and maximum slope (1V:3H)

It always pays to check the calculations

- Just because calculations are presented, or even neatly laid out, doesn't mean that they are correct
- Regulators should always check the calculations presented in LCAs
- If a design is approved with incorrect calculations, the regulator is just as responsible for the inappropriate design and installation as the designer

Use of water balance using Seepage Loss (Peak) vs DIR

- This water balance uses Seepage Loss (Peak) of 6.0 mm/day as an input
- It does not use a value for DIR of the soils
- The soils are Category 5 soils, DIR = 3.0 mm/day



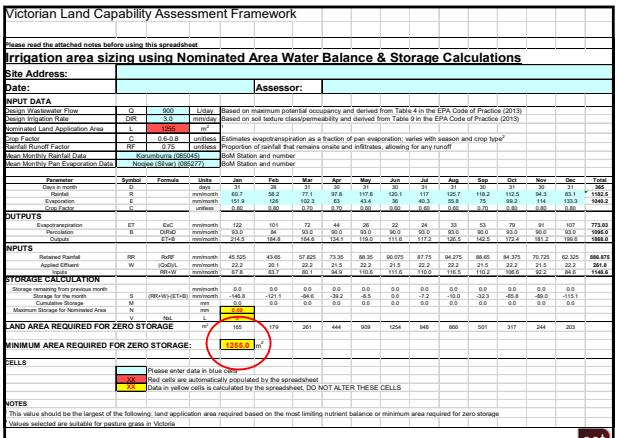
WATER BALANCE														
Rainfall Station:	Korumburra													
Evaporation Station:	Noojee (Silvan)													
Site Location:														
Date:														
Owner/Applicant:														
ITEM	UNIT	#	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	YEAR
Days in month	mm	A	31	28	31	30	31	30	31	31	30	31	30	31	365
Evaporation (Daily Mean)	mm	A1	4.9	4.5	3.3	2.1	1.4	1.2	1.3	1.8	2.5	3.2	3.8	4.3	
Evaporation (Monthly Mean)	mm	A2	151.9	126	102.3	63	43.4	36	40.3	55.8	75	99.2	114	133.3	1040.2
Rainfall (Mean)	mm	B	60.7	58.2	77.1	97.8	117.8	120.1	117	125.7	118.2	112.5	94.3	83.1	1182.5
Rainfall (9th Decile)	mm	B1	106.8	110.7	138.8	171.8	177.3	187.3	175.9	185.6	173.9	180.2	151.5	141.9	1901.7
Effective rainfall	mm	B2	80.1	83.025	104.1	128.85	132.975	140.475	131.925	139.2	130.425	135.15	113.625	106.425	1426.275
Peak Seepage Loss	mm	B3	186	168	186	180	186	180	186	186	180	186	180	186	2190
Evapotranspiration (J x A2)	mm	C1	121.52	100.8	71.61	44.1	26.04	21.6	24.18	33.48	52.5	79.36	91.2	106.64	773.03
Waste Loading (C1 + B3 - B2)	mm	C2	227.42	185.775	153.51	95.25	79.065	61.125	78.255	80.28	102.075	130.21	157.575	186.215	1536.755
Net Evaporation Loss from Lagoons 10(0.8A - B1 x lagoon area (ha)))	L	D	0	0	0	0	0	0	0	0	0	0	0	0	0
Volume of Wastewater	L	E	27900	25200	27900	27000	27900	27000	27900	27900	27000	27900	27000	27900	328500
Total Irrigation Water (E - D)/MAX G	mm	F	63.16	57.05	63.16	61.13	63.16	61.13	63.16	63.16	61.13	63.16	61.13	63.16	743.68
Total Irrigation Area (E/C2) annual	m2	G	122.7	135.6	181.7	283.5	352.9	441.7	356.5	347.5	264.5	214.3	171.3	149.8	441.7
Surcharge	mm	H	-164.26	-128.73	-90.35	-34.13	-15.90	0.00	-15.09	-17.12	-40.95	-67.05	-96.45	-123.05	-793.03
Actual Seepage Loss	mm	I	21.74	39.28	95.65	145.88	170.10	180.00	170.91	168.88	139.05	118.95	83.55	62.95	1396.93
Direct Crop Coefficient		J	0.80	0.80	0.70	0.70	0.60	0.60	0.60	0.60	0.70	0.80	0.80	0.80	
Rainfall Retained	75 %	K													
Lagoon Area	0 ha	L													
Wastewater (Irrigation)	900 L	M													
Seepage Loss (Peak)	6 mm	N													
Irrigation Area (No Storage)	441.7 m^2	O													
Annual Application Rate	2.0375 mm	P													
Nitrogen in Effluent	25 mg/L	Q													
Denitrification Rate	35 %	R													
Plant Uptake	280 kg/ha/yr	S													
Mean Daily Seepage Loss	3.83 mm	T													
Annual N load	8.21 kg/yr	U													
Area for N Uptake	293.3 m^2	V													
Annual Application Rate	3.1 mm	W													

Seepage Loss (Peak)

Rainfall Retained	75	%	K
Lagoon Area	0	ha	L
Wastewater (Irrigation)	900	L	M
Seepage Loss (Peak)	6	mm	N
Irrigation Area (No Storage)	441.7	m^2	O
Annual Application Rate	2.0375	mm	P
Nitrogen in Effluent	25	mg/L	Q
Denitrification Rate	35	%	R
Plant Uptake	280	kg/ha/yr	S
Mean Daily Seepage Loss	3.83	mm	T
Annual N load	8.21	kg/yr	U
Area for N Uptake	293.3	m^2	V
Annual Application Rate	3.1	mm	W

Seepage Loss (Peak)

- Seepage Loss (Peak) 6 mm/day
- Irrigation Area 441.7m^2
- Mean Daily Seepage Loss 3.83mm (exceeds DIR)



Victorian Land Capability Assessment Framework

Please read the attached notes before using this spreadsheet

Irrigation area sizing using Nominated Area Water Balance & Storage Calculations

Site Address:

Date: Assessor:

INPUT DATA

Design Wastewater Flow	Q	900	L/day	Based on maximum potential occupancy and derived from Table 4 in the EPA Code of Practice (2013)
Design Irrigation Rate	DIR	3.0	mm/day	Based on soil texture class/permeability and derived from Table 9 in the EPA Code of Practice (2013)
Nominated Land Application Area	L	1255	m^2	
Crop Factor	C	0.6-0.8	unitless	Estimates evapotranspiration as a fraction of pan evaporation; varies with season and crop type^2
Rainfall Runoff Factor	RF	0.75	unitless	Proportion of rainfall that remains onsite and infiltrates, allowing for any runoff
Mean Monthly Rainfall Data		Korumburra (085045)		BoM Station and number
Mean Monthly Pan Evaporation Data		Noojee (Silvan) (086277)		BoM Station and number

Parameter	Symbol	Formula	Units	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Days in month	D		days	31	28	31	30	31	30	31	31	30	31	30	31	365
Rainfall	R		mm/month	60.7	58.2	77.1	97.8	117.8	120.1	117	125.7	118.2	112.5	94.3	83.1	1182.5
Evaporation	E		mm/month	151.9	126	102.3	63	43.4	36	40.3	55.8	75	99.2	114	133.3	1040.2
Crop Factor	C		unitless	0.80	0.80	0.70	0.70	0.60	0.60	0.60	0.60	0.70	0.80	0.80	0.80	
OUTPUTS																
Evapotranspiration	ET	CxC	mm/month	122	101	72	44	26	22	24	33	53	79	91	107	773.03
Percolation	B	DIR×D	mm/month	93.0	84	93.0	90.0	93.0	90.0	93.0	93.0	90.0	93.0	90.0	93.0	1095.0
Outputs		ET+B	mm/month	214.5	184.8	164.8	134.1	119.0	111.6	117.2	126.5	142.5	172.4	181.2	199.6	1868.0
INPUTS																
Retained Rainfall	RR	RxRF	mm/month	45.525	43.65	57.825	73.35	88.35	90.075	87.75	94.275	88.65	84.375	70.725	62.325	886.875
Applied Effluent	W	(Q×D)/L	mm/month	22.2	20.1	22.2	21.5	22.2	21.5	22.2	22.2	21.5	22.2	21.5	22.2	261.6
Inputs		RR+W	mm/month	67.8	63.7	80.1	94.9	110.6	111.6	110.0	116.5	110.2	106.6	92.2	84.6	1148.6
STORAGE CALCULATION																
Storage remaining from previous month			mm/month	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Storage for the month	S	(RR+W)-(ET+B)	mm/month	-146.8	-121.1	-84.6	-39.2	-8.5	0.0	-7.2	-10.0	-32.3	-65.8	-89.0	-115.1	
Cumulative Storage	M		mm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Maximum Storage for Nominated Area	N		mm	-146.8												
	V	NxL	L	-184.3												
LAND AREA REQUIRED FOR ZERO STORAGE			m^2	165	179	261	444	909	1254	948	866	501	317	244	203	
MINIMUM AREA REQUIRED FOR ZERO STORAGE:				1254.0	m^2											

CELLS

	Please enter data in blue cells
XX	Red cells are automatically populated by the spreadsheet
XX	Data in yellow cells is calculated by the spreadsheet, DO NOT ALTER THESE CELLS

NOTES

This value should be the largest of the following: land application area required based on the most limiting nutrient balance or minimum area required for zero storage

Values selected are suitable for pasture grass in Victoria

MAV VLCAF spreadsheet

- Using the same input data and a DIR of 3.0 mm/day, MAV VLCAF spreadsheet requires an irrigation area of 1,255m^2

Seepage Loss Peak

Rainfall Retained	75	%	K
Lagoon Area	0	ha	L
Wastewater (Irrigation)	900	L	M
Seepage Loss (Peak)	5.2	mm	N
Irrigation Area (No Storage)	727.3	m^2	O
Annual Application Rate	1.2375	mm	P
Nitrogen in Effluent	25	mg/L	Q
Denitrification Rate	35	%	R
Plant Uptake	280	kg/ha/yr	S
Mean Daily Seepage Loss	3.03	mm	T
Annual N load	8.21	kg/yr	U
Area for N Uptake	293.3	m^2	V
Annual Application Rate	3.1	mm	W

Seepage Loss (Peak)

- Seepage Loss (Peak) 5.2 mm/day
- Irrigation Area 727.2m^2
- Mean Daily Seepage Loss 3.03mm (equivalent to DIR)

Seepage Loss Peak

Rainfall Retained	75	%	K
Lagoon Area	0	ha	L
Wastewater (Irrigation)	900	L	M
Seepage Loss (Peak)	4.7	mm	N
Irrigation Area (No Storage)	1220.3	m^2	O
Annual Application Rate	0.7375	mm	P
Nitrogen in Effluent	25	mg/L	Q
Denitrification Rate	35	%	R
Plant Uptake	280	kg/ha/yr	S
Mean Daily Seepage Loss	2.53	mm	T
Annual N load	8.21	kg/yr	U
Area for N Uptake	293.3	m^2	V
Annual Application Rate	3.1	mm	W

Seepage Loss (Peak)

- Seepage Loss (Peak) 4.7 mm/day
- Irrigation Area 1,220.3 m^2 (to match VLCAF area)
- Mean Daily Seepage Loss 2.53 mm
- Shows that irrigation area is highly sensitive to value of Seepage Loss (Peak) used
- Great potential for misuse to decrease apparent size of required irrigation area