



Land Capability Services

Site & Soil Assessment  
for  
On-site Effluent Disposal

Proposed Subdivision  
Lot 2 in Lot 1 DP1114409 & Lot 12 DP1043697  
424 Beralston Road  
Gundaroo NSW 2620

October 2024

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## INTRODUCTION

**Scope** This report provides site and soil assessment for on-site effluent disposal at the applicant's proposed new subdivision. The report focuses on the land in proximity to the proposed building envelope. Other areas within the proposed subdivision may also be suitable for on-site effluent disposal pending further investigation at building DA stage. A five-bedroom dwelling is assumed. An Aerated Wastewater Treatment System (AWTS) is proposed.

An AWTS coupled with surface or subsurface irrigation provides a suitable form of effluent treatment for the site and soil characteristics of the land in question.

The management recommendations include the size and location of the proposed irrigation areas.



## References

- AS/NZS 1547:2012 *On-site domestic wastewater management*  
*On-site sewerage management for single households* (Anon, 1998)  
Hird, C. (1991). *Soil Landscapes of the Goulburn 1:250 000 Sheet*

## SITE CHARACTERISTICS

The terrain of the site comprises a gently inclined mid slope of 3-5 degrees overlying Wyangala granodiorite. The slope across the proposed irrigation area has a linear divergent configuration ensuring that runoff does not concentrate within the site. The soil at the site is an imperfectly drained Kurosol within the Wyangala soil landscape. It comprises sandy loam then fine sandy clay loam topsoil horizons to 8cm and 25cm respectively, overlying a medium clay subsoil to 70cm. Weathered granodiorite underlies the soil profile.





## SITE EVALUATOR

**Company Name** Land Capability Services  
**ph:** 0417 694 638  
**email:** [rgmiller@me.com](mailto:rgmiller@me.com)  
**Date of assessment** October 2, 2024

**Signature of evaluator**



## SITE INFORMATION

**Address** Proposed Lot 2 in Lot 1 DP1114409 &  
Lot 12 DP1043697  
424 Beralston Road, Gundaroo NSW 2620

**Council area** Yass Valley

**Owner/developer** Titterton

**Area:** 20 ha

**Site plan attached** Yes

**Photograph attached** Yes

**Intended water supply** Rainwater

**Expected wastewater quantity (litres/day)** 720  
(Assumed 5-bedroom dwelling, potentially housing 6 occupants generating design flows of 120L/person/day = 720 litres/day)

**Local experience** Aerated wastewater treatment systems provide adequate treatment of effluent on appropriate soils.



## SITE ASSESSMENT

**Climate** Warm to hot summers with a high evaporative deficit. Cool to cold winters with a small evaporative deficit

**Where appropriate:**

**Rainfall water balance calculated** Yes  
**Land application area calculated** Yes  
**Wet weather storage area calculation attached** NA

**Flood potential:**

**Land application area above 1 in 20 year flood level** Yes  
**Land application area above 1 in 100 year flood level** Yes  
**Electrical components above 1 in 100 year flood level** Yes

**Exposure** Well exposed with no shade

**Slope** Linear divergent

**Landform** Mid slope

**Run-on** Slight

**Seepage** None

**Erosion Potential** Moderate

**Site Drainage** Imperfectly drained

**Fill** None in application area

**Groundwater:**

**Horizontal distance to groundwater well used for domestic water supply** >250m

**Groundwater vulnerability map referred to** Yass LEP 2013 Sheet CL2\_005

**Vulnerability rating** Not within vulnerability area

**Bores in the area and their purpose** Stock & domestic

**Buffer distance from wastewater management system to:**

**Perennial Watercourses – Gundaroo Creek** >100m

**Dams** >40m

**Drainage lines** >40m

**Boundary of property** >6m

**Driveway** >6m

**Swimming pools** >6m

**Dwelling** >15m

**Is there sufficient land area for:**

**Application system (including buffer distances)** Yes

**Reserve application system (including buffer distances)** Yes

**Surface rocks** Outcropping outside of effluent application area

## SOIL ASSESSMENT

<b>Depth to bedrock or hardpan</b>	70cm
<b>Depth to soil water table</b>	>70cm
<b>Hydraulic loading rate</b>	
<b>Soil structure</b>	Massive to weakly structured topsoil Moderately structured subsoil
<b>Soil texture</b>	Sandy loam to sandy clay loam topsoil Medium clay subsoil
<b>Permeability category</b>	(4) 0.12-0.5m/day in topsoil (6) <0.06m/day in subsoil
<b>Hydraulic loading recommended for irrigation system</b>	1.8mm/day irrigation
<b>Coarse Fragments</b>	20% to 50mm in topsoil None in subsoil
<b>Bulk Density</b>	Estimate 1.5 in topsoil Estimate 1.3 in subsoil
<b>Ph (1:5 Water)</b>	Topsoil 4.8 Subsoil 5.0
<b>Electrical conductivity (dS/m)</b>	Topsoil .03 Subsoil .02
<b>Geology &amp; soil landscape survey</b>	
<b>Presence of discontinuities</b>	None
<b>Presence of fractured rock</b>	None
<b>Soil landscape reference</b>	Wyangala
<b>Dispersiveness</b>	None in topsoil EAT 5(3) None in subsoil EAT 5(2)

## SYSTEM SELECTION

### Consideration of connection to a centralised sewerage system

Nearest feasible connection point >5km

Potential for future connection to centralised sewerage None

Potential for future connection to reticulated water None

### Type of land application system best suited to site:

Surface or subsurface irrigation

#### Reason

Suits site and soil characteristics. Medium clay subsoil unsuited to subsoil dispersal of effluent.

### Type of treatment system best suited to site and application system:

Aerated wastewater treatment system

#### Reason

Superior standard of treatment for site and soil conditions.

## GENERAL COMMENTS

### Are there any specific environmental constraints?

See management prescriptions regarding application of lime to ameliorate strongly acid topsoils.

### Are there any specific health constraints?

None



## MANAGEMENT PRESCRIPTIONS

Aerated wastewater treatment systems treat effluent to an improved, or secondary standard, reducing any impact on groundwater and making available water for landscaping and other purposes. The following prescriptions are site specific and must be strictly adhered to, in order to maximise water and nutrient uptake, and thus minimise runoff and seepage.

The AWTS must be accredited by NSW Health.

An irrigation area of 400 m<sup>2</sup> should be determined within the area shown as suitable in Figure 1. Livestock to be excluded from the site.

The irrigation is to be sown to improved perennial pastures, which once established, should be regularly mown to improve rates of nitrogen uptake.

Lime to be spread over the effluent application area at the rate of 1500kg/ha or approximately 60kg over the 400m<sup>2</sup> area, and thereafter every 3 years.

The treated effluent may be applied by surface irrigation. Surface sprays must be of the large droplet type that do not produce aerosols, and are to be regularly rotated throughout the area to evenly spread hydraulic and nutrient loads.

The treated effluent may also be applied by sub-surface irrigation. Return lines to the tank should be installed to ensure flocculants in the lines can be flushed back to the tank. Pressure compensating dripper heads to be used. Vacuum breakers or air release valves to be installed at highest point in irrigation field, to prevent migration of soil into irrigation lines. Irrigation laterals to be installed on the contour at 100mm depth and at nominal 1000mm spacing. A single disc filter of nominal 100mm diameter (85mm internal) to be installed upstream of irrigation system. Filter to be cleaned at quarterly service intervals.

The distribution line from the AWTS to the effluent irrigation area must be buried at least 300mm underground or 450mm where vehicles pass over.

The irrigation area must not be disturbed by any building activity such as stockpiles of excavated material or vehicle traffic.

Detergents should be selected for low levels of phosphorus and sodium.  
(See appendix 3)

Fig 1. Area suitable for effluent application

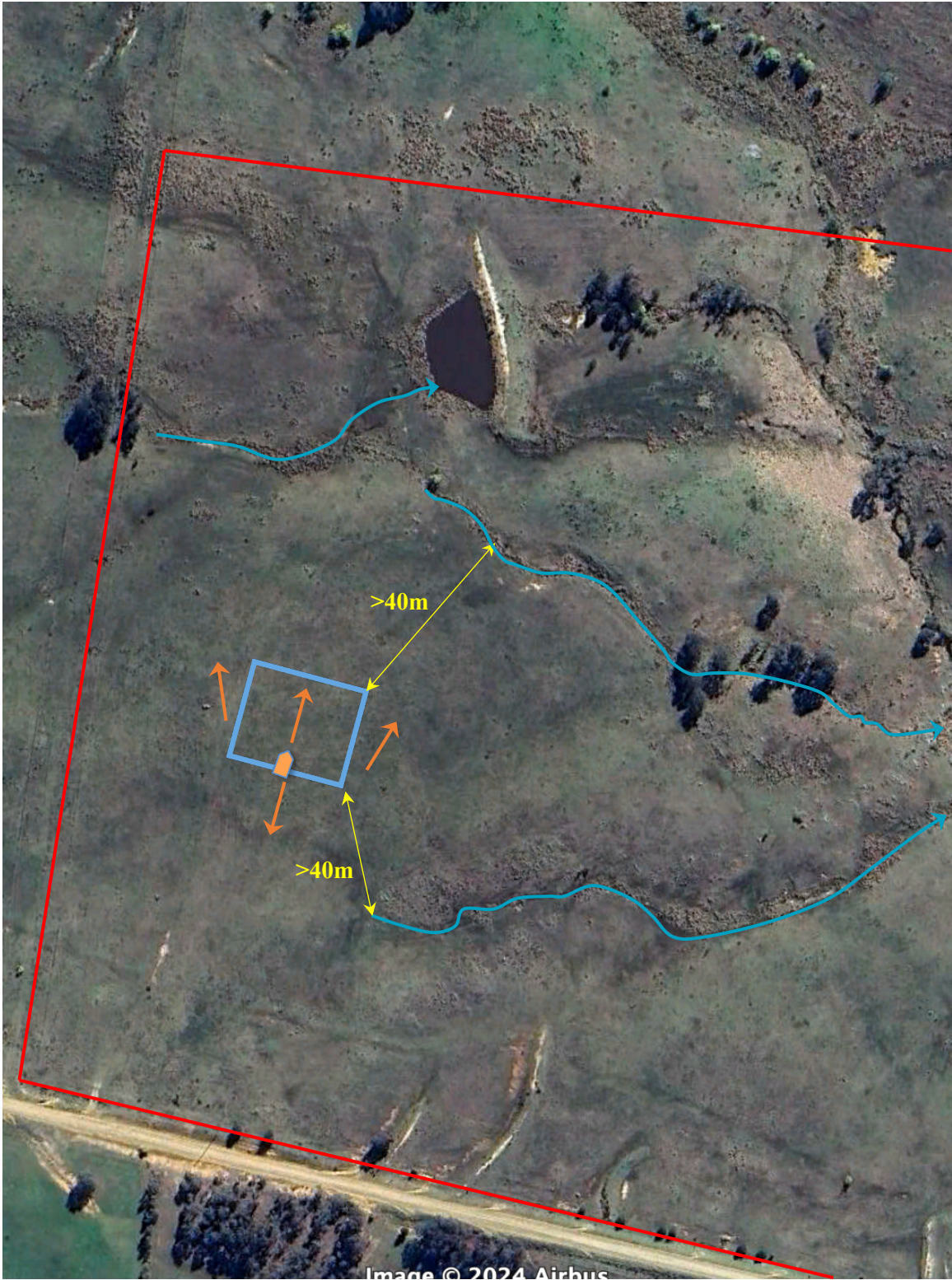




Photo point 

Slope direction 

Drainage line 

## WATER BALANCE

A water balance model is helpful in assessing the sensitivity of the design to various input and output characteristics.

<b>Irrigation area sizing using Nominated Area Water Balance for Zero Storage</b>																
<b>Site Address:</b>		<b>424 Beralston Road, Gundaroo</b>														
<b>Date:</b>				<b>Assessor:</b>												
<b>INPUT DATA</b>																
Design Wastewater Flow	Q	720	L/day	Based on maximum potential occupancy and derived from Table 4 in the EPA Code of Practice (2013)												
Design Irrigation Rate	DIR	3.5	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	400	m <sup>2</sup>													
Crop Factor	C	0.6-0.8	unitless	Estimates evapotranspiration as a fraction of pan evaporation; varies with season and crop type <sup>2</sup>												
Rainfall Runoff Factor	RF	1.0	unitless	Proportion of rainfall that remains onsite and infiltrates, allowing for any runoff												
Mean Monthly Rainfall Data	Yass(Linton Hostel) (070014)			BoM Station and number												
Mean Monthly Pan Evaporation Data	Canberra Airport (070091)			BoM Station and number												
<b>Parameter</b>	<b>Symbol</b>	<b>Formula</b>	<b>Units</b>	<b>Jan</b>	<b>Feb</b>	<b>Mar</b>	<b>Apr</b>	<b>May</b>	<b>Jun</b>	<b>Jul</b>	<b>Aug</b>	<b>Sep</b>	<b>Oct</b>	<b>Nov</b>	<b>Dec</b>	<b>Total</b>
Days in month	D		days	31	28	31	30	31	30	31	31	30	31	30	31	365
Rainfall	R		mm/month	50.3	45.5	46.7	49	49.9	57.9	59.6	59.3	56.8	64.5	56.6	55.8	651.9
Evaporation	E		mm/month	260.4	207.2	176.7	111	68.2	48	52.7	80.6	114	161.2	198	248	1726
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	
<b>OUTPUTS</b>																
Evapotranspiration	ET	ExC	mm/month	208	166	124	78	41	29	32	48	80	129	159	198	1290.73
Percolation	B	DIRxD	mm/month	108.5	98	108.5	105.0	108.5	105.0	108.5	108.5	105.0	108.5	105.0	108.5	1277.5
Outputs		ET+B	mm/month	316.8	263.76	232.2	182.7	149.4	133.8	140.1	156.9	184.8	237.5	263.4	306.9	2568.2
<b>INPUTS</b>																
Retained Rainfall	RR	RxRF	mm/month	50.3	45.5	46.7	49	49.9	57.9	59.6	59.3	56.8	64.5	56.6	55.8	651.9
Applied Effluent	W	(OxD)/L	mm/month	55.8	50.4	55.8	54.0	55.8	54.0	55.8	55.8	54.0	55.8	54.0	55.8	657.0
Inputs		RR+W	mm/month	106.1	95.9	102.5	103.0	105.7	111.9	115.4	115.1	110.8	120.3	110.6	111.6	1308.9
<b>STORAGE CALCULATION</b>																
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	0.0
Storage for the month	S	(RR+W)-(ET+B)	mm/month	-210.7	-167.9	-129.7	-79.7	-43.7	-21.9	-24.7	-41.8	-74.0	-117.2	-152.8	-195.3	
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	0.0
Maximum Storage for Nominated Area	N		mm	0.00												
	V	NxL	L	0												
<b>LAND AREA REQUIRED FOR ZERO STORAGE</b>			m <sup>2</sup>	84	92	120	162	224	285	277	229	169	129	104	89	
<b>MINIMUM AREA REQUIRED FOR ZERO STORAGE:</b>			m <sup>2</sup>	285.0												

Based on a potential quantity of 720 litres/day of wastewater, spread across 400 m<sup>2</sup> of irrigation area, the effluent application rate of 1.8mm/day results in a moisture deficit in all months of the year. Importantly, the deficit is theoretical and it should be noted that saturation is possible at any time following periods of extended wet weather.

The application rate of 1.8mm/day is comparatively conservative, against the rate of 3.5mm/day for a sandy clay loam determined from table M1 from AS1547:2012.

## NUTRIENT BALANCE

The nutrient balance examines the discharge of nitrogen and phosphorus against the capacity of plants and soil to assimilate those nutrients. Excess nutrients may eventually impact upon watercourses via surface run-off or groundwater.

<b>Nitrogen Balance</b>								
<b>Site Address:</b>	<b>424 Beralston Road, Gundaroo</b>							
<b>SUMMARY - LAND APPLICATION AREA REQUIRED BASED NITROGEN BALANCE</b>							<b>350</b>	m <sup>2</sup>
<b>INPUT DATA<sup>1</sup></b>								
<b>Wastewater Loading</b>				<b>Nutrient Crop Uptake</b>				
Hydraulic Load	720	L/day	Crop N Uptake	180	kg/ha/yr	which equals	49.32	mg/m <sup>2</sup> /day
Effluent N Concentration	30	mg/L						
% N Lost to Soil Processes (Geary & Gardner 1996)	0.2	Decimal						
Total N Loss to Soil	4320	mg/day						
Remaining N Load after soil loss	17280	mg/day						
<b>NITROGEN BALANCE BASED ON ANNUAL CROP UPTAKE RATES</b>								
<b>Minimum Area required with zero buffer</b>			<b>Determination of Buffer Zone Size for a Nominated Land Application Area (LAA)</b>					
Nitrogen	350	m <sup>2</sup>	Nominated LAA Size	400	m <sup>2</sup>			
			Predicted N Export from LAA	-0.89	kg/year			
			Minimum Buffer Required for excess nutrient	0	m <sup>2</sup>			

720 litres/day wastewater quantity at 30mg/l total N concentration  
 = 7.9 kg Nitrogen discharged per year, applied over an irrigation area of 400 m<sup>2</sup> = 198 kg/ha/yr.

A mix of existing native and improved grasses should provide a rate of nitrogen uptake of around 180kg/ha/yr at this location.

Total nitrogen loss to soil processes should account for 39kg/ha/yr.

Therefore the discharge of nitrogen should be balanced by plant uptake and soil processes.

### Phosphorus Loading

720 litres/day wastewater quantity at 10 mg/l of P  
 = 2.6 kg P discharged per year, applied over an irrigation area of 400m<sup>2</sup>  
 =65kg/ha/yr.

Native & improved grasses should provide a rate of P uptake of around 20kg/ha/yr.

Balance of 45kg/ha/yr. applied to P sorption capacity of soil;

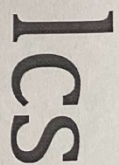
P sorption capacity of in-situ soil 3900kg/ha. <sup>1</sup>

Lifetime of irrigation area 87 years in terms of P sorption capacity.

<sup>1</sup> SCA "Design and Installation of On-site Wastewater Systems", P. Sorption Uptake Values (Typical)



Soil Survey Sheet



Land Capability Services

Date: 9.9.24

Site Address: 424 BERRISTON ROAD, CURDAREE

Client: TITBETON

	Depth	Boundary	Texture	Structure	Colour	Mottles	Coarse Frag	Consistence	Plasticity
A <sub>1</sub>	0-80		Sandy loam	Massive	Dark Yellowish Brown	-	10% to 30%	Slightly Moist Loose	Low
A <sub>2</sub>	80-250	Clear	Fine Sandy Clay loam	Weak	MOISTURE Yellowish Green	-	20% to 50%	Slightly Moist Weak	Moisture
B <sub>2</sub>	250-700	SHED	MEDIUM Clay	MOISTURE	DEEP REDDISH Brown	Clay	-	Moist Firm	Very
C <sub>2</sub>	700+	Gravel	Weathered Rock						

APPENDIX 1: SOIL SURVEY SHEET



## APPENDIX 2: NSW HEALTH ACCREDITED AWTS

<b>AWTS Model</b>	<b>Company/Agent</b>	<b>Contact</b>
Ultra Clear, ST8, ST10	Capital Waterworks	02 6258 1378
Taylex ABS 1500	Clearwater Sewage	0419 229 313
Fuji Clean CE1200, CRX1500,	Septics Filters & Pumps	0429 481 106
ECO PRO	The Tank People	02 6254 6949
Alpha Treat DP10	Alpha Treat Pty Ltd	0409 042 689
BioSeptic Performa, S-Ten	Bioseptic	02 4629 6630
Aqua Advanced	Septics Filters & Pumps	0429 481 106
Garden Master Elite Advanced	Garden Master	02 4932 1011
Ozzi Kleen RP10	Suncoast Waste Water	1800 450 767
Super-Treat SE 10, SB 10	Super-Treat Systems	02 4422 3861
Taylex Poly ABS, ABS, DMS	Clearwater Sewage	0419 229 313
Turbojet Single Advanced	Icon-Septech	1300 557 143
Alpha Treat DP10	EcoWater Qld Pty Ltd	07 3205 3666
Earthsafe SS10	Earthsafe Australia Pty Ltd	1800 043 635
UBI Aqua	Global Tanks	07 4697 7099
Kingspan BioFicient	Kingspan Water & Energy	1300 736 562
Rivatec RWT10	Rivatec Environmental	1300 327 847

## Appendix 3: Important Reading

Phone Office/Lab (02) 6775 1157  
Fax (02) 6775 1043  
ABN: 72 212 385 096  
email: rob@lanfaxlabs.com.au  
Website: <http://www.lanfaxlabs.com.au>  
493 Old Inverell Road  
(P.O. Box W90) Armidale NSW 2350  
Director: Dr Robert Patterson FIEAust, CPSS, CPAg  
Soil Scientists and Environmental Engineers

# Lanfax Laboratories

Performance certified by Aust. Soil & Plant Analysis Council

### LAUNDRY PRODUCTS RESEARCH

Laundry products were purchased by *Lanfax Labs* from supermarkets in Armidale, NSW and a number of boutique products were provided by manufacturers. A total of 41 liquids and 54 powders were tested by mixing each product at the manufacturer's recommended dose for either front loading or top loading automatic washing machines. The dose was calculated at the full cycle load, that is 75 L for front loaders and 150 L for top loaders. The full cycle accounts for the water used in the wash, spin, rinse, deep rinse and spin rinse cycle. The quantities of 75 L for front loaders and 150 L for top loaders were taken from averaged rates for those machines (Patterson, 2004).

Each sample was mixed with cold (20°C) deionised water (to replicate good quality rainwater). Where town water supplies are used, the values reported for sodium concentrations may increase because of sodium in the reticulated water – that will vary from location to location, usually higher in inland than coastal towns. Each sample was shaken for 30 minutes to replicate the washing action.

The concentrations of sodium and phosphorus (and other elements) were measured on the samples using Inductively Coupled Plasma (ICP) technology in accordance with current Good Laboratory Practices at *Lanfax Labs*.

Only sodium (g/wash) and phosphorus (mg/L) are reported in the graphs presented here.

Additional information on this unique research may be obtained at: [www.lanfaxlabs.com.au/laundry.htm](http://www.lanfaxlabs.com.au/laundry.htm)

Other papers on laundry detergents can be found at: [www.lanfaxlabs.com.au/publications.html](http://www.lanfaxlabs.com.au/publications.html)

#### HOW TO READ THE GRAPHS

Each product is represented by two bars: the top bar (if present) shows the phosphorus concentration (mg/L); while the lower bar shows the sodium load (g/wash). The graph is arranged in ranked order of sodium load. Figure F1 is for 54 detergents at the front loader rate, Figure T1 is for 89 detergents at the top loader rate.

#### Sodium Load

For all on-site systems that apply the effluent by surface or subsurface application, the levels of sodium in the discharge are critical to long term absorption. Choose the product with the lowest sodium load (g/wash). Levels above 20 g/wash are likely to be detrimental to plants and the soil although plant tolerance and soil types will vary. The shorter the bar, the lower the load. When in doubt, choose the lower sodium load.

The detergents with long sodium bars (greater than 20 g/wash) should not be thrown onto your favourite garden as the sodium may be detrimental to the plants. High pH (see the website for pH data) is also detrimental to plants and soil. The pH of liquids (average pH 8) is generally lower than pH of powder detergents (average pH 10.5).

#### Phosphorus Concentration

The choice of a suitable level of phosphorus in the greywater (laundry water discharge) will depend upon the soil type and the use of the effluent. In some soils, phosphorus is not a real concern because of the natural ability of the soil to immobilize the phosphorus and limit its leaching from the disposal site. In other soils, phosphorus is likely to build up to high levels and leach from the soil. It is preferable to choose the lower phosphorus values as well as the low sodium values. The load of phosphorus for each product is available in the website data.

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This material may only be reproduced in full (three pages) for educational purposes. None of the graphs should be construed as an endorsement of one product over another, or that one product is superior or inferior to another. The data are presented as measurements of fact, ranked in order of sodium.

*This research was funded by Lanfax Labs and was independent of any manufacturer or other organisation.*

*Caution: Formulations may have changes since these products were purchased in 2005.*

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Soil survey and analytical assessments, landscape analysis and plant nutrient relationships  
Independent research and commercial analytical laboratories. Environmental management consultants

**Figure F1 - FRONT LOADING MACHINE CYCLE**  
**Full wash cycle: Front loader = 75 L**

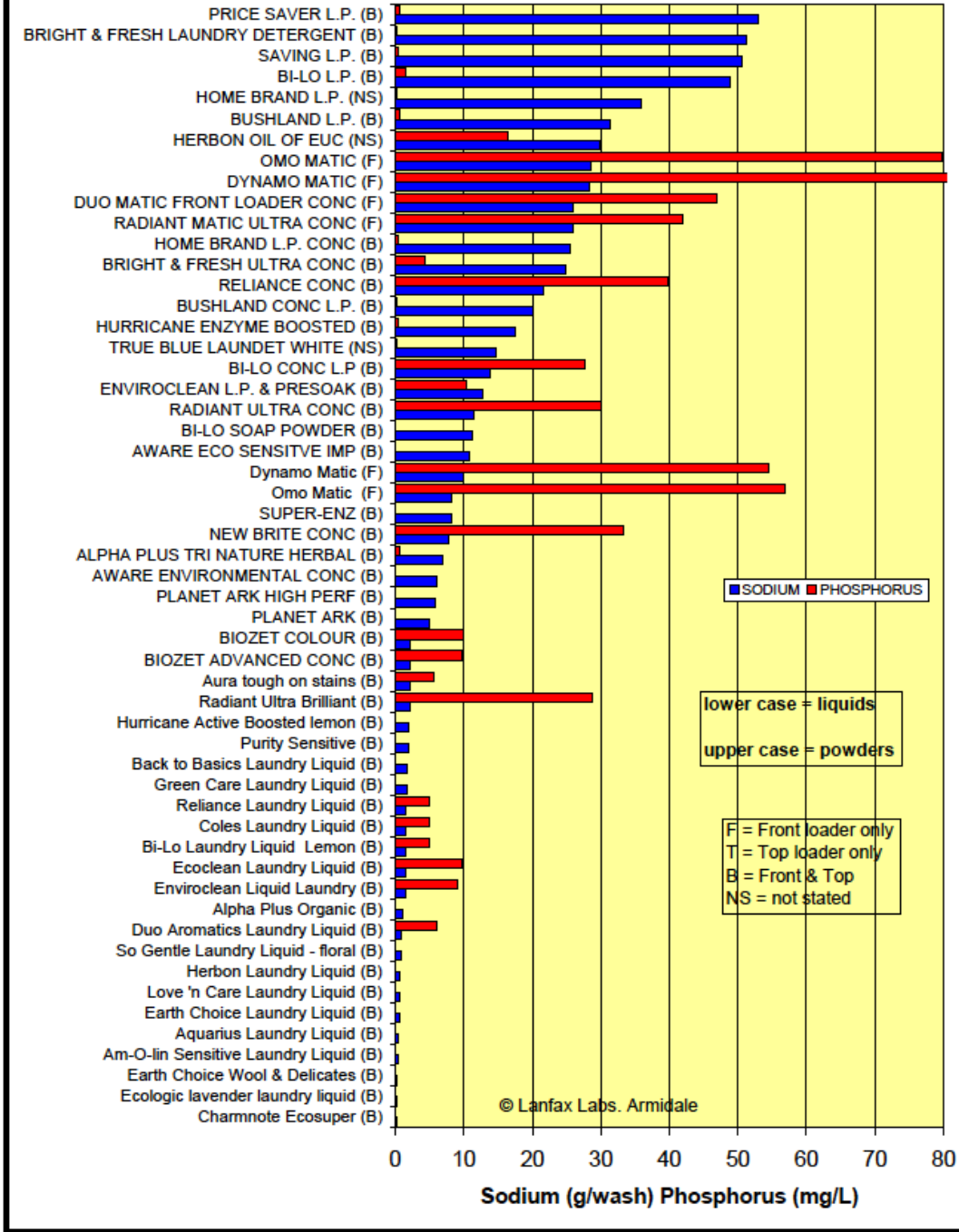
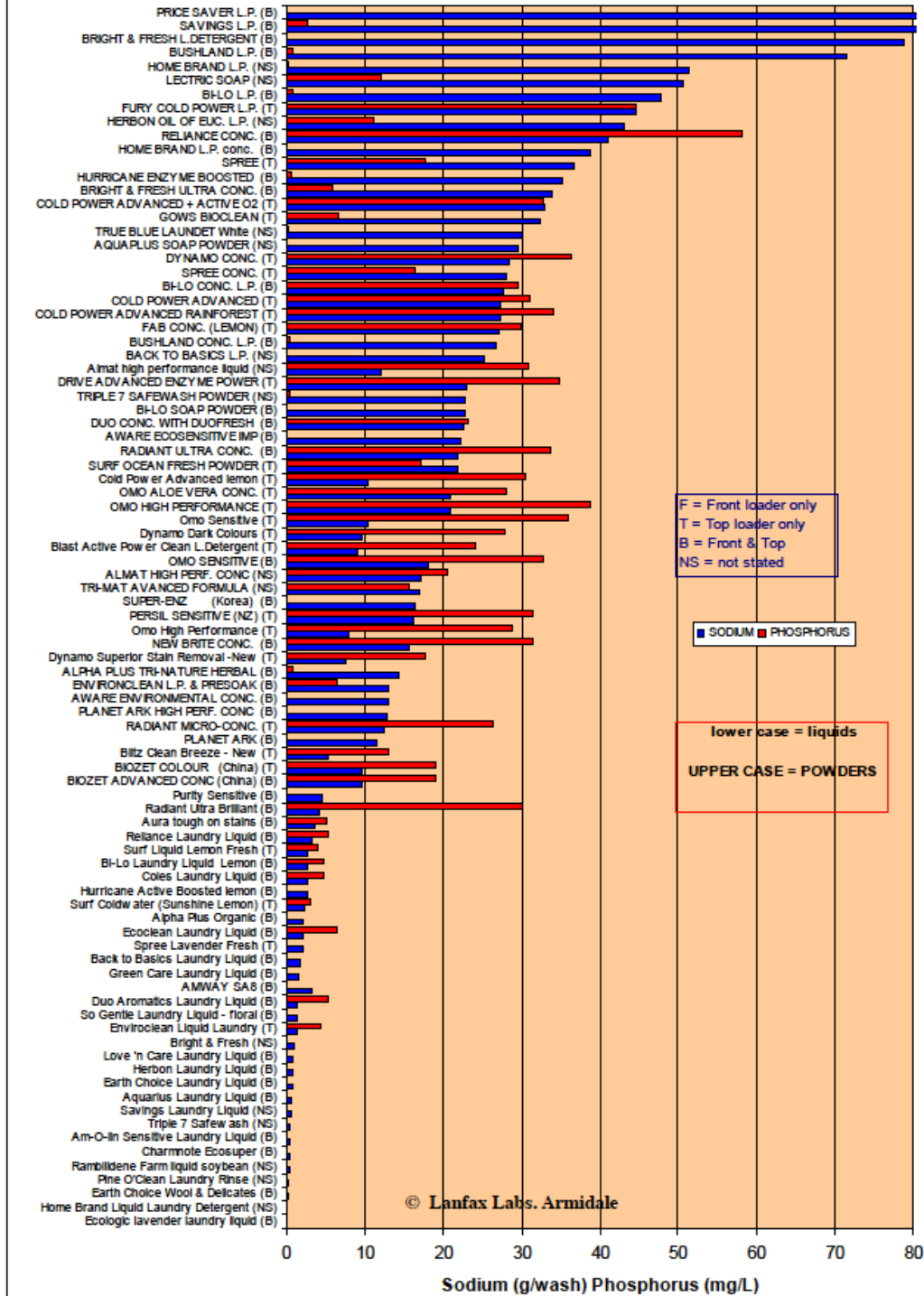


Figure T1 - TOP LOADING MACHINE CYCLE

Full wash cycle: Top loader = 150 L



## NOTES