ONSITE WASTEWATER REPORT

PROPOSED SUBDIVISION AND DWELLING AT 229 OAKENDALE ROAD, GLEN OAK

GSL Environmental
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GSL Environmental
Environmental Consultants

Limitations

This report has been developed based on agreed requirements between the client and GSL Environmental as understood by GSL Environmental at the time of investigation. This report only applies to the subject scope of works undertaken at the subject site. Other interpretations should not be made, including changes of scope or application to other projects. The contents of this report are based on a professional appraisal of the conditions that existed onsite at the time of this investigation. Where a subsurface soil investigation has been undertaken the results are only applicable to the specific sampling locations and the depths undertaken. Because of natural geological variability and possible anthropogenic influences, the subsurface conditions reported can change abruptly. Such changes can also occur after the site investigation has been undertaken. The accuracy of the results provided in this assessment is limited by these possible variations along with limitations by budget constraints imposed by others and by inadequate site accessibility.

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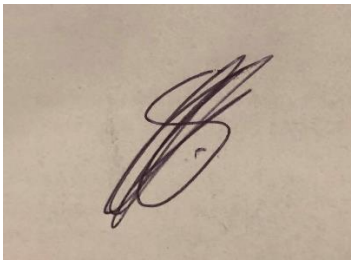

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1. Introduction

GSL Environmental has been commissioned by Narelle Hand to assess the suitability of an on-site sewage management system for the proposed subdivision, proposed dwelling and change of use of farm building to dwelling at 229 Oakendale Road, GLEN OAK NSW. This report will be submitted to Dungog Council in accordance with the relevant details in the 'Dungog Council Onsite Sewage DAF 2015'. Other guiding documents include,

- Australian Standard AS1547: 2012"On-site Domestic Wastewater Management"
- NSW Government Dept. Planning, housing and Infrastructure 2025, Onsite Wastewater Management Guidelines
- Water NSW 2023, "Designing and Installing Onsite Wastewater Systems''

This assessment is required to show that treated wastewater generated by the proposed subdivision, proposed dwelling and change of use of farm building to dwelling can be sustainably managed on the site.

2. Site Description

The subject allotment is irregular in shape and is approximately 117 Ha in size. The proposed development area, existing dwelling, proposed change of use and subject EDAs are located within the mid southern portion of the site. The proposed EDAs are within very gently inclined waning midslope landforms. The closest significant water body, Tumbledown creek meanders through the southern portion of the site. There are a number of farm dams and overland flowpaths traversing the large site.

According to the Dungog 1:100 000 Soil Map the proposed dispersal area onsite is underlain by "Brecon" residual soils. The Brecon Soil Landscape area generally consists of undulating rises to low hills on Carboniferous sediments and ignimbrites of the Paterson Mountains and Clarencetown Hills regions. Slope gradients are generally between 2-10%. Underlying soils mostly consist of brown sandy loams traversing to brown clays.

The proposal is for a two allotment subdivision, plans within appendix B. Proposed allotment 1 has the existing dwelling and proposed dwelling within. Proposed allotment 2 has the change of use structure. The existing septic systems onsite are currently septic to absorption systems. As such the upgrade to secondary level effluent treatment for the entire site is a significant environmental outcome for the site and surrounds.

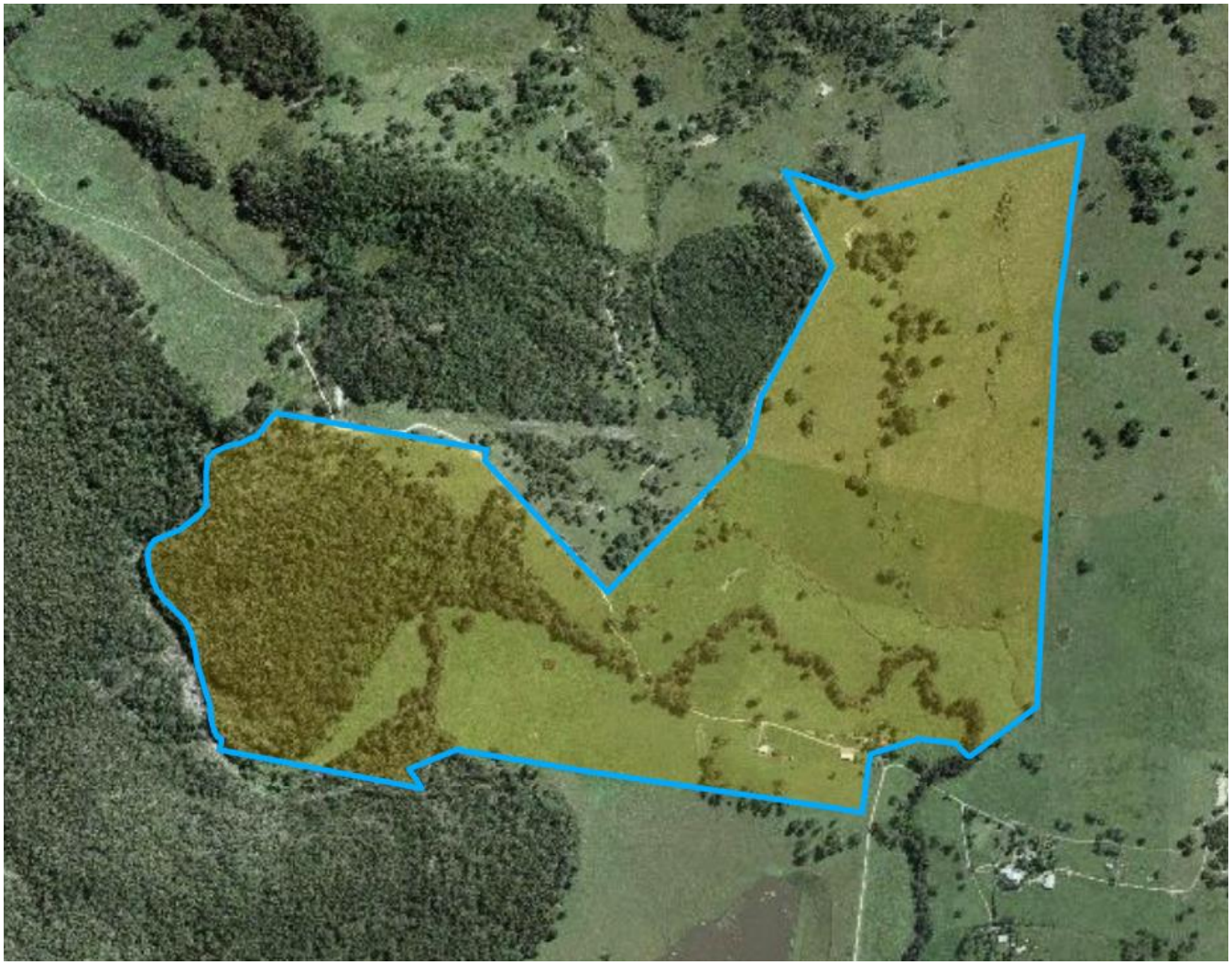


Figure 1: Subject Site, care of six maps showing property boundaries and associated landmarks.

3. Site Information

Site Address: 229 Oakendale Road, GLEN OAK

Water Supply: Tank

Proposed Development: Proposed subdivision, proposed dwelling and change of use of farm building to dwelling

Equivalent Population: Up to 5 persons/day – 3 bedroom – existing dwelling
Up to 4 persons/day – 2 bedroom – proposed dwelling
Up to 5 persons/day – 3 bedroom – existing change of use building

Wastewater Flow Allowance: 120L per person per day

Design Flowrate: 1080L per day – existing and proposed dwelling combined
600L per day – existing change of use building

Proposed Effluent Dispersal Type: Pressure Dosed Absorption

System Design: Aerated Wastewater Treatment Systems

Most restrictive Soil Texture: brown clays

Minimum Dispersal Area: 108m2 - existing and proposed dwelling combined
60m2 - existing change of use building

4. Physical Site Assessment

A site inspection was undertaken on the 8th January 2026. The fieldwork included an assessment of the site's physical parameters as well as hand excavation of boreholes to determine the underlying soil structures. This was undertaken to delineate the most suitable location for the proposed dispersal area. Potential onsite limitations have been investigated and are discussed below.

4.1 Landform

Varying landforms pose differing potential limitations to an effluent dispersal area. Risk of run-on and runoff may be enhanced dependent on the site's landform.

The proposed EDAs are within very gently inclined waning midslope landforms. To limit any potential runoff, spray irrigation has been ruled out. An upslope diversion drain is to be installed above EDAs.

Limitation: **LOW**

4.2 Slope Gradient

Excessive slope within an EDA can potentially lead to effluent leaching away from the EDA.

The proposed EDAs are within very gently inclined waning midslope landforms. The slope within the proposed EDAs is approximately 5%. To limit any potential runoff, spray irrigation has been ruled out. An upslope diversion drain is to be installed above EDA.

Limitation: **LOW**

4.3 Exposure

Providing the EDA with maximum wind and sun exposure is preferable. This will enhance the evapotranspiration properties of the EDA and should add to the life of the EDA.

The proposed EDAs are within an open area with very high levels of exposure.

Limitation: **LOW**

4.4 Flood Potential

All effluent dispersal areas are to be above the 1:20 flood level. In addition all electrical components, vents and inspection holes form the treatment system should be located above the 1:100-year flood

level. Effluent dispersal areas being inundated via flood waters can become a public health issue during times of high rain.

Limitation: **LOW**

4.5 Vegetation

All effluent dispersal areas should be covered with vegetation or mulch-based covers. A vegetated EDA provides the possibility of that area in enhancing nutrient uptake and evapotranspiration. Low vegetation cover can cause effluent runoff and low nutrient and evapotranspiration uptake rates.

A dense cover of grassland vegetation is currently within the proposed EDAs. A dense grassland is to be established and maintained within installed EDAs. The proposed EDAs should be regularly mowed and maintained.

Limitation: **LOW**

4.6 Stormwater Run-on

Stormwater runoff through the EDA has the potential to transport effluent away from the EDA to more sensitive receivers.

There were no visible signs of stormwater entering the proposed EDA. The proposed EDAs are within very gently inclined waning midslope landforms. The slope within the proposed EDAs is approximately 5%. To limit any potential runoff, spray irrigation has been ruled out. An upslope diversion drain is to be installed above EDA.

Limitation: **LOW**

4.7 Site Drainage

Damp and wet areas should be avoided for EDAs. These areas indicate seepage of waters and could become a transport option for effluent if placed in these areas.

Site appears to be well drained with semi-permeable soils. No visible signs of wet/damp areas in the proposed EDAs. The soil profile did not show evidence of water logging.

Limitation: **LOW**

4.8 Erosion Potential

Areas of visible soil movement and erosion should be avoided.

No visible signs of erosion within the EDA. Proposed EDA area is a very gently inclined landform and densely vegetated. A dense grassland is to be established and maintained within installed EDAs.

Limitation: **LOW**

4.9 Evidence of Fill

No evidence of fill was seen onsite or in the excavated boreholes. Soil logs are consistent of the description for underlying soils within the Brecon Soil Areas.

Limitation: **LOW**

4.10 Groundwater Depth

Groundwater not observed in bore holes.

Limitation: **LOW**

4.11 Surface Rock

No surface boulders or rock outcrops were observed within the proposed EDA. Whilst depth was found in boreholes excavated within the proposed EDA, if during installation a “floater” is found it is to be removed from the proposed EDA.

Limitation: **LOW**

4.12 Groundwater Bores

A search of Water’s all groundwater mapping was undertaken to determine the proximity of any bores to the EDA. There are no domestic registered bores within 100m of the proposed EDA

Limitation: **LOW**

4.13 Watercourse Proximity

The closest significant water body, Tumbledown creek meanders through the southern portion of the site. There are a number of farm dams and overland flowpaths traversing the large site. Not all recommended setbacks will be adhered to.

It should be acknowledged that the existing primary treated effluent is also beaching the creek setback. The proposal is to install an AWTS and disperse into existing absorption area. As such the upgrade to secondary level effluent treatment for the entire site is a significant environmental outcome for the site and surrounds. The proposed EDA meets the waterbody setback easily.

Limitation: **MODERATE**

4.14 Stock Present

Stock can cause damage to irrigation systems and must be kept out of the EDA by fencing or other physical barrier.

4.15 Buffer Distances

All required buffer distances within AS1547:2012 can be achieved with setback discussion. All buffer distances within the NSW Government Dept. Planning, housing and Infrastructure 2025, "Onsite Wastewater Management Guidelines" can be achieved with setback discussion.

Buffer distances from the EDA are required to minimise risk to public health, maintain public amenity and protect sensitive environments. Table below from NSW Government Dept. Planning, housing and Infrastructure 2025, "Onsite Wastewater Management Guidelines"

Table 4–2. Appropriate buffer ranges for sensitive receptors – horizontal separation

Sensitive receptor	Buffer range (m)
Property boundaries[1]	1.5 to 15
Buildings	2 to 6
Retaining walls, embankments and cuttings	3 or 45° angle from toe of wall (whichever is the greater)
Drives, paths and walkways	1.5 to 6
Swimming pools, recreational areas,[2] market gardens	3 to 15
In-ground water tanks and services (water, electrical, telecommunications and plumbing)	3 to 15
Permanent surface water bodies[3]	50 to 100
Intermittent water bodies, farm dams, roadside drainage, drainage depressions, stormwater systems[3]	15 to 40
Bores and wells[3 4]	15 to 100

Table 4–3. Appropriate buffer ranges for sensitive receptors – vertical separation

Sensitive receptor	Buffer range (m)
Groundwater	0.6 to 1.5
Bedrock and hardpans	0.6 to 1.5

Limitation: **MODERATE**

A viral dieoff calculation was undertaken with 2.9m being the calculated distance.

It should be acknowledged that the existing primary treated effluent is also beaching the creek setback. The proposal is to install an AWTS and disperse into existing absorption area. As such the upgrade to secondary level effluent treatment for the entire site is a significant environmental outcome for the site and surrounds. The proposed EDA meets the waterbody setback easily.

Proposed Tumbledown Creek setback: 66m

As per table R1 of AS1547:2012 a risk assessment utilizing table R2 AS1547:2012 is to be undertaken for reduced setback proposals. For surface water site constraint items of specific concern from table R2 – A, B, D, E, F, G, J were discussed.

The following is the discussion utilizing Table R2 from AS1547:2012.

Item	Site/system Feature	Comment	Constraint Rating
A	Microbial Quality of effluent	Secondary Effluent	**LOW**
B	Surface Water	Tumbledown Creek 66m away	**MODERATE**
D	Slope	Very Gently Inclined	**LOW**
E	Position of land Application	Best position onsite in regards to all onsite wastewater parameters as a whole	**LOW**
F	Drainage	Category 1 and 2 soils within the topsoil's	**LOW**
G	Flood Potential	Above the 1:20 Flood Level	**LOW**
J	Application Method	Subsurface Absorption	**LOW**

With the majority of the constraints being on the lower end the R2 table suggests that the proposed subsurface absorption in the proposed area is in a Low constraint area.

Furthermore a viral die-off calculation was conducted and presented within Appendix F. The calculations suggest that within 2.9m of any effluent leaving the proposed EDA viral die-off will occur.

Figure 2: Proposed EDA for existing and proposed dwelling combined .

Figure 3: Proposed EDA for existing change of use building.

5. Onsite Soil Assessment

During the site inspection 4 boreholes were hand excavated with a 100mm auger within the proposed EDA. The following are the results from the excavation. The auger holes were used to determine the underlying soil properties. No groundwater was observed in the excavated boreholes.

According to the Dungog 1:100 000 Soil Map the proposed dispersal area onsite is underlain by "Brecon" residual soils. The Brecon Soil Landscape area generally consists of undulating rises to low hills on Carboniferous sediments and ignimbrites of the Paterson Mountains and Clarencetown Hills regions. Slope gradients are generally between 2-10%. Underlying soils mostly consist of brown sandy loams traversing to brown clays.

Borehole 1

0 – 250mm – brown sandy loams,
250 – 1000mm – brown clays,

Figure 4: Borehole 1 excavated onsite

Borehole 2

0 – 300mm – brown sandy loams,
300 – 1000mm – brown clays,

Borehole 3

0 – 300mm – brown sandy loams,
300 – 1000mm – brown clays,

Figure 5: Borehole 3 excavated onsite

Borehole 4

0 – 250mm – brown sandy loams,
250 – 1000mm – brown clays,

An insitu probe, tested the soil layers for pH and EC, results as below.

Ph and EC

Borehole 1

Depth	pH	EC_e (µS/cm)
0 – 250mm	6.2	1390
250 – 1000mm	5.7	2287

Borehole 2

Depth	pH	EC_e (µS/cm)
0 – 300mm	6.0	992
300 – 1000mm	5.6	1542

Borehole 3

Depth	pH	EC_e (µS/cm)
0 – 300mm	5.8	1411
300 – 1000mm	5.6	1999

Borehole 4

Depth	pH	EC_e (µS/cm)
0 – 250mm	5.9	1028
250 – 1000mm	5.5	2201

The pH of a soil influences its ability to supply nutrients to vegetation. If the soil is too acidic vegetative growth is inhibited. The electrical conductivity of the soil relates to the amount of salts present. A high salt concentration inhibits vegetative growth.

The electrical conductivity of the soils is less than 4 dS/m. This will not inhibit vegetative growth. The pH of the soil is between 5.5 and 6.2. A regular application of lime and gypsum is recommended to maintain healthy vegetation growth.

A Sample was sent to ALS Australia, a NATA accredited laboratory to determine the insitu reliability as well as the testing of further parameters. Results below and in appendix.

The sample tested at the laboratory was from borehole 1, 0-250mm and borehole 3 0-300mm.

Coarse fragments

Coarse fragments are those over 2 mm in diameter. They can pose limitations to vegetative growth by lowering the soil's ability to supply water and nutrients.

<2% course fragment was observed within the excavated soils onsite. There were some peds which could be crushed easily using fingers.

Limitation: **LOW**

Exchangeable Sodium Percentage

The exchangeable sodium percentage (ESP) measures the proportion of cation exchange sites occupied by sodium. Soils are considered sodic when the ESP is greater than 6, and highly sodic when the ESP is greater than 15.

TP1 ESP 4.8%, suggesting non sodic soils within the proposed EDA.
TP3 ESP 1.7%, suggesting non sodic soils within the proposed EDA.

Cation Exchange Capacity

Cation exchange capacity (CEC) is a measure of the soil's ability to hold positively charged ions. It is a very important soil property influencing soil structure stability, nutrient availability, soil pH and the soil's reaction to fertilisers and other ameliorants. A figure above 15 meq/100g is preferred for plant production. You can improve CEC in weathered soils by adding lime and raising the pH.

TP1 CEC = 12.0 meq/100g
TP3 CEC = 8.7 meq/100g

Once EDA is installed an annual maintenance application rate of the following is to be implemented.

Lime 0.5kg/m2 – Subject site calculation = A minimum 30kg across the proposed 60m2 EDAs.
Gypsum 0.5kg/m2 – Subject site calculation = A Minimum 30kg across the proposed 60m2 EDAs.

Lime 0.5kg/m2 – Subject site calculation = A minimum 54kg across the proposed 108m2 EDAs.
Gypsum 0.5kg/m2 – Subject site calculation = A Minimum 54kg across the proposed 108m2 EDAs.

Phosphorus Sorption Index

The capacity of a soil to adsorb phosphorus is expressed as its phosphorus sorption capacity.

TP1 P sorb = 988mg P sorbed/kg – laboratory
TP3 P sorb = 1070mg P sorbed/kg - laboratory
P sorb = 400mg P sorbed/kg – given figure within literature for clay loam soils

For nutrient balance calculations the lesser of value above is to be utilized.

Emerson Aggregate Test

The combination of slaking and dispersion caused a reduction in macroporosity and, therefore, lower infiltration rates and hydraulic conductivities as well as an increase in soil strength and other undesirable soil physical properties. This test classifies the behavior of soil aggregates, when immersed, on their coherence in water. This test was competed inhouse. Soils are divided into seven classes on the basis of their coherence in water, with one further class being distinguished by the presence of calcium-rich minerals.

EAT Class = 2(2). Some slight dispersion potential within underlying soils.

6. System Design/Selection

Effluent should be treated to a secondary level followed by subsurface dispersal. A number of dispersal options could be considered, subsurface irrigation, pressure dosed absorption bed and mounds. Pressure dosed absorption bed was the dispersal method recommended and designed. Subsurface irrigation reduces the chance of human contact with the effluent and significantly reduces any potential public health risk.

Proposed Treatment Node

The proposal is to install NSW Health accredited AWTS systems onsite. An Aerated Wastewater Treatment System (AWTS) uses aerobic treatment to promote oxidation and microbiological consumption of organic matter by bacteria through facilitated biological processes.

Proposed Effluent Dispersal

The proposed effluent dispersal is to be via pressure-dosed absorption beds. Absorption beds can be used to manage secondary treated effluent, in which case higher loading rates are acceptable, as outlined in 'AS/NZS 1547:2012 On-site Domestic Wastewater Management'. Absorption trenches or beds used together with secondary treated effluent are generally small footprint systems. They are often used where there is limited space available for effluent disposal or a small effluent footprint is desired.

Moderately Structured Clays: flowrate of 10mm/day, AS1547:2012

Proposed and Existing Dwelling

Total flowrate dispersing into adsorption beds 1080L/day.

Area of bed(s): 1080/10 = 108m2

Continued use of approx. 300m absorption area.

Existing Change of Use Building

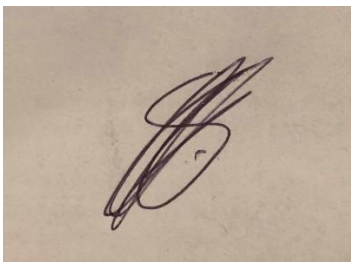
Total flowrate dispersing into adsorption beds 600L/day.

Area of bed(s): 600/10 = 60m2

Installation of a 60m2 pressure dosed bed(s) as per AS1547:2012 and the Water NSW schematic within appendix E.

7. Recommendations

- Installation of a NSW Health accredited AWTS system onsite to treat the calculated flowrate of 1080L/day for the proposed and existing dwelling.
- Installation of a NSW Health accredited AWTS system onsite to treat the calculated flowrate of 600L/day for the change of use to dwelling building.
- Continued use of existing 300m2 absorption area for the proposed and existing dwelling.
- Installation of a 60m2 pressure dosed bed(s) as per AS1547:2012 and the Water NSW schematic within appendix E for the change of use to dwelling building.
- Decommission existing septic's.
- Maintain a dense grassland within the EDA once installed.
- Stock must be kept out of the EDA by fencing or other physical barrier.
- This design assumes at least three-star rated plumbing fixtures are used in any new development.



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Appendix A – Site Plans


60m2 Pressure Dosed Absorption
20000
3000
X1
X2
Proposed AWTS (Approx Position Only)
Change of use to Dwelling
Proposed AWTS (Approx Position Only)
Proposed Dwelling
Shed
Existing Dwelling
X3
X4
Existing 300m2 Absorption Area
Tumbledown Creek
Tumbledown Creek
Tumbledown Creek
N


71000
60m2 Pressure
Dosed Absorption
20000
×2
×1
3000
Proposed AWTS
(Approx Position Only)
42000
Change of use
to Dwelling


Proposed AWTS
(Approx Position Only)
Proposed
Dwelling
Shed
Existing
Dwelling
×3
Existing 300m2
Absorption Area
×4


4000m2 Available EDA
4000m2 Available EDA
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Appendix B – Proposed Plans

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PROJECT: **PROPOSED NEW DWELLING AT, 229 OAKENDALE RD, GLEN OAK 2320**

CLIENT: **PERCEPTION PLANNING**

TITLE: **TITLE PAGE**

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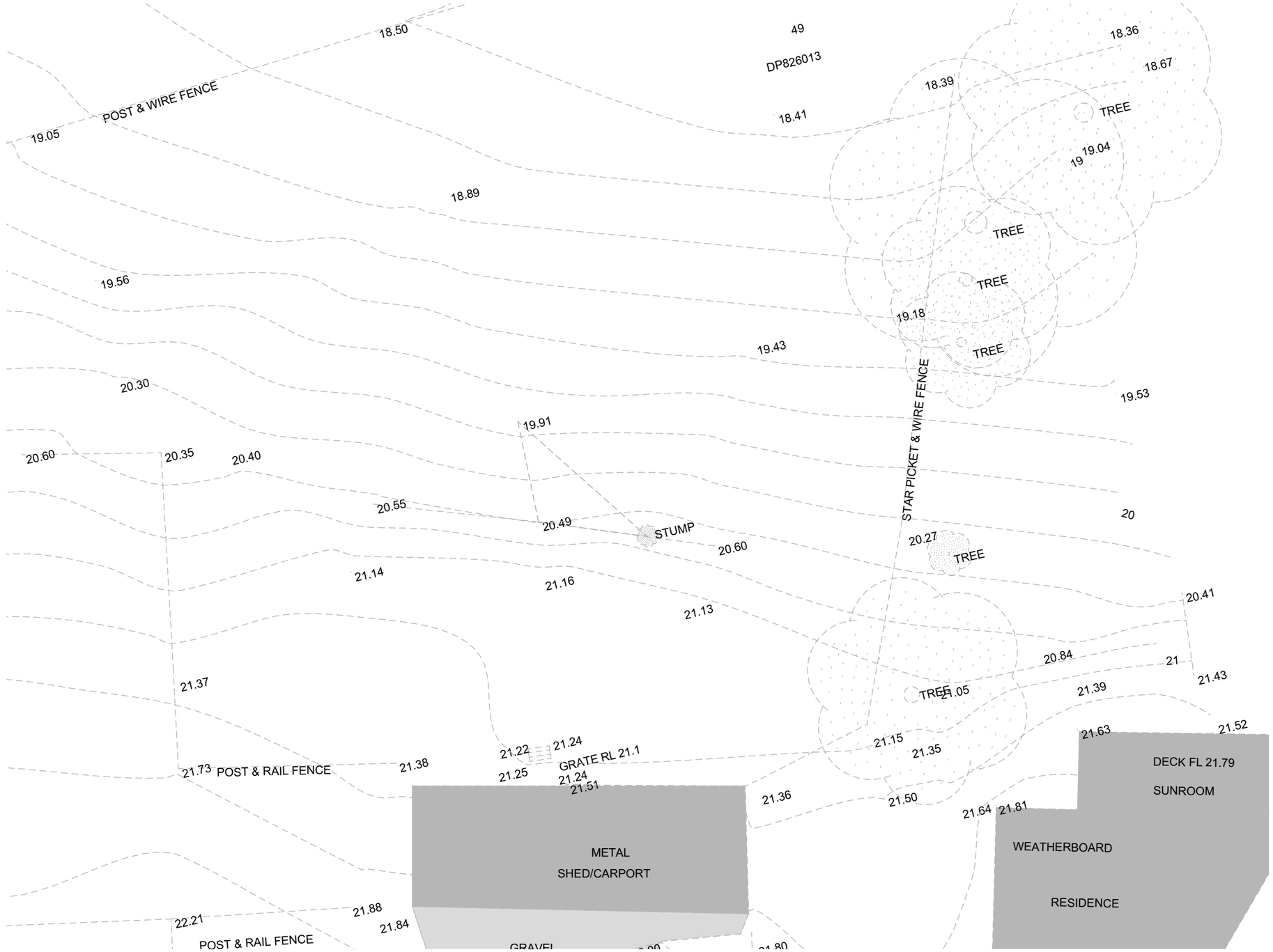

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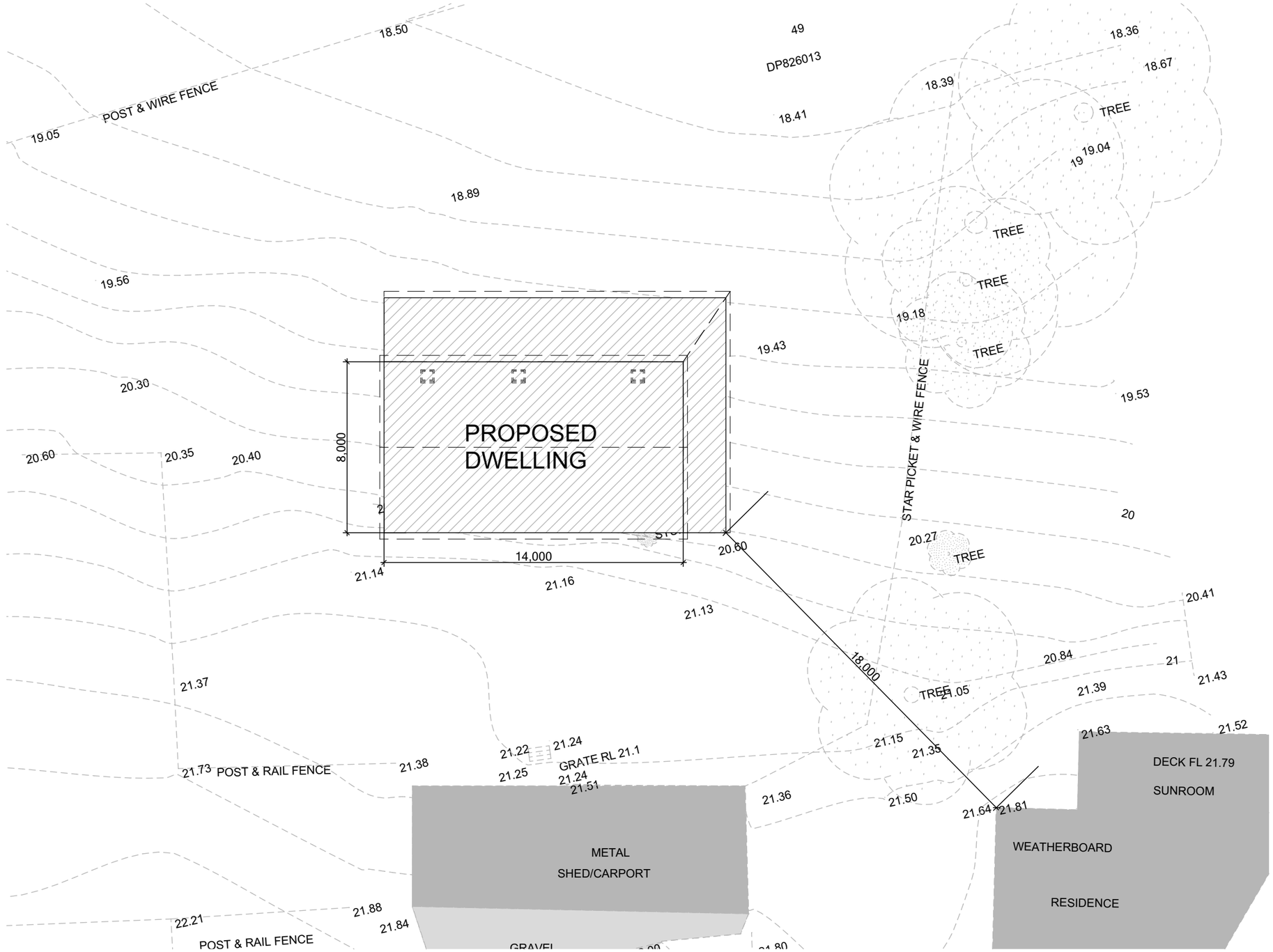

SITE PLAN

1:200

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LEGEND

AW	AWNING WINDOW
BFD	BI-FOLD DOOR
DH	DOUBLE-HUNG WINDOW
DP	DOWNPIPE
CONC	CONCRETE
CPT	CARPET
CW	CASEMENT WINDOW
CSD	CAVITY SLIDING DOOR
FG	FIXED GLASS
f.w.	FLOOR WASTE
GB	GLASS BLOCKS
HWS	HOT WATER SYSTEM
LV	LOUVRE WINDOW
PLD	PANEL LIFT DOOR
REF	REFRIGERATOR
RD	ROLLER DOOR
SH	SHOWER
SD	SLIDING DOOR
SW	SLIDING WINDOW
S.D.	SMOKE DETECTOR
VA	VANITY BASIN
WM	WASHING MACHINE
WC	WATER CLOSET

LEGEND

- FLOOR/DECK LINE OVER
- ROOFLINE OVER
- EXISTING WALLS
- PROPOSED WALLS

[redacted]

N

GROUND FLOOR MODIFIED

1:100

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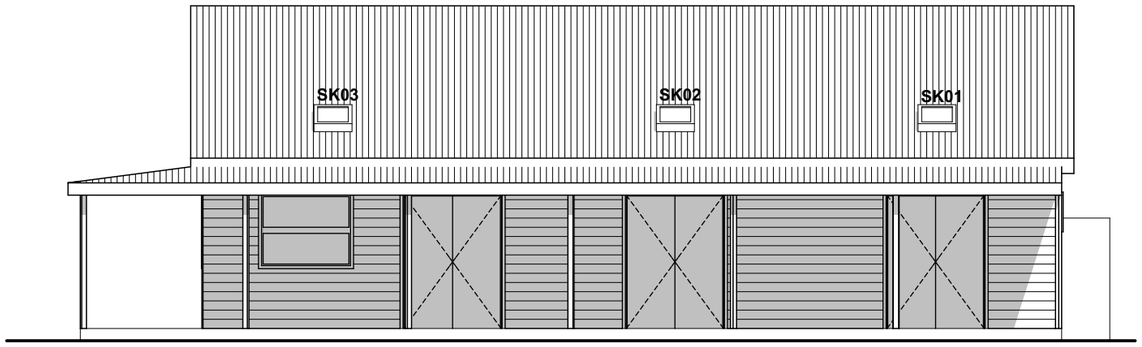
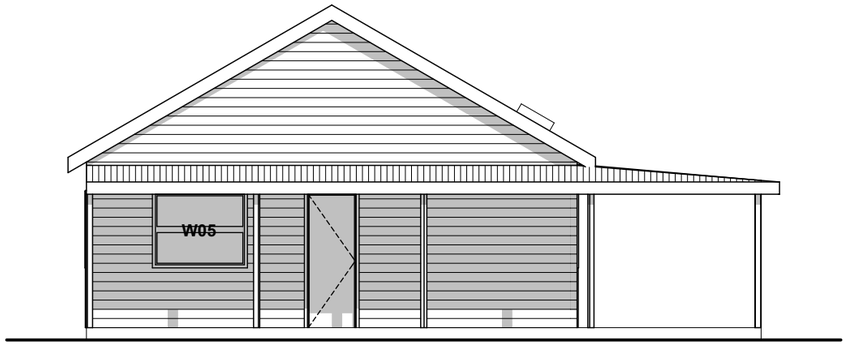


NORTH ELEVATION
1:100



EAST ELEVATION
1:100

MATERIALS LEGEND

- ROOF - COLORBOND 'CUSTOM ORB' METAL ROOF SHEETING
- SELECT HORIZONTAL JAMES HARDIE CLADDING
- WINDOWS AND DOORS - ALUMINIUM FRAMED
- COLORBOND 'QUAD' GUTTER & FASCIA

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PROJECT: **PROPOSED NEW DWELLING AT, 229 OAKENDALE RD, GLEN OAK 2320**

CLIENT: **PERCEPTION PLANNING**

TITLE: **NORTH & EAST ELEVATIONS**

FILE: **2503787** DATE: **12/11/2025** SHEET: **5** OF **8**

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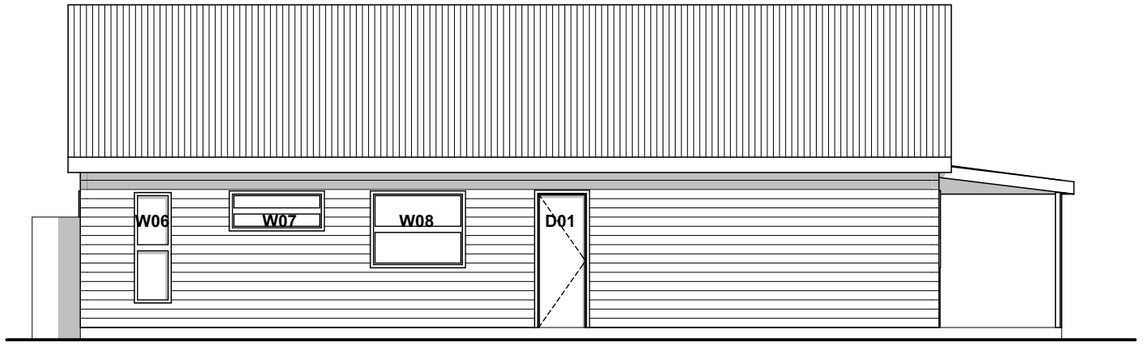

SOUTH ELEVATION
1:100

WEST ELEVATION
1:100

MATERIALS LEGEND

- ROOF - COLORBOND 'CUSTOM ORB' METAL ROOF SHEETING
- SELECT HORIZONTAL JAMES HARDIE CLADDING
- WINDOWS AND DOORS - ALUMINIUM FRAMED
- COLORBOND 'QUAD' GUTTER & FASCIA

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PROJECT: **PROPOSED NEW DWELLING AT, 229 OAKENDALE RD, GLEN OAK 2320**
CLIENT: **PERCEPTION PLANNING**
TITLE: **SOUTH & WEST ELEVATIONS**
FILE **2503787** DATE: **12/11/2025** SHEET: **6** OF **8**

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PROJECT: **PROPOSED NEW DWELLING AT, 229 OAKENDALE RD, GLEN OAK 2320**

CLIENT: **PERCEPTION PLANNING**

TITLE: **SECTION A-A**

FILE **2503787** DATE: **12/11/2025** SHEET: **7** OF **8**

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BASIX™ Certificate

Building Sustainability Index
www.planningportal.nsw.gov.au/development-and-assessment/basix

Single Dwelling

Certificate number: 1799212S

This certificate confirms that the proposed development will meet the NSW government's requirements for sustainability, if it is built in accordance with the commitments set out below. Terms used in this certificate, or in the commitments, have the meaning given by the document entitled "BASIX Definitions" dated 10/09/2020 published by the Department. This document is available at www.planningportal.nsw.gov.au/definitions

Secretary
Date of issue: Tuesday, 10 June 2025
To be valid, this certificate must be submitted with a development application or lodged with a complying development certificate application within 3 months of the date of issue.

Project summary	
Project name	229 Oakendale Road GLEN OAK 2320
Street address	229 OAKENDALE Road GLEN OAK 2320
Local Government Area	Dungog Shire Council
Plan type and plan number	Deposited Plan DP826013
Lot no.	49
Section no.	-
Project type	dwelling house (detached) - secondary dwelling
No. of bedrooms	2

Project score		
Water	✔ 45	Target 40
Thermal Performance	✔ Pass	Target Pass
Energy	✔ 74	Target 66
Materials	✔ 29	Target n/a

Certificate Prepared by
Name / Company Name: clockwork consulting
ABN (if applicable):

Description of project

Project address	
Project name	229 Oakendale Road GLEN OAK 2320
Street address	229 OAKENDALE Road GLEN OAK 2320
Local Government Area	Dungog Shire Council
Plan type and plan number	Deposited Plan DP826013
Lot no.	49
Section no.	-
Project type	
Project type	dwelling house (detached) - secondary dwelling
No. of bedrooms	2
Site details	
Site area (m²)	1147800
Roof area (m²)	112
Conditioned floor area (m²)	91.78
Unconditioned floor area (m²)	11.18
Total area of garden and lawn (m²)	100
Roof area of the existing dwelling (m²)	200
Number of bedrooms in the existing dwelling	4

Assessor details and thermal loads	
NatHERS assessor number	n/a
NatHERS certificate number	n/a
Climate zone	n/a
Area adjusted cooling load (MJ/m².year)	n/a
Area adjusted heating load (MJ/m².year)	n/a

Project score		
Water	✔ 45	Target 40
Thermal Performance	✔ Pass	Target Pass
Energy	✔ 74	Target 66
Materials	✔ 29	Target n/a

Schedule of BASIX commitments

The commitments set out below regulate how the proposed development is to be carried out. It is a condition of any development consent granted, or complying development certificate issued, for the proposed development, that BASIX commitments be complied with.

Water Commitments	Show on DA plans	Show on CC/CDC plans & specs	Certifier check
Landscape			
The applicant must plant indigenous or low water use species of vegetation throughout 30 square metres of the site.	✔	✔	
Fixtures			
The applicant must install showerheads with a minimum rating of 4 star (> 6 but <= 7.5 L/min plus spray force and/or coverage tests) in all showers in the development.		✔	✔
The applicant must install a toilet flushing system with a minimum rating of 5 star in each toilet in the development.		✔	✔
The applicant must install taps with a minimum rating of 5 star in the kitchen in the development.		✔	
The applicant must install basin taps with a minimum rating of 5 star in each bathroom in the development.		✔	
Alternative water			
Rainwater tank			
The applicant must install a rainwater tank of at least 2500 litres on the site. This rainwater tank must meet, and be installed in accordance with, the requirements of all applicable regulatory authorities.	✔	✔	✔
The applicant must configure the rainwater tank to collect rain runoff from at least 100 square metres of the roof area of the development (excluding the area of the roof which drains to any stormwater tank or private dam).		✔	✔
The applicant must connect the rainwater tank to:			
• all toilets in the development		✔	✔
• the cold water tap that supplies each clothes washer in the development		✔	✔

Water Commitments	Show on DA plans	Show on CC/CDC plans & specs	Certifier check
• at least one outdoor tap in the development (Note: NSW Health does not recommend that rainwater be used for human consumption in areas with potable water supply.)		✔	✔

Thermal Performance and Materials commitments	Show on DA plans	Show on CC/CDC plans & specs	Certifier check
Do-it-yourself Method			
General features			
The dwelling must be a Class 1 dwelling according to the National Construction Code, and must not have more than 2 storeys.	✔	✔	✔
The conditioned floor area of the dwelling must not exceed 300 square metres.	✔	✔	✔
The dwelling must not contain open mezzanine area exceeding 25 square metres.	✔	✔	✔
The dwelling must not contain third level habitable attic room.	✔	✔	✔
Floor, walls and ceiling/roof			
The applicant must construct the floor(s), walls, and ceiling/roof of the dwelling in accordance with the specifications listed in the table below.	✔	✔	✔
The applicant must adopt one of the options listed in the tables below to address thermal bridging in metal framed floor(s), walls and ceiling/roof of the dwelling.	✔	✔	✔
The applicant must show through receipts that the materials purchased for construction are consistent with the specifications listed in the tables below.			✔

Construction	Area - m²	Additional insulation required	Options to address thermal bridging	Other specifications
floor - suspended floor above enclosed subfloor, particle board; frame: laminated veneer lumber (LVL).	112	3 (or 3.7 including construction) (down);fibreglass batts or roll	nil	subfloor wall insulation: >R1.0
external wall: framed (fibre cement sheet or boards); frame: timber - H2 treated softwood.	all external walls	3.00 (or 3.50 including construction);fibreglass batts or roll + reflective foil in the cavity	nil	wall colour: Medium (solar absorptance 0.48-0.7)
internal wall: plasterboard; frame: timber - H2 treated softwood.	80	none	nil	

Construction	Area - m²	Additional insulation required	Options to address thermal bridging	Other specifications
ceiling and roof - flat ceiling / pitched roof, framed - metal roof, timber - H2 treated softwood.	112	ceiling: 4.5 (up), roof: foil backed blanket (with anti-glare); ceiling: rockwool batts, roll or pump-in; roof: foil backed blanket.	nil	roof space ventilation: wind-driven ventilator(s) + eave vents; roof colour: medium (solar absorptance 0.48-0.59); ceiling area fully insulated

Note	• Insulation specified in this Certificate must be installed in accordance with the ABCB Housing Provisions (Part 13.2.2) of the National Construction Code.
Note	• If the additional ceiling insulation listed in the table above is greater than R3.0, refer to the ABCB Housing Provisions (Part 13.2.3 (6)) of the National Construction Code.
Note	• In some climate zones, insulation should be installed with due consideration of condensation and associated interaction with adjoining building materials.
Note	• Thermal breaks must be installed in metal framed walls and applicable roofs in accordance with the ABCB Housing Provisions of the National Construction Code.

Thermal Performance and Materials commitments	Show on DA plans	Show on CC/CDC plans & specs	Certifier check
Ceiling fans			
The applicant must install at least one ceiling fan in at least one daytime habitable space, such as living room.	✔	✔	✔
The applicant must install at least one ceiling fan in each bedroom.	✔	✔	✔
• The minimum number and diameter of ceiling fans in a daytime habitable space must be installed in accordance with the ABCB Housing Provisions (Part 13.5.2) of the National Construction Code .	✔	✔	✔

Thermal Performance and Materials commitments	Show on DA plans	Show on CC/CDC plans & specs	Certifier check
Glazed windows, doors and skylights			
The applicant must install the windows, glazed doors and shading devices described in the table below, in accordance with the specifications listed in the table. Relevant overshadowing specifications must be satisfied for each glazed window and door.	✔	✔	✔
The dwelling may have 1 skylight (<0.7 square metres) which is not listed in the table.	✔	✔	✔
The following requirements must also be satisfied in relation to each window and glazed door:	✔	✔	✔
• The applicant must install windows and glazed doors in accordance with the height and width, frame and glazing types listed in the table.	✔	✔	✔
• Each window and glazed door must have a U- value no greater than that listed and a Solar Heat Gain Coefficient (SHGC) within the range listed. Total system U values and SHGC must be calculated in accordance with National Fenestration Rating Council (NFRC) conditions.		✔	✔
The applicant must install the skylights described in the table below, in accordance with the specifications listed in the table. Total skylight area must not exceed 3 square metres (the 3 square metre limit does not include the optional additional skylight of less than 0.7 square metres that does not have to be listed in the table).	✔	✔	✔

Skylight no.	Maximum area (m²)	Skylight specification	Shading device
S01	1.00	aluminium, double clear (U: <=4.2, SHGC: 0.68 - 0.76)	adjustable awning or blind
S02	1.00	aluminium, double clear (U: <=4.2, SHGC: 0.68 - 0.76)	adjustable awning or blind
S03	1.00	aluminium, double clear (U: <=4.2, SHGC: 0.68 - 0.76)	adjustable awning or blind

Glazed window/door no.	Maximum height (mm)	Maximum width (mm)	Frame and glass specification	Shading device (Dimension within 10%)	Overshadowing
North facing					

Glazed window/door no.	Maximum height (mm)	Maximum width (mm)	Frame and glass specification	Shading device (Dimension within 10%)	Overshadowing
W01	1200.00	1800.00	aluminium, double glazed (U-value: <=3.5, SHGC: 0.60 - 0.74)	verandah 3000 mm, 2200 mm above base of window or glazed door	not overshadowed
W02	1200.00	1200.00	aluminium, double glazed (U-value: <=3.5, SHGC: 0.60 - 0.74)	verandah 3000 mm, 2200 mm above base of window or glazed door	not overshadowed
W03	2100.00	1620.00	aluminium, double glazed (U-value: <=3.5, SHGC: 0.60 - 0.74)	verandah 3000 mm, 2200 mm above base of window or glazed door	not overshadowed
W04	2100.00	1620.00	aluminium, double glazed (U-value: <=3.5, SHGC: 0.60 - 0.74)	verandah 3000 mm, 2200 mm above base of window or glazed door	not overshadowed
East facing					
W05	1200.00	1500.00	aluminium, double glazed (U-value: <=3.5, SHGC: 0.60 - 0.74)	verandah 3000 mm, 2200 mm above base of window or glazed door	not overshadowed
South facing					
W06	1800.00	600.00	aluminium, double glazed (U-value: <=3.5, SHGC: 0.60 - 0.74)	verandah 3000 mm, 2200 mm above base of window or glazed door	not overshadowed
W07	600.00	1500.00	aluminium, double glazed (U-value: <=3.5, SHGC: 0.60 - 0.74)	verandah 3000 mm, 2200 mm above base of window or glazed door	not overshadowed
W08	1200.00	1500.00	aluminium, double glazed (U-value: <=3.5, SHGC: 0.60 - 0.74)	verandah 3000 mm, 2200 mm above base of window or glazed door	not overshadowed
D01	2100.00	820.00	timber, double glazed (U-value: <=3.5, SHGC: 0.60 - 0.74)	verandah 3000 mm, 2200 mm above base of window or glazed door	not overshadowed
West facing					
W10	600.00	1800.00	aluminium, double glazed (U-value: <=3.5, SHGC: 0.60 - 0.74)	none	not overshadowed

Energy Commitments	Show on DA plans	Show on CC/CDC plans & specs	Certifier check
Hot water			
The applicant must install the following hot water system in the development, or a system with a higher energy rating: electric heat pump with a performance of 41 to 45 STCs or better.	✔	✔	✔
Cooling system			
The applicant must install the following cooling system, or a system with a higher energy rating, in at least 1 living area: 1-phase airconditioning - ducted; Energy rating: 7 star (average zone)		✔	✔
The applicant must install the following cooling system, or a system with a higher energy rating, in at least 1 bedroom: 1-phase airconditioning - ducted; Energy rating: 7 star (average zone)		✔	✔
Heating system			
The applicant must install the following heating system, or a system with a higher energy rating, in at least 1 living area: 1-phase airconditioning - ducted; Energy rating: 7 star (average zone)		✔	✔
The applicant must install the following heating system, or a system with a higher energy rating, in at least 1 bedroom: 1-phase airconditioning - ducted; Energy rating: 7 star (average zone)		✔	✔
Ventilation			
The applicant must install the following exhaust systems in the development:			
At least 1 Bathroom: individual fan, ducted to façade or roof; Operation control: manual switch on/off		✔	✔
Kitchen: individual fan, ducted to façade or roof; Operation control: manual switch on/off		✔	✔
Laundry: individual fan, ducted to façade or roof; Operation control: manual switch on/off		✔	✔
Artificial lighting			
The applicant must ensure that a minimum of 80% of light fixtures are fitted with fluorescent, compact fluorescent, or light-emitting-diode (LED) lamps.		✔	✔
Natural lighting			
The applicant must install a window and/or skylight in the kitchen of the dwelling for natural lighting.	✔	✔	✔

Energy Commitments	Show on DA plans	Show on CC/CDC plans & specs	Certifier check
The applicant must install a window and/or skylight in 1 bathroom(s)/toilet(s) in the development for natural lighting.	✔	✔	✔
Other			
The applicant must install a fixed outdoor clothes drying line as part of the development.		✔	

Legend
In these commitments, "applicant" means the person carrying out the development.
Commitments identified with a ✔ in the "Show on DA plans" column must be shown on the plans accompanying the development application for the proposed development (if a development application is to be lodged for the proposed development).
Commitments identified with a ✔ in the "Show on CC/CDC plans and specs" column must be shown in the plans and specifications accompanying the application for a construction certificate / complying development certificate for the proposed development.
Commitments identified with a ✔ in the "Certifier check" column must be certified by a certifying authority as having been fulfilled, before a final occupation certificate (either interim or final) for the development may be issued.

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CLIENT: **PERCEPTION PLANNING**
TITLE: **BASIX**
FILE **2503787** DATE: **12/11/2025** SHEET: **8** OF **8**
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Appendix C – Operation and Maintenance Guideline

ON-SITE SEWAGE MANAGEMENT SYSTEMS

If you live in or rent a house that is not connected to the main sewer then chances are that your yard contains an on-site sewage management system. If this is the case then you have a special responsibility to ensure that it is working as well as it can.

The aim of this pamphlet is to introduce you to some of the most popular types of on-site sewage management systems and provide some general information to help you maintain your system effectively. You should find out what type of system you have and how it works.

More information can be obtained from the pamphlets:

Your Septic System
Your Aerated Wastewater Treatment System
Your Composting Toilet
Your Land Application Area

You can get a copy of these pamphlets from your local council or the address marked on the back of this pamphlet.

It is important to keep in mind that maintenance needs to be performed properly and regularly. Poorly maintained on-site sewage management systems can significantly affect you and your family's health as well as the local environment.

What is an on-site sewage management system?

A domestic on-site sewage management system is made up of various components which - if properly designed, installed and maintained - allow the treatment and utilisation of wastewater from a house, completely within the boundary of the property.

Wastewater may be blackwater (toilet waste), or greywater (water from showers, sinks, and washing machines), or a combination of both.

Partial on-site systems - eg. pump out and common effluent systems (CES) - also exist. These usually involve the preliminary on-site treatment of wastewater in a septic tank, followed by collection and transport of the treated wastewater to an off-site management facility. Pump out systems use road tankers to transport the effluent, and CES use a network of small diameter pipes.

How does an on-site sewage management system work?

For complete on-site systems there are two main processes:

1. treatment of wastewater to a certain standard
2. its application to a dedicated area of land.

The type of application permitted depends on the quality of treatment, although you should try to avoid contact with all treated and untreated wastewater, and thoroughly wash affected areas if contact does occur.

Treatment and application can be carried out using various methods:

Septic Tank
Septic tanks treat both greywater and blackwater, but they provide only limited treatment through the settling of solids and the flotation of fats and greases. Bacteria in the tank break down the solids over a period of time. Wastewater that has been treated in a septic tank can only be applied to land through a covered soil absorption system, as the effluent is still too contaminated for above ground or near surface irrigation.

AWTS
Aerated wastewater treatment systems (AWTS) treat all household wastewater and have several treatment compartments. The first is like a septic tank, but in the second compartment air is mixed with the wastewater to assist bacteria to break down solids. A third compartment allows settling of more solids and a final chlorination contact chamber allows disinfection. Some AWTS are constructed with all the compartments inside a single tank. The effluent produced may be surface or sub-surface irrigated in a dedicated area.

Composting Toilets
Composting toilets collect and treat toilet waste only. Water from the shower, sinks and the washing machine needs to be treated separately (for example in a septic tank or AWTS as above). The compost produced by a composting toilet has special requirements but is usually buried on-site.

These are just some of the treatment and application methods available, and there are many other types such as sand filter beds, wetlands, and amended earth mounds. Your local council or the NSW Department of Health have more information on these systems if you need it.

Regulations and recommendations

The NSW Department of Health determines the design and structural requirements for treatment systems for single households. Local councils are primarily responsible for approving the installation of smaller domestic septic tank systems, composting toilets and AWTSs in their area, and are also responsible for approving land application areas. The NSW Environment Protection Authority approves larger systems.

The design and installation of on-site sewage management systems, including plumbing and drainage, should only be carried out by suitably qualified or experienced people. Care is needed to ensure correct sizing of the treatment system and application area.

Heavy fines may be imposed under the Clean Waters Act if wastewater is not managed properly.

Keeping your on-site sewage management system operating well

What you put down your drains and toilets has a lot to do with how well your system performs. Maintenance of your sewage management system also needs to be done well and on-time. The following is a guide to the types of things you should and should not do with your system.

DO

- ✓ Learn how your sewage management system works and its operational and maintenance requirements.
- ✓ Learn the location and layout of your sewage management system.
- ✓ Have your AWTS (if installed) inspected and serviced four times per year by an approved contractor. Other systems should be inspected at least once every year. Assessment should be applicable to the system design.
- ✓ Keep a record of desludgings, inspections, and other maintenance.
- ✓ Have your septic tank or AWTS desludged every three years to prevent sludge build up, which may 'clog' the pipes.
- ✓ Conserve water. Conservative water use around the house will reduce the amount of wastewater which is produced and needs to be treated.
- ✓ Discuss with your local council the adequacy of your existing sewage management system if you are considering house extensions for increased occupancy.

DON'T

- ✗ Don't let children or pets play on land application areas.
- ✗ Don't water fruit and vegetables with effluent.
- ✗ Don't extract untreated groundwater for cooking and drinking.
- ✗ Don't put large quantities of bleaches, disinfectants, whiteners, nappy soakers and spot removers into your system via the sink, washing machine or toilet.
- ✗ Don't allow any foreign materials such as nappies, sanitary napkins, condoms and other hygiene products to enter the system.
- ✗ Don't put fats and oils down the drain and keep food waste out of your system.
- ✗ Don't install or use a garbage grinder or spa bath if your system is not designed for it.

Reducing water usage

Reducing water usage will lessen the likelihood of problems such as overloading with your septic system. Overloading may result in wastewater backing up into your house, contamination of your yard with improperly treated effluent, and effluent from your system contaminating groundwater or a nearby waterway.

Your sewage management system is also unable to cope with large volumes of water such as several showers or loads of washing over a short period of time. You should try to avoid these 'shock loads' by ensuring water use is spread more evenly throughout the day and week.

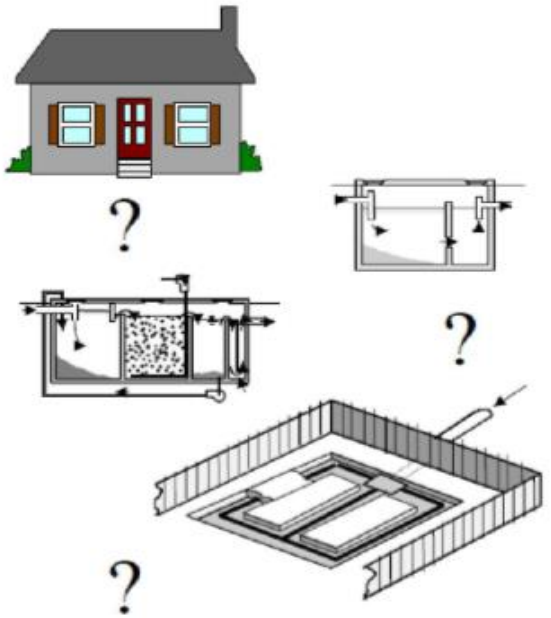
HELP PROTECT YOUR HEALTH AND THE ENVIRONMENT

Poorly maintained sewage management systems are a serious source of water pollution and may present health risks, cause odours and attract vermin and insects.

By looking after your management system you can do your part in helping to protect the environment and the health of you and your community.

For more information please contact:

Managing Wastewater In Your Backyard



Aerated Wastewater Treatment Systems (AWTS)

In unsewered areas, the proper treatment and utilisation of household wastewater on-site is critical in preserving the health of the public and the environment. AWTS have been developed as a way of achieving this.

What is an AWTS?

An AWTS is a purpose built system used for the treatment of sewage and liquid wastes from a single household or multiple dwellings.

It consists of a series of treatment chambers combined with an irrigation system. An AWTS enables people living in unsewered areas to treat and utilise their wastewater.

How does an AWTS work?

Wastewater from a household is treated in stages in several separate chambers. The first chamber is similar to a conventional septic tank. The wastewater enters the chamber where the solids settle to the bottom and are retained in the tank forming a sludge layer. Scum collects at the top, and the partially clarified wastewater flows into a second chamber. Here the wastewater is mixed with air to assist bacteria to further treat it. A third chamber allows additional clarification through the settling of solids, which are returned for further treatment to either the septic chamber (as shown) or to the aeration chamber. The clarified effluent is disinfected in another chamber (usually by chlorination) before irrigation can take place.

Bacteria in the first chamber break down the solid matter in the sludge and scum layers. Material that cannot be fully broken down gradually builds up in the chamber and must be pumped out periodically.

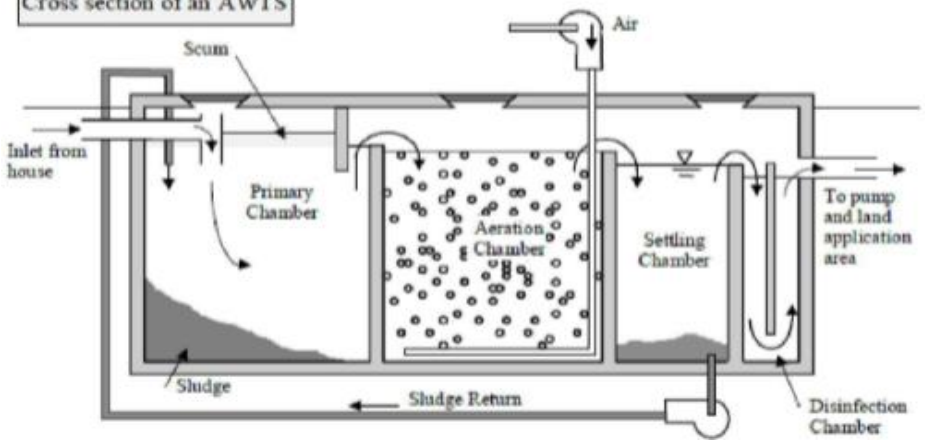
Regulations and recommendations

Local councils are primarily responsible for approving the smaller, domestic AWTSs in their area. The Environment Protection Authority (EPA) approves larger units, whilst the NSW Department of Health determines the design and structural requirements for all AWTSs.

At present AWTSs need to be serviced quarterly by an approved contractor at a cost to the owner. Local councils should also maintain a register of the servicing of each system within their area.

AWTSs should be fitted with an alarm having visual and audible components to indicate mechanical and electrical equipment malfunctions. The alarm should provide a signal adjacent to the alarm and at a relevant position inside the house. The alarm should incorporate a warning lamp which may only be reset by the service agent.

Cross section of an AWTS



Maintaining your AWTS

The effectiveness of the system will, in part, depend on how it is used and maintained. The following is a guide on good maintenance procedures that you should follow:

DO

- ✓ Have your AWTS inspected and serviced four times per year by an approved contractor. Assessment should be applicable to the system design.
- ✓ Have your system service include assessment of sludge and scum levels in all tanks, and performance of irrigation areas.
- ✓ Have all your tanks desludged at least every three years.
- ✓ Have your disinfection chamber inspected and tested quarterly to ensure correct disinfectant levels.
- ✓ Have your grease trap (if installed) cleaned out at least every two months.
- ✓ Keep a record of pumping, inspections, and other maintenance.
- ✓ Learn the location and layout of your AWTS and land application area.
- ✓ Use biodegradable liquid detergents such as concentrates with low sodium and phosphorous levels.
- ✓ Conserve water.

DON'T

- ✗ Don't put bleaches, disinfectants, whiteners, nappy soakers and spot removers in large quantities into your AWTS via the sink, washing machine or toilet.
- ✗ Don't allow any foreign materials such as nappies, sanitary napkins, condoms and other hygiene products to enter the system.
- ✗ Don't use more than the recommended amounts of detergents.
- ✗ Don't put fats and oils down the drain and keep food waste out of your system.
- ✗ Don't switch off power to the AWTS, even if you are going on holidays

Reducing water usage

Reducing water usage will lessen the likelihood of problems such as overloading with your AWTS. Overloading may result in wastewater backing up into your house, contamination of your yard with improperly treated effluent, and effluent from your system entering a nearby river, creek or dam.

Conservative water use around the house will reduce the amount of wastewater which is produced and needs to be treated.

Your AWTS is also unable to cope with large volumes of water such as several showers or loads of washing over a short period of time. You should try to avoid these 'shock loads' by ensuring water use is spread more evenly throughout the day and week.

Warning signs

You can look out for a few warning signs that signal to you that there are troubles with your AWTS. Ensure that these problems are attended to immediately to protect your health and the environment.

Look out for the following warning signs:

- Water that drains too slowly.
- Drain pipes that gurgle or make noises when air bubbles are forced back through the system.
- Sewage smells, this indicates a serious problem.
- Water backing up into your sink which may indicate that your system is already failing.
- Wastewater pooling over the land application area.
- Black coloured effluent in the aerated tank.
- Excess noise from the blower or pumping equipment.
- Poor vegetation growth in irrigated area.

Odour problems from a vent on the AWTS can be a result of slow or inadequate breakdown of solids. Call a technician to service the system.

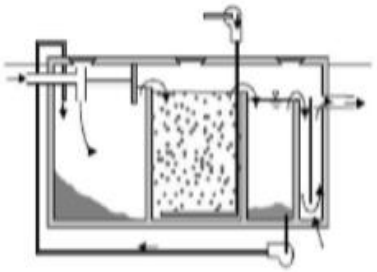
HELP PROTECT YOUR HEALTH AND THE ENVIRONMENT

Poorly maintained AWTSs are a serious source of water pollution and may present health risks, cause odours and attract vermin and insects.

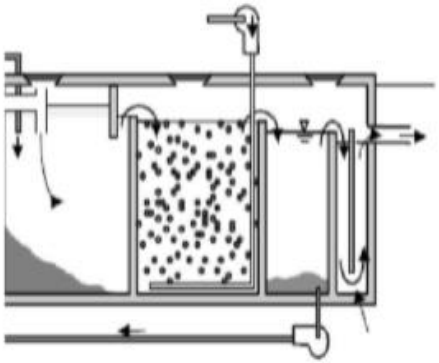
By looking after your treatment system you can do your part in helping to protect the environment and the health of you and your family.

If you would like more information please contact:

Your Aerated Wastewater Treatment System



Your Aerated /astewater Treatment System



- Black coloured effluent in the aerated tank.
- Excess noise from the blower or pumping equipment
- Poor vegetation growth in irrigated area.

LAND APPLICATION AREAS

The reuse of domestic wastewater on-site can be an economical and environmentally sound use of resources.

What are land application areas?

These are areas that allow treated domestic wastewater to be managed entirely on-site.

The area must be able to utilise the wastewater and treat any organic matter and wastes it may contain. The wastewater is rich in nutrients, and can provide excellent nourishment for flower gardens, lawns, certain shrubs and trees. The vegetation should be suitably tolerant of high water and nutrient loads.

How does a land application area work?

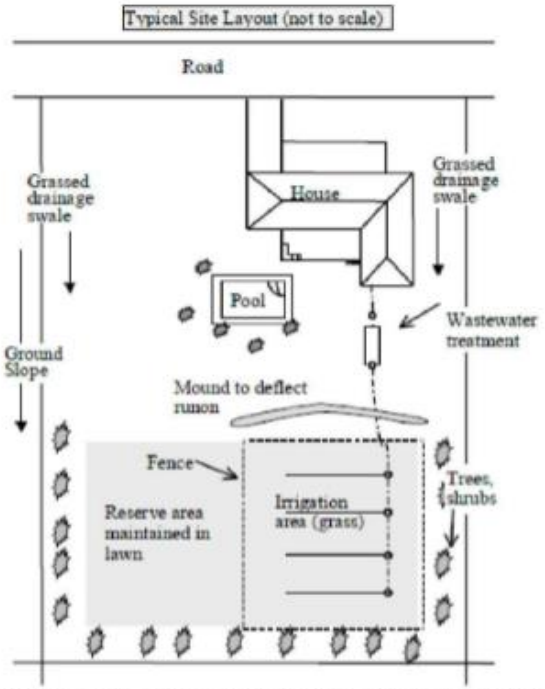
Treated wastewater applied to a land application area may be utilised or simply disposed, depending on the type of application system that is used. The application of the wastewater can be through a soil absorption system (based on disposal) or through an irrigation system (based on utilisation).

Soil absorption systems do not require highly treated effluent, and wastewater treated by a septic tank is reasonable as the solids content in the effluent has been reduced. Absorption systems release the effluent into the soil at a depth that cannot be reached by the roots of most small shrubs and grasses. They rely mainly on the processes of soil treatment and then transmission to the water table, with minimal evaporation and up-take by plants. **These systems are not recommended in sensitive areas as they may lead to contamination of surface water and groundwater.**

Irrigation systems may be classed as either subsurface or surface irrigation. If an irrigation system is to be used, wastewater needs to be pre-treated to at least the quality produced by an aerated wastewater treatment system (AWTS).

Subsurface irrigation requires highly treated effluent that is introduced into the soil close to the surface. The effluent is utilised mainly by plants and evaporation.

Surface irrigation requires highly treated effluent that has undergone aeration and disinfection treatments, so as to reduce the possibility of bacteria and virus contamination.



The effluent is then applied to the land area through a series of drip, trickle, or spray points which are designed to eliminate airborne drift and run-off into neighbouring properties.

There are some public health and environmental concerns about surface irrigation. There is the risk of contact with treated effluent and the potential for surface run-off. Given these problems, subsurface irrigation is arguably the safest, most efficient and effective method of effluent utilisation.

Regulations and recommendations

The design and installation of land application areas should only be carried out by suitably qualified or experienced people, and only after a site and soil evaluation is done by a soil scientist. Care should be taken to ensure correct buffer distances are left between the application area and bores, waterways, buildings, and neighbouring properties.

Heavy fines may be imposed under the Clean Waters Act if effluent is managed improperly.

At least two warning signs should be installed along the boundary of a land application area. The signs should comprise of 20mm high Series C lettering in black or white on a green background with the words:

RECLAIMED EFFLUENT
NOT FOR DRINKING
AVOID CONTACT

Depending on the requirements of your local council, wet weather storage and soil moisture sensors may need to be installed to ensure that effluent is only irrigated when the soil is not saturated.

Regular checks should be undertaken of any mechanical equipment to ensure that it is operating correctly. Local councils may require periodic analysis of soil or groundwater characteristics

Humans and animals should be excluded from land application areas during and immediately after the application of treated wastewater. The longer the period of exclusion from an area, the lower the risk to public health.

The householder is required to enter into a service contract with the installation company, its agent or the manufacturer of their sewage management system, this will ensure that the system operates efficiently.

Location of the application area

Treated wastewater has the potential to have negative impacts on public health and the environment. For this reason the application area must be located in accordance with the results of a site evaluation, and approved landscaping must be completed prior to occupation of the building. Sandy soil and clayey soils may present special problems.

The system must allow even distribution of treated wastewater over the land application area.

Maintaining your land application area

The effectiveness of the application area is governed by the activities of the owner.

DO

- ✓ Construct and maintain diversion drains around the top side of the application area to divert surface water.
- ✓ Ensure that your application area is kept level by filling any depressions with good quality top soil (not clay).
- ✓ Keep the grass regularly mowed and plant small trees around the perimeter to aid absorption and transpiration of the effluent.
- ✓ Ensure that any run off from the roof, driveway and other impermeable surfaces is directed away from the application area.
- ✓ Fence irrigation areas.
- ✓ Ensure appropriate warning signs are visible at all times in the vicinity of a spray irrigation area.
- ✓ Have your irrigation system checked by the service agent when they are carrying out service on the treatment system.

DON'T

- ✗ Don't erect any structures, construct paths, graze animals or drive over the land application area.
- ✗ Don't plant large trees that shade the land application area, as the area needs sunlight to aid in the evaporation and transpiration of the effluent.
- ✗ Don't plant trees or shrubs near or on house drains.
- ✗ Don't alter stormwater lines to discharge into or near the land application area.
- ✗ Don't flood the land application area through the use of hoses or sprinklers.
- ✗ Don't let children or pets play on land application areas.
- ✗ Don't water fruit and vegetables with the effluent.
- ✗ Don't extract untreated groundwater for potable use.

Warning signs

Regular visual checking of the system will ensure that problems are located and fixed early.

The visual signs of system failure include:

- ⚠ surface ponding and run-off of treated wastewater
- ⚠ soil quality deterioration
- ⚠ poor vegetation growth
- ⚠ unusual odours

Volume of water

Land application areas and systems for on-site application are designed and constructed in anticipation of the volume of waste to be discharged. Uncontrolled use of water may lead to poorly treated effluent being released from the system.

If the land application area is waterlogged and soggy the following are possible reasons:

- Λ Overloading the treatment system with wastewater.
- Λ The clogging of the trench with solids not trapped by the septic tank. The tank may require desludging.
- Λ The application area has been poorly designed.
- Λ Stormwater is running onto the area.

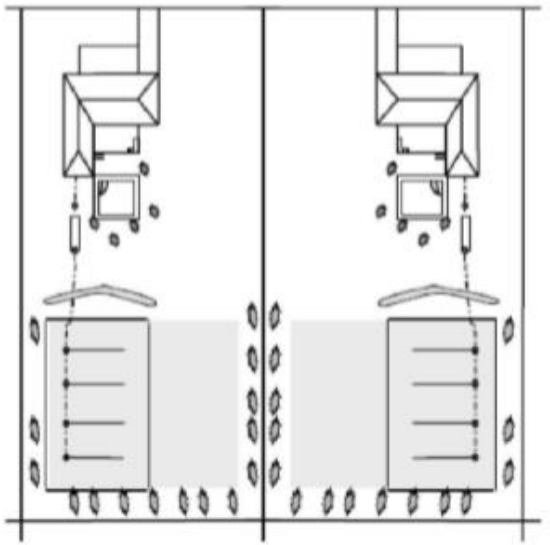
HELP PROTECT YOUR HEALTH AND THE ENVIRONMENT

Poorly maintained land application areas are a serious source of water pollution and may present health risks, cause odours and attract vermin and insects.

By looking after your sewage management system you can do your part in helping to protect the environment and the health of you and your family.

For more information please contact:

Your Land Application Area



Appendix D – Laboratory Results

CERTIFICATE OF ANALYSIS

Work Order	: **EW2600151**	Page	: 1 of 3
Client	: **GSL Environmental**	Laboratory	: Environmental Division NSW South Coast
Contact	: Simon Doberer	Contact	: Mechelle Sahyoun
Address	: 71 Moona Creek Road Vincentia	Address	: 1/19 Ralph Black Dr, North Wollongong 2500 NSW Australia
Telephone	: ----	Telephone	: 02 42253125
Project	: Oakendale Road, GLEN OAK	Date Samples Received	: 12-Jan-2026 12:00
Order number	: 199425	Date Analysis Commenced	: 15-Jan-2026
C-O-C number	: ----	Issue Date	: 19-Jan-2026 16:12
Sampler	: Client - Simon Doberer		
Site	: ----		
Quote number	: EW23GSLENV0001 V2		
No. of samples received	: 2		
No. of samples analysed	: 2		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contract for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- ED007 and ED008: When Exchangeable Al is reported from these methods, it should be noted that Rayment & Lyons (2011) suggests Exchange Acidity by 1M KCl - Method 15G1 (ED005) is a more suitable method for the determination of exchange acidity (H+ + Al3+).

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	TP1	TP3	----	----	----
			Sampling date / time	08-Jan-2026 00:00	08-Jan-2026 00:00	----	----	----
Compound	CAS Number	LOR	Unit	EW2600151-001	EW2600151-002	--------	--------	--------
				Result	Result	----	----	----
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	**6.2**	**5.8**	**----**	**----**	**----**
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	**77**	**83**	**----**	**----**	**----**
ED007: Exchangeable Cations								
Exchangeable Calcium	----	0.1	meq/100g	**9.2**	**5.1**	**----**	**----**	**----**
Exchangeable Magnesium	----	0.1	meq/100g	**2.0**	**2.0**	**----**	**----**	**----**
Exchangeable Potassium	----	0.1	meq/100g	**0.3**	**1.4**	**----**	**----**	**----**
Exchangeable Sodium	----	0.1	meq/100g	**0.6**	**0.1**	**----**	**----**	**----**
Cation Exchange Capacity	----	0.1	meq/100g	**12.0**	**8.7**	**----**	**----**	**----**
Exchangeable Sodium Percent	----	0.1	%	**4.8**	**1.7**	**----**	**----**	**----**
EK072: Phosphate Sorption Capacity								
Phosphate Sorption Capacity	----	250	mg P sorbed/kg	**988**	**1070**	**----**	**----**	**----**

Inter-Laboratory Testing

Analysis conducted by ALS Sydney, NATA accreditation no. 825, site no. 10911 (Chemistry / Biology).

(SOIL) EA010: Conductivity (1:5)

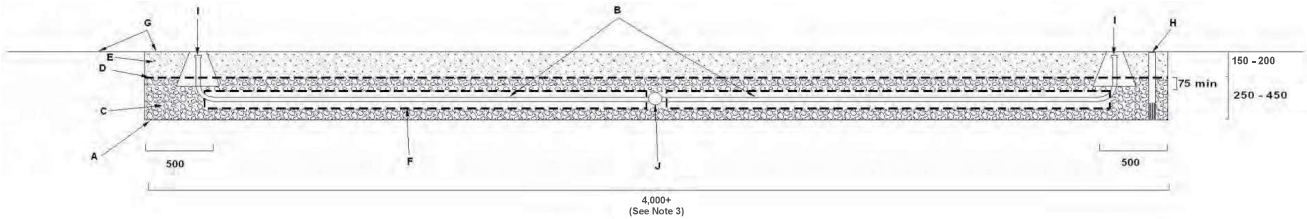
(SOIL) EA002: pH 1:5 (Soils)

(SOIL) EK072: Phosphate Sorption Capacity

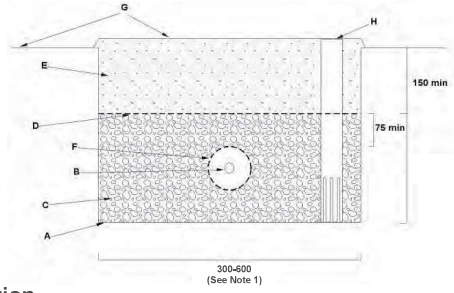
(SOIL) ED007: Exchangeable Cations

Appendix E – Pressure Dosed Absorption Schematics

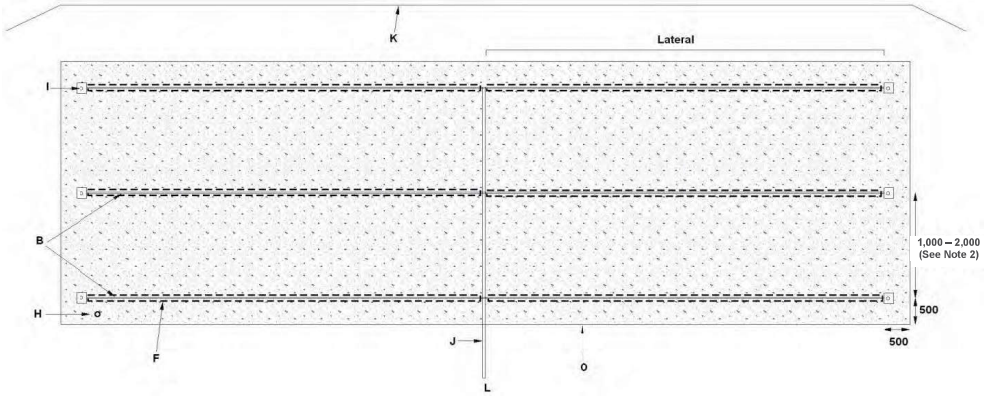
Cross Section: Pressure-dosed Bed



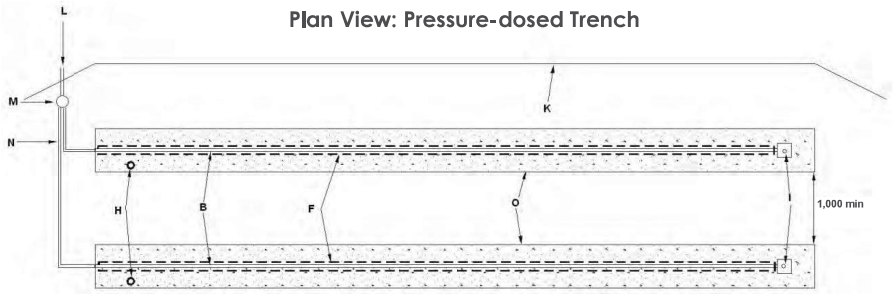
Cross Section: Pressure-dosed Trench



Plan View: Pressure-dosed Bed



Plan View: Pressure-dosed Trench



Pressure-dosed Trench / Bed Construction

A The base of the trench / bed must be level to ensure even distribution of effluent. Base levels should be checked with a dumpy / laser level.

B Pressure-dosing manifold consisting of 25mm PVC pipe with 3mm holes drilled (deburred) at 400mm centres facing upwards. Where a dosing device is used in place of a pump, holes will need to be 4-5mm depending on flow rate achieved. The total number and length of laterals will be determined by the required bed size (m^2) and the lateral spacings shown in this drawing.

C 20-40mm distribution aggregate.

D Geotextile filter cloth.

E Clean local or imported topsoil (sandy loam to clay loam).

F 90mm slotted PVC or agricultural pipe over manifold laterals.

G Grass must be established across the construction area as soon as possible. Trench / bed surface should be level or slightly mounded.

H Inspection port on downhill side of trench / bed. Made from 50mm PVC pipe with perforations in the aggregate level of the trench / bed.

I Individual flush points for each lateral. May be a screw cap fitting on a 90 degree elbow level with the bed surface or a pressure controlled flush valve (such as those used for subsurface irrigation systems) inside an irrigation control box. Manual flushing should be carried out at least every 12 months.

J 40mm PVC dosing manifold. Larger systems may require different pipe sizes and orifice reducers at lateral connection points.

K Upslope stormwater diversion drain (see Standard Drawing 9A for design detail). Sub-soil drainage may be necessary on particular sites.

L Pump dosed effluent from treatment system. The pump must be capable of delivering the total flow rate required for all laterals whilst providing a 1.5m residual head (i.e. squirt height) at the highest orifice (with no more than 10% variation in squirt height across the whole bed). For beds with individual laterals no more than 10m long, it is acceptable to adopt a flow rate of 3.5-4L/min/lineal metre. Total dynamic head (including friction loss) will need to be determined on a site-specific basis.

M Hydraulically operated indexing valve that delivers effluent to a different trench / bed or set of laterals at each pump cut-in.

N 25mm polyethylene or PVC dosing manifold.

O Trench / bed dimensions are an example only. The basal area of the land application area must be determined according to the procedures in AS/NZS 1547:2012 and this Manual. A minimum bed length to width ratio of 3:1 must be adopted when developing individual designs and beds must be installed parallel to the site contours. The location and orientation of the area should be based on a site and soil assessment by a suitably qualified person. The system may comprise a single trench / bed or multiple smaller trenches / beds.

Notes

1. Trenches should optimally be 600mm wide. Optimum width will balance storage requirements against footprint and required trench length.
2. Nominal lateral spacing of 2,000mm for clay loams to light clays. 1,000mm for sandy loams to sands.
3. Consideration should be given to ensuring all beds have a level base when determining an appropriate width. The distribution manifold must also be level. Beds longer than 30m will require specialist hydraulic design.
4. WaterNSW notes that drilling holes within PVC pipe makes them non-compliant with the AS/NZS 3500, as it impacts the structural integrity of the pipe.

Standard Drawing 10C – Pressure-dosed Bed / Trench

(not to scale)

Appendix F – Viral Dieoff Calculation

Beavers, Cromer, Gardner Viral Dieoff Model

Input Data		**Source**
Groundwater Temperature (C)	12.1	Mean minimum air temp (BoM)
Orders of Magnitude Reduction	2	Cromer et al for wastewater treatment level
Days Required for Viral Reduction	27	Figure 1 of Cromer et al
Bulk Density of Soil (g/m3)	1.6	Table 2.18 of Hazelton and Murphy (2007)
Saturated Hydraulic Conductivity (m/day)	0.5	Table 5.2 AS1547:2012
Groundwater Gradient (fraction)	0.1	From Site Investigation
Vertical Drainage before Entering Groundwater	1	From Site Investigation

Calculate the predicted travel distance using equation 4 form Cromer et al (2001).

$Dg = (t-d_v*P/K)/(P/K*i)$

Time in days = t	27
Effective porosity of soil = P	0.45
Saturated hydraulic conductivity = K	0.5
Groundwater gradient = i	0.1
Vertical draingage before entering groundwater = d_v	1
Distance Travelled in Groundwater = Dg (m)	2.9