CALARE CIVIL
CONSULTING ENGINEERS

20220544
12 May, 2022

Toby Gilmour
5964 Castlereagh Highway
Running Stream NSW 2850

Attention: Toby Gilmour

Dear Toby

RE: Effluent Disposal Investigation – 5964 Castlereagh Highway, Running Stream NSW 2850

INTRODUCTION

At your request we have carried out a Geotechnical investigation for the above project. The objectives of this work were to i) identify the subsoils generally underlying the area, and assess subsoil reactivity, ii) Design a method of on-site effluent disposal for the site in accordance with the following Current Recommended Practice (CRP) documents:

- AS/NZS 1547:2012 On-site Domestic Wastewater Management (Standards Australia 2012)
- On-site Sewage Management for Single Households (Office of Local Government 1998)
- Designing & Installing On-Site Wastewater Systems (Sydney Catchment Authority 2019)
- The New South Wales Feedlot Manual (NSW DPI / Agriculture 1998)
- Septic Tank and Collection Well Accreditation Guideline (NSW Health 2001)

LOCATION

The site is located on a large rural lot along Castlereagh Highway, in Running Stream. The lot is approximately 1.03km^2 in size, and the proposed dwelling site is not near any permanent surface waters.

SITES 1-2

SUBSURFACE CONDITIONS

One soil-observation pit was dug at the site using an excavator. The site stratigraphy at the proposed disposal site as revealed by the soil pit comprised typically of the following:

0mm-200mm: Brown, slightly moist, silt sand, with very few fine gravels, weakly structured
200mm-800mm: Brown orange, slightly moist, sandy clay loam, with very few fine gravels, weakly structured
800mm-1200mm: Brown orange, slightly moist, sandy clay loam, with few fine to medium gravels, weakly structured
EOP 1200mm

Groundwater was not encountered during the fieldwork.

Calare Civil Pty Ltd
ABN 41 050 057 933
170 Rankin Street
Bathurst NSW 2795

Tel: 02 6332 3343
Fax: 02 6331 8210
Email: bathurst@calare-civil.com.au
Web: www.calare-civil.com.au

Image 1: Subsoil investigation at the proposed development sites 1-2

DISPOSAL OF EFFLUENT

General

For the subject development, on-site disposal of primary treated effluent from a septic tank using conventional absorption beds is considered appropriate. Neutral effects on groundwater are predicted due to moderate percolation rates and large buffer zones.

Restrictive Site and Soil Features

In accordance with OSMSH the most limiting site or soil feature determines the capability of the subject site for land application of effluent, or the modifications to the site required to allow land application.

Relevant sections of the CRP documents have been reviewed with respect to the subject site and reveal that the limiting feature for absorption disposal is **soil permeability, imposing minor limitation.**

Potential restrictive site & soil features located relative to the proposed disposal site are:

- Proposed tent site 1 approximately 64m S. Minor limitation.
- Proposed tent site 2 approximately 20m E. Minor limitation.
- Drainage depression approximately 145m S. Minor limitation.
- No intermittent waterway within 500m of site. Minor limitation.
- No bore within 500m of site. Minor limitation.
- Closest property boundary approximately 103m N. Minor limitation.
- Weakly structured Category 4 Clay Loam soil. Minor limitation.

The following buffer distances should be adhered to:

- 6m from building or property boundary at higher elevation
- 12m from building or property boundary at lower elevation
- 40m from intermittent water course or dam
- 100m from permanent surface waters (eg rivers)

Design Effluent Flow

The proposed development comprises of two 1-bedroom glamping tents supplied by tank water .

Potential Bedrooms	Reticulated/Bore Water	Tank Water
1-2 potential bedrooms	600 L/d	400 L/d
3 potential bedrooms	900 L/d	600 L/d
4 potential bedrooms	1200 L/d	800 L/d
More than 4 potential bedrooms	1200 + 150 L/d per additional bedroom	800 + 100 L/d per additional bedroom

Qd = 1-bedroom tent + 1-bedroom tent = 800 L/d (average daily flow for dwelling)

Soil Properties

The methods used to determine absorptive characteristics of site soils in this study were:
1) Visual/tactile assessment of site soil profile
2) Assessment of soil landscape sheets.

In accordance with Table L1, we have identified the underlying soils as Category 3 (Clay Loam). Taking into account visual and tactile assessment of soils, in conjunction with documented soil landscape data, we conclude that on site disposal of effluent at the development is possible using conventional absorption beds. We have adopted an indicative permeability (k_{sat}) of 3.0m/d with an associated Design Loading Rate (DLR) of 12 mm/d.

Sizing of Bed

In accordance with AS/NZS 1547:2012 (Appendix Q), the disposal area required is calculated using a water balance analysis. Rainfall and evaporation data from local gauging stations is used in the calculations.

The spreadsheets below summarise calculations. It can be seen that a design disposal area of **63.2m²** is required, with a maximum effluent depth of **236mm**.

Month	E mm	ET mm	R mm	Rr mm	DLR/mth mm	Disposal Rate mm	Effluent Applied per month (L)	Size of area m2
January	204.60	153	73.80	55	372	470	24800	53
February	162.40	122	73.90	55	336	402	22400	56
March	139.50	105	47.60	36	372	441	24800	56
April	84.00	63	32.80	25	360	398	24000	60
May	49.60	37	40.00	30	372	379	24800	65
June	33.00	25	41.40	31	360	354	24000	68
July	37.20	28	43.20	32	372	368	24800	67
August	55.80	42	38.30	29	372	385	24800	64
September	78.00	59	48.80	37	360	382	24000	63
October	120.90	91	56.40	42	372	420	24800	59
November	156.00	117	76.00	57	360	420	24000	57
December	204.60	153	69.60	52	372	473	24800	52

DEPTH OF STORED EFFLUENT
DLR 12 mm/d

Month	First trial m2	Application Rate	Disposal Rate	AR-DR (mm)	Increase in depth of stored effluent	Depth of effluent for month	Increase in depth of effluent	Design depth per mth (mm)
December	63.22							
January		392	470	-78	-259	0	-259	0
February		354	402	-48	-160	0	-160	0
March		392	441	-49	-162	0	-162	0
April		380	398	-19	-63	0	-63	0
May		392	379	13	44	0	44	44
June		380	354	26	86	44	86	130
July		392	368	25	83	130	83	212
August		392	385	7	24	212	24	236
September		380	382	-2	-8	236	-8	228
October		392	420	-28	-94	228	-94	135
November		380	420	-40	-135	135	-135	0
December		392	473	-81	-270	0	-270	0

From AS1547:2012, the total required bed length is calculated as follows:

$L = A_e/B_e$

Where A_e = 63.22m^2 (required area)
B_e = 2.4m (wetted base of 2.4m wide bed)
n.b. a nominal depth of bed of 0.45m is adopted from 0.236m + 0.05m freeboard, rounded up to 0.45m.

Then: L = 63.22/2.4

= 26.3m (say 26.5m)

In summary, for the dwelling, adopt **two beds each 13.5m long x 2.4m wide x 0.45m deep**, adjacent to each other and 2.0m spacing between the beds side wall to side wall (see attached sketch).

With reference to AS/NZ 1547:2012 section L6, individual bed lengths should be limited to around 20m. A longer bed is possible if the installer can guarantee a level bottom over the entire length.

Effluent delivery to all beds should be even via a distribution box or similar and preferably delivered into the centre of the beds through the top of the self-supporting arches (see attached sketch).

The septic tank shall be a minimum 3000L. Make and model of septic tank is to be selected by installer and must be NSW Health approved (a full list of approved tanks is available on the NSW Health website). Final location of septic tank is to be determined by the installer with consideration given to the drainage plan of the house and site limitations to ensure all plumbing meets the required minimum grades specified in AS3500.2.

If site conditions (ie slope restrictions) are greater than 10% then a 1200mm wide bed can be utilised ensuring that the same Required Area (A_e) is achieved (i.e. halving the width will double the required length of the bed) or regrade the site to achieve the required grade of 10%.

SITE 3

SUBSURFACE CONDITIONS

One soil-observation pit was dug at the site using an excavator. The site stratigraphy at the proposed disposal site as revealed by the soil pit comprised typically of the following:

0mm-200mm: Brown, slightly moist, silt sand, with very few fine gravels, weakly structured
200mm-800mm: Brown orange, slightly moist, sandy loam, with very few fine gravels, weakly structured
800mm-1200mm: Brown orange, slightly moist, loam, with few fine to medium gravels, weakly structured
EOP 1200mm

Groundwater was not encountered during the fieldwork.

Image 2: Subsoil investigation at the proposed development site 3

DISPOSAL OF EFFLUENT

General

For the subject development, on-site disposal of primary treated effluent from a septic tank using conventional absorption beds is considered appropriate. Neutral effects on groundwater are predicted due to moderate percolation rates and large buffer zones.

Restrictive Site and Soil Features

In accordance with OSMSH the most limiting site or soil feature determines the capability of the subject site for land application of effluent, or the modifications to the site required to allow land application.

Relevant sections of the CRP documents have been reviewed with respect to the subject site and reveal that the limiting feature for absorption disposal is **soil permeability, imposing minor limitation.**

Potential restrictive site & soil features located relative to the proposed disposal site are:

- Proposed tent site 3 approximately 17m NW. Minor limitation.
- Drainage depression approximately 65m W. Minor limitation.
- No intermittent waterway within 500m of site. Minor limitation.
- No bore within 500m of site. Minor limitation.
- Closest property boundary approximately 229m N. Minor limitation.
- Weakly structured Category 3 Loam soil. Minor limitation.

The following buffer distances should be adhered to:

- 6m from building or property boundary at higher elevation
- 12m from building or property boundary at lower elevation
- 40m from intermittent water course or dam
- 100m from permanent surface waters (eg rivers)

Design Effluent Flow

The proposed development comprises of a 1-bedroom glamping tent supplied by tank water.

Potential Bedrooms	Reticulated/Bore Water	Tank Water
1-2 potential bedrooms	600 L/d	400 L/d
3 potential bedrooms	900 L/d	600 L/d
4 potential bedrooms	1200 L/d	800 L/d
More than 4 potential bedrooms	1200 + 150 L/d per additional bedroom	800 + 100 L/d per additional bedroom

Qd = 1 bedroom tent = 400 L/d (average daily flow for dwelling)

Soil Properties

The methods used to determine absorptive characteristics of site soils in this study were:
1) Visual/tactile assessment of site soil profile
2) Assessment of soil landscape sheets.

In accordance with Table L1, we have identified the underlying soils as Category 3 (Clay Loam). Taking into account visual and tactile assessment of soils, in conjunction with documented soil landscape data, we conclude that on site disposal of effluent at the development is possible using conventional absorption beds. We have adopted an indicative permeability (k_{sat}) of 3.0m/d with an associated Design Loading Rate (DLR) of 15 mm/d.

Sizing of Bed

In accordance with AS/NZS 1547:2012 (Appendix Q), the disposal area required is calculated using a water balance analysis. Rainfall and evaporation data from local gauging stations is used in the calculations.

The spreadsheets below summarise calculations. It can be seen that a design disposal area of **25.6m²** is required, with a maximum effluent depth of **236mm**.

Month	E mm	ET mm	R mm	Rr mm	DLR/mth mm	Disposal Rate mm	Effluent Applied per month (L)	Size of area m2
January	204.60	153	73.80	55	465	563	12400	22
February	162.40	122	73.90	55	420	486	11200	23
March	139.50	105	47.60	36	465	534	12400	23
April	84.00	63	32.80	25	450	488	12000	25
May	49.60	37	40.00	30	465	472	12400	26
June	33.00	25	41.40	31	450	444	12000	27
July	37.20	28	43.20	32	465	461	12400	27
August	55.80	42	38.30	29	465	478	12400	26
September	78.00	59	48.80	37	450	472	12000	25
October	120.90	91	56.40	42	465	513	12400	24
November	156.00	117	76.00	57	450	510	12000	24
December	204.60	153	69.60	52	465	566	12400	22

DEPTH OF STORED EFFLUENT
DLR 15 mm/d

Month	First trial m2	Application Rate	Disposal Rate	AR-DR (mm)	Increase in depth of stored effluent	Depth of effluent for month	Increase in depth of effluent	Design depth per mth (mm)
December	25.55							
January		485	563	-78	-259	0	-259	0
February		438	486	-48	-160	0	-160	0
March		485	534	-49	-162	0	-162	0
April		470	488	-19	-63	0	-63	0
May		485	472	13	44	0	44	44
June		470	444	26	86	44	86	130
July		485	461	25	83	130	83	212
August		485	478	7	24	212	24	236
September		470	472	-2	-8	236	-8	228
October		485	513	-28	-94	228	-94	135
November		470	510	-40	-135	135	-135	0
December		485	566	-81	-270	0	-270	0

From AS1547:2012, the total required bed length is calculated as follows:

$$L = A_e/B_e$$

Where A_e = 25.55m^2 (required area)
B_e = 2.4m (wetted base of 2.4m wide bed)
n.b. a nominal depth of bed of 0.45m is adopted from 0.236m + 0.05m freeboard, rounded up to 0.45m.

Then: L = 25.55/2.4

= 10.6m (say 10.5m)

In summary, for the dwelling, adopt **one bed 10.5m long x 2.4m wide x 0.45m deep** (see attached sketch).

The septic tank shall be a minimum 3000L. Make and model of septic tank is to be selected by installer and must be NSW Health approved (a full list of approved tanks is available on the NSW Health website). Final location of septic tank is to be determined by the installer with consideration given to the drainage plan of the house and site limitations to ensure all plumbing meets the required minimum grades specified in AS3500.2.

If site conditions (ie slope restrictions) are greater than 10% then a 1200mm wide bed can be utilised ensuring that the same Required Area (A_e) is achieved (i.e. halving the width will double the required length of the bed) or regrade the site to achieve the required grade of 10%.

SITES 4-5

SUBSURFACE CONDITIONS

It is proposed to dispose of effluent generated by sites 4 and 5 in the same area.

One soil-observation pit was dug at the site using an excavator. The site stratigraphy at the proposed disposal site as revealed by the soil pit comprised typically of the following:

0mm-200mm: Brown, slightly moist, silt sand, with very few fine gravels, moderately structured
200mm-800mm: Orange brown, slightly moist, silty sand, with very few fine gravels, weakly structured
800mm-1200mm: Brown yellow, slightly moist, silty sand, with few fine to medium gravels, weakly structured
EOP 1200mm

Groundwater was not encountered during the fieldwork.

Image 3: Subsoil investigation at the proposed development sites 4-5

DISPOSAL OF EFFLUENT

General

For the subject development, on-site disposal of primary treated effluent from a septic tank using conventional absorption beds is considered appropriate. Neutral effects on groundwater are predicted due to moderate percolation rates and large buffer zones.

Restrictive Site and Soil Features

In accordance with OSMSH the most limiting site or soil feature determines the capability of the subject site for land application of effluent, or the modifications to the site required to allow land application.

Relevant sections of the CRP documents have been reviewed with respect to the subject site and reveal that the limiting feature for absorption disposal is **soil permeability, imposing minor limitation.**

Potential restrictive site & soil features located relative to the proposed disposal site are:

- Proposed tent site 4 approximately 21m W. Minor limitation.
- Proposed tent site 5 approximately 95m E. Minor limitation.
- Drainage depression approximately 129m S. Minor limitation.
- No intermittent waterway within 500m of site. Minor limitation.
- No bore within 500m of site. Minor limitation.
- Closest property boundary approximately 66m N. Minor limitation.
- Weakly structured Category 3 Loam soil. Minor limitation.

The following buffer distances should be adhered to:

- 6m from building or property boundary at higher elevation
- 12m from building or property boundary at lower elevation
- 40m from intermittent water course or dam
- 100m from permanent surface waters (eg rivers)

Design Effluent Flow

The proposed development comprises of two 1-bedroom glamping tents supplied by tank water .

Potential Bedrooms	Reticulated/Bore Water	Tank Water
1-2 potential bedrooms	600 L/d	400 L/d
3 potential bedrooms	900 L/d	600 L/d
4 potential bedrooms	1200 L/d	800 L/d
More than 4 potential bedrooms	1200 + 150 L/d per additional bedroom	800 + 100 L/d per additional bedroom

Qd = 1-bedroom tent + 1-bedroom tent = 800 L/d (average daily flow for dwelling)

Soil Properties

The methods used to determine absorptive characteristics of site soils in this study were:
1) Visual/tactile assessment of site soil profile
2) Assessment of soil landscape sheets.

In accordance with Table L1, we have identified the underlying soils as Category 3 (Clay Loam). Taking into account visual and tactile assessment of soils, in conjunction with documented soil landscape data, we conclude that on site disposal of effluent at the development is possible using conventional absorption beds. We have adopted an indicative permeability (k_{sat}) of 3.0m/d with an associated Design Loading Rate (DLR) of 12 mm/d.

Sizing of Bed

In accordance with AS/NZS 1547:2012 (Appendix Q), the disposal area required is calculated using a water balance analysis. Rainfall and evaporation data from local gauging stations is used in the calculations.

The spreadsheets below summarise calculations. It can be seen that a design disposal area of **63.2m²** is required, with a maximum effluent depth of **236mm**.

Month	E mm	ET mm	R mm	Rr mm	DLR/mth mm	Disposal Rate mm	Effluent Applied per month (L)	Size of area m2
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March	139.50	105	47.60	36	372	441	24800	56
April	84.00	63	32.80	25	360	398	24000	60
May	49.60	37	40.00	30	372	379	24800	65
June	33.00	25	41.40	31	360	354	24000	68
July	37.20	28	43.20	32	372	368	24800	67
August	55.80	42	38.30	29	372	385	24800	64
September	78.00	59	48.80	37	360	382	24000	63
October	120.90	91	56.40	42	372	420	24800	59
November	156.00	117	76.00	57	360	420	24000	57
December	204.60	153	69.60	52	372	473	24800	52

DEPTH OF STORED EFFLUENT
DLR 12 mm/d

Month	First trial m2	Application Rate	Disposal Rate	AR-DR (mm)	Increase in depth of stored effluent	Depth of effluent for month	Increase in depth of effluent	Design depth per mth (mm)
December	63.22							
January		392	470	-78	-259	0	-259	0
February		354	402	-48	-160	0	-160	0
March		392	441	-49	-162	0	-162	0
April		380	398	-19	-63	0	-63	0
May		392	379	13	44	0	44	44
June		380	354	26	86	44	86	130
July		392	368	25	83	130	83	212
August		392	385	7	24	212	24	236
September		380	382	-2	-8	236	-8	228
October		392	420	-28	-94	228	-94	135
November		380	420	-40	-135	135	-135	0
December		392	473	-81	-270	0	-270	0

From AS1547:2012, the total required bed length is calculated as follows:

$L = A_e/B_e$

Where A_e = 63.22m^2 (required area)
B_e = 2.4m (wetted base of 2.4m wide bed)
n.b. a nominal depth of bed of 0.45m is adopted from 0.236m + 0.05m freeboard, rounded up to 0.45m.

Then: L = 63.22/2.4

= 26.3m (say 26.5m)

In summary, for the dwelling, adopt **two beds each 13.5m long x 2.4m wide x 0.45m deep**, adjacent to each other and 2.0m spacing between the beds side wall to side wall (see attached sketch).

With reference to AS/NZ 1547:2012 section L6, individual bed lengths should be limited to around 20m. A longer bed is possible if the installer can guarantee a level bottom over the entire length.

Effluent delivery to all beds should be even via a distribution box or similar and preferably delivered into the centre of the beds through the top of the self-supporting arches (see attached sketch).

The septic tank shall be a minimum 3000L. Make and model of septic tank is to be selected by installer and must be NSW Health approved (a full list of approved tanks is available on the NSW Health website). Final location of septic tank is to be determined by the installer with consideration given to the drainage plan of the house and site limitations to ensure all plumbing meets the required minimum grades specified in AS3500.2.

If site conditions (ie slope restrictions) are greater than 10% then a 1200mm wide bed can be utilised ensuring that the same Required Area (A_e) is achieved (i.e. halving the width will double the required length of the bed) or regrade the site to achieve the required grade of 10%.

PREPARATION AND MAINTENANCE OF DISPOSAL AREAS

General

We note that the bed should not be constructed in an area subject to stormwater run-off or ground water concentrations. The upstream flow of stormwater run-off should be diverted from the disposal area. The disposal area is to be stock and vehicle free.

Excavation Techniques

The following excavation techniques recommended in AS1547:2012 shall be observed so as to minimize the risk of damage to the soil.

- Plan to excavate only when the weather is fine.
- During wet seasons or when construction cannot be delayed until the weather becomes fine, smeared soil surfaces may be raked to reinstate a more natural soil surface, taking care to use fine tines and only at the surface.

In particular for absorption beds:

- If rain is forecast then cover any open beds, to protect them from rain damage.
- Excavate perpendicular to the line of fall or parallel to the contour of sloping ground.
- Ensure that the inverts are horizontal.

Disposal Site Cover

It is recommended that a fescue/fescue blend (Temperate and Mediterranean blend varieties) or similar be planted on the disposal area, which has year-round active growth, enhancing nutrient uptake (Ref. NSW Feedlot Manual 1998, NSW Department of Agriculture). Other recommended species providing similar data include Ryegrass. Also small trees with non-intrusive root systems planted below the disposal area will improve transpiration and uptake of nutrients (plants suitable for growing in wet soils can be recommended by local nurseries)

Further Considerations

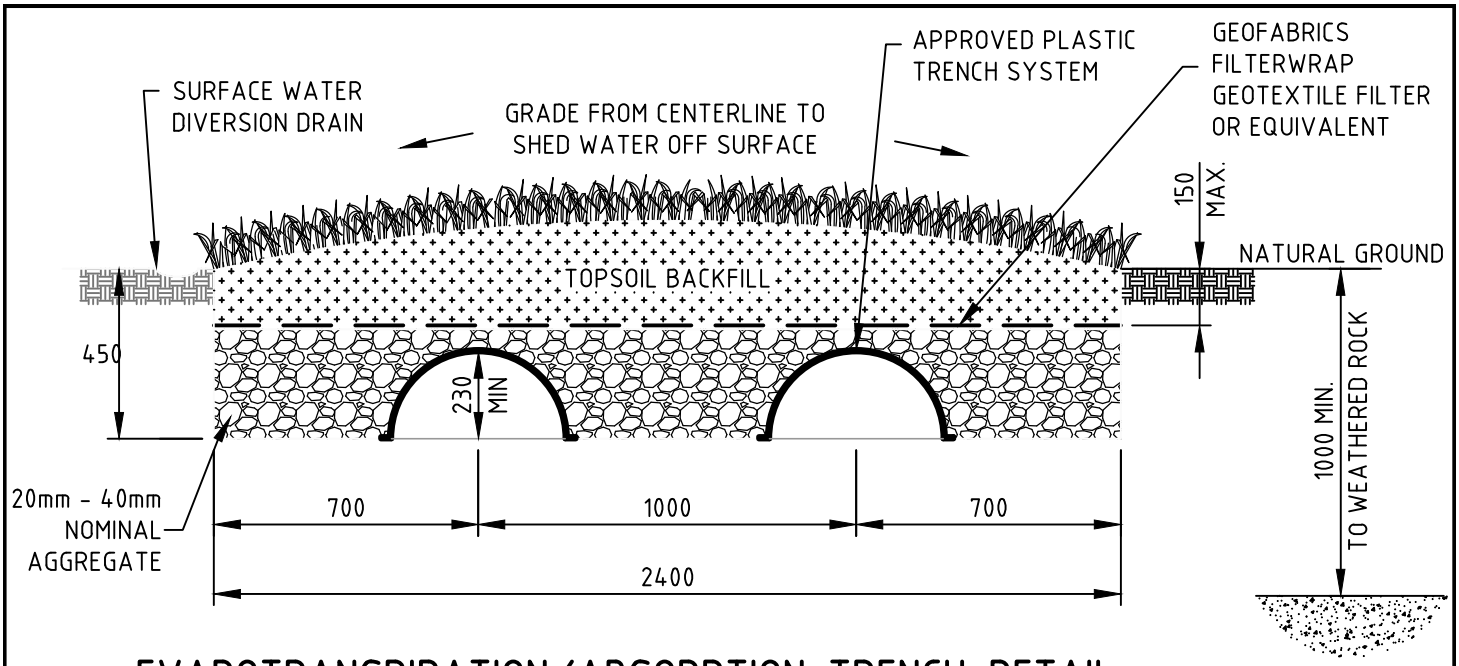
The implementation of wastewater and nutrient reduction initiatives such as the following will further improve the performance of the system:

- Use of low phosphate/low SAR detergents, and low quantities where practicable.
- Water saving shower heads, taps and appliances.
- Consideration of 3/4.5 litre dual flush toilets.
- Avoid placing fats, oils or food waste into the system.
- Reducing peak hydraulic loading by reducing shower time and washing laundry over several days as opposed to completing multiple cycles in one day

We trust that this information meets your requirements. Please do not hesitate to contact the undersigned should you require any further information.

Yours faithfully,
CALARE CIVIL PTY LTD

Sean Johnson
BE MIEAust.



EVAPOTRANSPIRATION/ABSORPTION TRENCH DETAIL

NOT TO SCALE

SUITABLE FOR LEVEL SITE TO SLOPING SITE LESS THAN 10%

LOCATION OF PROPOSED DEVELOPMENT AND DISPOSAL AREA ARE INDICATIVE ONLY.
FINAL LOCATION DETERMINED BY INSTALLER PENDING SUITABILITY.

REFERENCE

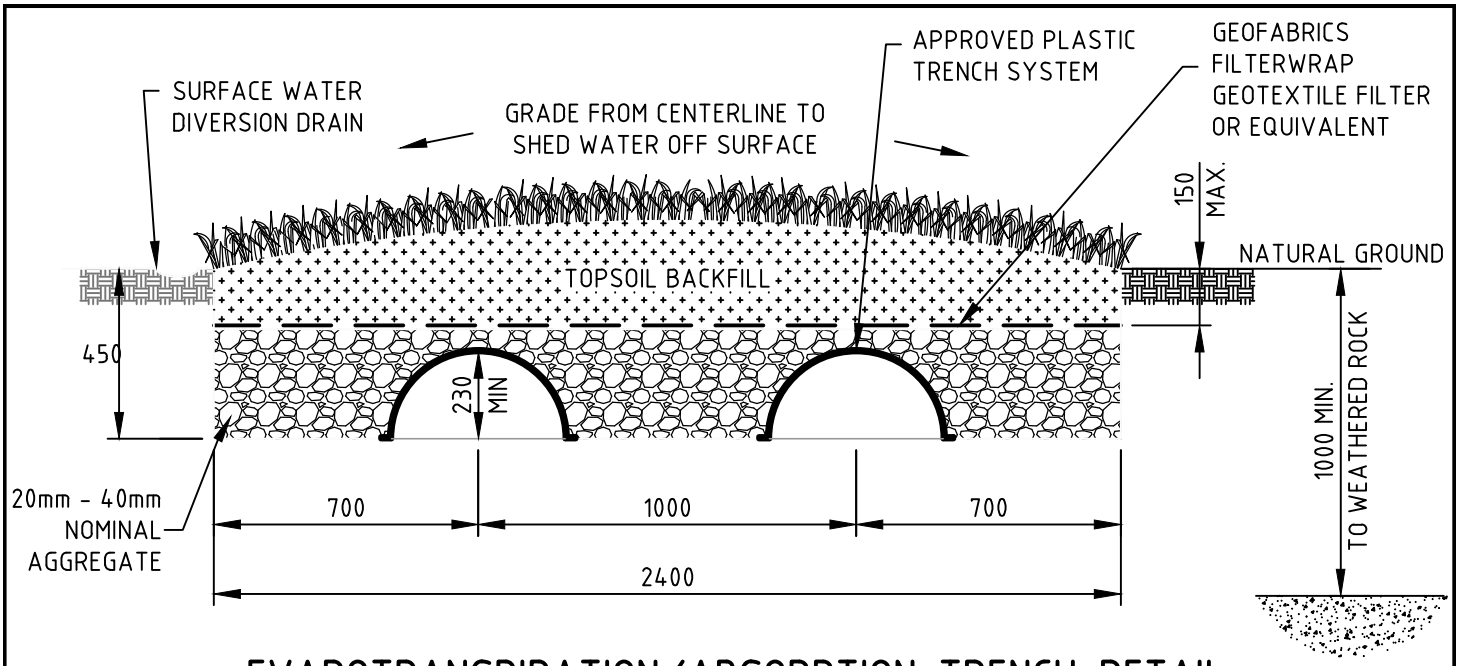
TEST HOLE LOCATION

SITE PLAN

SCALE 1:1000

DWG. No.: E1 Rev. A	Drawn: DB	EFFLUENT DISPOSAL REPORT 5964 CASTLEREAGH HIGHWAY RUNNING STREAM NSW 2850 TOBY GILMOUR
JOB No.: 22.0544	Date: 12-05-22	
	Scales: AS SHOWN	
	Approved: S.J.	

CALARE CIVIL
CONSULTING ENGINEERS
170 RANKIN STREET,
BATHURST, N.S.W. 2795
Tel: (02) 63323343 Fax: (02) 63318210



EVAPOTRANSPIRATION/ABSORPTION TRENCH DETAIL

NOT TO SCALE

SUITABLE FOR LEVEL SITE TO SLOPING SITE LESS THAN 10%

LOCATION OF PROPOSED DEVELOPMENT AND DISPOSAL AREA ARE INDICATIVE ONLY.
FINAL LOCATION DETERMINED BY INSTALLER PENDING SUITABILITY.

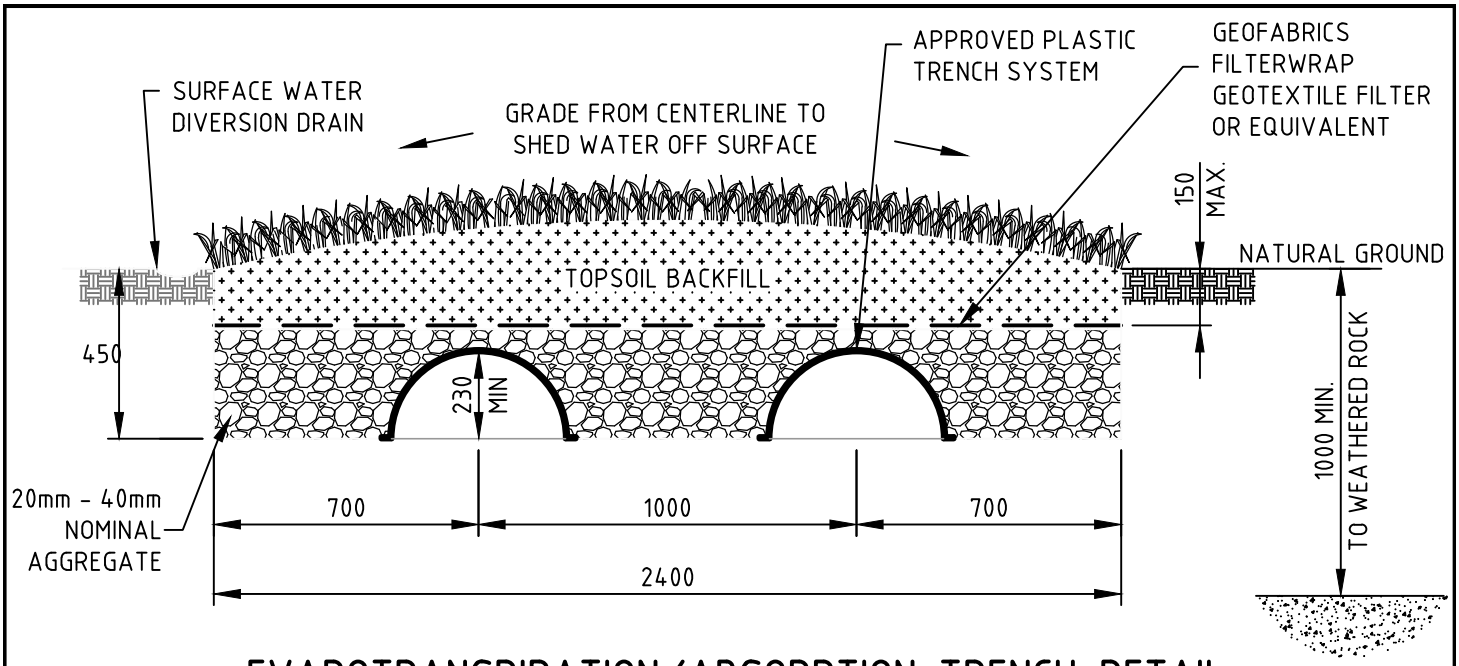
REFERENCE

TEST HOLE LOCATION

SITE PLAN

SCALE 1:1000

DWG. No.: E2 Rev. A	Drawn: DB	EFFLUENT DISPOSAL REPORT 5964 CASTLEREAGH HIGHWAY RUNNING STREAM NSW 2850 TOBY GILMOUR	CALARE CIVIL CONSULTING ENGINEERS 170 RANKIN STREET, BATHURST, N.S.W. 2795 Tel: (02) 63323343 Fax: (02) 63318210
	Date: 12-05-22		
JOB No.: 22.0544	Scales: AS SHOWN		
	Approved: S.J.		



EVAPOTRANSPIRATION/ABSORPTION TRENCH DETAIL

NOT TO SCALE

SUITABLE FOR LEVEL SITE TO SLOPING SITE LESS THAN 10%

LOCATION OF PROPOSED DEVELOPMENT AND DISPOSAL AREA ARE INDICATIVE ONLY.
FINAL LOCATION DETERMINED BY INSTALLER PENDING SUITABILITY.

REFERENCE

TEST HOLE LOCATION

SITE PLAN

SCALE 1:1000

DWG. No.: E3 Rev. A	Drawn: DB	EFFLUENT DISPOSAL REPORT 5964 CASTLEREAGH HIGHWAY RUNNING STREAM NSW 2850 TOBY GILMOUR	CALARE CIVIL CONSULTING ENGINEERS 170 RANKIN STREET, BATHURST, N.S.W. 2795 Tel: (02) 63323343 Fax: (02) 63318210
	Date: 12-05-22		
JOB No.: 22.0544	Scales: AS SHOWN		
	Approved: S.J.		