Report on

SITE AND SOIL EVALUATION
PROPOSED CHILDCARE FACILITY
LOT 2, NO 1785 KEANE STREET EAST, MOUNT HELENA WA

Submitted to:

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1. INTRODUCTION

This revised report presents the outcomes of Galt Geotechnics' (Galt's) site and soil evaluation for the proposed childcare facility on Lot 2, No 1785 Keane Street East, Mount Helena WA ("the site"). The location of the site relative to the surrounding area is shown on Figure 1, Site and Location Plan.

This report includes additional testing undertaken in winter (August 2023), and supersedes our original report referenced WAG220058-01 001 R Rev0.

2. DEFINITIONS

Site and Soil Evaluation (SSE) – an assessment of all relevant constraints and the risks to public health and the environment in accordance with AS1547-2012 "On-site domestic wastewater management". This SSE is a general assessment SSE, with the purpose being to undertake a site suitability assessment for onsite wastewater management and to recommend the type of onsite wastewater system for the proposed development.

A specific assessment is required to support an "application to install" an onsite wastewater system. This is for when a particular type of system/model is proposed, and a detailed design, including management recommendations and operation requirements. This document is not a specific assessment.

Land Application Area (LAA) – The unencumbered plan area to which treated sewage from an on-site sewage system is distributed for further in-soil treatment and absorption or evaporation. This area is restricted to the distribution of treated sewage and may not be developed for other purposes.

Land Application System (LAS) – The system used to apply effluent from a wastewater treatment unit into or onto the soil for further in-soil treatment and absorption or evaporation.

Effluent – The liquid discharged from a wastewater treatment unit.

Primary Treatment – The separation of suspended material from sewage in septic tanks, primary settling chambers or other structures before discharge to either a LAS or secondary treatment process.

Secondary Treatment – Microbiological digestions and physical settling and filtering processes and decomposition of sewage constituents following primary treatment.

Sewage – Any kind of sewage, faecal matter or urine, and any waste composed wholly or in part of liquid.

Infiltrative Area – Is the area within an LAA that has treated effluent directly discharged onto, and does not include setback areas. I.e., the base of leach drains, evapotranspiration beds etc.

3. SITE DESCRIPTION AND PROPOSED DEVELOPMENT

3.1 General

The site is roughly square in shape, covering an area of approximately 1,896 m^2. Based on a provided feature survey plan (refer Appendix A), the site slopes down from around RL 281.5 m AHD in the north eastern corner, to around RL 279.75 m AHD along in the south west corner. The site is located near the middle of a slope within the surrounding undulating terrain.

The site is currently developed with a single storey residence and associated paved and landscaped areas.

We understand that a single storey daycare centre is proposed for the site (refer Appendix A). Some filling and boundary retention is proposed to form design site levels. Leach drains (2 x 30 m of 1.4 m wide TunnelWell Arch System drains) are proposed beneath the carpark in the western portion of the site to expose of treated effluent. A leach drain invert level of RL 279.5 m AHD is indicated on the plans (1.78 m below finished ground level of RL 281.28 m AHD).

3.2 Hydraulic Loading of Proposed Development

A design hydraulic loading has been determined in accordance with the WA Department of Health Regulations 28, 29 and Schedule 9 of the Health Regulations (1974).

A breakdown of the assumed hydraulic loading for the proposed development is shown below in Table 1.

Table 1: Hydraulic Loading Breakdown

Type of Premises	User Type	Number of Persons	L/person / day	Total (L/day)
Child Care Centre	Childcare Staff	14	70	980
	Children	79	45	3,555
			TOTAL	**4,535**

Based on the above table, the design hydraulic loading for the proposed development is 4,535 L/day.

4. GOVERNING STANDARDS, REGULATIONS AND POLICIES

SSEs are governed by various National and State Standards, Regulations and Policies, including:

- AS/NZS 1547:2012, *On-site domestic wastewater management.*
- Western Australia Government Sewerage Policy (2019)
- Western Australia Health (Treatment of Sewage and Disposal of Effluent and Liquid Waste) Regulations (1974)
- Western Australia State Planning Policy 2.9, Water Resources (2005)

Other regulatory requirements may become relevant depending on the outcomes of any SSE.

SSEs can be rejected on the basis of not meeting the regulatory requirements of the above. This proposal is intended to address all these various requirements.

5. FIELDWORK

Fieldwork was originally undertaken on 30 November 2022, with additional work undertaken on 15 August 2023. The fieldwork comprised:

- **November 2022:**
  - a site walkover including inspection of the site features relevant to AS1547-2012;
  - drilling of boreholes at 5 locations extending to a depth of 0.4 m to 1.5 m;
  - installation of a standpipe within BH02 (MW01) to a depth of 2.5 m;
  - constant head permeability tests at 5 locations using a Guelph permeameter at depths of around 0.5 m;
  - collection of representative soil samples.

- **August 2023:**
  - drilling of boreholes at 3 locations (across revised leach drain area) extending to a depth of 0.8 m to 2.6 m;
  - installation of a standpipe within BH06 (MW02) to a depth of 2.3 m;
  - constant head permeability tests at 2 locations using a Guelph permeameter at depths of around 0.3 m; and
  - measurement of water levels in MW01 and MW02.

General

A geotechnical engineer from Galt conducted the walkover survey, located and positioned the tests, drilled the machine auger boreholes, installed the standpipe, conducted the constant head infiltration testing and collected samples for laboratory testing.

The approximate test locations are shown on Figure 1, Site and Location Plan. Photographs of the site are presented in Appendix B, Site Photographs.

Boreholes

Boreholes were drilled using a utility mounted Scout drill rig equipped with a 90 mm nominal diameter solid auger. Borehole reports, including a photograph of the spoil are presented in Appendix C, Borehole Reports.

Constant Head Infiltration Testing

Constant head infiltration tests were conducted using a constant head permeameter. The tests were generally conducted in accordance with Appendix G of AS 1547 (2012) "On-site domestic wastewater management". The results of the testing are presented in Appendix D, Constant Head Infiltration Test Results and summarised in Table 2.

Table 2: Constant Head Infiltration Test Results

Test	Test Depth (m)	Soil Description	k[1] (m/day)	Soil Type
P01 / BH01	0.45	Clayey Sandy GRAVEL (GC)	0.80	3
P01 / BH02	0.50		0.70	
P03 / BH03	0.45	Sandy GRAVEL (GP)	1.80	
P04 / BH04	0.43		1.10	
P05 / BH05	0.52	Clayey Sandy GRAVEL (GC)	1.00	
G01 / BH06	0.32	Gravelly CLAY (CL-CI)	0.23	4 [3]
G02/ BH08	0.32	Sandy GRAVEL (GP)	3.40	2

Notes:
1. k – saturated hydraulic conductivity
2. Soil type in accordance with Table L1 of AS1547-2012.
3. Based on information provided, Gravelly Clay layer is generally above invert level of proposed leach drains.

6. LABORATORY TESTING

6.1 Geotechnical

Geotechnical laboratory testing was conducted by HiQA in their NATA accredited laboratory. The testing comprised determination of:

- particle size distribution on 4 samples; and
- Emerson class on 2 samples.

The geotechnical laboratory test results are presented in Appendix E, Geotechnical Laboratory Test Results along with the test methods followed and a summary of the test results is presented in Table 3.

Table 3: Summary of Geotechnical Laboratory Test Results

Test Name	Sample Depth (m)	Soil Class (AS1726 2017)	% Gravel	% Sand	% Fines	Emerson Class
BH02	1.0 – 1.5	Clayey GRAVEL (GC)	60	26	14	6
BH03	0.2 – 1.4	GRAVEL (GP)	71	22	7	5

6.2 Chemical

Chemical laboratory testing was undertaken by Envirolab Services (WA) and CSBP Soil and Plant Laboratory. The testing comprised determination of:

- phosphorus retention index (PRI) testing on 2 samples;
- electrical conductivity on 2 samples; and
- pH on 2 samples.

The results of the testing are presented in Appendix F, Chemical Laboratory Test Results and a summary of the test results is presented in Table 4.

Table 4: Summary of Chemical Laboratory Test Results

Test Location	Depth (m)	Phosphorous Retention Index (PRI)	pH	Electrical Conductivity (dS/m)
BH02	1.0 – 1.5	> 1000	6.1	0.044
BH03	0.2 – 1.4	> 1000	7.1	0.053

7. SITE ASSESSMENT

7.1 Climate

7.1.1 Rainfall

The nearest Bureau of Meteorology (BoM) weather station to the site is presented below.

Table 5: Bureau of Meteorology Weather Station Details

Location	BoM Station Number	Latitude	Longitude	Elevation
Mount Helena	9202	31.83°	116.22°	300 m

Monthly rainfall data was sourced for this station on 12 December 2022, with outcomes presented in Table 6.

Table 6: Weather Station (9202) Monthly Rainfall Data for All Years (1986-2021)

Statistic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean	23	15.6	23.7	35.8	97.7	146.1	175.6	146.4	105.8	51.8	29.6	12.9	863.8
Lowest	0	0	0.4	0	20.9	20.8	33.8	20.4	32.4	5.4	0	0	443.6
5th %ile	0	0	1.2	3.1	42.8	35	82.6	65.2	39.5	13.4	2.2	0	636.8
10th %ile	0	0	2.4	5	46.9	47.4	108.1	82	50.9	14.4	6.8	0.1	655
Median	2.5	5	18.4	25.6	85.6	147.4	170.4	148.6	98.6	52.8	24.9	7.8	886.8
90th %ile	71.6	46.8	39.6	78.1	157.1	244.2	259	198.1	157.6	80.1	57	26.5	1053
95th %ile	95.8	54.8	88.3	79.3	167.6	252.4	271	225.8	168.8	103.8	76.5	43.8	1073.7
Highest	147.4	133.8	107.8	88.8	225	286.4	283.8	240.6	219.6	127.4	92	61	1144.6

7.1.2 Evaporation

Evaporation data is estimated from The Department of Agriculture and Food (1987)[1] data. The nearest referenced locations in the document are Armadale and Northam (both about 40 km from the site). Armadale has a slightly lower evaporation rate and has been adopted for the site.

Table 7: Evaporation Data Estimates – Monthly

Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Armadale	297	257	224	123	87	59	60	69	106	154	203	259	1,898
Northam	366	311	263	150	91	56	57	69	110	167	236	329	2,204

The evaporation generally exceeds the rainfall annually at the site. On average, there are 4 months of the year (May-August) where the rainfall exceeds the evaporation at the site.

7.1.3 Water Balance

A water balance calculation for zero storage has been undertaken in accordance with the Department of Health requirements. The purpose of the calculation is to ensure the minimum storage requirement is met. A calculation sheet is presented in Appendix G.

The calculation sheet indicates that a minimum land application area (LAA) of 186 m^2 is required for zero storage.

7.2 Exposure

Medium coverage of large mature trees along northern and western site boundaries. Some shelter anticipated from proposed building. Mild aspect down towards the south west.

7.3 Vegetation

Existing vegetation to be removed and replaced with car park as shown in Figure 1 and Appendix A. No significant or native vegetation is currently present on site.

7.4 Landform and Drainage

The Mundaring sheet of the 1:50,000 scale Environmental Geology series map indicates that the area is underlain by "*GRAVEL - yellow-brown to reddish brown, loose, fine to coarse, ferruginous pisolites, poorly sorted; variable amounts of sand and silt in matrix, minor recementation; colluvial origin*".

A road table drain is present along the eastern site boundary (adjacent Blair Place), which connects to a drain on the southern side of Keane Street East via a culvert. The table drain was dry at the time of our investigation, and we anticipate limited flow in the drain, associated with runoff from the adjacent sealed roads.

The Keane Street table drain flows west to tributary creeks of Jane Brook (the nearest water body), about 550 m west of the site.

[1] Luke, G J, Burke, K L, and O'Brien T M. (1987), *Evaporation data for Western Australia.* Department of Agriculture and Food, Western Australia, Perth. Report 65.

7.5 Slope

Based on a provided feature survey plan (presented in Appendix A), the site slopes down from around RL 281.5 m AHD in the north eastern corner, to around RL 279.75 m AHD along in the south west corner. The feature survey indicates and average site slope of about 4 %.

The drawings provided show the LAA is to be filled about 0.8 m to 1.55m, with a retaining wall proposed along the site boundary. Proposed finished slopes across the LAA appear to be relatively flat (likely up to about 1% to 2%). No reduction in the design irrigation rate will be required due to the slope of the LAA.

7.6 Fill (Imported)

Fill has not yet been imported to the site.

The drawings provided show the LAA is to be filled about 0.8 m to 1.55 m. However, the leach drain invert levels appear to be below current ground levels (leach drain invert level of RL 279.5 m AHD, with current ground levels of about RL 279.75 m AHD to RL 280.5 m AHD).

Recommendations for imported fill used to build up site levels (excluding any surficial pavement layers), is discussed in Section 8.1.

7.7 Surface Gravel and Rock Outcrops

We did not note any significant surficial rock outcrops. In situ soils are generally gravelly, however a reduction of soil classification is not considered necessary. Laterite boulders are expected at depth.

7.8 Erosion Potential

There is no obvious evidence of erosion and, given the gentle slope of the site, we do not consider that there is a high erosion potential.

7.9 Separation from Groundwater

We have reviewed water Bore information collected by DWER. The nearest water levels reported near the site are as follows:

- Well 61611146 (about 1 km north of the site, near the corner of Cook Street and Grahame Street), which measured water levels of between about RL 281.2 m AHD and RL 283 m AHD between 1983 and 1992. This equates to about 4 m to 7 m below ground, based on a nominal published ground level at the well of roughly RL 287 m AHD; and
- Well 61611148 (about 1.6 km south east of the site, near the corner of Lion Street and Lance Street), which measured water levels of between about RL 289.8 m AHD and RL 292.9 m AHD between 1983 and 1991. This equates to about 0 m to 3 m below ground, based on a nominal published ground level at the well of roughly RL 293 m AHD.

We note that both of the above wells are near creeks, and therefore, groundwater levels at these locations are likely to be shallower than those at the site (which is located near the middle of a slope within the surrounding undulating terrain).

The Perth Groundwater Atlases do not extend to the site.

Groundwater was encountered during our investigation as summarised in Table 8 below. Some overland flow / perched water could be anticipated in the table drains described in Section 7.4.

Table 8: Measured Groundwater Levels (November 2022 and August 2023)

Borehole	Ground Level [3] (m AHD)	Borehole Depth (m)	Groundwater Depth (m)		Groundwater Elevation (m AHD)	
			November 2022	August 2023	November 2022	August 2023
BH01	280.3	1.5	GNE	NA	*< 278.8* [2]	NM
BH02 / MW01	280.0	1.5	GNE	GNE	*< 278.5* [2]	*< 278.5* [2]
BH03	280.8	1.4	GNE	NA	*< 279.4* [2]	NM
BH04	281.2	0.4	GNE	NA	*< 280.8* [2]	NM
BH05	281.0	0.8	GNE	NA	*< 280.2* [2]	NM
BH06 / MW02	280.0	2.6	NA	2.1 / 1.6 [1]	NM	278.4
BH07	280.0	1.2	NA	GNE	NM	*< 278.8* [2]
BH08	280.5	0.8	NA	GNE	NM	*< 279.7* [2]

Notes:

- Where 'GNE' indicates Groundwater not Encountered, and 'NA' indicates not applicable as borehole not drilled on this date.
- [1] Groundwater measured at 2.1 m depth in BH06 / MW02, however soil was wet from about 1.6 m depth. Therefore, groundwater judged to be about 1.6 m depth at BH06 / MW02.
- [2] Hole dry. Therefore groundwater present below elevation stated.
- [3] Ground level inferred from feature survey provided (refer Appendix A).

Based on the results of our investigation, we recommend a design groundwater level of about RL 278.5 m AHD.

The following vertical separation distances are required from the base of the discharge point to the highest known groundwater level.

Table 9: Required Vertical Separation Distances (AS1547) – Primary Treatment Only

Area	Soil Type	Vertical Separation Distance (m)
PDWSAs	All	2.0
Sensitive water resource areas	All	1.5
All other areas	Sands	1.5
	Gravels	1.0
	Loams and heavy soils	0.6
	Hardpan/bedrock	0.6-1.5

PDWSA: public drinking water source area

We consider that the underside of leach drains or the like would need to be at least **1 m** above the design groundwater level, i.e. about RL 279.5 m AHD (which is as proposed, refer Appendix A).

7.10 PDWSAs and SSAs

The Department of Water and Environmental Regulation (DWER) maps the site as ***not*** being within a public drinking water source area (PDWSA).

The Department of Planning Lands and Heritage (DPLH) maps the site as ***not*** being within a sewage sensitive area (SSA).

7.11 Surface Waters and Separation from Water Resources

A road table drain is present along the eastern site boundary (adjacent Blair Place), which connects to a drain on the southern side of Keane Street East via a culvert. The table drain was dry at the time of our investigation, and we anticipate limited flow in the drain, associated with runoff from the adjacent sealed roads.

The Keane Street table drain flows west to tributary creeks of Jane Brook (the nearest water body), about 550 m west of the site.

7.12 Rainfall Run-on and Seepage

As noted in Section 7.5, the site has an about 1.75 m drop in elevation from the north eastern corner, down to the south west corner. The feature survey indicates an average site slope of about 4 %.

We note that the proposed development is likely to influence the direction of stormwater flow. We have assumed this will be considered during the civil design and stormwater from the overlying carpark will be directed away from the LAA.

7.13 Flood Potential

The Department of Water maps the site as not being within the flood level for both the 1:10 (10%) and 1:100 (1%) annual exceedance probability (AEP).

7.14 Setbacks

The following horizontal setbacks are applicable, which must be incorporate into the LAA.

Table 10: Required Horizontal Setback Distances (AS1547)

Feature	Sub-Type	Horizontal Setback Distance (m)
Treatment tanks to buildings, property boundaries, driveways, paths and other tanks	-	1.5
Trenches, beds and soak wells to boundary, building, tanks and other land application systems	-	2.0
Trenches, beds and soak wells to trafficable areas	-	1.2
Any land application system to wells, streams, private bores or underground source of water intended for human consumption	-	30
Trenches, beds and soak wells to subsoil drains or open drainage channels	-	6.0
Spray irrigation	Boundaries, buildings, driveways etc.	1.8
	Subsoil and open drains	6.0
	Swimming pools	3.0
	Treatment tanks	1.2
Subsurface Drippers	Boundaries, buildings, driveways etc.	1.8
	Subsoil and open drains	3.0
	Swimming pools	2.0
	Garden bore	10.0
On-site waste system to water resources (river, stream etc.)	-	100

7.15 Available Land Application Area (LAA)

7.15.1 Methods

There are two methods available for determining the indicative size of the land application area:

- Schedule 2 of the Government Sewerage Policy (2019).
- Regulation 49 of the WA Health Regulations (2005).

The GSP only considers the downward movement of effluent into the surrounding soil directly below the base of any leach drain or bed. The Health Regulations consider both downward and lateral movement of the effluent into the soil.

Accordingly, the GSP is considered a more conservative method for calculation of the required minimum land application area. However, given the site conditions and size of the LAA, we consider that the Health Regulations method to be more suitable.

7.15.2 GSP Method

The required minimum Land Application Area (LAA) has been determined in accordance with Schedule 2 of the GSP (2019) using the conversion factors as follows:

Table 11: Conversion Factors used to calculate minimum required LAA (GSP 2019)

Soil Category	Soil Texture	Conversion Factors (m^2 per 1 L/day)	
		Primary Treatment	Secondary Treatment
2	Sandy loams	0.477	0.25

For the estimated hydraulic load of 4,535 L/day, the calculated minimum LAA is 2,163 m^2 (for primary treatment, i.e., septic tanks with leach drains etc.). The minimum area for effluent subject to secondary treatment would be 1,133 m^2.

7.15.3 WA Health Regulations Method

7.15.3.1 Minimum Infiltration Area

Regulation 49 of the WA Health Regulations (2005) allows the LAA to be calculated based on the infiltrative area required for leach drains. Further, the manufacturer of any approved leach drain system confirms that infiltration area per length of leach drain, considered in Section 7.15.3.3.

The minimum infiltration area, in accordance with The Health Regulations (1974) is determined by:

$$A = \frac{V}{DLR}$$

Where:

- A = minimum infiltration area (m^2)
- V = Volume of wastewater (L/day), i.e. 4,535 L/day as determined in Section 3.2
- DLR = Design Load Rate (mm/day), taken as 30 mm/day (Table M1 of AS1547-2012)

The required minimum infiltration area is therefore 151.2 m^2.

7.15.3.2 Required Length of Leach Drains

Referring to approved units as outlined in the Department of Health list of approved leach drain units, we understand that the Tunnelwell Arch System leach drains have an indicative infiltrative area of 2.53 m^2/m. The required length of leach drains is therefore 59.7 m.

The current proposed layout drawing shows the proposed leach drains have a total length of around 60 m. Therefore, the length of leach drains is adequate.

7.15.3.3 Minimum LAA (Area Required to Accommodate Leach Drain Length)

Based on the provided drawings, there will be two rows of leach drains present at 1 location below the car park. As shown in the drawings, the following setbacks will be required (refer Section 7.14):

- setback to buildings, trafficable areas and boundaries: 1.8 m;
- spacing from edge of leach drain to adjacent leach drain: 1.8 m.

Required width = width of leach drain (2 no.) + boundary setbacks (2 no.) + Spacing (1 no.)

= (1.4 x 2) + (1.8 x 2) + 3.6 = 10 m

Required length = Length to achieve 63.1 m (with two lengths of drains) + boundary setbacks (3 no.)

= (60/2) + (1.8 x 3) = 35.4 m

Minimum LAA = 10 x 35.4 = 354 m^2

7.15.4 Summary

The below presents a summary of the available and required LAA:

Table 12: Subsurface Soil Conditions (Summary)

Item	Reference	Land Application Area (m^2)
GSP (2019) Minimum	Section 7.15.2	1,197[1]
WA Health Regulations Minimum	Section 7.15.3	159.7
Area required to meet water balance	Section 7.1.3	186
MINIMUM REQUIRED LAA		354
LAA AS SHOWN ON PLAN		354[2]

Notes: 1. GSP (2019) method for this site is considered too conservative based on the infiltration assumptions over the size of the proposed LAA. GSP area is for secondary treated effluent.
2. LAA estimated based off scale on proposed plan.

The LAA shown above is based on upon hydraulic loading assumptions made in Section 3.2. The proposed LAA as shown on the plan is adequate to meet the infiltration area, water balance and WA Health Regulations minimum.

8. SOIL ASSESSMENT

8.1 Subsurface Conditions

The subsurface conditions at the site can be summarised as comprising:

Table 13: Subsurface Soil Conditions (Summary)

Depth to base of layer (m bgl)	Soil Type (AS1726-2017)	Soil Type (AS1547-2012)	Description
0.6 m **IN BH06 ONLY**	Gravelly CLAY	'Clay loams'	Low to medium plasticity, brown, with sand, gravel content increasing with depth, **IN BH06 ONLY**.
up to 0.2	SAND / Sandy GRAVEL	'Gravels and sands' to 'Loams'	Includes fill, surficial topsoil and roadbase layers, gravel typically fine to coarse grained, sub-rounded, sand typically fine to medium grained, orange/brown/grey, trace / with fines, trace roots / organics in topsoil layers.
Beyond investigated depths of 0.4 to 1.5	Sandy GRAVEL / Clayey Sandy GRAVEL	'Gravel'	Fine to coarse grained, sub-rounded, brown/orange, low plasticity clayey fines.

Notes: 1. bgl – below ground level

The findings of our field investigation indicate subsurface conditions that are consistent with the geological mapping, as discussed in Section 7.4. No clay soils were encountered at depth.

We consider that the fill material must be of uniform quality, and similar to the existing material, and achieve the following:

- Minimum saturated hydraulic conductivity (k) = 0.7 m/day (when compacted to a dry density ratio of at least 95% MMDD

8.2 Acid Sulfate Soils

The Department of Environmental Regulation (DER) has not mapped the site. We did not encounter any indicators of ASS during our investigation.

Provided no significant deep excavations (more than 2 m depth) are required and no dewatering is required, we do not consider that a further ASS study will be necessary for the site.

8.3 Soil Category

We have assessed the soil types based on our visual-tactile assessment, laboratory and infiltration testing, in accordance with Table L1 of AS1547. A soil type of Category 3 with a hydraulic conductivity of no less than 0.7 m/day is considered applicable.

A surficial layer of lower permeability 'Clay loams' (Category 4) was encountered in BH06 to about 0.6 m depth. Based on the drawing provided, this surficial layer is to be removed from the LAA, with the LAA founded on the underlying Category 3 soils. **Any clay loam soils exposed at the base of the LAA is to be removed and replaced with fill as described in Section 8.1.**

8.4 Design Loading Rates

Based on Table 5.2 of AS1547-2012, the following design loading rates (DLRs) are considered applicable for treated effluent in trenches and beds.

Table 14: Design Loading Rates (mm/day)

Trenches and Beds		
Primary Treated Effluent (Conservative Rate)	**Primary Treated Effluent (Maximum Rate)**	**Secondary Treated Effluent (ATUs)**
10	15	30

8.5 Soil Chemistry

The results of the soil chemistry testing and the values associated with level of constraint (as outlined in AS1547-2012) are presented in Table 15.

Table 15: Soil Chemistry Summary

Chemical Feature	Test Result	Level of Constraint/Risk (AS1547[1])		
		Low	Medium	High
pH	6.1-7.1	6-8	4.5-6	<4.5, >8
Electrical Conductivity (dS/m)	0.044-0.053	<0.3	0.3-2	>2
Phosphorus retention index (PRI)[1]	>1000	>20	5-20	<5

Notes: 1. Phosphorus retention index requirements are based on our interpretation of The Department of Primary Industries and Regional Development Standards for Land Resource Mapping (2005), as this is not specified in AS1547.

The results indicate a low risk to the site on the basis of pH, phosphorus retention and electrical conductivity potential.

9. SITE AND SOIL ASSESSMENT RESULTS

A risk-based assessment has been carried out in accordance with AS1547-2012 and is presented below. This assessment is based on the information presented in Sections 7 and 8.

Table 16: Site and Soil Risk-Based Assessment (AS1547)

Characteristic	Level of Constraint	Mitigation Measures
Climate	Low	-
Exposure	Low	-
Vegetation	Low	-
Landform & Drainage	Low	-
Slope	Moderate	Diversion of stormwater from effluent disposal area
Fill (Imported)	Low	Some filling may be required to create design lot levels. Fill to comply with requirements set out in Section 8.1.
Surface Gravel and Rock Outcrops	Low	Insitu soils are generally gravelly. No rock outcrop observed.
Erosion Potential	Low	-
Separation from Groundwater	Low	Suitable separation can be achieved from nominated design groundwater level of RL 278.5 m AHD.
PDWSAs and SSAs	Low	Site is *not* in SSA or PDWSA.
Surface Water	Nil	-
Rainfall Run-on	Moderate	Need for diversion of stormwater from treatment area and units.
Flood Potential	Nil	-
Setbacks	Low to Moderate	Proposed LAA will likely meet setback requirements.
Available LAA	Low	Proposed configuration will accommodate required minimum LAA.
Sufficient Profile Depth	Low	A surficial layer of lower permeability 'Clay loams' (Category 4) was encountered in BH06 to about 0.6 m depth. Based on the drawing provided, this surficial layer is to be removed from the LAA, with the LAA founded on the underlying Category 3 soils. **Any clay loam soils exposed at the base of the LAA is to be removed and replaced with fill as described in Section 8.1.**
Coarse Fragments	Low	Abundance of coarse fragments, however, reduction of soil classification not considered necessary.
Soil Colour & Mottling	Nil	-
Soil Permeability and Design Loading Rates	Low	Soil modification/replacement not required.
pH	Low	Soil modification/replacement not required.
Electrical Conductivity	Low	Soil modification/replacement not required.
Sodicity	Nil	-
Phosphorus Adsorption	Low	Soil modification/replacement not required.

We consider that all of the constraints at the site can be appropriately mitigated at the site using the risk-based approach outlined in AS1547-2012.

10. SITE SUITABILITY FOR EFFLUENT DISPOSAL AND RECOMMENDATIONS

Based on our assessment, the site is suitable for disposal of wastewater. We understand wastewater will be treated with an ATU system followed by disposal of secondary effluent using a leach drain system. We consider this is suitable for this site provided that:

- The proposed leach drain configuration is designed to accommodate both the length of leach drains required, as well as the ATU capacity requirements (this is the case based on current plans provided). Any configuration must also meet the horizontal setback requirements as outlined in Section 7.14 (appears to be addressed based on current plans). The leach drains are currently located under the carpark, which will require regulator approval, however we consider that they will function adequately below the car park.

- The leach drains be positioned such that there is a minimum vertical separation of 1 m from the base of the leach drain to the design groundwater level (we have provided a design groundwater level of RL 278.5 m AHD based on the investigation and site topography). This has been taken into account on the existing design drawings.
- The base of any leach drain must not be confined to restrict the movement of effluent or nutrients. We note that the drawings indicate that leach drains may be installed very close to concrete/impermeable separators. The permeable base and sides of the leach drain must be allowed to drain freely into soil.
- A surficial layer of lower permeability 'Clay loams' (Category 4) was encountered in BH06 to about 0.6 m depth. Based on the drawing provided, this surficial layer is to be removed from the LAA, with the LAA founded on the underlying Category 3 soils. Any clay loam soils exposed at the base of the LAA is to be removed and replaced with fill as described in Section 8.1.

Treatment Units

The wastewater may be treated using an ATU (secondary treatment), also known as aerated wastewater treatment systems (AWTS). ATU's use the processes of aeration followed by clarification to achieve biological treatment of wastewater.

ATU's (or any other proposed system) must be certified to AS1546.3 (2008) and require approval by the Chief Health Officer. A list of approved ATU's is presented in Table 2 on the Department of Health website. The selected ATU must meet the hydraulic loading for the site (estimated to be 4,790 L/day) and must treat sewage to achieve the following nutrient targets:

- Phosphorous: <1 mg/L
- Nitrogen: <10 mg/L

Land Application Area (LAA)

The site is susceptible to stormwater intrusion. Surface interception drains or stormwater diversion drains may be required to divert stormwater away from the LAA, depending on the final levels of the LAA. We assume this will be addressed during the civil design.

11. CLOSURE

We draw your attention to Appendix H of this report, "Understanding your Report". The information provided within is intended to inform you as to what your realistic expectations of this report should be. This information is provided not to reduce the level of responsibility accepted by Galt, but to ensure that all parties who rely on this report are aware of the responsibilities each assumes in so doing.

Yours Faithfully,

GALT GEOTECHNICS PTY LTD

Owen Woodland CPEng
Geotechnical Engineer

Tyrone Mardesic CPEng
Geotechnical Engineer

https://galtgeo.sharepoint.com/sites/WAG220058/Shared Documents/02 VALM SSE/03 Correspondence/WAG220058-02 001 R Rev1.docx

Figures

www.galtgeo.com.au
50 Edward Street OSBORNE PARK WA 6017

ABN: 64 625 054 729

Legend

- Site Boundary

Test Locations

- Borehole
- Borehole / Guelph Permeameter

Galt Previous Test Locations

- Borehole

N

0 4.5 9 13.5 18 22.5

Meters

NOTES

Aerial Imagery and Cadastre sourced from Landgate/SLIP

SCALE	1:300	(A3)
DRAWN	CED	
DATE DRAWN	21/8/2023	
CHECKED	–	
DATE CHECKED	–	
PROJECTION	GDA 1994 MGA Zone 50	

Galt Geotechnics Pty Ltd
ACN : 138 490 865
Tel : +61 (0)8 6272-0200
Address : 50 Edward Street
Osborne Park WA 6017

CLIENT	**VALM PTY LTD**
PROJECT	PROPOSED CHILD CARE CENTRE
LOCATION	LOT 2 (NO 1785) KEANE STREET EAST MOUNT HELENA
TITLE	SITE & LOCATION PLAN
Job No	WAG220058-02
Fig No	FIGURE 1
Rev	**A**

O:\Projects\WAG\220058\02\04 MXD\WAG220058-02-001-G01.mxd (claire.doyle) 21/8/2023 3:39:26 PM

Appendix A: Supplied Drawings

www.galtgeo.com.au
50 Edward Street OSBORNE PARK WA 6017
ABN: 64 625 054 729

SERVICE LEGEND

DRAINAGE
- SIDE ENTRY PIT
- STORM WATER MANHOLE
- DRAINAGE PIPE

ELECTRICITY
- POWER DOME
- POWER PIT
- POWER POLE
- LIGHT POLE
- STEEL WIRE ANCHOR
- STAY POLE
- POWER LINE

GAS
- GAS MANHOLE
- GAS MARKER
- GAS METER
- GAS VALVE
- GAS LINE

SEWER
- SEWER MANHOLE
- SEWER INSPECTION OPENING
- SEWER LINE

COMMUNICATIONS
- COMMUNICATIONS PIT
- COMMUNICATIONS MARKER
- COMMUNICATIONS LINE

WATER
- FIRE HYDRANT
- STOP VALVE
- WATER TAP
- WATER MARKER
- WATER METER
- WATER PIPE

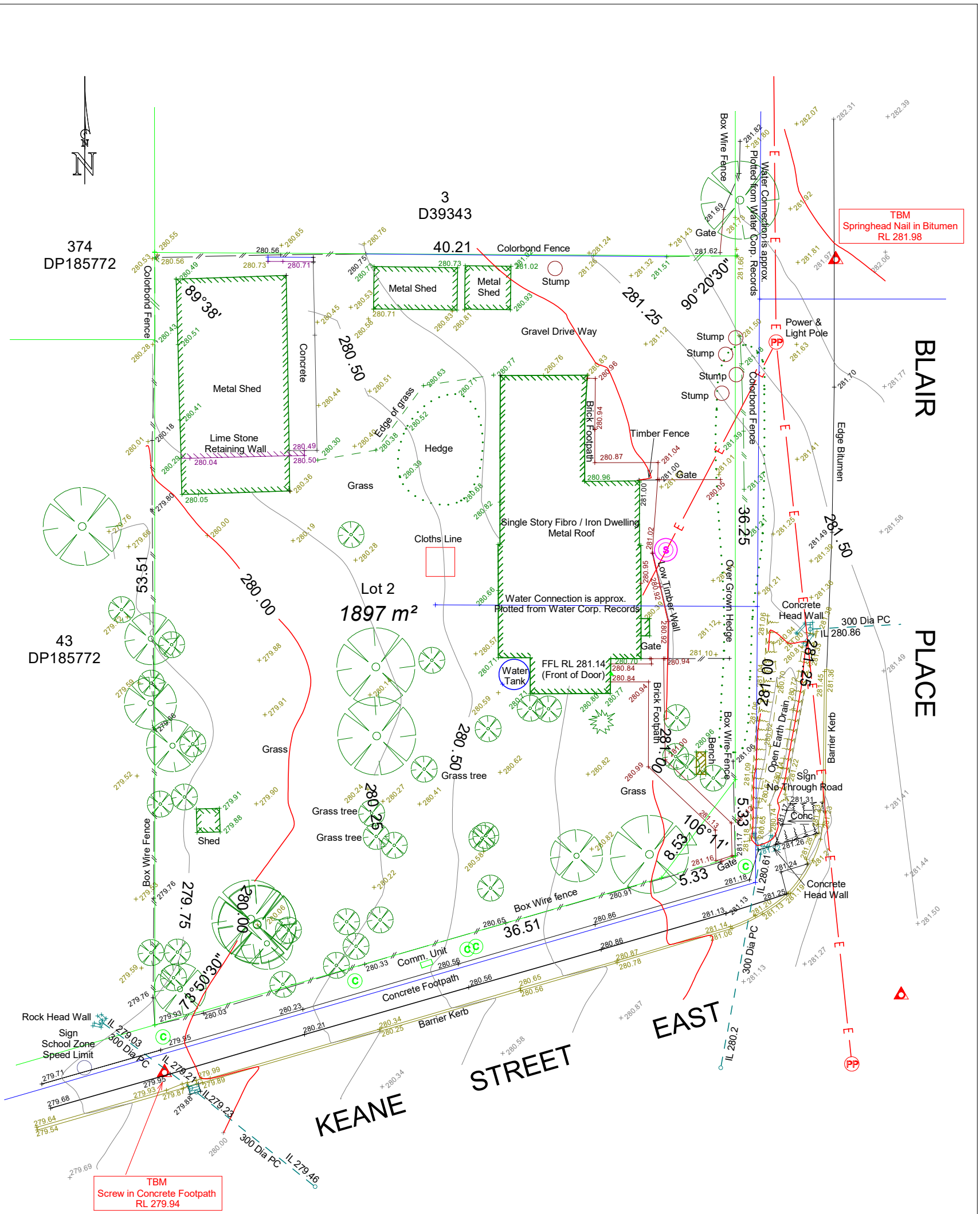
UNDEFINED
- UNDEFINED SERVICE MARKER
- UNDEFINED MANHOLE
- UNDEFINED SERVICE

SURVEY
- DATUM
- PEG FOUND

STRUCTURES
- BUILDING
- RETAINING WALL
- ROAD CENTRE LINE

SERVICE RECORDS

SERVICE \ STATUS	LOCATED	ONLY SIGHTED	OBSTRUCTION	NOT AVAILABLE
WATER			✓	
SEWER				✓
GAS				✓
TEL/COMM	✓			
POWER U/G				✓
O/H	✓			



WARNING!
BOUNDARY RE-ESTABLISHMENT SURVEY REQUIRED TO CONFIRM LOT BOUNDARY POSITION AND DIMENSIONS

REV	DATE	BY	DESCRIPTION
A	30/09/2022	MK	ISSUE FOR REVIEW
0	01/10/2022	CF	ISSUE FOR USE

SITE SURVEY ONLY. The in formation shown on this drawing is current at the date of survey. Boundary information, Easements ETC. to be verified from the Certificeate of Title, Plan/Diagram or a boundary Repeg. Boundary position approximate only. Location of boundary pegs or fences in relation to the boundary lines are not guaranteed. Sewer, drainage may vary from the Schematic representation, clearances to be checked on site. Service information to be confirmed with the relevant authorities. For underground services ring "DIAL BEFORE YOU DIG" for confirmation.

NOTE:
LEVELS ARE TO AHD 71
ORIGIN OF LEVELS: SSM MT HELENA 24

PSS GROUP
PO Box 2036 Wangara DC WA 6947
ABN: 35 158 910 162
(08) 9303 2408 (08) 9303 2407
admin@pssgroup.com.au
www.pssgroup.com.au

SCALE @ A3: 1:300
0 15 30

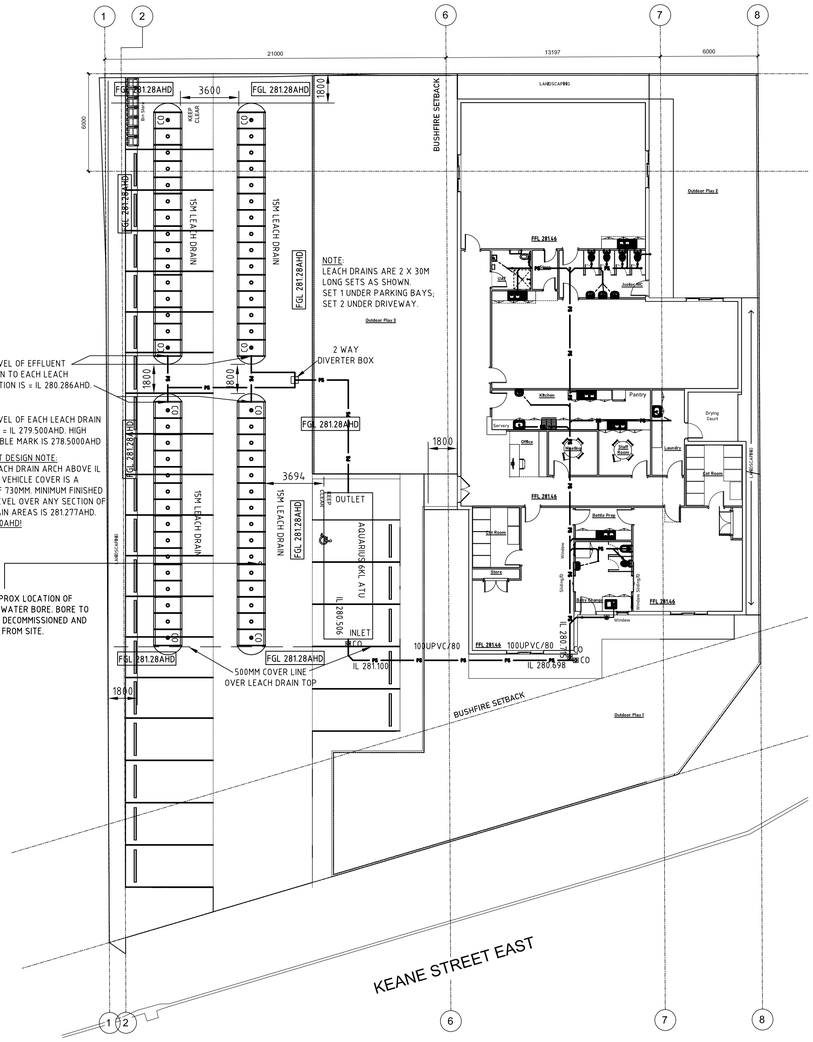
Feature and Contour Survey

DOCUMENT NUMBER	220923-220381a-MK-FS-2					PLAN/DIA	D 27974
SURVEYED	DATE	DRAFTED	DATE	REVIEWED	DATE	CERT/TITLE	1282/508
MK	23/09/2022	MK	29/09/2022	CAF	01/10/2022		

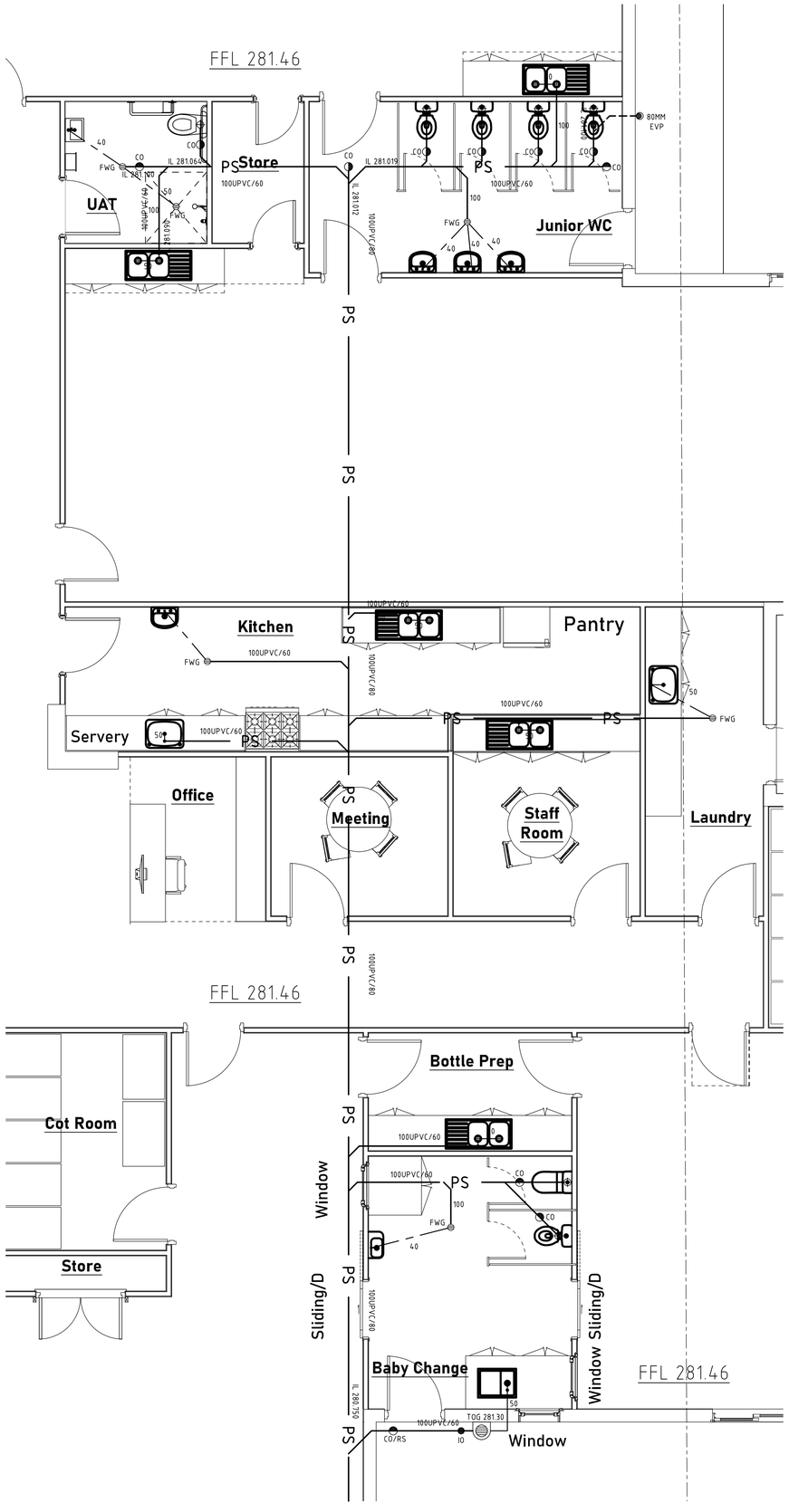
BUILDER REF:
VERT. DATUM: AHD 71
LOT NUMBER: 2

ADDRESS
1785 Keane St East
MOUNT HELENA

BUILDER
Arise Developments



SITE PLAN - SCALE 1:200



FLOOR PLAN DETAILED- SCALE 1:50

LEGEND

LINE TYPES

PS	Property Sewer Drain
	40-50mm wastes

SYMBOLS

	50mm EVP
	80mm EVP
	Pan Line or Waste Centre
	Inspection Opening
	Clean Out Point (CO)
	Overflow and Relief Gully/Trade Waste Inspection Point (TWSP)
	Waste outlet - 40mm & 50mm
	Waste dropper - 40mm & 50mm
	Floor Waste Gully (FWG)

ABBREVIATIONS

CO	Clean Out Point
CO/RS	Clean Out Point/Rising shaft
EVP	Educt Vent Pipe
FWG	Floor Waste Guly
IL	Invert Level
ORG	Overflow Relief Gully

PROPOSED CHILD CARE CENTRE

0-18 MONTHS	12 CHILDREN	3 STAFF	39m²	84m²
18-24 MONTHS	12 CHILDREN	3 STAFF	39m²	84m²
24-36 MONTHS	25 CHILDREN	5 STAFF	81.25m²	175m²
+36 MONTHS	30 CHILDREN	3 STAFF	97.5m²	210m²
TOTAL	**79 CHILDREN**	**14 STAFF**		

HYDRAULIC LOADING CALCULATIONS

TYPE OF PREMISES	USER TYPE	NUMBER OF PERSONS	L/PERSON/DAY	TOTAL (L/DAY)
CHILDCARE	CHILDCARE STAFF	14	70	980
	CHILDREN	79	45	3,555
			TOTAL:	4,535
ATU SIZING	AQUARIUS WASTE WATER TREATMENT	6KL		
LEACH DRAIN CALCULATIONS	4535/30/253=59.75M	LAYOUT - 4 X 15M TUNNEL WELL ARCHES		

DEPT OF HEALTH REGULATION REQUIREMENTS

LEACH DRAINS OFFSET DISTANCES	BOUNDARY	1800MM	YES	
	SEPARATION DISTANCE	3600MM	YES	
	GROUND WATER SEPARATION	+1000MM	YES	
	MINIMUM LEACH DRAIN COVERAGE UNDER CAR PARK	600MM	YES	
	PUMP OUT ACCESS		YES	

DATE	REVISION	ITEM	ISSUE No.
24/07/23	B	ISSUED FOR HEALTH APPROVAL	02
19/07/23	A	ISSUED FOR HEALTH APPROVAL	01

OTG HYDRAULIC DESIGN
0408 694 623
RUSSELL@OTGGROUP.COM.AU
WWW.OTGGROUP.COM.AU
LEVEL 1, 32 DENNINUP WAY MALAGA 6090

NORTH

ISSUED FOR HEALTH APPROVAL

PROJECT: LOT 1578 KEANE ST, EAST, MT HELENA

PLAN: SITE PLAN, DETAILS, LEGENDS & ATU & LEACH DRAIN PROPOSAL

DESIGNED	MJW	SCALE @ A1	As shown	JOB NUMBER	DWG No.	REV No.
DRAWN	MJW	DATUM	- AHD	8/23	HS 01	B
CHECKED	RWG	DATE	- JULY 23			

Appendix B: Site Photographs

www.galtgeo.com.au
50 Edward Street OSBORNE PARK WA 6017
ABN: 64 625 054 729

Photograph 1: Site from Blair Place

Photograph 2: Near BH03 facing west

Photograph 3: Near BH03 facing east

Photograph 4: Near BH01 facing north

Appendix C: Borehole And Monitoring Well Reports

www.galtgeo.com.au
50 Edward Street OSBORNE PARK WA 6017
ABN: 64 625 054 729

EXPLANATORY NOTES TO BE READ WITH BOREHOLE AND TEST PIT REPORTS

METHOD OF DRILLING OR EXCAVATION

AC	Air Core	E	Excavator	PQ3	PQ3 Core Barrel
AD/T	Auger Drilling with TC-Bit	EH	Excavator with Hammer	PT	Push Tube
AD/V	Auger Drilling with V-Bit	HA	Hand Auger	R	Ripper
AT	Air Track	HMLC	HMLC Core Barrel	RR	Rock Roller
B	Bulldozer Blade	HQ3	HQ3 Core Barrel	SON	Sonic Rig
BH	Backhoe Bucket	N	Natural Exposure	SPT	Driven SPT
CT	Cable Tool	NMLC	NMLC Core Barrel	WB	Washbore
DT	Diatube	PP	Push Probe	X	Existing Excavation

SUPPORT

T	Timbering

PENETRATION EFFORT (RELATIVE TO THE EQUIPMENT USED)

VE	Very Easy	E	Easy	F	Firm
H	Hard	VH	Very Hard		

WATER

►	Water Inflow	▼	Water Level
◄	Water Loss (complete)		
◁	Water Loss (partial)		

SAMPLING AND TESTING

B	Bulk Disturbed Sample	P	Piston Sample
BLK	Block Sample	PBT	Plate Bearing Test
C	Core Sample	U	Undisturbed Push-in Sample
CBR	CBR Mould Sample		U50: 50 mm diameter
D	Small Disturbed Sample	SPT	Standard Penetration Test
ES	Environmental Soil Sample		Example: 3, 4, 5 N=9
EW	Environmental Water Sample		3,4,5: Blows per 150 mm
G	Gas Sample		N=9: Blows per 300 mm after
HP	Hand Penetrometer		150 mm seating interval
LB	Large Bulk Disturbed Sample	VS	Vane Shear; P = Peak
M	Mazier Type Sample		R = Remoulded (kPa)
MC	Moisture Content Sample	W	Water Sample

ROCK CORE RECOVERY

TCR = Total Core Recovery (%) $= \frac{CRL}{TCL} \times 100$

RQD = Rock Quality Designation (%) $= \frac{ALC>100}{TCL} \times 100$

TCL	Length of Core Run
CRL	Length of Core Recovered
ALC>100	Total Length of Axial Lengths of Core Greater than 100 mm Long

METHOD OF SOIL DESCRIPTION
BOREHOLE AND TEST PIT REPORTS

GRAPHIC LOG & SOIL CLASSIFICATION SYMBOLS

Graphic	USCS	Soil Name
		FILL (various types)
		COBBLES / BOULDERS
	GP	GRAVEL (poorly graded)
	GW	GRAVEL (well graded)
	GC	Clayey GRAVEL
	GM	Silty GRAVEL
	SP	SAND (poorly graded)
	SW	SAND (well graded)
	SC	Clayey SAND

Graphic	USCS	Soil Name
	SM	Silty SAND
	ML	SILT (low liquid limit)
	MH	SILT (high liquid limit)
	CL	CLAY (low plasticity)
	CI	CLAY (medium plasticity)
	CH	CLAY (high plasticity)
	OL	Organic SILT (low liquid limit)
	OH	Organic SILT (high liquid limit)
	Pt	PEAT

NOTE: Dual classification given for soils with a fines content between 5% and 12%.

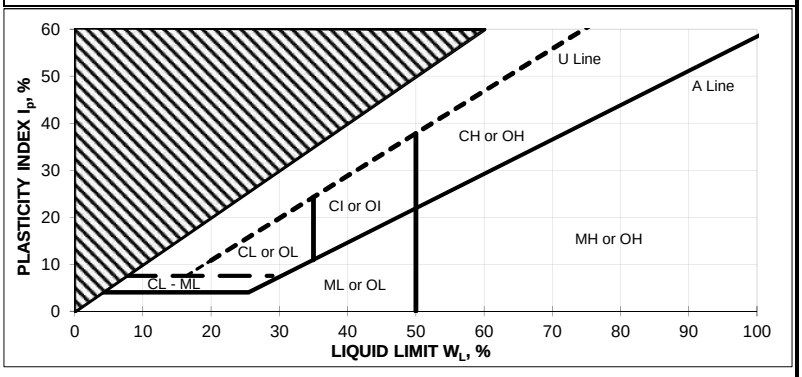
SOIL CLASSIFICATION AND INFERRED STRATIGRAPHY

Soil descriptions are based on AS1726-2017. Material properties are assessed in the field by visual/tactile methods in combination with field and laboratory testing techniques (where used).

NOTE: AS 1726-2017 defines a fine grained soil where the total dry mass of fine fractions (<0.075 mm particle size) exceeds 35%.

PARTICLE SIZE		
Soil Name		**Particle Size (mm)**
BOULDERS		>200
COBBLES		63 to 200
GRAVEL	Coarse	19 to 63
	Medium	6.7 to 19
	Fine	2.3 to 6.7
SAND	Coarse	0.6 to 2.36
	Medium	0.21 to 0.6
	Fine	0.075 to 0.21
FINES	SILT	0.002 to 0.075
	CLAY	<0.002

PLASTICITY - MODIFIED CASAGRANDE CHART - AS1726-2017



RESISTANCE TO EXCAVATION		
Symbol	**Term**	**Description**
VE	Very easy	All resistances are relative to the selected method of excavation
E	Easy	
F	Firm	
H	Hard	
VH	Very hard	

MOISTURE CONDITION	
Symbol	**Term**
D	Dry
M	Moist
W	Wet

CEMENTATION	
Cementation	**Description**
Weakly cemented	Soil may be easily disaggregated by hand in air or water
Moderately cemented	Effort is required to disaggregate the soil by hand in air or water

CONSISTENCY		
Symbol	**Term**	**Undrained Shear Strength (kPa)**
VS	Very Soft	0 to 12
S	Soft	12 to 25
F	Firm	25 to 50
St	Stiff	50 to 100
VSt	Very Stiff	100 to 200
H	Hard	>200

ORGANIC SOILS	
Material	**Organic Content % of dry mass**
Inorganic soil	<2%
Organic soil	2% to 25%
Peat	>25%

DENSITY		
Symbol	**Term**	**Density Index (%)**
VL	Very Loose	<15
L	Loose	15 to 35
MD	Medium Dense	35 to 65
D	Dense	65 to 85
VD	Very Dense	>85

REPORT OF BOREHOLE: BH01

Client : Arise Developments
Project : Proposed Childcare
Location : 1785 Keane St, Mt Helena
Job No : WAG220058-01

Contractor : Galt Geotechnics
Driller Rig : Galt Geotechnics
Drill Rig : EVH Scout 1750
Inclination : -90 deg

Sheet : 1 OF 1
Logged : William Feng
Logged Date : 30/11/2022
Checked : Tyrone Mardesic
Checked Date : 13/12/2022

Drilling Method	Excavation Resistance	PSP	DCP	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency	Remarks	Sample
90mm Solid Auger	Easy to Hard		SET		0.1	Topsoil		SP	SAND: grey, fine to medium grained, (trace fines, grass and rootlets at surface.) .	D	D-VD		
			7			Natural		GC	Clayey Sandy GRAVEL: low plasticity, brown orange, fine to coarse sized, fine to medium grained sand, (about 10-15 % fines) .	D	D-VD		
			11										
			9										
			4		0.5								
			5										
			13										
			10+(R)		1								
					1.5				**BH01 Terminated at 1.5m (TD/GNE)**				
					2								

REPORT OF BOREHOLE: BH02

Sheet : 1 OF 1

Client : Arise Developments
Project : Proposed Childcare
Location : 1785 Keane St, Mt Helena
Job No : WAG220058-01

Contractor : Galt Geotechnics
Driller Rig : Galt Geotechnics
Drill Rig : EVH Scout 1750
Inclination : -90 deg

Logged : William Feng
Logged Date : 30/11/2022
Checked : Tyrone Mardesic
Checked Date : 13/12/2022

Drilling Method	Excavation Resistance	PSP	DCP	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency	Remarks	Sample
90mm Solid Auger	Easy to Hard		SET 4 6 7 5 4 9 12 20		0.2 0.5 1 1.5 2	Natural Natural		SP GC	SAND: grey, fine to medium grained, (trace fines, grass and rootlets at surface) . Clayey Sandy GRAVEL: low plasticity, brown orange, fine to coarse sized, fine to medium grained sand, (about 10-15% fines) .	D M-D	MD D-VD		
									BH02 Terminated at 1.5m (TD/GNE)				

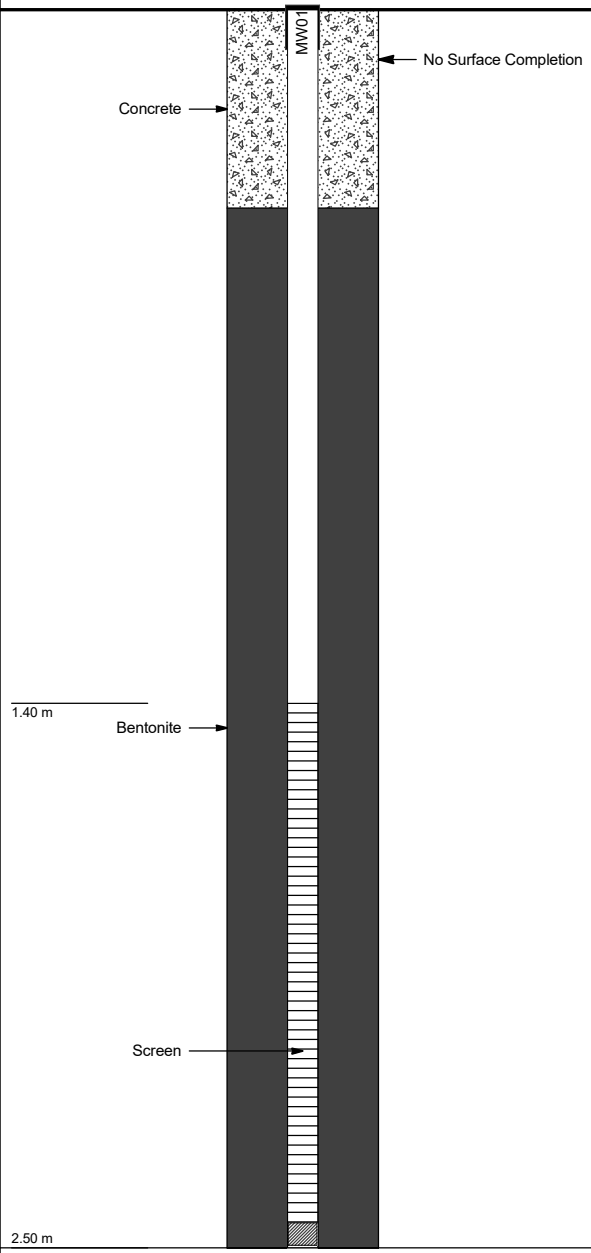
GROUNDWATER MONITORING BORE: BH02

Job Number:	WAG220058-01	**Contractor:**		**Date:**	30/11/2022
Client:	Arise Developments	**Drill Rig:**		**Logged:**	WF
Project:	Proposed Childcare Centre	**Inclination:**	-90°	**Checked Date:**	13/12/2022
Location:	Lot 2, No 1785 Keane St East, Mount Helena	**Hole Dia:**	90 mm	**Checked By:**	TM

Method	Ground Water	Depth (m)	Elevation (m AHD)	Graphic Log	Soil / Rock Description
		0.5			
		1.0			
		1.5			
		2.0			
		2.5			
		3.0			

WELL INSTALLATION DETAILS

ID:	MW01	**Stick Up & RL:**	0.85 m
Type:	Standpipe	**Tip Depth & RL:**	2.50 m
Installation Date:		**Static Water Level:**	NA



Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

REPORT OF BOREHOLE: BH03

Sheet : 1 OF 1

Client : Arise Developments
Project : Proposed Childcare
Location : 1785 Keane St, Mt Helena
Job No : WAG220058-01

Contractor : Galt Geotechnics
Driller Rig : Galt Geotechnics
Drill Rig : EVH Scout 1750
Inclination : -90 deg

Logged : William Feng
Logged Date : 30/11/2022
Checked : Tyrone Mardesic
Checked Date : 13/12/2022

Drilling Method	Excavation Resistance	PSP	DCP	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency	Remarks	Sample
90mm Solid Auger	Hard		SET SET SET SET SET SET 4 5 5 6 (HB)		0.2 0.5 1	Natural Natural		GP GP	Sandy GRAVEL: brown orange, fine to medium sized, fine to medium grained sand, (hardstand driveway) . Sandy GRAVEL: fine to coarse sized, brown orange, fine to medium grained sand, (about 5-12 % fines) .	D D	D-VD D-VD		
					1.5 2				**BH03 refusal at 1.4m (Refusal on gravel. GNE)**				

REPORT OF BOREHOLE: BH04

Sheet : 1 OF 1

Client : Arise Developments
Project : Proposed Childcare
Location : 1785 Keane St, Mt Helena
Job No : WAG220058-01

Contractor : Galt Geotechnics
Driller Rig : Galt Geotechnics
Drill Rig : EVH Scout 1750
Inclination : -90 deg

Logged : William Feng
Logged Date : 30/11/2022
Checked : Tyrone Mardesic
Checked Date : 13/12/2022

Drilling Method	Excavation Resistance	PSP	DCP	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency	Remarks	Sample
90mm Solid Auger	Hard		SET SET SET 10+ (R		0.2	Natural		GP	Sandy GRAVEL: brown orange, fine to medium sized, fine to medium grained sand, (hardstand driveway, about 5% to 10% low plasticity fines) .	D	D-VD		
						Natural		GP	Sandy GRAVEL: brown orange, fine to coarse sized, fine to medium grained sand, (about 5% to 10% low plasticity fines) .	D	D-VD		
					0.5				**BH04 refusal at 0.4m (Refusal on gravel. GNE)**				

REPORT OF BOREHOLE: BH05

Sheet : 1 OF 1

Client : Arise Developments
Project : Proposed Childcare
Location : 1785 Keane St, Mt Helena
Job No : WAG220058-01

Contractor : Galt Geotechnics
Driller Rig : Galt Geotechnics
Drill Rig : EVH Scout 1750
Inclination : -90 deg

Logged : William Feng
Logged Date : 30/11/2022
Checked : Tyrone Mardesic
Checked Date : 13/12/2022

Drilling Method	Excavation Resistance	PSP	DCP	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency	Remarks	Sample
90mm Solid Auger	Easy to Hard		SET		0.1	Topsoil		SP	SAND: grey, fine to medium grained, (trace fines, grass and rootlets at surface.) .	D	MD		
			3			Natural		GC	Clayey Sandy GRAVEL: low plasticity, brown orange yellow, fine to coarse sized, fine to medium grained sand, (about 10-15 % fines or gravelly sand) .	D	MD		
			3										
			6								D-VD		
			7		0.5								
			6										
			4										
			10+(R)						**BH05 refusal at 0.8m (Refusal on gravel. GNE)**				

REPORT OF BOREHOLE: BH06

Job No	: WAG220058-02	Easting	: 425900.0	Sheet	: 1 OF 1
Client	: VALM PTY LTD	Northing	: 6472996.5	Logged	: MS
Project	: Proposed Childcare Centre	UTM	: 50J	Logged Date	: 15/08/2023
Location	: Lot 2 (#1785) Keane St E, Mount Helena WA	Drill Rig	: EVH Scout 1750	Checked	: TM
Contractor	: Galt Geotechnics	Inclination	: -90 deg	Checked Date	: 20/08/2023

Excavator Attachment	Excavation Resistance	PSP	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks: General Remarks	Sample
90 mm Solid Auger V-Bit				▼	0.1	Natural		SC	Natural clayey SAND: low plasticity clay, dark brown, fine to coarse grained, with fine to medium sized gravel, (trace organics present).	M		Standpipe installed to 2.3m depth. 50 mm PVC pipe, 0.8 m solid over 1.5m slotted.	
					0.6	Natural		CL-Cl	Natural gravelly CLAY: low to medium plasticity, brown, fine to coarse sized gravel, with fine to coarse grained sand, inorganic, (gravel content increasing with depth).	M	F		
					1	Natural		GC	Natural clayey GRAVEL: rounded: low to medium plasticity clay, brown, fine to coarse sized, with fine to coarse grained sand.	M			
					1.6	Natural		GC	Natural clayey GRAVEL: rounded: low to medium plasticity clay, brown, fine to coarse sized, with fine to coarse grained sand.	W-M			
					2				**BH06 Terminated at 2.6 m (target depth)**				

REPORT OF BOREHOLE: BH07

Job No	: WAG220058-02	Easting	: 425892.3	Sheet	: 1 OF 1
Client	: VALM PTY LTD	Northing	: 6473008.4	Logged	: MS
Project	: Proposed Childcare Centre	UTM	: 50J	Logged Date	: 15/08/2023
Location	: Lot 2 (#1785) Keane St E, Mount Helena WA	Drill Rig	: EVH Scout 1750	Checked	: TM
Contractor	: Galt Geotechnics	Inclination	: -90 deg	Checked Date	: 20/08/2023

Excavator Attachment	Excavation Resistance	PSP	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks: General Remarks	Sample
90 mm Solid Auger V-Bit					1	Natural		GP	Natural sandy GRAVEL: rounded: brown, fine to coarse sized, fine to coarse grained sand, trace low plasticity clay.	M			
					2				**BH07 refusal at 1.2 m (Refusal on inferred laterite)**			Existing BH02 standpipe dipped, and dry to 1.5m depth.	

REPORT OF BOREHOLE: BH08

Job No	: WAG220058-02	Easting	: 425895.0	Sheet	: 1 OF 1
Client	: VALM PTY LTD	Northing	: 6473033.6	Logged	: MS
Project	: Proposed Childcare Centre	UTM	: 50J	Logged Date	: 15/08/2023
Location	: Lot 2 (#1785) Keane St E, Mount Helena WA	Drill Rig	: EVH Scout 1750	Checked	: TM
Contractor	: Galt Geotechnics	Inclination	: -90 deg	Checked Date	: 20/08/2023

Excavator Attachment	Excavation Resistance	PSP	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
90 mm Solid Auger V-Bit					0	Fill		GP	Fill sandy GRAVEL: rounded: dark reddish brown, fine to coarse sized, fine to coarse grained sand, trace low plasticity clay.	M			
					0.2	Natural		GP	Natural sandy GRAVEL: rounded: brown, fine to coarse sized, fine to coarse grained sand, trace low plasticity clay.				
					1				**BH08 refusal at 0.8 m (Refusal on inferred laterite)**				
					2								

Appendix D: Constant Head Infiltration Test Results

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50 Edward Street OSBORNE PARK WA 6017
ABN: 64 625 054 729

Hydraulic Conductivity Calculation - Constant Head by Permeameter

Galt Geotechnics

Spreadsheet author:	AQ	19-Oct-20

REFERENCE: AS1547-2012, "On-site domestic wastewater management" - Appendix G

Job No:	WAG220058
Client:	Arise Developments
Project:	Proposed Childcare
Location:	Lot 2, No. 1785
Calc by:	Kean St East, Mt. Helena
Test Name	P01/BH01

$$K = \frac{4.4Q[0.5\ \sinh^{-1}\left(\frac{H}{2r}\right) - \sqrt{\left(\frac{r}{H}\right)^2 + 0.25} + \frac{r}{H}]}{2\,\pi H^2}$$

Spreadsheet Legend

	Required input
	Calculated field
	Comment field
	Field not used
	Fixed field

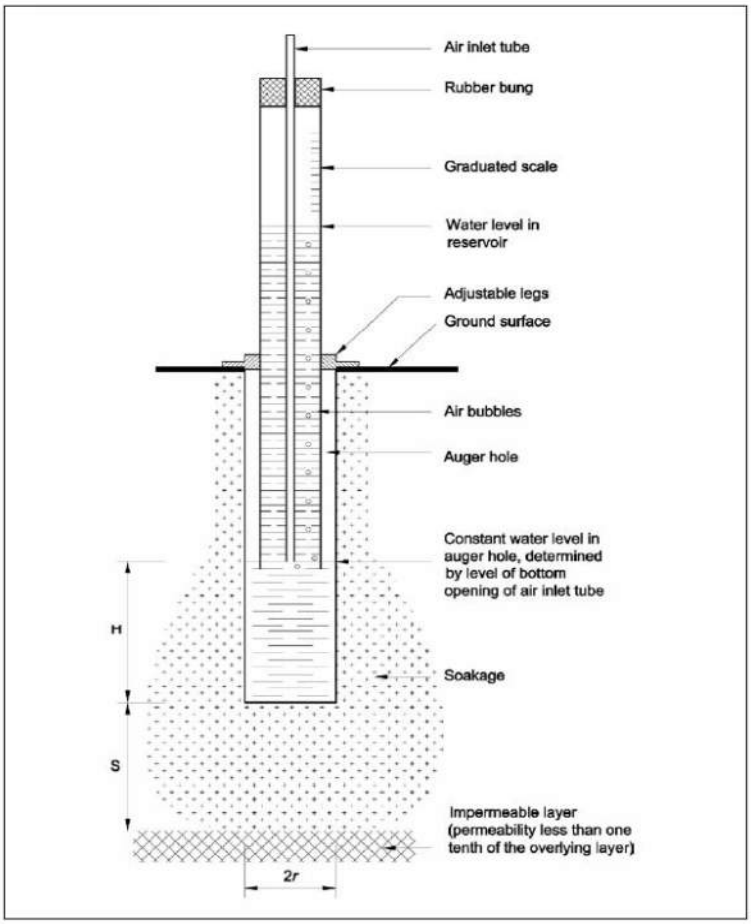
Parameter	Description	Value	Units
K_{sat}	Saturated hydraulic conductivity		cm/min
D	Depth of auger hole	45	cm
H	Head of water above base	16.5	cm
r	Radius of auger hole	4.5	cm
S	Depth to impermeable stratum		cm
Reservoir	Chosen Guelph reservoir (inner or outer)	**Outer**	
Area	Area of chosen reservoir	35.2	cm^2
F	Reading of water level in reservoir		cm

Test Results

Time (min)	F (cm)	ΔF (cm)	ΔF (cm)/min
0	60.6		
1	58.8	1.80	1.80
2	57.2	1.60	1.60
3	55	2.20	2.20
4	53.4	1.60	1.60
5	51.6	1.80	1.80
6	49.8	1.80	1.80
7	48.2	1.60	1.60
8	46.8	1.40	1.40
9	45.2	1.60	1.60
10	43.4	1.80	1.80
11	41.4	2.00	2.00
12	39.8	1.60	1.60
13	38.2	1.60	1.60
14	36.8	1.40	1.40
15	35.2	1.60	1.60
16	33.6	1.60	1.60
17	31.2	2.40	2.40
18	29.8	1.40	1.4
19	28.4	1.40	1.4
20	26.6	1.80	1.8
21	24.6	2.00	2.0
22	23	1.60	1.6
23	21.8	1.20	1.2
24	20.6	1.20	1.2
25	18.4	2.20	2.2
26	16.8	1.60	1.6
			1.56

Calculation

Steady State Flow	1.56	cm/min
Flow from reservoir (Q)	54.91	cm^3/min
K_{sat}	0.055	cm/min
K_{sat}	9.1E-06	m/s
K_{sat}	**0.786**	**m/day**



where:
H = depth of water in test hole
S = the depth to an underlying impermeable layer
r = radius of the test hole

Hydraulic Conductivity Calculation - Constant Head by Permeameter

Galt Geotechnics

Spreadsheet author:	AQ	19-Oct-20

REFERENCE: AS1547-2012, "On-site domestic wastewater management" - Appendix G

Job No:	WAG220058
Client:	Arise Developments
Project:	Proposed Childcare
Location:	Lot 2, No. 1785
Calc by:	Kean St East, Mt. Helena
Test Name	P02/BH02

$$K = \frac{4.4Q[0.5\ \sinh^{-1}\left(\frac{H}{2r}\right) - \sqrt{\left(\frac{r}{H}\right)^2 + 0.25} + \frac{r}{H}]}{2\,\pi H^2}$$

Spreadsheet Legend

	Required input
	Calculated field
	Comment field
	Field not used
	Fixed field

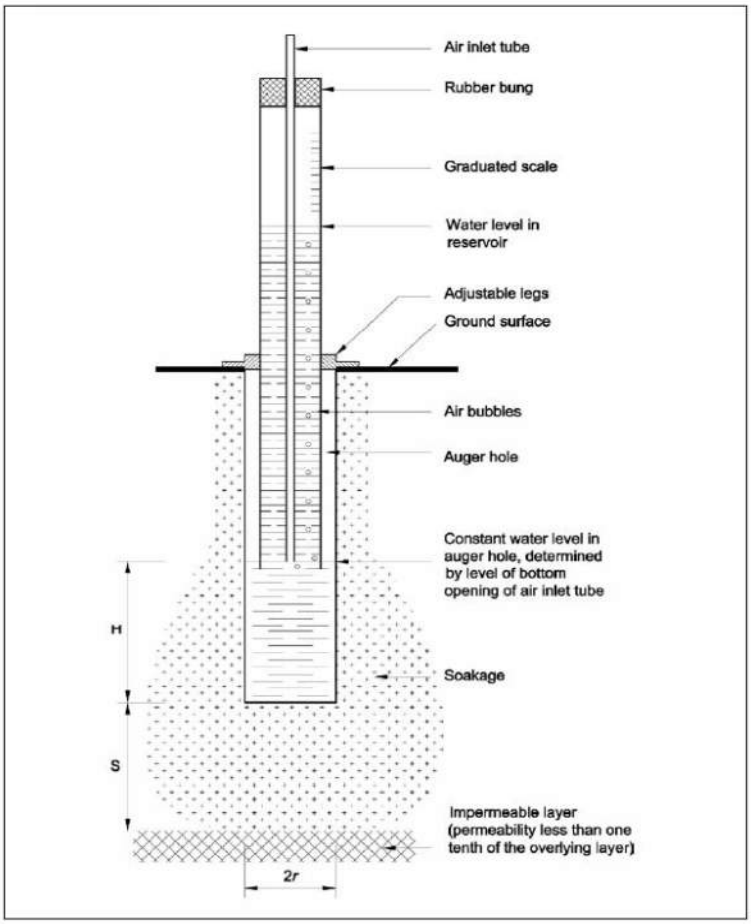
Parameter	Description	Value	Units
K_{sat}	Saturated hydraulic conductivity		cm/min
D	Depth of auger hole	50	cm
H	Head of water above base	21.5	cm
r	Radius of auger hole	4.5	cm
S	Depth to impermeable stratum		cm
Reservoir	Chosen Guelph reservoir (inner or outer)	**Outer**	
Area	Area of chosen reservoir	35.2	cm^2
F	Reading of water level in reservoir		cm

Test Results

Time (min)	F (cm)	ΔF (cm)	ΔF (cm)/min
0	61.8		
1	59.4	2.40	2.40
2	57	2.40	2.40
3	54.6	2.40	2.40
4	52.4	2.20	2.20
5	50.4	2.00	2.00
6	48	2.40	2.40
7	46	2.00	2.00
8	44	2.00	2.00
9	42	2.00	2.00
10	39.6	2.40	2.40
11	37.6	2.00	2.00
12	35.4	2.20	2.20
13	33.4	2.00	2.00
14	32.2	1.20	1.20
15	29.6	2.60	2.60
16	27.2	2.40	2.40
17	25	2.20	2.20
18	23	2.00	2.0
19	20.8	2.20	2.2
20	19.2	1.60	1.6
21	16.6	2.60	2.6
22	14.8	1.80	1.8
23	13	1.80	1.8
24	11.2	1.80	1.8
25	9.6	1.60	1.6
26	6.4	3.20	3.2
			2.04

Calculation

Steady State Flow	2.04	cm/min
Flow from reservoir (Q)	71.81	cm^3/min
K_{sat}	0.051	cm/min
K_{sat}	8.5E-06	m/s
K_{sat}	**0.736**	**m/day**



where:
H = depth of water in test hole
S = the depth to an underlying impermeable layer
r = radius of the test hole

Hydraulic Conductivity Calculation - Constant Head by Permeameter

Galt Geotechnics

Spreadsheet author:	AQ	19-Oct-20

REFERENCE: AS1547-2012, "On-site domestic wastewater management" - Appendix G

Job No:	WAG220058
Client:	Arise Developments
Project:	Proposed Childcare
Location:	Lot 2, No. 1785
Calc by:	Kean St East, Mt. Helena
Test Name	P03/BH03

$$K = \frac{4.4Q[0.5\ \sinh^{-1}\left(\frac{H}{2r}\right) - \sqrt{\left(\frac{r}{H}\right)^2 + 0.25} + \frac{r}{H}]}{2\,\pi H^2}$$

Spreadsheet Legend

	Required input
	Calculated field
	Comment field
	Field not used
	Fixed field

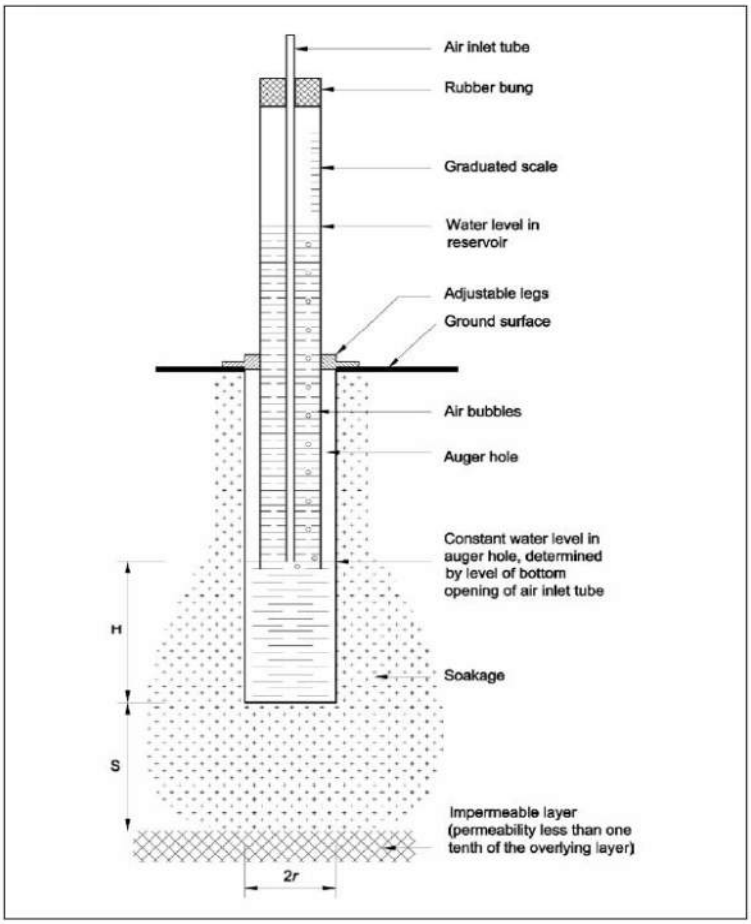
Parameter	Description	Value	Units
K_{sat}	Saturated hydraulic conductivity		cm/min
D	Depth of auger hole	45	cm
H	Head of water above base	16.5	cm
r	Radius of auger hole	4.5	cm
S	Depth to impermeable stratum		cm
Reservoir	Chosen Guelph reservoir (inner or outer)	**Outer**	
Area	Area of chosen reservoir	35.2	cm^2
F	Reading of water level in reservoir		cm

Test Results

Time (min)	F (cm)	ΔF (cm)	ΔF (cm)/min
0	57		
1	52.8	4.20	4.20
2	48.6	4.20	4.20
3	44.6	4.00	4.00
4	40.8	3.80	3.80
5	36.8	4.00	4.00
6	33	3.80	3.80
7	29.6	3.40	3.40
8	26.4	3.20	3.20
9	22.4	4.00	4.00
10	18.6	3.80	3.80
11	14.8	3.80	3.80
12	11.4	3.40	3.40
13	7.6	3.80	3.80
14	4	3.60	3.60
15	0.4	3.60	3.60
			3.64

Calculation

Steady State Flow	3.64	cm/min
Flow from reservoir (Q)	128.13	cm^3/min
K_{sat}	0.127	cm/min
K_{sat}	2.1E-05	m/s
K_{sat}	**1.834**	**m/day**



where:
H = depth of water in test hole
S = the depth to an underlying impermeable layer
r = radius of the test hole

Hydraulic Conductivity Calculation - Constant Head by Permeameter

Galt Geotechnics

Spreadsheet author:	AQ	19-Oct-20

REFERENCE: AS1547-2012, "On-site domestic wastewater management" - Appendix G

Job No:	WAG220058
Client:	Arise Developments
Project:	Proposed Childcare
Location:	Lot 2, No. 1785
Calc by:	Kean St East, Mt. Helena
Test Name	P04/BH04

$$K = \frac{4.4Q[0.5\ \sinh^{-1}\left(\frac{H}{2r}\right) - \sqrt{\left(\frac{r}{H}\right)^2 + 0.25} + \frac{r}{H}]}{2\,\pi H^2}$$

Spreadsheet Legend

	Required input
	Calculated field
	Comment field
	Field not used
	Fixed field

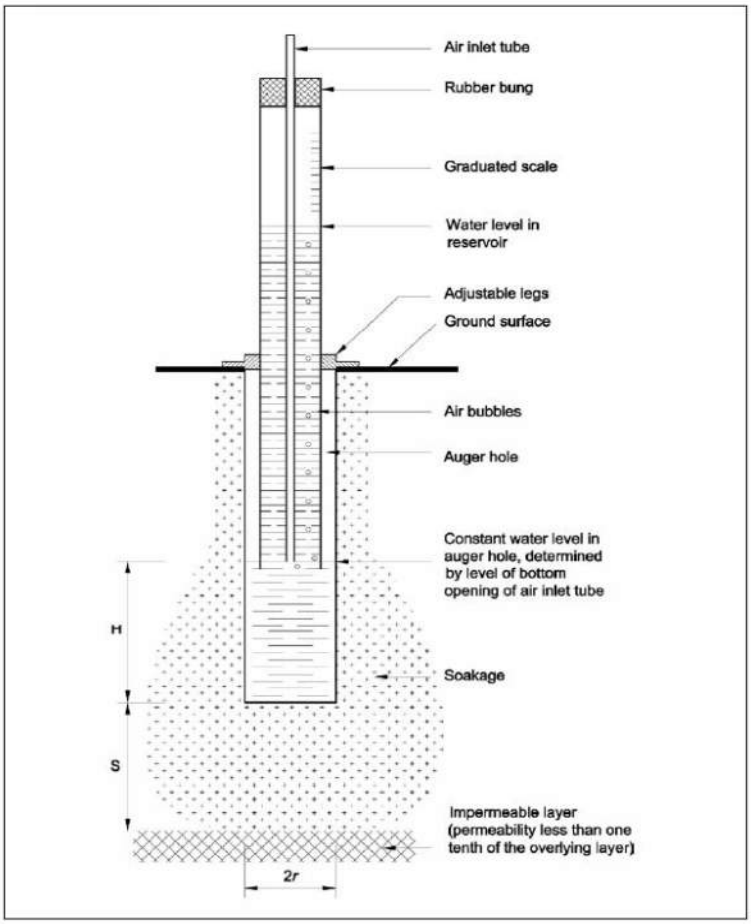
Parameter	Description	Value	Units
K_{sat}	Saturated hydraulic conductivity		cm/min
D	Depth of auger hole	43	cm
H	Head of water above base	14.5	cm
r	Radius of auger hole	4.5	cm
S	Depth to impermeable stratum		cm
Reservoir	Chosen Guelph reservoir (inner or outer)	**Outer**	
Area	Area of chosen reservoir	35.2	cm^2
F	Reading of water level in reservoir		cm

Test Results

Time (min)	F (cm)	ΔF (cm)	ΔF (cm)/min
0	47		
1	44.4	2.60	2.60
2	42.4	2.00	2.00
3	40	2.40	2.40
4	38.2	1.80	1.80
5	36.4	1.80	1.80
6	34.6	1.80	1.80
7	32.4	2.20	2.20
8	30.2	2.20	2.20
9	28.2	2.00	2.00
10	26	2.20	2.20
11	24	2.00	2.00
12	22.4	1.60	1.60
13	20	2.40	2.40
14	18.4	1.60	1.60
15	16.8	1.60	1.60
16	15	1.80	1.80
17	13.6	1.40	1.40
18	11	2.60	2.6
19	9	2.00	2.0
20	7.2	1.80	1.8
21	5.2	2.00	2.0
22	3.2	2.00	2.0
23	1.2	2.00	2.0
			1.96

Calculation

Steady State Flow	1.96	cm/min
Flow from reservoir (Q)	68.99	cm^3/min
K_{sat}	0.080	cm/min
K_{sat}	1.3E-05	m/s
K_{sat}	**1.156**	**m/day**



where:
H = depth of water in test hole
S = the depth to an underlying impermeable layer
r = radius of the test hole

Hydraulic Conductivity Calculation - Constant Head by Permeameter

Galt Geotechnics

Spreadsheet author:	AQ	19-Oct-20

REFERENCE: AS1547-2012, "On-site domestic wastewater management" - Appendix G

Job No:	WAG220058
Client:	Arise Developments
Project:	Proposed Childcare
Location:	Lot 2, No. 1785
Calc by:	Kean St East, Mt. Helena
Test Name	P05/BH05

$$K = \frac{4.4Q[0.5\ \sinh^{-1}\left(\frac{H}{2r}\right) - \sqrt{\left(\frac{r}{H}\right)^2 + 0.25} + \frac{r}{H}]}{2\,\pi H^2}$$

Spreadsheet Legend

	Required input
	Calculated field
	Comment field
	Field not used
	Fixed field

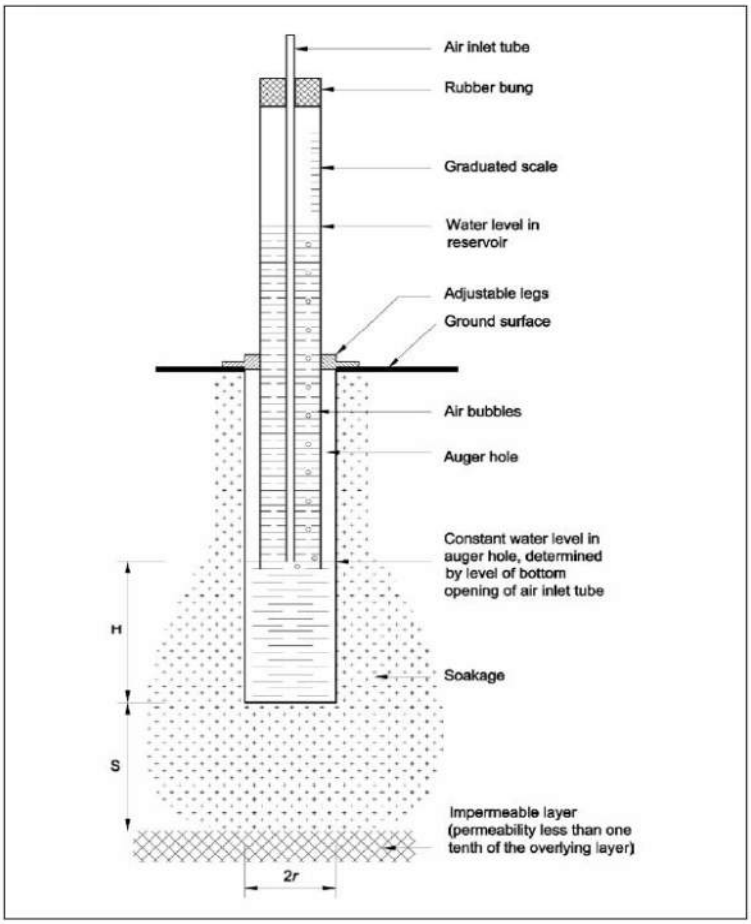
Parameter	Description	Value	Units
K_{sat}	Saturated hydraulic conductivity		cm/min
D	Depth of auger hole	52	cm
H	Head of water above base	23.5	cm
r	Radius of auger hole	4.5	cm
S	Depth to impermeable stratum		cm
Reservoir	Chosen Guelph reservoir (inner or outer)	**Outer**	
Area	Area of chosen reservoir	35.2	cm^2
F	Reading of water level in reservoir		cm

Test Results

Time (min)	F (cm)	ΔF (cm)	ΔF (cm)/min
0	60.8		
1	56.6	4.20	4.20
2	53.2	3.40	3.40
3	49.8	3.40	3.40
4	47	2.80	2.80
5	43.8	3.20	3.20
6	40.8	3.00	3.00
7	37.8	3.00	3.00
8	34.8	3.00	3.00
9	31.8	3.00	3.00
10	28.8	3.00	3.00
11	25.8	3.00	3.00
12	23	2.80	2.80
13	20.6	2.40	2.40
14	17.4	3.20	3.20
15	14.2	3.20	3.20
16	11	3.20	3.20
17	7.4	3.60	3.60
18	4.8	2.60	2.6
			3.16

Calculation

Steady State Flow	3.16	cm/min
Flow from reservoir (Q)	111.23	cm^3/min
K_{sat}	0.071	cm/min
K_{sat}	1.2E-05	m/s
K_{sat}	**1.015**	**m/day**



where:
H = depth of water in test hole
S = the depth to an underlying impermeable layer
r = radius of the test hole

Hydraulic Conductivity Calculation - Constant Head by Permeameter

Galt Geotechnics

REFERENCE: AS1547-2012, "On-site domestic wastewater management" - Appendix G

Job No:	WAG220058-02
Client:	VALM PTY LTD
Project:	Proposed Childcare Centre
Location:	Lot 2 (#1785) Keana St East, Mt Helena
Calc by:	MDS
Test Name	G01/BH06

$$K = \frac{4.4Q[0.5\ \sinh^{-1}\left(\frac{H}{2r}\right) - \sqrt{\left(\frac{r}{H}\right)^2 + 0.25} + \frac{r}{H}]}{2\,\pi H^2}$$

Parameter	Description	Value	Units
K_{sat}	Saturated hydraulic conductivity		cm/min
D	Depth of auger hole	32	cm
H	Head of water above base	9	cm
r	Radius of auger hole	4	cm
S	Depth to impermeable stratum	100	cm
Reservoir	Chosen Guelph reservoir (inner or outer)	**Outer**	
Area	Area of chosen reservoir	35.22	cm^2
F	Reading of water level in reservoir		cm

Spreadsheet Legend

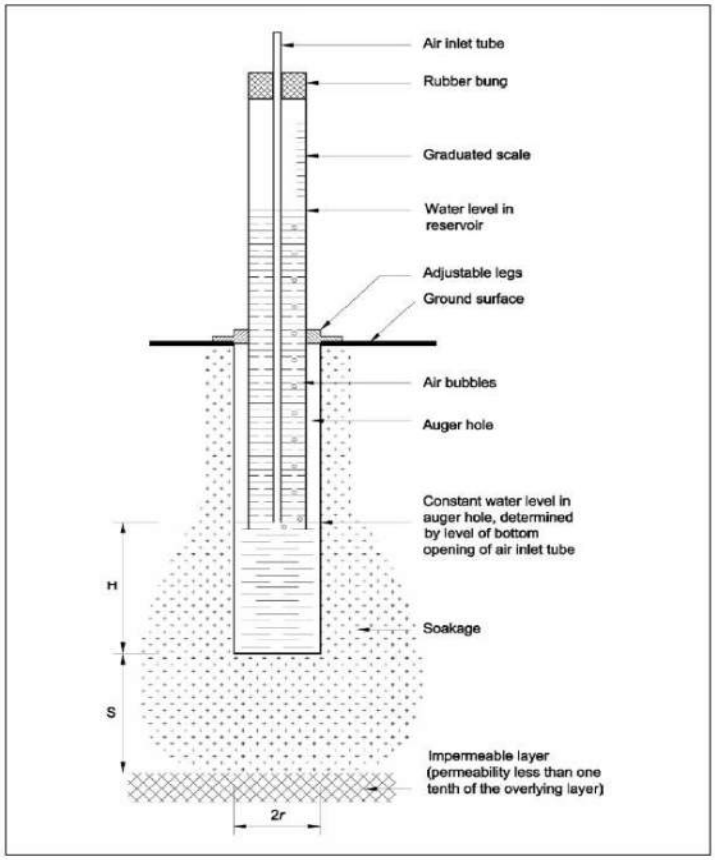
	Required input
	Calculated field
	Comment field
	Field not used
	Fixed field

Test Results

Time (min)	F (cm)	ΔF (cm)	ΔF (cm)/min
0	61		
10	60	1.00	0.10
20	59.5	0.50	0.05
30	57.2	2.30	0.23
40	55.2	2.00	0.20
50	53.2	2.00	0.20
60	51.2	2.00	0.20
70	49.2	2.00	0.20
AVERAGE - LAST 5 READINGS			0.21

Calculation

Steady State Flow	0.21	cm/min
Flow from reservoir (Q)	7.26	cm^3/min
K_{sat}	0.016	cm/min
K_{sat}	2.708E-06	m/s
K_{sat}	**0.23**	**m/day**



where:
H = depth of water in test hole
S = the depth to an underlying impermeable layer
r = radius of the test hole

Hydraulic Conductivity Calculation - Constant Head by Permeameter

Galt Geotechnics

REFERENCE: AS1547-2012, "On-site domestic wastewater management" - Appendix G

Job No:	WAG220058-02
Client:	VALM PTY LTD
Project:	Proposed Childcare Centre
Location:	Lot 2 (#1785) Keana St East, Mt Helena
Calc by:	MDS
Test Name	G02/BH08

$$K = \frac{4.4Q[0.5\ \sinh^{-1}\left(\frac{H}{2r}\right) - \sqrt{\left(\frac{r}{H}\right)^2 + 0.25} + \frac{r}{H}]}{2\pi H^2}$$

Spreadsheet Legend

	Required input
	Calculated field
	Comment field
	Field not used
	Fixed field

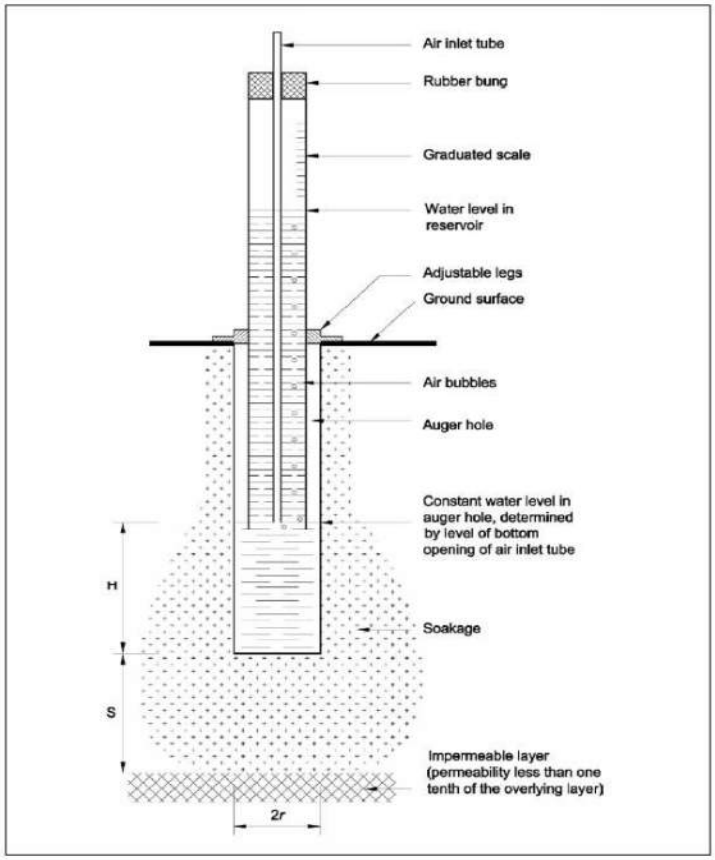
Parameter	Description	Value	Units
K_{sat}	Saturated hydraulic conductivity		cm/min
D	Depth of auger hole	32	cm
H	Head of water above base	9	cm
r	Radius of auger hole	4	cm
S	Depth to impermeable stratum	100	cm
Reservoir	Chosen Guelph reservoir (inner or outer)	**Outer**	
Area	Area of chosen reservoir	35.22	cm^2
F	Reading of water level in reservoir		cm

Test Results

Time (min)	F (cm)	ΔF (cm)	ΔF (cm)/min
0	59		
1.5	50	9.00	6.00
2	48	2.00	4.00
3	45	3.00	3.00
6.5	37	8.00	2.29
7	36	1.00	2.00
8	33	3.00	3.00
9	30	3.00	3.00
10	28.5	1.50	1.50
11	26	2.50	2.50
12	23.5	2.50	2.50
13	20.5	3.00	3.00
14	18	2.50	2.50
15	14.5	3.50	3.50
16	12	2.50	2.50
17	9	3.00	3.00
18	6	3.00	3.00
19	3	3.00	3.00
AVERAGE - LAST 5 READINGS			3.00

Calculation

Steady State Flow	3.00	cm/min
Flow from reservoir (Q)	105.66	cm^3/min
K_{sat}	0.237	cm/min
K_{sat}	3.943E-05	m/s
K_{sat}	**3.41**	**m/day**



where:
H = depth of water in test hole
S = the depth to an underlying impermeable layer
r = radius of the test hole

Appendix E: Geotechnical Laboratory Test Results

www.galtgeo.com.au
50 Edward Street OSBORNE PARK WA 6017
ABN: 64 625 054 729

Material Test Report

KANGA & ASSOCIATES
HiQA Kanga & Associates
Naval Base Laboratory
42 Lionel Street Naval Base WA 6165
Phone: 0406 480 589
Email: navalbase@hiqa.com.au

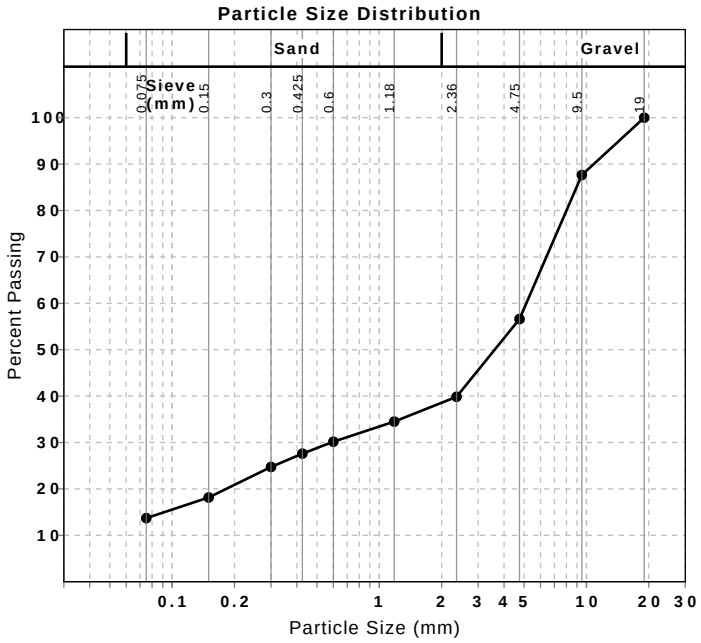
Accredited for compliance with ISO/IEC 17025 - Testing

NATA WORLD RECOGNISED ACCREDITATION

Approved Signatory: Kirubakaran Shanmuganathan
Testing Coordinator
NATA Accredited Laboratory Number: 2337

Report Number: **P22402-1**
Issue Number: 1
Date Issued: 13/12/2022
Client: Galt Geotechnics
50 Edward Street, OSBORNE PARK WA 6107
Project Number: P22402
Project Name: WAG220058 - Proposed Childcare Centre
Work Request: 2755
Sample Number: PS22-2755C
Date Sampled: 05/12/2022
Dates Tested: 05/12/2022 - 12/12/2022
Sampling Method: Sampled by Client
The results apply to the sample as received
Remarks: Sample tested as received Sample tested as received
Sample Location: **BH02, Depth: 1.0 - 1.5**
Material: Sandy Gravel

Particle Size Distribution (AS1289 3.6.1)			
Sieve	Passed %	Passing Limits	
19 mm	**100**		
9.5 mm	**88**		
4.75 mm	**57**		
2.36 mm	**40**		
1.18 mm	**35**		
0.6 mm	**30**		
0.425 mm	**28**		
0.3 mm	**25**		
0.15 mm	**18**		
0.075 mm	**14**		



Material Test Report

Report Number: **P22402-1**
Issue Number: 1
Date Issued: 13/12/2022
Client: Galt Geotechnics
50 Edward Street, OSBORNE PARK WA 6107
Project Number: P22402
Project Name: WAG220058 - Proposed Childcare Centre
Work Request: 2755
Sample Number: PS22-2755C
Date Sampled: 05/12/2022
Dates Tested: 05/12/2022 - 09/12/2022
Sampling Method: Sampled by Client
The results apply to the sample as received
Remarks: Sample tested as received Sample tested as received
Sample Location: **BH02, Depth: 1.0 - 1.5**
Material: Sandy Gravel

KANGA & ASSOCIATES
HiQA Kanga & Associates
Naval Base Laboratory
42 Lionel Street Naval Base WA 6165
Phone: 0406 480 589
Email: navalbase@hiqa.com.au

Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Kirubakaran Shanmuganathan
Testing Coordinator
NATA Accredited Laboratory Number: 2337

Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	**6**		
Soil Description	Sandy Gravel		
Nature of Water	Distilled Water		
Temperature of Water (^{o}C)	21.8		

Material Test Report

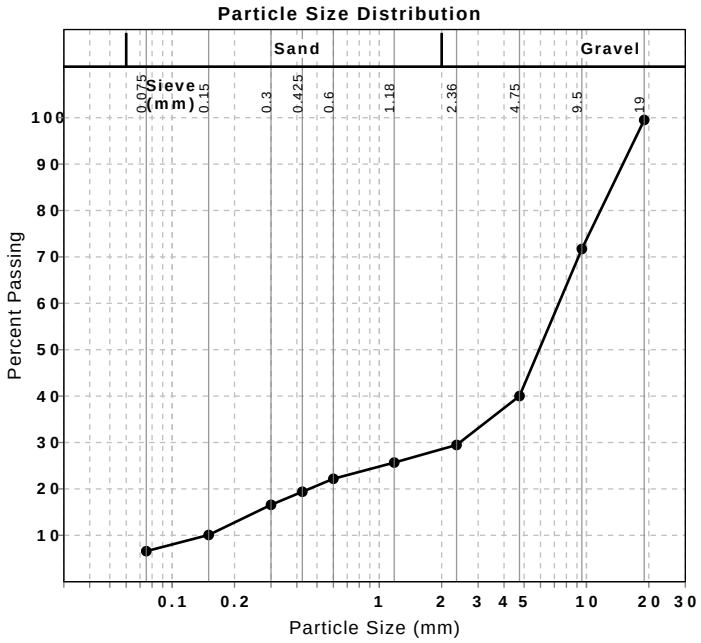
Report Number: **P22402-1**
Issue Number: 1
Date Issued: 13/12/2022
Client: Galt Geotechnics
50 Edward Street, OSBORNE PARK WA 6107
Project Number: P22402
Project Name: WAG220058 - Proposed Childcare Centre
Work Request: 2755
Sample Number: PS22-2755D
Date Sampled: 05/12/2022
Dates Tested: 05/12/2022 - 12/12/2022
Sampling Method: Sampled by Client
The results apply to the sample as received
Remarks: Sample tested as received Sample tested as received
Sample Location: **BH03, Depth: 0.2 - 1.4**
Material: Gravel

KANGA & ASSOCIATES
HiQA Kanga & Associates
Naval Base Laboratory
42 Lionel Street Naval Base WA 6165
Phone: 0406 480 589
Email: navalbase@hiqa.com.au

Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Kirubakaran Shanmuganathan
Testing Coordinator
NATA Accredited Laboratory Number: 2337

Particle Size Distribution (AS1289 3.6.1)			
Sieve	Passed %	Passing Limits	
19 mm	**100**		
9.5 mm	**72**		
4.75 mm	**40**		
2.36 mm	**29**		
1.18 mm	**26**		
0.6 mm	**22**		
0.425 mm	**19**		
0.3 mm	**17**		
0.15 mm	**10**		
0.075 mm	**7**		



Material Test Report

Report Number: **P22402-1**
Issue Number: 1
Date Issued: 13/12/2022
Client: Galt Geotechnics
50 Edward Street, OSBORNE PARK WA 6107
Project Number: P22402
Project Name: WAG220058 - Proposed Childcare Centre
Work Request: 2755
Sample Number: PS22-2755D
Date Sampled: 05/12/2022
Dates Tested: 05/12/2022 - 10/12/2022
Sampling Method: Sampled by Client
The results apply to the sample as received
Remarks: Sample tested as received Sample tested as received
Sample Location: **BH03, Depth: 0.2 - 1.4**
Material: Gravel

KANGA & ASSOCIATES
HiQA Kanga & Associates
Naval Base Laboratory
42 Lionel Street Naval Base WA 6165
Phone: 0406 480 589
Email: navalbase@hiqa.com.au

Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Kirubakaran Shanmuganathan
Testing Coordinator
NATA Accredited Laboratory Number: 2337

Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	**5**		
Soil Description	Gravel		
Nature of Water	Distilled Water		
Temperature of Water (^{o}C)	21.6		

Appendix F: Chemical Laboratory Test Results

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50 Edward Street OSBORNE PARK WA 6017
ABN: 64 625 054 729

Analysis Results

CSBP Soil and Plant Laboratory

97507
HiQA Geotechnical

	Lab No	H1S22050	H1S22051
	Name	BH02 Depth 1.0 - 1.5	BH03 Depth 0.2 - 1.4
	Code	WR 2755 A	WR 2755 B
	Customer	Lot 2 Keane Street	Lot 2 Keane Street
	Depth	0-10	0-10
Conductivity	dS/m	0.044	0.053
pH Level (CaCl2)		5.6	6.1
pH Level (H2O)		6.1	7.1
Phosphorus Retention Index		> 1000.0	> 1000.0

CSBP Lab. Extract Value.

Appendix G: Water Balance Calculation

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ABN: 64 625 054 729

WA Site & Soil Evaluation

Irrigation area sizing

Please read the attached notes before using this spreadsheet

Water Balance for Zero Storage

Site Address:	**LOT 2, NO 1785 KEANE STREET EAST, MOUNT HELENA WA**		
Date:	Monday, 12 December 2022	**Assessor:**	Tyrone Mardesic

INPUT DATA

Design Wastewater Flow	Q	4,790	L/day	Based on maximum potential occupancy and derived from the Supplement to Regulation 29 and Schedule 9 - Wastewater system loading rates
Design Irrigation Rate	DIR	30.0	mm/day	Based on soil texture class/permeability and derived from Table L1 of AS/NZS 1547:2012 for Secondary treated effluent disposed of in trenches / beds
Nominated Land Application Area	L	200	m^2	[1]
Crop Factor	C	0.8-1.0	unitless	Estimates evapotranspiration as a fraction of pan evaporation; varies with season and crop type[2]
Rainfall Runoff Factor	RF	1.0	untiless	Proportion of rainfall that remains onsite and infiltrates, allowing for any runoff
Mean Monthly Rainfall Data	Mount Helena			BoM Station and number
Mean Monthly Pan Evaporation Data	Armadale			BoM Station and number or data from the Evaporation Data for Western Australia Report (https://researchlibrary.agric.wa.gov.au/cgi/viewcontent.cgi?article=1058&context=rmtr

Parameter	Symbol	Formula	Units	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Days in month	D		days	31	28	31	30	31	30	31	31	30	31	30	31	**365**
Rainfall	R		mm/month	23	15.6	23.7	35.8	97.7	146.1	175.6	146.4	105.8	51.8	29.6	12.9	**864**
Evaporation	E		mm/month	297	257	224	123	87	59	60	69	106	154	203	259	**1898**
Crop Factor	C		unitless	1.00	1.00	0.90	0.90	0.80	0.80	0.80	0.80	0.90	1.00	1.00	1.00	
OUTPUTS																
Evapotranspiration	ET	ExC	mm/month	297	257	202	111	70	47	48	55	95	154	203	259	**1797.7**
Percolation	B	DIRxD	mm/month	930.0	840	930.0	900.0	930.0	900.0	930.0	930.0	900.0	930.0	900.0	930.0	**10950.0**
Outputs		ET+B	mm/month	1227.0	1097	1131.6	1010.7	999.6	947.2	978.0	985.2	995.4	1084.0	1103.0	1189.0	**12747.7**
INPUTS																
Retained Rainfall	RR	RxRF	mm/month	23	15.6	23.7	35.8	97.7	146.1	175.6	146.4	105.8	51.8	29.6	12.9	**864**
Applied Effluent	W	(QxD)/L	mm/month	742.5	670.6	742.5	718.5	742.5	718.5	742.5	742.5	718.5	742.5	718.5	742.5	**8741.8**
Inputs		RR+W	mm/month	765.5	686.2	766.2	754.3	840.2	864.6	918.1	888.9	824.3	794.3	748.1	755.4	**9605.8**
STORAGE CALCULATION																
Storage remaining from previous month			mm/month	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Storage for the month	S	(RR+W)-(ET+B)	mm/month	-461.6	-410.8	-365.5	-256.4	-159.5	-82.6	-59.9	-96.4	-171.1	-289.8	-354.9	-433.7	
Cumulative Storage	M		mm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Maximum Storage for Nominated Area	N		mm	0.00												
	V	NxL	L	0												
LAND AREA REQUIRED FOR ZERO STORAGE			m^2	123	124	134	147	165	179	185	177	162	144	134	126	

MINIMUM AREA REQUIRED FOR ZERO STORAGE: 186 m^2

CELLS

	Please enter data in blue cells
XX	Enter available Land Application Area
XX	Data in yellow cells is calculated by the spreadsheet, DO NOT ALTER THESE CELLS

NOTES

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

[2] Values selected are suitable for grass in WA

Appendix H: Understanding Your Report

www.galtgeo.com.au
50 Edward Street OSBORNE PARK WA 6017
ABN: 64 625 054 729

UNDERSTANDING YOUR REPORT

GALT FORM PMP11 Rev4

1. EXPECTATIONS OF THE REPORT

This document has been prepared to clarify what is and is not provided in your report. It is intended to inform you of what your realistic expectations of this report should be and how to manage your risks associated with the conditions on site.

Geotechnical engineering and environmental science are less exact than other engineering and scientific disciplines. We include this information to help you understand where our responsibilities begin and end. You should read and understand this information. Please contact us if you do not understand the report or this explanation. We have extensive experience in a wide variety of projects and we can help you to manage your risk.

2. THIS REPORT RELATES TO PROJECT-SPECIFIC CONDITIONS

This report was developed for a unique set of project-specific conditions to meet the needs of the nominated client. It took into account the following:

- the project objectives as we understood them and as described in this report;
- the specific site mentioned in this report; and
- the current and proposed development at the site.

It should not be used for any purpose other than that indicated in the report. You should not rely on this report if any of the following conditions apply:

- the report was not written for you;
- the report was not written for the site specific to your development;
- the report was not written for your project (including a development at the correct site but other than that listed in the report); or
- the report was written before significant changes occurred at the site (such as a development or a change in ground conditions).

You should always inform us of changes in the proposed project (including minor changes) and request an assessment of their impact.

Where we are not informed of developments relevant to your report, we cannot be held responsible or liable for problems that may arise as a consequence.

Where design is to be carried out by others using information provided by us, we recommend that we be involved in the design process by being engaged for consultation with other members of the project team. Furthermore, we recommend that we be able to review work produced by other members of the project team that relies on information provided in our report.

3. DATA PROVIDED BY THIRD PARTIES

Where data is provided by third parties, it will be identified as such in our reports. We necessarily rely on the completeness and accuracy of data provided by third parties in order to draw conclusions presented in our reports. We are not responsible for omissions, incomplete or inaccurate data associated with third party data, including where we have been requested to provide advice in relation to field investigation data provided by third parties.

4. SOIL LOGS

Our reports often include logs of intrusive and non-intrusive investigation techniques prepared by Galt. These logs are based on our interpretation of field data and laboratory results. The logs should only be read in conjunction with the report they were issued with and should not be re-drawn for inclusion in other documents not prepared by us.

5. THIRD PARTY RELIANCE

We have prepared this report for use by the client. This report must be regarded as confidential to the client and the client's professional advisors. We do not accept any responsibility for contents of this document from any party other than the nominated client. We take no responsibility for any damages suffered by a third party because of any decisions or actions they may make based on this report. Any reliance or decisions made by a third party based on this report are the responsibility of the third party and not of us.

6. CHANGE IN SUBSURFACE CONDITIONS

The recommendations in this report are based on the ground conditions that existed at the time when the study was undertaken. Changes in ground conditions can occur in numerous ways including anthropogenic events (such as construction or contaminating activities on or adjacent to the site) or natural events (such as floods, groundwater fluctuations or earthquakes). We should be consulted prior to use of this report so that we can comment on its reliability. It is important to note that where ground conditions have changed, additional sampling, testing or analysis may be required to fully assess the changed conditions.

7. SUBSURFACE CONDITIONS DURING CONSTRUCTION

Practical constraints mean that we cannot know every minute detail about the subsurface conditions at a particular site. We use professional judgement to form an opinion about the subsurface conditions at the site. Some variation to our evaluated conditions is likely and significant variation is possible. Accordingly, our report should not be considered as final as it is developed from professional judgement and opinion.

The most effective means of dealing with unanticipated ground conditions is to engage us for construction support. We can only finalise our recommendations by observing actual subsurface conditions encountered during construction. We cannot accept liability for a report's recommendations if we cannot observe construction.

8. ENVIRONMENTAL AND GEOTECHNICAL ISSUES

Unless specifically mentioned otherwise in our report, environmental considerations are not addressed in geotechnical reports. Similarly, geotechnical issues are not addressed in environmental reports. The investigation techniques used for geotechnical investigations can differ from those used for environmental investigations. It is the client's responsibility to satisfy themselves that geotechnical and environmental considerations have been taken into account for the site.

Geotechnical advice presented in a Galt Environmental report has been provided by Galt Geotechnics under a sub-contract agreement. Similarly, environmental advice presented in a Galt Geotechnics report has been provided by Galt Environmental under a sub-contract agreement.

Unless specifically noted otherwise, no parties shall draw any inferences about the applicability of the Western Australian state government landfill levy from the contents of this document.

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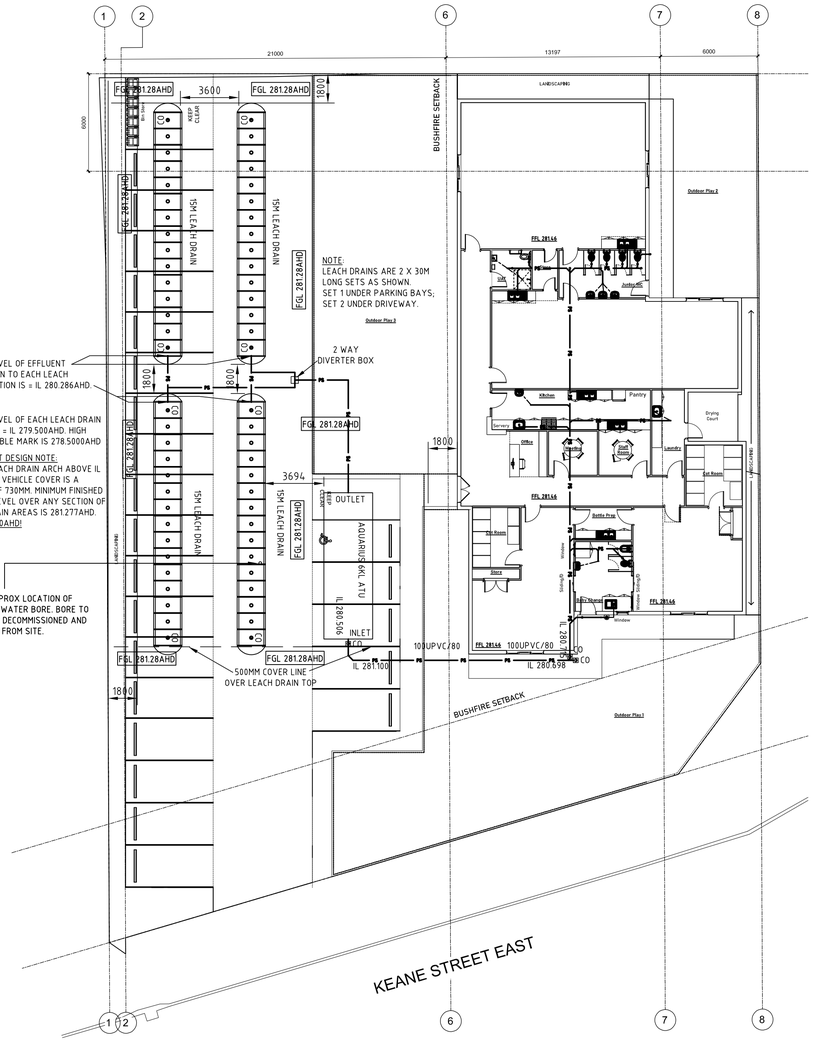
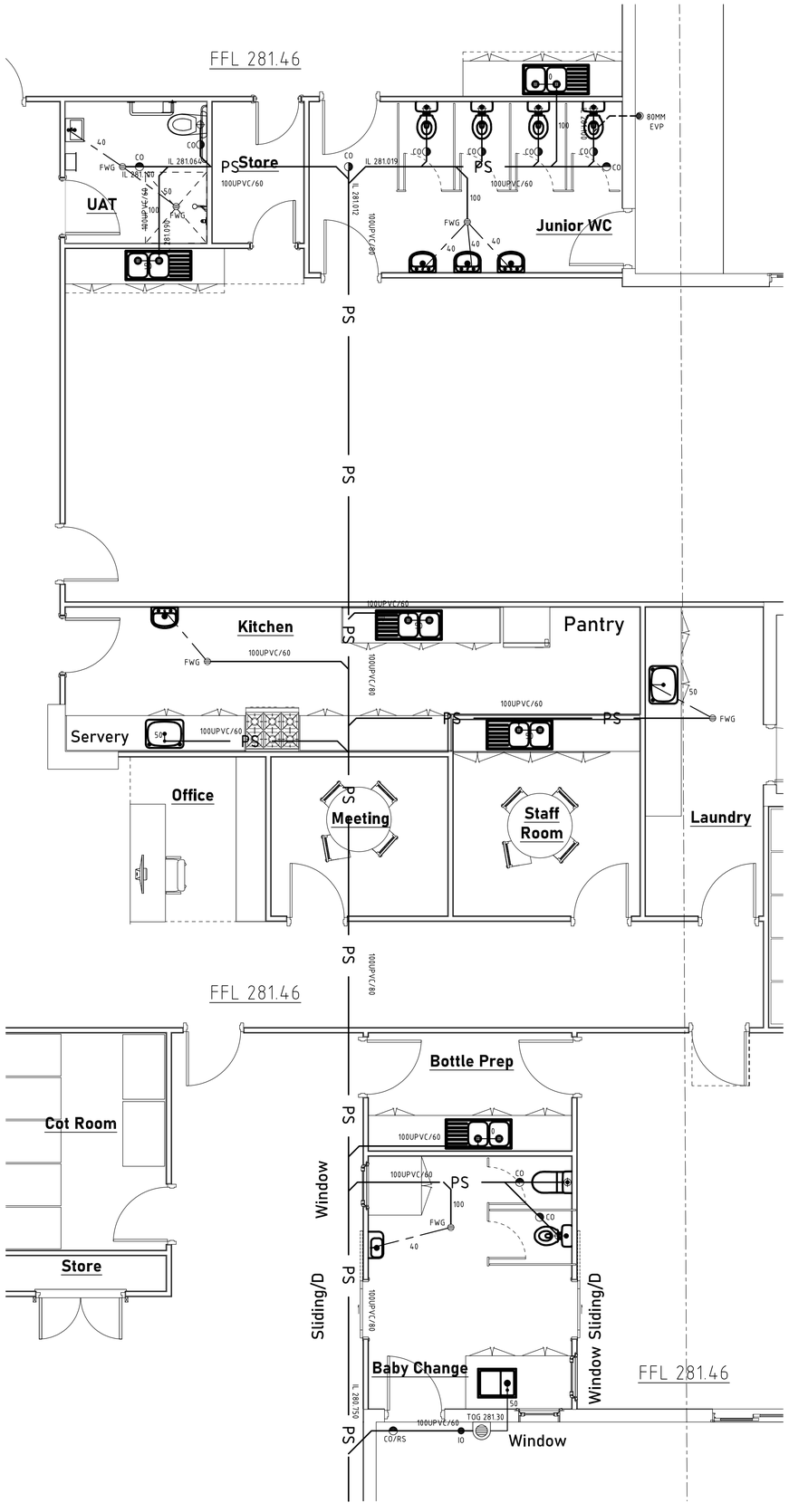


SITE PLAN - SCALE 1:200



FLOOR PLAN DETAILED- SCALE 1:50

LEGEND

LINE TYPES

PS	Property Sewer Drain
	40-50mm wastes

SYMBOLS

	50mm EVP
	80mm EVP
	Pan Line or Waste Centre
	Inspection Opening
	Clean Out Point (CO)
	Overflow and Relief Gully/Trade Waste Inspection Point (TWSP)
	Waste outlet - 40mm & 50mm
	Waste dropper - 40mm & 50mm
	Floor Waste Gully (FWG)

ABBREVIATIONS

CO	Clean Out Point
CO/RS	Clean Out Point/Rising shaft
EVP	Educt Vent Pipe
FWG	Floor Waste Guly
IL	Invert Level
ORG	Overflow Relief Gully

PROPOSED CHILD CARE CENTRE

0-18 MONTHS	12 CHILDREN	3 STAFF	39m²	84m²
18-24 MONTHS	12 CHILDREN	3 STAFF	39m²	84m²
24-36 MONTHS	25 CHILDREN	5 STAFF	81.25m²	175m²
+36 MONTHS	30 CHILDREN	3 STAFF	97.5m²	210m²
TOTAL	**79 CHILDREN**	**14 STAFF**		

HYDRAULIC LOADING CALCULATIONS

TYPE OF PREMISES	USER TYPE	NUMBER OF PERSONS	L/PERSON/DAY	TOTAL (L/DAY)
CHILDCARE	CHILDCARE STAFF	14	70	980
	CHILDREN	79	45	3,555
			TOTAL:	4,535
ATU SIZING	AQUARIUS WASTE WATER TREATMENT	6KL		
LEACH DRAIN CALCULATIONS	4535/30/253=59.75M	LAYOUT - 4 X 15M TUNNEL WELL ARCHES		

DEPT OF HEALTH REGULATION REQUIREMENTS

LEACH DRAINS OFFSET DISTANCES	BOUNDARY	1800MM	YES	
	SEPARATION DISTANCE	3600MM	YES	
	GROUND WATER SEPARATION	+1000MM	YES	
	MINIMUM LEACH DRAIN COVERAGE UNDER CAR PARK	600MM	YES	
	PUMP OUT ACCESS		YES	

DATE	REVISION	ITEM	ISSUE No.
24/07/23	B	ISSUED FOR HEALTH APPROVAL	02
19/07/23	A	ISSUED FOR HEALTH APPROVAL	01

OTG HYDRAULIC DESIGN
0408 694 623
RUSSELL@OTGGROUP.COM.AU
WWW.OTGGROUP.COM.AU
LEVEL 1, 32 DENNINUP WAY MALAGA 6090

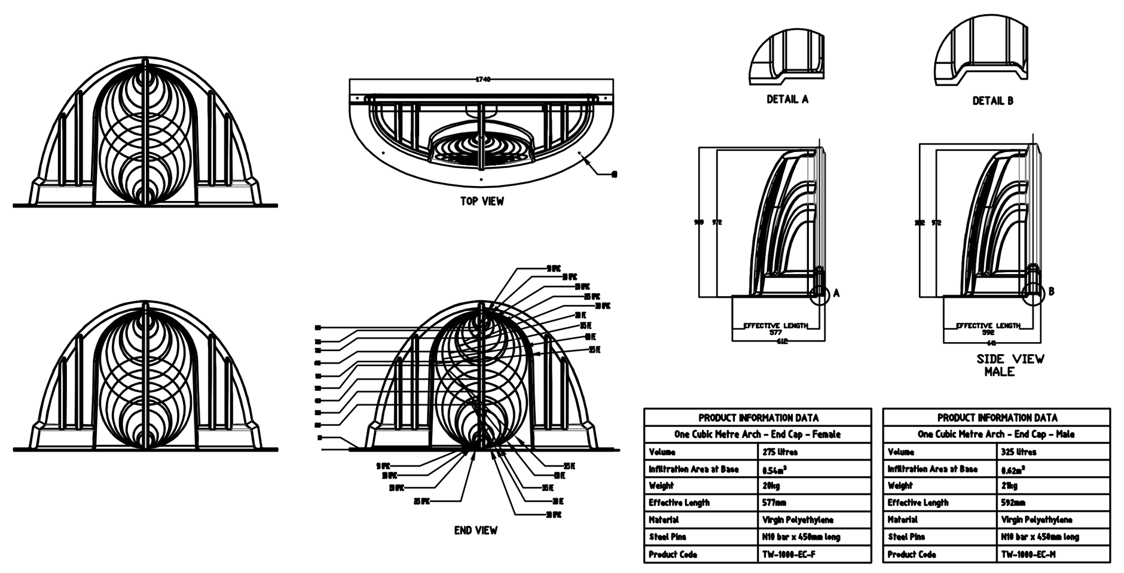
NORTH

ISSUED FOR HEALTH APPROVAL

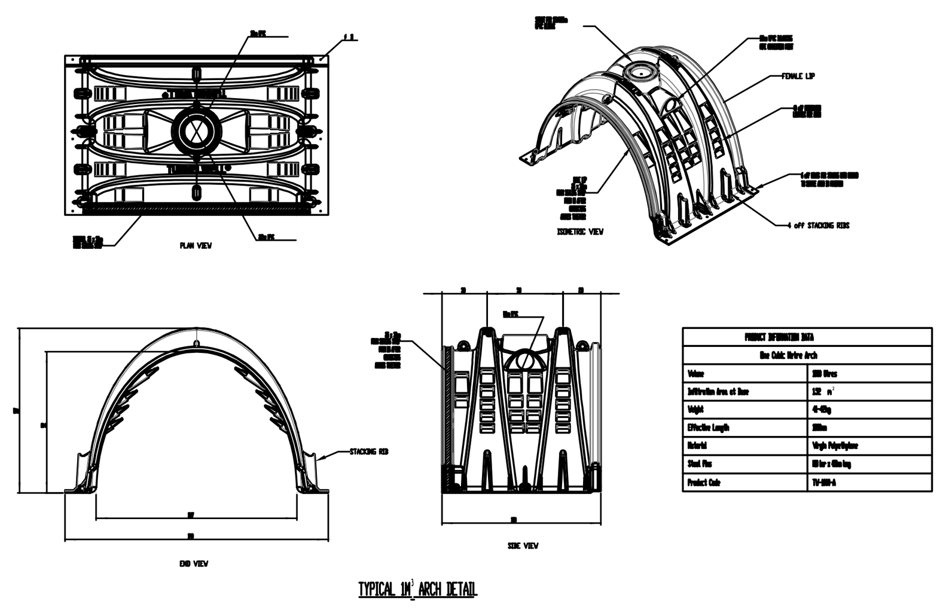
PROJECT: LOT 1578 KEANE ST, EAST, MT HELENA

PLAN: SITE PLAN, DETAILS, LEGENDS & ATU & LEACH DRAIN PROPOSAL

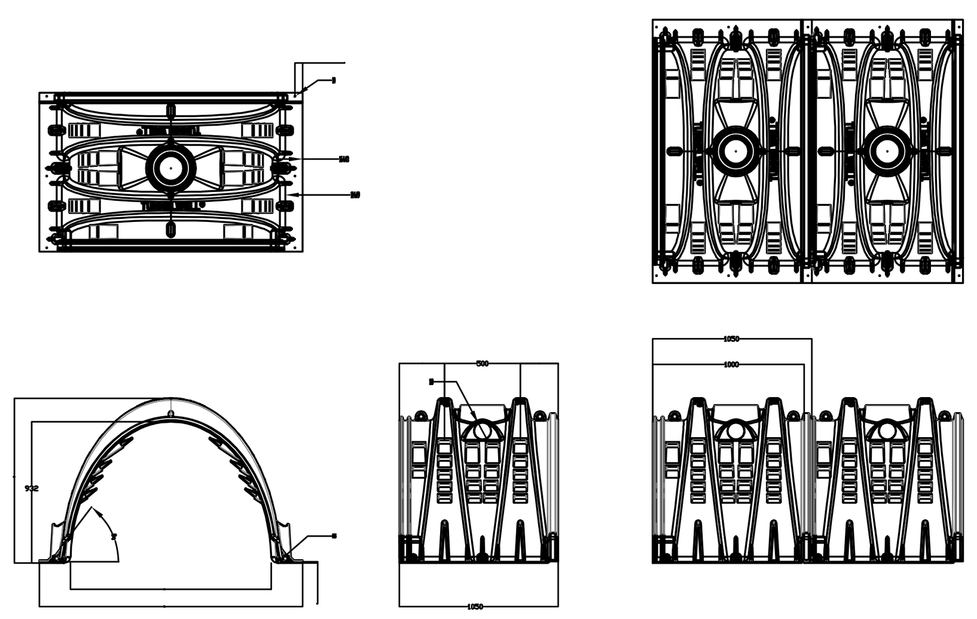
DESIGNED	MJW	SCALE @ A1	As shown	JOB NUMBER	DWG No.	REV No.
DRAWN	MJW	DATUM	- AHD	8/23	HS 01	B
CHECKED	RWG	DATE	- JULY 23			



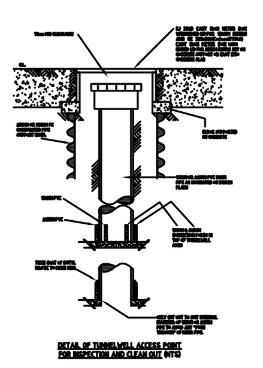
TUNNELWELL END CAP DETAILS (NTS)



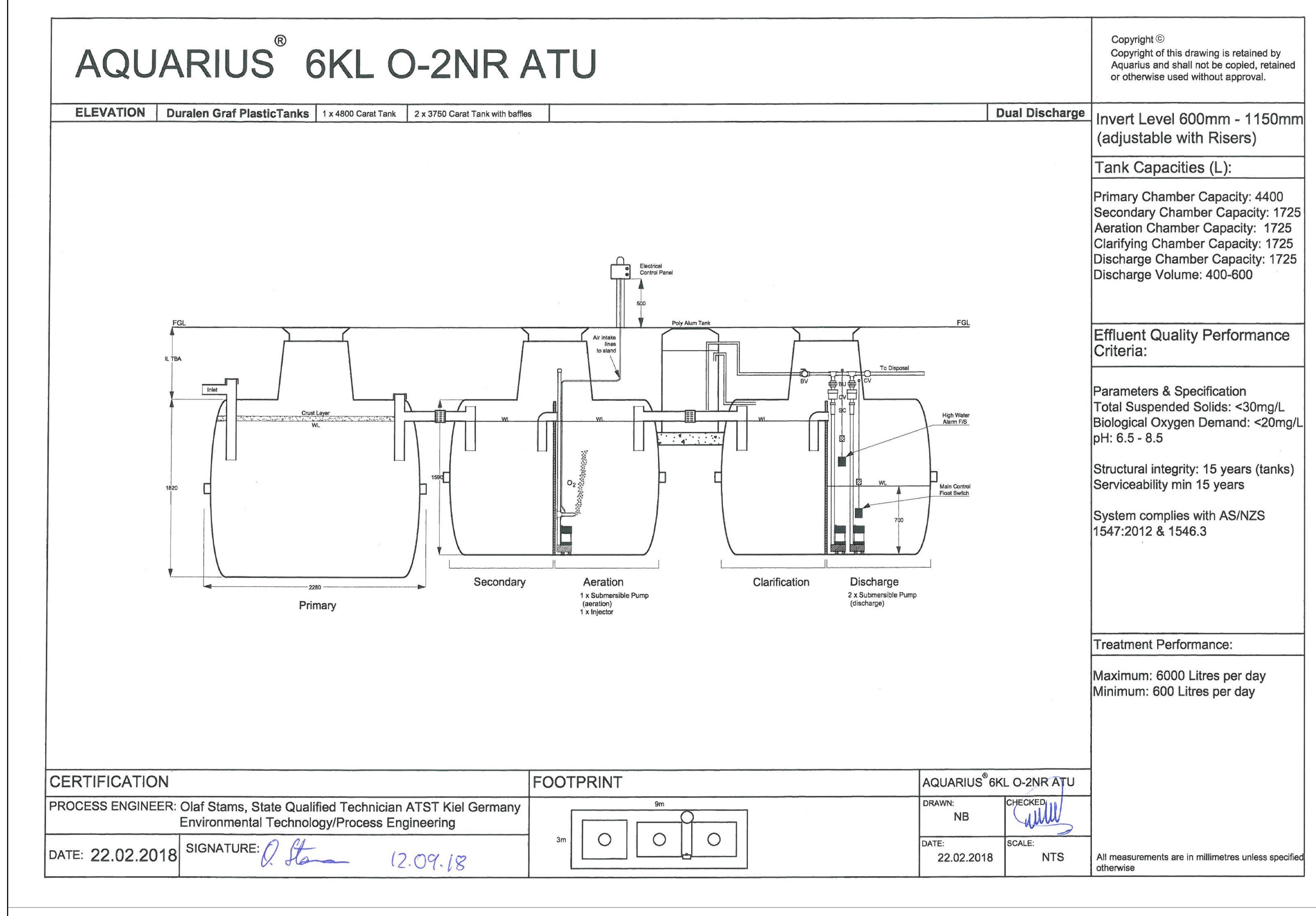
TUNNELWELL ARCH DETAILS (NTS)



TUNNELWELL ARCH SECTIONS (NTS)



TUNNELWELL PUMP-OUT/CLEAN-OUT POINT DETAIL (NTS)



AQUARIUS® 6KL O-2NR ATU
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ELEVATION
Duralen Graf PlasticTanks
1 x 4800 Carat Tank
2 x 3750 Carat Tank with baffles
Dual Discharge
Invert Level 600mm - 1150mm (adjustable with Risers)
Tank Capacities (L):
Primary Chamber Capacity: 4400
Secondary Chamber Capacity: 1725
Aeration Chamber Capacity: 1725
Clarifying Chamber Capacity: 1725
Discharge Chamber Capacity: 1725
Discharge Volume: 400-600
Effluent Quality Performance Criteria:
Parameters & Specification
Total Suspended Solids: <30mg/L
Biological Oxygen Demand: <20mg/L
pH: 6.5 - 8.5
Structural integrity: 15 years (tanks)
Serviceability min 15 years
System complies with AS/NZS 1547:2012 & 1546.3
Treatment Performance:
Maximum: 6000 Litres per day
Minimum: 600 Litres per day
Primary
Secondary
Aeration
1 x Submersible Pump (aeration)
1 x Injector
Clarification
Discharge
2 x Submersible Pump (discharge)
CERTIFICATION
PROCESS ENGINEER: Olaf Stams, State Qualified Technician ATST Kiel Germany
Environmental Technology/Process Engineering
DATE: 22.02.2018
SIGNATURE:
12.09.18
FOOTPRINT
AQUARIUS® 6KL O-2NR ATU
DRAWN: NB
CHECKED:
DATE: 22.02.2018
SCALE: NTS
All measurements are in millimetres unless specified otherwise

ATU DETAILS (NTS)

Tunnelwell Notes:

General

During construction and transport to site the arches shall be maintained in a stable condition with no part becoming overstressed or permanently deformed. Leach drains cannot be installed in trafficable areas without the approval from the Department of Health.

Subgrade

The load design of the Tunnelwell® Arch System (TWAS) is based on a subgrade which is of naturally occurring cohesive soil material with a minimum allowable bearing capacity of 150 kPa for non-trafficable installations and 250 kPa for trafficable installations. For subgrades which consist of soils with cohesion, the subgrade material shall be compacted to 98% modified dry density± 2% from optimum moisture content. For subgrades which consist of soils without cohesion, the minimum requirement for the foundation material is that it shall pass 8 blows from a Perth Sand Penetrometer (PSP). Subgrades are to be approved by a suitably qualified geotechnical engineer shall be uniform in nature free from significant irregularities. It is noted that preparation of the subgrade shall consist of the removal of any topsoil, organic material, and the like with the naturally occurring subgrade material exposed prior to placing the TWAS over. The contractor shall be mindful of on-site drainage to ensure that ponding of water around the subgrade does not occur.

In circumstances where the base of the Tunnelwell® arch trench has rock in the base, the TWAS requires an additional excavation of 600mm below the underside of the arch with 600mm of compacted base course extending to 300mm beyond the side walls of the arch.

Backfilling:

Appropriate backfilling and compaction are critical elements for the successful installation of the TWAS. Given that the TWAS does not use gravel, crushed rock/bluestone, or reconstituted concrete over to the arches, the methodology of the compaction is pivotal for a TWAS to meet the car park load requirements.

The backfill material must be a free draining and granular backfill, have a dry density greater than 18kg/m3 and less than 20kg/m3 and have a minimum angle of internal friction of 30 degrees. (This means Perth/Bassendean soil types.)

The backfill material shall be compacted in 300mm maximum depth compacted layers. Compaction must be to 95% Modified Dry Density (MDD) ±2% from optimum moisture content or 8 blows to the foot/300mm for a PSP. Each compacted layer of backfill must be installed evenly on each side of the TWAS prior to going to the next compacted backfill layer. The maximum differential in compacted backfill level on either side of the arch shall not exceed 150mm. Repeat the backfill material compaction process until the crest of the arches is reached. When compacting the sides of the arches immediately adjacent the arch side, keep the compactor 100mm away from the arch walls so the plate does not contact the arches.

Once the compacted backfill on either side of the arches has reached the top of the arches and associated pipework has been installed and connected, continue compacted backfill as previously specified over the entire width of the arches. When backfilling the first 300mm maximum deep lift of compacted backfill, lower the vibration intensity of the compactor when going directly over the crests of the arches as the compactor will tend to “bounce” slightly. The location of compaction testing shall be limited to that shown in the table below:

Tunnelwell Arch Systems (TWAS) Compaction Regime

Cover over the arch	Test Point - Offset from Centreline
Minimum cover - 600mm	600mm
600mm to 900mm	Varies linearly from 600mm to zero.
≥ 900mm to 2500mm	Zero

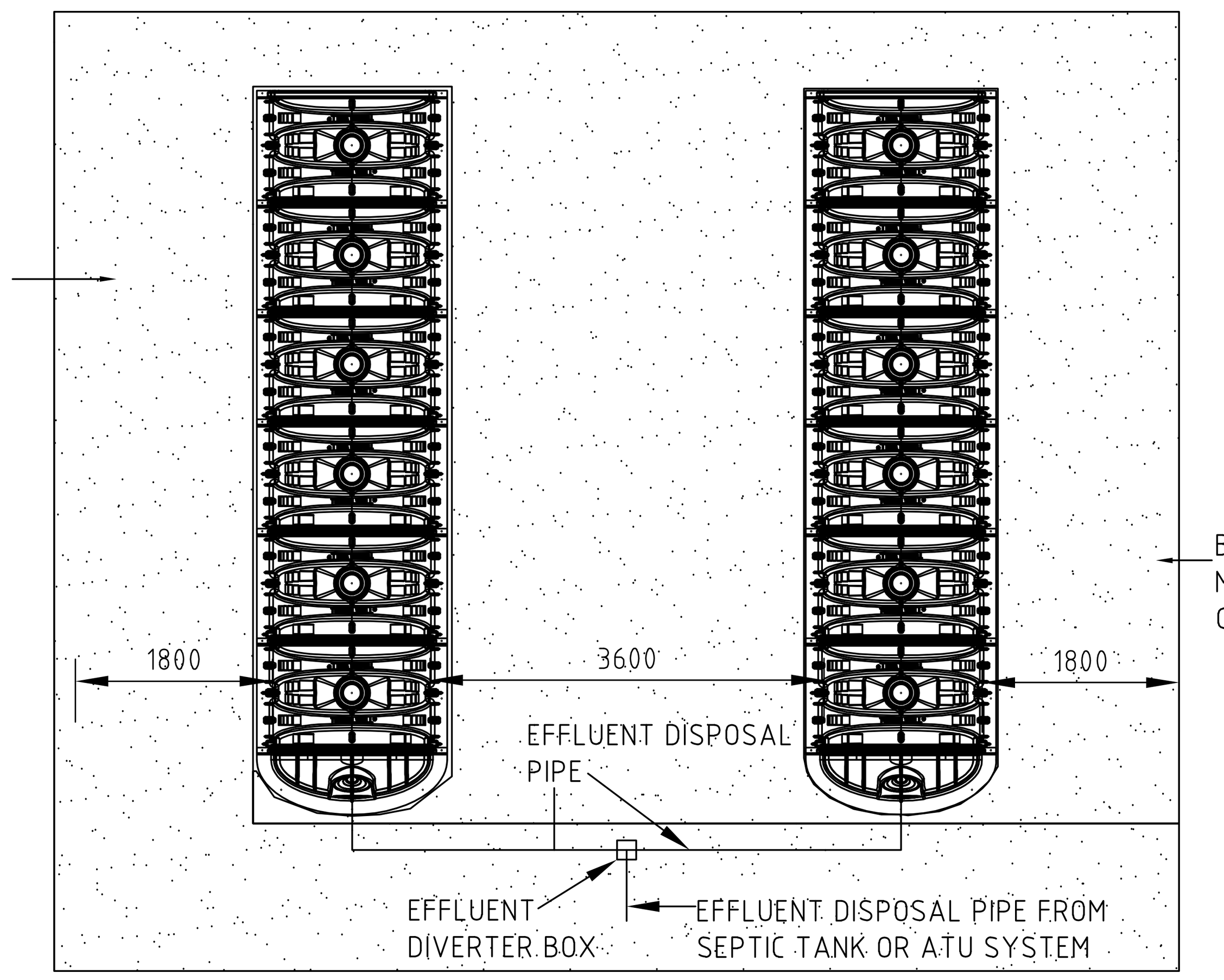
Recommended backfill height is 750mm for any application.

Construction load warning

Until final design intent and interpretation of the intended installation, the installed TWAS shall not be subjected to “construction loads” during the construction period. The TWAS areas should be cordoned off to all traffic during construction. The TWAS shall never be subjected to “construction loads” such as but not limited to cranes > 10 tonne aggregate loadings, crane stabilisers, front end loaders laden with heavy loads, turning of heavy equipment over the installed TWAS, water tankers and the like until final finishes have been completed. After completion of hardstand areas all loads must comply with or be within the limits of the structural certificate issued by Tunnelwell®.

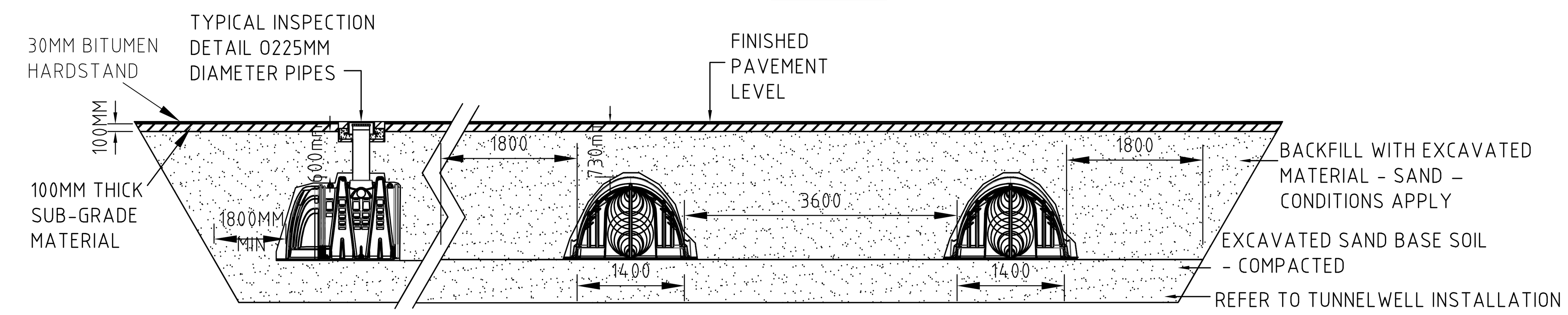
It is recommended to carry out CCTV inspection of leach drains systems before final trim and after hardstand has been completed and keep a colour video and compaction reports on file for future reference.

These notes are to be read in conjunction with Tunnelwell's Installation Instructions provided to the installing contractor and builder.



TYPICAL SECTION OF CLEAN OUT POINT DETAIL (NTS)

PLAN VIEW



30MM BITUMEN HARDSTAND
TYPICAL INSPECTION DETAIL Ø225MM DIAMETER PIPES
FINISHED PAVEMENT LEVEL
100MM
100MM THICK SUB-GRADE MATERIAL
1800MM MIN
1800
3600
1800
1400
1400
BACKFILL WITH EXCAVATED MATERIAL - SAND - CONDITIONS APPLY
EXCAVATED SAND BASE SOIL - COMPACTED
REFER TO TUNNELWELL INSTALLATION INSTRUCTIONS - BASE COMPACTION TO 98% OR 8 BLOWS/300MM ON A PSP

TYPICAL CROSS SECTION

ONE CUBIC METRE (1M³) TUNNELWELL® ARCH SYSTEMS FOR LEACH DRAINS UNDER CAR PARK 3KPA LOADS - NTS

NOTE: THESE PLANS ARE SUBJECT TO TUNNELWELL COPYRIGHT©

LEACH DRAIN DETAILS (NTS)

NORTH

DATE	REVISION	ITEM	ISSUE No.
24/07/23	B	ISSUED FOR HEALTH APPROVAL	02
19/07/23	A	ISSUED FOR HEALTH APPROVAL	01

OTG HYDRAULIC DESIGN
0408 694 623
RUSSELL@OTGGROUP.COM.AU
WWW.OTGGROUP.COM.AU
LEVEL 1, 32 DENNINUP WAY MALAGA 6090

ISSUED FOR HEALTH APPROVAL

PROJECT: LOT 1578 KEANE ST, EAST, MT HELENA

PLAN: DETAILS

DESIGNED	MJW	SCALE @ A1	NA	JOB NUMBER	DWG No.	REV No.
DRAWN	MJW	DATUM	- AHD	8/23	HS 02	B
CHECKED	RWG	DATE	- JULY 23			