Minarah College
C/- Midson Group Pty Ltd

Wastewater Management Assessment: Minarah College, 268 -278 Catherine Fields Road, Catherine Fields NSW

ENVIRONMENTAL

WATER

WASTEWATER

GEOTECHNICAL

CIVIL

PROJECT
MANAGEMENT

P2108320JR05V03
May 2022

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Document and Distribution Status

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Revision No.	Description	Status	Release Date	Document Location			
				File Copy	Minarah College	Midson Group Pty Ltd	
1	Client review	Draft	16/03/2022	1E, 1P, 1H	1P	1P	
2	Client review	Final	12/04/2022	1E, 1P, 1H	1P	1P	
3	Clarification of assumptions regarding weekend use	Final	18/05/2022	1E, 1P, 1H	1P	1P	

Distribution Types: F = Fax, H = hard copy, P = PDF document, E = Other electronic format. Digits indicate number of document copies.

All enquiries regarding this project are to be directed to the Project Manager.

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1 Introduction

1.1 Overview

This wastewater management assessment has been prepared by Martens and Associates Pty Ltd on behalf of the Minarah College (the Applicant). It accompanies an Environmental Impact Statement (EIS) in support of State Significant Development Application (SSD-30759158) for Minarah College – Catherine Field (the School) at 268 and 278 Catherine Fields Road, Catherine Field (the site).

Minarah College will be a co-educational K-12 school accommodating 1,580 students. There are to be 840 in primary school; 660 in high school; 60 in an Early Learning Centre (ELC) and 20 in a School for Specific Purpose (SSP). The school will be constructed in 5 stages, growing in line with growth in the local population.

The proposal seeks consent for:

- Demolition of the existing dwellings and ancillary structures onsite.
- Regrading of the site to allow suitable levelled areas for buildings and outdoor areas as well as allowing access and drainage of the site. Stage 1 works will include up to 2.25 m of cut in the eastern portion of the site and 2.25 m of filling in the western portion of the site.
- The construction of the following:
  - One storey early learning centre with attached two storey administration building to service the high school and early learning centre.
  - Two storey primary school building comprising of primary school classrooms, SPP classrooms, primary school hall which attached outside school hours care (OSHC).
  - Two storey high school building comprising high school classrooms.
  - Two storey high school hall.
  - Shared one storey canteen adjoining the high school building.
  - Shared library located on the second storey above administration building below.

- Site access from Catherine Fields Road at two points with a bus zone, 30 kiss and drop car parking spaces, and car parking.
- Consolidation of the allotments.
- Associated site landscaping and public domain improvements.
- An onsite car park for 123 parking spaces.
- Construction of ancillary infrastructure and utilities as required.

This report provides an assessment of the site and soil suitability for onsite effluent management and recommendations for site wastewater treatment and effluent disposal systems during the multi stage construction.

1.2 Aims and Objectives

The aims and objectives of this assessment are to:

- Characterise site effluent land capability and assess suitability and design loading for onsite effluent management.
- Estimate design wastewater generation rates based on proposed site usage numbers provided by the Client.
- Provide recommendations for the most appropriate onsite wastewater management system (i.e. treatment and disposal or pump out) for each stage of the development.

1.3 Relevant Standards and Guidelines

Guidelines and standards considered in this assessment include:

- Camden Council (2006) *Sewage Management Strategy*.
- NSW Department of Environment and Conservation (2004) *Use of Effluent by Irrigation.*
- NSW Department of Local Government *et al*. (1998) *On-site Sewage Management for Single Households.*
- NSW Health (2001) *Septic Tank and Collection Well Accreditation Guideline.*
- Standards Australia (2012) *Australian / New Zealand Standard 1547: On-site domestic wastewater management.*

2 Site Description

General site details are summarised in Table 1, and a site plan is provided in Attachment A with proposed development plans in Attachment B.

Table 1: Summary of site details.

Item	Comment
Address	268 - 278 Catherine Fields Road, Catherine Fields, NSW.
Lot / DP	Lots 11 in DP833983 and Lot 12 in DP833784 (CMS, 2021)
Site Area	4.5 ha (CMS, 2021)
Local Government Area (LGA)	Camden Council ('Council')
Existing development	The northern lot (Lot 12) is occupied by a dwelling in the western portion and two sheds in the central portion. The southern lot (Lot 11) is occupied by a dwelling and three sheds in the western portion. Two farm dams were present near the central portion of the site. The remainder of the site consists of overgrown grass covered land.
Topography	The site is gently undulating, with local relief of 10 m, south west aspect and slopes typically 5 – 10 %. Site elevation ranges between approximately 74.5 mAHD in the north west corner to 84.5 mAHD in the south east corner (CMS, 2021).
Vegetation	Grass, shrubs and some mature trees.
Neighbouring environment	At the time of the field investigations (November, 2021) the site was surrounded by residential land use to the north and south, bushland to the east and Catherine Fields Road to the west.
Expected soil landscape	The NSW Office of Environment and Heritage's (OEH) information system (eSPADE) indicates the site to be located in the Blacktown (bt) soil landscape, with shallow to moderately deep (>100cm) hard setting mottled texture contrast soils, red and brown podzolic soils on crests grading to yellow podzolic soils on lower slopes and in drainage lines. This soil landscape often associated with localised seasonal waterlogging, localised water erosion hazard, moderately reactive highly plastic subsoil and localised surface movement potential.
Expected geology	The geological map indicates the site is underlain by Bringelly Shale comprising shale, carbonaceous claystone, claystone, laminite, fine to medium grained lithic sandstone and rare coal and tuff (Clark, 1991).
Drainage	Drainage of the site is via overland flow to the Council stormwater network on Catherine Hill Road.

2.1 Field Investigations

Geotechnical and wastewater field investigations conducted on 25 November 2021 included:

- A general site walkover inspection of the site and nearby areas to review topography, geology and drainage.

- Drilling of fourteen boreholes (BH101 to BH114) to a maximum depth of approximately 2.0 mbgl.
- Collection of soil samples for laboratory geotechnical testing and future reference.

Investigation locations are shown on Map 01, Attachment A and borehole logs provided in Attachment B.

2.2 Climate Data

The nearest rainfall station with adequate data is at Bringelly (Maryland) (rain station 068192, rainfall 1867 – 2021) and nearest station with adequate evaporation records is Prospect Reservoir (station 67019, 1987 – 2021). These stations are considered sufficiently representative of the site for use in water balance modelling. A comparison of median rainfall and evaporation is provided in Table 2.

Table 2: Comparison of rainfall and Class A Pan evaporation data for the site.

Month	Median monthly rainfall (mm)	Median monthly Class A pan evaporation (mm)	Rainfall surplus rainfall – evap. (mm)
January	66.0	170.5	-104.5
February	63.4	131.6	-68.2
March	63.0	120.9	-57.9
April	47.1	87.0	-39.9
May	37.3	62.0	-24.7
June	42.1	48.0	-5.9
July	28.6	52.7	-24.1
August	24.1	77.5	-53.4
September	36.0	108.0	-72
October	44.6	136.4	-91.8
November	55.4	150.0	-94.6
December	49.4	173.6	-124.2
Annual	**727.7**	**1318.2**	**-590.5**

2.3 Hydrogeological Assessment

Groundwater inflow was observed in the southern lot in BH107 at 0.5 mbgl. Based on our observation, groundwater inflow is considered likely to have originated from the previous dam located in the central portion of the southern lot.

Groundwater inflow was not observed in any other boreholes on the southern lot with auger drilling to 1.6 mbgl (BH114). Groundwater inflow was not observed in boreholes on the northern lot during borehole auger drilling to 2.0 mbgl (BH105).

Review of WaterNSW's Real Time groundwater database indicates that no licenced groundwater bores are located within 500 m of the site.

3 Wastewater Management Assessment

3.1 Soil Profile and Effluent Application Rates

As part of the school development significant regrading is required to provide suitable level areas for buildings and outdoor areas as well as site access and drainage. The large amount of cut and fill will disturb a large portion of the natural soil profile and topography. Review of the proposed cut and fill plan indicates that up to 2.25 m of cut and up to 2.25 m of filling is required.

The amount of cut in the eastern portion of the site (i.e. the area proposed for the playing field) results in a large portion of the site not being suitable for effluent irrigation as the resulting finished levels will likely be in shale bedrock. Additionally, there will be up to 2.25 m of filling which is likely to consist of an engineered fill unsuitable for effective effluent irrigation due to compaction requirements. If irrigation of these areas is planned placed topsoil would be required.

Subsoil investigations carried out by Martens and Associates in November 2021 included the excavation of fourteen boreholes (BH101 – BH114). Borehole locations are provided on Map 01 in Attachment A.

Natural soil profiles within potential effluent management areas (EMAs) are likely characterised by the profiles of BH107, BH108, BH109 and BH112. Some areas identified for potential effluent reuse shall be regraded during proposed Stage 1 works. Where filling or cutting exceeds 1.0 m suitable topsoil of minimum 300 mm depth would be required prior to construction of the irrigation area. Detailed effluent management system design must consider any placed soils or removal of subsoils as a result of site earthworks.

Natural soil profiles and design irrigation rates (DIRs), for secondary treated effluent, according to AS/NZS 1547 (2012) and Camden Council Sewage Management Strategy (2006) are summarised in Table 3. These provide an indication of the hydraulic capacity of the soil to assimilate effluent. Detailed borehole logs for soil profile are provided in Attachment C.

Table 3: Summary of subsurface profiles and DIRs based on AS/NZS 1547 (2012).

Soil category	Depth (m) [1]	Texture	Structure	Indicative permeability (K_{sat}) (m/d) [2]	Design irrigation rate (DIR) (mm/day) [3]
TOPSOIL	0.0 – 0.1	Clay LOAM	Moderately structured	1.2 - 0.5	3.5
SUBSOIL	0.1 – 1.7	Light CLAY	Moderately structured	0.06 – 0.12	3.0
Design					**3.0**

Notes: [1] Depth range based on BH109 and B112.

[2] Camden Council (2006)

[3] DIR for drip irrigation system with secondary treated effluent (AS/NZS 1547, 2012).

A secondary treatment system with a subsurface irrigation system comprises an 'improved wastewater treatment and land application system'. In accordance with c 5.5.3.4 of AS / NZS 1547 (2012) no reserve irrigation field is therefore required.

3.2 Landform and Soil Constraints Assessment

Landform and soil constraints in the intended EMA locations are summarised in Table 4 in accordance with NSW DLG *et al.*, (1998). The assessment assumes secondary treated effluent being applied.

Table 4: Summary of land and soils capability NSW DLG *et al.*, (1998).

Feature	Site details	Limitation rating [1]
Flood potential	Rare	Minor
Sun and wind exposure	High	Minor
Slope (%)	5 -10 %	Minor
Landform	Convex slope	Minor
Surface water	Buffer available	Minor
Fill	Fill	Moderate
Rock outcropping	<10 %	Minor
Geology	No major discontinuities	Minor
Depth to bedrock (m)	Range of 0.9 – 1.8 m	Minor – Moderate
Depth to water table (m)	Not encountered	Minor
Coarse fragments (%)	0 – 20 %	Minor
Electrical conductivity (dS / m)	< 4	Minor [2]

Notes: [1] Subsurface irrigation system.

[2] Indicative value from Denham Court study on same soil landscape.

The land and soil capability assessment indicates that the identified potential EMA presents a number of moderate limitations to the application of effluent:

- Depth to rock: Soils with shallower depth to rock have less capacity to store effluent for evapotranspiration and to filter nutrients and pathogens. EMA are to be located only in areas with sufficient (>1.0 m) soil after any site regrading, as shown in Map 01, Attachment A.
- Fill: The presence fill in BH107 has been addressed through the adoption of a DIR consistent with the fill.

3.3 Buffers and Setbacks to Effluent Management Area

Relevant setbacks have been assessed using Camden Council (2006) with recommended buffers summarised in Table 5. An additional buffer of 3.0 m upslope and 1.5 m downslope has been used (Attachment A) for all stormwater designs during stage 1 and 2.

Table 5: Recommended setback distances in metres.

Feature	Buffer setback (m)
Permanent surface water	100
Groundwater bores	250
Other waters	40
Property boundaries	6 / 3 [1]
Driveways	6 / 3 [1]
Dwellings and buildings	6 / 3 [1]

Notes: [1]. Upslope / downslope setback.

3.4 Site Wastewater Generation Rates

Wastewater generation is calculated based on expected site occupation during each stage. The Wastewater Assessment was undertaken with the following assumptions:

1. Site use is limited to students and teachers on weekdays.
2. The school would not be used on weekends during Stage 1 to Stage 3.
3. The weekend use of the school would only occur from Stage 4 onwards once the multi-purpose hall and sports fields are constructed and to align with infrastructure upgrades including road upgrades to Catherine Fields Road and sewer upgrades.

AS/NZS 1547 (2012) only provides recommendation for design wastewater loads for residential activities in Australia (Table H1). Recommended flow rates for New Zealand non residential applications are provided (Table H4) with wastewater generation rate of 15 - 30 L / person / day indicated for a school. New Zealand design water usage rates are consistently higher than Australian rates (compare Table H3 and H1) for comparable development types in this standard.

Sydney Water WSA (2002) provides a design rate of 40 L/ person / day but state that flow rates should be determined from records of similar developments.

Accordingly, we have used water usage invoices obtained for similar studies conducted for comparably sized schools. These water usage invoices showed that on average, water usage was approximately 13 L/person/day, which included water used for watering of landscaped areas and other external uses. This figure is comparable to the wastewater generation rate of 18 L/person/day given in NSW Health (2001) guidelines.

By comparison, the wastewater generation rates for schools in Sydney Water WSA (2002) and AS/NZS1547 (2012) of 36 L/person/day and 40 L/person/day respectively, are considered to be highly conservative and will not accurately reflect the site water usage and hence wastewater generation rate.

Based on our extensive experience with school wastewater management systems, we recommend an appropriate design figure for a school of 20 L / person / day. This has been demonstrated in a number of previous wastewater assessments completed by MA (where the average generation rate was approximately 13 L/person/day), through methods such as the collection of water usage invoices over an 18 month period at the Northern Beaches Christian School and analysis of wastewater pump out data for the Australian Christian College, Marsden Park. The proposed design figure is higher than water usage records for comparable schools and is an appropriately conservative rate providing adequate factor of safety for the design.

For the purposes of this assessment, a conservative wastewater generation rate of 20 L / person / day has been adopted. Design assumes 5 days of site use and wastewater generation and 7 days of effluent irrigation as we are advised there is not site use which generated wastewater on the weekend. Design wastewater generation calculations are provided in Table 6. Staging plans are provided in Attachment B.

Table 6: Wastewater generation for development stages.

Stage	Student and teacher numbers	Weekday generation (20 L / person / day)	Balanced wastewater flow (L/day) [1]	Weekly wastewater load (kL/week)
1	350	7,000	5,000	35.0
2	716	14,320	10,229	71.6
3	1,087	21,740	15,529	108.7
4	1,400	28,000	20,000	140.0
5	1,720	34,400	24,571	172.0

Notes: [1]. Flow balance system providing distribution of 5 days generation over 7 days.

4 Brief Wastewater Options Assessment

4.1 Introduction

This assessment considered three wastewater management options for the proposed school development as follows:

- Pump to Sydney Water reticulated sewer;
- Collection and storage of site wastewater with periodic pump out; and,
- On site collection, treatment and reuse of wastewater for irrigation.

Each of the options is discussed briefly as follows.

4.2 Pump to Sydney Water reticulated sewer

This option involves the collection of all site wastewater to a single pump-station and transfer of wastewater to the nearest Sydney Water reticulated sewer. A Sydney Water assessment of the feasibility of such a scheme (and connection of the site to reticulated water supply) has been lodged however at the time of reporting this was still being processed. However, based on initial correspondence from Sydney Water we understand that connection to town sewer option is not feasible for the site within the next five years minimum and is therefore not considered further in this assessment.

4.3 Pump Out

Pump out involves the collection and storage of generated wastewater in a dedicated storage tank which is periodically pumped out by licenced contractor for off site disposal. An assessment of the site topography and proposed layout shows that it is possible to drain all waste generating fixtures to a central storage tank located in the north western corner of the site and adjacent to the proposed car parking area as shown on the attached site plan.

The key advantages of such a system are that the wastewater generated on the site would be managed (i.e. treated and reused or disposed) offsite and system capital costs are generally lower than for an onsite wastewater treatment and reuse system. The key disadvantages for this type of system are that long term pump out costs can be significantly higher than for an onsite wastewater treatment and the benefit of reusing effluent for irrigation would be lost.

4.4 Onsite Treatment and Irrigation

This option involves the collection of all site wastewater to an onsite sewage treatment plant (STP) with treated effluent reused onsite through surface or subsurface irrigation. An assessment of the site has determined that it is possible to drain all waste generating fixtures to a collection well in the north western corner of the site and adjacent to the proposed car parking area which is then pumped to a STP located in the south western corner of the site and adjacent to the buss parking area. Should site irrigation be adopted it should be shallow subsurface irrigation of secondary treated effluent to minimise the risk of contact between site users and irrigated effluent and to mitigate the impact should this occur.

The key advantages to this scheme would be the ongoing benefit of reduced potable water use for irrigation and lower system operational cost. The key disadvantages of this scheme would be the higher capital costs to construct and the necessity for periodic maintenance of the wastewater management system.

5 On Site Wastewater Management

5.1 Overview

Preliminary assessment of available EMA and flows concludes that an onsite wastewater management system is a viable solution up to the end of Stage 2 of the development. After that stage the increasing school footprint is likely to have reduced available EMAs to the point that significant pump out would be required. Preliminary timing of stages advised by the client, together with advice regarding availability of reticulated sewer services to the site, indicate that by the end of Stage 2 connection to Sydney Water sewer services would be available.

Subject to ongoing flow monitoring at the site it may be possible that Stage 3 EMAs are able to be accommodated in the design if per person flow data for the site is lower than the adopted design values.

Design assessment is completed for a system to service the site with Stage 2 fully occupied.

5.2 Wastewater Collection and Transfer System.

All wastewater generating fixtures are to be connected to a collection well. The collection well should be sealed with suitable wet well, dual pumps, appropriate vent stacks and odour scrubbers and inspection ports and to be built in the north west corner of the site under the carpark (Attachment A). We recommend that the collection well is minimum 14.4 kL which is 1 day of flow for Stage 2. After stage 2 it is anticipated that the site shall be connected to Sydney Water's reticulated sewer system and the pump station shall not be required.

To allow for potential pump failure (i.e. mechanical or from loss of power) an emergency storage tank with minimum 3 days design wastewater flow should be built adjacent to the collection well. We recommend a minimum 43 kL underground tank be built to cater for stage 2 predicted daily flows.

A rising main (estimated distance 350 m) from the collection well to the treatment plant will be required.

5.3 Treatment and Effluent Management

5.3.1 Wastewater Treatment System

Wastewater is to be treated in a secondary sewage treatment plant (STP) with disinfection systems capable of treating 14.4 kL/day of wastewater to the effluent standard in Table 7. Refer to Attachment A for STP and EMA locations.

5.3.2 Effluent Storage System

An effluent storage system is to be provided to:

- Temporarily store effluent through week days for irrigation on weekends when no effluent is generated.
- To store effluent when rainfall makes the EMA unsuitable for irrigation.
- Storage of excess flow for Stage 2 caused by inadequate EMA (Table 10).

To store effluent from weekdays for weekend irrigation a tank capacity of 20.5 kL is required. Analysis completed in Section 5.4.3 concludes that a wet weather storage capacity of 35 kL is required.

The effluent storage capacity required for the site is therefore 55.5 kL to satisfy functions. It is recommended that the constructed tank be 1.25 times this capacity (70 kL) with alarms installed at 50% and 80% capacity. Should the tank reach 80% capacity pump out and offsite disposal of effluent should be arranged.

5.3.3 Effluent Quality

Wastewater treatment using secondary treatment technologies is required. Disinfection of secondary effluent is to be via chlorine dosing, UV treatment or other means suitable in conjunction with the adopted secondary treatment technology. Effluent should be appropriately filtered prior to disinfection to maximise the effectiveness of disinfection. Specific quality for effluent is summarised in Table 7.

Table 7: Assumed effluent treatment standards.

Parameter	Required quality
BOD_5 (mg/L)	< 20
Suspended Solids (mg/L)	< 30
E. Coli (CFU/100mL)	< 1000
Total Phosphorus (mg/L)	< 10
Total Nitrogen (mg/L)	< 30

5.4 Effluent Application Assessment

Assessment of requirements for effluent irrigation is undertaken based on the following design considerations:

1. Protection of public health – the principal risk to public health results from the runoff or resurfacing of effluent due to hydraulic overloading of soils. To determine the required area for effluent irrigation areas to mitigate this risk design based on soil hydraulics is undertaken. Required irrigation area is determined based on peak daily effluent load and soil's ability to hydraulically assimilate the effluent as determined by the DIR.
2. Nutrient assimilation and environmental protection – design is refined based on assessment of nutrient balances and water balance / wet weather storage requirements. These assessments are completed based on annual average flow (nutrient balance) and monthly patterns of effluent generation (water balance).

The final EMA design is then determined based on review of the results of these design assessments with consideration of the site's end use and sensitivity of human and environmental receptors.

5.4.1 Soil Hydraulics Design

The required EMA based on soil hydraulics is capacity of the available effluent irrigation area has been assessed based on the calculated DIR of 3.0 mm/day (Table 3) and daily irrigation rate (Stage 2) of 10.3 kL (Table 6). To irrigate Stage 2 wastewater flows a total EMA of not less than 3,435 m^2 is required.

5.4.2 Nutrient Modelling

Nutrient balance modelling (Attachment D) has been completed to determine sustainable effluent irrigation rates based on daily wastewater generation (Table 6). The model used effluent quality specified in Table 7 and physiochemical parameters from soil laboratory testing from a study completed at Denham Court on the same soil landscape.

Nutrient balance results conclude that the sustainable irrigation rate for the nitrogen balance is the limiting factor. A maximum irrigation rate of 1.8 mm/day is sustainable for nitrogen and 4.2 mm/day for phosphorous.

5.4.3 Water Balance Assessment

Water balance modelling (Attachment E) has been undertaken to assess required wet weather storage for the irrigation of effluent from Stage 2 of the development. The required volume of wet weather storage varies with the EMA area adopted. Table 9 shows the change in EMA for a range of areas from the AS/NZS 1547 (2012) required area of 3,435 m^2 and for areas adequate for common available commercial tank sizes.

Table 8: A summary of required EMA based on wet weather storage tank volume (Stage 2).

Wet Weather Storage Tank (kL)	Required EMA (m^2)	Resulting DIR (mm/day)
0	6,928	1.5
35	6,138	1.7
50	5,799	1.8

The final tank size shall allow for irrigation scheduling (20.5 kL) and required wet weather storage volume (35 kL) with an additional 25% emergency storage capacity.

5.4.4 Irrigation Field Design Summary

Table 9 provides a summary of the soil hydraulics, nutrient and water balance modelling results. The adopted EMA design irrigation rate is selected as the limiting factor of the design approaches. Nitrogen assimilation is the limiting factor and an irrigation rate of 1.8 mm/day is adopted for Stage 1 and an irrigation rate of 1.7 mm/day for water balance modelling (with 35 kL storage). The corresponding wet weather storage capacity is 35 kL.

Table 9: A summary of EMA requirements for soil hydraulics, nutrient budget and water balance assessments.

Method	Irrigation rate mm/day
Nitrogen balance	1.8
Phosphorus balance	4.2
Water balance	1.5 – 1.8 [1]
AS/NZS 1547	3.0
Design	**1.8**

Notes: [1] Range of irrigation rates to achieve final storage tank capacity of 0 – 50 kL

Results indicate that water balance and nitrogen balance are the limiting factors. Therefore, a design value of 1.8 mm/day is to be used for determining required irrigation areas for each stage.

The available and required irrigation area for Stage 1 and 2 of the development are summarised in Table 10 using the adopted design irrigation rate from Table 9.

Table 10: Design summary for Stage 1 and 2.

Stage	Wastewater applied (L/day)	Wet weather storage (kL)	Required effluent management area (m^2)	Area available[1]
1	5,000	0	2,738	8,100
2	10,229	35 kL	6,138	6,585

Notes: [1]. Area available for irrigation based on land capability assessment.

The available EMAs for stages 1 and 2 are shown in Attachment A. The EMA is to be positioned in areas with sufficient soil depth while maintaining the required buffer setback distances.

To prevent potential site user exposure to effluent we propose the use of subsurface irrigation and a fence around the treatment system and EMA.

5.4.5 Effluent Reuse Management Requirements

The effluent irrigation system will be operated so that:

1. Irrigation does not occur when EMA is over wet. A rain sensor is proposed to control this irrigation.
2. That average effluent loading rates do not exceed 1.8 mm/day for Stage 1 and 1.7 mm/day for Stage 2.
3. That peak daily irrigation rates does not exceed 3.0 mm/day.

4. That effluent is pumped out when storage tank exceeds the design ‘full capacity’ of 55.5 kL.

5. That effluent (or wastewater) is pumped out where generated wastewater exceeds the capacity of the irrigation fields.

Suitable access and standing areas are to be provided adjacent to the STP and the sewage pump station to allow for maintenance and pump out vehicle access. Tanks are to be fitted with a vandal proof Camlock fitting on a pump out line from the tank and suitable odour control devices.

5.4.6 Effluent Management Area (EMA) Requirements

The proposed EMAs are to be constructed in the areas shown in Attachment A. Requirements for the EMAs are follows:

- The EMA is to be constructed as a subsurface irrigation system, with a minimum area of 2,740 m^2 for stage 1, and be enlarged to 6,140 m^2 for stage 2.

- The EMAs are to maintain all relevant buffers and setbacks, as described in Section 3.3.

- The subsurface irrigation system must comply with Appendix L of AS/NZS 1547 (2012). Laterals are to be installed at 1 m intervals, parallel with site contours.

- The EMAs shall not be used for growing fruit, vegetables or other consumable products, or to be grazed or subject to vehicular traffic.

- The EMAs are to be maintained and kept well landscaped / grassed.

- The school facilities manager is to visually inspect the EMAs regularly.

- Equipment must be maintained at all times. Flushing main to be installed to allow clearing of lines (with water directed back to the STP).

- The EMAs identified in this report is indicative only. The final location of all system elements are to be confirmed on site and to be subject to Council S68 approvals to install and operate.

6 Pump Out Wastewater Management

6.1 Overview

Details of requirements for a site wastewater management system where generated wastewater is collected, then removed from site by licenced waste contractor using pump out tankers is described in this section.

6.2 Proposed Wastewater Treatment and Storage

Septic tank treatment is required for wastewater to be removed by pump out contractors. The septic tank is to be design to treat 14.5 kL/day (stage 2 generation rate), - connection to Sydney Water reticulated sewer services are expected after Stage 2. A septage storage tank with a capacity not less than 86 kL is recommended. This shall provide for the storage of one week's flows (71.6 kL) with a 20% freeboard.

6.3 Pump Out System Requirements

The pump out system is to have the following components as a minimum:

- Site sewer system draining all waste producing fixtures to the septic tank.
- Septic tank to have capacity to treat 14.5 kL/day with design in accordance with AS 1546.1 and AS/NZS 1547.
- 86 kL collection well capable of holding 1 week of effluent (71.6 kL) plus 20% in accordance with NSW Health (2001). This design shall service the development up to the end of stage 2.
- Collection well to be fitted with level monitoring equipment (float switch or similar), alarm and communication system to advise operator when system at 80% (57 kL) and 100% (72 kL) design capacity, and at the top water level (86 kL) to allow for management timing of pump out.
- The septic tank and collection well are to be located in the north western corner of the site and adjacent to the proposed car parking area to allow for access for pump out tankers.
- A tanker standing bay to be located adjacent to the collection well and within the car parking area to allow for pump out tankers to stand during pump out without adversely affecting traffic.
- Collection well to be fitted with appropriately located outlet with 50 mm Camlock fitting to allow pump out tanker access.

Indicative locations of the septic tank, collection well and tanker standing bay are provided on Map 03, Attachment A. It is recommended that weekly pump out volumes and site occupancy rates be recorded to allow ongoing assessment of onsite wastewater generation rates.

7 Recommendations and Conclusion

7.1 Further Approvals

Prior to the construction of a site sewage management system, an approval under section 68A of the Local Government Act (1993) will be required where final design specifications for the effluent treatment and reuse systems shall be submitted for approval to Council. Prior to occupation of the school a section 68 approval to operate the system must be obtained.

7.2 Inspection and Maintenance Schedule

All new wastewater treatment, transfer systems and effluent irrigation systems are to be installed, then inspected and certified by a person acceptable to Camden Council prior to system commissioning.

Operations and maintenance for the systems are summarised as follows:

- The treatment system and any required storage tanks shall be maintained by a suitably qualified person or persons. As a minimum, this shall include periodic inspection and maintenance of all system components including all pumps, plumbing, float switches and warning system. It is recommended that, as a minimum, quarterly inspections and maintenance be undertaken.

- Periodic solids management will be required for the treatment system with all waste transported to a suitable off site facility for disposal. Frequency of solids management is expected to be to the order of once every 1 – 3 years for a septic tank and 3 – 5 years for the STP.

- Flushing of irrigation laterals shall be undertaken on a quarterly basis and should coincide with STP maintenance.

- Regular visual inspection of the EMA by the School should be undertaken to verify that the irrigation areas, storage tank and the flow balance system are operating satisfactorily. All leaks, odours or surface ponding of effluent are signs of system malfunction and are to be remediated as soon as practical, with a plumber's assistance as required.

7.3 Ongoing Environmental Monitoring

Monitoring of the performance of the treatment systems and reuse schemes is recommended to allow for the identification of any decline in system performance. We recommend an ongoing environmental monitoring plan while the onsite sewage management scheme is in operation.

7.4 Ongoing Flow Monitoring

It is recommended that flow and site occupation data be recorded and reviewed to inform the design of subsequent site stages.

Data to be collected is:

1. Flow rate to the treatment system – daily rate.
2. Irrigation rate (for onsite system) – daily rate.
3. Pump out volumes – on any days pump out occurs.
4. Site occupancy – number of students and staff on site each day.

The collated data shall allow for the school to review and assess the need for EMA infrastructure expansion as Stage 1 nears full occupancy and to allow for review of the likelihood of Stage 2 effluent pump out as that stage approaches full capacity.

7.5 Conclusion

The provided wastewater management assessment demonstrates the proposed school is capable of being provided an adequate wastewater management system for stages 1 and 2. It is anticipated that reticulated sewer services shall be available prior to stage 3 commencing in approximately 2035.

8 References

Australian / New Zealand Standard 1547 (2012), *On-site domestic wastewater management.*

Australian / New Zealand Standard 1546.1 (2008), *On-site domestic wastewater treatment units.*

Bureau of Meteorology (1929 – 2021) Climate statistics for Australian locations. www.bom.gov.au

Camden Council (2019) *Flood Risk Precincts*.

Camden Council (2006) *Sewage Management Strategy*.

Clark, N.R., and Jones, D.C., (1991), *Penrith 1:100 000 Geological Sheet 9030*, Geological Survey of New South Wales, Sydney.

C.M.S Surveyors Pty Limited (2021) *Survey Plan Showing Detail & Levels, Boundary Marking & Underground Services Over Lot 11 In DP833983 & Over Lot 12 In DP833784 No. 268-278 Catherine Field, NSW, 2171*. Drawing Name: 2013detail.

Department of Local Government, NSW Environment Protection Authority, NSW Health Department, NSW Department of Land and Water Conservation and the NSW Department of Urban Affairs and Planning (1998), *Environment and Health Protection Guidelines, On-site Sewage Management for Single Households.*

Martens and Associates (MA) Pty Ltd (2022) *Geotechnical Assessment: Minarah College – 268 – 278 Catherine Fields Road, Catherine Field, NSW.*

Martens and Associates (MA) Pty Ltd (2022) *P2108320 – Catherine Fields Road – Concept Grading: Cut-Fill Analysis.*

NSW Department of Environment and Conservation (2004) *Use of Effluent by Irrigation.*

NSW Department of Planning, Industry and Environment (eSPADE, NSW soil and land information), www.environment.nsw.gov.au.

NSW Health (2001) *Septic Tank and Collection Well Accreditation Guideline.*

Sydney Water WSA (2002) *Sewerage Code of Australia (version 4).*

Tonkin Zulaikha Greer Architects (2022) *Minarah College* Project no 21019.

WaterNSW (2021) *Realtime Data; All Groundwater Map* viewed 14.02.2022. (https://realtimedata.waternsw.com.au/).

9 Attachment A – Site Plans

Map	Title
Map 01	Site Test and Cut / Fill Plan
Map 02	Stage 1: Onsite Treatment & Irrigation
Map 03	Stage 2: Onsite Treatment & Irrigation
Map 04	Stages 1 - 2: Pump Out System

1:1000 @ A3

Source: Cut and fill plan prepared by Martens and Associates Pty Ltd (2022). Proposal development layout prodvided by Tokin Zulaikha Greer Architects

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Project No: P2108320 Map Set: MS04-R04 EPSG: 28356

Map Title / Figure:

Site Test and Cut / Fill Plan

Map 01	Map
268 and 278 Catherine Fields Road, Catherine Fields, NSW.	Site
Wastewater Management Assessment	Project
Site Effluent Disposal Constraints Map	Sub-Project
Minarah College	Client
07/04/2022	Date

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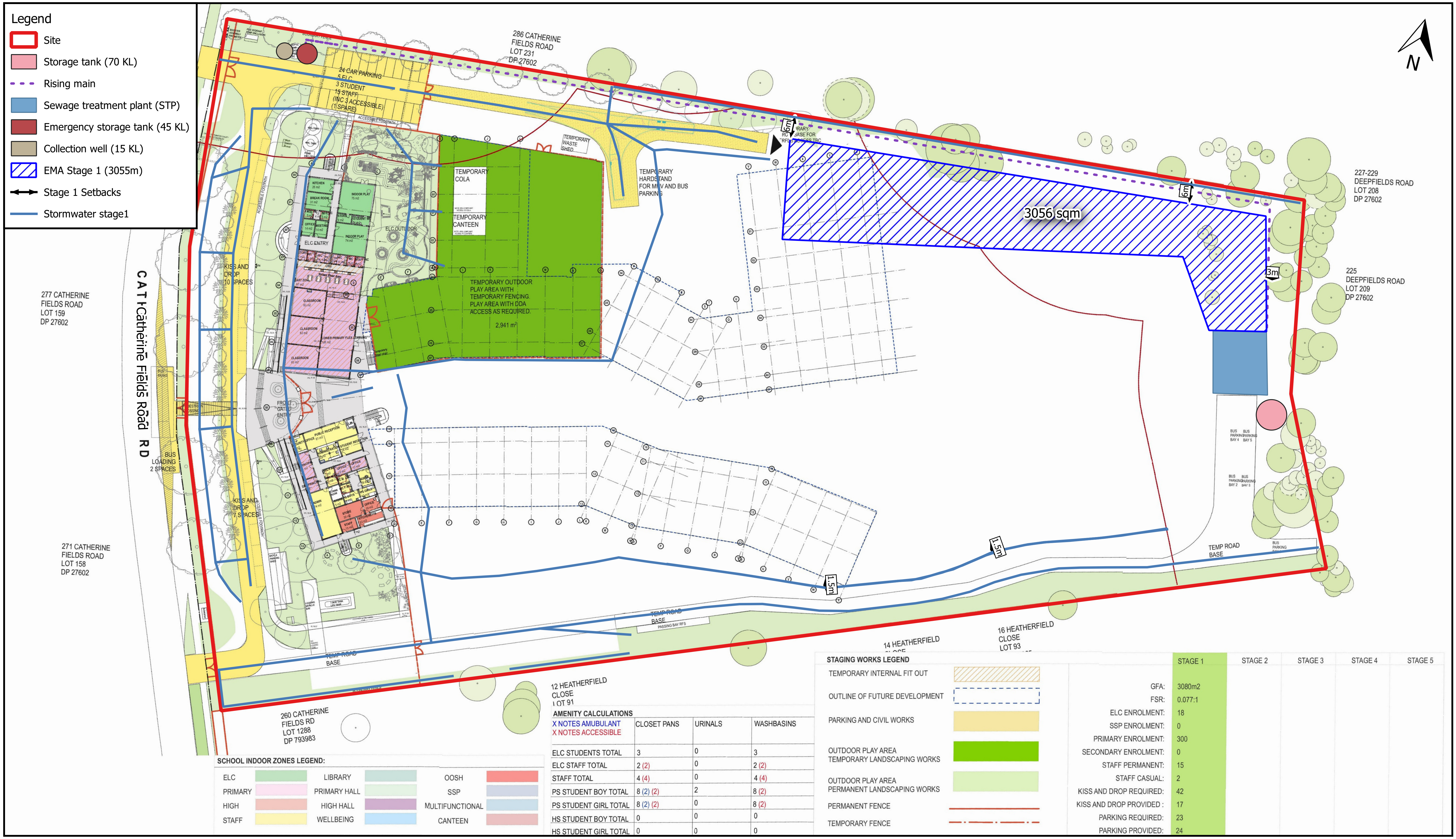

Legend

🟥	Site
🟥	Storage tank (70 KL)
- - -	Rising main
🟦	Sewage treatment plant (STP)
🟥	Emergency storage tank (45 KL)
▨	Collection well (15 KL)
▨	EMA Stage 1 (3055m)
←→	Stage 1 Setbacks
—	Stormwater stage1

SCHOOL INDOOR ZONES LEGEND:

ELC	🟩	LIBRARY	🟩	OOSH	🟥
PRIMARY	🟪	PRIMARY HALL	🟩	SSP	🟦
HIGH	🟥	HIGH HALL	🟪	MULTIFUNCTIONAL	🟦
STAFF	🟨	WELLBEING	🟦	CANTEEN	🟥

AMENITY CALCULATIONS

X NOTES AMUBULANT X NOTES ACCESSIBLE	CLOSET PANS	URINALS	WASHBASINS
ELC STUDENTS TOTAL	3	0	3
ELC STAFF TOTAL	2 (2)	0	2 (2)
STAFF TOTAL	4 (4)	0	4 (4)
PS STUDENT BOY TOTAL	8 (2) (2)	2	8 (2)
PS STUDENT GIRL TOTAL	8 (2) (2)	0	8 (2)
HS STUDENT BOY TOTAL	0	0	0
HS STUDENT GIRL TOTAL	0	0	0

STAGING WORKS LEGEND

TEMPORARY INTERNAL FIT OUT	▨
OUTLINE OF FUTURE DEVELOPMENT	- - -
PARKING AND CIVIL WORKS	🟨
OUTDOOR PLAY AREA TEMPORARY LANDSCAPING WORKS	🟩
OUTDOOR PLAY AREA PERMANENT LANDSCAPING WORKS	🟩
PERMANENT FENCE	—
TEMPORARY FENCE	-·-·-

	STAGE 1	STAGE 2	STAGE 3	STAGE 4	STAGE 5
GFA:	3080m2				
FSR:	0.077:1				
ELC ENROLMENT:	18				
SSP ENROLMENT:	0				
PRIMARY ENROLMENT:	300				
SECONDARY ENROLMENT:	0				
STAFF PERMANENT:	15				
STAFF CASUAL:	2				
KISS AND DROP REQUIRED:	42				
KISS AND DROP PROVIDED :	17				
PARKING REQUIRED:	23				
PARKING PROVIDED:	24				

0 10 20 30 40 50 m

1:1000 @ A3

Notes: Available effluent management areas (EMAs) is dependant on final regrading of the site, suitable soil profile and necessary buffer setbacks.
Locations of all wastewater infrastructure are indicative and subject to change at detailed design.

Map Title / Figure:

Stage 1: Onsite Treatment & Irrigation

Map 02	Map
268 and 278 Catherine Fields Road, Catherine Fields, NSW.	Site
Wastewater Management Assessment	Project
Site Effluent Disposal Constraints Map	Sub-Project
Minarah College	Client
07/04/2022	Date

Project No: P2108320 Map Set: MS04-R04 EPSG: 28356

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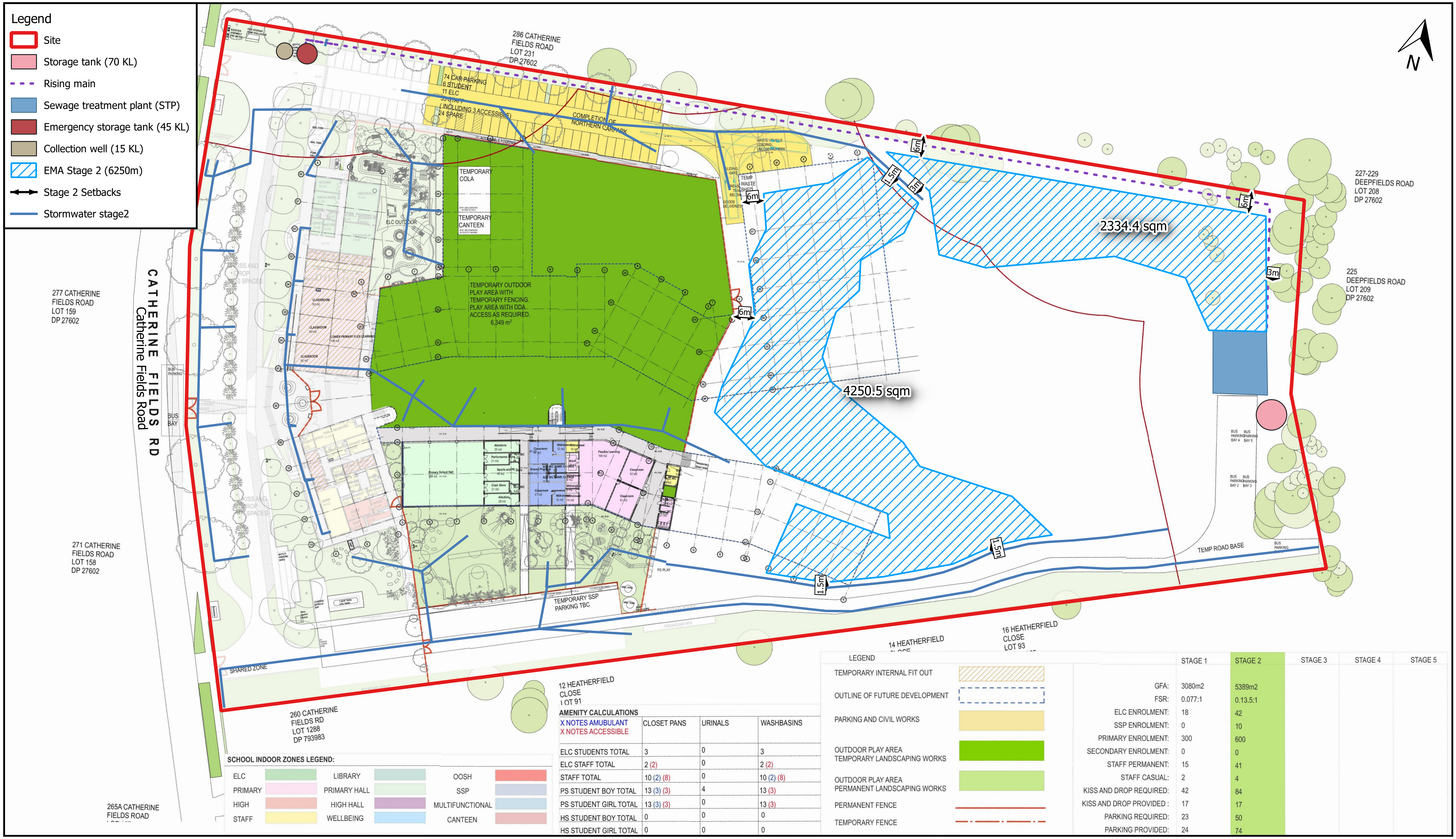

AMENITY CALCULATIONS

X NOTES AMUBULANT X NOTES ACCESSIBLE	CLOSET PANS	URINALS	WASHBASINS
ELC STUDENTS TOTAL	3	0	3
ELC STAFF TOTAL	2 (2)	0	2 (2)
STAFF TOTAL	10 (2) (8)	0	10 (2) (8)
PS STUDENT BOY TOTAL	13 (3) (3)	4	13 (3)
PS STUDENT GIRL TOTAL	13 (3) (3)	0	13 (3)
HS STUDENT BOY TOTAL	0	0	0
HS STUDENT GIRL TOTAL	0	0	0

	STAGE 1	STAGE 2	STAGE 3	STAGE 4	STAGE 5
GFA:	3080m2	5389m2			
FSR:	0.077:1	0.13.5:1			
ELC ENROLMENT:	18	42			
SSP ENROLMENT:	0	10			
PRIMARY ENROLMENT:	300	600			
SECONDARY ENROLMENT:	0	0			
STAFF PERMANENT:	15	41			
STAFF CASUAL:	2	4			
KISS AND DROP REQUIRED:	42	84			
KISS AND DROP PROVIDED :	17	17			
PARKING REQUIRED:	23	50			
PARKING PROVIDED:	24	74			

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Project No: P2108320 Map Set: MS04-R04 EPSG: 28356

0 10 20 30 40 50 m

1:1000 @ A3

Map Title / Figure:

Stage 2: Onsite Treatment & Irrigation

Notes: Available effluent management areas (EMAs) is dependant on final regrading of the site, suitable soil profile and necessary buffer setbacks.
Locations of all wastewater infrastructure are indicative and subject to change at detailed design.

Map 03	Map
268 and 278 Catherine Fields Road, Catherine Fields, NSW.	Site
Wastewater Management Assessment	Project
Site Effluent Disposal Constraints Map	Sub-Project
Minarah College	Client
07/04/2022	Date

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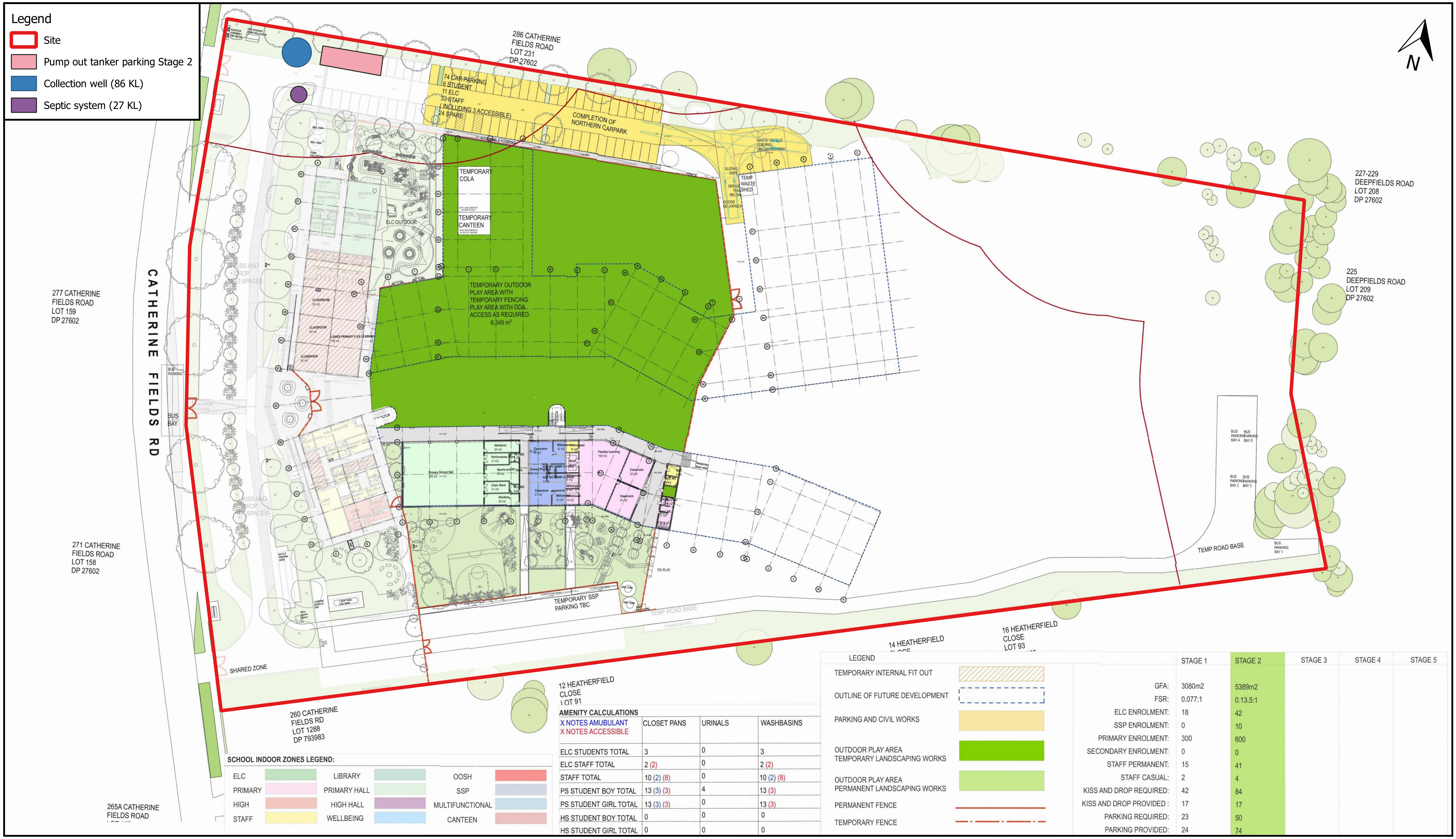
Legend

🟥	Site
🟥	Pump out tanker parking Stage 2
🟦	Collection well (86 KL)
🟪	Septic system (27 KL)



SCHOOL INDOOR ZONES LEGEND:

ELC	🟩	LIBRARY	🟩	OOSH	🟥
PRIMARY	🟪	PRIMARY HALL	🟩	SSP	🟦
HIGH	🟥	HIGH HALL	🟪	MULTIFUNCTIONAL	🟦
STAFF	🟨	WELLBEING	🟦	CANTEEN	🟥

AMENITY CALCULATIONS

X NOTES AMUBULANT X NOTES ACCESSIBLE	CLOSET PANS	URINALS	WASHBASINS
ELC STUDENTS TOTAL	3	0	3
ELC STAFF TOTAL	2 (2)	0	2 (2)
STAFF TOTAL	10 (2) (8)	0	10 (2) (8)
PS STUDENT BOY TOTAL	13 (3) (3)	4	13 (3)
PS STUDENT GIRL TOTAL	13 (3) (3)	0	13 (3)
HS STUDENT BOY TOTAL	0	0	0
HS STUDENT GIRL TOTAL	0	0	0

LEGEND

TEMPORARY INTERNAL FIT OUT	▨
OUTLINE OF FUTURE DEVELOPMENT	┅
PARKING AND CIVIL WORKS	🟨
OUTDOOR PLAY AREA TEMPORARY LANDSCAPING WORKS	🟩
OUTDOOR PLAY AREA PERMANENT LANDSCAPING WORKS	🟩
PERMANENT FENCE	—
TEMPORARY FENCE	-·-

	STAGE 1	STAGE 2	STAGE 3	STAGE 4	STAGE 5
GFA:	3080m2	5389m2			
FSR:	0.077:1	0.13.5:1			
ELC ENROLMENT:	18	42			
SSP ENROLMENT:	0	10			
PRIMARY ENROLMENT:	300	600			
SECONDARY ENROLMENT:	0	0			
STAFF PERMANENT:	15	41			
STAFF CASUAL:	2	4			
KISS AND DROP REQUIRED:	42	84			
KISS AND DROP PROVIDED :	17	17			
PARKING REQUIRED:	23	50			
PARKING PROVIDED:	24	74			

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Project No: P2108320 Map Set: MS04-R04 EPSG: 28356

0 10 20 30 40 50 m

1:1000 @ A3

Map Title / Figure:

Stages 1 - 2: Pump Out System

Source: Tokin Zulaikha Greer Architects (2022) Site Plan.
Locations of all wastewater infrastructure are indicative and subject to change at detailed design.

Map 04	Map
268 and 278 Catherine Fields Road, Catherine Fields, NSW.	Site
Wastewater Management Assessment	Project
Site Effluent Disposal Constraints Map	Sub-Project
Minarah College	Client
07/04/2022	Date

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10 Attachment B – Proposed Development Plans

DATE	REV	DESCRIPTION:
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MINARAH COLLEGE
268-278 CATHERINE
FIELDS RD
CATHERINE FIELD
N
PROJECT NO : #21019

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DRAWING TITLE
SITE PLAN

SCALES
1:500

PHASE
SCHEMATIC DESIGN

DRAWING NO
A 003

DRAWN BY
BS, RL, JD, WR

CHECKED
PT

DATE
DD.MM.201X

REV

DATE	REV	DESCRIPTION:
31.03.22	A	ISSUE FOR SSDA

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PROJECT :
MINARAH COLLEGE
268-278 CATHERINE
FIELDS RD
CATHERINE FIELD
N
PROJECT NO : #21019

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tonkin zulaikha greer ARCHITECTS

DRAWING TITLE
SITE PLAN GROUND

SCALES
1:500

PHASE
SCHEMATIC DESIGN

DRAWING NO
A 005

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DATE
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DATE	REV	DESCRIPTION:
31.03.22	A	ISSUE FOR SSDA

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CATHERINE FIELD
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PROJECT NO : #21019

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DRAWING TITLE
STAGING PLAN
SCALES
1:500
PHASE
SCHEMATIC DESIGN
DRAWING NO
A 004

DRAWN BY
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PT
DATE
DD.MM.201X
REV

11 Attachment C – Borehole Logs

CLIENT	Minarah College	COMMENCED	22/11/2021	COMPLETED	22/11/2021	**REF BH107**	
PROJECT	Geotechnical Investigation	LOGGED	MH	CHECKED	WB/SK	Sheet 1 OF 1	
SITE	268 & 278 Catherine Fields Road, Catherine Field	GEOLOGY	Bringelly Shale	VEGETATION	Grass	PROJECT NO. P2108320	
EQUIPMENT	4WD truck-mounted hydraulic drill rig	LONGITUDE	150.760541	RL SURFACE	79.8 m	DATUM	AHD
EXCAVATION DIMENSIONS	Ø100 mm x 1.80 m depth	LATITUDE	-33.985386	ASPECT	West	SLOPE	5%

Drilling					**Sampling**		**Field Material Description**					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	L	Inflow		79.80				CL	CLAY LOAM; moderate strucutre; pale brown and brown.	W		
	L-M			*0.70* 79.10				LC	LIGHT CLAY; moderate structure; light brown and reddish brown.	M		
	H			*1.65* 78.15				LC	LIGHT CLAY (extremely weathered rock); moderate structure; pale brown, grey and reddish brown.			
			1.8	*1.80*					Hole Terminated at 1.80 m			1.80: V-bit refusal on inferred very low to low strength shale / siltstone.

Depth scale: 0.2, 0.4, 0.6, 0.8, 1.0, 1.2, 1.4, 1.6, 1.8, 2.0, 2.2, 2.4

EXCAVATION LOG TO BE READ IN CONJUCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

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Engineering Log - BOREHOLE

CLIENT	Minarah College	COMMENCED	22/11/2021	COMPLETED	22/11/2021	**REF BH108**
PROJECT	Geotechnical Investigation	LOGGED	MH	CHECKED	WB/SK	Sheet 1 OF 1
SITE	268 & 278 Catherine Fields Road, Catherine Field	GEOLOGY	Bringelly Shale	VEGETATION	Grass	PROJECT NO. P2108320
EQUIPMENT	4WD truck-mounted hydraulic drill rig	LONGITUDE	150.760737	RL SURFACE	81.6 m	DATUM: AHD
EXCAVATION DIMENSIONS	Ø100 mm x 1.50 m depth	LATITUDE	-33.984995	ASPECT	West	SLOPE: 5%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	L	Not Encountered		81.60				CL	CLAY LOAM; moderate strucutre; brown and black.	M		
	M		0.2	*0.20* 81.40				LC	LIGHT CLAY; moderate structure; dark brown, dark grey and reddish brown.	M		
			0.4									
			0.6	*0.60* 81.00					Becoming light brown.			
			0.8									
			1.0									
	H		1.2									
			1.4	*1.40* 80.20				LC	LIGHT CLAY (extremely weathered rock); weakly structured; light brown, grey and reddish brown.			
				1.50					Hole Terminated at 1.50 m			1.50: V-bit refusal on inferred very low to low strength shale / siltstone.
			1.6									
			1.8									
			2.0									
			2.2									
			2.4									

EXCAVATION LOG TO BE READ IN CONJUCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

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Engineering Log - BOREHOLE

CLIENT	Minarah College	COMMENCED	22/11/2021	COMPLETED	22/11/2021	**REF BH109**
PROJECT	Geotechnical Investigation	LOGGED	MH	CHECKED	WB/SK	Sheet 1 OF 1
SITE	268 & 278 Catherine Fields Road, Catherine Field	GEOLOGY	Bringelly Shale	VEGETATION	Grass	PROJECT NO. P2108320
EQUIPMENT	4WD truck-mounted hydraulic drill rig	LONGITUDE	150.760709	RL SURFACE	81.2 m	DATUM AHD
EXCAVATION DIMENSIONS	Ø100 mm x 1.70 m depth	LATITUDE	-33.984646	ASPECT	West	SLOPE 5%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	L	Not Encountered		81.20 *0.10*				CL	CLAY LOAM; moderate structure; brown and black.	M		
	L-M		0.2 0.4 0.6	81.10				LC	LIGHT CLAY; moderate structure; dark brown, dark grey and reddish brown.	M		
	M		0.8 1.0 1.2	*1.40*						M		
	H		1.4 1.6	79.80 *1.70*				LC	LIGHT CLAY (extremely weathered rock); moderate structure; light brown, grey and reddish brown.			
			1.8 2.0 2.2 2.4						Hole Terminated at 1.70 m			1.70: V-bit refusal on inferred very low to low strength shale / siltstone.

EXCAVATION LOG TO BE READ IN CONJUCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

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Engineering Log - BOREHOLE

CLIENT	Minarah College	COMMENCED	22/11/2021	COMPLETED	22/11/2021	**REF BH110**	
PROJECT	Geotechnical Investigation	LOGGED	MH	CHECKED	WB/SK	Sheet 1 OF 1	
SITE	268 & 278 Catherine Fields Road, Catherine Field	GEOLOGY	Bringelly Shale	VEGETATION	Grass	PROJECT NO. P2108320	
EQUIPMENT	4WD truck-mounted hydraulic drill rig	LONGITUDE	150.761116	RL SURFACE	82.1 m	DATUM	AHD
EXCAVATION DIMENSIONS	Ø100 mm x 1.60 m depth	LATITUDE	-33.984903	ASPECT	West	SLOPE	5%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	L	Not Encountered		82.10				CL	CLAY LOAM; moderate structure; brown and black.	M		
			0.2	0.20 81.90				LC	LIGHT CLAY; moderate structure; dark brown, dark grey and reddish brown.	M		
			0.4									
			0.6									
	M		0.8									
			1.0									
				1.05 81.05				LC	LIGHT CLAY (extremely weathered rock); moderate structure; light brown, grey and reddish brown.	M		
			1.2									
	H		1.4									
			1.6	1.60					Hole Terminated at 1.60 m			1.60: V-bit refusal on inferred very low to low strength shale / siltstone.
			1.8									
			2.0									
			2.2									
			2.4									

EXCAVATION LOG TO BE READ IN CONJUCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

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Engineering Log - BOREHOLE

CLIENT	Minarah College	COMMENCED	22/11/2021	COMPLETED	22/11/2021	**REF BH111**	
PROJECT	Geotechnical Investigation	LOGGED	MH	CHECKED	WB/SK	Sheet 1 OF 1	
SITE	268 & 278 Catherine Fields Road, Catherine Field	GEOLOGY	Bringelly Shale	VEGETATION	Grass	PROJECT NO. P2108320	
EQUIPMENT	4WD truck-mounted hydraulic drill rig	LONGITUDE	150.761087	RL SURFACE	81.2 m	DATUM	AHD
EXCAVATION DIMENSIONS	Ø100 mm x 1.50 m depth	LATITUDE	-33.985239	ASPECT	West	SLOPE	5%

Drilling					**Sampling**		**Field Material Description**					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	L	Not Encountered		81.20				CL	CLAY LOAM; moderate structure; brown and black.	M		
			0.2	*0.20* 81.00				LC	LIGHT CLAY; moderate structure; dark brown, dark grey and reddish brown.	M		
	M			*1.10* 80.10					Becoming olive and brown.			
	H		1.4	*1.40* 79.80				LC	LIGHT CLAY (extremely weathered rock); moderate structure; pale olive and brown.			
				1.50					Hole Terminated at 1.50 m			1.50: V-bit refusal on inferred very low to low strength shale / siltstone.

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Engineering Log - BOREHOLE

MARTENS 2.00 LIB.GLB Log MARTENS BOREHOLE P2108320BH107-BH114V01-AGG.GPJ <<DrawingFile>> 13/04/2022 13:58 10.02.00.04 Datgel Lab and In Situ Tool - DGD | Lib: Martens 2.00 2016-11-13 Prj: Martens 2.00 2016-11-13

CLIENT	Minarah College	COMMENCED	22/11/2021	COMPLETED	22/11/2021	**REF BH112**
PROJECT	Geotechnical Investigation	LOGGED	MH	CHECKED	WB/SK	Sheet 1 OF 1
SITE	268 & 278 Catherine Fields Road, Catherine Field	GEOLOGY	Bringelly Shale	VEGETATION	Grass	PROJECT NO. P2108320

EQUIPMENT	4WD truck-mounted hydraulic drill rig	LONGITUDE	150.761121	RL SURFACE	80 m	DATUM	AHD
EXCAVATION DIMENSIONS	Ø75 mm x 0.90 m depth	LATITUDE	-33.985527	ASPECT	West	SLOPE	5%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
HA	L	Not Encountered		80.00				CL	CLAY LOAM; moderate structure; brown and black.	M		
	L-M		0.2 0.4	0.10 79.90				LC	LIGHT CLAY; moderate structure; dark brown, dark grey and reddish brown.	M		
	M		0.6 0.8	0.90								
			1.0 1.2 1.4 1.6 1.8 2.0 2.2 2.4						Hole Terminated at 0.90 m			0.90: Hand auger refusal.

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Engineering Log - BOREHOLE

MARTENS 2.00 LIB.GLB Log MARTENS BOREHOLE P2108320BH107-BH114V01-AGG.GPJ <<DrawingFile>> 13/04/2022 13:59 10.02.00.04 Datgel Lab and In Situ Tool - DGD | Lib: Martens 2.00 2016-11-13 Prj: Martens 2.00 2016-11-13

CLIENT	Minarah College	COMMENCED	22/11/2021	COMPLETED	22/11/2021	**REF BH113**	
PROJECT	Geotechnical Investigation	LOGGED	MH	CHECKED	WB/SK	Sheet	1 OF 1
SITE	268 & 278 Catherine Fields Road, Catherine Field	GEOLOGY	Bringelly Shale	VEGETATION	Grass	PROJECT NO. P2108320	
EQUIPMENT	4WD truck-mounted hydraulic drill rig	LONGITUDE	150.761454	RL SURFACE	82.5 m	DATUM	AHD
EXCAVATION DIMENSIONS	Ø100 mm x 0.90 m depth	LATITUDE	-33.984819	ASPECT	West	SLOPE	5%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	L	Not Encountered		82.50				CL	CLAY LOAM; moderate structure; brown and black.	M		
	L-M		0.2	*0.20* 82.30				LC	LIGHT CLAY; moderate structure; brown, reddish brown; trace shale gravels.	M		
			0.4									
	M-H		0.6	*0.60* 81.90				LC	LIGHT CLAY (extremely weathered rock); moderate structure; light brown, grey and reddish brown.			
			0.8									
				0.90					Hole Terminated at 0.90 m			0.90: V-bit refusal on inferred very low to low strength shale / siltstone.
			1.0									
			1.2									
			1.4									
			1.6									
			1.8									
			2.0									
			2.2									
			2.4									

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MARTENS 2.00 LIB.GLB Log MARTENS BOREHOLE P2108320BH107-BH114V01-AGG.GPJ <<DrawingFile>> 13/04/2022 13:59 10.02.00.04 Datgel Lab and In Situ Tool - DGD | Lib: Martens 2.00 2016-11-13 Prj: Martens 2.00 2016-11-13

CLIENT	Minarah College	COMMENCED	22/11/2021	COMPLETED	22/11/2021	**REF BH114**
PROJECT	Geotechnical Investigation	LOGGED	MH	CHECKED	WB/SK	Sheet 1 OF 1
SITE	268 & 278 Catherine Fields Road, Catherine Field	GEOLOGY	Bringelly Shale	VEGETATION	Grass	PROJECT NO. P2108320
EQUIPMENT	4WD truck-mounted hydraulic drill rig	LONGITUDE	150.761922	RL SURFACE	83.1 m	DATUM AHD
EXCAVATION DIMENSIONS	Ø100 mm x 1.60 m depth	LATITUDE	-33.485188	ASPECT	West	SLOPE 5%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	L	Not Encountered		83.10				CL	CLAY LOAM; moderate structure; brown and black; with rootlets and organics.	M		
				0.30 82.80				LC	LIGHT CLAY; moderate structure; dark brown, dark grey and reddish brown.			
										M		
	M											
	H			1.30 81.80				LC	LIGHT CLAY (extremely weathered rock); moderate structure; light brown, grey and reddish brown.			
			1.6	1.60					Hole Terminated at 1.60 m			1.60: V-bit refusal on inferred very low to low strength shale / siltstone.

Depth scale (metres): 0.2, 0.4, 0.6, 0.8, 1.0, 1.2, 1.4, 1.6, 1.8, 2.0, 2.2, 2.4

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Engineering Log - BOREHOLE

12 Attachment D – Water and Nutrient Balance Modelling

Effluent Disposal Field - Water Balance Assessment

Method ST-XX Revised 11.8.2010

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PROJECT DETAILS

Project	Onsite Wastewater Management - Minarah College, 268 & 278 Catherine Fields, NSW			Ref. No.	P2108320JS03V01
Author	RJK	Reviewed	AN/GT	Date Created	16.03.22

STEP 1 : ENTER SITE AND FIELD CHARACTERISTICS

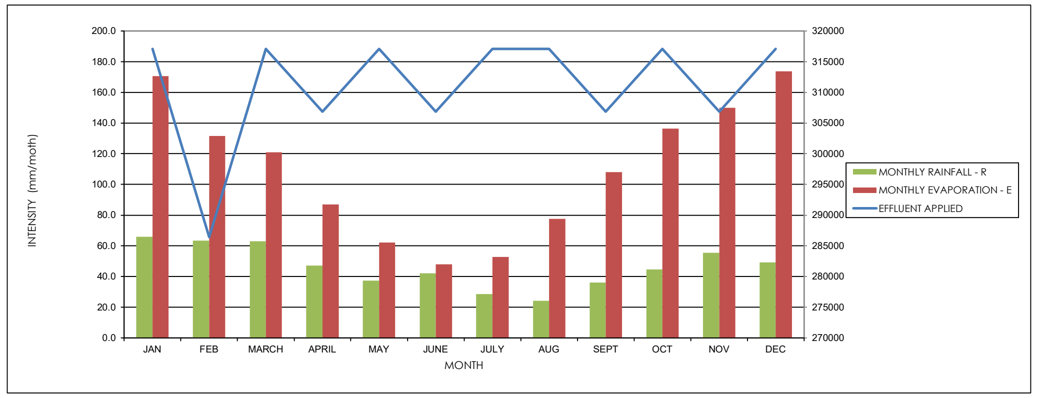
FACTOR	Enter Data	Unit
Runoff Factor - RF	0.35	%
Daily Effluent Load - DEL	10229	L
Effluent Disposal Area - A	5573	m^2
Design Percolation Rate (DPR)	1.4	mm/day

Peak Design Irrigation Rate - DIR	1.8	mm/day
Wet-Weather Storage (KL)	60.0	KL

STEP 2 : ENTER CLIMATE DATA

Source(s):	Bringelly (Maryland) (67015) 1867-2021 / Prospect Reservoir (67019) 1987-2021	Bringelly (Maryland) (67015)	Prospect Reservoir (67019)

	MONTHLY RAINFALL - R	MONTHLY EVAPORATION - E
MONTH	Enter Data	Enter Data
JAN	66.00	170.50
FEB	63.40	131.60
MARCH	63.00	120.90
APRIL	47.10	87.00
MAY	37.30	62.00
JUNE	42.10	48.00
JULY	28.60	52.70
AUG	24.10	77.50
SEPT	36.00	108.00
OCT	44.60	136.40
NOV	55.40	150.00
DEC	49.30	173.60



STEP 3 : ASSESSMENT

MONTH	NUMBER OF DAYS	MONTHLY RAINFALL (mm)	RETAINED RAINFALL	MONTHLY EVAPORATION	CROP FACTOR	EVAPO-TRANSPIRATION RATE	DESIGN PERCOLATION	AVAILABE IRRIGATION CAPACITY	EFFLUENT APPLIED	APPLICATION RATE	INCREASE IN PONDING DEPTH OF EFFLUENT	CUMULATIVE PONDING DEPTH OF EFFLUENT FROM PREVIOUS MONTH	DEPTH OF EFFLUENT	PONDING DEPTH OF EFFLUENT	Average Daily Flow	WET-WEATHER STORAGE REQUIRED
-	(days)	(mm/month)	(mm/month)	(mm/month)	-	(mm/month)	(mm/day)	(mm/month)	(L/month)	(mm/month)	(mm)	(mm)	(mm/month)	(mm)	(L/day)	(L)
-	DAY	R	RR = R x (1- RF)	E	CF	ETR = E x CF	DP = DPR x DAYS	AIC = ETR - RR +DP	EA = DEL x DAY	AR = EA / A	D = (AIC - AR)	CPD = PD from previous month	DE = D + CPD	PD	ADF	WWS
JAN	31	66.00	42.9	170.50	0.80	136.4	44.3	137.8	317086	56.9	-80.9	0.0	-80.9	**0.0**	**10228.6**	**0.0**
FEB	28	63.40	41.2	131.60	0.80	105.3	40.0	104.1	286400	51.4	-52.7	0.0	-52.7	**0.0**	**10228.6**	**0.0**
MARCH	31	63.00	41.0	120.90	0.80	96.7	44.3	100.1	317086	56.9	-43.2	0.0	-43.2	**0.0**	**10228.6**	**0.0**
APRIL	30	47.10	30.6	87.00	0.80	69.6	42.9	81.8	306857	55.1	-26.8	0.0	-26.8	**0.0**	**10228.6**	**0.0**
MAY	31	37.30	24.2	62.00	0.70	43.4	44.3	63.4	317086	56.9	-6.5	0.0	-6.5	**0.0**	**10228.6**	**0.0**
JUNE	30	42.10	27.4	48.00	0.60	28.8	42.9	44.3	306857	55.1	10.8	0.0	10.8	**10.8**	**10228.6**	**60000.0**
JULY	31	28.60	18.6	52.70	0.60	31.6	44.3	57.3	317086	56.9	-0.4	10.8	10.3	**10.3**	**10228.6**	**57643.2**
AUG	31	24.10	15.7	77.50	0.60	46.5	44.3	75.1	317086	56.9	-18.2	10.3	-7.9	**0.0**	**10228.6**	**0.0**
SEPT	30	36.00	23.4	108.00	0.70	75.6	42.9	95.1	306857	55.1	-40.0	0.0	-40.0	**0.0**	**10228.6**	**0.0**
OCT	31	44.60	29.0	136.40	0.80	109.1	44.3	124.4	317086	56.9	-67.5	0.0	-67.5	**0.0**	**10228.6**	**0.0**
NOV	30	55.40	36.0	150.00	0.80	120.0	42.9	126.8	306857	55.1	-71.8	0.0	-71.8	**0.0**	**10228.6**	**0.0**
DEC	31	49.30	32.0	173.60	0.80	138.9	44.3	151.1	317086	56.9	-94.2	0.0	-94.2	**0.0**	**10228.6**	**0.0**

Effluent Disposal Field - Annual Nutrient Balance Assessment

Method ST-14 Revised 20.3.2007

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PROJECT DETAILS

Project	Stage 2: Minarah College, 268 & 278 Catherine Fields, NSW	Ref. No.	P2108320JS04V01
Author	RJK	Reviewed	AN/GT
Date Created	16.03.22		

STEP 1 : ENTER SITE AND FIELD CHARACTERISTICS

FACTOR	Enter Data	Unit	
Treatment System	AWTS	-	
Effluent flow rate	10229	L/day	
Effluent N	30.0	mg/L	
Effluent P	10.0	mg/L	
Design soil depth	1.00	m	
Soil P-sorption	403.0	mg/kg	(value is 50% of the weighted average P-sorption value)
Plant N uptake	200.0	kg/ha/year	
Plant P uptake	20.0	kg/ha/year	

STEP 2 : ASSESSMENT

NITROGEN BUDGET FOR RE-USE FIELD

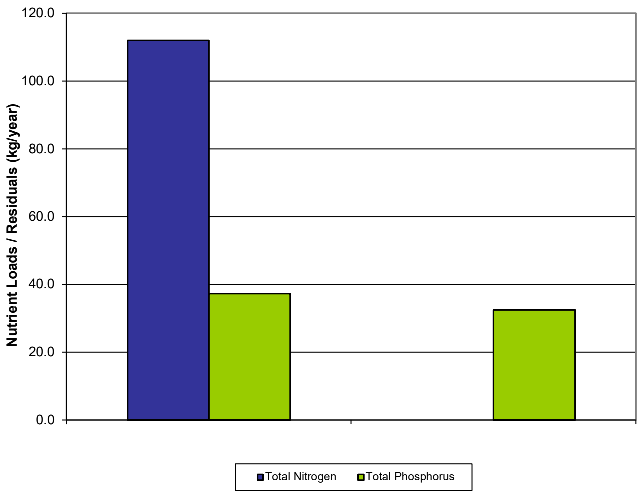
N generated	112.01	kg/year
N consumed	112.01	kg/year
N balance	0.00	kg/year
Min Area	5600	m^2

PHOSPHORUS BUDGET FOR RE-USE FIELD

P generated	37.34	kg/year
P consumed	4.88	kg/year
P balance	32.45	kg/year
P sorption	1622.8	kg P/design soil depth
Field life (for P)	50.0	Years
Min Area	2440	m^2

MINIMUM NUTRIENT ASSIMILATION AREA

Minimum Area	**5600**	m^2



13 Attachment E – Soil Testing Results

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ANALYSIS REPORT SOIL

PROJECT NO:	**EW200934**	**Date of Issue:**	**07/08/2020**
Customer:	MARTENS CONSULTING	Report No:	1
Address:	Suite 201, Level 2 20 George St HORNSBY NSW 2077	Date Received:	31/07/2020
		Matrix:	Soil
Attention:	Richard Kightley	Location:	P1907128 - Denham Co
Phone:	02 9476 9999	Sampler ID:	Client
Fax:	02 9476 8767	Date of Sampling:	24/07/2020
Email:	rkightley@martens.com.au	Sample Condition:	Acceptable

Results apply to the samples as submitted. All pages of this report have been checked and approved for release.

Signed:

Stephanie Cameron
Laboratory Operations Manager

ASPAC
PROFICIENT LAB
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This analysis relates to the sample submitted and it is the client's responsibility to make certain the sample is representative of the matrix to be tested.

Samples will be discarded one month after the date of this report. Please advise if you wish to have your sample/s returned.

results you can rely on

ANALYSIS REPORT

PROJECT NO: EW200934 **Location: P1907128 - Denham Court**

CLIENT SAMPLE ID					7128/BH106/0.0-0.2	7128/BH105/0.5-0.6		
DEPTH								
Test Parameter	**Method Description**	**Method Reference**	**Units**	**LOR**	**200934-1**	**200934-2**		
WMAX Field capacity	Shaw & Yule	24.4.1	%	na	28.4	41.0		
WMIN Wilting Point	Shaw & Yule	24.4.1	%	na	19.5	27.1		
pH (1:5 in H20)	Electrode	R&L 4A2	pH units	na	7.41	5.86		
Electrical Conductivity	Electrode	R&L 3A1	dS/m	0.01	0.23	0.30		
Phosphorus Buffer Index	UV-Vis	PMS-12	mg/kg	na	147	272		
Phosphorus (Colwell)	Bicarb/UV-Vis	R&L 9B1	mg/kg	1	49.7	45.2		
Phosphorus Sorption Capacity	Calc	PMS-12	mg/kg	na	611	828		
Phosphorus Sorption Capacity	Calc	na	kg/ha	na	6100	8280		
Exchangeable Potassium	NH4Cl/ICP	R&L 15A1	mg/kg	10	184	224		
Exchangeable Calcium	NH4Cl/ICP	R&L 15A1	mg/kg	20	2555	1166		
Exchangeable Magnesium	NH4Cl/ICP	R&L 15A1	mg/kg	10	297	1168		
Exchangeable Sodium	NH4Cl/ICP	R&L 15A1	mg/kg	10	174	683		
Exchangeable Potassium	R&L 15A1	R&L 15A1	cmol/kg	na	0.47	0.57		
Exchangeable Calcium	R&L 15A1	R&L 15A1	cmol/kg	na	12.8	5.83		
Exchangeable Magnesium	R&L 15A1	R&L 15A1	cmol/kg	na	2.48	9.73		
Exchangeable Sodium	R&L 15A1	R&L 15A1	cmol/kg	na	0.76	2.97		
ECEC	Calculation	PMS-15A1	cmol/kg	na	16.5	19.1		
Ca/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na	5.16	0.60		
K/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na	0.19	0.06		
Exchangeable Potassium %	Calculation	PMS-15A1	%	na	2.86	3.01		
Exchangeable Calcium %	Calculation	PMS-15A1	%	na	77.5	30.5		

ANALYSIS REPORT

PROJECT NO: EW200934 **Location: P1907128 - Denham Court**

				CLIENT SAMPLE ID	**7128/BH106/0.0-0.2**	**7128/BH105/0.5-0.6**		
				DEPTH				
Test Parameter	**Method Description**	**Method Reference**	**Units**	**LOR**	**200934-1**	**200934-2**		
Exchangeable Magnesium %	Calculation	PMS-15A1	%	na	15.0	50.9		
Exchangeable Sodium %	Calculation	PMS-15A1	%	na	4.59	15.5		
Emerson Aggregate Test	Class	PMS-21	Number	na	5	5		

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Soils are air dried at 40^{0}C and ground <2mm.

NB: LOR is the Lowest Obtainable Reading.

DOCUMENT END