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VERSION [1.2]

OCTOBER 30, 2017

SOIL & SITE ASSESSMENT FOR ONSITE WASTEWATER DISPOSAL

PROPOSED BAPS SWAMINARAYAN HINDU TEMPLE ON 230-242 ALDINGTON ROAD, KEMPS CREEK, NSW

LGA: Penrith

Lot 18 DP 253503

C/-: Jayesh Garach

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VERSION CONTROL

Title	Soil & Site Assessment for Onsite Wastewater Disposal			
Site address	230-242 Aldington Road, Kemps Creek, NSW			
Description	Proposed BAPS Swaminarayan Hindu Temple			
Created By	Phillip Baird B.Env Engineering (UOW)			
Date Created	16/06/2017			
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				-
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1. INTRODUCTION

This Site and Soil Assessment for On-site Wastewater was prepared by Harris Environmental Consulting at the request of Jayesh Garach. It relates to the construction of a new (BAPS) Swaminarayan Hindu Temple on Lot 18 DP 253503 at 230-242 Aldington Road, Kemps Creek, NSW. The proposed center will include a community kitchen and dining hall, prayer and congressional hall, youth/sports center, community gardens, library, book store, traditional temple and offices. Field work was undertaken by a representative of Harris Environmental Consulting (HEC) on the 8th June 2017. This plan is based on the primary investigation of the soils, topography and hydrology of the site observed on the day of inspection. Soil samples and photos of the site were taken for further analysis. This assessment was undertaken for a proposal to install an onsite Sewerage Management Facility (SMF) for wastewater treatment, and a land application system for treated wastewater disposal on site.

2. ASSESSMENT CRITERIA

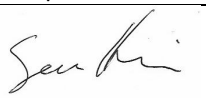
Harris Environmental Consulting was commissioned by the owner to undertake this Soil and Site Assessment for On Site Wastewater Management in accordance with:

- Penrith City Council's On-site Sewage Management and Greywater Reuse Policy;
- Environment and Health Protection Guidelines (1998) On-site Sewage Management for Single Households (Department of Local Government); and;
- Local Government Act 1993
- AS/NZ 1547:2012 On-site wastewater management (Standards Australia, 2012).
- AS/NZS 3500 Plumbing and Drainage 2003 (Standards Australia, 2012)

FIGURE 1 LOCATION OF PROPOSED BAPS SWAMINARAYAN HINDU TEMPLE

Source: NSW SixMaps

3. SITE INFORMATION

Project manager	Jayesh Garach BPAS Project Team E: Jayesh_Garach@hotmai.com M: 0405425601	
Size of property:	10.19 ha	
Legal title:	Lot 18 DP 253503	
Local Government:	Penrith Council	
Water supply:	Town (150L/person/day)	
Design wastewater load:	Central facilities	Flow regulated 6,600 L/day
	Monks residence	2,250L/day
Wastewater treatment	Central facilities	Commercial Sewage Management Facility
	Monks residence	Domestic AWTS
Wastewater disposal	Central facilities	3804m^2 Subsurface irrigation
	Monks residence	1297m^2 Subsurface irrigation
Date site assessed:	June 8, 2017	
Date report prepared:	October 30, 2017	
Report prepared by	Phillip Baird B.Env Engineering (UOW)	
Site assessor:	 Msc Env Science (UOW), Grad dip Nat Res (UNE), BscAppSc, Agriculture (HAC) Sean Harris	

4. SITE ASSESSMENT

Climate - rainfall	Orchard Hills Treatment Works Rainfall Station (median annual 853.8mm)
Climate - evaporation	Badgerys Creek (median 1557mm)
Flood potential	Proposed wastewater treatment system is above 1 in 100 year flood level; minor limitation. Proposed wastewater disposal area above 1 in 20 year flood level; minor limitation.
Frost potential	Not known to be subject to frosts, minor limitation
Exposure	Western aspect; minor limitation
Slope	6-15%, minor limitation for soil absorption bed
Landform	Convex side slope, minor limitation
Run-on and seepage	Minor upslope stormwater runon; minor limitation
Erosion potential	Moderate erosion potential
Site drainage	Moderate to well drained soil profile; minor limitation
Evidence of fill	No evidence of fill; minor limitation
Domestic groundwater use	No groundwater bores within 100m
Surface rock	No surface rock; minor limitation
Area available for effluent disposal	Area available for effluent disposal within designated Effluent Management Area (EMA), minor limitation
Buffer distance from wastewater management system:	Permanent waters : 100m+ Intermittent waters : 40m+ Boundary of premises: 3-6m Swimming pools: 6m+ Buildings (shed): 15m

5. DESIGN WASTEWATER LOAD

CENTRAL FACILITIES			
	Persons per day	**Wastewater assumption**	**Total**
Weekdays	50 persons/day	28 L/person/day	1400 L/d
Festival days	800 persons/day	28 L/person/day	22,400 L/d
Sunday event	600 persons/day	28 L/person/day	16,800 L/d
		Flow regulated volume to treatment system	6,600 L/d

MONKS RESIDENCE			
	Design occupation	**Wastewater assumption**	**Total**
Daily	15 persons	150 L/person/day	2,250 L/d

6. SOIL ASSESSMENT

Method:	Hand augur/crowbar/shovel
Depth to bedrock (m):	>1200mm to restrictive layer; minor limitation
Depth to high soil watertable:	No groundwater encountered at a depth of 1200mm; minor limitation
Mottling	Grey subsoil mottling observed (poorly drained soils)
Coarse (%):	No coarse fragments in subsoil, minor limitation
pH (soil/water):	pH 5.4-6.5; moderate limitation
Electrical conductivity:	<4, indicating salinity is not a constraint; minor limitation
EAT class	Class 1; major limitation
Salinity hazard:	The Department of Infrastructure, Planning and Natural Resources map of salinity hazard throughout Western Sydney shows the proposed irrigation area as having a **moderate salinity hazard**.
Domestic groundwater use:	The Department of Primary Industries Office of Water search of groundwater bores found there are **no known groundwater bores** within 100m of the proposed effluent management area
Geological unit: Soil landscape: Greater Soil Group:	Wianamatta Group (sandstone, siltstone and shale) Luddenham Soil Landscape (Erosional) Red Podzolic Soils - less fertile (granites and metasediment) Red Clayey subsoils
Surface rock:	No surface rock in proposed effluent management area
Bulk density:	Topsoil bulk density 1.91g/cm^3, Major limitation
Phosphorus balance assumptions for design irrigation area:	Phosphorus uptake by grass growth assumed to be 30 kg/ha/yr, 8mg/m^2/day. P sorption 500mg/kg, which equals 9000kg/ha. Available soil depth is 1m soil depth, of which 30% of profile is available for P sorption (potential rage of 30-75%), Bulk density 1.8g/cm^3

7. SOIL TESTING

Seven representative soil samples were sent to the NATA Accredited Australian Laboratory Services (ALS). Soil samples were tested for:

- Electrical Conductivity;
- pH;
- Exchangeable Cation Exchange Capacity;
- Emerson Aggregate Test; and
- Phosphorus Retention Index;
- Bulk Density

a) Emerson Aggregate Class

The Emerson Aggregate Test is used as a general guide to soil sodicity, dispersibility and structural stability. Soils are separated into classes based on the behavior of the soil colloids when immersed in water. Hazelton and Murphy (1992) have defined aggregate classes and interpretations of these classes, as shown in Table 1.

Table 1 Soil analysis results: Emerson Aggregate Test

BH/Layer	Emerson Stability class	Comments
BH1/L1	Class 2	Moderate limitation
BH1/L2	Class 1	Major limitation

DEC (2004) provides a better assessment of EAT classes for effluent irrigation systems than DLG (1998). DEC (2004) ranks Class 4,5,6,7 & 8 as a minor limitation, Class 2 & 3 as a moderate limitation and Class 1 as a major limitation. The results in Table 1 indicate a major limitation for the subsoil sample BH1/L2.

b) Electrical conductivity

Measurement of electrical conductivity (EC) in a 1 to 5 soil/water extract were used to determine salt content as a measure of salinity. DLG (1998) ranks a soil EC (dS/m) <4 as a minor limitation, 4 to 8 as moderate limitation and more than 8 as a major limitation. The results shown in table 2 for all samples were less than 4 dS/m when converted to ECe by soil texture, and therefore a minor limitation.

Table 2 Soil analysis results: electrical conductivity

BH/Layer	EC dS/m 1:5	Soil type	ECe dS/m 1:5	Comments
BH1/L1	0.115	Sandy clay (x8.6)	0.989	Minor Limitation
BH1/L2	0.260	Silty clay loam (x8.6)	2.236	Minor Limitation

c) pH

DLG (1998) ranks soil pH ($CaCl_2$) >6 as a minor limitation, 4.5 - 6 as a moderate limitation and less than 4.5 as a major limitation. The results obtained in table 3 indicate a moderate to major soil limitation.

Table 3 Soil analysis results: pH

BH/Lot	pH in water 1:5	Comments
BH1/L1	6.5	Minor limitation
BH1/L2	5.4	Moderate limitation

Acidity is not a major constraint, however problems associated with an acid soil include:

- Mineralisation of organic matter and release of other nutrients adversely affecting soils with a pH below 4.6 (slows microbial activity);
- Molybdenum, which is required by legumes to fix nitrogen and grasses for protein synthesis, is very insoluble and unavailable for plants in acid soils;
- Aluminium is elevated under acid conditions, which causes phosphorus to become immobilised within the plant and soil. For pH <5.5 Aluminium can be toxic to roots;
- Uptake of calcium and magnesium is restricted with very high levels of soluble aluminium.

For acidic soils it will be necessary to apply lime on a regular basis and grow pasture species that are tolerant of these conditions.

d) Exchangeable Cations and Effective Cation Exchange Capacity

The Effective Cation Exchange Capacity (ECEC) is the sum of the five most abundant exchangeable cations, which includes magnesium (Mg), sodium (Na), calcium (Ca), potassium (K) and in strongly acid soil, aluminum (Al).

The DLG (1998) ranks soil Cation Exchange Capacity >15% as a minor limitation, 5-15% as a moderate limitation and <5% as a major limitation. A low ECEC means the soil has a low resistance to changes in soil chemistry that are caused by land use. The results obtained for layer 1 indicates a moderate limitation.

Sodicity is measured by the Exchangeable Sodium Percentage (ESP), which is the portion of the CEC occupied by sodium (Na) cations. DLG (1998) ranks soil sodicity (ESP) <5% as a minor limitation, 5-10% as a moderate limitation and >10% as a major limitation. Sodic soils may impact plant growth and soil dispersion. Furthermore, Soils that are high in magnesium and sodium show more dispersion than soils that are high in sodium and calcium. Ca/Mg ratios <1 are Ca deficient, 1-4 are Ca Low, 6-4 are balanced, 6-10 are Mg low, and >10 are Mg high. Gypsum is needed to replace the sodium with calcium in sodic soils. The results of table 4 indicate sodicity is a major constraint for soil samples BH1/L1 and BH1/L2.

Table 4 Soil analysis results: Exchangeable Cation Exchange

Exchangeable Cations and Effective Cation Exchange Capacity							
BH1 / L1	**Calcium**	**magnesium**	**Potassium**	**Sodium**	**Aluminium**	**ECEC**	**Ca/Mg**
Meq/100g	4.5	5.4	0.2	1.4	<0.1	11.5	0.8
% CEC	12	47	2.2	38.8 (ESP)	-	100	-
Level	Low	High	Low	High	-	-	-
Limitation	-	-	-	Major	-	Moderate	Ca Def
BH1 / L2	**Calcium**	**magnesium**	**Potassium**	**Sodium**	**Aluminium**	**ECEC**	**Ca/Mg**
Meq/100g	1.2	7.9	0.1	3.2	11.2	23.6	0.2
% CEC	25.4	63.5	1.1	10 (ESP)	-	100	-
Level	Very low	High	Very low	Very high	-	-	-
Limitation	-	-	-	Major	-	Minor	Ca Def

e) Phosphorus Retention/Sorption

The phosphorus sorption capacity is used to predict the life of the site in terms of its ability to immobilise P. The Phosphorus Retention Index (PRI) is a measure of the capacity of the soil to sorb phosphorus, in order to differentiate between soils exhibiting high and low P retention.

Table 5 Soil analysis results: Phosphorus Retention

BH/Lot	PRI (%)	PRI(mgP/kg)	PRI(kg/ha) to 1000mm
BH1/L1	44 (medium)	739	14114.9
BH1/L2	77 (low)	1740	31313

The results in Table 5 shows the PRI % is low to medium. DLG (1998) ranks phosphorus sorption, in kg/ha over a depth of 1000mm, as:

- >6000, minor limitation,
- 2000-6000, moderate limitation; and
- less than 2000, major limitation.

P sorption is a minor limitation in regards to DLG (1998).

e) Bulk Density

Bulk density is the oven dry weight of the soil per unit volume. It affects porosity and soil strength. Bulk density is a measure of the density of a porous material that takes into account the density of solid material and the amount of porosity

Table 6 Soil analysis results: Phosphorus Retention

BH/Lot	Bulk density (g/cm^3)	Comments
BH1/L1	1.91	Major limitation
BH1/L2	1.81	Na for subsoil

Bulk density is a major limitation in regards to DLG (1998), however this assessment expects the topsoil will be reworked to facilitate landscaping.

8. SUMMARY OF SOIL AND SITE CONSTRAINTS

This report highlights those areas suitable for treated wastewater disposal across the site as well as highlighting any major soil or site constraints that may limit effluent disposal, highlighting the minimum setback distances required. It is proposed a new BAPS Swaminarayan Hindu Temple will be constructed on this approximately 10.19-ha property located in the Penrith Local Government Area. Field work was undertaken by a representative of Harris Environmental Consulting on the 8th of June 2017 to assess the underlying soil condition, the topography and hydrology of the site. Soil samples and photos of the site were taken for further analysis.

Photos of the proposed development site are included in the following section of this report. The proposed development site predominately faces west, merging with a dam and drainage depression that travel south west towards Kemps Creek 1.5km away. To the west and across drainage depression towards Aldington Road, the development site faces predominately south-south east, again merging with the central drainage depression. Local relief is approximately 39m (92m-53m AHD).

Of the seven soil samples sent to ALS for further testing, which included Electrical Conductivity, pH, Exchangeable Cation Exchange Capacity, Emerson Aggregate Test; and Phosphorus Retention Index, the only major limitations included an elevated topsoil bulk density, an Emerson Aggregate Class 1 subsoil and an elevated ESP. Class 1 subsoils are almost certainly sodic, confirmed by the elevated ESP. They are defined as “dispersive soils that disperse spontaneously in water – they are unstable, sodic soils that can have severe management and erosion problems”. For effluent disposal in sodic soils, gypsum is needed to replace the sodium with calcium and stablise the soil. When removing the topsoil onsite, care will need to be taken to mitigate the potential for erosion of the dispersible subsoil, this includes but is not limited to the stockpiling topsoil onsite for reuse, the use of sediment fencing and upslope stormwater diversion banks. It is not expected the elevated topsoil bulk density will be an issue. Higher values of bulk density are an indication of poor permeability and restricted plant growth, however, it is expected the topsoil will be replaced to promote plant growth for landscaping. pH is a moderate constraint in the subsoil, which has elevated the aluminium levels in the subsoil. Applying lime with the topsoil will neutralise the acidity and promote plant growth. The clay loam to heavy clay soil profile has suitable phosphorus absorption properties for the application of secondary treated wastewater by subsurface irrigation. The presence of white subsoil mottling is indicative of a fluctuating or seasonably high water table and slow internal drainage, however, subsurface irrigation is ideal for low permeable heavy clay subsoils.

Effluent disposal will be carried out within land nominated as landscaping for the proposed development, indicated on plans submitted to Harris Environmental Consulting. The nominated effluent disposal areas are compliant with the buffers and setback distances required by Penrith City Council. Overland flows will be diverted using stormwater diversion banks and swales to minimise the impact of stormwater crossing the effluent disposal area and into receiving waters.

Further requirements including the buffers and setback distances must be in accordance with the DCP for Penrith City Council. Sections 9-14 of this report will discuss the design and installation of the proposed treatment and disposal measures in further detail.

Photo 1 Onsite soil assessment and soil profile

Photo 2 Existing dam onsite

Photo 3 Looking north along existing access road towards Aldington Road

Photo 4 Looking south along existing access road towards existing property

9. CENTRAL FACILITIES

9.1 PROPOSED METHOD OF WASTEWATER TREATMENT

9.1.1 COMMERCIAL SEWERAGE MANAGEMENT FACILITY

A **commercial** sewerage management facility is proposed to treat wastewater from the proposed Hindu Temple. The owner will need to lodge with council separate applications to install and operate a Sewage Management System under the Local government act 1993, Section 68. Council will require the owner to have selected an SMF manufacturer and provide Council with the necessary plans and specifications including tank dimensions and capacity, operation and maintenance details, plus installers name, address, phone number and license number.

The SMF will be installed and maintained in accordance with Section 5 of the guidelines 'On-site Sewage Management for Single Households' (Department of Local Government, 1998) and AS/NZS 1547-2012 'On-site Domestic Wastewater Management' (Standards Australia, 2012). Upon approval from Penrith City Council, the owner is to enter into a servicing contract with an approved servicing agent for the life of the system. Copies of the written service reports should be lodged with Penrith City Council following each quarterly service.

Penrith council is the approving authority, with the Department of Water and Energy (DWE) and NSW Health acting in an advisory role (to council) for processing section 68 approvals. The Local Government (General) Regulation 2005 provides detail on the approval to operate as well as the broad performance standards and other criteria for the operation of a recycled water scheme.

9.1.2 RISK ASSESSMENT

The treated wastewater will be applied via subsurface irrigation to the subsoil. Wastewater will not be re-used for any other purpose. The proposed SMF will provide secondary and tertiary treatment. After wastewater is applied by subsurface irrigation, there is a low risk of human contact and it is consistent with the DWE definition of a **low level** of risk (DWE, 2008). A low level of risk assumes:

a) Urban irrigation with enhanced restricted access and application irrigation, which assumes:

- no access after irrigation (1-4 hours or until dry);
- minimum buffer zones to the nearest point of public access;
- spray drift controls; or

b) Agricultural irrigation.

The commercial SMF will be designed to meet and exceed the effluent compliance values for low level risk, which includes the compliance values listed in Table 7:

Table 7 Effluent compliance values for low level risk exposure (DWE, 2008)

E.coli	<1000cfu/100ml
BOD	<20mg/L
SS	< 30mg/L
pH	6.5-8.5
Disinfection (if used) *	Cl:0.2-2.0 mg/L residual UV (TBA)

9.1.2 MONITORING REQUIREMENTS

DWE (2008) describes the scope of monitoring to include:

- Validate and verify that the system design and equipment is adequate for the necessary treatment;
- Confirm the ongoing operational performance of the treatment system to protect human health and the environment; and
- Detect any potential or actual failures on the treatment system and implement the appropriate corrective actions.

The commercial SMF will be designed to meet the NSW Health compliance values for a commercial SMF. The SMF should achieve the standards shown in Table 7.

Table 8 Anticipated treatment from proposed SMF

Parameter	Influent (untreated wastewater)	Effluent (after treatment by proposed SMF)
Biochemical Oxygen Demand	200 - 600 mg / L	< 20 mg / L
Suspended Solids	200 - 600 mg / L	< 30 mg / L
Faecal Coliforms	10^3 - 10^{10} cfu / 100 ml.	< 30 cfu / 100 ml.
pH		6.5-8.5
Disinfection Cl: (if used)		0.2-2.0 mg/L residual

The level of treatment shown in Table 8 exceeds the level of treatment required for compliance with the DWE (2008) low level risk exposure, as shown in Table 7.

9.1.3 CONFIRM PERFORMANCE

The manufacturer will provide Council with certification stating that the SMF was installed as per the plan provided to Council. This includes:

- The SMF will be installed and maintained in accordance with Section 5 of the guidelines 'On-site Sewage Management for Single Households' (Department of Local Government, 1998) and AS/NZS 1547-2012 'On-site Domestic Wastewater Management' (Standards Australia, 2000);

- Within 6 months of installation, a sample of treated wastewater will be tested for the parameters listed in Table 8. The results will be provided to Council and used to confirm performance and whether any adjustments are required;

- A sample of treated wastewater will be tested for the parameters listed in Table 8 every 12 months. The results will be provided to Council and used to confirm performance and whether any adjustments are required;

9.1.4 SITE INSPECTION AND MONITORING

The owner shall arrange for the commercial SMF and subsurface irrigation area to be inspected by an occupant or employee at least once a week to look for signs of failure, which could include ponding of effluent or odours. Appropriate action is to be taken.

9.2 COLLECTION TANK (BUFFER TANK)

Prior to treatment, wastewater will be collected via a **30,000L collection tank** which is a storage vessel used to hold effluent before treatment and prior to pumping to a land application system. The purpose of the buffer tank is throttle the flow of wastewater entering the proposed treatment system, as not to overload the treatment system during peak effluent events.

The collection well shall include a submersible pump, operated by timer that would be configured to discharge 6600L/day evenly over a 24-hour period. Dual pumps shall be installed to ensure there is a backup pump in the event of failure.

Other aspects of the design include:

- A suitable submersible Vortex Pump will be connected to and controlled by a float switch and electronic timer. The float switch on the pump would be activated when the volume of the tank exceeds 300 litres.
- The pressure line (32mm lilac poly pipe, buried 300mm deep) is to be fitted with a backflow prevention device.
- An alarm is installed on a high level float switch.

Table *9* **Sizing buffer tank**

BUSY WEEK WITH 800 FESTIVAL GOERS				
Wastewater source		**Persons**	**Wastewater load (L/p/d)**	**Volume (L/d)**
Weekly wastewater load, 5 days/week		50	28	1400
Sunday event		600	28	16800
Festival event		800	28	22400
Flow regulated irrigation volume (L/d)		6600		
Days	**In**	**Out**	**Balance**	**Cumulative**
Sunday	16,800	6,600	10,200	10,200
Saturday	22,400	6,600	15,800	26,000
Monday	1,400	6,600	-5,200	20,800
Tuesday	1,400	6,600	-5,200	15,600
Wednesday	1,400	6,600	-5,200	10,400
Thursday	1,400	6,600	-5,200	5,200
Friday	1,400	6,600	-5,200	0
			BALANCING TANK SIZE (L)	26,000

NORMAL WEEK				
Wastewater source		**Persons**	**Wastewater load (L/p/d)**	**Volume (L/d)**
Weekly wastewater load, 5 days/week		50	28	1400
Sunday event		600	28	16800
No festival event		50	28	1400
Flow regulated irrigation volume (L/d)		3600		
Days	**In**	**Out**	**Balance**	**Cumulative**
Sunday	16,800	3,600	13,200	13,200
Saturday	1,400	3,600	-2,200	11,000
Monday	1,400	3,600	-2,200	8,800
Tuesday	1,400	3,600	-2,200	6,600
Wednesday	1,400	3,600	-2,200	4,400
Thursday	1,400	3,600	-2,200	2,200
Friday	1,400	3,600	-2,200	0
			BALANCING TANK SIZE (L)	13,200

9.3 LOCATION OF TREATMENT SYSTEMS

The location of the treatment system should be decided in conjunction by the licensed plumber in consultation with the property owner. The treatment system must be positioned on a stable, level base and be downslope of the building so there is sufficient fall from drainage outlets in the dwelling. The location of treatment system must be

- Downslope of the buildings from where wastewater is generated;
- at least 2.5m away from the building
- at least 5m from the property boundary
- at least 6m downslope from any in ground water storage tanks.

Treatment systems installation must comply with the manufacturer's recommendations, AS/NZS 3500.2:2003 Plumbing and Drainage Part 2 Sanitary Plumbing and Drainage' and Council requirements.

9.4 INSTALLATION OF PIPES

The sewer pipes between the buildings, treatment system and irrigation area must be buried at a depth that provides protection against mechanical damage or deformation, in accordance with 'AS/NZS 3500(Set):2003 Plumbing and Drainage Set'. Table 11 shows the minimum pipe depth for trafficable areas.

Table 10 Minimum pipe diameter calculations

Nominal pipe size (DN)	Minimum grade %	Minimum grade ratio
65	2.5	1:40
80	1.65	1:60
100	1.65	1:60
125	1.25	1:80
150	1.00	1:100
Source: 'AS/NZS 3500.2.:2003 Plumbing and Drainage Part 2 Sanitary Plumbing and Drainage' Table 3.2. NB: pipe grades are expressed as a percentage of vertical to horizontal distances.		

Table 11 Minimum pipe depth for trafficable areas

Location	Minimum depth of cover (mm)
Where subject to heavy vehicular traffic	500
Where subject to light vehicular traffic	450
Elsewhere	300
Source:'AS/NZS 3500:2003 Table 3.4 Minimum Cover for Buried Piping'	

9.5 SIZING EFFLUENT DISPOSAL AREA

The irrigation area needed to manage the flow regulated volume of 6600L /d was calculated using a monthly water and nutrient balance, following the method described in DLG (1998). Soil texture classification for Design Irrigation Rate is from ASNZ1547(2012).

The ***water balance*** requires a **3804m²** irrigation area based on the following variables:

- Orchard Hills Treatment Works median monthly rainfall;
- Badgerys Creek monthly average evaporation; and
- Application rate of 14mm/week or 2mm/day.

The ***nitrogen balance*** requires a **2313m²** irrigation area based on the following variables:

- SMF will reduce Total Nitrogen to 30mg/L; and
- Vegetative rate for managed pastures is assumed to be 250kg/N/ha/year

The ***phosphorus balance*** requires an area of **3441m²** irrigation area based on the following variables:

- SMF will reduce Total Phosphorus to 12mg/L;
- P-sorption of 500mg/kg;
- soils will be effective to retain 0.3% of predicted sorption for a soil depth of 1m. Crop uptake is assumed to be 30kg/ha/annum; and
- 50 year design life of system.
- Bulk density of 1.8g/cm^3

The largest of the three methods (most limiting) is required. For this site, the largest of the three methods is 3804m^2. The proposed location and set back distances of the land application area relevant to the site are to be consistent with the requirements in the Conditions of consent, Penrith City Council Development Control Plan and this report.

9.6 LOCATION AND METHOD OF IRRIGATION

Subsurface irrigation reduces the chance of human contact with the effluent and significantly reduces public health risk. By placing the effluent in the root zone of plants, beneficial reuse of both the hydraulic and nutrient components of the effluent is maximised., offering enhanced environmental benefits. With Subsurface irrigation there is less chance of surface saturation and effluent runoff.

The land available for subsurface irrigation is divided into three (3) locations. Subsurface irrigation areas A1, A2 and A3, for the central facilities. Subsurface irrigation areas A1, A2 and A3 are located towards the far western boundary line towards Aldington Road, and the far eastern boundary line, within a parcels of land previously nominated for landscaping, plans submitted to Harris Environmental Consulting “SITE LAYOUT 31-5-17” prepared by Shayona Consultants.

Effluent disposal must not occur within the minimum buffers and setback distances listed in table 12. Effluent disposal within the minimum buffers and setback distances will be mitigated by providing additional nutrient removal with the proposed sewerage management facility and the use of stormwater diversion banks and swales to increase overland flow paths and minimise stormwater run on. See appendix III for installation methods and appendix VIII for the proposed location.

10. MONKS RESIDENCE

10.1 DOMESTIC WASTEWATER TREATMENT SYSTEM

The design wastewater load is **2250L/day**. A domestic AWTS will be able to treat the design wastewater load from the proposed Monks residence.

The owner is required to provide Council with the AWTS manufacturer's specifications of the proposed treatment system. (Information on proposed AWTS can be obtained from the manufacturer or NSW Heath Register of Accredited Sewage Management Systems at http://www.health.nsw.gov.au/publichealth/environment/water/waste_water.asp).

The AWTS manufacturer will provide Council with the necessary plans and specifications including NSW Health Accreditation, tank dimensions and capacity, operation and maintenance details, plus Licensed Plumber's name, address, phone number and license number.

The AWTS will be installed and maintained in accordance with Section 5 of the guidelines 'On-site Sewage Management for Single Households' (Department of Local Government, 1998) and AS/NZS 1547-2012 'On-site Domestic Wastewater Management' (Standards Australia, 2012).

Upon approval from Penrith Council, the owner is to enter into a servicing contract with an approved servicing agent for the life of the system. Copies of the written service reports should be lodged with Penrith Council following each quarterly service.

A power supply (and telephone line if telemetry or an automated monitoring/ alarm is fitted), will be required to deliver power to the treatment unit.

10.2 LOCATION OF PROPOSED AWTS

The location of the AWTS should be decided in conjunction by the licensed plumber in consultation with the property owner. The AWTS must be positioned on a stable, level base and be downslope of the building so there is sufficient fall from drainage outlets in the dwelling. The location of AWTS must be

- Downslope of the buildings from where wastewater is generated;
- at least 2.5m away from the building
- at least 5m from the property boundary
- at least 6m downslope from any in ground water storage tanks.

AWTS installation must comply with the manufacturer's recommendations, AS/NZS 3500.2:2003 Plumbing and Drainage Part 2 Sanitary Plumbing and Drainage' and Council requirements.

10.3 INSTALLATION OF PIPES

The sewer pipes between the house, AWTS and irrigation area must be buried at a depth that provides protection against mechanical damage or deformation, in accordance with 'AS/NZS 3500(Set):2003 Plumbing and Drainage Set'. Table 13 shows the minimum pipe depth for trafficable areas.

Table 12 Minimum pipe diameter calculations

Nominal pipe size (DN)	Minimum grade %	Minimum grade ratio
65	2.5	1:40
80	1.65	1:60
100	1.65	1:60
125	1.25	1:80
150	1.00	1:100
Source: 'AS/NZS 3500.2.:2003 Plumbing and Drainage Part 2 Sanitary Plumbing and Drainage' Table 3.2. NB: pipe grades are expressed as a percentage of vertical to horizontal distances.		

Table 13 Minimum pipe depth for trafficable areas

Location	Minimum depth of cover (mm)
Where subject to heavy vehicular traffic	500
Where subject to light vehicular traffic	450
Elsewhere	300
Source:'AS/NZS 3500:2003 Table 3.4 Minimum Cover for Buried Piping'	

10.4 SIZING EFFLUENT DISPOSAL AREA

Subsurface irrigation is proposed for all lots. The irrigation area needed to manage **1350L/day** was calculated using a monthly water and nutrient balance, in accordance with DLG (1998) and SCA (2012).

The ***water balance*** requires a **1296.9m^2** irrigation area based on the following variables:

- Orchard Hills Treatment Works median monthly rainfall;
- Badgerys Creek monthly average evaporation; and
- Application rate of 14mm/week or 2mm/day.

The ***nitrogen balance*** requires a **788m^2** irrigation area based on the following variables:

- AWTS will reduce Total Nitrogen to 30mg/L; and
- Vegetative rate for managed pastures is assumed to be 250kg/N/ha/year

The ***phosphorus balance*** requires an area of **1173m^2** irrigation area based on the following variables:

- AWTS will reduce Total Phosphorus to 12mg/L;
- P-sorption of 500mg/kg;
- soils will be effective to retain 0.3% of predicted sorption for a soil depth of 1m. Crop uptake is assumed to be 30kg/ha/annum; and
- 50 year design life of system.
- Bulk density of 1.8g/cm^3

The largest of the three methods (most limiting) is required. For this site, the largest of the three methods is 3804m^2.

The largest of the three methods (most limiting) is required. For this site, the largest of the three methods is **1297m^2** The proposed location and set back distances of the land application area relevant to the site are to be consistent with the requirements in the Conditions of consent, Penrith City Council Development Control Plan and this report.

10.5 LOCATION AND METHOD OF IRRIGATION

Subsurface irrigation reduces the chance of human contact with the effluent and significantly reduces public health risk. By placing the effluent in the root zone of plants, beneficial reuse of both the hydraulic and nutrient components of the effluent is maximised., offering enhanced environmental benefits. With Subsurface irrigation there is less chance of surface saturation and effluent runoff.

The land available for subsurface irrigation is divided into two (2) locations. Subsurface irrigation areas B1 and B2 for the Monks Residence. Subsurface irrigation areas B1 and B2 are located directly adjacent to the proposed Monks residence, within parcels of land previously nominated for landscaping, plans submitted to Harris Environmental Consulting “SITE LAYOUT 31-5-17” prepared by Shayona Consultants.

Effluent disposal must not occur within the minimum buffers and setback distances listed in table 12. Effluent disposal within the minimum buffers and setback distances will be mitigated by providing additional nutrient removal with the proposed sewerage management facility and the use of stormwater diversion banks and swales to increase overland flow paths and minimise stormwater run on. See appendix III for installation methods and appendix VIII for the proposed location.

11. COMPLETION OF WORKS

The last stage of this process involves submitting an Installation Certificate provided by the installer. This is to certify that the systems have been installed according to the System Design. A copy of the installation certificate must be provided to council and the system designer. A council certifier will make a final inspection before the system is approved for use.

The treatment and application systems must be installed by a contractor(s) licensed by NSW Fair Trading. That could be a licensed plumped or a licensed irrigation contractor (or both), each with at least three years’ experience in effluent disposal.

12. GENERAL RECOMMENDATIONS

Chemical cleaning compounds and other chemicals that enter the treatment system should be low in phosphate non-antibacterial. Detergents low in phosphorus and sodium should be used to reduce salt and nutrient loadings.

Water conservation can reduce the volume of wastewater that needs to be treated and discharged on site. Water reduction fixtures will also be required to conform to BASIX, which requires a 40% reduction below average rates of water consumption. The following AAA-rated would help achieve this:

- Dual flush toilets (6/3L)
- Aerator taps
- Shower heads that limit flow to no more than 6L/minute
- Dishwashers that use no more than 18 litres per wash cycle
- Washing machines that use no more than 22 litres per dry kg of clothes

13. IN HOUSE WATER MANAGEMENT

This assessment assumes standard water conservation practices in accordance with the requirements needed to comply with BASIX. This assumes that water efficient choices are made when purchasing and installing:

- clothes washing machines
- dishwashers
- flow controllers
- toilet (lavatory equipment)
- showers
- taps for use over a kitchen sink, bathroom basin, laundry tub etc
- urinal equipment.

For further information on the Water Efficient Labelling Scheme, which is recognised by BASIX as the measure of an efficient product, go to *http://www.savewater.com.au/products/product-labelling.*
http://www.waterrating.gov.au/

14. REQUIRED BUFFERS

The following buffers must be applied when installing all onsite sewage management systems in accordance with the Penrith City Council Development Control Plan

TABLE 14 MINIMUM REQUIRED SETBACK DISTANCES AND BUFFERS

SYSTEM	BUFFER DISTANCES
All Onsite Sewage Management Systems	• 100 metres to domestic groundwater well • 100 metres to permanent surface waters (e.g. rivers, creeks, streams, lakes etc.) • 40 metres to other waters (e.g. dams, intermittent water courses, overland flow paths etc.) • 15metres from in-ground water tank • 1 metre from the drip line of native trees and shrubs
Subsurface irrigation	• 6 metres if area up-slope and 3 metres if area down-slope of buildings, driveways and property boundaries

15. SUMMARY

The purpose of this assessment is to assess whether on site wastewater management can be undertaken on the subject lot to achieve the relevant assessment criteria. This assessment finds that on site wastewater management can be undertaken for the proposed BAPS Hindu Temple.

Following the soil and site assessment, this assessment recommends the following:

1. For the central services level

- Installation of a Commercial Aerated Wastewater Treatment System with a suitable capacity to treat approximately 6,600L of wastewater per day from the central services building and amenities accessible to the public.
- Installation of a 30,000L balancing tank. used to hold effluent prior to treatment in the proposed commercial Aerated Wastewater Treatment System. The collection well shall include a submersible pump, operated by timer, and an alarm installed on a high flow float switch.
- Installation of 3,804m^2 of subsurface irrigation to dispose of treated wastewater from the commercial Aerated Wastewater Treatment System, as described in the Appendix and shown on the Site Plan. Nominated subsurface irrigation areas A1, A2 and A3.

2. For the Monks Residence

- Installation of a domestic Aerated Wastewater Treatment System with a suitable capacity to treat approximately 2,250L of wastewater per day from the Monks residence.
- Installation of 1297m^2 of subsurface irrigation to dispose of treated wastewater from the domestic Aerated Wastewater Treatment System, as described in the Appendix and shown on the Site Plan. Nominated subsurface irrigation areas B1 and B2.

3. For all land application systems

- Installation of stormwater diversion banks to increase overland flow paths and minimise stormwater run on to the proposed effluent disposal area.
- Treat slightly Acidic soils with lime on a regular basis and pasture species tolerant of these conditions are grown; and
- Treat sodic soil with Gypsum to replace the sodium with calcium and improve soil structure.

16. REFERENCES

Department of Local Government (1998) *On-site Sewage Management for Single Households*. NSW Government.

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

NSW Health (2016) Sewerage Management Facility Vessel Accreditation Guideline

Hazelton, P.A and Murphy, B.W ed. (1992) *What Do All the Numbers Mean? A Guide for the Interpretation of Soil Test Results.* Department of Conservation and Land Management (incorporating the Soil Conservation Service of NSW), Sydney.

Department of Water & Energy, (2008) Management of Private Recycled Water Schemes

APPENDIX I SUBSURFACE IRRIGATION

i) The irrigation area should be split into zones of 200 to 300m^2.

ii) Each zone is to receive an even proportion of wastewater, using a sequencing valve, such as a water rotor or similar.

iii) Immediately after the SMF, a disc filter or a 100 to 150-micron filter is to be installed (ie, before the sequencing valve or distribution manifold). The filter must be cleaned regularly (at least every 3 months).

iv) The distribution pipe from the SMF to the distribution manifold shall consist of a 32mm uPVC or polythene pipe, buried 300mm underground. Where vehicles pass over the line, it should be 450mm for light traffic and 500mm for heavy traffic.

v) Pressure compensating subsurface drip line is used with emitters and laterals at approximately 800mm spacing's (min 600mm, maximum of 1000mm depending on soil type) and buried to a depth of 100mm – 150mm below finished ground level (in accordance with ASNZ1547:2012).

vi) The drip line is to be impregnated with root inhibitor or include a tech filter that dispenses a root inhibitor (a chemical injector assembly or impregnated emitter tube) to protect drip line from root ingress.

vii) Air release valves should be located at the highest point and flush valves at the lowest point of each sub-surface zone and shall be contained within a durable protective housing with a lilac lid to indicate wastewater.

viii) Additional air/vacuum valves, pressure-reducing valves and non-return / tube non-leakage valves are to be included into the design as needed. ie., where the effluent irrigation area is located above the treatment system or pump well, a non-return valve.

ix) The system must have capacity to enable flushing to remove any suspended solids and organic growth that may accumulate.

x) The effluent irrigation system should be tested to ensure there is uniform effluent delivery to all parts of the irrigation area.

xi) The effluent management area must be fenced off from livestock and vehicles.

The irrigation area should be vegetated with grass before commissioning. The grass within the irrigation should be mown on a regular basis and dispose of clippings outside the irrigation area. The vegetation in such areas should be suitably tolerant of high water and nutrient loads.

APPENDIX II EXTRACT FROM PENRITH DCP - BUFFERS AND SETBACK DISTANCES

System	Buffer Distances
All OSSM systems (including tank)	• 250 metres to domestic groundwater well • 100 metres to permanent surface waters (e.g. rivers, creeks, streams, lakes etc) • 40 metres to other waters (e.g. dams, stormwater easements, overland flow paths, intermittent waterways and drainage areas etc) • 15 metres from an in-ground water tank • 1 metre from the drip line of native trees and shrubs • For tank – minimum 1.5 metres from dwelling
Surface spray irrigation	• 15 metres to dwellings • 6 metres if area up-slope and 3 metres if area down-slope of buildings, driveways and property boundaries • 3 metres to paths and walkways • 6 metres to swimming pools and recreational areas
Surface drip and trickle irrigation	• 6 metres if area up-slope and 3 metres if area down-slope of dwellings, swimming pools, property boundaries, driveways and buildings
Subsurface irrigation	• 6 metres if area up-slope and 3 metres if area down-slope of dwellings, swimming pools, property boundaries, driveways and buildings
Absorption system	• 12 metres if area up-slope and 6 metres if area down-slope of property boundaries and dwellings • 6 metres if area up-slope and 3 metres if area down-slope of swimming pools, driveways and buildings

Notes: (1) Additional buffer distances may be required as identified during Council's assessment of the development proposal.

APPENDIX III WATER BALANCE

Nominated Area Water Balance for Zero Storage

Site Address: **Central Facilities (230-242 Alington Road, Kemps Creek, NSW)**

INPUT DATA

Design Wastewater Flow	Q	6600	L/day
Design DIR (from AS/NZ 1547,2012)	DIR	14	mm/week
Daily DIR		2.0	mm/day
Nominated Land Application Area	L	3804	m sq
Rainfall Data	Orchard Hills Treatment Works		
Evaporation Data	Badgerys Creek monthly averages		

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	103.6	86.6	74.8	42.7	42.5	32.8	20.9	17.7	29	41	60.4	60.4	**853.8**
Evaporation	E	\	mm/month	202	157	136	105	81	63	81	96	120	152	183	220	**1557**
Crop Factor	C			0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	
INPUTS																
Precipitation	(P)		mm/month	103.6	86.6	74.8	42.7	42.5	32.8	20.9	17.7	29	41	60.4	60.4	853.8
Effluent Irrigation	(W)	(Q x D) / L	mm/month	53.8	48.6	53.8	52.1	53.8	52.1	53.8	53.8	52.1	53.8	52.1	53.8	**633.28076**
Inputs		(P+W)	mm/month	157.4	135.2	128.6	94.8	96.3	84.9	74.7	71.5	81.1	94.8	112.5	114.2	1245.7
OUTPUTS																
Evapotranspiration	ET	ExC	mm/month	162	126	109	74	57	44	57	67	96	122	146	176	**1234.2**
Percolation	B	(DIR/7)xD	mm/month	62.0	56	62.0	60.0	62.0	60.0	62.0	62.0	60.0	62.0	60.0	62.0	**730.0**
Outputs		ET+B	mm/month	223.6	181.6	170.8	133.5	118.7	104.1	118.7	129.2	156.0	183.6	206.4	238.0	**1964.2**
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	S	(P+I)-(ET+B)	mm/month	-66.2	-46.4	-42.2	-38.7	-22.4	-19.2	-44.0	-57.7	-74.9	-88.8	-93.9	-123.8	
Cumulative Storage	M		mm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
Largest M	**(V)**		mm	**0.00**												
		(V x L)/1000	m^3	**0.0**												
LAND AREA REQUIRED FOR ZERO STORAGE			m^2	1205	1389	1749	2431	3152	3804	3152	2713	1905	1576	1283	1111	

MINIMUM AREA REQUIRED FOR ZERO STORAGE: **3804.1** m^2

Nominated Area Water Balance for Zero Storage

Site Address: **Monks Residence (230-242 Alington Road, Kemps Creek, NSW)**

INPUT DATA

Design Wastewater Flow	Q	2250	L/day
Design DIR (from AS/NZ 1547,2012)	DIR	14	mm/week
Daily DIR		2.0	mm/day
Nominated Land Application Area	L	1296.8	m sq
Rainfall Data	Orchard Hills Treatment Works		
Evaporation Data	Badgerys Creek monthly averages		

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	103.6	86.6	74.8	42.7	42.5	32.8	20.9	17.7	29	41	60.4	60.4	**853.8**
Evaporation	E	\	mm/month	202	157	136	105	81	63	81	96	120	152	183	220	**1557**
Crop Factor	C			0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	
INPUTS																
Precipitation	(P)		mm/month	103.6	86.6	74.8	42.7	42.5	32.8	20.9	17.7	29	41	60.4	60.4	853.8
Effluent Irrigation	(W)	(Q x D) / L	mm/month	53.8	48.6	53.8	52.1	53.8	52.1	53.8	53.8	52.1	53.8	52.1	53.8	**633.28964**
Inputs		(P+W)	mm/month	157.4	135.2	128.6	94.8	96.3	84.9	74.7	71.5	81.1	94.8	112.5	114.2	1245.7
OUTPUTS																
Evapotranspiration	ET	ExC	mm/month	162	126	109	74	57	44	57	67	96	122	146	176	**1234.2**
Percolation	B	(DIR/7)xD	mm/month	62.0	56	62.0	60.0	62.0	60.0	62.0	62.0	60.0	62.0	60.0	62.0	**730.0**
Outputs		ET+B	mm/month	223.6	181.6	170.8	133.5	118.7	104.1	118.7	129.2	156.0	183.6	206.4	238.0	**1964.2**
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	S	(P+I)-(ET+B)	mm/month	-66.2	-46.4	-42.2	-38.7	-22.4	-19.2	-44.0	-57.7	-74.9	-88.8	-93.9	-123.8	
Cumulative Storage	M		mm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
Largest M	**(V)**		mm	**0.00**												
		(V x L)/1000	m^3	**0.0**												
LAND AREA REQUIRED FOR ZERO STORAGE			m^2	411	474	596	829	1075	1297	1075	925	649	537	437	379	

MINIMUM AREA REQUIRED FOR ZERO STORAGE: **1296.9** m^2

APPENDIX IV NITROGEN BALANCE

	NITROGEN BALANCE				
	SITE ADDRESS	**Central Facilities (230-242 Alington Road, Kemps Creek, NSW)**			
	1. DETERMINE THE DAILY N LOAD				
(a)	Effluent concentration TN	30	mg/L		
(b)	Daily hydraulic load	6600	L/day		
(c)	(a) x (b) =	198000	mg/day		
	2.DETERMINE THE ANNUAL N LOAD				
(d)	(c) x 365 days	72,270,000	mg		
	3. ALLOW 20% LOSS THROUGH DENITRIFICATION, VOLATIZATION, MICROBIAL ATTACK ETC				
	(d) x 0.8	57,816,000	mg/yr		
(e)	Annual N load	57,816	kg/yr		
	3. ALLOW FOR PLANT UPTAKE	Managed lawn		Unmanaged lawn	
(f)	Vegetation N Uptake	250	kgN/ha/yr	150	kgN/ha/yr
(g)	Which equates to (c) / (h)	86	$mg/m^2/day$	51	$mg/m^2/day$
	5. DIVIDE THE ANNUAL N LOAD X APPLICATION RATE				
(g)	(e) / (f)	0.2313	ha	0.3854	ha
(h)	**MINIMUM AREA FOR P UPTAKE UNDER MANAGED LAWN**	**2313 m^2**		**3854 m^2**	

	NITROGEN BALANCE				
	SITE ADDRESS	**Monks Residence (230-242 Alington Road, Kemps Creek, NSW)**			
	1. DETERMINE THE DAILY N LOAD				
(a)	Effluent concentration TN	30	mg/L		
(b)	Daily hydraulic load	2250	L/day		
(c)	(a) x (b) =	67500	mg/day		
	2.DETERMINE THE ANNUAL N LOAD				
(d)	(c) x 365 days	24,637,500	mg		
	3. ALLOW 20% LOSS THROUGH DENITRIFICATION, VOLATIZATION, MICROBIAL ATTACK ETC				
	(d) x 0.8	19,710,000	mg/yr		
(e)	Annual N load	19,710	kg/yr		
	3. ALLOW FOR PLANT UPTAKE	Managed lawn		Unmanaged lawn	
(f)	Vegetation N Uptake	250	kgN/ha/yr	150	kgN/ha/yr
(g)	Which equates to (c) / (h)	86	$mg/m^2/day$	51	$mg/m^2/day$
	5. DIVIDE THE ANNUAL N LOAD X APPLICATION RATE				
(g)	(e) / (f)	0.0788	ha	0.1314	ha
(h)	**MINIMUM AREA FOR P UPTAKE UNDER MANAGED LAWN**	**788 m^2**		**1314 m^2**	

APPENDIX V PHOSPHORUS BALANCE

PHOSPHORUS BALANCE								
SITE ADDRESS	**Central Facilities (230-242 Alington Road, Kemps Creek, NSW)**							
Daily hydraulic load	6600	L/day						
Effluent P Concentration	12	mg/L						
Design Life of System	50	years						
Crop P uptake	30	kg/ha/yr	which equals	8	$mg/m^2/day$			
P sorption of soils								
P-sorption result	500	mg/kg	which equals	9000	kg/ha			
			which equals	0.9	mg/m^2			
Bulk density	1.8	g/cm^2						
Depth of soil	1	m						
% of Predicted P-sorp	0.3	Decimal						
Nominated EMA	3441	m^2						
Daily P Load	0.0792	kg/day	→	Phosphorus generated over life of system		1445.4	kg	
Daily Uptake	0.028285714	kg/day	→	Phosphorus vegetative uptake for life of system		0.150	kg/m^2	
Measured p-sorption capacity	0.9	kg/m^2						
Assumed p-sorption capacity	0.270	kg/m^2	→	Phosphorus adsorbed in 50 years		0.270	kg/m^2	
Site P-sorption capacity	929.19	kg	→	Desired Annual P Application Rate		18.6	kg/yr	
MINIMUM AREA FOR P UPTAKI	**3441**	**m^2**						

PHOSPHORUS BALANCE

SITE ADDRESS	Monks Residence (230-242 Alington Road, Kemps Creek, NSW)							
Daily hydraulic load	2250	L/day						
Effluent P Concentration	12	mg/L						
Design Life of System	50	years						
Crop P uptake	30	kg/ha/yr	which equals	8	$mg/m^2/day$			
P sorption of soils								
P-sorption result	500	mg/kg	which equals	9000	kg/ha			
			which equals	0.9	mg/m^2			
Bulk density	1.8	g/cm^2						
Depth of soil	1	m						
% of Predicted P-sorp	0.3	Decimal						
Nominated EMA	1173	m^2						
Daily P Load	0.0270	kg/day	→	Phosphorus generated over life of system		492.75	kg	
Daily Uptake	0.009642857	kg/day	→	Phosphorus vegetative uptake for life of system		0.150	kg/m^2	
Measured p-sorption capacity	0.9	kg/m^2						
Assumed p-sorption capacity	0.270	kg/m^2	→	Phosphorus adsorbed in 50 years		0.270	kg/m^2	
Site P-sorption capacity	316.77	kg	→	Desired Annual P Application Rate		6.3	kg/yr	
MINIMUM AREA FOR P UPTAKI	**1173**	**m^2**						

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EW1702974**	Page	: 1 of 3
Client	: **HARRIS ENVIRONMENTAL CONSULTING**	Laboratory	: Environmental Division NSW South Coast
Contact	: SEAN HARRIS	Contact	: Glenn Davies
Address	: PO Box 13, Wallaby Hill Road Jamberoo 2533	Address	: 1/19 Ralph Black Dr, North Wollongong 2500 4/13 Geary Pl, North Nowra 2541 Australia NSW
Telephone	: 02 4236 0954	Telephone	: 02 42253125
Project	: BAPS Project	Date Samples Received	: 06-Jul-2017 09:22
Order number	: ----	Date Analysis Commenced	: 10-Jul-2017
C-O-C number	: ----	Issue Date	: 18-Jul-2017 09:59
Sampler	: ----		
Site	: ----		
Quote number	: ----		
No. of samples received	: 2		
No. of samples analysed	: 2		

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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Ben Felgendrejeris		Brisbane Acid Sulphate Soils, Stafford, QLD
Dian Dao		Sydney Inorganics, Smithfield, NSW

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

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

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

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

When no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component.

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

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

- EA058 Emerson: V. = Very, D. = Dark, L. = Light, VD. = Very Dark
- ED007 and ED008: When Exchangeable Al is reported from these methods, it should be noted that Rayment & Lyons (2011) suggests Exchange Acidity by 1M KCl - Method 15G1 (ED005) is a more suitable method for the determination of exchange acidity (H+ + Al3+).

Analytical Results

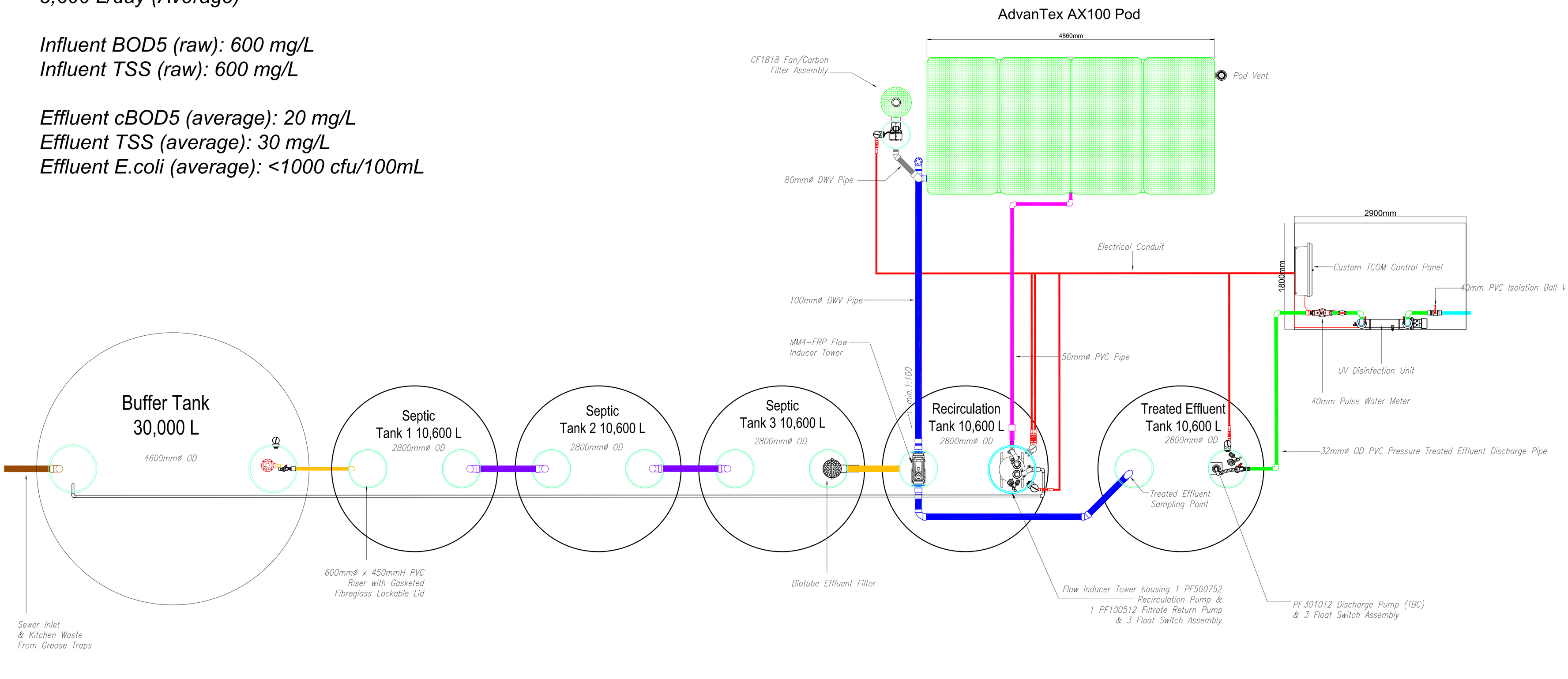
Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	Sample 1 Topsoil	Sample 2 Subsoil	----	----	----
			Client sampling date / time	06-Jul-2017 00:00	06-Jul-2017 00:00	----	----	----
Compound	CAS Number	LOR	Unit	EW1702974-001	EW1702974-002	--------	--------	--------
				Result	Result	----	----	----
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	**6.5**	**5.4**	----	----	----
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	**115**	**260**	----	----	----
EA051 : Bulk Density								
Bulk Density	BULK_DENSITY	1	kg/m3	**1910**	**1810**	----	----	----
EA058: Emerson Aggregate Test								
Color (Munsell)	----	-	-	**Brown**	**Red**	----	----	----
Texture	----	-	-	**Sandy Clay**	**Silty Clay Loam**	----	----	----
Emerson Class Number	EC/TC	-	-	**2**	**1**	----	----	----
ED007: Exchangeable Cations								
Exchangeable Calcium	----	0.1	meq/100g	**4.5**	**1.2**	----	----	----
Exchangeable Magnesium	----	0.1	meq/100g	**5.4**	**7.9**	----	----	----
Exchangeable Potassium	----	0.1	meq/100g	**0.2**	**0.1**	----	----	----
Exchangeable Sodium	----	0.1	meq/100g	**1.4**	**3.2**	----	----	----
Cation Exchange Capacity	----	0.1	meq/100g	**11.5**	**23.6**	----	----	----
Exchangeable Aluminium	----	0.1	meq/100g	<0.1	**11.2**	----	----	----
Exchangeable Sodium Percent	----	0.1	%	**12.0**	**25.4**	----	----	----
Exchangeable Magnesium Percent	----	0.1	%	**47.0**	**63.5**	----	----	----
Exchangeable Potassium Percent	----	0.1	%	**2.2**	**1.1**	----	----	----
Exchangeable Calcium Percent	----	0.1	%	**38.8**	**10.0**	----	----	----
Calcium/Magnesium Ratio	----	0.1	-	**0.8**	**0.2**	----	----	----
Magnesium/Potassium Ratio	----	0.1	-	**21.6**	**58.6**	----	----	----
EK072: Phosphate Sorption Capacity								
Phosphate Sorption Capacity	----	250	mg P sorbed/kg	**739**	**1730**	----	----	----
Phosphate Sorption Index	----	1	mgkg-1/log10 ugL-1	**44**	**77**	----	----	----

Bochasanwasi Shri Akshar Purushottam Swaminarayan Sanstha (BAPS) Centre

Design
Flow: 6,600 L/day (Peak)
3,600 L/day (Average)

Influent BOD5 (raw): 600 mg/L
Influent TSS (raw): 600 mg/L

Effluent cBOD5 (average): 20 mg/L
Effluent TSS (average): 30 mg/L
Effluent E.coli (average): <1000 cfu/100mL



WWTP Plan View

LEGEND:

- Raw Wastewater
- Screened Effluent
- Underdrain Collection
- Pod Dosing
- Pod Ventilation
- Discharge
- Electrical
- Tank Inter-connection (Low Level)
- Tank Inter-connection (High Level)

0 0.5 1 2 3 4 5
GRAPHIC SCALE (m)

REV.	DESCRIPTION	DATE
–	–	–

DATE 17 July 2017
SCALE 1:35 (A1)

APPROVED	–	–
CHECKED	–	–
DESIGNED	SR	17/07/2017

STATUS Concept

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CLIENT Harris Environmental Ltd

PROJECT BAPS Centre

TITLE AdvanTex Wastewater Treatment Plant Plan

DRAWING No. 170762870-10

REVISION -

LOT 25
DP 255560

LOT 21
DP 255560

HARRIS

LOT 20
DP 255560

LOT 24
DP 255560

Landscape Zone

Central Facilities Level

Carpark & Playground Zone

Mandir Level

Monks Residence Level

Aldington Road

Above ground overland flow path (dry creek bed) Catchment

LOT 10
DP 253503

LOT 17
DP 253503

LOT 9
DP 253503

LOT 16
DP 253503

MONKS RESIDNECE
SEWERAGE MANAGEMENT FACILITY (SMF)
APPROX FOOTPRINT

Issue:	Description:	Date	Drawn	Approved
A	ISSUE FOR CLIENT REVIEW	28/07/17	PB	SH
B	SECOND SUBMISSION FOR REVIEW	21/09/17	PB	SH
C	ISSUE FOR DA SUBMISSION	30/10/17	PB	SH

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Wastewater | Bushfire | Stormwater

Project
BAPS SWAMINARAYAN HINDU TEMPLE
LOT: 18 DP: 253503
230-242 ALDINGTON RD, KEMPS CREEK
LGA: PENRITH

Drawing Title:
WASTEWATER MANAGEMENT PLAN DETAILS SHEET No.1

Drawn:	Date:	Scale:	Q.A. Check:	Date:
PB	30/10/2017	AS NOTED		30/10/17
Designed:	Our reference:		Dwg. No.	Issue:
PB	2383WW		#1	C

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LGA: PENRITH

Drawing Title:
WASTEWATER MANAGEMENT PLAN DETAILS SHEET No.2

Drawn:	Date:	Scale:	Q.A. Check:	Date:
PB	30/10/2017	AS NOTED		30/10/17
Designed:	Our reference:		Dwg. No.	Issue:
PB	2383WW		#1	C

LOT 24
DP 255560

Landscape Zone

Ce HARRIS

Aldington Road

Security House
3m Landscape Setback Zone
Gates Vehicular Entry
RL 62.00 (LVL +2.40 MT)
RL 59.60 (LVL +0.00 MT)
6 Metre Wide Road
Parking (8 Cars)
Upstream Point of Discharge refer to Page 5 of 8 Project Design Calculations by Wood & Grieves Engineers
Central Facilities Subsurface Irrigation Area A3 385m²
Landscape Gardens
RL 59.60 (LVL +0.00 MT)
Parking (11 Cars)
4.5m Landscape Setback Zone
6 Metre Wide Road
RL 59.60 (LVL +0.00 MT)
Overflow Bypass (100sq.m)
Reed Bed (100sq.m)
Landscape Gardens (Water Storage Under)
RL 59.60 (LVL +0.00 MT)
Landscape
Carparking RL 60.90 (LVL +1.30 MT)
Entry to Basement
RL 62.65 (LVL +3.05 MT)
Gates
Signage Panel
Gates
RL 59.60 (LVL +0.00 MT)
Above ground overland flow area (dry creek bed) - Centerline
RL 59.60 (LVL +0.00 MT)
RL 60.70 (LVL + 1.10 MT)
Reed Bed (100sq.m)
Waste Water Treatment Tanks Below
RL 60.90 (LVL +1.30 MT)
8.10 Metre Wide Road
Courtyard 1
Central Facilities Subsurface Irrigation Area A3 385m²
RL 59.60 (LVL +0.00 MT)
Landscape Gardens
RL 59.60 (LVL +0.00 MT)
Reed Bed (100sq.m)
RL 60.70 (LVL + 1.10 MT)
Landscape Gardens (Water Storage Under)
RL 59.60 (LVL +0.00 MT)
Parking Buses)
RL 60.90 (LVL +1.30 MT)
Vehicular Exit Gates
Security House
Substation
Gradient 1:20
Parking (20 Cars
RL 59.60 (LVL +0.00 MT)
6 Metre Wide Road
Overflow Bypass (100sq.m)
Landscape
RL 62.65 (LVL +3.05 MT)
Downstream Point of Discharge refer to Project Design Calculations by Wood & Grieves Engineers
4.5m Landscape Setback Zone
RL 59.60 (LVL +0.00 MT)
6 Metre Wide Road

0
503

Issue:	Description:	Date	Drawn	Approved
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C	ISSUE FOR DA SUBMISSION	30/10/17	PB	SH

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Project
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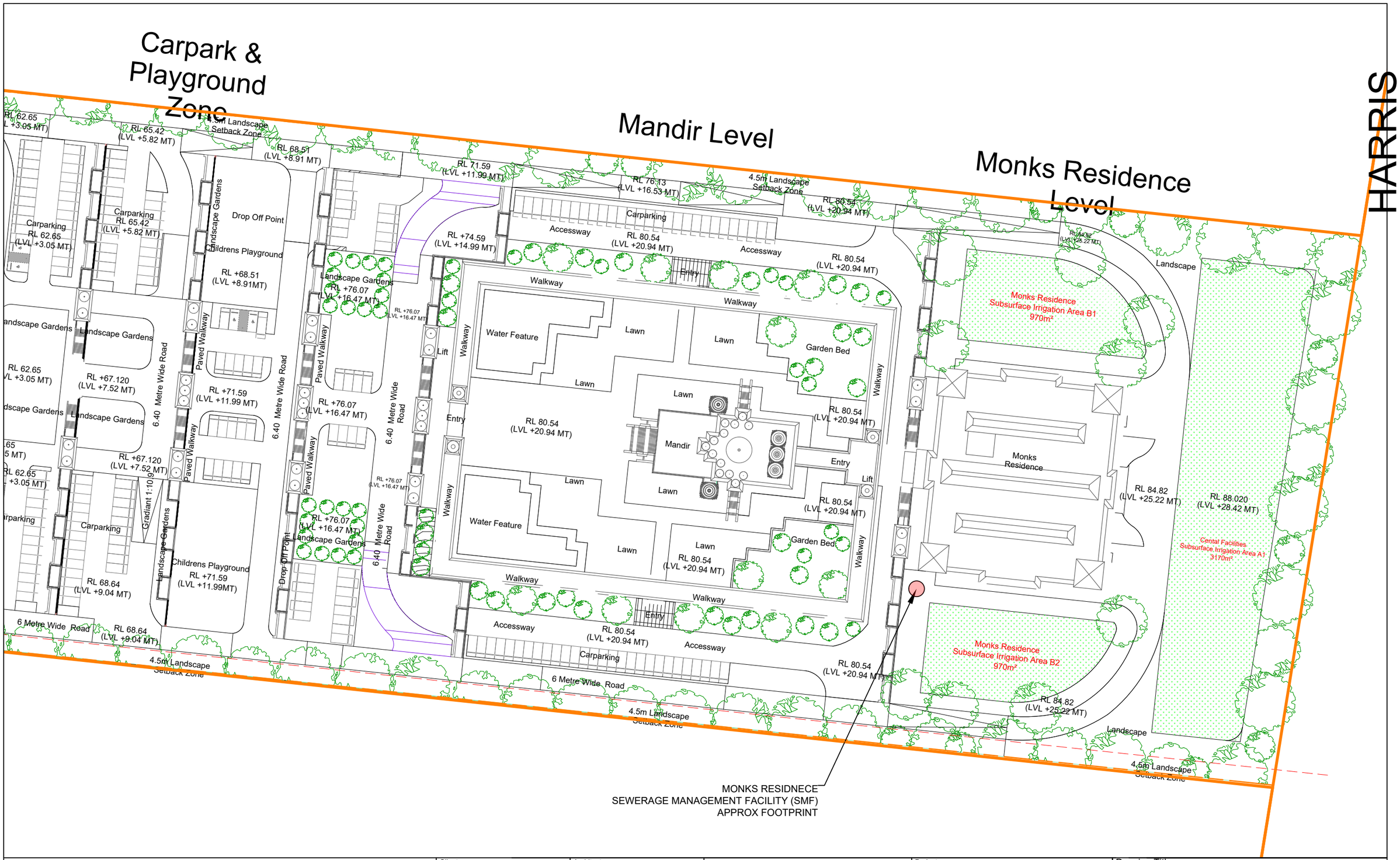
LOT: 18 DP: 253503
230-242 ALDINGTON RD, KEMPS CREEK
LGA: PENRITH

Drawing Title:
WASTEWATER MANAGEMENT PLAN DETAILS SHEET No.3

Drawn:	Date:	Scale:	Q.A. Check:	Date:
PB	30/10/2017	AS NOTED		30/10/17
Designed:	Our reference:		Dwg. No.	Issue:
PB	2383WW		#1	C



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230-242 ALDINGTON RD, KEMPS CREEK
LGA: PENRITH

Drawing Title:
WASTEWATER MANAGEMENT PLAN DETAILS SHEET No.4

Drawn:	Date:	Scale:	Q.A. Check:	Date:
PB	30/10/2017	AS NOTED		30/10/17
Designed:	Our reference:		Dwg. No.	Issue:
PB	2383WW		#1	C

APPENDIX 3 //
APPROVAL TO INSTALL AND OPERATE LODGEMENT FORM

SECTION 68

PRIVATE RECYCLED WATER SCHEME APPLICATION

The completion of ALL applicable questions on this form is mandatory for all applications.
Any information requested in the form may be provided as an attachment to the application.

DESCRIPTION OF DEVELOPMENT

All land the subject of the application must be identified.

Street address (including house number, street name, suburb name and postcode)

Lot on plan description (e.g. 123 on RP456/GPS coordinates)

Local government area in which land is situated (e.g. Manly/ Woollahra etc.)

PROPOSAL DETAILS

Existing use of the land (vacant, golf course, multi-dwelling residential etc.)

Proposed use of land (e.g. 6-unit apartment building, golf course)

APPLICANT DETAILS

Clearly identify who is making the application. The applicant need not be the owner of the land but must attach the land owner's consent if they are not the owner (as per s78 of the LGA 1993).

When signing and lodging this application, the applicant is responsible for ensuring that the information provided is correct. The council and any advisory department will rely on this information when deciding and assessing the application.

If the applicant is a company, a contact person must be nominated

Applicant's name **Primary contact person**

Contact number **Email address**

Postal address

Signature **Date**

x

APPENDIX 3 //
APPROVAL TO INSTALL AND OPERATE LODGEMENT FORM

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Contact number **Email address**

Postal address

Signature **Date**

x