REF: 3379WW VERSION [1.0]

OCTOBER 10, 2019



SOIL AND SITE ASSESSMENT FOR ONSITE WASTEWATER DISPOSAL

187 TOORONGA ROAD, TERREY HILLS

LGA: Northern Beaches

Lot 187 DP 752017

CLIENT: David Denton, Denton Homes

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VERSION CONTROL

Title	Soil and Site	Soil and Site Assessment for Onsite Wastewater Disposal						
Site address	187 Toorong	a Road, Terrey Hills						
Description	Proposed de dwelling	molition of existing dwelling a	and construction o	f new				
Created By	Michael Wils	on BSc (UNSW)						
Date Created	10/10/2019							
Version Number	Modified By							
[1.0]	M.W.	Issue for client review	10/10/2019	Complete				
		-						
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				-				
		-						
				-				

TABLE OF CONTENTS

1.	NTRODUCTION	4					
2.	SITE INFORMATION						
3.	TE ASSESSMENT6						
4.	SOIL ASSESSMENT	7					
5.	SUMMARY OF SOIL AND SITE CONSTRAINTS	8					
6.	PROPOSED METHOD OF WASTEWATER TREATMENT1	1					
7.	REQUIRED IRRIGATION AREA1	2					
8.	LOCATION AND METHOD OF IRRIGATION1	4					
9.	SUMMARY 1	4					
10.	REFERENCES1	5					
	TABLES						
Tab	e 1 Minimum pipe diameter and grade calculations12						
Tab	e 2 Minimum pipe depth for trafficable areas12						
	FIGURES						
	TIOUNED						
Figu	re 1 Location5						

APPENDICES

Appendix i	Semi Fixed Spray Irri	gation	16
Appendix ii	General recomendati	ons to manage water quality and quantity	18
Appendix III	Standard Drawing 9A	A - Upslope Diversion Drain	19
Appendix IV	Water Balance		20
Appendix V	Nutrient Balance		21
Appendix VI	Site Plan- Sheet 1		22
Appendix VI	l Site Plan- Sheet 2		23
Appendix VI	II Standard Drawing- S	Spray Irrigation	24

1. INTRODUCTION

This Site and Soil Assessment for On-site Wastewater was prepared by Harris Environmental Consulting at the request of David Denton, Denton Homes. It relates to the proposed demolition of an existing dwelling and construction of a new dwelling on Lot 187 DP 752017 at 187 Tooronga Road, Terrey Hills.

Field work was undertaken by Harris Environmental Consulting (HEC) on the 27th June 2019. 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 Aerated Wastewater Treatment System (AWTS) for wastewater treatment and spray irrigation for treated wastewater disposal on site.

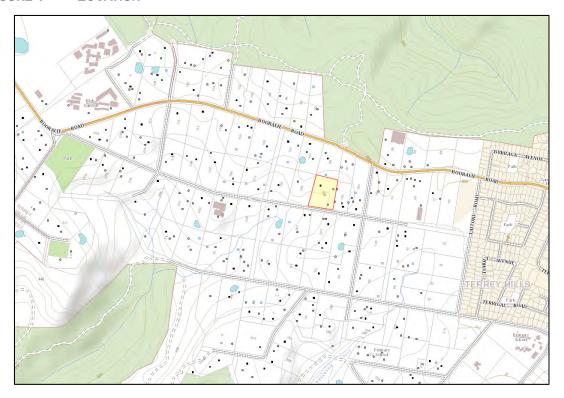
An AWTS located on the property currently treats the wastewater (generated by an existing dwelling), with spray irrigation used to dispose of this wastewater. It is proposed to replace both the AWTS tank/s and the disposal system.

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

- Northern Beaches Council's Development Control Plan;
- Environment and Health Protection Guidelines (1998) On-site Sewage Management for Single Households (Department of Local Government);
- Local Government Act 1993
- AS/NZ 1547:2012 On-site wastewater management (Standards Australia, 2012);
- AS/NZS 3500 Plumbing and Drainage 2015 (Standards Australia, 2012).
- SCA (2012), Designing and Installing On-Site Wastewater Systems. A Sydney Catchment Authority Current Recommended Practice

The location of the property is shown in Figure 1.

FIGURE 1 LOCATION





Source: SixMaps

2. SITE INFORMATION

Project manager: Size of property: Legal title: Local Government: Water supply:	David Denton, Denton Homes P: 0412 448 325 E: daviddenton@dentonhomes.com.au 1.624ha Lot 187 DP 752017 Northern Beaches Council				
Design Wastewater load and daily wastewater (L/day):	Town (reticulated) No. bedrooms in proposed dwelling (including potential bedrooms) Total wastewater load @150L/person and 2 persons/bedroom				
Proposed wastewater treatment:	AWTS				
Proposed wastewater disposal:	Spray irrigation				
Date report prepared:	October 10, 2019				
Report prepared by	Michael Wilson BSc (UNSW)				
Site assessor:	Jec 0	c Env Science (UOW), Grad dip Nat Res (UNE), cAppSc, Agriculture (HAC)			

3. SITE ASSESSMENT

Climate - rainfall	Terrey Hills AWS Rainfall Station (r 1084.1mm)	median annual		
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	The site is not known to be subject minor limitation	to severe frosts,		
Exposure	Slight northerly aspect, partially shaded; moderate limitation			
Slope	0-3%, minor limitation for spray irrigation			
Landform	Flat, minor limitation			
Run-on and seepage	Minor upslope stormwater run-on; r	ninor limitation		
Erosion potential	Minor erosion potential			
Site drainage	Well drained, permeable soil profile	; minor limitation		
Evidence of fill	Some fill in top 200mm of profile; m	inor 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	Permanent waters :	100m+		
management system:	Intermittent waters :	40m+		
	Boundary of premises:	3-6m		
	Swimming pools:	6m+		
	Buildings (shed):	15m		

4. SOIL ASSESSMENT

Method:	Crowbar and shovel						
Depth to bedrock (m):	350mm to rest	rictive layer; major limita	tion; addition	al soil			
		required to raise soil depth					
Depth to high soil		er or subsoil mottling end	ountered at	a depth of			
watertable:	350mm; minor						
Coarse (%):		agments in subsoil, mind	or limitation				
pH (soil/water):	pH 6-6.5; mino						
Electrical conductivity:		salinity is not a constraint	; minor limita	ation			
Salinity hazard:		rmation available.					
Domestic groundwater		nt of Primary Industries (er search			
use:		r bores found there are n					
		bores within 100m of the	proposed e	ffluent			
_	management area						
Geological unit:	Hawkesbury Sandstone (Medium to coarse grained quartz						
	sandstone with minor shale and laminite lenses)						
	GSG: Earthy Sands						
Soil landscape:		s and Tenosols					
Surface rock:		k in proposed effluent m					
Bulk density:		ately structured topsoil; r					
Phosphorus balance		take by grass growth ass	sumed to be	30 kg/ha/yr,			
assumptions:	8mg/m²/day.						
	D 050)	9-1-19			
		P sorption 350mg/kg, which equals 2625kg/ha. Available soil depth is 0.5m, of which 30% of profile is available for P					
			s avallable id	אור			
Soil profile:	sorption (potential rage of 30-75%) Laver 1 DIR DLR						
Soil profile.	Texture	Layer 1 Sandy loam	5mm	N/A			
	Colour	Black	Sillill	IN/A			
	Depth	0-350mm					
	Structure	Mod structured					
	Coarse frag.						
	Coarse riag.	0-5%	<u> </u>				

5. SUMMARY OF SOIL AND SITE CONSTRAINTS

There are no soil or site constraints that are unable to be mitigated, preventing the installation of an Aerated Wastewater Treatment System (AWTS) for wastewater treatment and spray irrigation for treated wastewater disposal for a 6-bedroom dwelling (5bdrm plus 1 potential) that is proposed for construction on Lot 2 DP740570, 187 Tooronga Rd, Terrey Hills.

The soil depth in the location proposed for use as the effluent management area is only 350mm, requiring augmentation such that a minimum of 500mm depth is achieved. The proposed spray irrigation area would be installed along the northern boundary and to the east of the proposed dwelling, in accordance with the buffers and setback distances required by Northern Beaches Council. This includes being more than 100m from permanent watercourses, 40m from drainage depressions, 3m/6m from upslope/ downslope of boundary lines, driveways, and dwellings.

The existing loam soil profile has suitable permeability and nutrient absorption properties for this method of treatment and disposal. The soil required for augmenting the existing profile should be of a similar texture, with medium and heavy clays to be avoided, as should sands. Ideally a soil of loam or sandy loam texture would be sourced.

A reticulated, artificial water feature oriented in a north to south direction has been constructed at some stage in the past, with water circulated from its downslope extent (a small dam) to a storage and supply tank located near the northern boundary (its upper extent), to the east of the proposed effluent management area. The current plans for the proposed replacement dwelling on this site have the dwelling footprint across the water feature midway along its course. Thus, it is assumed this feature is to be decommissioned.

An upslope diversion bank will not be required due to the constructed upslope stormwater drain (installed when the area was used as a horse arena) running above the proposed irrigation area. This drain directs water to the east then south along the property boundary. Any run-off from the irrigation area should flow to the south and not into this channel. If the raising of the soil level requires it, extra height should be added to the channel wall (see photo 4) such that the flow path of run off is to the south, not to the north.

Photo 1 On site soil assessment- Borehole 2



Photo 2 Looking across proposed irrigation area



Photo 3 Constructed stormwater drain to north of proposed irrigation area



Photo 4 Constructed water feature running beyond trees. Storage tank (to right) marks upper extent, towards the northern property boundary



6. PROPOSED METHOD OF WASTEWATER TREATMENT

6.1 Wastewater Treatment System

An Aerated Wastewater Treatment System is proposed for wastewater treatment. 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 owner will need to lodge an application to install/operate a Sewage Management System under the Local government act 1993, Section 68. Council will require the owner to have selected an AWTS manufacturer and 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 Northern Beaches 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 Northern Beaches Council following each quarterly service.

6.2 Location of proposed AWTS

The location of the AWTS should be decided 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 3500.2:2015 Plumbing and Drainage Part 2 Sanitary Plumbing and Drainage' and Council requirements.

6.3 Installation of pipes

The sewer pipes between the plumbing amenities, AWTS and irrigation area must conform with 'AS/NZS 3500(Set):2015 Plumbing and Drainage Set' specifying the nominal pipe sizes and respective minimum grades. Table 1 contains these specifications.

In addition, where a sewer carrying untreated wastewater to a treatment system is longer than 60 metres, the minimum grade should be doubled, and inspection ports should be installed at least every 30 metres or at an angle or change of grade.

The sewer pipes between the plumbing amenities, 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):2015 Plumbing and Drainage Set'. Table 2 shows the minimum pipe depth for trafficable areas.

TABLE 1 MINIMUM PIPE DIAMETER AND GRADE 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

^{*}except for drains from septic tanks, sewage treatment plants which may have a minimum grade of 1%

Source: 'AS/NZS 3500.2::2015 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 2 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 3500:2015 Table 3.4 Minimum	Cover for Buried Piping'

7. REQUIRED IRRIGATION AREA

As stated previously in this report, the soil depth in the proposed treated wastewater disposal area is 350mm, below which rock is found, and excavation halted. As per DLG (1998), the minimum required soil depth for spray irrigation is 500mm. It is proposed that the soil depth is increased by 150mm to achieve the required 500mm, and then the irrigation infrastructure installed following suitable compaction. As per SCA (2012) the soil used should be an organic loam or sandy loam with minimal clay content. Any batter required on the perimeter of the area should be of no greater gradient than 1:3.

The following calculations are based on the addition of soil as outlined above.

The irrigation area needed to manage the flow regulated volume of **1800L** /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 an 802m² spray irrigation area based on the following variables:

- Terrey Hills AWS median monthly rainfall;
- Badgerys Creek monthly average evaporation; and
- Application rate of 35mm/week or 5mm/day.



The *nitrogen balance* requires an **739m**² spray 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 240kg/N/ha/year

The **phosphorus balance** requires an area of **796m**² irrigation area based on the following variables:

- AWTS will reduce Total Phosphorus to 10mg/L;
- P-sorption of 350mg/kg;
- Predicted sorption for a soil depth of 0.5 m. Crop uptake is assumed to be 30kg/ha/annum; and
- 50 year design life of system.
- Bulk density of 1.5g/cm³

The largest area (most limiting) is required. For this site, the largest area is 802m².

8. LOCATION AND METHOD OF IRRIGATION

Spray irrigation:

- 802m² of spray irrigation is proposed.
- 150mm of suitable soil is to be added to the area (see above) to ensure a minimum depth of 500mm.
- The installer is expected to make adjustments to the alignment of drip lines, location
 of distribution lines and hydraulic sequencing valve (water rotor) to suit the site
 conditions.
- The Site Plans show the 802m² irrigation area is split into 2 x 401m² zones.
- The installation and location of spray irrigation can be found in the site plans (see appendices).

9. SUMMARY

The assessment was prepared for a 6-bedroom dwelling on town water and recommends the following:

- Installation of an Aerated Wastewater Treatment System capable of treating 1800L/d;
- Augmentation of soil depth to 500mm minimum
- Install 802m² spray irrigation, as shown on Site Plan and Appendices.

10. 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 Septic Tank Accreditation Guidelines (2001).

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.

Northern Beaches Council's Development Control Plan

APPENDIX I SEMI FIXED SPRAY IRRIGATION

- a) The irrigation area is to be split into manageable areas using turf valves;
- b) Within each zone, 2 or 3 low plume wobbler / butterfly / rose sprinklers are to be mounted along the length of a ~5m length of 19mm purple wastewater irrigation pipe;
- c) The low plume sprinklers should not be capable of producing aerosols;
- d) All distribution lines shall be buried to a minimum depth of 300mm below finished surface level or, where this is not possible, covered with 150mm of concrete;
- e) The throw on the sprinklers shall not exceed beyond the designated disposal area.

Management of irrigation area

- f) The grass within the irrigation should be mown on a regular basis to ensure sprinklers can be seen through grass and any breakage or leaks can be seen and repaired;
- g) The effluent disposal area shall be clearly identified within the property by post or some other means.
- h) All stormwater and seepage from higher levels shall be diverted away from the effluent disposal area using a dish drain or similar.
- i) Fruit or salad vegetables should not be irrigated with effluent from the wastewater treatment system.
- j) The irrigation area should not be used for recreational purposes or used for parking a car.
- k) Horse and cattle should not be kept within the effluent disposal area.
- I) Buffer distances are 6m if area up gradient and 3m if area down gradient of swimming pools, property boundaries and driveways; 15m buffer to buildings.
- m) A warning sign complying with AS1319:1994 Safety signs for the occupational environment should be located at the boundary of the designated area in one or two places, clearly visible to property uses, with wording such as, RECYCLED WATER, AVOID CONTACT, DO NOT DRINK'.
- n) Stormwater Run-on stormwater is to be diverted around the subsurface irrigation area by means of an earthy bank or diversion drain. Guidance on the installation of an appropriate earth bank and diversion drain as shown in Appendix IV.

page | 16

Photos 4-7 Example of turf valve, flexible 19mm poly pipe and 'wobbler' sprinklers









APPENDIX II GENERAL RECOMENDATIONS TO MANAGE WATER QUALITY AND QUANTITY

InSinkErator style kitchen garbage disposal units should be avoided as they increase water consumption and raise the nutrient and BOD concentrations of household effluent.

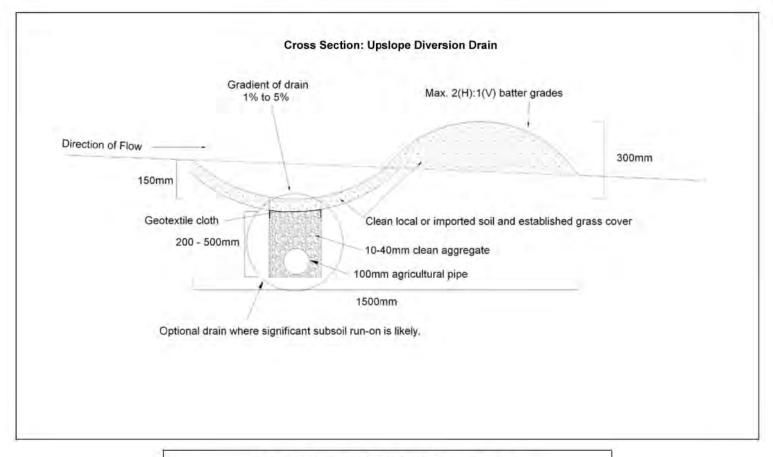
Water conservation can reduce the volume of wastewater that needs to be treated and discharged on site. The residence should include appliances that are rated under the Water Efficiency Labelling and Standards (WELS) Scheme that includes:

- i. 4 star dual-flush toilets;
- ii. 3 star showerheads;
- iii. 4 star taps (for all taps other than bath outlets and garden taps);
- iv. 3 star urinals; and
- v. Water efficient washing machines and dishwashers are to be specified and used wherever possible.

Chemical cleaning compounds and other chemicals that enter the treatment system should be low in phosphate and salt. Anti-bacterial chemical cleaning compounds and other chemicals that enter the treatment system should be avoided. This includes chlorine, disinfectants, bleaches etc.

SOIL AND SITE ASSESSMENT FOR ONSITE WASTEWATER DISPOSAL ON 187 TOORONGA ROAD, TERREY HILLS





Standard Drawing 9A - Upslope Diversion Drain

(not to scale)

APPENDIX IV WATER BALANCE

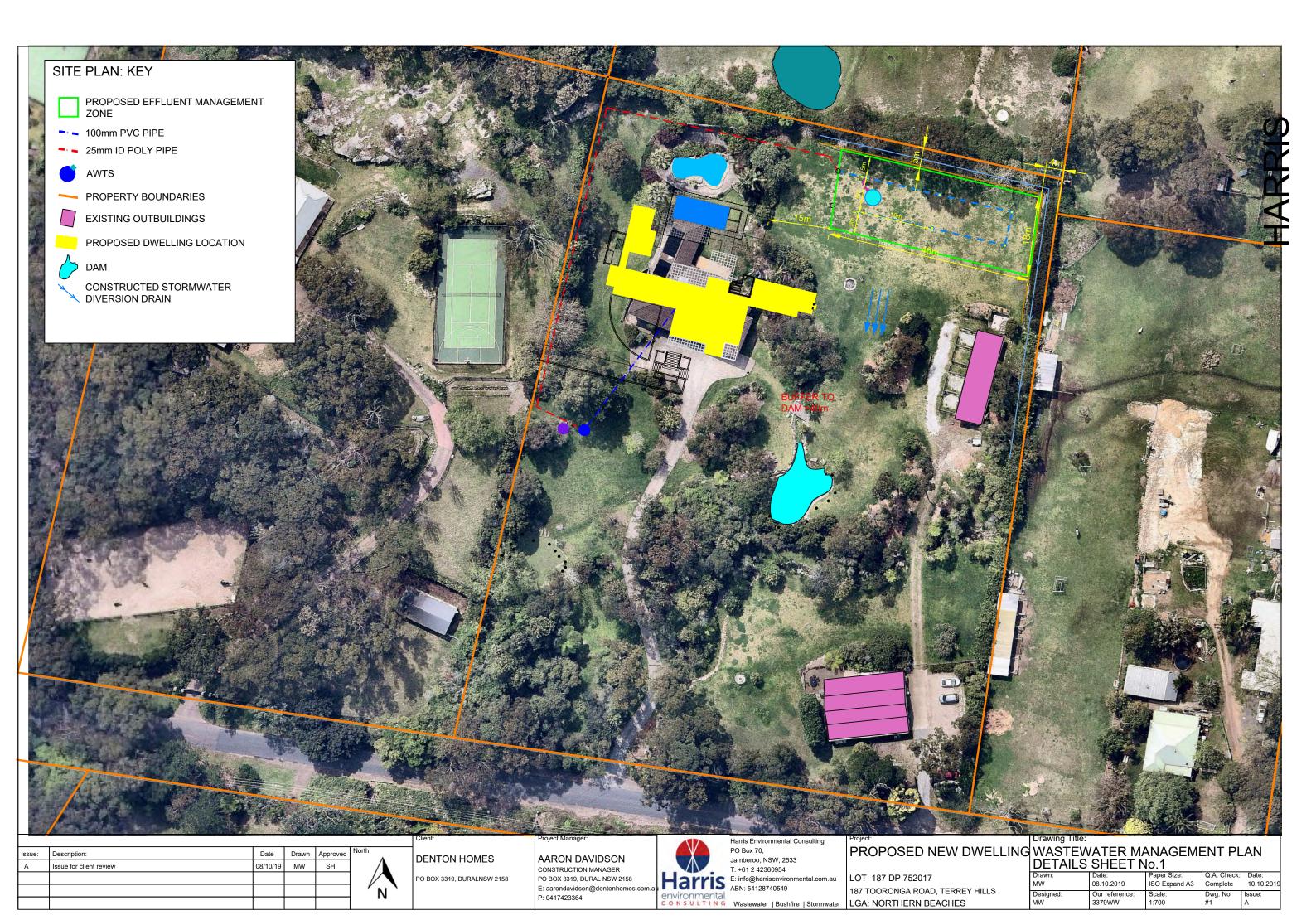
Nominated Area Water Bal	ance for	Zero Stor	age													
Site Address:	187 Too	ronga Rd,	Terrey Hi	lls												
INPUT DATA																
Design Wastewater Flow	Q	1800	L/day													
Design DIR (from AS/NZ 1547,2000)	DIR	35	mm/week													
Daily DIR		5.0	mm/day													
Nominated Land Application Area	L	802	m sq													
Rainfall Data	Т	errey Hills AW														
Evaporation Data		adgerys Cree														
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	Р	\	mm/month	70.7	114.4	117.6	103.5	27.6	120.4	42	36.2	49	61	80.8	76.4	899.6
Evaporation	E	\	mm/month	202	157	136	105	81	63	81	96	120	152	183	220	1557
Crop Factor	С			0.80	0.75	0.70	0.65	0.60	0.60	0.60	0.60	0.65	0.70	0.75	0.80	
INPUTS																
Precipitation	(P)		mm/month	70.7	114.4	117.6	103.5	27.6	120.4	42	36.2	49	61	80.8	76.4	899.6
Effluent Irrigation	(W)	(Q x D) / L	mm/month	69.6	62.8	69.6	67.3	69.6	67.3	69.6	69.6	67.3	69.6	67.3	69.6	819.202
Inputs		(P+W)	mm/month	140.3	177.2	187.2	170.8	97.2	187.7	111.6	105.8	116.3	130.6	148.1	146.0	1718.8
OUTPUTS																
Evapotranspiration	ET	ExC	mm/month	162	118	95	68	49	38	49	58	78	106	137	176	1133.05
Percolation	В	(DIR/7)xD	mm/month	155.0	140	155.0	150.0	155.0	150.0	155.0	155.0	150.0	155.0	150.0	155.0	1825.0
Outputs		ET+B	mm/month	316.6	257.75	250.2	218.3	203.6	187.8	203.6	212.6	228.0	261.4	287.3	331.0	2958.1
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	-176.3	-80.5	-63.0	-47.4	-106.4	-0.1	-92.0	-106.8	-111.7	-130.8	-139.1	-185.0	
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	0.00
Largest M	(V)		mm	0.00												
		(V x L)/1000	m ³	0.0												

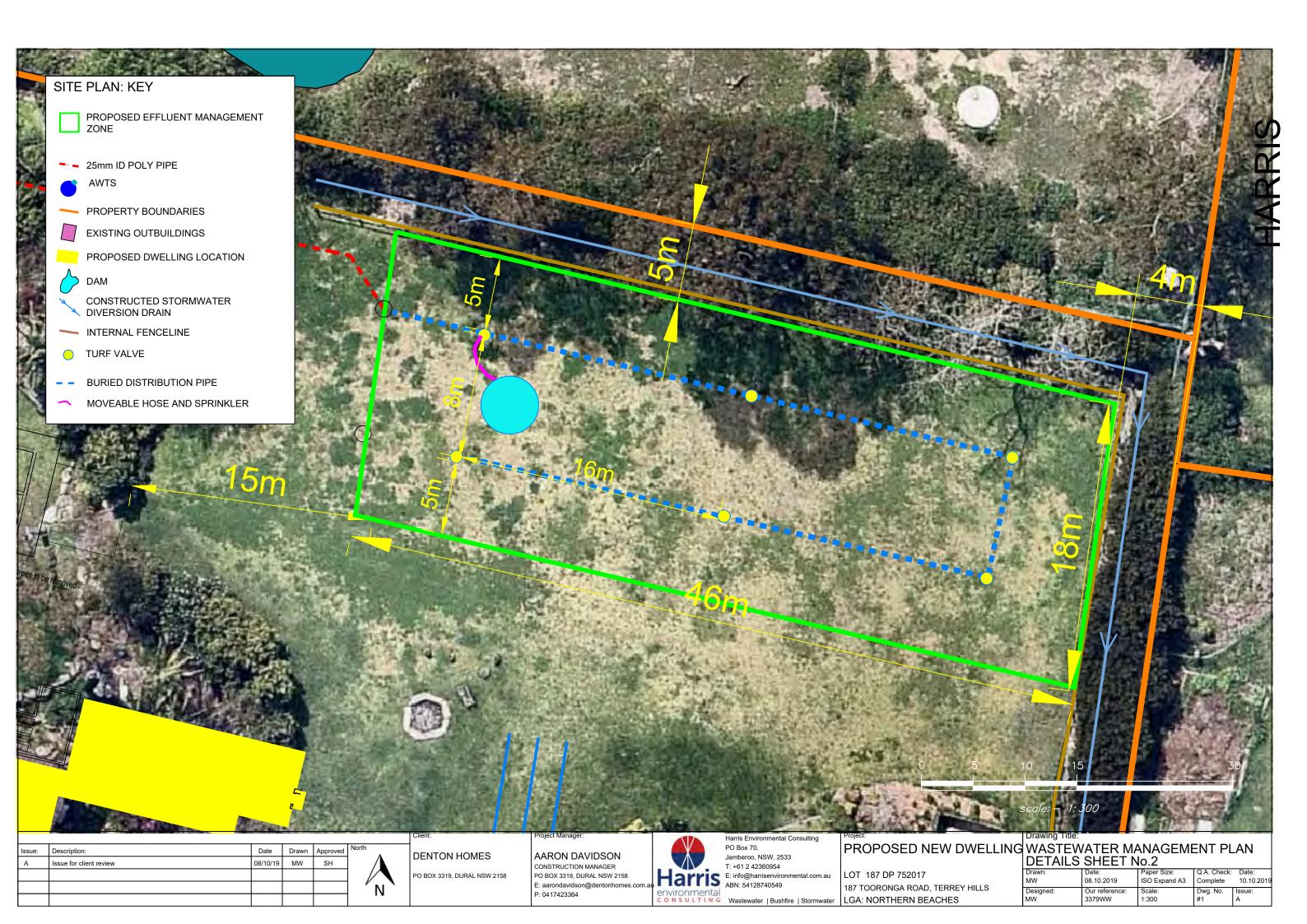


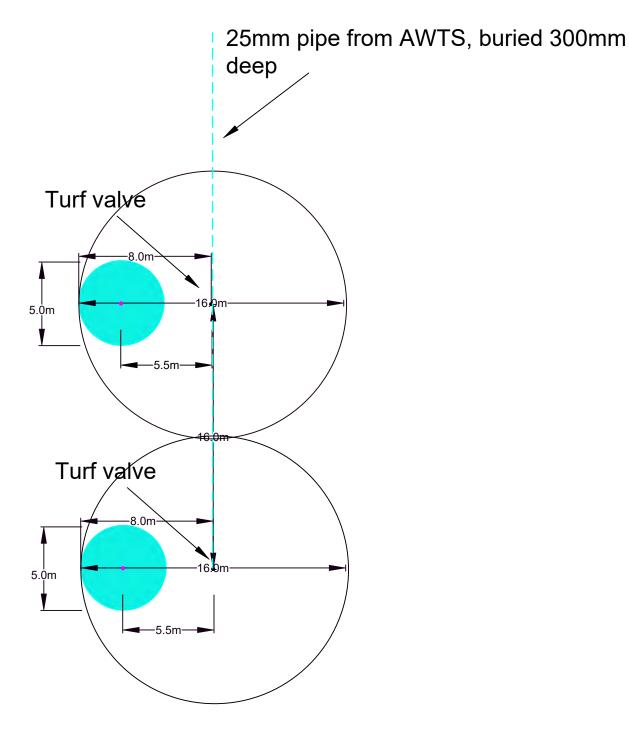
APPENDIX V NUTRIENT BALANCE

NITROGEN BALANCE					
SITE ADDRESS	187 Tooronga Rd	, Terrey Hills			
Daily volume		L/day			
TN effluent conc	27.0	mg/L			
TN	0.0486	kg/d			
	17.739				
Irrigation Area	739	m2	0.0739	ha	
TN annual application rate	0.024	kg/m2/yr			
	240.0	kg/ha/yr			
Denitrification	20%				
TN Uptake (managed land)	240	kg/ha/yr			
TN available for leaching	0	kg/ha/yr			
Or for site	0.00	kg/yr			
PHOSPHORUS BALANCE					
SITE ADDRESS	187 Tooronga Rd	, Terrey Hills	errey Hills		
		_			
Daily hydraulic load	1800	L/day			
TP effluent conc	10	mg/L			
TP effluent conc per day	18000	mg/day			
	6570	g/year			
P sorption rate of soil		mg/kg			
Bulk density of soil		g/cm3			
	1500	kg/m3			
Land application area	796.0	m2			
Soil depth	0.5	m			
Volume of soil	398.000	m3			
Mass of soil	597000	kg			
Total P sorption capacity	208950	g			
Vegetation	Grass				
P annual uptake by vegetation	30	kg/ha/yr			
	2388				
Net annual P (in soil)	4182				
Life of system	50.0	years			









GENERAL DESIGN AND CONSTRUCTION

- a) The irrigation area is to be split into manageable areas using turf
- b) Within each zone, 2 or 3 low plume wobbler / butterfly / rose sprinklers are to be mounted along the length of a ~6m length of 19mm purple wastewater irrigation pipe;
- c) The low plume sprinklers should not be capable of producing aerosols;
- d) All distribution lines shall be buried to a minimum depth of 300mm below finished surface level or, where this is not possible, covered with
- e) The throw on the sprinklers shall not exceed beyond the designated disposal area.

Management of irrigation area

- f) The grass within the irrigation should be mown on a regular basis to ensure sprinklers can be seen through grass and any breakage or leaks can be seen and repaired;
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- h) All stormwater and seepage from higher levels shall be diverted away from the effluent disposal area using a dish drain or similar.
- i) Fruit or salad vegetables should not be irrigated with effluent from the wastewater treatment system.
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- k) Horse and cattle should not be kept within the effluent disposal area.
- I) Buffer distances are 6m if area up gradient and 3m if area down gradient of swimming pools, property boundaries and driveways; 15m buffer to buildings.
- m) A warning sign complying with AS1319:1994 Safety signs for the occupational environment should be located at the boundary of the designated area in one or two places, clearly visible to property uses, with wording such as, RECYCLED WATER, AVOID CONTACT, DO NOT DRINK".
- n) Stormwater Run-on stormwater is to be diverted around the subsurface irrigation area by means of an earthy bank or diversion

Issue:	Description:	Date	Drawn	Approved	
Α	HEC Standard Drawing	4/10/19	SH	SH	

STANDARD DRAWING: SEMI-FIXED SPRAY IRRIGATION



Harris Environmental Consulting PO Box 70 Jamberoo, NSW, 2533 T: +61 2 42360954 E: office@harrisenvironmental.com.au

ABN: 541 287 40549

Drawing Title.
ON-SITE WASTEWATER
MANAGEMENT SHEET 3

)rawn:	Date:	Scale:	Q.A. Check:	Date:
SH	4/10/19	NTS		4/10/19
Designed:	Our reference:		Dwg. No.	Issue:
SH			#3	Α