Penrith Retirement Living

Stormwater drainage design report

Fresh Hope Care

23 April 2019
Ref: 20181340R001A

Building exceptional
outcomes together

Document History and Status

Rev	Description	Author	Reviewed	Approved	Date
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1 Introduction

Fresh Hope Care is proposing to construct a retirement living facility at 154-162 Stafford Street, Penrith, New South Wales. The proposed development comprises two-storey buildings above a basement car park. The buildings will accommodate 35 residential apartments and communal spaces surrounding a central landscaped area.

Tonkin has been engaged to provide a preliminary design and documentation of stormwater drainage within the site to support the Development Application (DA) to the Penrith City Council (Council).

1.1 This report

This report forms the basis for the stormwater drainage design. It outlines the design requirements for site drainage and discharge, details the design procedure and presents the proposed stormwater drainage plan for the management of site runoff.

1.2 Design inputs

The most recent architectural plans from Fulton Trotter (Revision DA01, 5 April 2019) and most recent survey of the site (Project Surveyors, 20 November 2018) were used to provide input into the preliminary design of the stormwater drainage system.

1.3 Relevant standards and guidelines

The preliminary stormwater drainage design has been carried out in accordance with the relevant local, state and national design guidelines and Australian Standards. These include, but are not limited to:

- Australian Rainfall and Runoff guidelines (2016)
- AS 3500.3 – Plumbing and Drainage – Stormwater Drainage
- Penrith Development Control Plan (2014)
- Penrith City Council – Stormwater Drainage Specification for Building Developments (2018)
- Penrith City Council – Water Sensitive Urban Design (WSUD) Policy (2013)
- Penrith City Council – WSUD Technical Guidelines (2015)

1.4 Council requirements

There are a number of Council requirements that guided the design of the preliminary stormwater drainage design. The most notable of these requirements include:

- site flood information must be assessed to determine whether additional stormwater management measures are required to protect the development from external floodwaters in a 1% AEP event.
- on-site detention (OSD) is required to limit site discharge so as not to adversely impact downstream drainage systems or adjacent properties.
- site drainage systems must be designed to the major/minor system design principles outlined in Australian Rainfall and Runoff guidelines, allowing for overflows of the piped system and flows in excess of the capacity of the piped system to be discharged in a controlled manner.
- Water Sensitive Urban Design (WSUD) principles are to be implemented into the development through the design of stormwater drainage, on-site detention and landscaping in order to improve the quality of site discharge so that natural drainage systems downstream of the development are protected.

2 Site description and conditions

The site of the proposed development currently comprises two single-dwelling allotments and a larger allotment that houses the Churches of Christ. It is proposed that all development across the site is demolished and the existing allotments amalgamated to form a single allotment, approximately 4,880 m^2 in size, in preparation for construction of the proposed retirement living facility.

In its pre-development state, the site comprises dwellings, buildings, carparks, driveways and other paved surfaces. The impervious area across the entire site when in its current state of development is approximately 67% of the total site area.

The proposed development will only increase the impervious area by 3% – a total impervious area of 70% – which is unlikely to significantly increase the amount of runoff generated by the site.

Review of available survey shows that the site generally falls in a north-easterly direction at an approximate grade of 4%, towards Stafford Street (Project Surveyors, 2018). Runoff from the site currently discharges directly to Stafford Street via kerb outlets and as overland flow.

It is proposed to raise surface levels surrounding the proposed buildings to match with finished floor levels of the buildings. These areas will be used to provide landscaped areas for the residents. Retaining walls along the site boundaries will be required as the site will be raised above adjacent properties. Overland flow paths incorporated within these landscaped areas will aim to direct flow towards Stafford Street so as to retain existing flow patterns.

The piped system within the site will also discharge to Stafford Street. Flows will then be directed in an easterly direction towards Council's underground drainage network. The nearest pit or pipe within Council's drainage network is approximately 40 m east of the site. Council's drainage system then directs flow in a north-westerly direction, eventually discharging to the Nepean River – a tributary to the Hawkesbury River.

3 Flood assessment

The design of stormwater systems must give consideration to the management of flows from external catchments in addition to the management of flows generated within the site. The following flood studies were used to determine whether the site is subject to flooding from external catchments:

- the overland flow flood overview study for Penrith (Cardno, 2006)
- an overland flow flood study within Penrith CBD (Cardno, 2015)
- Nepean River flood study (Advisian, 2018).

Review of these flood studies has indicated that the site is not subject to flooding in all events up to and including a 1% AEP event. As the site is not subject to flooding, the stormwater drainage design for the site does not need to include measures to manage flows from external catchments – it only needs to provide measures to manage runoff generated within the site.

4 On-site detention

On-site detention (OSD) is required for the proposed residential flat building so as to ensure that the proposed development does not adversely impact flooding at downstream locations in all storm events up to 1% AEP events.

Design of the OSD system has been guided by the permissible site discharge (PSD) and site storage requirements (SSR) outlined in Council's stormwater drainage policy (Penrith City Council, 2018). These requirements are as follows:

- PSD: 120 L/s/ha
- SSR: 280 m^3/ha

Considering that the site is 4880 m^2 (0.488 ha) in size, the OSD system has been designed in accordance with the above requirements such that it can achieve:

- PSD: 59 L/s
- SSR: 137 m^3

As the site is located 40 m upstream of Council's piped drainage network, it is not practicable to provide a connection to Council's drainage system. Outlets from the OSD system will therefore discharge directly to the kerb and gutter. As the PSD is greater than the allowable discharge rate for a single kerb outlet (25 L/s), two discharge points will be required, at least 15 m apart.

The OSD tank has been split into two chambers; a primary and secondary chamber, to allow for the two discharge points. Having two chambers allows the total volume of the tank to be optimised while maintaining invert levels above the kerb outlets.

DRAINS modelling was used to confirm the design of the OSD tank. Details of the proposed OSD configuration are shown on sheet number DA403 of the preliminary design drawings provided in Appendix A.

By providing 170 m^3 of storage within the tank, the total discharge from the tank can be limited to 46 L/s in a 1% AEP event by providing a 130 mm diameter orifice on the outlet of the primary chamber and a 95 mm diameter orifice on the outlet of the secondary chamber.

5 Site drainage system

The stormwater drainage system within the site has been designed to provide both major and major systems, as detailed in Australian Rainfall and Runoff. The major and minor systems are required to provide the following drainage standards, at a minimum:

- the minor system will consist of a pit and pipe network that has the capacity to collect and convey the 10% AEP flows
- the major system will consist of overland flow paths that have the capacity to safely convey the 1% AEP flows that exceed the capacity of the minor system around the proposed buildings in such a manner that does not encroach on adjacent properties.

DRAINS modelling has been used for the hydraulic analysis and preliminary design of the major/minor stormwater drainage system. The modelling approach is consistent with Council's guidelines and the latest (2016) Australian Rainfall and Runoff guidelines.

The development will also require a pumped system to pump out any water that collects within the basement.

Details of the preliminary internal drainage system design are provided on sheet numbers DA401 and DA402 of the preliminary design drawings provided in Appendix A.

5.1 Flow estimation

The DRAINS model was used to estimate the peak flows generated by sub-catchments within the site. As various design elements, including roof drainage and landscaping, are yet to be confirmed, the sub-catchment boundaries have been approximated. The catchment plan is shown on sheet number DA410 of Appendix A.

Consistent with the Australian Rainfall and Runoff guidelines, the model was run for an ensemble of storm events (i.e. varied temporal patterns and storm durations), and the median peak flow was adopted. The latest (2016) rainfall data was obtained from the Bureau of Meteorology (BoM).

The calculated peak flow rates were based on an ILSAX type hydrological model. The adopted model parameters are summarised in Table 5.1. Details of the DRAINS model including model layout, input data and results are provided in Appendix B.

Table 5.1 ILSAX hydrological model parameters

Parameter	
Impervious area depression storage	1 mm
Pervious area depression storage	5 mm
Soil type for antecedent conditions and infiltration rates	3

5.2 Hydraulic analysis

The hydraulic modelling undertaken in DRAINS assumed the following Manning's roughness (n) values:

- 0.011 for all uPVC pipes
- 0.013 for all concrete pipes
- 0.015 for all paved surfaces
- 0.030 for all landscaped surfaces.

The pressure head change coefficients (k_u) at all pits were calculated using guidelines from the Queensland Urban Drainage Manual (QUDM, 2013).

5.2.1 Design criteria

In accordance with the relevant standards and guidelines, the site drainage system was designed to achieve the following:

- the minor system caters for 10% AEP storm events, with a minimum freeboard of 150 mm at all pits.
- the major system caters for 1% AEP events, such that:
  - there is sufficient freeboard between overland flow and building floor levels so as to protect buildings from inundation
  - site runoff is not directed into adjacent properties
  - the product of flow depth and velocity within overland flow paths does not exceed 0.4.

5.2.2 Design considerations

In order to connect the piped network within the central portion of the site with the OSD system on the northern side of the site, it is proposed that a pipe passes under one of the housing units. Although this is not an ideal solution, it is considered necessary. The piped network would be too deep to drain to the OSD tank if it was directed around all buildings at the minimum 1% grade.

The pipe passing under the building has been sized with sufficient capacity to convey 1% AEP flows so as to reduce the risk of damage to the pipe.

5.2.3 Summary of results

As can be seen from the modelled results provided in Appendix B, the proposed drainage system meets the design criteria outlined above.

The minor pit and pipe system has sufficient capacity to convey the 10% AEP flows while maintaining a minimum freeboard of 150 mm at all pits.

Any overland flow that exceeds the capacity of the minor system is safely directed around the buildings, towards Stafford Street, via overland flow paths. Flow depths within these overland flow paths remain below 25 mm in all events up to 1% AEP events, which allows for sufficient freeboard between major flows and building floor levels. Review of the results confirms that the product of flow depth and velocity (a measure of hazard) within these flow paths remains well below the acceptable limit of 0.4.

The proposed OSD configuration limits post-development discharge rates to 25 L/s from the primary chamber and 21 L/s from the secondary chamber in 1% AEP events – at total of 46 L/s discharging to Stafford Street via kerb outlets. There is an additional 12 L/s of site runoff that bypasses the OSD system and discharges directly to Stafford Street. This results in a total site discharge rate of 58 L/s – less than the PSD rate of 59 L/s.

The modelling indicates that the OSD tank, which has an approximate volume of 170 m^3, has sufficient capacity to detain site runoff in a 1% AEP event. The maximum water level in the tank in a 1% AEP event is 47.30 mAHD. This provides 150 mm of freeboard from the peak water level to the soffit level of the tank (47.45 mAHD).

In events larger than 1% AEP events, or if the downstream system is blocked, water within the OSD tank will spill to Stafford Street via the grated access pits.

5.3 Basement pump

A pumped system is required within the basement to evacuate flows that cannot be drained via a gravity line. Only a portion of the driveway (80 m^2) will contribute to flows directed into the basement.

In accordance with Council requirements, the pumped system must include:

- a pump-out pit which has been sized to store the total runoff entering the basement in a 1% AEP, 2-hour duration storm event.
- pump(s) with capacity to pump the peak flow rate entering the basement in a 1% AEP, 5-minute duration storm event.

On this basis, an 8 m^3 pump-out pit is required to store flows that enter the basement and two pumps, each with capacity to pump at a rate of 6 L/s on an alternative basis, are required to evacuate these flows. The pumps will direct flows into the OSD tank via a rising main.

6 Water Sensitive Urban Design

Council requires that all developments implement the principles of Water Sensitive Urban Design (WSUD) in order to meet the water quality improvement targets provided in Table 6.1. Improving the quality of water leaving the site is aimed at protecting or enhancing natural drainage systems downstream, including natural watercourses such as Nepean River.

Table 6.1 Water quality improvement targets

Pollutant	Performance target reduction loads
Gross pollutants	90% reduction in the mean annual load of gross pollutants
Total suspended solids (TSS)	85% reduction in the mean annual load of TSS
Total phosphorus (TP)	60% reduction in the mean annual load of TP
Total nitrogen (TN)	45% reduction in the mean annual load of TN

6.1 Water quality modelling

The water quality of runoff from the site was modelled using the eWater Model for Urban Stormwater Improvement Conceptualisation (MUSIC). The meteorological data, parameters for source nodes (catchments) and water quality improvement measures were selected using the Penrith City Council MUSIC-link.

The site will consist of the following water quality improvement measures in order to meet the aforementioned performance objectives:

- vegetated buffer strips;
- vegetated swales;
- gross pollutant traps;
- rainwater tank and re-use; and
- a filtration system.

6.1.1 Vegetated buffer strips

To minimise the amount of direct runoff from impervious areas, runoff from paved/impervious areas will be directed through a grassed buffer prior to entering the minor system, where possible. The purpose of the buffer strip is to slow down runoff, allowing the grass to trap sediment and enhance the removal of nutrients.

It is assumed that all grass buffer strips will be mowed and maintained regularly; therefore, a grass thickness of 50 mm was adopted. As flow is likely to sheet across the buffer strip relatively quickly, it was not reasonable to assume that any exfiltration would occur.

6.1.2 Vegetated swales

It is proposed that the majority of overland flow from the buffer strips will be collected by shallow vegetated swales that will convey and infiltrate stormwater runoff, allowing pollutants to settle out in the process. The swales will be incorporated within the proposed landscaped areas and will convey flow towards the proposed inlet pits, where possible.

Similar to the buffer strips, a grass thickness of 50 mm was adopted as it is expected that the vegetated swales will be maintained and mowed on a regular basis.

The intent of vegetated swales is attenuate and infiltrate site runoff. As the swales are located within deep soil zones, it is unlikely that infiltrated water will re-enter the stormwater drainage system. It was therefore conservatively assumed that the swales will have an exfiltration rate of 3.6 mm/hr.

6.1.3 Gross pollutant traps

It is proposed that gross pollutant traps (GPTs) are installed at all grated inlet pits (GIPs) within the site to capture contaminants before discharging to the OSD tank. This will also help to prevent blockage of the piped network.

It is recommended that Ocean Protect OceanGuards or an approved equivalent are used. The treatment efficiency data required for input into the MUSIC model was provided by the manufacturer.

6.1.4 Rainwater tank and re-use

A 15-kL rainwater tank (RWT) will be implemented into the stormwater drainage system for collecting and retaining runoff from roofs of the proposed buildings for on-site re-use. The RWT will be designed by the hydraulic engineers.

It has been assumed that all roofs will be connected to the RWT, and overflows from the tank will spill to the StormFilter chamber within the OSD tank. In accordance with Council guidelines, it has been assumed that the site will have an annual demand of 640 kL/year (for 1600 m^2 of landscaped area) from the RWT for irrigation purposes.

6.1.5 Filtration system

While the proposed GPTs are an effective measure for removing gross pollutants, they are not very effective at removing suspended and dissolved pollutants, including total suspended solids, phosphorus and nitrogen. It is therefore proposed that a filtration system within the OSD tank is used to absorb and retain these pollutants.

In order to meet the water quality improvement objectives, the proposed filtration system will comprise 8x 460 PSorb StormFilters by Ocean Protect, or an approved equivalent. It is proposed that the StormFilters are located within a chamber at the upstream end of the OSD tank. Pipes entering the tank will be directed to the StormFilter chamber so as to ensure that all water entering the tank is filtered through the system.

The treatment efficiency data and model parameters for the StormFilters and their chamber within the OSD tank were provided by the manufacturer.

6.2 Modelled results

Modelling of the above water quality improvement measures has confirmed that the pollutant loads leaving the site meet the targets outlined in Table 6.1. The modelled results, shown in Table 6.2, demonstrate the level of treatment that is provided by the proposed water quality improvement measures outlined in the above sections. More details of the model and modelled results are provided in Appendix C.

Table 6.2 Mean annual pollutant loads leaving the site

	Source	Residual load	Reduction
Flow (ML/yr)	2.1	1.5	29%
Total Suspended Solids (kg/yr)	173	25	86%
Total Phosphorus (kg/yr)	0.44	0.10	77%
Total Nitrogen (kg/yr)	4.7	1.8	61%
Gross Pollutants (kg/yr)	63.3	1.2	98%

7 Conclusion

This stormwater design report has been developed to support the development application for the proposed retirement living facility at 154-162 Stafford Street, Penrith, New South Wales. The preliminary stormwater drainage design has been carried out in accordance with the relevant local, state and national design guidelines and Australian Standards.

The key design elements include:

- on-site detention storage that has been designed to meet the permissible site discharge rates and site storage requirements set by Penrith City Council.
- a major/minor stormwater drainage system that was designed in accordance with Australian Rainfall and Runoff guidelines, and consisting of:
  - a pit and pipe system of sufficient capacity to collect and convey runoff in 10% AEP events.
  - overland flow paths for ensuring that the 1% AEP flows that exceed the capacity of the pit and pipe system are safely conveyed towards the discharge point.
- water quality improvement measures that meet the principles of Water Sensitive Urban Design (WSUD) and provide the level of treatment that is required by the City of Parramatta. The adopted measures include:
  - grassed buffers;
  - grassed swales;
  - gross pollutant traps;
  - rainwater tank and re-use; and
  - a filtration system.

8 References

Advisian (2018). *Nepean River Flood Study – Final Report.* Volume 1: Main Report. Reference no. 301077-14401.

Cardno (2006). *Penrith Overland Flow Flood "Overview Stufy" – Flood Analysis for Central Urban (Zone 1), Northern Rural (Zone 2), Southern Rural (Zone 3).* Prepared for Penrith City Council. Reference no. J2453/R2251.

Cardno (2015). *Penrith CBD Detailed Overland Flow Flood Study – Final Report.* Prepared for Penrith City Council. Reference no. W4735.

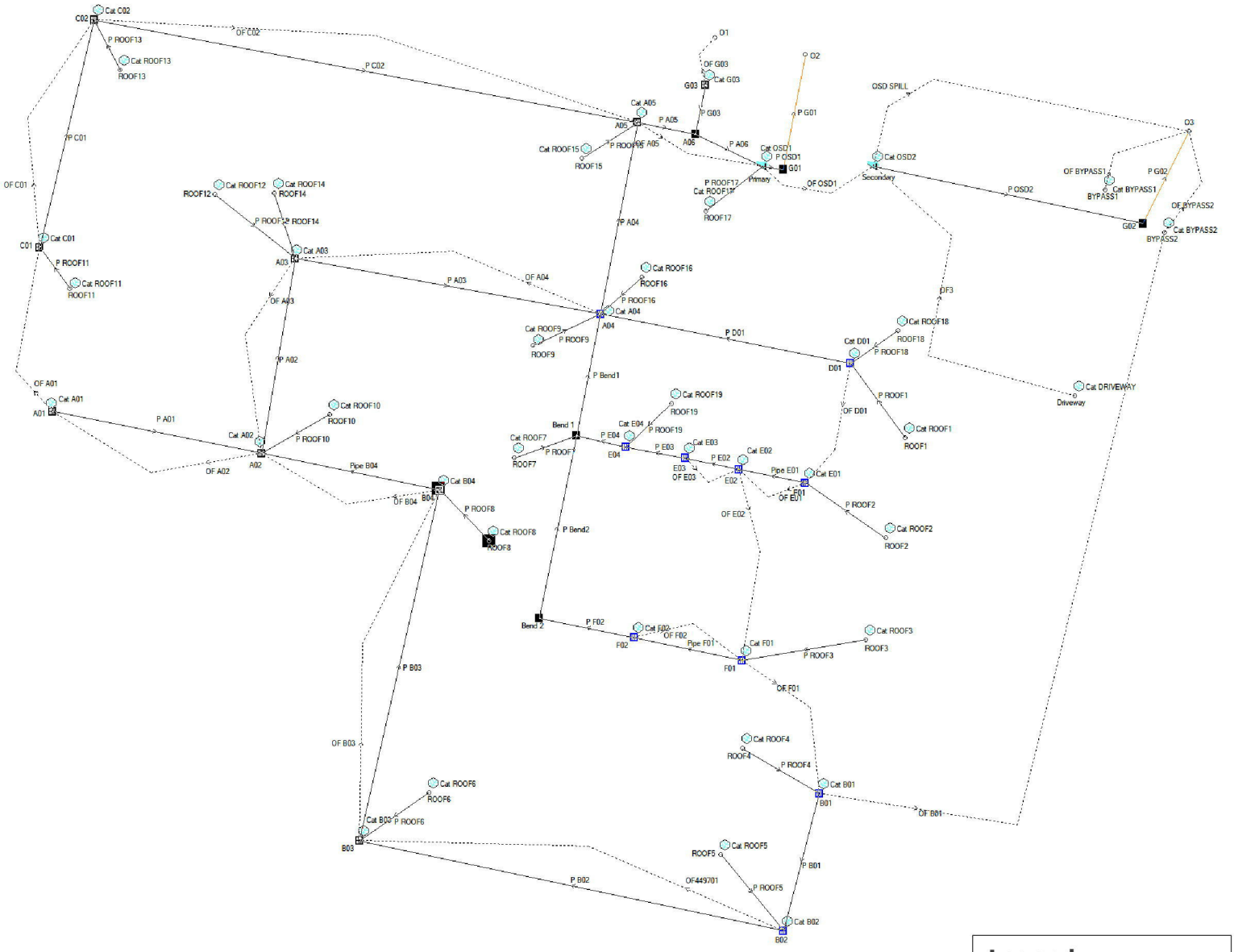
Fulton Trotter (2019). *Penrith Retirement Living – State Environent Planning Policy (Housing for Seniors or People with a Disability) 2004 – Development Application.* Project no. 7082PE01. Dated 05/04/2019.

Penrith City Council (2018). *Stormwater Drainage Specification for Building Developments.*

Project Surveyors (2018). *154-162 Stafford Street, Penrith – General detail and site levels.* Job ref. B04360. Date of survey: 05/09/2018.

Appendix A – Preliminary design drawings

Appendix B – DRAINS results

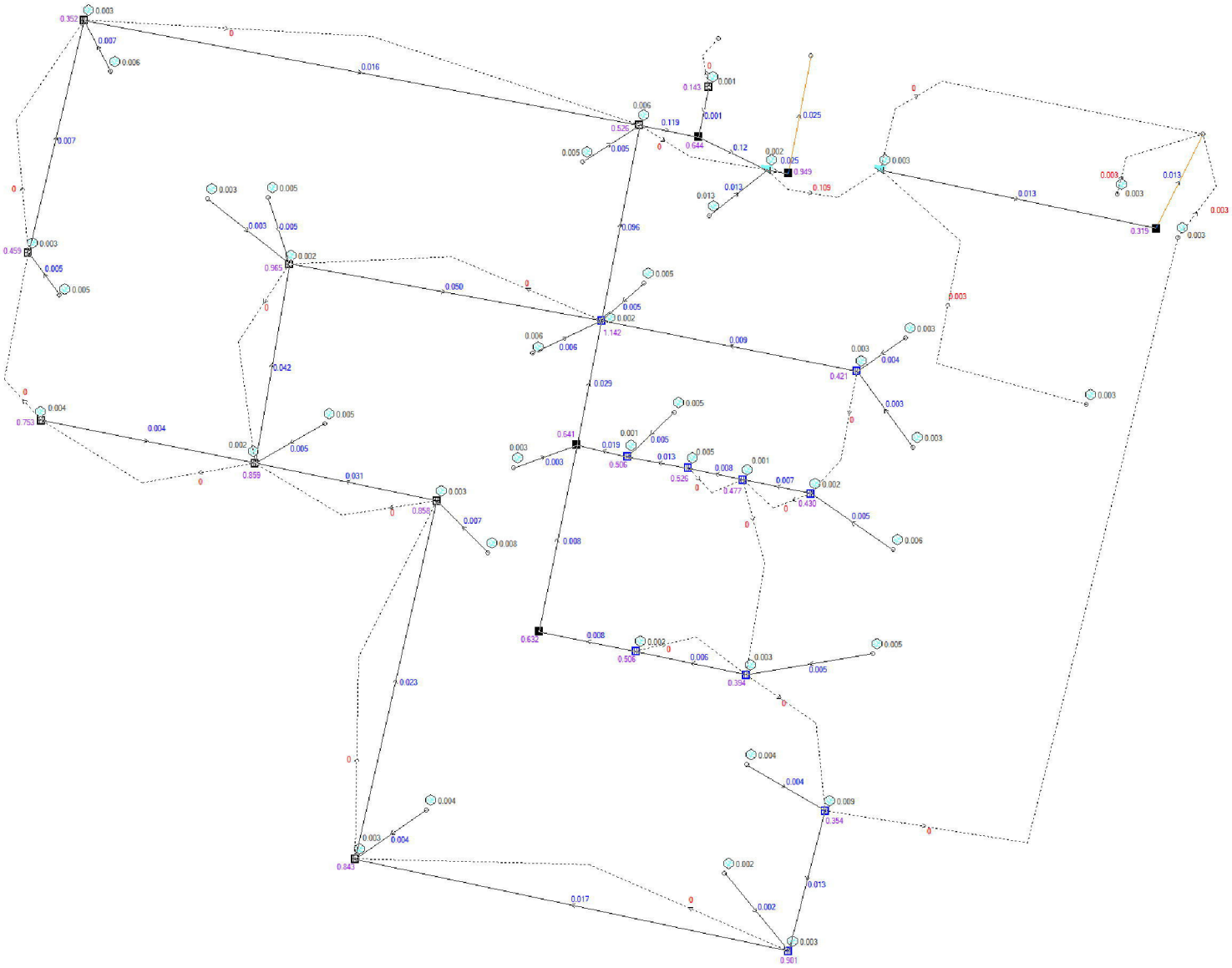


Legend

- Existing pit
- Existing junction box
- Existing pipe
- New on-grade pit
- New sag pit
- New junction box
- New pipe

Fresh Hope Care

Penrith Retirement Living
DRAINS layout

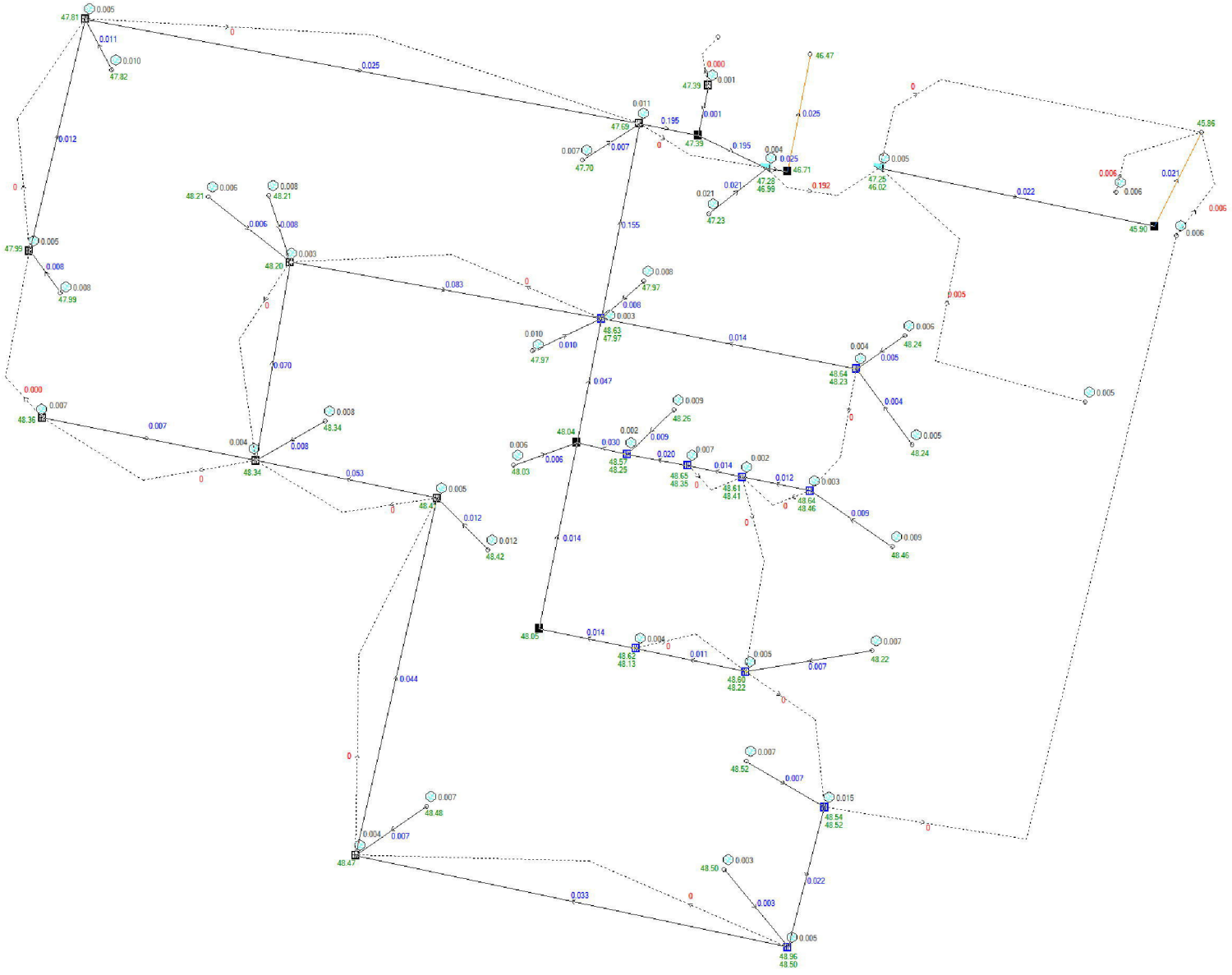


Legend

0.00 Freeboard at pit
0.00 Peak overflow
0.00 Peak pipe flow

Fresh Hope Care

Penrith Retirement Living
DRAINS results
10% AEP storm events



Legend

0.00 Peak water level at pit
0.00 Peak overflow
0.00 Peak pipe flow

Fresh Hope Care

Penrith Retirement Living
DRAINS results
1% AEP storm events

DRAINS input data

PIT / NODE DETAILS Version 14

Name	Type	Family	Size	Ponding Volume (cu.m)	Pressure Change Coeff. Ku	Surface Elev (m)	Max Pond Depth (m)	Base Inflow (cu.m/s)	Blocking Factor	x	y	Bolt-down lid	id	Part Full Shock Loss	Inflow Hydrograph	Pit is	Internal Width (mm)	Inflow is Misaligned	Minor Safe Pond Depth (m)	Major Safe Pond Depth (m)
A01	OnGrade	Grated Inlet Pi	900x900			2	48.4		0	0.5	287299131	6261927053	No	16	1 x Ku	No	New	450	No		
A02	OnGrade	Grated Inlet Pi	900x900			2.3	48.49		0	0.5	287315978.1	6261923681	No	18	1 x Ku	No	New		No		
A03	OnGrade	Grated Inlet Pi	900x900			2.3	48.52		0	0.5	287318677.2	6261939361	No	23	1 x Ku	No	New		No		
A04	Sag	Grated Inlet Pi	900x900		1	1.9	48.62	0.05	0	0.5	287343302.6	6261934888	No	30	1 x Ku	No	New		No	0.05	0.15
A05	OnGrade	Grated Inlet Pi	900x900			1.6	47.9		0	0.5	287346284.3	6261950310	No	49	1 x Ku	No	New		No		
A06	OnGrade	Junction Pit or	Junction Pit or Manhole			0.4	47.9		0	0.5	287350920.5	6261949383	Yes	36592679	1 x Ku	No	New		No		
G01	OnGrade	Junction Pit or	Junction Pit or Manhole			2.2	47.65		0	0.5	287357987.6	6261946501	Yes	13556377	1 x Ku	No	New		Yes		
O2	Node						46		0		287359791.9	6261955799		13556380		No					
BYPASS1	Node								0		287383958.3	6261944848		94		No					
G02	OnGrade	Junction Pit or	Junction Pit or Manhole			1.7	46.2		0	0.5	287386999.6	6261942172	Yes	156	1 x Ku	No	New		Yes		
O3	Node						45.78		0		287390676.6	6261949594		161		No					
Driveway	Node						49		0		287381474.1	6261928260		172		No					
BYPASS2	Node						48		0		287388697.3	6261941459		22848729		No					
O1	Node						47.2		0		287352514.4	6261957142		23232965		No					
G03	OnGrade	Grated Inlet Pi	450x450			3.4	47.4		0	0.5	287351747.5	6261953343	No	26246058	1 x Ku	No	New		No		
ROOF13	Node						55		0		287304596.2	6261954523		36592843		No					
C02	OnGrade	Grated Inlet Pi	900x900			3	48.1		0	0.5	287302508.7	6261958562	No	45	1 x Ku	No	New		No		
ROOF11	Node						55		0		287300546.4	6261936938		36592860		No					
C01	OnGrade	Grated Inlet Pi	900x900			5.6	48.34		0	0.5	287298112.9	6261940241	No	43	1 x Ku	No	New		No		
ROOF14	Node						55		0		287316984.8	6261944577		36592862		No					
ROOF9	Node						55		0		287337833.4	6261932323		36592863		No					
ROOF16	Node						55		0		287346657.2	6261937873		36592865		No					
ROOF15	Node						55		0		287341815.7	6261947418		36592866		No					
ROOF10	Node						55		0		287321462.5	6261926805		36592867		No					
ROOF12	Node						55		0		287312238.6	6261944473		36592902		No					
ROOF17	Node						55		0		287351749.8	6261943174		36592970		No					
ROOF8	Node						55		0		287334341.3	6261916609		36592992		No					
B04	OnGrade	Grated Inlet Pi	900x900			2.1	48.59		0	0.5	287330308.7	6261920725	No	25	1 x Ku	No	New		No		
ROOF6	Node						55		0		287329477.3	6261896342		36593006		No					
B03	OnGrade	Grated Inlet Pi	900x900			2.5	48.73		0	0.5	287323869.6	6261892475	No	28	1 x Ku	No	New		No		
ROOF5	Node						55		0		287352986.6	6261891354		36593024		No					
B02	Sag	Grated Inlet Pi	900x900		1	2.7	48.95	0.05	0	0.5	287358011.6	6261885232	No	22848593	1 x Ku	No	New			0.05	0.15
ROOF4	Node						55		0		287354732.6	6261899897		36593025		No					
B01	Sag	Grated Inlet Pi	900x900		1	4.9	48.48	0.15	0	0.5	287360913.1	6261896275	No	22848595	1 x Ku	No	New		No	0.15	0.3
ROOF7	Node						55		0		287336336.8	6261923281		36593051		No					
Bend 1	OnGrade	Vertical Drain	SPS300mm			0.8	48.6		0	0.5	287341339.4	6261925109	Yes	22848283	1 x Ku	No	New				
ROOF19	Node						55		0		287348995.6	6261927688		36593073		No					
E04	Sag	Vertical Drain	SPS300mm		1	1.2	48.56	0.05	0	0.5	287345323.4	6261924163	No	22848275	1 x Ku	No	New		No	0.05	0.15
ROOF18	Node						55		0		287367235.5	6261933560		36593076		No					
D01	Sag	Vertical Drain	SPS300mm		1	2.9	48.62	0.05	0	0.5	287363424.7	6261930919	No	22848254	1 x Ku	No	New		No	0.05	0.15
ROOF1	Node						55		0		287367807.2	6261924934		36593080		No					
ROOF2	Node						55		0		287366248.2	6261916827		36593082		No					
E01	Sag	Vertical Drain	SPS300mm		1	1.5	48.62	0.05	0	0.5	287359779.9	6261921283	No	41	1 x Ku	No	New		No	0.05	0.15
E02	Sag	Vertical Drain	SPS300mm		1	1.1	48.6	0.05	0	0.5	287354402.9	6261922366	No	22848261	1 x Ku	No	New		No	0.05	0.15
E03	Sag	Vertical Drain	SPS300mm		1	1	48.62	0.05	0	0.5	287350108.5	6261923280	No	22848265	1 x Ku	No	New		No	0.05	0.15
ROOF3	Node						55		0		287364637.3	6261908669		36593084		No					
F01	Sag	Vertical Drain	SPS300mm		1	1.8	48.58	0.05	0	0.5	287354691.6	6261906993	No	22848287	1 x Ku	No	New		Yes	0.05	0.15
F02	Sag	Vertical Drain	SPS300mm		1	1.4	48.6	0.05	0	0.5	287345994.6	6261908833	No	22848290	1 x Ku	No	New		No	0.05	0.15
Bend 2	OnGrade	Vertical Drain	SPS300mm			0.8	48.6		0	0.5	287338344.1	6261910385	Yes	22848295	1 x Ku	No	New				

DETENTION BASIN DETAILS

Name	Elev	Surf. Area	Not Used	Outlet Type	K	Dia(mm)	Centre RL	Pit Family	Pit Type	x	y	HED	Crest RL	Crest Length(m	id
Primary	46.405	1		Orifice		130	46.5175			287356333.6	6261946777	No			13556373
	46.52	25													
	46.659	25													
	46.66	41													
	47.45	41													
	47.451	1													
	47.8	1													
Secondary	45.86	1		Orifice		95	45.935			287365295.8	6261946764	No			153
	45.98	101.5													
	47.45	101.5													

	47.451	1
	47.8	1

SUB-CATCHMENT DETAILS

Name	Pit or Node	Total Area (ha)	Paved Area %	Grass Area %	Supp Area %	Paved Time (min)	Grass Time (min)	Supp Time (min)	Paved Length (m)	Grass Length (m)	Supp Length (m)	Paved Slope(%) %	Grass Slope %	Supp Slope %	Paved Rough	Grass Rough	Supp Rough	Lag Time or Factor	Gutter Length (m)	Gutter Slope %	Gutter FlowFactor	Rainfall Multiplier
Cat A01	A01	0.0138	0	30	70	5	7	5											0			1
Cat A02	A02	0.009	0	90	10	5	7	5											0			1
Cat A03	A03	0.0057	0	40	60	5	7	5											0			1
Cat A04	A04	0.0058	80	20	0	5	7	5											0			1
Cat A05	A05	0.0236	0	95	5	5	7	5											0			1
Cat OSD1	Primary	0.0082	0	100	0	5	7	5											0			1
Cat BYPASS1	BYPASS1	0.0097	80	20	0	5	7	5											0			1
Cat OSD2	Secondary	0.0079	100	0	0	5	7	5											0			1
Cat DRIVEWAY	Driveway	0.0081	100	0	0	5	7	5											0			1
Cat BYPASS2	BYPASS2	0.0183	0	100	0	0	0	0	-1	46.9	-1	-1	5	-1	-1	0.48	-1		0			1
Cat G03	G03	0.0015	100	0	0	5	7	5											0			1
Cat ROOF13	ROOF13	0.0161	100	0	0	5	7	5											0			1
Cat C02	C02	0.0103	0	100	0	5	7	5											0			1
Cat ROOF11	ROOF11	0.0126	100	0	0	5	7	5											0			1
Cat C01	C01	0.0097	0	70	30	5	7	5											0			1
Cat ROOF14	ROOF14	0.0122	100	0	0	5	7	5											0			1
Cat ROOF9	ROOF9	0.015	100	0	0	5	7	5											0			1
Cat ROOF16	ROOF16	0.0121	100	0	0	5	7	5											0			1
Cat ROOF15	ROOF15	0.0114	100	0	0	5	7	5											0			1
Cat ROOF10	ROOF10	0.0127	100	0	0	5	7	5											0			1
Cat ROOF12	ROOF12	0.0087	100	0	0	5	7	5											0			1
Cat ROOF17	ROOF17	0.0333	100	0	0	5	7	5											0			1
Cat ROOF8	ROOF8	0.0194	100	0	0	5	7	5											0			1
Cat B04	B04	0.0109	0	90	10	5	7	5											0			1
Cat ROOF6	ROOF6	0.0113	100	0	0	5	7	5											0			1
Cat B03	B03	0.0094	0	90	10	5	7	5											0			1
Cat ROOF5	ROOF5	0.0054	100	0	0	5	7	5											0			1
Cat B02	B02	0.011	0	90	10	5	7	5											0			1
Cat ROOF4	ROOF4	0.0104	100	0	0	5	7	5											0			1
Cat B01	B01	0.032	0	45	55	5	7	5											0			1
Cat ROOF7	ROOF7	0.0087	100	0	0	5	7	5											0			1
Cat ROOF19	ROOF19	0.0134	100	0	0	5	7	5											0			1
Cat E04	E04	0.0048	0	100	0	5	7	5											0			1
Cat ROOF18	ROOF18	0.0087	100	0	0	5	7	5											0			1
Cat D01	D01	0.0068	100	0	0	5	7	5											0			1
Cat ROOF1	ROOF1	0.0072	100	0	0	5	7	5											0			1
Cat ROOF2	ROOF2	0.0139	100	0	0	5	7	5											0			1
Cat E01	E01	0.0051	98	2	0	5	7	5											0			1
Cat E02	E02	0.0035	100	0	0	5	7	5											0			1
Cat E03	E03	0.012	92	8	0	5	7	5											0			1
Cat ROOF3	ROOF3	0.0115	100	0	0	5	7	5											0			1
Cat F01	F01	0.0096	0	95	5	5	7	5											0			1
Cat F02	F02	0.0074	0	100	0	5	7	5											0			1

PIPE DETAILS

Name	From	To	Length (m)	U/S IL (m)	D/S IL (m)	Slope (%)	Type	Dia (mm)	I.D. (mm)	Rough	Pipe Is	No. Pipes	Chg From	At Chg	Chg (m)	Rl (m)	Chg (m)	RL (m)	etc (m)
P A01	A01	A02	15.038	47.57	47.42	1	uPVC, not unde	150	154	0.03	New	1	A02		0				
P A02	A02	A03	13.568	47.42	47.284	1	uPVC, not unde	300	303	0.03	New	1	A03		0				
P A03	A03	A04	22.058	47.284	47.047	1.07	uPVC, not unde	300	303	0.03	New	1	A04		0				
P A04	A04	A05	15.104	47.047	46.896	1	Concrete, not u	375	375	0.3	New	1	A05		0				
P A05	A05	A06	7	46.896	46.826	1	Concrete, not u	375	375	0.3	NewFixed	1	A06		0				
P A06	A06	Primary	15	46.826	46.69	0.91	Concrete, not u	375	375	0.3	NewFixed	1	Primary		0				
P OSD1	Primary	G01	1.5	46.405	46.405	0	uPVC, under rc	225	242	0.03	NewFixed	1	G01		0				
P G01	G01	O2	4	46.405	46.374	0.77	Rectangular Hc	0.2W x 0.1H		0.3	Existing	1	O2		0				
P OSD2	Secondary	G02	8	45.86	45.82	0.5	uPVC, under rc	150	154	0.03	NewFixed	1	G02		0				
P G02	G02	O3	4.65	45.82	45.797	0.49	Rectangular Hc	0.2W x 0.1H		0.3	Existing	2	O3		0				
P G03	G03	A06	3.2	46.842	46.826	0.5	uPVC, not unde	150	154	0.03	New	1	A06		0				
P ROOF13	ROOF13	C02	5	47.66	47.61	1	uPVC, not unde	150	154	0.03	New	1	C02		0				
P C02	C02	A05	37.78	47.61	47.231	1	uPVC, not unde	225	242	0.03	New	1	A05		0				

P ROOF11	ROOF11	C01	5	47.812	47.762	1	uPVC, not unde	150	154	0.03	New	1 C01 0
P C01	C01	C02	15.06	47.762	47.611	1	uPVC, not unde	150	154	0.03	New	1 C02 0
P ROOF14	ROOF14	A03	5	47.334	47.284	1	uPVC, not unde	150	154	0.03	New	1 A03 0
P ROOF9	ROOF9	A04	5	47.097	47.047	1	uPVC, not unde	150	154	0.03	New	1 A04 0
P ROOF16	ROOF16	A04	5	47.097	47.047	1	uPVC, not unde	150	154	0.03	New	1 A04 0
P ROOF15	ROOF15	A05	5	47.281	47.231	1	uPVC, not unde	150	154	0.03	New	1 A05 0
P ROOF10	ROOF10	A02	5	47.47	47.42	1	uPVC, not unde	150	154	0.03	New	1 A02 0
P ROOF12	ROOF12	A03	5	47.334	47.284	1	uPVC, not unde	150	154	0.03	New	1 A03 0
P ROOF17	ROOF17	Primary	5	46.74	46.69	1	uPVC, not unde	150	154	0.03	NewFixed	1 Primary 0
P ROOF8	ROOF8	B04	5	47.62	47.57	1	uPVC, not unde	150	154	0.03	New	1 B04 0
Pipe B04	B04	A02	15.092	47.57	47.419	1	uPVC, not unde	300	303	0.03	New	1 A02 0
P ROOF6	ROOF6	B03	5	47.789	47.739	1	uPVC, not unde	150	154	0.03	New	1 B03 0
P B03	B03	B04	33.74	47.739	47.57	0.5	uPVC, not unde	300	303	0.03	New	1 B04 0
P ROOF5	ROOF5	B02	5	47.97	47.92	1	uPVC, not unde	150	154	0.03	New	1 B02 0
P B02	B02	B03	36.147	47.92	47.739	0.5	uPVC, not unde	300	303	0.03	New	1 B03 0
P ROOF4	ROOF4	B01	5	48.05	48	1	uPVC, not unde	150	154	0.03	New	1 B01 0
P B01	B01	B02	15.648	48	47.922	0.5	uPVC, not unde	300	303	0.03	New	1 B02 0
P ROOF7	ROOF7	Bend 1	5	47.861	47.811	1	uPVC, not unde	150	154	0.03	New	1 Bend 1 0
P Bend1	Bend 1	A04	11.125	47.811	47.75	0.55	uPVC, not unde	225	242	0.03	New	1 A04 0
P ROOF19	ROOF19	E04	5	47.93	47.88	1	uPVC, not unde	150	154	0.03	New	1 E04 0
P E04	E04	Bend 1	5.752	47.88	47.811	1.2	uPVC, not unde	150	154	0.03	New	1 Bend 1 0
P ROOF18	ROOF18	D01	5	48.15	48.1	1	uPVC, not unde	150	154	0.03	New	1 D01 0
P D01	D01	A04	27.64	48.1	47.824	1	uPVC, not unde	150	154	0.03	New	1 A04 0
P ROOF1	ROOF1	D01	5	48.15	48.1	1	uPVC, not unde	150	154	0.03	New	1 D01 0
P ROOF2	ROOF2	E01	5	48.15	48.1	1	uPVC, not unde	150	154	0.03	New	1 E01 0
Pipe E01	E01	E02	8.053	48.1	48.019	1.01	uPVC, not unde	150	154	0.03	New	1 E02 0
P E02	E02	E03	8.165	48.019	47.937	1	uPVC, not unde	150	154	0.03	New	1 E03 0
P E03	E03	E04	5.655	47.937	47.88	1.01	uPVC, not unde	150	154	0.03	New	1 E04 0
P ROOF3	ROOF3	F01	5	48.15	48.1	1	uPVC, not unde	150	154	0.03	New	1 F01 0
Pipe F01	F01	F02	10.04	48.1	48	1	uPVC, not unde	150	154	0.03	New	1 F02 0
P F02	F02	Bend 2	13.46	48	47.865	1	uPVC, not unde	150	154	0.03	New	1 Bend 2 0
P Bend2	Bend 2	Bend 1	10.8	47.865	47.811	0.5	uPVC, not unde	225	242	0.03	New	1 Bend 1 0

DETAILS of SERVICES CROSSING PIPES

Pipe	Chg	Bottom	Height of Servi	Chg	Bottom	Height of Servi	Chg	Bottom	Height of Servi	etc
	(m)	Elev (m)	(m)	(m)	Elev (m)	(m)	(m)	Elev (m)	(m)	etc

CHANNEL DETAILS

Name	From	To	Type	Length	U/S IL	D/S IL	Slope	Base Width	L.B. Slope	R.B. Slope	Manning	Depth	Roofed
				(m)	(m)	(m)	(%)	(m)	(1:?)	(1:?)	n	(m)	

OVERFLOW ROUTE DETAILS

Name	From	To	Travel	Spill	Crest	Weir	Cross	Safe Depth	SafeDepth	Safe	Bed	D/S Area	id	
			Time	Level	Length	Coeff. C	Section	Major Storms	Minor Storms	DxV	Slope	Contributing		
			(min)	(m)	(m)			(m)	(m)	(sq.m/sec)	(%)	%		
OF A01	A01	C01		0.2				Grassed swales	0.3	0.3	0.4	1	0	22849195	15
OF A02	A02	A01		0.3				Grassed swales	0.3	0.3	0.4	0.5	0	22849191	15
OF A03	A03	A02		0.2				Grassed swales	0.3	0.3	0.4	1	0	22849182	14
OF A04	A04	A03		0.3				Grassed swales	0.3	0.3	0.4	1	0	22849153	22
OF A05	A05	Primary		0.3				Grassed swales	0.3	0.3	0.4	1	0	22849209	22
OF OSD1	Primary	Secondary		0.1	47.15	10	1.67	HED weir	0.3	0.3	0.6	0.1	0	13556383	1
OF BYPASS1	BYPASS1	O3		0.1				4 m wide path	0.3	0.15	0.4	1	0	139	4
OSD SPILL	Secondary	O3		0.1	47.65	10	1.67	4 m wide path	0.3	0.15	0.4	1	0	12151402	4
OF3	Driveway	Secondary		0.1				4 m wide path	0.3	0.15	0.4	1	0	174	10
OF BYPASS2	BYPASS2	O3		0.1				4 m wide path	0.3	0.15	0.4	1	0	22848733	4
OF G03	G03	O1		0.1				4 m wide path	0.3	0.15	0.4	1	0	26246086	10
OF C02	C02	A05		0.6				Grassed swales	0.3	0.3	0.4	1	0	22849200	38
OF C01	C01	C02		0.3				Grassed swales	0.3	0.3	0.4	1	0	169685	20
OF B04	B04	A02		0.2				Grassed swales	0.3	0.3	0.4	1	0	22849186	15
OF B03	B03	B04		0.5				Grassed swales	0.3	0.3	0.4	1	0	22849171	34
OF449701	B02	B03		0.2				Grassed swales	0.3	0.3	0.4	1	0	22849167	12.983
OF B01	B01	BYPASS2		0.6				Grassed swales	0.3	0.3	0.4	5	0	22849162	65
OF D01	D01	E01		0.1				4 m wide path	0.3	0.15	0.4	1	0	22849132	10
OF E01	E01	E02		0.1				4 m wide path	0.3	0.15	0.4	1	0	36592806	8
OF E02	E02	F01		0.1				4 m wide path	0.3	0.15	0.4	1	0	22849137	12
OF E03	E03	E02		0.1				4 m wide path	0.3	0.15	0.4	1	0	36592812	8
OF F01	F01	B01		0.1				4 m wide path	0.3	0.15	0.4	1	0	22849141	15

OF F02	F02	F01	0.1		4 m wide path	0.3	0.15	0.4	1	0	22849157	10

PIPE COVER DETAILS

Name	Type	Dia (mm)	Safe Cover (m)	Cover (m)	
P A01	uPVC, not unde	154	0.3	0.67	
P A02	uPVC, not unde	303	0.3	0.76	
P A03	uPVC, not unde	303	0.3	0.93	
P A04	Concrete, not u	375	0.45	0.59	
P A05	Concrete, not u	375	0.45	0.59	
P A06	Concrete, not u	375	0.45	-0.69	Unsafe
P OSD1	uPVC, under rc	242	0.5	-0.25	Unsafe
P G01	Rectangular Hc	0	50	-0.48	Unsafe
P OSD2	uPVC, under rc	154	0.5	0.22	Unsafe
P G02	Rectangular Hc	0	50	-0.13	Unsafe
P G03	uPVC, not unde	154	0.3	0.4	
P ROOF13	uPVC, not unde	154	0.3	0.33	
P C02	uPVC, not unde	242	0.3	0.24	Unsafe
P ROOF11	uPVC, not unde	154	0.3	0.42	
P C01	uPVC, not unde	154	0.3	0.33	
P ROOF14	uPVC, not unde	154	0.3	1.08	
P ROOF9	uPVC, not unde	154	0.3	1.42	
P ROOF16	uPVC, not unde	154	0.3	1.42	
P ROOF15	uPVC, not unde	154	0.3	0.51	
P ROOF10	uPVC, not unde	154	0.3	0.91	
P ROOF12	uPVC, not unde	154	0.3	1.08	
P ROOF17	uPVC, not unde	154	0.3	-0.44	Unsafe
P ROOF8	uPVC, not unde	154	0.3	0.86	
Pipe B04	uPVC, not unde	303	0.3	0.71	
P ROOF6	uPVC, not unde	154	0.3	0.83	
P B03	uPVC, not unde	303	0.3	0.68	
P ROOF5	uPVC, not unde	154	0.3	0.87	
P B02	uPVC, not unde	303	0.3	0.68	
P ROOF4	uPVC, not unde	154	0.3	0.32	
P B01	uPVC, not unde	303	0.3	0.17	Unsafe
P ROOF7	uPVC, not unde	154	0.3	0.63	
P Bend1	uPVC, not unde	242	0.3	0.54	
P ROOF19	uPVC, not unde	154	0.3	0.52	
P E04	uPVC, not unde	154	0.3	0.52	
P ROOF18	uPVC, not unde	154	0.3	0.36	
P D01	uPVC, not unde	154	0.3	0.36	
P ROOF1	uPVC, not unde	154	0.3	0.36	
P ROOF2	uPVC, not unde	154	0.3	0.36	
Pipe E01	uPVC, not unde	154	0.3	0.36	
P E02	uPVC, not unde	154	0.3	0.42	
P E03	uPVC, not unde	154	0.3	0.52	
P ROOF3	uPVC, not unde	154	0.3	0.32	
Pipe F01	uPVC, not unde	154	0.3	0.32	
P F02	uPVC, not unde	154	0.3	0.44	
P Bend2	uPVC, not unde	242	0.3	0.49	

This model has no pipes with non-return valves

DRAINS results - 10% AEP storm event

DRAINS results prepared from Version 2019.03

PIT / NODE DETAILS Version 8

Name	Max HGL	Max Pond HGL	Max Surface Flow Arrivin (cu.m/s)	Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint
A01	47.65		0.004		0.75	0	None
A02	47.63		0.003		0.86	0	None
A03	47.55		0.002		0.97	0	None
A04	47.48	48.63	0.003	0.1	1.14	0	Inlet Capacity
A05	47.37		0.008		0.53	0	None
A06	47.26		0		0.64		None
G01	46.7		0		0.95		None
O2	46.47		0				
G02	45.88		0		0.32		None
O3	45.84		0.007				
G03	47.26		0.001		0.14	0	None
ROOF13	47.75		0.008				
C02	47.75		0.003		0.35	0	None
ROOF11	47.88		0.006				
C01	47.88		0.003		0.46	0	None
ROOF14	47.55		0.006				
ROOF9	47.47		0.007				
ROOF16	47.47		0.006				
ROOF15	47.38		0.006				
ROOF10	47.63		0.006				
ROOF12	47.55		0.004				
ROOF17	47.2		0.017				
ROOF8	47.74		0.01				
B04	47.73		0.004		0.86	0	None
ROOF6	47.89		0.006				
B03	47.89		0.003		0.84	0	None
ROOF5	48.05		0.003				
B02	48.05	48.96	0.004	0.1	0.9	0	Inlet Capacity
ROOF4	48.13		0.005				
B01	48.13	48.5	0.01	0.1	0.35	0	Inlet Capacity
ROOF7	47.96		0.004				
Bend 1	47.96		0		0.64		None
ROOF19	48.06		0.007				
E04	48.05	48.57	0.002	0.1	0.51		Inlet Capacity
ROOF18	48.2		0.004				
D01	48.2	48.63	0.003	0.2	0.42	0	Inlet Capacity
ROOF1	48.2		0.004				
ROOF2	48.2		0.007				
E01	48.19	48.63	0.003	0.1	0.43	0	Inlet Capacity
E02	48.12	48.61	0.002	0.1	0.48	0	Inlet Capacity
E03	48.09	48.64	0.006	0.3	0.53	0	Inlet Capacity
ROOF3	48.2		0.006				
F01	48.19	48.59	0.003	0.2	0.39	0	Inlet Capacity
F02	48.09	48.61	0.002	0.1	0.51	0	Inlet Capacity
Bend 2	47.97		0		0.63		None

SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc	Due to Storm
Cat A01	0.004	0	0	5	7	5	10% AEP, 10 min burst, Storm 5
Cat A02	0.002	0	0	5	7	5	10% AEP, 10 min burst, Storm 9
Cat A03	0.002	0	0	5	7	5	10% AEP, 10 min burst, Storm 9
Cat A04	0.002	0	0	5	7	5	10% AEP, 15 min burst, Storm 4
Cat A05	0.006	0	0	5	7	5	10% AEP, 10 min burst, Storm 5
Cat OSD1	0.002	0	0	5	7	5	10% AEP, 10 min burst, Storm 8
Cat BYPASS1	0.003	0	0	5	7	5	10% AEP, 15 min burst, Storm 4
Cat OSD2	0.003	0	0	5	7	5	10% AEP, 5 min burst, Storm 1
Cat DRIVEW	0.003	0	0	5	7	5	10% AEP, 5 min burst, Storm 1
Cat BYPASS2	0.003	0	0	0	20.16	0	10% AEP, 30 min burst, Storm 9
Cat G03	0.001	0	0	5	7	5	10% AEP, 5 min burst, Storm 1
Cat ROOF13	0.006	0	0	5	7	5	10% AEP, 5 min burst, Storm 1
Cat C02	0.003	0	0	5	7	5	10% AEP, 10 min burst, Storm 8
Cat ROOF11	0.005	0	0	5	7	5	10% AEP, 5 min burst, Storm 1
Cat C01	0.003	0	0	5	7	5	10% AEP, 10 min burst, Storm 8
Cat ROOF14	0.005	0	0	5	7	5	10% AEP, 5 min burst, Storm 1
Cat ROOF9	0.006	0	0	5	7	5	10% AEP, 5 min burst, Storm 1

Cat ROOF16	0.005	0	0	5	7	5 10% AEP, 5 min burst, Storm 1
Cat ROOF15	0.005	0	0	5	7	5 10% AEP, 5 min burst, Storm 1
Cat ROOF10	0.005	0	0	5	7	5 10% AEP, 5 min burst, Storm 1
Cat ROOF12	0.003	0	0	5	7	5 10% AEP, 5 min burst, Storm 1
Cat ROOF17	0.013	0	0	5	7	5 10% AEP, 5 min burst, Storm 1
Cat ROOF8	0.008	0	0	5	7	5 10% AEP, 5 min burst, Storm 1
Cat B04	0.003	0	0	5	7	5 10% AEP, 10 min burst, Storm 9
Cat ROOF6	0.004	0	0	5	7	5 10% AEP, 5 min burst, Storm 1
Cat B03	0.003	0	0	5	7	5 10% AEP, 10 min burst, Storm 9
Cat ROOF5	0.002	0	0	5	7	5 10% AEP, 5 min burst, Storm 1
Cat B02	0.003	0	0	5	7	5 10% AEP, 10 min burst, Storm 9
Cat ROOF4	0.004	0	0	5	7	5 10% AEP, 5 min burst, Storm 1
Cat B01	0.009	0	0	5	7	5 10% AEP, 10 min burst, Storm 7
Cat ROOF7	0.003	0	0	5	7	5 10% AEP, 5 min burst, Storm 1
Cat ROOF19	0.005	0	0	5	7	5 10% AEP, 5 min burst, Storm 1
Cat E04	0.001	0	0	5	7	5 10% AEP, 10 min burst, Storm 8
Cat ROOF18	0.003	0	0	5	7	5 10% AEP, 5 min burst, Storm 1
Cat D01	0.003	0	0	5	7	5 10% AEP, 5 min burst, Storm 1
Cat ROOF1	0.003	0	0	5	7	5 10% AEP, 5 min burst, Storm 1
Cat ROOF2	0.006	0	0	5	7	5 10% AEP, 5 min burst, Storm 1
Cat E01	0.002	0	0	5	7	5 10% AEP, 5 min burst, Storm 1
Cat E02	0.001	0	0	5	7	5 10% AEP, 5 min burst, Storm 1
Cat E03	0.005	0	0	5	7	5 10% AEP, 15 min burst, Storm 10
Cat ROOF3	0.005	0	0	5	7	5 10% AEP, 5 min burst, Storm 1
Cat F01	0.003	0	0	5	7	5 10% AEP, 10 min burst, Storm 5
Cat F02	0.002	0	0	5	7	5 10% AEP, 10 min burst, Storm 8

PIPE DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Due to Storm
P A01	0.004	0.68	47.626	47.631	10% AEP, 15 min burst, Storm 6
P A02	0.042	1.3	47.558	47.549	10% AEP, 15 min burst, Storm 6
P A03	0.05	1.18	47.456	47.467	10% AEP, 15 min burst, Storm 6
P A04	0.096	0.88	47.405	47.374	10% AEP, 15 min burst, Storm 5
P A05	0.119	1.08	47.28	47.257	10% AEP, 15 min burst, Storm 5
P A06	0.12	1.09	47.246	47.237	10% AEP, 15 min burst, Storm 5
P OSD1	0.025	0.54	46.952	46.701	10% AEP, 25 min burst, Storm 1
P G01	0.025	1.24	46.535	46.474	10% AEP, 15 min burst, Storm 5
P OSD2	0.013	1.03	45.962	45.924	10% AEP, 30 min burst, Storm 8
P G02	0.013	1	45.854	45.844	10% AEP, 30 min burst, Storm 8
P G03	0.001	0.03	47.273	47.272	10% AEP, 10 min burst, Storm 8
P ROOF13	0.007	0.59	47.754	47.748	10% AEP, 5 min burst, Storm 1
P C02	0.016	1.37	47.683	47.365	10% AEP, 15 min burst, Storm 3
P ROOF11	0.005	0.54	47.89	47.886	10% AEP, 5 min burst, Storm 1
P C01	0.007	1.15	47.819	47.748	10% AEP, 10 min burst, Storm 7
P ROOF14	0.005	0.26	47.619	47.622	10% AEP, 15 min burst, Storm 10
P ROOF9	0.006	0.32	47.472	47.47	10% AEP, 15 min burst, Storm 1
P ROOF16	0.005	0.26	47.472	47.47	10% AEP, 15 min burst, Storm 1
P ROOF15	0.005	0.27	47.413	47.405	10% AEP, 5 min burst, Storm 1
P ROOF10	0.005	0.26	47.646	47.643	10% AEP, 15 min burst, Storm 4
P ROOF12	0.003	0.18	47.619	47.622	10% AEP, 15 min burst, Storm 10
P ROOF17	0.013	0.71	47.201	47.244	10% AEP, 5 min burst, Storm 1
P ROOF8	0.007	0.47	47.742	47.739	10% AEP, 5 min burst, Storm 1
Pipe B04	0.031	1.62	47.665	47.631	10% AEP, 15 min burst, Storm 6
P ROOF6	0.004	0.32	47.895	47.893	10% AEP, 15 min burst, Storm 10
P B03	0.023	1.15	47.835	47.732	10% AEP, 15 min burst, Storm 6
P ROOF5	0.002	0.19	48.056	48.052	10% AEP, 5 min burst, Storm 1
P B02	0.017	1.07	48.003	47.888	10% AEP, 10 min burst, Storm 7
P ROOF4	0.004	0.43	48.131	48.129	10% AEP, 5 min burst, Storm 1
P B01	0.013	0.94	48.076	48.049	10% AEP, 10 min burst, Storm 7
P ROOF7	0.003	0.26	47.965	47.963	10% AEP, 15 min burst, Storm 10
P Bend1	0.029	1.55	47.915	47.871	10% AEP, 15 min burst, Storm 5
P ROOF19	0.005	0.29	48.069	48.067	10% AEP, 15 min burst, Storm 10
P E04	0.019	1.1	48.012	47.959	10% AEP, 15 min burst, Storm 4
P ROOF18	0.004	0.63	48.203	48.199	10% AEP, 5 min burst, Storm 1
P D01	0.009	2.23	48.14	47.887	10% AEP, 15 min burst, Storm 6
P ROOF1	0.003	0.54	48.201	48.199	10% AEP, 5 min burst, Storm 1
P ROOF2	0.005	0.95	48.204	48.19	10% AEP, 5 min burst, Storm 1
Pipe E01	0.007	1.15	48.158	48.135	10% AEP, 15 min burst, Storm 10
P E02	0.008	0.84	48.1	48.094	10% AEP, 5 min burst, Storm 1
P E03	0.013	0.73	48.072	48.054	10% AEP, 15 min burst, Storm 4
P ROOF3	0.005	0.86	48.2	48.191	10% AEP, 5 min burst, Storm 1
Pipe F01	0.006	1.11	48.153	48.094	10% AEP, 10 min burst, Storm 7

P F02	0.008	1.18	48.061	47.968	10% AEP, 10 min burst, Storm 7
P Bend2	0.008	0.46	47.962	47.961	10% AEP, 15 min burst, Storm 4

CHANNEL DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Due to Storm

OVERFLOW ROUTE DETAILS

Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm
OF A01	0	0	0.811	0	0	0	0	
OF A02	0	0	0.573	0	0	0	0	
OF A03	0	0	0.811	0	0	0	0	
OF A04	0	0	0.811	0	0	0	0	
OF A05	0	0	0.811	0	0	0	0	
OF OSD1	0.109	0.109	6.737	0.025	0.01	20.99	0.2	10% AEP, 15 min burst, Storm 5
OF BYPASS1	0.003	0.003	0.908	0.016	0	1.63	0.26	10% AEP, 15 min burst, Storm 4
OSD SPILL	0	0	0.908	0	0	0	0	
OF3	0.003	0.003	0.908	0.015	0	1.53	0.27	10% AEP, 5 min burst, Storm 1
OF BYPASS2	0.003	0.003	0.908	0.014	0	1.43	0.26	10% AEP, 30 min burst, Storm 9
OF G03	0	0	0.908	0	0	0	0	
OF C02	0	0	0.811	0	0	0	0	
OF C01	0	0	0.811	0	0	0	0	
OF B04	0	0	0.811	0	0	0	0	
OF B03	0	0	0.811	0	0	0	0	
OF449701	0	0	0.811	0	0	0	0	
OF B01	0	0	0.807	0	0	0	0	
OF D01	0	0	0.908	0	0	0	0	
OF E01	0	0	0.908	0	0	0	0	
OF E02	0	0	0.908	0	0	0	0	
OF E03	0	0	0.908	0	0	0	0	
OF F01	0	0	0.908	0	0	0	0	
OF F02	0	0	0.908	0	0	0	0	

DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level
Primary	47.22	0	0.134	0.025	0.109
Secondary	46.45	0	0.013	0.013	0

Run Log for FHC_DA design_10% AEP.DRN run at 15:42:04 on 17/4/2019

No water upwelling from any pit.

Freeboard was less than 0.15m at G03

Flows were safe in all overflow routes.

DRAINS results - 1% AEP storm event

DRAINS results prepared from Version 2019.03

PIT / NODE DETAILS Version 8

Name	Max HGL	Max Pond HGL	Max Surface Flow Arrivin (cu.m/s)	Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint
A01	48.36		0.009		0.04	0	None
A02	48.34		0.005		0.15	0	None
A03	48.2		0.003		0.32	0	None
A04	47.97	48.63	0.004	0.1	0.65	0	Inlet Capacity
A05	47.69		0.014		0.21	0	None
A06	47.39		0		0.51		None
G01	46.71		0		0.94		None
O2	46.47		0				
G02	45.9		0		0.3		None
O3	45.86		0.027				
G03	47.39		0.001		0.01	0	Inlet Capacity
ROOF13	47.82		0.013				
C02	47.81		0.015		0.29	0	None
ROOF11	47.99		0.01				
C01	47.99		0.024		0.35	0	None
ROOF14	48.21		0.01				
ROOF9	47.97		0.012				
ROOF16	47.97		0.01				
ROOF15	47.7		0.009				
ROOF10	48.34		0.01				
ROOF12	48.21		0.007				
ROOF17	47.23		0.027				
ROOF8	48.42		0.016				
B04	48.41		0.006		0.18	0	None
ROOF6	48.48		0.009				
B03	48.47		0.005		0.26	0	None
ROOF5	48.5		0.004				
B02	48.5	48.96	0.006	0.2	0.45	0	Inlet Capacity
ROOF4	48.52		0.008				
B01	48.52	48.54	0.017	0.9	0	0	Outlet System
ROOF7	48.03		0.007				
Bend 1	48.04		0		0.56		None
ROOF19	48.26		0.011				
E04	48.25	48.57	0.003	0.1	0.31		Inlet Capacity
ROOF18	48.24		0.007				
D01	48.23	48.64	0.006	0.2	0.39	0	Inlet Capacity
ROOF1	48.24		0.006				
ROOF2	48.46		0.011				
E01	48.46	48.64	0.004	0.6	0.16	0	Inlet Capacity
E02	48.41	48.61	0.003	0.3	0.19	0	Inlet Capacity
E03	48.35	48.65	0.01	0.7	0.27	0	Inlet Capacity
ROOF3	48.22		0.009				
F01	48.22	48.6	0.006	0.2	0.36	0	Inlet Capacity
F02	48.13	48.62	0.004	0.2	0.47	0	Inlet Capacity
Bend 2	48.05		0		0.55		None

SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm
Cat A01	0.007	0	0	5	7	5	1% AEP, 10 min burst, Storm 10
Cat A02	0.004	0	0	5	7	5	1% AEP, 10 min burst, Storm 7
Cat A03	0.003	0	0	5	7	5	1% AEP, 10 min burst, Storm 8
Cat A04	0.003	0	0	5	7	5	1% AEP, 5 min burst, Storm 1
Cat A05	0.011	0	0	5	7	5	1% AEP, 10 min burst, Storm 7
Cat OSD1	0.004	0	0	5	7	5	1% AEP, 10 min burst, Storm 7
Cat BYPASS1	0.006	0	0	5	7	5	1% AEP, 5 min burst, Storm 1
Cat OSD2	0.005	0	0	5	7	5	1% AEP, 5 min burst, Storm 1
Cat DRIVEW	0.005	0	0	5	7	5	1% AEP, 5 min burst, Storm 1
Cat BYPASS2	0.006	0	0	0	15.22	0	1% AEP, 20 min burst, Storm 2
Cat G03	0.001	0	0	5	7	5	1% AEP, 5 min burst, Storm 1
Cat ROOF13	0.01	-9999	-9999	5	7	5	1% AEP, 5 min burst, Storm 1
Cat C02	0.005	0	0	5	7	5	1% AEP, 10 min burst, Storm 7
Cat ROOF11	0.008	0.007	-9999	5	7	5	1% AEP, 5 min burst, Storm 1
Cat C01	0.005	0	0	5	7	5	1% AEP, 10 min burst, Storm 7
Cat ROOF14	0.008	-9999	-9999	5	7	5	1% AEP, 5 min burst, Storm 1
Cat ROOF9	0.01	-9999	-9999	5	7	5	1% AEP, 5 min burst, Storm 1

Cat ROOF16	0.008	0	-9999	5	7	5 1% AEP, 5 min burst, Storm 1
Cat ROOF15	0.007	0	0	5	7	5 1% AEP, 5 min burst, Storm 1
Cat ROOF10	0.008	0	-9999	5	7	5 1% AEP, 5 min burst, Storm 1
Cat ROOF12	0.006	0.007	-9999	5	7	5 1% AEP, 5 min burst, Storm 1
Cat ROOF17	0.021	-9999	-9999	5	7	5 1% AEP, 5 min burst, Storm 1
Cat ROOF8	0.012	0	0	5	7	5 1% AEP, 5 min burst, Storm 1
Cat B04	0.005	0	0	5	7	5 1% AEP, 10 min burst, Storm 7
Cat ROOF6	0.007	0	-9999	5	7	5 1% AEP, 5 min burst, Storm 1
Cat B03	0.004	0	0	5	7	5 1% AEP, 10 min burst, Storm 7
Cat ROOF5	0.003	0	-9999	5	7	5 1% AEP, 5 min burst, Storm 1
Cat B02	0.005	0	0	5	7	5 1% AEP, 10 min burst, Storm 7
Cat ROOF4	0.007	-9999	-9999	5	7	5 1% AEP, 5 min burst, Storm 1
Cat B01	0.015	0	0	5	7	5 1% AEP, 10 min burst, Storm 7
Cat ROOF7	0.006	0	0	5	7	5 1% AEP, 5 min burst, Storm 1
Cat ROOF19	0.009	-9999	0	5	7	5 1% AEP, 5 min burst, Storm 1
Cat E04	0.002	0	0	5	7	5 1% AEP, 10 min burst, Storm 7
Cat ROOF18	0.006	-9999	-9999	5	7	5 1% AEP, 5 min burst, Storm 1
Cat D01	0.004	0	0	5	7	5 1% AEP, 5 min burst, Storm 1
Cat ROOF1	0.005	-9999	-9999	5	7	5 1% AEP, 5 min burst, Storm 1
Cat ROOF2	0.009	0	0.006	5	7	5 1% AEP, 5 min burst, Storm 1
Cat E01	0.003	0	0	5	7	5 1% AEP, 5 min burst, Storm 1
Cat E02	0.002	0	0	5	7	5 1% AEP, 5 min burst, Storm 1
Cat E03	0.007	0	0	5	7	5 1% AEP, 5 min burst, Storm 1
Cat ROOF3	0.007	-9999	0	5	7	5 1% AEP, 5 min burst, Storm 1
Cat F01	0.005	0	0	5	7	5 1% AEP, 10 min burst, Storm 7
Cat F02	0.004	0	0	5	7	5 1% AEP, 10 min burst, Storm 7

PIPE DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Due to Storm
P A01	0.007	0.37	48.4	48.435	1% AEP, 10 min burst, Storm 2
P A02	0.07	0.97	48.214	48.182	1% AEP, 10 min burst, Storm 3
P A03	0.083	1.15	48.111	48.058	1% AEP, 10 min burst, Storm 5
P A04	0.155	1.4	47.773	47.694	1% AEP, 10 min burst, Storm 7
P A05	0.195	1.76	47.443	47.387	1% AEP, 10 min burst, Storm 7
P A06	0.195	1.77	47.325	47.297	1% AEP, 10 min burst, Storm 7
P OSD1	0.025	0.55	46.994	46.707	1% AEP, 15 min burst, Storm 8
P G01	0.025	1.26	46.536	46.474	1% AEP, 10 min burst, Storm 7
P OSD2	0.022	1.3	46.021	45.952	1% AEP, 45 min burst, Storm 8
P G02	0.021	1.17	45.866	45.861	1% AEP, 45 min burst, Storm 2
P G03	0.001	0.05	47.397	47.398	1% AEP, 10 min burst, Storm 2
P ROOF13	0.011	0.57	47.871	47.863	1% AEP, 5 min burst, Storm 1
P C02	0.025	1.15	47.727	47.694	1% AEP, 10 min burst, Storm 7
P ROOF11	0.008	0.45	48.093	48.088	1% AEP, 5 min burst, Storm 1
P C01	0.012	1.16	47.843	47.813	1% AEP, 5 min burst, Storm 1
P ROOF14	0.008	0.42	48.13	48.126	1% AEP, 5 min burst, Storm 1
P ROOF9	0.01	0.52	47.912	47.905	1% AEP, 5 min burst, Storm 1
P ROOF16	0.008	0.41	47.91	47.905	1% AEP, 5 min burst, Storm 1
P ROOF15	0.007	0.39	47.756	47.753	1% AEP, 5 min burst, Storm 1
P ROOF10	0.008	0.43	48.241	48.237	1% AEP, 5 min burst, Storm 1
P ROOF12	0.006	0.3	48.116	48.114	1% AEP, 5 min burst, Storm 1
P ROOF17	0.021	1.15	47.238	47.321	1% AEP, 5 min burst, Storm 1
P ROOF8	0.012	0.66	48.326	48.319	1% AEP, 5 min burst, Storm 1
Pipe B04	0.053	0.73	48.352	48.34	1% AEP, 10 min burst, Storm 7
P ROOF6	0.007	0.37	48.379	48.377	1% AEP, 10 min burst, Storm 8
P B03	0.044	0.61	48.508	48.464	1% AEP, 10 min burst, Storm 5
P ROOF5	0.003	0.18	48.557	48.556	1% AEP, 10 min burst, Storm 5
P B02	0.033	0.46	48.482	48.476	1% AEP, 10 min burst, Storm 7
P ROOF4	0.007	0.37	48.485	48.483	1% AEP, 5 min burst, Storm 1
P B01	0.022	0.3	48.493	48.49	1% AEP, 15 min burst, Storm 8
P ROOF7	0.006	0.31	48.012	48.005	1% AEP, 5 min burst, Storm 1
P Bend1	0.047	1.8	47.945	47.914	1% AEP, 10 min burst, Storm 1
P ROOF19	0.009	0.46	48.407	48.395	1% AEP, 5 min burst, Storm 1
P E04	0.03	1.6	48.236	48.133	1% AEP, 10 min burst, Storm 5
P ROOF18	0.005	0.5	48.236	48.231	1% AEP, 10 min burst, Storm 8
P D01	0.014	3.31	48.142	47.949	1% AEP, 10 min burst, Storm 8
P ROOF1	0.004	0.42	48.235	48.231	1% AEP, 10 min burst, Storm 8
P ROOF2	0.009	0.48	48.574	48.573	1% AEP, 5 min burst, Storm 1
Pipe E01	0.012	0.63	48.421	48.401	1% AEP, 5 min burst, Storm 1
P E02	0.014	0.74	48.563	48.53	1% AEP, 5 min burst, Storm 1
P E03	0.02	1.07	48.283	48.247	1% AEP, 5 min burst, Storm 1
P ROOF3	0.007	0.57	48.249	48.269	1% AEP, 5 min burst, Storm 1
Pipe F01	0.011	1.37	48.168	48.134	1% AEP, 10 min burst, Storm 7

P F02	0.014	0.76	48.175	48.158	1% AEP, 10 min burst, Storm 5
P Bend2	0.014	0.38	48.042	48.037	1% AEP, 10 min burst, Storm 4

CHANNEL DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Due to Storm

OVERFLOW ROUTE DETAILS

Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm
OF A01	0	0	0.811	0	0	0	0	
OF A02	0	0	0.573	0	0	0	0	
OF A03	0	0	0.811	0	0	0	0	
OF A04	0	0	0.811	0	0	0	0	
OF A05	0	0	0.811	0	0	0	0	
OF OSD1	0.192	0.192	6.737	0.035	0.01	20.99	0.26	1% AEP, 10 min burst, Storm 7
OF BYPASS1	0.006	0.006	1.479	0.019	0.01	1.92	0.3	1% AEP, 5 min burst, Storm 1
OSD SPILL	0	0	1.479	0	0	0	0	
OF3	0.005	0.005	1.479	0.019	0.01	1.92	0.28	1% AEP, 5 min burst, Storm 1
OF BYPASS2	0.006	0.006	1.479	0.021	0.01	4	0.25	1% AEP, 20 min burst, Storm 10
OF G03	0	0	1.479	0	0	0	0	
OF C02	0	0	0.811	0	0	0	0	
OF C01	0	0	0.811	0	0	0	0	
OF B04	0	0	0.811	0	0	0	0	
OF B03	0	0	0.811	0	0	0	0	
OF449701	0	0	0.811	0	0	0	0	
OF B01	0	0	0.807	0	0	0	0	
OF D01	0	0	1.479	0	0	0	0	
OF E01	0	0	1.479	0	0	0	0	
OF E02	0	0	1.479	0	0	0	0	
OF E03	0	0	1.479	0	0	0	0	
OF F01	0	0	1.479	0	0	0	0	
OF F02	0	0	1.479	0	0	0	0	

DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level
Primary	47.28	3015.8	0.217	0.025	0.192
Secondary	47.25	0	0.022	0.022	0

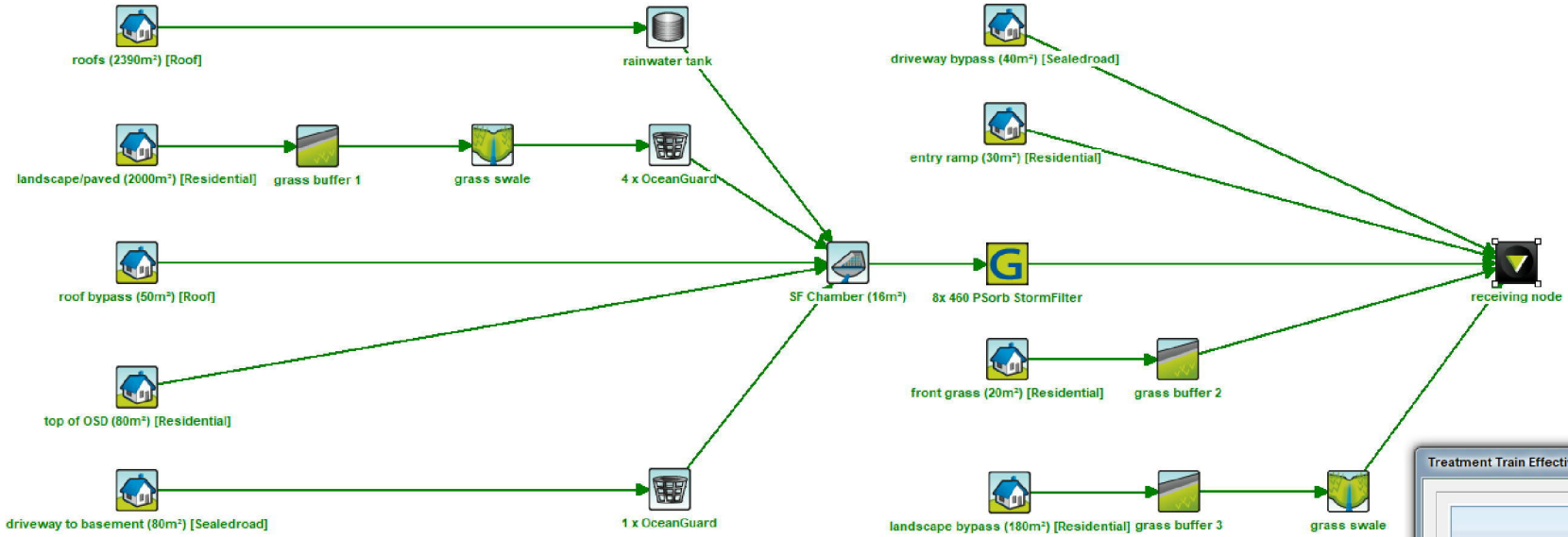
Run Log for FHC_DA design_1% AEP.DRN run at 11:42:06 on 17/4/2019

No water upwelling from any pit.

Freeboard was less than 0.15m at G03, B01, A01

Flows were safe in all overflow routes.

Appendix C – MUSIC results



Treatment Train Effectiveness - receiving node

	Sources	Residual Load	% Reduction
Flow (ML/yr)	2.14	1.52	28.9
Total Suspended Solids (kg/yr)	173	24.6	85.8
Total Phosphorus (kg/yr)	0.439	0.1	77.2
Total Nitrogen (kg/yr)	4.68	1.81	61.3
Gross Pollutants (kg/yr)	63.3	1.16	98.2

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MUSIC-*link* Report

Project Details		Company Details	
Project:	Penrith Retirement Living	**Company:**	Tonkin
Report Export Date:	16/04/2019	**Contact:**	Tim Djaja
Catchment Name:	FHC_DA design	**Address:**	Level 6, 1 James Place; North Sydney NSW 2060
Catchment Area:	0.487ha	**Phone:**	02 8425 7526
Impervious Area*:	69.41%	**Email:**	Tim.Djaja@tonkin.com.au
Rainfall Station:	67113 PENRITH		
Modelling Time-step:	6 Minutes		
Modelling Period:	1/01/1999 - 31/12/2008 11:54:00 PM		
Mean Annual Rainfall:	691mm		
Evapotranspiration:	1158mm		
MUSIC Version:	6.2.0		
MUSIC-link data Version:	6.20		
Study Area:	Penrith		
Scenario:	Penrith Development		

* takes into account area from all source nodes that link to the chosen reporting node, excluding Import Data Nodes

Treatment Train Effectiveness

Node: receiving node	Reduction
Flow	28.9%
TSS	85.8%
TP	77.2%
TN	61.3%
GP	98.2%

Treatment Nodes

Node Type	Number
Rain Water Tank Node	1
Buffer Node	3
Swale Node	2
Sedimentation Basin Node	1
Generic Node	1
GPT Node	2

Source Nodes

Node Type	Number
Urban Source Node	9

Comments

There are some mean pollutant values that aren't met, but these appear to be duplicates. The parameters from the MUSIC-link have not been altered, so this may be a glitch.

The percentage of reuse from the rainwater tank is not met as the site is covered by BASIX. The rainwater tank has been designed by others.

The StormFilter Chamber parameters were provided by the manufacturer (i.e. Ocean Protect).

An exfiltration rate of 3.6 mm/hr within the swales was assumed as they are within deep soil zones and it is unlikely that infiltrated water will re-enter the site's underground drainage system.

Passing Parameters

Node Type	Node Name	Parameter	Min	Max	Actual
GPT	1 x OceanGuard	Hi-flow bypass rate (cum/sec)	None	99	0.02
GPT	4 x OceanGuard	Hi-flow bypass rate (cum/sec)	None	99	0.08
Receiving	receiving node	% Load Reduction	None	None	28.9
Receiving	receiving node	GP % Load Reduction	90	None	98.2
Receiving	receiving node	TN % Load Reduction	45	None	61.3
Receiving	receiving node	TP % Load Reduction	60	None	77.2
Receiving	receiving node	TSS % Load Reduction	85	None	85.8
Sedimentation	SF Chamber (16m²)	High Flow Bypass Out (ML/yr)	None	None	0
Swale	grass swale	Bed slope	0.01	0.05	0.01
Swale	grass swale	Bed slope	0.01	0.05	0.05
Urban	driveway bypass (40m²)	Area Impervious (ha)	None	None	0.004
Urban	driveway bypass (40m²)	Area Impervious (ha)	None	None	0.004
Urban	driveway bypass (40m²)	Area Pervious (ha)	None	None	0
Urban	driveway bypass (40m²)	Area Pervious (ha)	None	None	0
Urban	driveway bypass (40m²)	Total Area (ha)	None	None	0.004
Urban	driveway bypass (40m²)	Total Area (ha)	None	None	0.004
Urban	driveway to basement (80m²)	Area Impervious (ha)	None	None	0.008
Urban	driveway to basement (80m²)	Area Impervious (ha)	None	None	0.008
Urban	driveway to basement (80m²)	Area Pervious (ha)	None	None	0
Urban	driveway to basement (80m²)	Area Pervious (ha)	None	None	0
Urban	driveway to basement (80m²)	Total Area (ha)	None	None	0.008
Urban	driveway to basement (80m²)	Total Area (ha)	None	None	0.008
Urban	entry ramp (30m²)	Area Impervious (ha)	None	None	0.003
Urban	entry ramp (30m²)	Area Impervious (ha)	None	None	0.003
Urban	entry ramp (30m²)	Area Pervious (ha)	None	None	0
Urban	entry ramp (30m²)	Area Pervious (ha)	None	None	0
Urban	entry ramp (30m²)	Total Area (ha)	None	None	0.003
Urban	entry ramp (30m²)	Total Area (ha)	None	None	0.003
Urban	front grass (20m²)	Area Impervious (ha)	None	None	0
Urban	front grass (20m²)	Area Impervious (ha)	None	None	0
Urban	front grass (20m²)	Area Pervious (ha)	None	None	0.002
Urban	front grass (20m²)	Area Pervious (ha)	None	None	0.002
Urban	front grass (20m²)	Total Area (ha)	None	None	0.002
Urban	front grass (20m²)	Total Area (ha)	None	None	0.002
Urban	landscape bypass (180m²)	Area Impervious (ha)	None	None	0.008
Urban	landscape bypass (180m²)	Area Impervious (ha)	None	None	0.008
Urban	landscape bypass (180m²)	Area Pervious (ha)	None	None	0.009
Urban	landscape bypass (180m²)	Area Pervious (ha)	None	None	0.009
Urban	landscape bypass (180m²)	Total Area (ha)	None	None	0.018
Urban	landscape bypass (180m²)	Total Area (ha)	None	None	0.018

Only certain parameters are reported when they pass validation

Node Type	Node Name	Parameter	Min	Max	Actual
Urban	landscape/paved (2000m²)	Area Impervious (ha)	None	None	0.062
Urban	landscape/paved (2000m²)	Area Impervious (ha)	None	None	0.062
Urban	landscape/paved (2000m²)	Area Pervious (ha)	None	None	0.137
Urban	landscape/paved (2000m²)	Area Pervious (ha)	None	None	0.137
Urban	landscape/paved (2000m²)	Total Area (ha)	None	None	0.2
Urban	landscape/paved (2000m²)	Total Area (ha)	None	None	0.2
Urban	roof bypass (50m²)	Area Impervious (ha)	None	None	0.005
Urban	roof bypass (50m²)	Area Pervious (ha)	None	None	0
Urban	roof bypass (50m²)	Total Area (ha)	None	None	0.005
Urban	roofs (2390m²)	Area Impervious (ha)	None	None	0.239
Urban	roofs (2390m²)	Area Pervious (ha)	None	None	0
Urban	roofs (2390m²)	Total Area (ha)	None	None	0.239
Urban	top of OSD (80m²)	Area Impervious (ha)	None	None	0.008
Urban	top of OSD (80m²)	Area Impervious (ha)	None	None	0.008
Urban	top of OSD (80m²)	Area Pervious (ha)	None	None	0
Urban	top of OSD (80m²)	Area Pervious (ha)	None	None	0
Urban	top of OSD (80m²)	Total Area (ha)	None	None	0.008
Urban	top of OSD (80m²)	Total Area (ha)	None	None	0.008

Only certain parameters are reported when they pass validation

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Failing Parameters

Node Type	Node Name	Parameter	Min	Max	Actual
Rain	rainwater tank	% Reuse Demand Met	80	None	56.00
Sedimentation	SF Chamber (16m)	Notional Detention Time (hrs)	8	12	0.483
Sedimentation	SF Chamber (16m)	Total Nitrogen - k (m/yr)	500	500	1
Sedimentation	SF Chamber (16m)	Total Phosphorus - k (m/yr)	6000	6000	1
Sedimentation	SF Chamber (16m)	Total Suspended Solids - k (m/yr)	8000	8000	1
Swale	grass swale	Exfiltration Rate (mm/hr)	0	0	3.6
Swale	grass swale	Exfiltration Rate (mm/hr)	0	0	3.6
Urban	driveway bypass (40m)	Stormflow Total Suspended Solids Mean (log mg/L)	3	3	2.43
Urban	driveway to basement (80m)	Stormflow Total Suspended Solids Mean (log mg/L)	3	3	2.43
Urban	entry ramp (30m)	Baseflow Total Nitrogen Mean (log mg/L)	-0.05	-0.05	0.11
Urban	entry ramp (30m)	Baseflow Total Phosphorus Mean (log mg/L)	-1.22	-1.22	-0.85
Urban	entry ramp (30m)	Baseflow Total Suspended Solids Mean (log mg/L)	1.15	1.15	1.2
Urban	entry ramp (30m)	Stormflow Total Phosphorus Mean (log mg/L)	-0.66	-0.66	-0.6
Urban	entry ramp (30m)	Stormflow Total Suspended Solids Mean (log mg/L)	1.95	1.95	2.15
Urban	front grass (20m)	Baseflow Total Nitrogen Mean (log mg/L)	-0.05	-0.05	0.11
Urban	front grass (20m)	Baseflow Total Phosphorus Mean (log mg/L)	-1.22	-1.22	-0.85
Urban	front grass (20m)	Baseflow Total Suspended Solids Mean (log mg/L)	1.15	1.15	1.2
Urban	front grass (20m)	Stormflow Total Phosphorus Mean (log mg/L)	-0.66	-0.66	-0.6
Urban	front grass (20m)	Stormflow Total Suspended Solids Mean (log mg/L)	1.95	1.95	2.15
Urban	landscape bypass (180m)	Baseflow Total Nitrogen Mean (log mg/L)	-0.05	-0.05	0.11
Urban	landscape bypass (180m)	Baseflow Total Phosphorus Mean (log mg/L)	-1.22	-1.22	-0.85
Urban	landscape bypass (180m)	Baseflow Total Suspended Solids Mean (log mg/L)	1.15	1.15	1.2
Urban	landscape bypass (180m)	Stormflow Total Phosphorus Mean (log mg/L)	-0.66	-0.66	-0.6
Urban	landscape bypass (180m)	Stormflow Total Suspended Solids Mean (log mg/L)	1.95	1.95	2.15
Urban	landscape/paved (2000m)	Baseflow Total Nitrogen Mean (log mg/L)	-0.05	-0.05	0.11
Urban	landscape/paved (2000m)	Baseflow Total Phosphorus Mean (log mg/L)	-1.22	-1.22	-0.85
Urban	landscape/paved (2000m)	Baseflow Total Suspended Solids Mean (log mg/L)	1.15	1.15	1.2
Urban	landscape/paved (2000m)	Stormflow Total Phosphorus Mean (log mg/L)	-0.66	-0.66	-0.6
Urban	landscape/paved (2000m)	Stormflow Total Suspended Solids Mean (log mg/L)	1.95	1.95	2.15
Urban	top of OSD (80m)	Baseflow Total Nitrogen Mean (log mg/L)	-0.05	-0.05	0.11
Urban	top of OSD (80m)	Baseflow Total Phosphorus Mean (log mg/L)	-1.22	-1.22	-0.85
Urban	top of OSD (80m)	Baseflow Total Suspended Solids Mean (log mg/L)	1.15	1.15	1.2
Urban	top of OSD (80m)	Stormflow Total Phosphorus Mean (log mg/L)	-0.66	-0.66	-0.6
Urban	top of OSD (80m)	Stormflow Total Suspended Solids Mean (log mg/L)	1.95	1.95	2.15

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