

# South View Farmhouse, Trowbridge

## Drainage Strategy

For: Coulston Estates Ltd

Date: 10/12/2025

File Ref: 19682-TUM-RP-XXX-0001



## Document Control

|              |                                                                                                                                                                                                                                       |
|--------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Issued by    | Tumu Consulting Limited<br>Castlemead, Lower Castle Street<br>Bristol BS1 3AG<br><a href="mailto:enquiries@tumuconsulting.com">enquiries@tumuconsulting.com</a><br><a href="http://www.tumuconsulting.com">www.tumuconsulting.com</a> |
| Client       | Coulston Estates Ltd                                                                                                                                                                                                                  |
| Project name | South View Farmhouse, Trowbridge                                                                                                                                                                                                      |
| Report title | Drainage Strategy                                                                                                                                                                                                                     |
| Reference    | 19682-TUM-RP-XXX-0001                                                                                                                                                                                                                 |
| Issue date   | 10/12/2025                                                                                                                                                                                                                            |

## Revision History

| Rev | Date     | Details                           | Author | Checked by |
|-----|----------|-----------------------------------|--------|------------|
| A   | 10.12.25 | First Issue                       | RP     | BF         |
| B   | 14.01.26 | Updated with new plan layout      | RP     | BF         |
| C   | 02.06.26 | Updated with New Site Plan        | JJ     | RP         |
| D   | 05.08.26 | Updated with new drainage drawing | RP     | BF         |
|     |          |                                   |        |            |
|     |          |                                   |        |            |

Tumu Consulting Limited has prepared this report in accordance with the instructions of the Coulston Estates Ltd for their sole and specific use. Any third parties who may use the information contained herein do so at their own risk.

In the production of this report, Tumu Consulting Limited has relied upon information obtained and provided by others. The accuracy and completeness of this information cannot be guaranteed by Tumu Consulting Limited however all reasonable measures have been implemented to ensure that the data/information is accurate and that the observations made regarding the information are precise. Tumu Consulting Limited cannot be made liable for any omissions or errors or for any losses/consequential losses following decisions made based on this report's findings.



## Executive Summary

Tumu Consulting Ltd have been appointed by Coulston Estates Ltd to undertake a Drainage Strategy for a proposed development at South View Farmhouse, Trowbridge.

## Contents

|     |                                               |    |
|-----|-----------------------------------------------|----|
| 1   | Introduction.....                             | 2  |
| 1.1 | Site Location .....                           | 2  |
| 1.2 | Existing Site Usage .....                     | 2  |
| 1.3 | Topography.....                               | 2  |
| 1.4 | Geology & Hydrogeology .....                  | 3  |
| 1.5 | Hydrology.....                                | 3  |
| 1.6 | Existing Drainage .....                       | 3  |
| 1.7 | Existing Discharge Rates .....                | 4  |
| 1.8 | Flood Risk.....                               | 4  |
| 2   | Development Proposals.....                    | 5  |
| 2.1 | Description of the Proposed Works.....        | 5  |
| 2.2 | Design Life.....                              | 5  |
| 3   | Surface Water Drainage Strategy .....         | 6  |
| 3.1 | Surface Water Discharge Hierarchy .....       | 6  |
| 3.2 | Surface Water Drainage Arrangement .....      | 6  |
| 3.3 | Climate Change.....                           | 7  |
| 3.4 | Discharge Rates.....                          | 7  |
| 3.5 | Calculations.....                             | 8  |
| 3.6 | Water Quality.....                            | 8  |
| 3.7 | Flood Exceedance .....                        | 8  |
| 3.8 | Maintenance Arrangements .....                | 8  |
| 4   | Foul Water Drainage Strategy .....            | 12 |
| 5   | Conclusion .....                              | 12 |
|     | Appendix A – Topographic Survey .....         | 13 |
|     | Appendix B – Site Plan .....                  | 14 |
|     | Appendix C – Proposed Drainage Strategy ..... | 15 |
|     | Appendix D – Standard Drainage Details .....  | 16 |
|     | Appendix E – Causeway FLOW Calculations ..... | 17 |

## Figures

|            |                                                                                             |   |
|------------|---------------------------------------------------------------------------------------------|---|
| Figure 1-1 | Site Location Plan .....                                                                    | 2 |
| Figure 1-2 | Wessex Water Asset Maps .....                                                               | 3 |
| Figure 1-3 | EA Flood Map for Planning .....                                                             | 4 |
| Figure 1-4 | EA Surface Water Flood Risk – 0.1% AEP .....                                                | 5 |
| Figure 3-1 | Avon Bristol and North Somerset Streams Management Catchment Peak Rainfall Allowances ..... | 7 |

## Tables

|           |                                                                                                  |    |
|-----------|--------------------------------------------------------------------------------------------------|----|
| Table 1-1 | Existing Brownfield Discharge Rates .....                                                        | 4  |
| Table 3-1 | Pre and Post Development Discharge Rates from the Development .....                              | 7  |
| Table 3-2 | CIRIA 753 Table 26.2 Pollution Hazard Indices for a Low Traffic Road .....                       | 8  |
| Table 3-3 | CIRIA 753 Table 26.3 Mitigation Indices for a Permeable Surfacing .....                          | 8  |
| Table 3-4 | Operation and Maintenance Requirements for Inlets, Outlets, Controls, and Inspection Chambers. . | 9  |
| Table 3-5 | Operation and Maintenance Requirements for Geocellular Attenuation Tanks .....                   | 9  |
| Table 3-6 | Operation and Maintenance Requirements for Permeable Surfacing .....                             | 10 |
| Table 3-7 | Operation and Maintenance Requirements for Green Roofs .....                                     | 11 |

# 1 Introduction

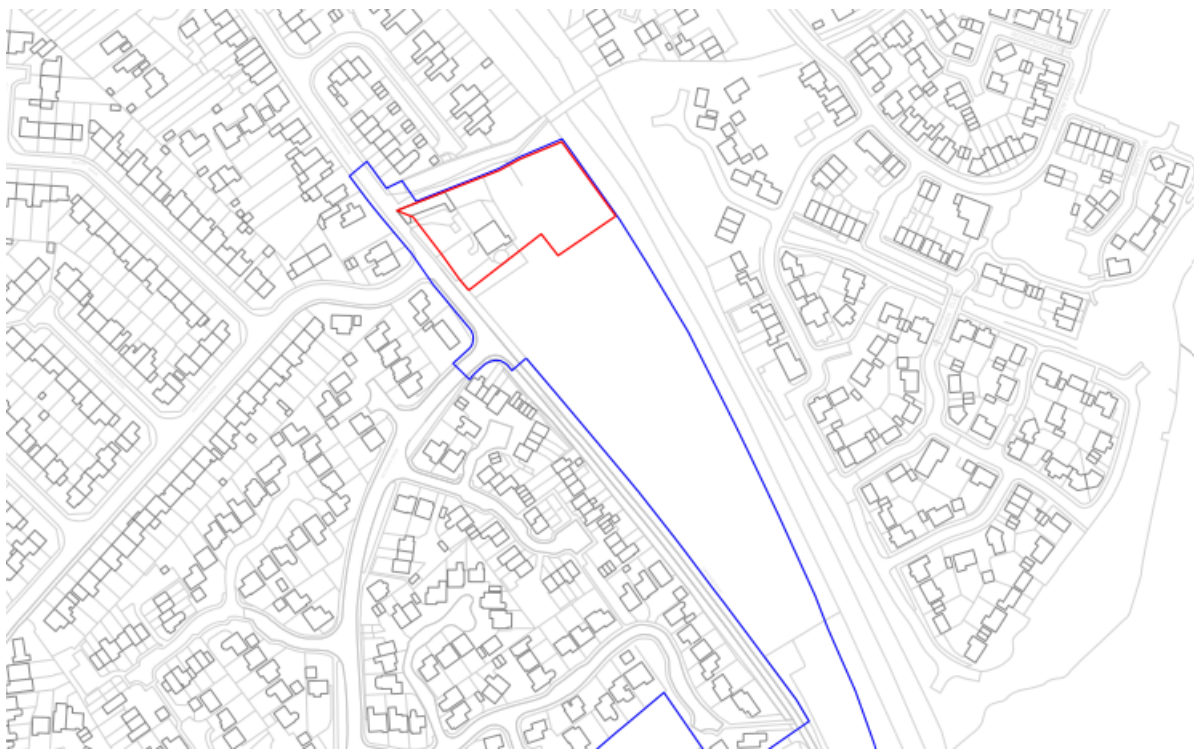
Tumu Consulting Ltd have been appointed by Coulston Estates Ltd to undertake a Drainage Strategy for a proposed development South View Farmhouse, Trowbridge. The report will support a planning application, it is proposed to redevelop the existing site with a renovation and extension of the farmhouse into a dwelling (Class C3) and a new nursery (Class E) with supporting infrastructure.

## 1.1 Site Location

The site has an area of approximately 0.42ha and is located to the southeast of Trowbridge at approximate grid reference 385950, 156800, as shown in Figure 1-1. The site is bounded by the Cardiff-Portsmouth railway line to the east, Drynham Lane to the west, an arable field associated with Southview Farmhouse to the south and existing residential areas to the north and west.

Land to the south of the site has secured planning permission under application reference 19/11459/OUT for the erection of up to 261-dwellings and erection of multi-use community facility.

Access to the site is via Drynham Lane to the north and Bradley Road to the west.



**Figure 1-1** Site Location Plan

## 1.2 Existing Site Usage

The site currently comprises South View Farmhouse and associated disused agricultural barns, with a historical agricultural usage.

## 1.3 Topography

A topographic survey of the site has been undertaken by Anthony Brookes Surveys Ltd in October 2018. There have been no significant changes to levels since this time. The survey was undertaken to Ordnance Survey Benchmark datum and grid.

The site falls from 47.0m AOD in the north to 45m AOD in the south. The topographic survey is provided as Appendix A.

## 1.4 Geology & Hydrogeology

The British Geological Survey mapping indicates that the site is underlain by bedrock geology of Oxford Clay Formation – mudstone. There are no superficial deposits shown to be present beneath the site.

The site is not shown to be located within a groundwater Source Protection Zone (SPZ).

## 1.5 Hydrology

There are no watercourses within the site boundary. The closest watercourse, the Drynham Brook, which is a tributary of the River Biss, is located 300m to the south of the site. This is classified as an ordinary watercourse and is therefore the responsibility of the LLFA.

## 1.6 Existing Drainage

Wessex Water sewer records are provided in the figure below, with these showing that there are existing surface water and foul water public sewers within the vicinity of the site.

The existing farmhouse is fully serviced, and the topographical survey indicates that there is existing foul drainage which runs approximately 300m south of the site across the fields to discharge into the public foul sewer system at MH 1501. The existing foul sewer is 150mm diameter up to the point where it connects to the public sewer system, where it increases to 1050mm diameter. sewer records appear to indicate a connection from the site into MH9803 to the north of the site. Given the age of the existing buildings on site it is likely that there is also some existing surface water discharged connected to this sewer.

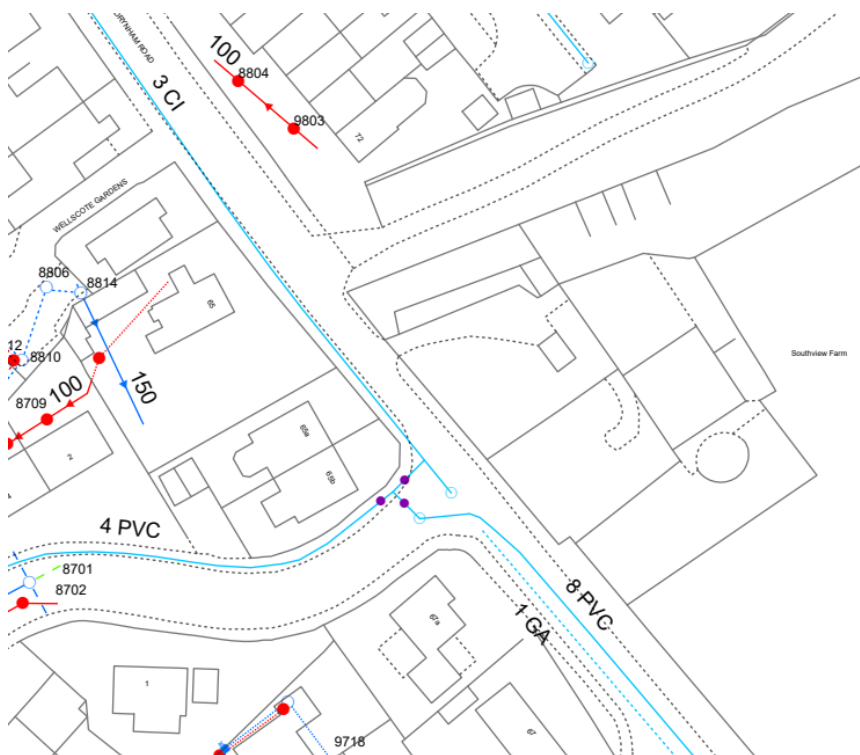


Figure 1-2 Wessex Water Asset Maps

## 1.7 Existing Discharge Rates

The existing site is primarily brownfield therefore the Modified Rational Method has been used to calculate the pre-development surface water rate. The average rainfall intensity has been derived from a 15-minute storm for each return period, using FEH22 data, which is appropriate given the time of concentration that would be anticipated for the small site area. The parameters used in the calculation and results are summarised in Table 1-1.

| Return Period (yr) | Rainfall Intensity, $R_i$ (mm/hr) | Area, A (ha) | Brownfield Discharge Rate (l/s) |
|--------------------|-----------------------------------|--------------|---------------------------------|
| $Q_2$              | 31.36                             | 0.073        | 6.36                            |
| $Q_{30}$           | 76.08                             | 0.073        | 15.44                           |
| $Q_{100}$          | 97.04                             | 0.073        | 16.69                           |

**Table 1-1 Existing Brownfield Discharge Rates**

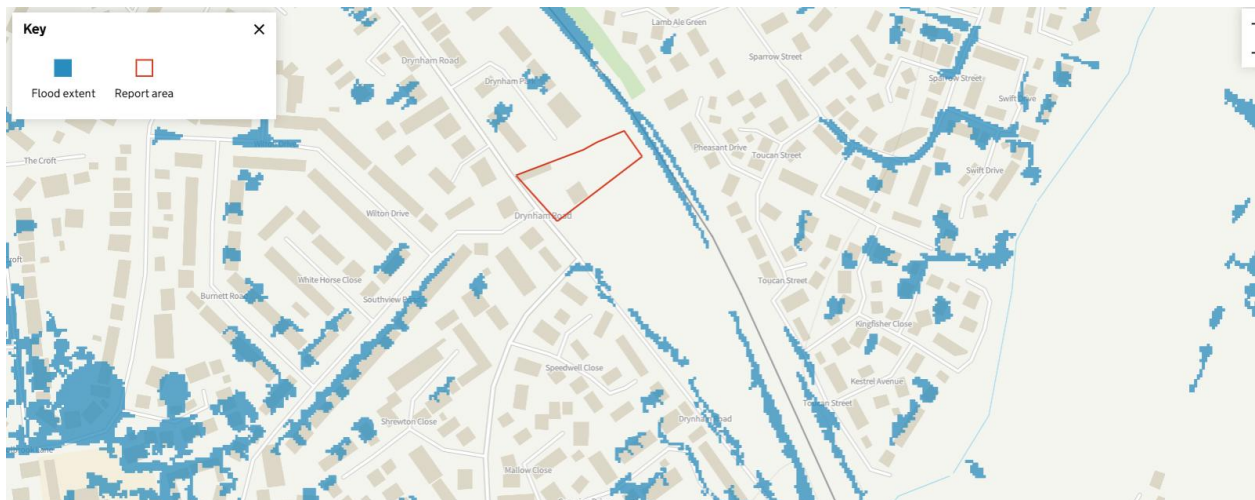
## 1.8 Flood Risk

As the site is under 1.0ha and not within a flood zone, a flood risk assessment is not required for this development. However, the report will briefly describe any flood risk to the property. Environment Agency (EA) desktop sources have been used to assess the risk for the development.



**Figure 1-3 EA Flood Map for Planning**

Figure 1-3 shows that the site is located within Flood Zone 1, which is the lowest classification of fluvial and tidal flood risk, corresponding to an annual risk of <0.1% AEP.



**Figure 1-4 EA Surface Water Flood Risk – 0.1% AEP**

Figure 1-4 shows that the site is not located within an area at risk of in the 0.1% AEP pluvial event. It is therefore considered that the site is at very low risk of flooding from surface water.

## 2 Development Proposals

### 2.1 Description of the Proposed Works

It is proposed to develop the existing brownfield site with the renovation and extension of the existing Farmhouse to the south of the site, as well as provide a new nursery to the north of the site as well as all associated infrastructure and engineering works. Refer to Appendix B for the Landscape Plan by Greenhalgh Landscape Architecture ref. 259\_GLA\_XX\_XX\_DR\_L\_1001\_PA.

### 2.2 Design Life

As the use of the site is mixed, the residential usage has an anticipated design life of 100 years, which has been adopted for the surface water drainage design.

### 3 Surface Water Drainage Strategy

The surface water drainage strategy has been developed in accordance with the relevant design standard and guidance, including but not limited to; CIRIA C753 The SuDS Manual, The Approved Documents: Building Regulations 2010 Part H: Drainage and Waste Disposal, and the Non-Statutory Technical Standards for SuDS (NTSS).

The NTSS states that for a previously developed site, the rate of discharge should never exceed the rate pre redevelopment. The NTSS also states that flooding should not occur to any part of the site in the 1 in 30 year event, and no flooding to buildings or utility plant should occur in the 1 in 100 year event.

Refer to Appendix C for the Proposed Drainage Strategy, and Appendix D for the Standard Drainage Details.

#### 3.1 Surface Water Discharge Hierarchy

In line with the surface water drainage discharge hierarchy, consideration should be given to discharge in order of priority to: Water re-use, Soakaways/Infiltrating Drainage system, Watercourse, Public Surface Water Sewer then finally, Public Combined Sewer.

Water butts are to be provided to both the nursery and the dwelling. However, these will feature a high level overflow into the surface water drainage network. As it can't be guaranteed that the water butts will be empty before every rainfall event.

Infiltration testing was undertaken as part of the Flood Risk Assessment (FRA) for the site to the south of the site (19/11459/OUT). This testing was undertaken to BRE 365 and concluded that infiltration is not a viable means of disposal. Given that BGS data indicates that the geology does not vary between this site and the application to the south, infiltration has been discounted.

The closest watercourse is the Drynham Brook which is over 300m from the site and not within the application boundary. The previously consented application for the site, PL/2023/11008, proposed to discharge into the existing ditch to the south west of the development. However, it is understood, this has now been infilled.

To the immediate south of the site, a Redrow Homes Ltd residential development is proposed. It has been agreed between the client, and Redrow Homes Ltd that a surface water spur is to be provided for the development at a discharge rate of 3.8l/s.

#### 3.2 Surface Water Drainage Arrangement

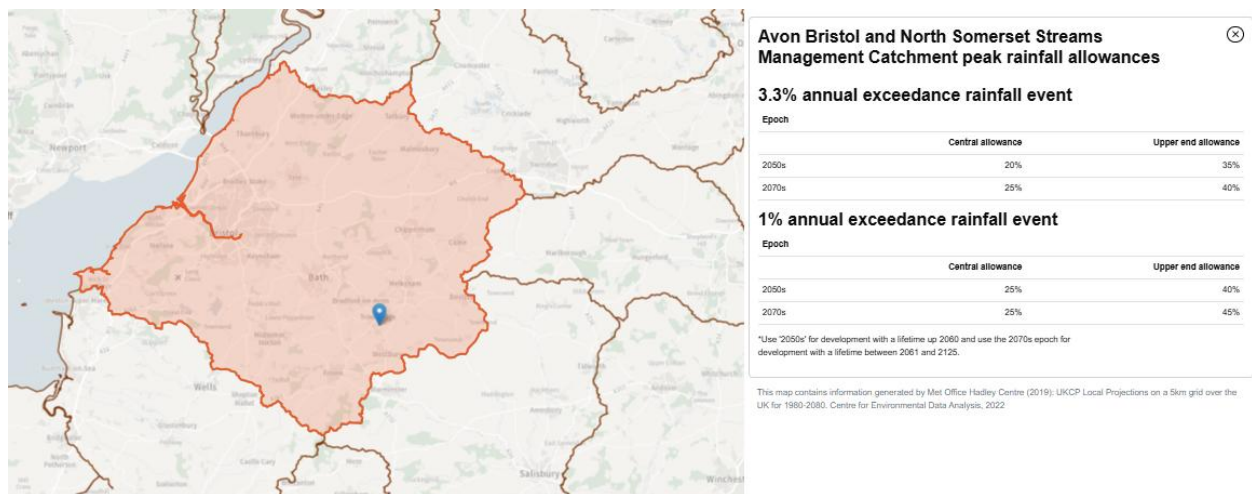
The development is accessed from Drynham Road to the west of the site. The access roads and car parks of both the farmhouse and the nursery will be permeable surfaced, with a clean stone sub-base suitable for attenuation. Where feasible, rainwater pipes from both roofs will discharge onto the surface, or into the sub base of the system. Flows from each permeable paving will be restricted by a 40mm orifice control chamber, downstream of the permeable paving, to surcharge the sub base in rainfall events, and limit the flow downstream to the wider system.

Sections of the nursery roof which cannot discharge through the permeable paving sub abse will discharge to a hydrobrake chamber to the east of the site. In heavier rainfall events, the system will surcharge into a geocellular attenuation tank. Rates will be limited to 3.8l/s. It is not possible to provide above ground attenuation, as the landscaped area to the east is used as a nursery play space.

A green roof is also proposed to the extension of the farmhouse roof. This will discharge to the private surface water drainage system serving the plot and allow for interception of the roofs runoff. Refer to Appendix C for the Proposed Drainage Strategy Layout and Appendix D for the Standard Drainage Details.

### 3.3 Climate Change

As a lifespan of 100 years is being considered, the end of life can be estimated as 2125. According to government guidance, a development with a lifespan after 2100 should use the Upper End allowance for a 2070's epoch when considering peak rainfall climate change allowances. For the Avon Bristol and North Somerset Streams Management Catchment, the climate change allowance to consider should be 40% for the 3.3%, and 45% for the 1% AEP events as shown in Figure 4-1 below.



**Figure 3-1 Avon Bristol and North Somerset Streams Management Catchment Peak Rainfall Allowances**

### 3.4 Discharge Rates

As part of the previously consented application, PL/2023/11008, a 3.8 l/s discharge rate from the development was deemed acceptable. The latest development continues to propose at this discharge rate.

| Rainfall Event       | Pre-Development Discharge Rate (l/s) | Post-Development Discharge Rate (l/s) | Betterment (%) |
|----------------------|--------------------------------------|---------------------------------------|----------------|
| Q <sub>2</sub>       | 6.36                                 | 3.8                                   | 40             |
| Q <sub>30+40%</sub>  | 15.44                                | 3.8                                   | 75             |
| Q <sub>100+45%</sub> | 16.69                                | 3.8                                   | 77             |

**Table 3-1 Pre and Post Development Discharge Rates from the Development**

Table 4-1 above shows a reduction in discharge rate as a result of the development, in the order of a minimum of 40% in the 2 year rainfall event. The betterment increases to 77% in the 100 year rainfall event, additionally considering climate change.

The Redrow Homes Ltd parcel in which the surface water is discharging to is limited to a rate agreed with the LLFA. The additional flow the Southview Farm development will be accommodated within the Redrow Homes Ltd surface water drainage system. The peak flow discharged from the Redrow development will be the limit of discharge for the Redrow development in addition to the 3.8l/s from the Southview Farm.

### 3.5 Calculations

A network model of the proposed surface water drainage system was developed using Causeway FLOW software. The Cv value has been set to 1.0 for the analysis. The calculations, which can be found in Appendix E, demonstrate that there is no flooding in the system for the 1.0% AEP rainfall event with a 45% allowance for climate change.

### 3.6 Water Quality

The CIRIA 753 SuDS Manual has been consulted to ensure that the SuDS provided successfully mitigate the anticipated pollutants, which may arise from the proposed land use. Table 26.2 of CIRIA 753 outlines the pollution hazard indices for the anticipated land use type. These are outlined below in Table 4-2.

| Land Use         | Pollution Hazard Level | TSS | Metals | Hydrocarbons |
|------------------|------------------------|-----|--------|--------------|
| Low Traffic Road | Low                    | 0.5 | 0.4    | 0.4          |

**Table 3-2 CIRIA 753 Table 26.2 Pollution Hazard Indices for a Low Traffic Road**

Table 26.3 of CIRIA 753 outlines the mitigation indices for SuDS which can mitigate the pollution indices above. The mitigation indices for permeable surfacing have been outlined below in Table 4-3.

| SuDS Component      | TSS | Metals | Hydrocarbons |
|---------------------|-----|--------|--------------|
| Permeable Surfacing | 0.7 | 0.6    | 0.7          |

**Table 3-3 CIRIA 753 Table 26.3 Mitigation Indices for a Permeable Surfacing**

As the mitigation indices are equal or greater than the pollution hazard indices, the permeable surfacing will successfully mitigate against the expected pollutants.

In addition to this, the extended farmhouse roof is proposed as a green roof. This will delay water discharging to the wider surface water network, and promote evapotranspiration, while providing biodiversity and amenity benefits.

### 3.7 Flood Exceedance

The calculations provided show no flooding in the 1% AEP event with a 45% allowance for climate change. However, in the rare event this is exceeded or the drainage system becomes blocked and cannot function, water is to be directed to the eastern boundary away from the nursery and farmhouse, as well as the Redrow Homes Ltd plots to the southern boundary. The nursery and farmhouse will be raised a minimum of 150mm from external levels, therefore no structure or utility will be affected by an exceedance event. A 500mm bund will retain any exceedance flows, which provides approximately 22m<sup>3</sup> of exceedance storage across a 91m<sup>2</sup> area.

### 3.8 Maintenance Arrangements

Drainage elements which serve the farmhouse only, the maintenance responsibility lies with the plot owner. Shared drainage features and serving the nursery will remain private and a maintenance company will be appointed by the client to undertake drainage maintenance.

Operation and maintenance will be undertaken in accordance with the recommendations outlined in the SuDS Manual (CIRIA C753), provided in Tables 4-4, 4-5, 4-6 and 4-7.

| Maintenance schedule | Required action                                                                                                                          | Typical frequency |
|----------------------|------------------------------------------------------------------------------------------------------------------------------------------|-------------------|
| Regular Maintenance  | Inspect surface structures, removing obstructions and silt as necessary. Check there is no physical damage.                              | Monthly           |
|                      | Remove cover and inspect, ensuring water is flowing freely and that the exit route for water is unobstructed. Remove any debris and silt | Annually          |
|                      | Undertake inspection after leaf fall in autumn.                                                                                          |                   |
|                      | Jet the pipes leading from overflow structures and check water is going through the overflow                                             | Annually          |
| Remedial Actions     | Repair physical damage                                                                                                                   | As required       |

**Table 3-4 Operation and Maintenance Requirements for Inlets, Outlets, Controls, and Inspection Chambers.**

| Maintenance schedule | Required action                                                                                                                                                                                        | Typical frequency                   |
|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|
| Regular Maintenance  | Inspect and identify any areas that are not operating correctly. If required, take remedial action.                                                                                                    | Monthly for 3 months, then annually |
|                      | Remove debris from the catchment surface (where it may cause risks to performance)                                                                                                                     | Monthly                             |
|                      | For systems where rainfall infiltrates into the tank from above, check surface of filter for blockage by sediment, algae, or other matter; remove and replace surface infiltration medium as necessary | Annually                            |
| Remedial Actions     | Remove sediment from pre-treatment structures and/ or internal forebays                                                                                                                                | Annually, or as required            |
| Monitoring           | Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed                                                                             | Annually                            |
|                      | Survey inside of tank for sediment build-up and remove if necessary                                                                                                                                    | Every 5 years or as required        |

**Table 3-5 Operation and Maintenance Requirements for Geocellular Attenuation Tanks**

| Maintenance schedule   | Required action                                                                                                                                                                       | Typical frequency                                                                                                                                                                                                                                                                                                            |
|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Regular inspections    | Brushing and vacuuming (standard cosmetic sweep over whole surface)                                                                                                                   | Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturers recommendations – pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment. |
| Occasional Maintenance | Removal of weeds                                                                                                                                                                      | As required – once per year on less frequently used pavements.                                                                                                                                                                                                                                                               |
| Remedial action        | Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material. | As required                                                                                                                                                                                                                                                                                                                  |
|                        | Rehabilitation of surface and upper substructure by remedial sweeping                                                                                                                 | Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)                                                                                                                                                                                                                     |
| Monitoring             | Initial inspection                                                                                                                                                                    | Monthly for three months after installation                                                                                                                                                                                                                                                                                  |
|                        | Inspect for evidence of poor operation and/or weed growth – if required, take remedial action                                                                                         | Three-monthly, 48h after large storms in first six months                                                                                                                                                                                                                                                                    |
|                        | Inspect silt accumulation rates and establish appropriate brushing frequencies                                                                                                        | Annually                                                                                                                                                                                                                                                                                                                     |
|                        | Monitor inspection chambers                                                                                                                                                           | Annually                                                                                                                                                                                                                                                                                                                     |

**Table 3-6**      **Operation and Maintenance Requirements for Permeable Surfacing**

| Maintenance schedule | Required action                                                                                                                                                                           | Typical frequency                                        |
|----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|
| Regular inspections  | Inspect all components including soil substrate, vegetation, drains, irrigation systems (if applicable), membranes and roof structures                                                    | Annually and after severe storms                         |
|                      | Inspect soil substrate for evidence of erosion channels and identify any sediment sources                                                                                                 | Annually and after severe storms                         |
|                      | Inspect drain inlets to ensure unrestricted runoff from the drainage layer to the conveyance or roof drain system                                                                         | Annually and after severe storms                         |
|                      | Inspect underside of roof for evidence of leakage                                                                                                                                         | Annually and after severe storms                         |
| Regular Maintenance  | Remove debris and litter to prevent clogging of inlet drains and interference with plant growth                                                                                           | Six monthly and annually or as required                  |
|                      | During establishment (i.e year one), replace dead plants as required                                                                                                                      | Monthly (but usually responsibility of the manufacturer) |
|                      | Post establishment, replace dead plants                                                                                                                                                   | Annually (in autumn)                                     |
|                      | Remove fallen leaves and debris from deciduous plant foliage                                                                                                                              | Six monthly or as required                               |
|                      | Remove nuisance and invasive vegetation                                                                                                                                                   | Six monthly or as required                               |
|                      | Mow grasses, prune shrubs and manage other planting – clippings should be removed and not allowed to accumulate                                                                           | Six monthly or as required                               |
| Remedial maintenance | If erosion channels are evident, these should be stabilised with extra soil substrate similar to the original material, and sources of erosion damage should be identified and controlled | As required                                              |
|                      | If drain inlet has settled, cracked or moved, investigate and repair as appropriate                                                                                                       | As required                                              |

**Table 3-7**      **Operation and Maintenance Requirements for Green Roofs**

## 4 Foul Water Drainage Strategy

The foul water drainage strategy has been designed in accordance with The Approved Documents: Building Regulations 2010 Part H: Drainage and Waste Disposal, and the Appendix C of the Design and Construction Guidance (DCG) for foul and surface water sewers offered for adoption . It is proposed to drain foul water from the nursery and dwelling into a shared system, which ultimately discharges to the east of the development. Redrow Homes Ltd will be providing a foul spur to accommodate the flows from the development.

## 5 Conclusion

- The site is at a low risk of all types of flooding.
- The access roads and car park will be permeable surfaced with a clean stone sub base, which will attenuate surface water runoff. Flow will be locally limited by an orifice control chamber before discharging to the wider system. Surface water ultimately discharges east and is finally limited by a flow control device. Geocellular storage has also been provided for surcharging flows from the hydrobrake. Redrow Homes Ltd will provide a surface water spurs for the development to discharge at 3.8l/s.
- The permeable paving proposed, has higher SuDS mitigation indices than the pollution hazard indices anticipated from the proposed land use type. The farmhouse extension will also feature a green roof.
- The site will not flood in the 1% AEP event with a 45% allowance for climate change.
- Flood exceedance flows will discharge east, and not affect and structure or utility.
- Foul sewerage will discharge east to a spur provided by Redrow Homes Ltd.
- Plot drainage for the farmhouse will remain private and the responsibility of the owner of the plot. Drainage serving the nursery and farmhouse will remain private and will be the responsibility of a management company as selected by the client.

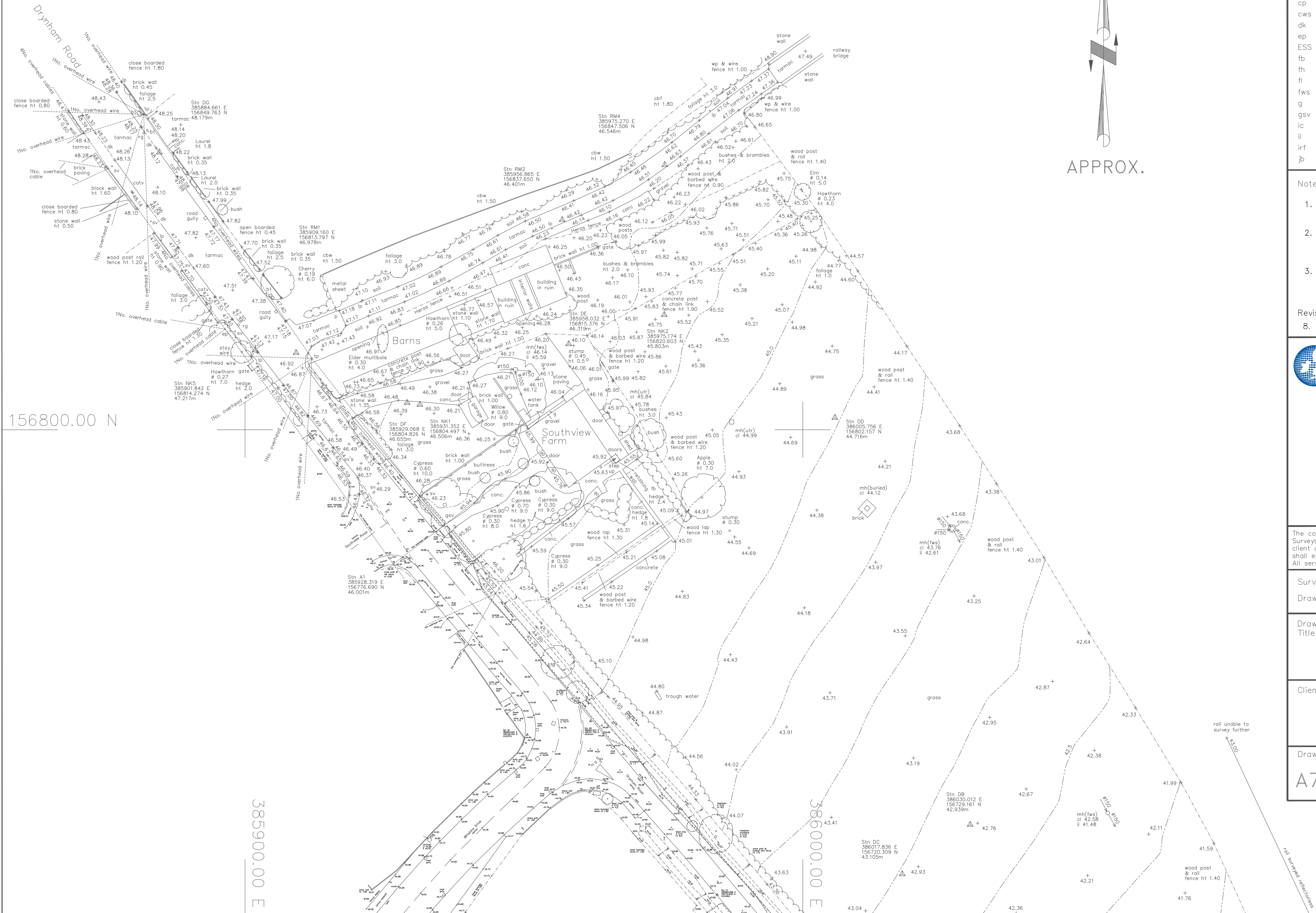
It is concluded that the development can be undertaken in a sustainable manner without increasing the flood risk to the proposed development or to existing properties/systems.

## Appendix A – Topographic Survey

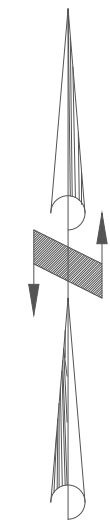
A blank coordinate plane with a horizontal x-axis and a vertical y-axis intersecting at the origin. The axes are represented by thin black lines.

7 No. Over

385900.00 E



APPROX.



|      |                      |       |                    |
|------|----------------------|-------|--------------------|
| bb   | belisha beacon       | ko    | kerb outlet        |
| bl   | bollard              | lp    | lamp post          |
| brw  | brick ret. wall      | mh    | manhole            |
| bs   | bus stop             | mk    | marker post        |
| bt   | telecoms cover       | nb    | nameplate (road)   |
| bw   | brick wall           | ofb   | open boarded fence |
| cstv | cable TV cover       | p     | post               |
| cbf  | closeboarded fence   | pb    | post box           |
| cbrw | conc block ret. wall | ret.  | retaining wall     |
| cbw  | conc block wall      | re    | rodding eye        |
| cl   | cover level          | rg    | road gully         |
| clf  | chainlink fence      | rs    | road sign          |
| conc | concrete             | rwp   | rainwater pipe     |
| cp   | concrete post        | sp    | signpost           |
| cws  | combined sewer       | srw   | stone ret. wall    |
| dk   | drop kerb            | sv    | stop valve         |
| ep   | electricity pole     | svp   | soil vent pipe     |
| ESS  | Elec. Sub-Station    | sw    | stone wall         |
| fb   | flower bed           | s/w   | stay wire          |
| fh   | fire hydrant         | sws   | storm water sewer  |
| fl   | floor level          | tcb   | telephone callbox  |
| fws  | foul water sewer     | tl    | traffic light      |
| g    | gully                | tp    | telegraph pole     |
| gsv  | gas valve            | utr   | unable to raise    |
| ic   | inspection cover     | vp    | vent pipe          |
| il   | invert level         | w'lap | woodlap fence      |
| irf  | iron railing fence   | wm    | water meter        |
| jb   | junction box         | wp    | wood post          |

1. This survey has been computed and drawn about the Ordnance Survey National Grid.
2. All levels are in metres and relate to the mean of the nearest five Ordnance Survey active GPS stations.
3. This survey was measured for a scale of 1:500, any subsequent enlargements should be verified on site.

8. Public cyclepath added October 2018.



Unit 2 Thornbury Office Park  
Midland Way  
Thornbury  
Bristol  
BS35 2BS  
TEL: (01454) 419 133  
FAX: (01454) 501 711  
e-mail: [Info@anthonybrookes.com](mailto:Info@anthonybrookes.com)  
web: [www.anthonybrookes.com](http://www.anthonybrookes.com)



The copyright in the plans remain vested in Anthony Brookes Surveys Ltd who will grant an irrevocable licence for use by the client upon receipt of full payment. No liability for accuracy shall extend beyond the specified scale of graphical mapping. All services and critical dimensions should be field verified.

|          |            |      |          |
|----------|------------|------|----------|
| Surveyed | R McArdell | Date | Oct 2018 |
|----------|------------|------|----------|

Drawn R McArdell Checked Oct 2018

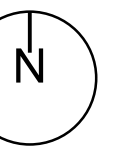
|                  |                                                                                      |
|------------------|--------------------------------------------------------------------------------------|
| Drawing<br>Title | Topographical Survey<br>Southview Farmhouse<br>Elm Grove, Drynham Lane<br>Trowbridge |
|------------------|--------------------------------------------------------------------------------------|

Client    Coulston Estates Ltd  
              Titsey Estate Office  
              Pilgrims Lane  
              Oxsted, Surrey

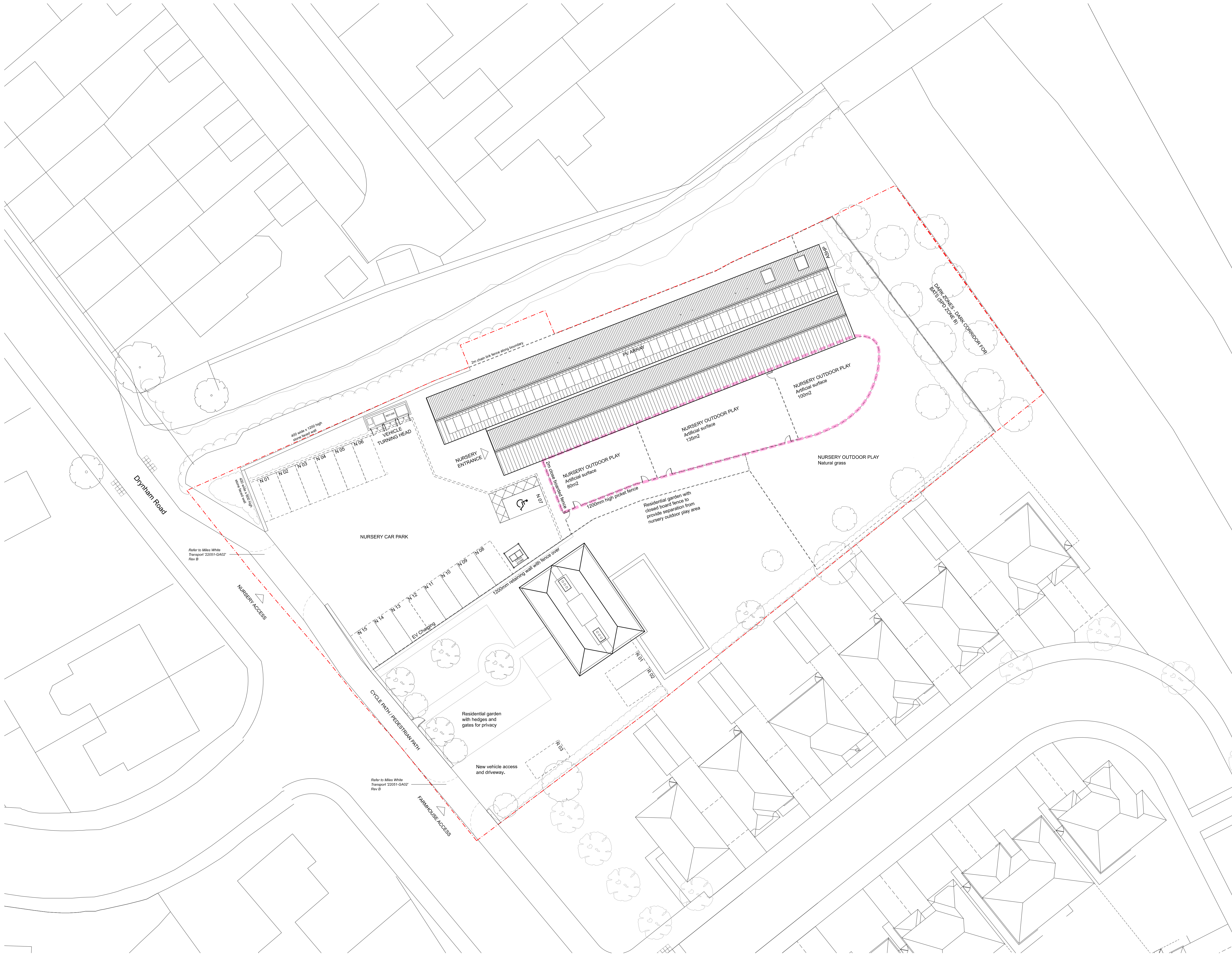
|             |     |            |
|-------------|-----|------------|
| Drawing No. | Rev | Scale A2 @ |
|-------------|-----|------------|

|             |       |
|-------------|-------|
| A768/8434/8 | 1:500 |
|-------------|-------|

## Appendix B – Site Plan



SCALE BAR 1:200



Area of Artificial Surface = 315 m2

C May 2025 Adjustment of visibility splays and landscaping  
B Mar 2025 Addition of scale bar  
A Jan 2025 Revised parking layout  
REV DATE DETAILS

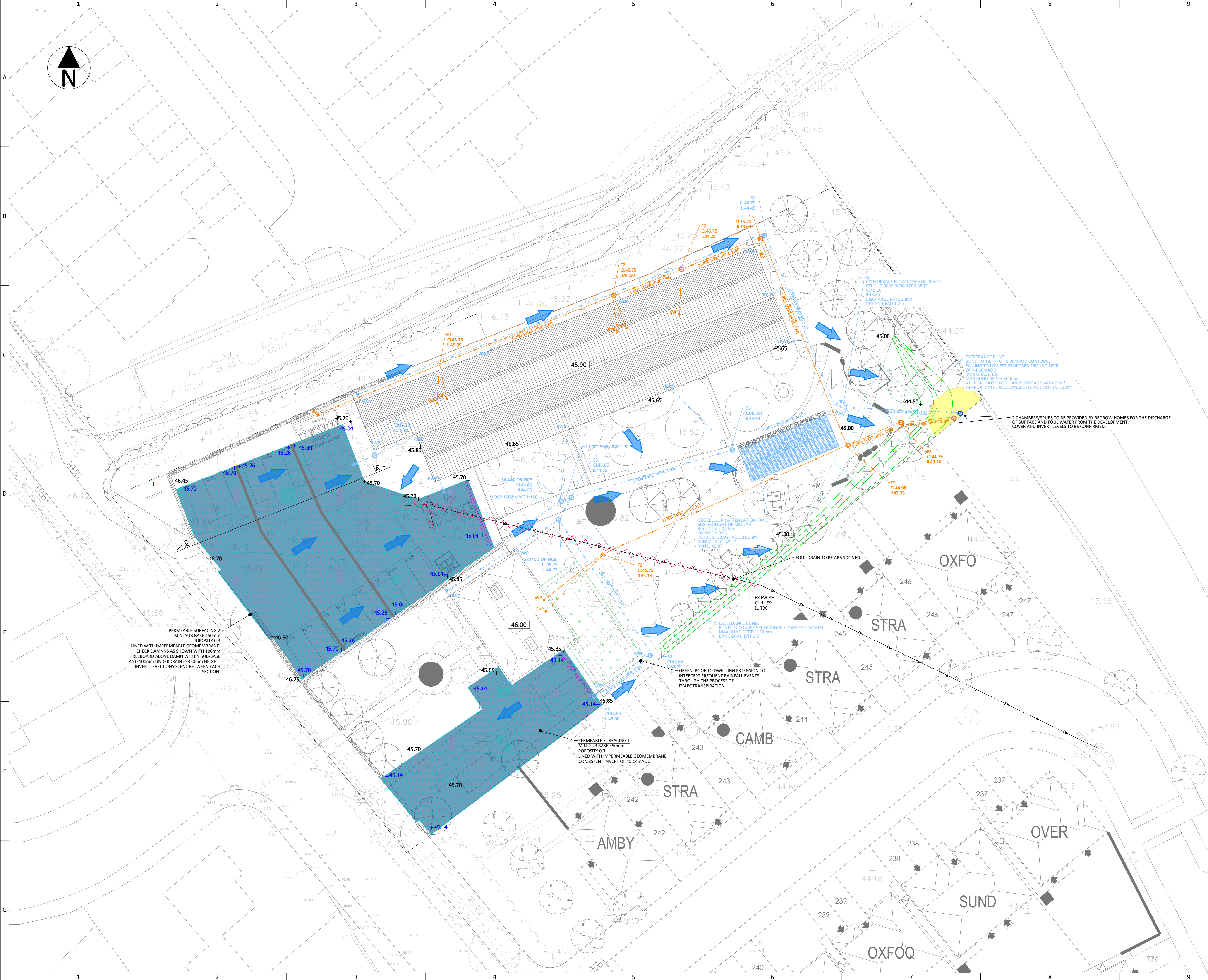
MITCHELL  
ELEY  
GOULD

SOUTHVIEW FARM  
PROPOSED SITE PLAN

PLANNING OCT 2025 1:200@A1 AM RM  
2226 AL(0)020 C

© MITCHELL ELEY GOULD ARCHITECTS 01225 799033  
THE KCE HOUSE G/F NORTH OFFICE 124-126 WALCOT STREET BATH BA1 5BG  
USE FIGURED DIMENSIONS ONLY

## Appendix C – Proposed Drainage Strategy



**KEY**

- PROPOSED PRIVATE SURFACE WATER DRAINAGE
- PROPOSED PRIVATE FOUL WATER DRAINAGE
- PROPOSED PRIVATE PPIC
- PROPOSED PRIVATE RODDING EYE
- PROPOSED TANKED PERMEABLE SURFACING (SURFACING AS PER LANDSCAPE ARCHITECT'S PROPOSALS)
- PROPOSED GREEN ROOF
- PROPOSED GECELLULAR ATTENUATION TANK
- PROPOSED HYDROBRAKE
- FLOOD EXCEEDANCE ROUTE
- INDICATIVE LEVEL
- INVERT OF PERMEABLE PAVING SUB BASE
- 3m SEWER EASEMENT

**NOTES**

ALL LEVELS, SVPS AND RWP'S INDICATIVE AND SUBJECT TO DETAILED DESIGN AND SETTING OUT POST-PLANNING.

|      |                                       |          |     |     |
|------|---------------------------------------|----------|-----|-----|
| E    | REVISED WITH LANDSAPING PLAN          | 05.08.26 | RIP | BF  |
| D    | EXCEEDANCE BUND PROVIDED              | 23.07.26 | RIP | BF  |
| C    | UPDATED IN LINE WITH NEW SITE PLAN    | 02.06.26 | JJ  | RIP |
| B    | UPDATED IN LINE WITH LANDSCAPING PLAN | 14.01.26 | RIP | BS  |
| A    | FIRST ISSUE                           | 10.12.25 | RIP | BF  |
| REV. | DESCRIPTION                           | Date     | BY  | CHK |

DESIGN BY:



CLIENT:

COULSTON ESTATES LTD

DRAWING STATUS:

PLANNING APPLICATION

SCALE @ A1:

0 1:200 10 metres

PROJECT:

SOUTH VIEW FARMHOUSE, TROWBRIDGE

TITLE:

DRAINAGE STRATEGY

Project Ref: 19862-TUM-DD-XXX-0200

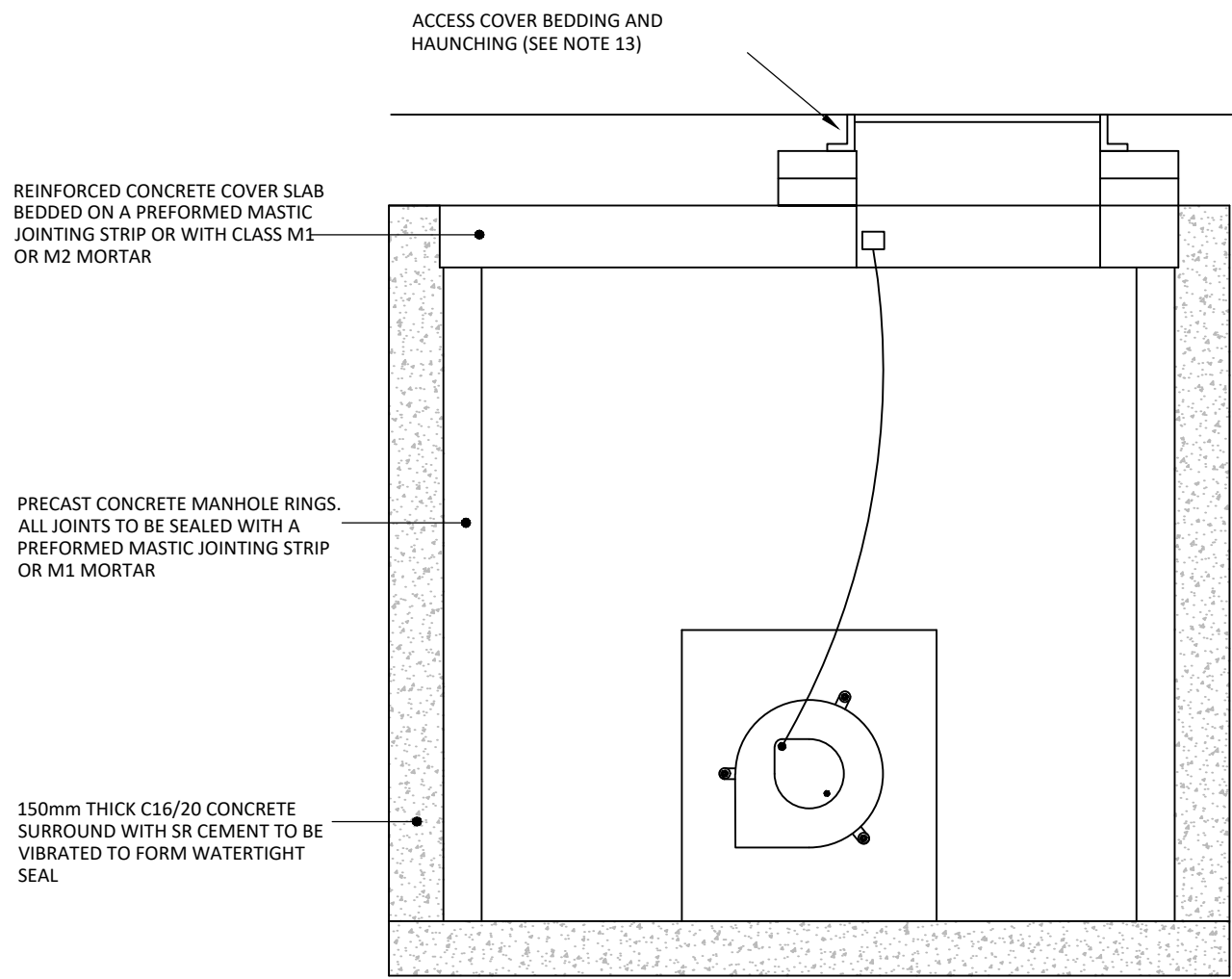
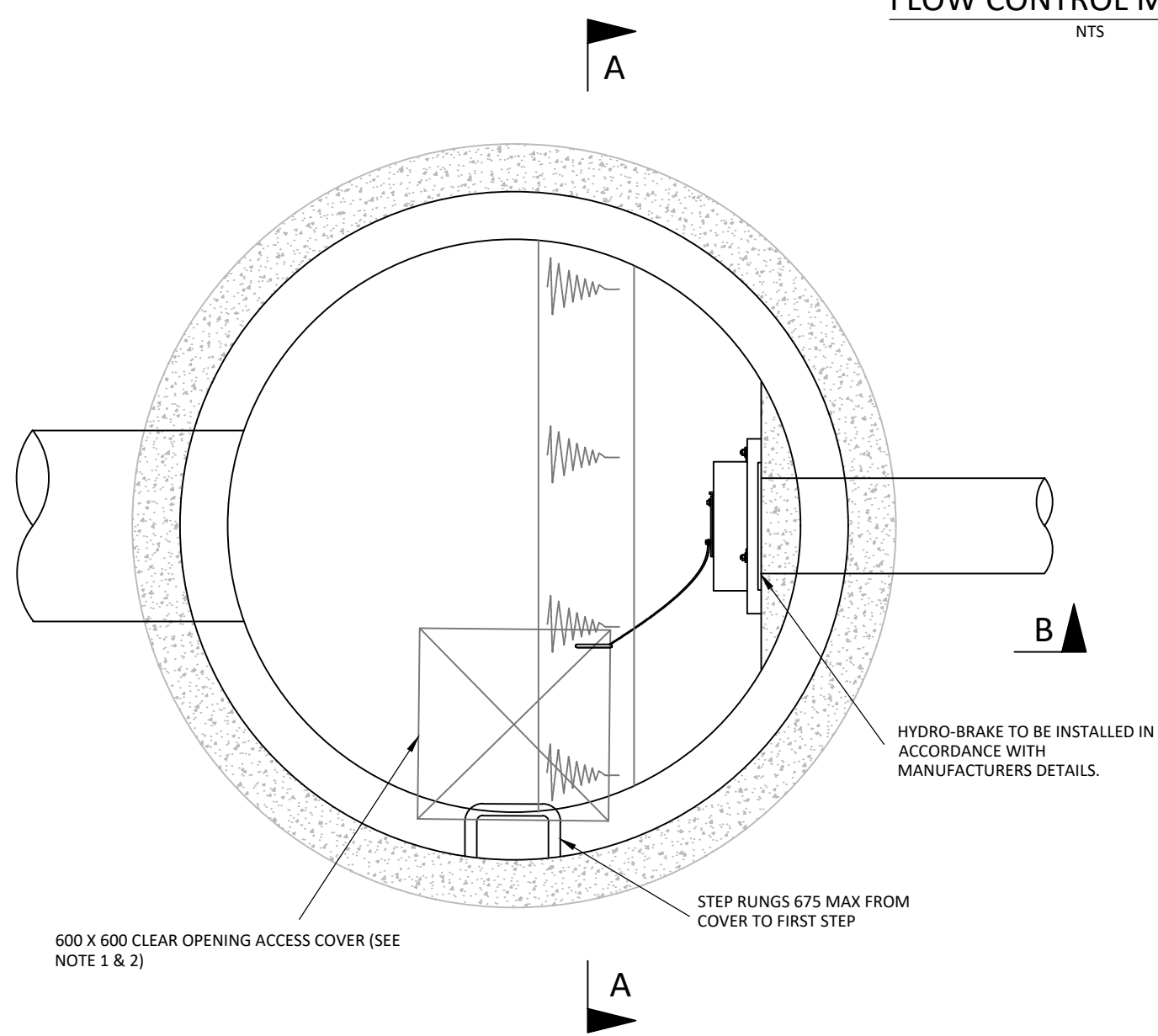
Originator: Stage: Phase: Number:

REV: E

## Appendix D – Standard Drainage Details

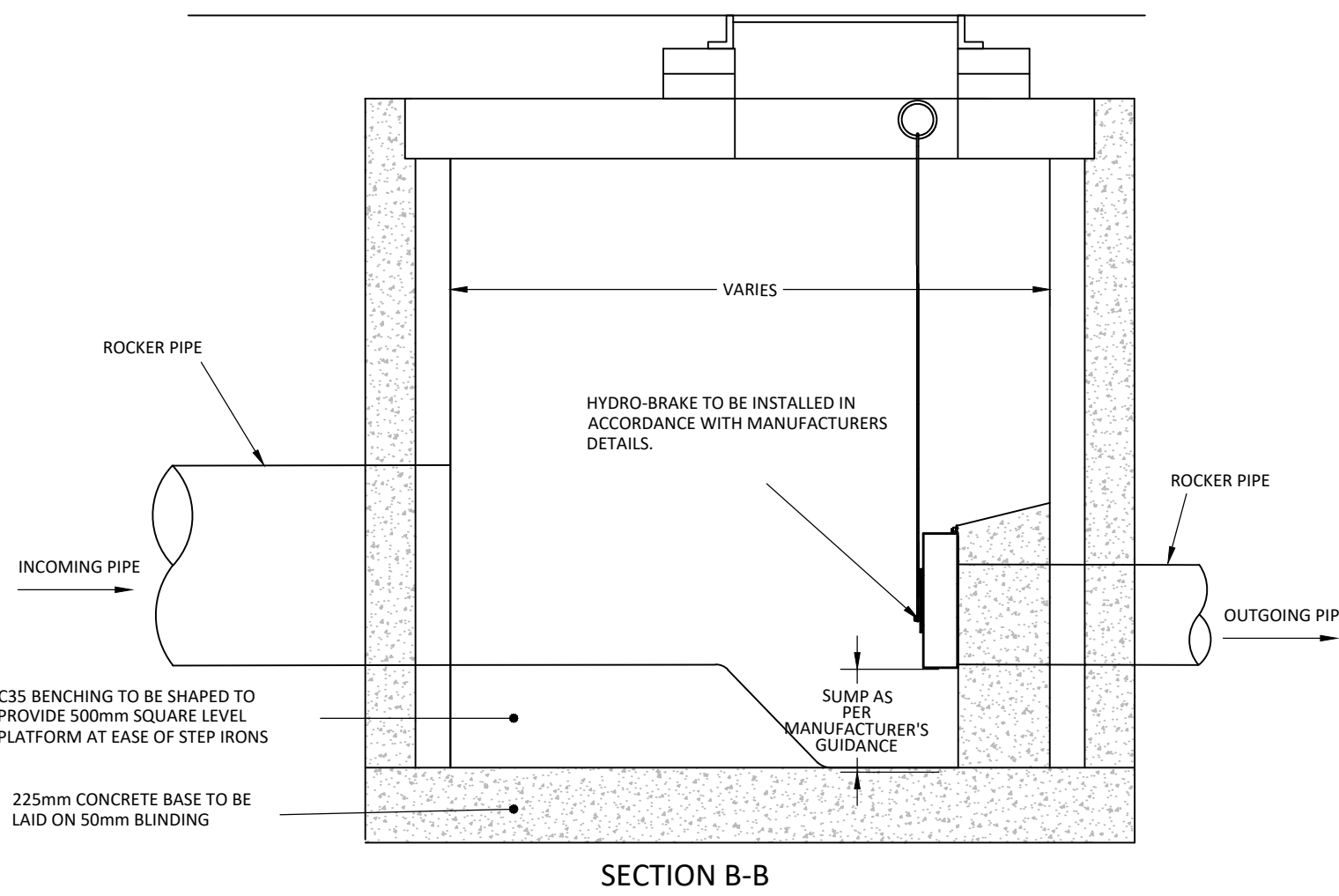
FLOW CONTROL MANHOLE

NTS



SECTION A-A

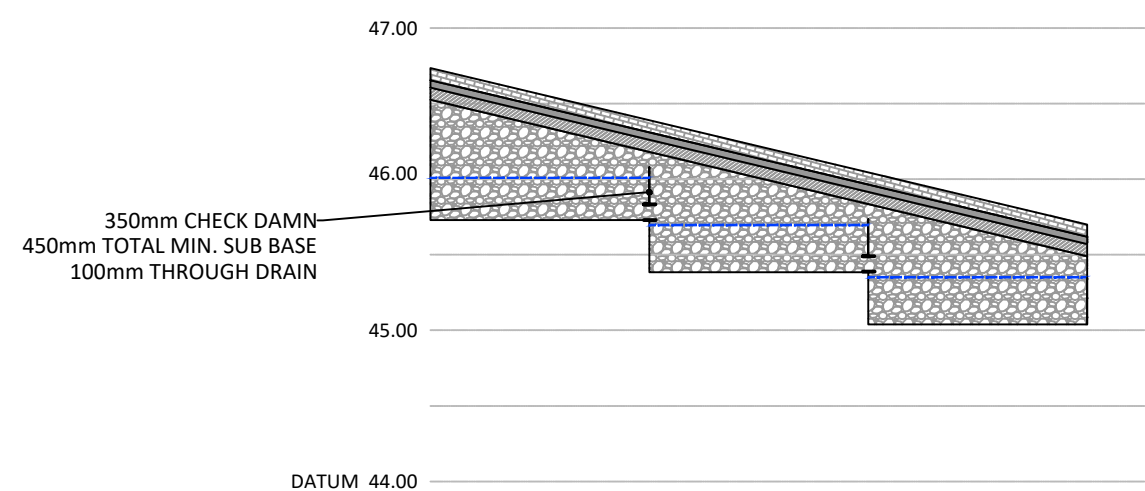
- NOTE:
- ACCESS COVER GRADES (DEPTH OF FRAME TO SUIT LOCATION AND HIGHWAY CATEGORY)  
BS EN 124  
CLASS D400 - CARRIAGEWAY AND PARKING AREAS  
CLASS B125 - FOOTWAYS, ETC
  - ACCESS COVERS TO HAVE A MINIMUM CLEAR OPENING OF 600mm SQUARE  
CHAMBER SHALL BE SIZED APPROPRIATELY IN RELATION TO PIPES, MAN ACCESS AND REQUIREMENTS AND REQUIREMENTS OF CONTROL DEVICES
  - PIPES BUILT INTO MANHOLES SHALL HAVE A FLEXIBLE JOINT AS CLOSE AS FEASIBLE TO THE EXTERNAL FACE OF THE STRUCTURE AND THE LENGTH OF THE NEXT ROCKER PIPE SHALL BE AS SHOWN BELOW
- | NOMINAL DIAMETER (mm) | EFFECTIVE LENGTH (m) |
|-----------------------|----------------------|
| 150 - 600             | 0.60                 |
| 601 - 750             | 1.00                 |
| OVER 750              | 1.25                 |
- EFFECTIVE LENGTH (m)
- STEP RUNGS SHALL BE DOUBLE POLYPROPYLENE ENCAPSULATED
  - ALL IN-SITU CONCRETE TO HAVE 50-75mm SLUMP AND TO BE VIBRATED TO FORM DENSE WATERTIGHT SEAL WITH PRECAST SECTIONS
  - BENCHING TO BE C28/35 OR GRANULITHIC TO FORM DENSE SMOOTH FINISH WITH A 500mm X 500mm FLAT AREA AT BOTTOM OF MAN ENTRY SYSTEM
  - IN-FILL COVERS OF ANY TYPE SHALL NOT BE USED, WHERE A COVER IS LOCATED IN AN AREA OF CLOCK PAVING THE FRAME SHALL BE 150mm DEEP
  - FRAME FOR MANHOLE COVERS SHALL BE BEDDED IN A POLYESTER RESIN BEDDING MORTAR IN ALL SITUATIONS WHERE COVERS ARE SITED IN NSW ROAD CATEGORIES 1, 2 OR 3
  - LADDERS SHALL BE EITHER STAINLESS STEEL OR GRP, FIXINGS TO BE STAINLESS STEEL. DOUBLE RUNG STEP IRONS ALSO AVAILABLE
  - WHERE FITTED LADDERS SHALL BE EXTENDABLE TO A HEIGHT OF 1m ABOVE GROUND LEVEL
  - WHERE TOP HOLE PROVIDED IN BENCHING, SIZE OF HOLE SHALL BE 150mm HIGH X 150mm (MIN) DEPTH AND WIDTH. VERTICAL SPACING SHALL BE SAME AS STEP RUNGS
  - FRAMES FOR MANHOLE COVERS SHALL BE BEDDED IN A POLYESTER RESIN BEDDING MORTAR IN ALL SITUATIONS WHERE COVERS ARE SITED IN NSW ROAD CATEGORIES 1, 2 OR 3
  - UNLESS NOTED OTHERWISE ALL DIMENSIONS ARE IN MILLIMETERS



SECTION B-B

SECTION A-A PERMEABLE PAVING SECTION

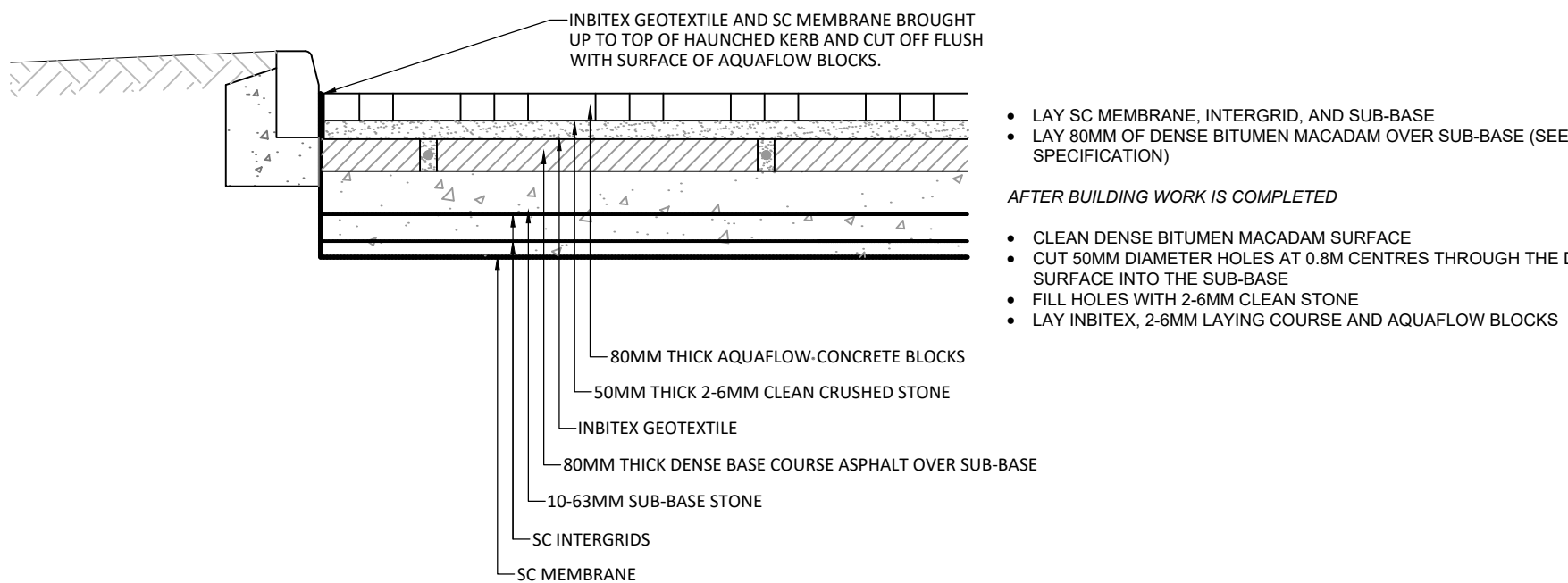
NTS



|                            |       |       |       |       |
|----------------------------|-------|-------|-------|-------|
| CHAINAGE                   | 0.00  | 7.24  | 14.48 | 21.72 |
| EXISTING GROUND LEVEL      | 46.58 |       |       | 46.30 |
| PROPOSED ROAD LEVEL        | 46.70 | 46.36 | 46.03 | 45.70 |
| ROAD LONGITUDINAL GRADIENT | 1:21  | 1:21  | 1:21  |       |
| INVERT LEVEL               | 45.70 | 45.36 | 45.04 | 45.04 |
| WATER LEVEL (1%AE+CC)      | 46.02 | 45.52 | 45.52 | 45.52 |

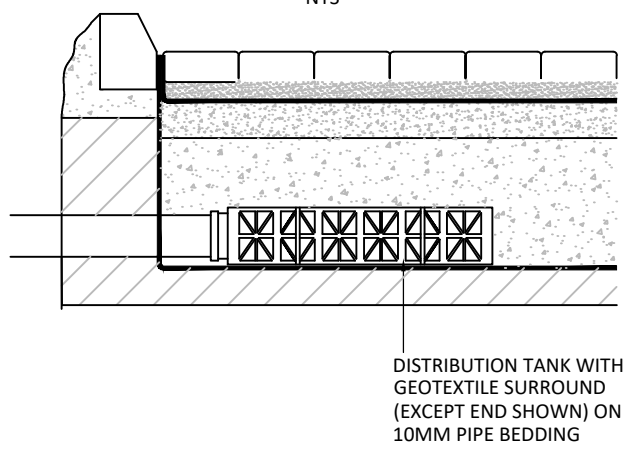
TYPICAL SECTION THROUGH FORMPAVE AQUAFLOW ATTENUATION SYSTEM

(HEAVY DUTY CONSTRUCTION) NTS



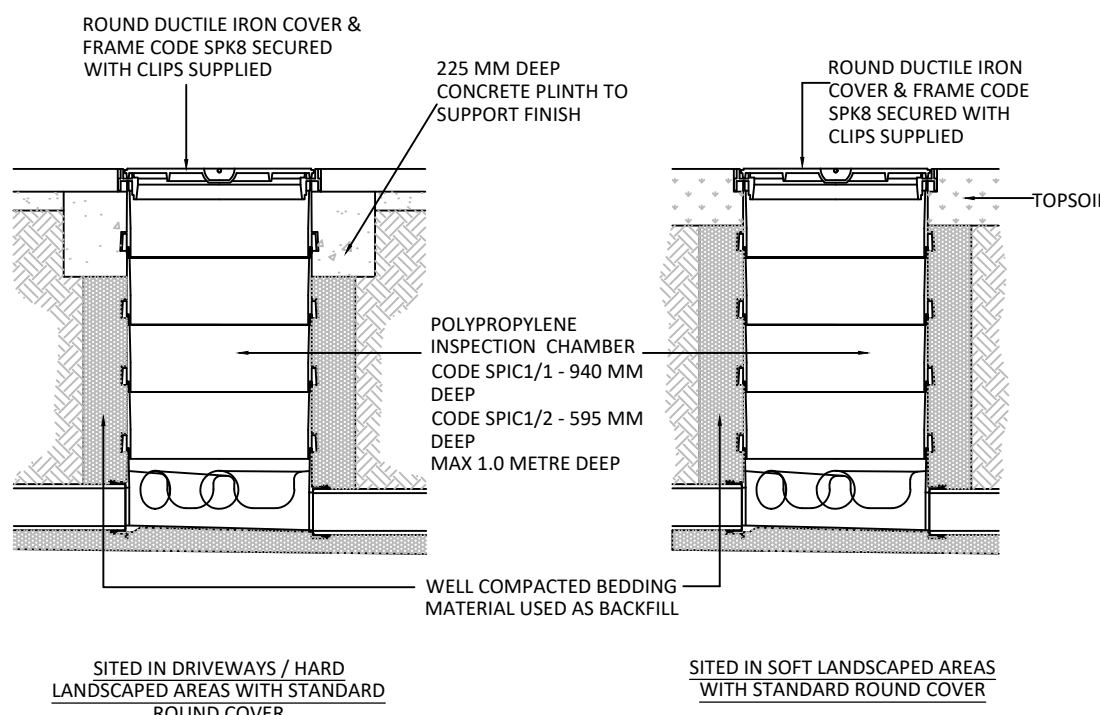
TYPICAL MODULAR BLOCK PAVING DISTRIBUTION BOX INLET DETAIL

NTS



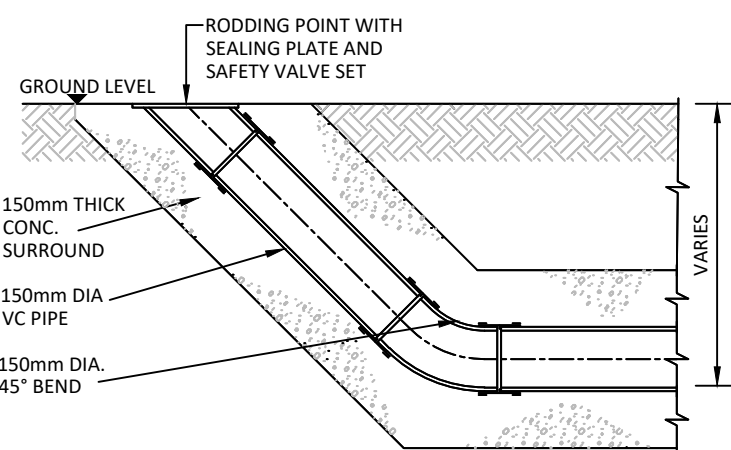
POLYPROPYLENE INSPECTION CHAMBER

SCALE 1:20



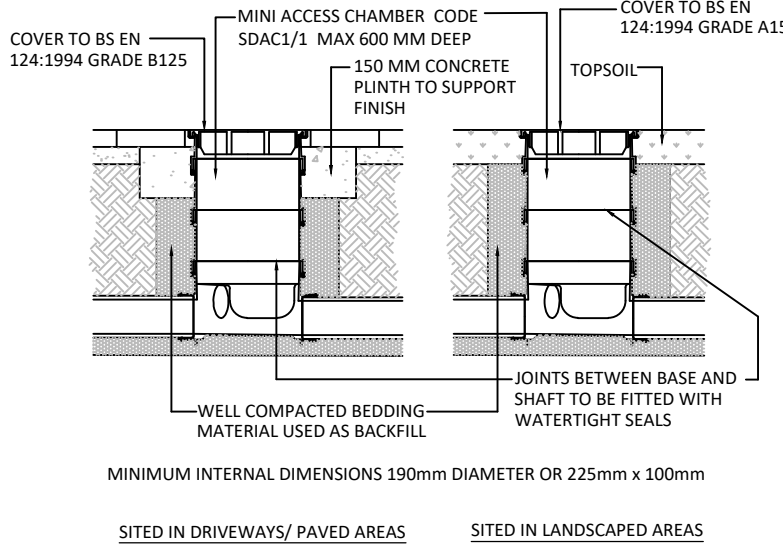
RODDING EYE DETAIL

SCALE 1:20



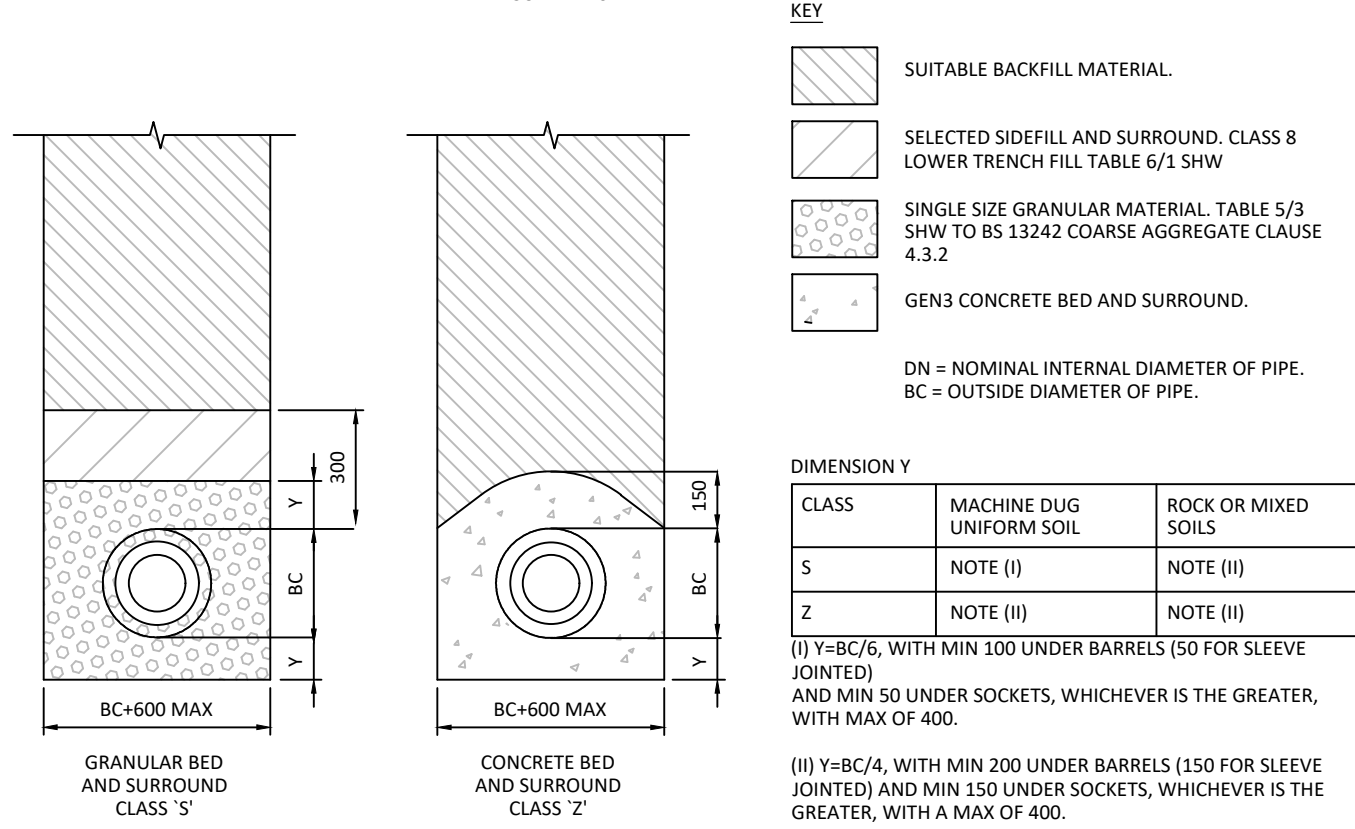
MINI ACCESS CHAMBER DETAIL

SCALE 1:20



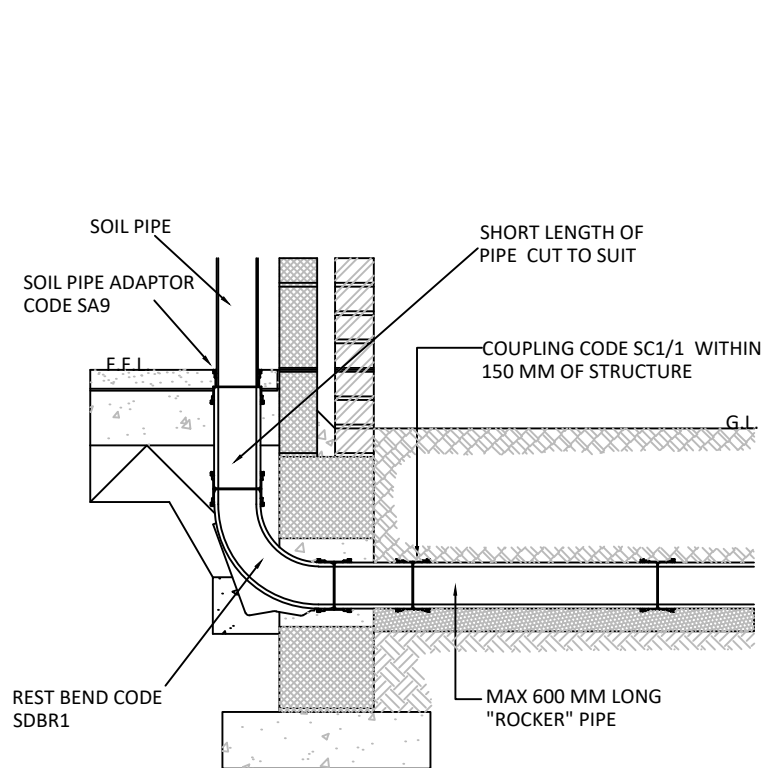
PIPE BEDDING DETAILS

SCALE 1:20



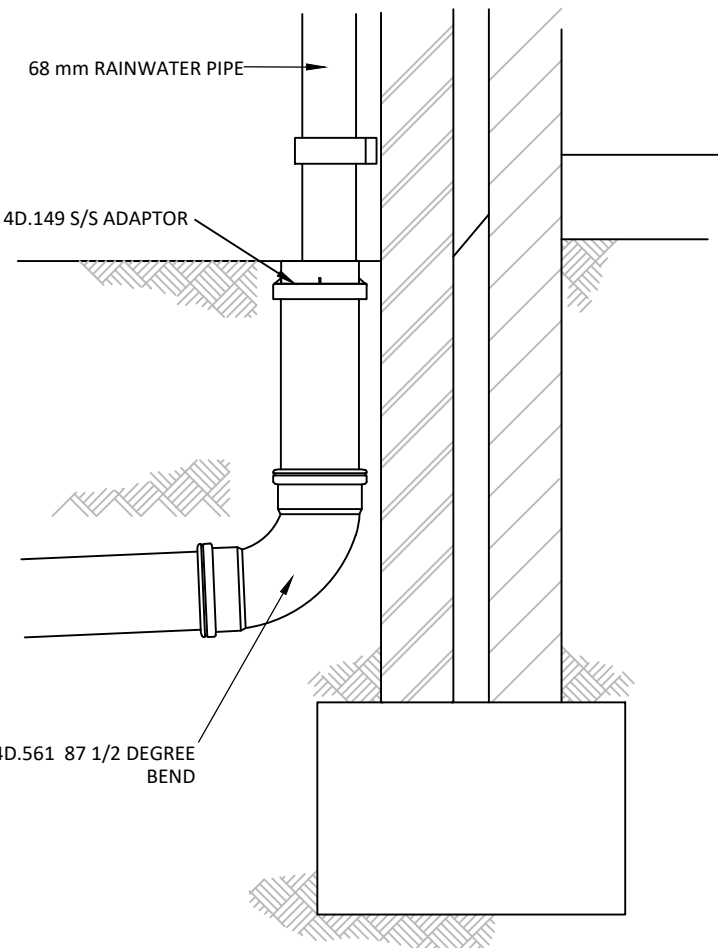
SOIL & VENT PIPE / STUB STACK / W.C. PIPE

SCALE 1:20



EXTERNAL R.W.P. TO DRAIN

SCALE 1:20



|                              |  |  |  |                      |  |                           |                 |
|------------------------------|--|--|--|----------------------|--|---------------------------|-----------------|
| DESIGN BY:                   |  |  |  | CLIENT:              |  | PROJECT:                  |                 |
|                              |  |  |  | COULSTON ESTATES LTD |  | SOUTH VIEW FARM HOUSE     |                 |
| ARCHITECT:                   |  |  |  | TITLE:               |  | STANDARD DRAINAGE DETAILS |                 |
| DRAWING STATUS:              |  |  |  | SCALE @ A1:          |  | PROJECT No:               | DRAWING No:     |
| PLANNING APPLICATION         |  |  |  | AS SHOWN             |  | 19682                     | TUM-PL-XXX-0220 |
| REV.                         |  |  |  | REVISION             |  | REV:                      |                 |
| B UPDATED WITH NEW SITE PLAN |  |  |  | 14/01/26             |  | RP                        |                 |
| A FIRST ISSUE                |  |  |  | 10/12/25             |  | NKS                       |                 |
| REV.                         |  |  |  | Date                 |  | BY                        |                 |
| DESCRIPTION                  |  |  |  | Date                 |  | CHK                       |                 |

## Appendix E – Causeway FLOW Calculations

### Design Settings

|                                      |        |                                    |               |
|--------------------------------------|--------|------------------------------------|---------------|
| Rainfall Methodology                 | FEH-22 | Minimum Velocity (m/s)             | 1.00          |
| Return Period (years)                | 2      | Connection Type                    | Level Soffits |
| Additional Flow (%)                  | 0      | Minimum Backdrop Height (m)        | 0.200         |
| CV                                   | 1.000  | Preferred Cover Depth (m)          | 1.200         |
| Time of Entry (mins)                 | 5.00   | Include Intermediate Ground        | ✓             |
| Maximum Time of Concentration (mins) | 30.00  | Enforce best practice design rules | ✓             |
| Maximum Rainfall (mm/hr)             | 50.0   |                                    |               |

### Nodes

| Name | Area<br>(ha) | T of E<br>(mins) | Cover<br>Level<br>(m) | Diameter<br>(mm) | Easting<br>(m) | Northing<br>(m) | Depth<br>(m) | Invert<br>Level<br>(m) |
|------|--------------|------------------|-----------------------|------------------|----------------|-----------------|--------------|------------------------|
| 1    | 0.029        | 5.00             | 45.850                | 450              | 385967.722     | 156788.502      | 0.850        | 45.000                 |
| 2    | 0.008        | 5.00             | 45.850                | 450              | 385974.284     | 156793.250      | 0.950        | 44.900                 |
| 3    | 0.005        | 5.00             | 45.850                | 450              | 385963.524     | 156809.058      | 1.080        | 44.770                 |
| 4    | 0.088        | 5.00             | 45.650                | 450              | 385963.880     | 156811.240      | 0.700        | 44.950                 |
| 5    |              |                  | 45.650                | 450              | 385965.046     | 156811.675      | 0.900        | 44.750                 |
| 6    | 0.004        | 5.00             | 45.400                | 450              | 385983.770     | 156817.485      | 1.470        | 43.930                 |
| 7    | 0.030        | 5.00             | 45.750                | 450              | 385987.641     | 156842.317      | 1.300        | 44.450                 |
| 8    |              |                  | 45.100                | 1200             | 385996.482     | 156822.193      | 1.240        | 43.860                 |
| 9    |              |                  | 44.600                | 450              | 386009.206     | 156820.480      | 0.868        | 43.732                 |

### Links

| Name  | US<br>Node | DS<br>Node | Length<br>(m) | US IL<br>(m) | DS IL<br>(m) | Fall<br>(m) | Slope<br>(1:X) | Dia<br>(mm) | Link<br>Type | T of C<br>(mins) |
|-------|------------|------------|---------------|--------------|--------------|-------------|----------------|-------------|--------------|------------------|
| 1.000 | 1          | 2          | 8.100         | 45.000       | 44.900       | 0.100       | 81.0           | 150         | Circular     | 5.12             |
| 1.001 | 2          | 3          | 19.123        | 44.900       | 44.770       | 0.130       | 147.1          | 150         | Circular     | 5.51             |
| 1.002 | 3          | 5          | 3.027         | 44.770       | 44.750       | 0.020       | 150.0          | 150         | Circular     | 5.57             |
| 2.000 | 4          | 5          | 1.245         | 44.950       | 44.750       | 0.200       | 6.2            | 150         | Circular     | 5.01             |
| 1.003 | 5          | 6          | 19.605        | 44.750       | 44.005       | 0.745       | 26.3           | 150         | Circular     | 5.73             |
| 1.004 | 6          | 8          | 13.556        | 43.930       | 43.860       | 0.070       | 193.7          | 225         | Circular     | 5.98             |
| 3.000 | 7          | 8          | 21.980        | 44.450       | 43.935       | 0.515       | 42.7           | 150         | Circular     | 5.24             |
| 1.005 | 8          | 9          | 12.839        | 43.860       | 43.732       | 0.128       | 100.0          | 225         | Circular     | 6.14             |

| Name  | Vel<br>(m/s) | Cap<br>(l/s) | Flow<br>(l/s) | US<br>Depth<br>(m) | DS<br>Depth<br>(m) | Σ Area<br>(ha) | Σ Add<br>Inflow<br>(l/s) | Pro<br>Depth<br>(mm) | Pro<br>Velocity<br>(m/s) |
|-------|--------------|--------------|---------------|--------------------|--------------------|----------------|--------------------------|----------------------|--------------------------|
| 1.000 | 1.118        | 19.8         | 4.9           | 0.700              | 0.800              | 0.029          | 0.0                      | 51                   | 0.927                    |
| 1.001 | 0.826        | 14.6         | 6.1           | 0.800              | 0.930              | 0.037          | 0.0                      | 68                   | 0.790                    |
| 1.002 | 0.818        | 14.5         | 6.9           | 0.930              | 0.750              | 0.042          | 0.0                      | 73                   | 0.808                    |
| 2.000 | 4.066        | 71.8         | 15.0          | 0.550              | 0.750              | 0.088          | 0.0                      | 47                   | 3.231                    |
| 1.003 | 1.970        | 34.8         | 20.7          | 0.750              | 1.245              | 0.130          | 0.0                      | 83                   | 2.055                    |
| 1.004 | 0.936        | 37.2         | 21.2          | 1.245              | 1.015              | 0.134          | 0.0                      | 122                  | 0.965                    |
| 3.000 | 1.544        | 27.3         | 5.0           | 1.150              | 1.015              | 0.030          | 0.0                      | 44                   | 1.183                    |
| 1.005 | 1.307        | 52.0         | 25.6          | 1.015              | 0.643              | 0.164          | 0.0                      | 111                  | 1.301                    |

### Manhole Schedule

| Node | Easting<br>(m) | Northing<br>(m) | CL<br>(m) | Depth<br>(m) | Dia<br>(mm) | Connections                                                                         | Link  | IL<br>(m) | Dia<br>(mm) |
|------|----------------|-----------------|-----------|--------------|-------------|-------------------------------------------------------------------------------------|-------|-----------|-------------|
| 1    | 385967.722     | 156788.502      | 45.850    | 0.850        | 450         |  |       |           |             |
|      |                |                 |           |              |             | 0                                                                                   | 1.000 | 45.000    | 150         |
| 2    | 385974.284     | 156793.250      | 45.850    | 0.950        | 450         |  | 1     | 1.000     | 44.900      |
|      |                |                 |           |              |             | 0                                                                                   | 1.001 | 44.900    | 150         |

### Manhole Schedule

| Node | Easting (m) | Northing (m) | CL (m) | Depth (m) | Dia (mm) | Connections                                                                         | Link | IL (m) | Dia (mm) |     |
|------|-------------|--------------|--------|-----------|----------|-------------------------------------------------------------------------------------|------|--------|----------|-----|
| 3    | 385963.524  | 156809.058   | 45.850 | 1.080     | 450      |    | 1    | 1.001  | 44.770   | 150 |
|      |             |              |        |           |          |                                                                                     | 0    | 1.002  | 44.770   | 150 |
| 4    | 385963.880  | 156811.240   | 45.650 | 0.700     | 450      |    |      |        |          |     |
|      |             |              |        |           |          |                                                                                     | 0    | 2.000  | 44.950   | 150 |
| 5    | 385965.046  | 156811.675   | 45.650 | 0.900     | 450      |    | 1    | 2.000  | 44.750   | 150 |
|      |             |              |        |           |          |                                                                                     | 2    | 1.002  | 44.750   | 150 |
|      |             |              |        |           |          |                                                                                     | 0    | 1.003  | 44.750   | 150 |
| 6    | 385983.770  | 156817.485   | 45.400 | 1.470     | 450      |    | 1    | 1.003  | 44.005   | 150 |
|      |             |              |        |           |          |                                                                                     | 0    | 1.004  | 43.930   | 225 |
| 7    | 385987.641  | 156842.317   | 45.750 | 1.300     | 450      |    |      |        |          |     |
|      |             |              |        |           |          |                                                                                     | 0    | 3.000  | 44.450   | 150 |
| 8    | 385996.482  | 156822.193   | 45.100 | 1.240     | 1200     |   | 1    | 3.000  | 43.935   | 150 |
|      |             |              |        |           |          |                                                                                     | 2    | 1.004  | 43.860   | 225 |
|      |             |              |        |           |          |                                                                                     | 0    | 1.005  | 43.860   | 225 |
| 9    | 386009.206  | 156820.480   | 44.600 | 0.868     | 450      |  | 1    | 1.005  | 43.732   | 225 |

### Simulation Settings

|                      |          |                            |        |                         |   |
|----------------------|----------|----------------------------|--------|-------------------------|---|
| Rainfall Methodology | FEH-22   | Analysis Speed             | Normal | Starting Level (m)      |   |
| Rainfall Events      | Singular | Skip Steady State          | x      | Check Discharge Rate(s) | ✓ |
| Summer CV            | 1.000    | Drain Down Time (mins)     | 240    | Check Discharge Volume  | x |
| Winter CV            | 1.000    | Additional Storage (m³/ha) | 0.0    |                         |   |

### Storm Durations

15 | 30 | 60 | 120 | 180 | 240 | 360 | 480 | 600 | 720 | 960 | 1440

| Return Period (years) | Climate Change (CC %) | Additional Area (A %) | Additional Flow (Q %) | Return Period (years) | Climate Change (CC %) | Additional Area (A %) | Additional Flow (Q %) |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| 2                     | 0                     | 0                     | 0                     | 100                   | 45                    | 0                     | 0                     |
| 30                    | 40                    | 0                     | 0                     |                       |                       |                       |                       |

### Pre-development Discharge Rate

|                              |            |                        |      |                  |   |
|------------------------------|------------|------------------------|------|------------------|---|
| Site Makeup                  | Greenfield | SPR                    | 0.10 | Betterment (%)   | 0 |
| Greenfield Method            | IH124      | Region                 | 1    | QBar             |   |
| Positively Drained Area (ha) |            | Growth Factor 1 year   | 0.85 | Q 1 year (l/s)   |   |
| SAAR (mm)                    |            | Growth Factor 30 year  | 1.95 | Q 30 year (l/s)  |   |
| Soil Index                   | 1          | Growth Factor 100 year | 2.48 | Q 100 year (l/s) |   |

### Node 3 Online Orifice Control

|                          |   |                  |        |                       |       |
|--------------------------|---|------------------|--------|-----------------------|-------|
| Flap Valve               | x | Invert Level (m) | 44.770 | Discharge Coefficient | 0.600 |
| Replaces Downstream Link | ✓ | Diameter (m)     | 0.040  |                       |       |

#### Node 4 Online Orifice Control

|                          |   |                  |        |                       |       |
|--------------------------|---|------------------|--------|-----------------------|-------|
| Flap Valve               | x | Invert Level (m) | 44.950 | Discharge Coefficient | 0.600 |
| Replaces Downstream Link | ✓ | Diameter (m)     | 0.040  |                       |       |

#### Node 8 Online Hydro-Brake® Control

|                          |        |                         |                                |
|--------------------------|--------|-------------------------|--------------------------------|
| Flap Valve               | x      | Objective               | (HE) Minimise upstream storage |
| Replaces Downstream Link | ✓      | Sump Available          | ✓                              |
| Invert Level (m)         | 43.860 | Product Number          | CTL-SHE-0090-3800-1200-3800    |
| Design Depth (m)         | 1.200  | Min Outlet Diameter (m) | 0.150                          |
| Design Flow (l/s)        | 3.8    | Min Node Diameter (mm)  | 1200                           |

#### Node 1 Carpark Storage Structure

|                             |         |                           |        |               |       |
|-----------------------------|---------|---------------------------|--------|---------------|-------|
| Base Inf Coefficient (m/hr) | 0.00000 | Invert Level (m)          | 45.140 | Slope (1:X)   | 999.0 |
| Side Inf Coefficient (m/hr) | 0.00000 | Time to half empty (mins) | 35     | Depth (m)     | 0.350 |
| Safety Factor               | 2.0     | Width (m)                 | 8.000  | Inf Depth (m) |       |
| Porosity                    | 0.30    | Length (m)                | 28.000 |               |       |

#### Node 4 Carpark Storage Structure

|                             |         |                           |        |               |        |
|-----------------------------|---------|---------------------------|--------|---------------|--------|
| Base Inf Coefficient (m/hr) | 0.00000 | Invert Level (m)          | 45.040 | Slope (1:X)   | 9999.0 |
| Side Inf Coefficient (m/hr) | 0.00000 | Time to half empty (mins) |        | Depth (m)     | 0.350  |
| Safety Factor               | 2.0     | Width (m)                 | 23.000 | Inf Depth (m) |        |
| Porosity                    | 0.30    | Length (m)                | 25.200 |               |        |

#### Node 8 Depth/Area Storage Structure

|                             |         |               |      |                           |        |
|-----------------------------|---------|---------------|------|---------------------------|--------|
| Base Inf Coefficient (m/hr) | 0.00000 | Safety Factor | 2.0  | Invert Level (m)          | 43.860 |
| Side Inf Coefficient (m/hr) | 0.00000 | Porosity      | 0.95 | Time to half empty (mins) | 168    |

| Depth (m) | Area (m²) | Inf Area (m²) | Depth (m) | Area (m²) | Inf Area (m²) | Depth (m) | Area (m²) | Inf Area (m²) |
|-----------|-----------|---------------|-----------|-----------|---------------|-----------|-----------|---------------|
| 0.000     | 44.0      | 0.0           | 0.750     | 44.0      | 0.0           | 0.751     | 0.0       | 0.0           |

**Results for 2 year Critical Storm Duration. Lowest mass balance: 100.00%**

| Node Event        | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status     |
|-------------------|---------|-------------|-----------|-----------|--------------|---------------|------------|------------|
| 30 minute summer  | 1       | 22          | 45.164    | 0.164     | 4.2          | 0.6934        | 0.0000     | SURCHARGED |
| 15 minute summer  | 2       | 13          | 45.164    | 0.264     | 4.3          | 0.0419        | 0.0000     | SURCHARGED |
| 15 minute summer  | 3       | 13          | 45.163    | 0.393     | 3.6          | 0.0625        | 0.0000     | SURCHARGED |
| 240 minute summer | 4       | 164         | 45.088    | 0.138     | 4.9          | 8.0430        | 0.0000     | OK         |
| 120 minute summer | 5       | 76          | 44.781    | 0.031     | 3.1          | 0.0049        | 0.0000     | OK         |
| 180 minute summer | 6       | 120         | 44.003    | 0.073     | 3.3          | 0.0117        | 0.0000     | OK         |
| 15 minute summer  | 7       | 10          | 44.492    | 0.042     | 4.6          | 0.0067        | 0.0000     | OK         |
| 180 minute summer | 8       | 120         | 44.003    | 0.143     | 5.2          | 6.1316        | 0.0000     | OK         |
| 15 minute summer  | 9       | 1           | 43.732    | 0.000     | 2.5          | 0.0000        | 0.0000     | OK         |

| Link Event<br>(Upstream Depth) | US Node | Link         | DS Node | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol (m³) | Discharge Vol (m³) |
|--------------------------------|---------|--------------|---------|---------------|----------------|----------|---------------|--------------------|
| 30 minute summer               | 1       | 1.000        | 2       | 2.7           | 0.544          | 0.139    | 0.1426        |                    |
| 15 minute summer               | 2       | 1.001        | 3       | 2.9           | 0.344          | 0.198    | 0.3367        |                    |
| 15 minute summer               | 3       | Orifice      | 5       | 2.0           |                |          |               |                    |
| 240 minute summer              | 4       | Orifice      | 5       | 1.1           |                |          |               |                    |
| 120 minute summer              | 5       | 1.003        | 6       | 3.1           | 1.212          | 0.090    | 0.0505        |                    |
| 180 minute summer              | 6       | 1.004        | 8       | 3.3           | 0.615          | 0.088    | 0.2561        |                    |
| 15 minute summer               | 7       | 3.000        | 8       | 4.5           | 1.133          | 0.166    | 0.0880        |                    |
| 180 minute summer              | 8       | Hydro-Brake® | 9       | 3.3           |                |          |               | 30.4               |

**Results for 30 year +40% CC Critical Storm Duration. Lowest mass balance: 99.80%**

| Node Event        | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status     |
|-------------------|---------|-------------|-----------|-----------|--------------|---------------|------------|------------|
| 60 minute winter  | 1       | 52          | 45.306    | 0.306     | 10.0         | 10.2702       | 0.0000     | SURCHARGED |
| 60 minute winter  | 2       | 51          | 45.305    | 0.405     | 2.6          | 0.0644        | 0.0000     | SURCHARGED |
| 60 minute winter  | 3       | 51          | 45.302    | 0.532     | 2.4          | 0.0846        | 0.0000     | SURCHARGED |
| 240 minute winter | 4       | 204         | 45.267    | 0.317     | 10.2         | 39.2106       | 0.0000     | SURCHARGED |
| 180 minute summer | 5       | 132         | 44.785    | 0.035     | 4.1          | 0.0056        | 0.0000     | OK         |
| 240 minute summer | 6       | 264         | 44.418    | 0.488     | 4.5          | 0.0775        | 0.0000     | SURCHARGED |
| 15 minute summer  | 7       | 10          | 44.544    | 0.094     | 18.3         | 0.0150        | 0.0000     | OK         |
| 240 minute summer | 8       | 264         | 44.417    | 0.557     | 9.2          | 23.8969       | 0.0000     | SURCHARGED |
| 15 minute summer  | 9       | 1           | 43.732    | 0.000     | 3.6          | 0.0000        | 0.0000     | OK         |

| Link Event<br>(Upstream Depth) | US Node | Link         | DS Node | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol (m³) | Discharge Vol (m³) |
|--------------------------------|---------|--------------|---------|---------------|----------------|----------|---------------|--------------------|
| 60 minute winter               | 1       | 1.000        | 2       | 2.3           | 0.542          | 0.116    | 0.1426        |                    |
| 60 minute winter               | 2       | 1.001        | 3       | 2.3           | 0.374          | 0.160    | 0.3367        |                    |
| 60 minute winter               | 3       | Orifice      | 5       | 2.4           |                |          |               |                    |
| 240 minute winter              | 4       | Orifice      | 5       | 1.8           |                |          |               |                    |
| 180 minute summer              | 5       | 1.003        | 6       | 4.1           | 1.235          | 0.119    | 0.2031        |                    |
| 240 minute summer              | 6       | 1.004        | 8       | 4.4           | 0.755          | 0.117    | 0.5391        |                    |
| 15 minute summer               | 7       | 3.000        | 8       | 18.2          | 1.609          | 0.666    | 0.2483        |                    |
| 240 minute summer              | 8       | Hydro-Brake® | 9       | 3.8           |                |          |               | 90.1               |

**Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.24%**

| Node Event        | US<br>Node | Peak<br>(mins) | Level<br>(m) | Depth<br>(m) | Inflow<br>(l/s) | Node<br>Vol (m³) | Flood<br>(m³) | Status     |
|-------------------|------------|----------------|--------------|--------------|-----------------|------------------|---------------|------------|
| 60 minute winter  | 1          | 58             | 45.390       | 0.390        | 14.2            | 15.8945          | 0.0000        | SURCHARGED |
| 60 minute winter  | 2          | 59             | 45.389       | 0.489        | 3.2             | 0.0777           | 0.0000        | SURCHARGED |
| 60 minute winter  | 3          | 59             | 45.385       | 0.615        | 2.6             | 0.0978           | 0.0000        | SURCHARGED |
| 240 minute winter | 4          | 228            | 45.357       | 0.407        | 13.3            | 54.8579          | 0.0000        | FLOOD RISK |
| 360 minute winter | 5          | 336            | 45.073       | 0.323        | 4.4             | 0.0514           | 0.0000        | SURCHARGED |
| 360 minute winter | 6          | 336            | 45.066       | 1.136        | 4.7             | 0.1806           | 0.0000        | SURCHARGED |
| 360 minute winter | 7          | 336            | 45.065       | 0.615        | 3.4             | 0.0979           | 0.0000        | SURCHARGED |
| 360 minute winter | 8          | 336            | 45.065       | 1.205        | 7.7             | 32.7339          | 0.0000        | FLOOD RISK |
| 15 minute summer  | 9          | 1              | 43.732       | 0.000        | 3.8             | 0.0000           | 0.0000        | OK         |

| Link Event<br>(Upstream Depth) | US<br>Node | Link         | DS<br>Node | Outflow<br>(l/s) | Velocity<br>(m/s) | Flow/Cap | Link<br>Vol (m³) | Discharge<br>Vol (m³) |
|--------------------------------|------------|--------------|------------|------------------|-------------------|----------|------------------|-----------------------|
| 60 minute winter               | 1          | 1.000        | 2          | 2.5              | 0.576             | 0.126    | 0.1426           |                       |
| 60 minute winter               | 2          | 1.001        | 3          | 2.5              | 0.437             | 0.173    | 0.3367           |                       |
| 60 minute winter               | 3          | Orifice      | 5          | 2.6              |                   |          |                  |                       |
| 240 minute winter              | 4          | Orifice      | 5          | 2.1              |                   |          |                  |                       |
| 360 minute winter              | 5          | 1.003        | 6          | 4.4              | 1.228             | 0.127    | 0.3451           |                       |
| 360 minute winter              | 6          | 1.004        | 8          | 4.6              | 0.709             | 0.124    | 0.5391           |                       |
| 360 minute winter              | 7          | 3.000        | 8          | 3.4              | 0.702             | 0.124    | 0.3870           |                       |
| 360 minute winter              | 8          | Hydro-Brake® | 9          | 3.8              |                   |          |                  | 115.1                 |