Storm Water Soakaway Design BRE Digest 365

STINGRAY ENVIRONMENTAL ENGINEERING
Protect Our Water

Reference Number: SEE-S378
Site: 23 Churchview, Gibraltar, D22, D22YD34, X306457, Y230431
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Introduction

This report is based on the findings of a soil infiltration test as per BRE Digest 365, carried out by Stingray Environmental Engineering Ltd. on the 25th of May 2022.

As required by South Dublin County Council, this report provides recommendations for the storm water soakaways design in line with the requirements of *BRE365*.

1. Site Specific Information

Information supplied by client /architect

- Total Impermeable Area Feeding Soakaway: **Total 55msq**
- Invert of the discharge drain into soakaway: **300mm below CL**
- Inlet drain: **DN100 UPVC Wavin**

Rainfall information

- Site Location: **23 churchview, Gibraltar, D22, D22YD34, X306457, Y230431**
- Return period: **30 years**
- Duration: **60min**
- Rainfall Depth (incl. 10% Climate Change):**33.33mm**

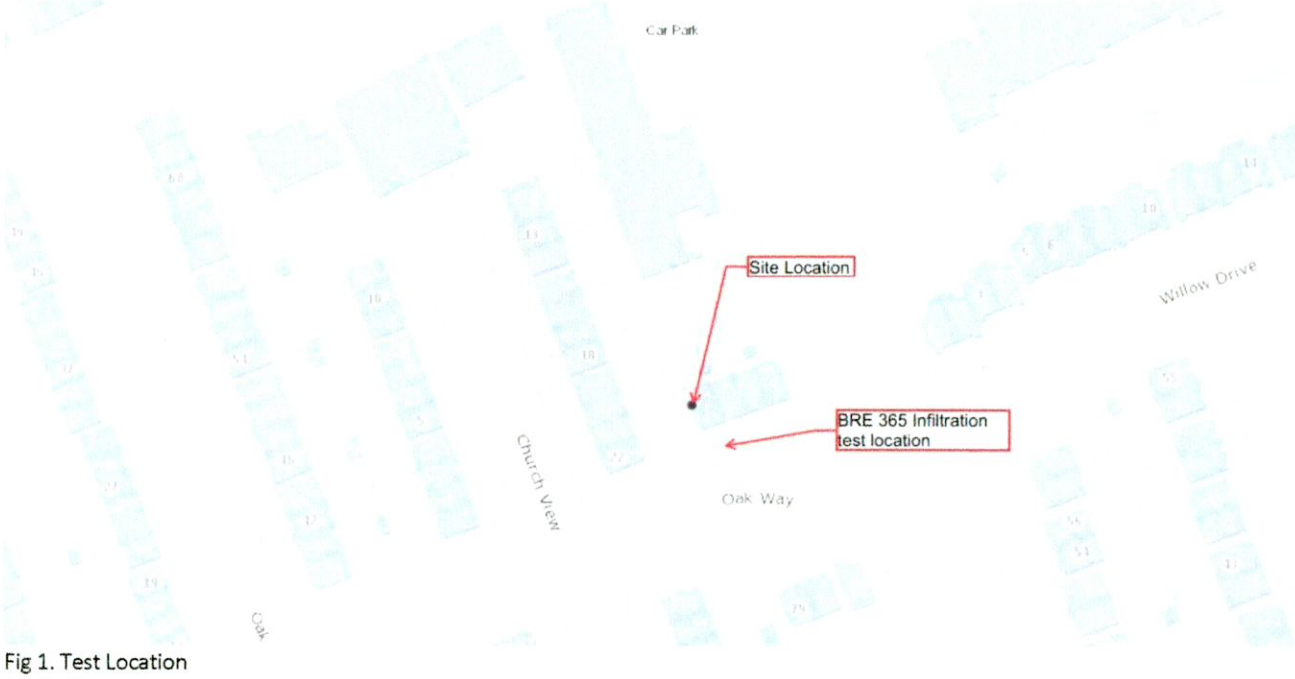

Fig 1. Test Location

2. Soakaway Design BRE Digest 365

- Free volumes for a trench fill to accommodate granular material (ie.20mm washed stone):**40%**
- The safety factor: **1**
- Total catchment area: **55m^2**
- Runoff coefficient as per BRE 365: **1**
- Dimensions of the test pit: **L 1000mm x W 300mm x D 1300mm**
- An effective storage depth adopted:**1000mm**

Soil Infiltration rate calculated as per BRE365 soakaway test:

- $f=V_{75-25}/(a_{50}*t_{75-25})$ =9.47 E-06=**0.0000095m/sec**

where:

- V_{75-25}=1000mm*300mm*500mm=0.15m3
- $A_{50\ base}$=(2*1000mm*500mm) +(2*300mm*500mm) +(1*1000mm*300mm) =1.6m2
- Fill 1 t_{75-25}=150min=9000sec
- Fill 2 t_{75-25}=160min=9600sec
- Fill 3 t_{75-25}=165min=9900sec

	Date	T_{75}=ED-300mm	T_{25}=ED-900mm	T_{75-25}[min]
Fill1	25/05/2022	09:00	11:30	150
Fill2	25/05/2022	11:40	14:20	160
Fill3	26/05/2022	08:00	10:45	165

Fig 2. Site View North

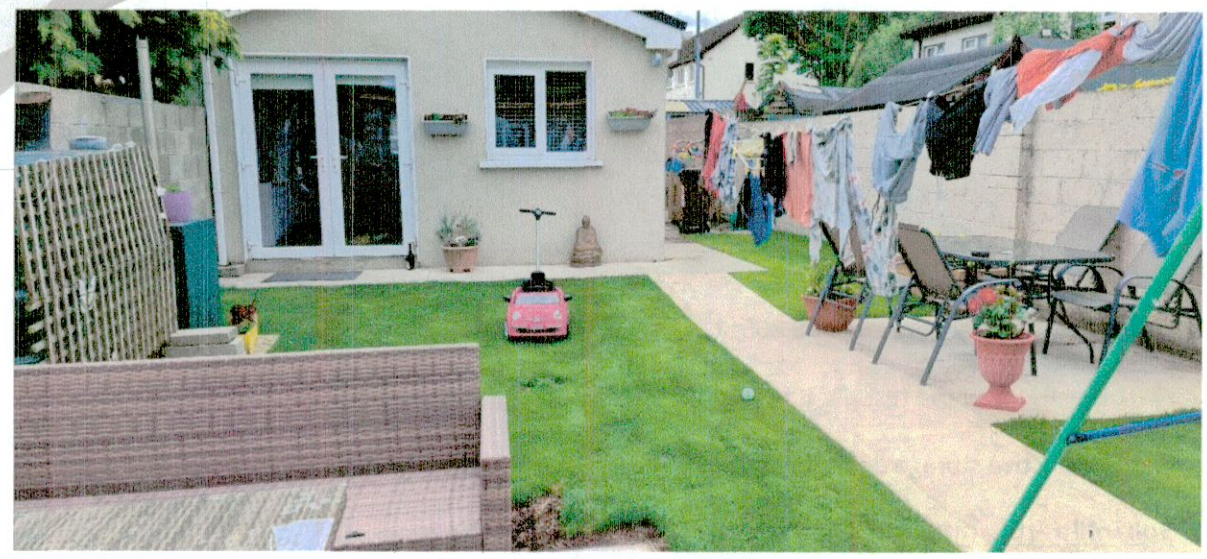

Fig 3. Site View South

Fig 4. Site View East

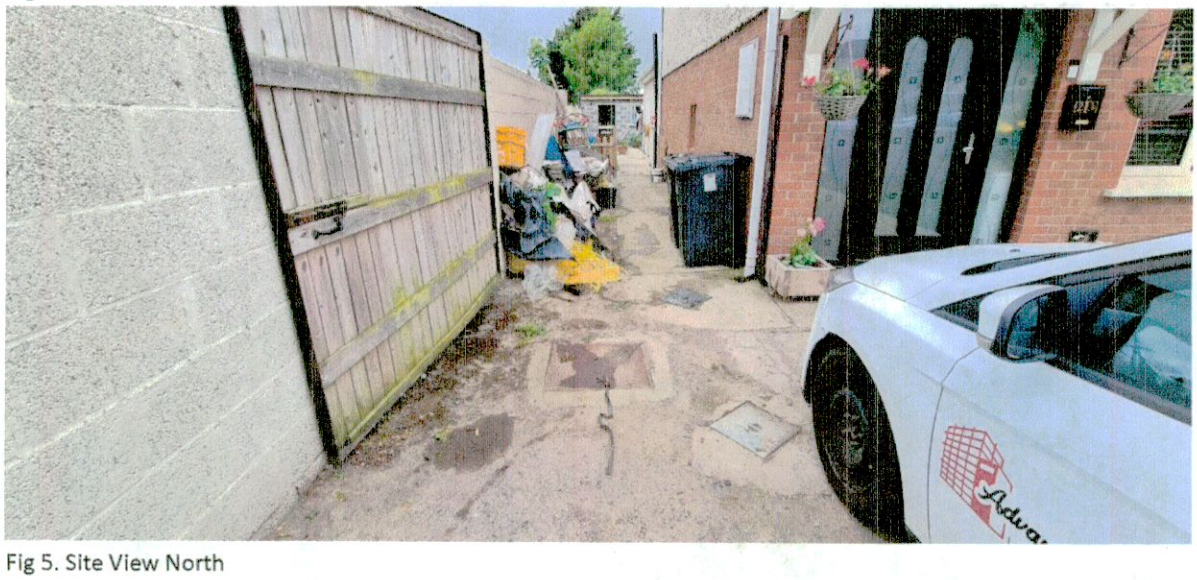

Fig 5. Site View North

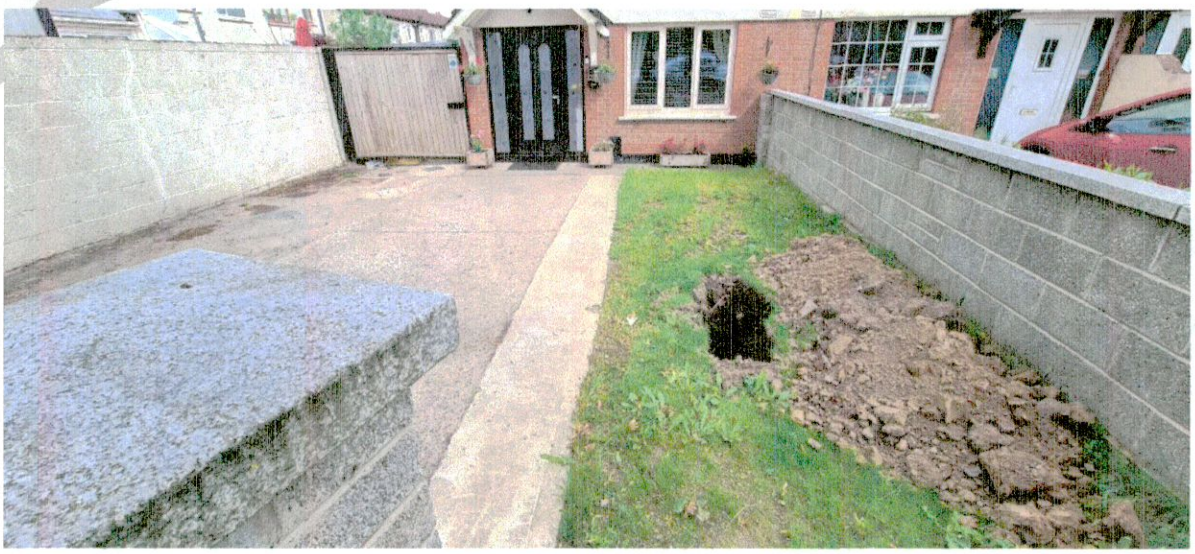

Fig 5. Infiltration test location 25/05/2022

Fig 5. Infiltration test 25/05/2022

Fig 6. Infiltration test 25/05/2022

Fig 7. Infiltration test 25/05/2022

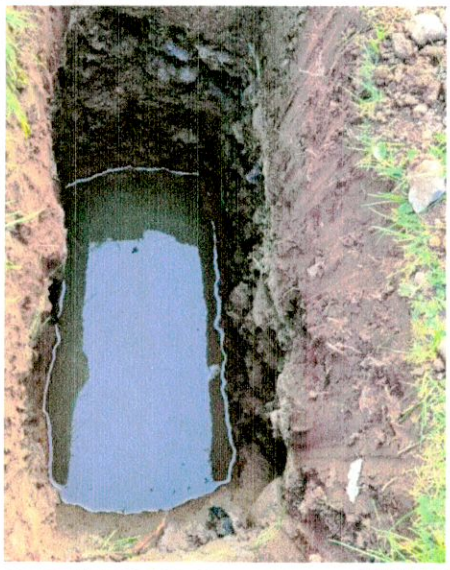

Fig 8. Infiltration test 25/05/2022

Fig 9. Infiltration test 25/05/2022

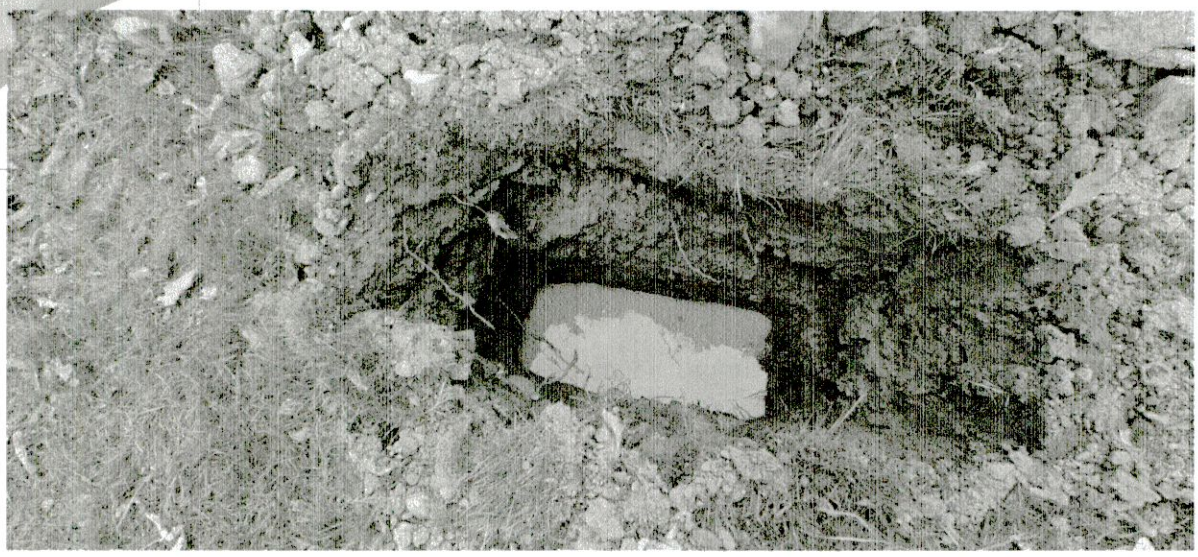

Fig 10. Infiltration test 26/05/2022

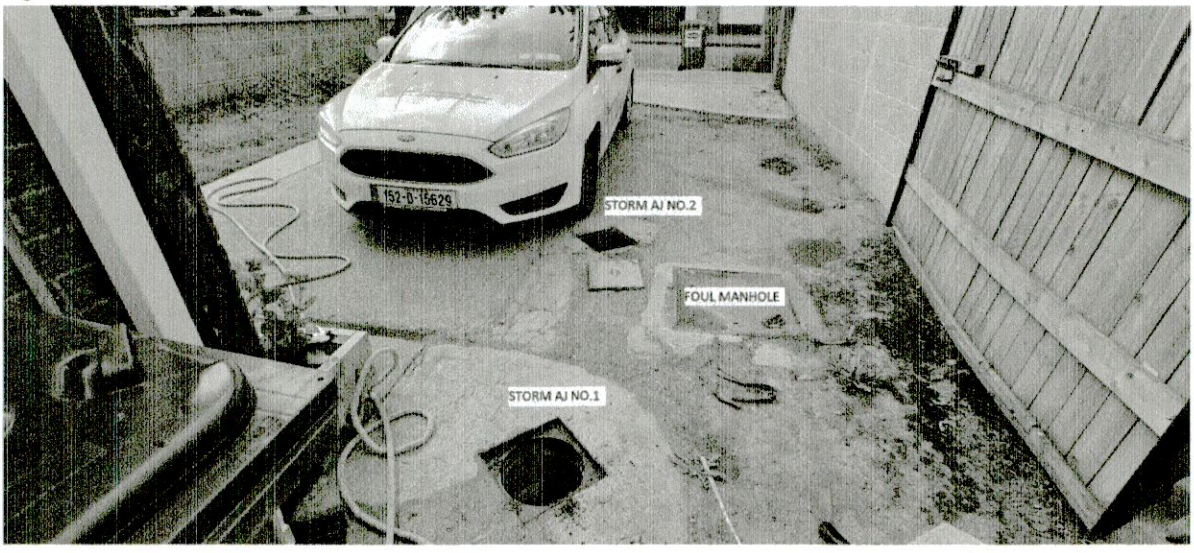

Fig 11. Storm and Foul AJ's Manholes location

Fig 12. Stormwater Road Gully Location

Inflow to Soakaway

- Total impermeable area: **55 m^2**
- Runoff coefficient: **1**
- Total Inflow: **I=55[m2] *1*0.03333[m]=1.83[m^3]**

Outflow from Soakaway

- Model soakaway dimensions adopted for design: **W=2.5m, Effective depth=1.0m, Length to be calculated**
- Internal surface area to 50% effective depth: **a_{s50} = 2*2.5m*0.5m + 2*L*0.5m = 2.5 [m] + 1.0 L [m]**
- Soil infiltration rate: **f = 0.0000095m/sec**
- Storm duration in seconds: **D = 3600sec**
- Outflow from soakaway: **O=as50*f*D=(2.5+1.0L)*0.0000095*3600=(2.5+1.0L)* 0.034=0.085 [m^3]+0.034L [m^3]**

Soakaway Storage Volume S

- Effective volume of soakaway with 40% free volume: **S=2.5m*1.0m*L*40% =1.0L[m^3]**
- Length of soakaway calculated as follows **S = I – O; 1.0L [m^3] =1.83[m^3] – 0.085[m3] – 0.034L [m3]; L= 1.69[m]**

The depth of the soakaway pit is set at 1000mm below the invert level (IL 300mm) of the inlet drain DN 100, and the proposed width of 2500mm. The calculated length of the model soakaway 1690mm as per BRE365.

Dimensions of the soakaway excavation

- It is proposed to round off dimensions of soakaway excavation to:

  Excavation volume: W2.5m * 1.7m * D1.3m = 5.52m3

  Granular material volume: W2.5m*L1.7m*1.0m= 4.25m3

A soakaway excavation of 2.5m long by 1.7m wide and 1.3m deep should be prepared and filled with washed drainage stone (30% void) up to 0.3m below CL. Proposed design will be suitable to cater for critical storm duration of 60min occurring once within 30 years.

- Effective soakaway volume: **S= 1.7 [m^3]**
- Outflow from soakaway: **O=0.14[m^3]**
- Internal surface area @ 50% effective depth: **a_{s50}= 4.2[m^2]**

The base of the soakaway has not been included in the design calculations which is assumed to clog with fine particles and become ineffective in the long term

Time of emptying half storage volume; Soakaway A

- $t_{50}=S*0.5/(a_{50}*f)$ =1.7*0.5 / (4.2*0.0000095) =21371sec=356min=**5hr 56min**
- S=1.7m3
- As_{50}=4.2m2
- f=0.0000095m/sec

Time for emptying half storage volume: **5hr 56min does meet the 24-hr time criterion for half empty volume therefore underground soakaway system will be satisfactory for this site.**

3. Soakaway location

The location and configuration of the soakaway pit will depend on the topography, the presence or otherwise of underground services, planning conditions, and on or other factors, whether existing, planned, or anticipated.

The separation distances tabulated below are taken from BRE365 and are provided as a guide. Separation distances should be such that any excavation work required for the soakaway does not undermine adjacent features, such as buildings, roads, or walls.

Features	Soakaway
Wastewater ground disposal system	5m
Any dwelling house	5m
Road Boundary	5m
Site Boundary	3m
Open Drain/Stream/River	10m

Fig 6. Minimum separation distances

4. Water Butt

Stingray Environmental Engineering would recommend, to reduce the consumption of potable water for gardening use, by utilizing the water efficient components and to install the rainwater butts.

The rainwater butt will collect, filter, store, and reuse rainwater from the roof. Water from water butt is to replace mains water in non-potable applications such as irrigation systems, vehicle washing, sprinkler systems and any other applications where water is not used for human consumption.

Typical details of water butt below:

- Large Square Water Butt Kit
- Complete Water Butt Kit Includes
  - ✓ Water Butt Tank
  - ✓ Lid
  - ✓ Stand
  - ✓ Downpipe Rainwater Diverter
  - ✓ Water Butt Tap
  - ✓ Capacity: 300L
  - ✓ Colour: Green
  - ✓ Material: 100% Recycled Plastic
  - ✓ Includes Metal Bracing for Increased Stability

Typical Water Butt Dimensions:

- ✓ (HxWxD): 91.6 x 79.6 x 66cm
- ✓ Water Butt Stand: 32cm

- Two Diverter Options:
- Round
  Or
- Square
- Downpipes
  Overflow Valve/Diverter Pipe Inlet

Water Butt Kit – Uses:

- Large capacity water butt kit is ideal for storing & saving water
- Watering garden
- Washing cars, bikes, pets
- Save money on water charges whilst helping the environment
- Store up water for the drier summer months
- Use in conjunction with a pump & timer to water greenhouse, vegetable plot or raised beds

Water Butt Kit – Advantages:

- Large yet neat
- Square shaped water butt fits neatly up against a wall
- Saves space, saves water
- Resistance to weathering
- Tap has an easy connect/disconnect

Fig 13. 300ltr Water butt example

To calculate potential yield and optimum storage requirements below calculation can be used as follows:

Annual yield roof 55msq is given as:

ARY_5 = A * e *AER *h *0.05=55*0.9*330*0.9*0.05= **735 litres/year**

ARY is 5% of Annual rainwater yield (litres)
A is the collection area (m2) =55m2
e is the yield coefficient (assume 0.9 in most cases) =0.9
AER average effective rainfall is the site specific annual average rainfall (mm) =330mm/year (as per GSI mapping for Dublin 22)
h is the hydraulic filter efficiency (varies) = 0.9

5. Recommendation

- It is the responsibility of the Project Supervisor (i.e. Engineer, Architect or other competent person) to ensure that the rainwater soakaway is located and installed in accordance with planning conditions and BRE 365 requirements.
- During the design process, a silt trap should be incorporated into any drains discharging into the soakaway system
- All elements of the soakaway should be effectively maintained by qualified service technicians/engineers
- It is proposed to install 1No. rainwater butt on this site with total recommended storage volume of 735ltrs.

6. Important note

- The percentage run-off is taken as 100% from the drained area. No reduction is made to the design run-off volume discharged to the soakaway for loses due to surface wetting or the filling of puddles during the storm

- No allowance is made for the time taken for run-off to discharge to the soakaway. The required storage volume is calculated based on instantaneous discharge to the soakaway
- The outflow from the soakaway is underestimated. Higher infiltration rates occur at the greater depths of storage in practice, than are adopted in design, and because the outflow is calculated of the rainfall duration rather than of run off duration. The latter maybe considerably longer depending on the size and length of drains.
- This report is only valid on the time of site inspection. The author cannot be responsible for any changes that could occur as result of construction, remediation, adjustment works completed afterwards.
- Additional ground investigation works may still be necessary if further required by local authorities or the other governing bodies.

7. Summary

- The effective volume of the soakaway filled with granular material (40% void) is 1.7m3.
- Soakaway with minimum dimensions of W1.7m * L2.5m * D 1.3m can be constructed. The sizing of the soakaway can be further reduced if rainwater collection system or additional sustainable drainage systems will be installed. Drw. 693-C02.
- Proposed storm water disposal system is to include high level emergency overflow into the existing stormwater mains. The overflow is to be connected into Stormwater AJ No. 1, then into Stormwater AJ No. 2 and finally enters the existing stormwater road gully. Details Fig. 11, Fig 12, Drw.693-C01.
- Proposed storage volume of rainwater butts 735ltrs.

Signed: *Waldemar Debowski* Date: 14 June 2022

Qualifications: B.Eng. P.Grad.Dips. FETAC Cert MIEI MIAH

Appendix A. BRE Drw.689-C01 A. Sterio, D22YD34_Site Layout Plan

Appendix B. BRE Drw.689-C02A. Sterio, D22YD34_Stormwater Details

Appendix C. BRE Met Eireann Return Period Rainfall Depths, D22YD34

Appendix D. BRE Existing Services Map_23 Churchview D22_Watermains & Drainage