



1 February 2019

Tauranga City Council  
Private Bag 12022  
Tauranga 3143

Attention: TCC Development Engineer

**RE: Soakage Assessment for Proposed Residential Dwellings in Stage 3D and 3E at Terrace Views, Te Okuroa Drive, Papamoa**

## 1.0 INTRODUCTION

Lysaght Consultants Ltd (LCL) was engaged by Zariba Properties Ltd to provide typical soakage system design details for Stage 3D and 3E of the Terrace Views residential development. This report provides a standardised soakage design which can be incorporated into Building Consent applications without the need for site specific engineering design (where the soakage system complies with the requirements of this report and attached drawings). Proposals outside of these report parameters will require specific design by a suitably experienced Chartered Professional Engineer.

This soakage assessment is for both area Stage 3D and Stage 3E and include the following lots:

*Table 1 – Lots included in Stage 3D and 3E*

| Lot Numbers – Stage 3D |     |     |     |     |     |     |     |     |     |
|------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 391                    | 392 | 393 | 394 | 395 | 396 | 397 | 398 | 399 | 400 |
| 439                    | 440 | 441 | 442 | 443 | 444 | 445 | 446 | 447 | 448 |
| 449                    | 450 | 451 | 452 | 453 | 454 | 455 | 456 | 457 | 458 |
| 459                    | -   | -   | -   | -   | -   | -   | -   | -   | -   |
| Lot Numbers – Stage 3E |     |     |     |     |     |     |     |     |     |
| 460                    | 461 | 462 | 463 | 464 | 465 | 466 | 467 | 468 | 469 |
| 470                    | 471 | 472 | 473 | 474 | 475 | 476 | 477 | 478 | 479 |
| 480                    | 481 | 482 | 483 | 484 | 485 | 486 | 487 | 488 | 489 |
| 490                    | 491 | 492 | -   | -   | -   | -   | -   | -   | -   |

No stormwater connections are provided to lots within the Terrace Views development. All stormwater runoff from private roofs and hardstand areas is to be collected and discharged to stormwater soakage within each lot boundary in accordance with the following recommendations.

## 2.0 DESIGN RECCOMENDATIONS

Aurecon's Soakage Memorandum 'Terrace Views Subdivision – Stage 3D/3E Soakage Testing and Assessment' dated 21 January 2019 recommends the following a design soakage rates:

Table 2 – Design soakage rates

| Area            | Design Soakage Rate (L/min/m <sup>2</sup> ) |
|-----------------|---------------------------------------------|
| Stage 3D and 3E | 0.72                                        |

Stage 3D and 3E Area 1 has generally been undercut to the natural dune sand to +3.0mRL and then filled with imported pumice sand to finished subgrade level. Stage 3D and 3E Area 2 was undercut of peat to approximately +1.5mRL. This area then filled to +3.0mRL with dune sand cut from other areas of the site and further filled with imported pumice fill from +3.0mRL to finished subgrade level.

Due to this pumice fill above +3.0mRL the soakage rate applies to dune sand material below +3.0mRL only. All soakage systems shall be founded at/or below +3.0mRL within dune sands.

## 3.0 STORMWATER SOAKAGE DESIGN

As per Aurecon's soakage testing, LCL has adopted the design soakage rate of 0.72 L/min/m<sup>2</sup> for system design calculations for both Stage 3D and Stage 3E.

The final ground level (FGL) across Stages 3D and 3E ranges from RL 5.15m to RL5.9m. Due to the varying pumice fill thickness above RL3.0m, separate standardized designs for Stage 3D and Stage 3E have been provided.

LCL's calculations confirm the following designs:

### 3.1 Stage 3D

#### 3.1.1 Porous Soak holes

1 x 2.0m deep 1200mmø (ID) soak hole per 37m<sup>2</sup> of roof area. Note; where calculations indicate part systems (e.g. 2.4 soak hole systems) the number of soak holes shall be rounded up to the next whole number.

1 x 2.0m deep 900mmø (ID) soak hole per 21m<sup>2</sup> of roof area. Note; where calculations indicate part systems (e.g. 2.4 soak hole systems) the number of soak holes shall be rounded up to the next whole number.

#### 3.1.2 Storage Cells

A proprietary cell system with a base area of 4.19m<sup>2</sup> (1.22m width x 3.43m length x 1.72m depth) per 100m<sup>2</sup> of roof/hardstand (based on Atlantis Flo Tank or approved equivalent). Note; where calculations indicate part systems (e.g 2.4 cells long) the number of cells shall be rounded up to the next whole cell number.

A 'Cell' refers to a proprietary system made up of crates equalling the following dimensions, 1.22m width x 3.43m length x 1.72 m depth (3 crates width by 5 crates length x 4 crates depth).

## 3.2 Stage 3E

### 3.2.3 Porous Soak holes

1 x 1.5m deep 1200mmø (ID) soak hole per 29m<sup>2</sup> of roof area. Note; where calculations indicate part systems (e.g. 2.4 soak hole systems) the number of soak holes shall be rounded up to the next whole number.

1 x 1.5m deep 900mmø (ID) soak hole per 16m<sup>2</sup> of roof area. Note; where calculations indicate part systems (e.g. 2.4 soak hole systems) the number of soak holes shall be rounded up to the next whole number.

### 3.2.4 Storage Cells

A proprietary cells with a base area of 5.03m<sup>2</sup> (1.22m width x 4.11m length x 1.31m depth) per 100m<sup>2</sup> of roof/hardstand (based on Atlantis Flo Tank or approved equivalent). Note; where calculations indicate part systems (e.g 2.4 cells long) the number of cells shall be rounded up to the next whole cell number.

A 'Cell' refers to a proprietary system made up of crates equalling the following dimensions, 1.22m width x 4.11m length x 1.31 m depth (3 crates width by 6 crates length x 3 crates depth).

## 3.3 Groundwater

The generic design assumes the base of the system is located at the high winter ground water level which is assumed to be RL +3.0m based on previous stage designs. No freeboard allowance has been provided to the groundwater. This departure from the IDC freeboard allowance has been accounted for in Aurecon's design soakage rates.

## 4.0 CONSTRUCTION AND MAINTENANCE REQUIREMENTS

Typical construction details are provided below for the selected soakage options.

### 4.1 System Installation

Due to the several meters of low permeability compacted pumiced fill across Stage 3D and 3E, the base of soakage systems are to be located on the underlying dune sands located at approximately RL +3.0m. Additional soak rings/crates may be added to the base of system to intercept this sand layer. However the additional depth shall not be used to reduce the number of soak holes/storage cells (i.e. additional depth is sacrificial). Where these additional soak rings intercept groundwater, this bottom ring shall be constructed of solid concrete (not pumice).

### 4.2 Porous Soak Holes

Porous soakage rings should be obtained from a reputable manufacturer and be designed for proposed soil loads. A suitable lid should be installed with adequate strength for the expected surcharge loads. Typical details are provided in the Building Codes E1/VM1. Accessible covers are required on all soak holes. Geofabric is only required where sand ingress will occur into the soak hole. Soak holes shall be linked together with a 100ø minimum uPVC pipe. Minimum spacing between soak holes shall be 1.5m edge to edge.

### 4.3 Storage Cells

Storage cell systems shall be installed in accordance with the manufacturer's specifications. All cells shall be wrapped in geofabric, additionally the walls and base of the excavation trench shall be lined with geofabric. A number of suitable proprietary systems are available. LCL has undertaken calculations using typical cell dimensions for the Atlantis Flo-Tank system. Alternative products may require slight alteration of the design. The manufacturers of alternative products shall confirm their system complies with LCL's generic design. Multiple storage cell systems shall be no closer than 1.0m edge to edge.

### 4.4 Setback Requirements

All soakage systems shall be designed in accordance with the following;

| Description                      | Setback Distance (minimum)                      |
|----------------------------------|-------------------------------------------------|
| Road boundaries                  | 0.5m                                            |
| Neighbouring property boundaries | 1.5m                                            |
| Buildings                        | 2.0m from building foundations.                 |
| Services (sewer etc.)            | 1.0m                                            |
| System Cover                     | 0.5m minimum or to manufacturers specifications |

### 4.5 Building Foundation Offset

Aurecon's Geotechnical Completion Report '*Terrace Views Subdivision, Parton Road, Tauranga – Stage 3D/3E Geotechnical Completion Report*' dated January 2019 provides a formula to determine the soakage system offset from building foundations and is shown as follows:

$$\text{Foundation Offset Distance} = \frac{D}{\sqrt{3}}$$

*D = Depth to base of soakage system measured from ground level*

LCL have adopted this formula for the maximum likely soakage system depth installation within Stages 3D and 3E and applied this setback to all lots within these stages. The calculated building foundation offset is 2.0m from edge of soakage system.

### 4.6 Additional Requirements

- A Chartered professional Engineer shall be engaged to review the design where setbacks, groundwater depths or systems do not comply with the generic design requirements, or where any future design changes increase the hydraulic load on the soakage system.
- LCL's standardised soakage designs assume 0.5m cover over the system. Minimum cover requirements shall be in accordance with the soakage system manufacturer's specifications.
- All cesspit connections shall be directed through a filter to ensure that leaves, debris and sediment are prevented from entering the soakage system. It is recommended that downpipes are also directed through the filter or first flush diverter wherever possible to maintain longevity of the soakage system. The filtration device shall be regularly maintained to ensure effective system operation.

- A system overflow point shall be located at a low point on the roadside boundary to ensure surcharge is directed to the road. Overland flow is to be directed toward the road without crossing neighbouring boundaries or causing inundation of buildings. Building floor levels shall comply with the NZBC and TCC IDC requirements.

#### **4.7 General Requirements**

A reputable drain layer experienced in the installation of soakage systems should be engaged for the construction of the site drainage network. System maintenance shall include regular filter cleaning and replacing as necessary. Maintenance frequency should be at least quarterly and after heavy rainfall events. The system has been sized for the selected design storm events. Larger or more intense events may exceed the system's capacity. All construction shall be to TCC's Infrastructure Development Code (IDC) and NZ Building Code requirements.

#### **5.0 LIMITATIONS**

It is assumed that the soakage recommendations provided in Aurecon's memo are representative of Stages 3D and 3E soils. There may be special conditions pertaining to specific sites which have not been disclosed by the investigation nor taken into account in this report. This office should be contacted immediately in the event that soils and/or site conditions are found to differ from the observations and assumptions presented in this report. The typical design details are intended for the specific situations described in this report and no responsibility or liability is accepted by LCL to any third party that may use or rely on any part of the content of this document where used in contradiction to the intent of the design. A suitably experienced Chartered Professional Engineer should be engaged to review any designs outside of the scope of this report or where there are any doubts about compliance with the report specifications.

Please contact the undersigned if you have any questions about the above.

Kind Regards

**LYSAGHT**



Peter Moodie  
Director - Civil and Environmental Engineer -  
CPEng – MIPENZ –BE Hons Nat Res

#### **Attachments:**

Lysaght soakage system calculations  
152870-088-SKT – Typical Soakage Sections Stage 3D  
152870-089-SKT – Typical Soakage Sections Stage 3E  
152870-085-SKT – Stage 3 Soakage Area

## Infiltration Calculation - Soakage Hole 1200mmØ



**Project** 152870  
**Address** Terrace Views, Stage 3D  
**Date** 24/01/2019

### System Calcs

|                               |                     |
|-------------------------------|---------------------|
| Catchment Area                | 37 m <sup>2</sup>   |
| Volumetric Runoff Coefficient | 0.9                 |
| Soil K <sub>h</sub>           | 43.2 mm/hr          |
| No. of Wells                  | 1                   |
| Well Diameter                 | 1.2 m               |
| Depth of Storage              | 2.00 m              |
| Porosity                      | 1                   |
| Base Area                     | 1.13 m <sup>2</sup> |

### Area Calculation

|                                  | Include |                     |
|----------------------------------|---------|---------------------|
| Base Infiltration Area           | Yes     | 1.13 m <sup>2</sup> |
| Effective Side Infiltration Area | No      | 0.00 m <sup>2</sup> |

Soakage rate 0.72 L/min/m<sup>2</sup>  
 43.2 L/hr/m<sup>2</sup>  
 43.2 mm/hr

### Infiltration Requirements

|                                   |                     |
|-----------------------------------|---------------------|
| Effective Side Area Factor        | 0%                  |
| Total Effective Infiltration Area | 1.13 m <sup>2</sup> |
| Effective Volume                  | 2.26 m <sup>3</sup> |

| Storm Duration | Storm Mean Intensity (10yr) | Volume in         | Volume out (during storm duration period) | Storage Volume Required | Percentage of Storage provided | Test       | Actual Depth | Emptying Time (hrs) | Check         |
|----------------|-----------------------------|-------------------|-------------------------------------------|-------------------------|--------------------------------|------------|--------------|---------------------|---------------|
| (minutes)      | (mm/hr)                     | (m <sup>3</sup> ) | (m <sup>3</sup> )                         | (m <sup>3</sup> )       | %                              |            |              |                     |               |
| 6              |                             | 0.000             | 0.000                                     | 0.0                     |                                | OK         | 0.00         |                     |               |
| 10             | 126                         | 0.699             | 0.008                                     | 0.7                     | 327%                           | OK         | 0.61         | 14.31               | OK            |
| 20             | 99                          | 1.099             | 0.016                                     | 1.1                     | 209%                           | OK         | 0.96         | 22.49               | OK            |
| 30             | 88                          | 1.465             | 0.024                                     | 1.4                     | 157%                           | OK         | 1.27         | 29.99               | OK            |
| 45             |                             | 0.000             | 0.000                                     | 0.0                     |                                | OK         | 0.00         |                     |               |
| 60             | 65                          | 2.165             | 0.049                                     | 2.1                     | 107%                           | OK         | 1.87         | 44.30               | OK            |
| 90             |                             | 0.000             | 0.000                                     | 0.0                     |                                | OK         | 0.00         |                     |               |
| 120            | 45                          | 2.997             | 0.098                                     | 2.9                     | 78%                            | Inadequate | 2.56         | 61.34               | Increase Area |
| 180            |                             | 0.000             | 0.000                                     | 0.0                     |                                | OK         | 0.00         |                     |               |
| 240            |                             | 0.000             | 0.000                                     | 0.0                     |                                | OK         | 0.00         |                     |               |
| 300            |                             | 0.000             | 0.000                                     | 0.0                     |                                | OK         | 0.00         |                     |               |
| 360            | 22                          | 4.396             | 0.293                                     | 4.1                     | 55%                            | Inadequate | 3.63         | 89.97               | Increase Area |
| 480            |                             | 0.000             | 0.000                                     | 0.0                     |                                | OK         | 0.00         |                     |               |
| 600            |                             | 0.000             | 0.000                                     | 0.0                     |                                | OK         | 0.00         |                     |               |
| 720            | 13.2                        | 5.275             | 0.586                                     | 4.7                     | 48%                            | Inadequate | 4.15         | 107.96              | Increase Area |
| 840            |                             | 0.000             | 0.000                                     | 0.0                     |                                | OK         | 0.00         |                     |               |
| 960            |                             | 0.000             | 0.000                                     | 0.0                     |                                | OK         | 0.00         |                     |               |
| 1080           |                             | 0.000             | 0.000                                     | 0.0                     |                                | OK         | 0.00         |                     |               |
| 1200           |                             | 0.000             | 0.000                                     | 0.0                     |                                | OK         | 0.00         |                     |               |
| 1320           |                             | 0.000             | 0.000                                     | 0.0                     |                                | OK         | 0.00         |                     |               |
| 1440           | 7.63                        | 6.098             | 1.173                                     | 4.9                     | 46%                            | Inadequate | 4.35         | 124.81              | Increase Area |
| 2160           |                             | 0.000             | 0.000                                     | 0.0                     |                                | OK         | 0.00         |                     |               |
| 2880           | 4.41                        | 7.049             | 2.345                                     | 4.7                     | 48%                            | Inadequate | 4.16         | 144.27              | Increase Area |
| 3600           |                             | 0.000             | 0.000                                     | 0.0                     |                                | OK         | 0.00         |                     |               |
| 4320           |                             | 0.000             | 0.000                                     | 0.0                     |                                | OK         | 0.00         |                     |               |

## Infiltration Calculation - Soakage Hole 900Ø

**Project** 152870  
**Address** Terrace Views, Stage 3D  
**Date** 24/01/2019



### System Calcs

|                               |            |
|-------------------------------|------------|
| Catchment Area                | 21 $m^2$   |
| Volumetric Runoff Coefficient | 0.9        |
| Soil $K_h$                    | 43.2 mm/hr |
| No. of Wells                  | 1          |
| Well Diameter                 | 0.9 m      |
| Depth of Storage              | 2.00       |
| Porosity                      | 1          |
| Base Area                     | 0.64 $m^2$ |

### Area Calculation

|                                  | Include |            |
|----------------------------------|---------|------------|
| Base Infiltration Area           | Yes     | 0.64 $m^2$ |
| Effective Side Infiltration Area | No      | 0.00 $m^2$ |

Soakage rate 0.72 L/min/ $m^2$   
 43.2 L/hr/ $m^2$   
 43.2 mm/hr

### Infiltration Requirements

|                                   |            |
|-----------------------------------|------------|
| Effective Side Area Factor        | 0%         |
| Total Effective Infiltration Area | 0.64 $m^2$ |
| Effective Volume                  | 1.27 $m^3$ |

| Storm Duration | Storm Mean Intensity (10yr) | Volume in | Volume out (during storm duration period) | Storage Volume Required | Percentage of Storage provided | Test       | Actual Depth | Emptying Time (hrs) | Check         |
|----------------|-----------------------------|-----------|-------------------------------------------|-------------------------|--------------------------------|------------|--------------|---------------------|---------------|
| (minutes)      | (mm/hr)                     | ( $m^3$ ) | ( $m^3$ )                                 | ( $m^3$ )               | %                              |            |              |                     |               |
| 6              |                             | 0.000     | 0.000                                     | 0.0                     |                                | OK         | 0.00         |                     |               |
| 10             | 126                         | 0.397     | 0.005                                     | 0.4                     | 324%                           | OK         | 0.62         | 14.44               | OK            |
| 20             | 99                          | 0.624     | 0.009                                     | 0.6                     | 207%                           | OK         | 0.97         | 22.69               | OK            |
| 30             | 88                          | 0.832     | 0.014                                     | 0.8                     | 156%                           | OK         | 1.29         | 30.26               | OK            |
| 45             |                             | 0.000     | 0.000                                     | 0.0                     |                                | OK         | 0.00         |                     |               |
| 60             | 65                          | 1.229     | 0.027                                     | 1.2                     | 106%                           | OK         | 1.89         | 44.70               | OK            |
| 90             |                             | 0.000     | 0.000                                     | 0.0                     |                                | OK         | 0.00         |                     |               |
| 120            | 45                          | 1.701     | 0.055                                     | 1.6                     | 77%                            | Inadequate | 2.59         | 61.89               | Increase Area |
| 180            |                             | 0.000     | 0.000                                     | 0.0                     |                                | OK         | 0.00         |                     |               |
| 240            |                             | 0.000     | 0.000                                     | 0.0                     |                                | OK         | 0.00         |                     |               |
| 300            |                             | 0.000     | 0.000                                     | 0.0                     |                                | OK         | 0.00         |                     |               |
| 360            | 22                          | 2.495     | 0.165                                     | 2.3                     | 55%                            | Inadequate | 3.66         | 90.78               | Increase Area |
| 480            |                             | 0.000     | 0.000                                     | 0.0                     |                                | OK         | 0.00         |                     |               |
| 600            |                             | 0.000     | 0.000                                     | 0.0                     |                                | OK         | 0.00         |                     |               |
| 720            | 13.2                        | 2.994     | 0.330                                     | 2.7                     | 48%                            | Inadequate | 4.19         | 108.93              | Increase Area |
| 840            |                             | 0.000     | 0.000                                     | 0.0                     |                                | OK         | 0.00         |                     |               |
| 960            |                             | 0.000     | 0.000                                     | 0.0                     |                                | OK         | 0.00         |                     |               |
| 1080           |                             | 0.000     | 0.000                                     | 0.0                     |                                | OK         | 0.00         |                     |               |
| 1200           |                             | 0.000     | 0.000                                     | 0.0                     |                                | OK         | 0.00         |                     |               |
| 1320           |                             | 0.000     | 0.000                                     | 0.0                     |                                | OK         | 0.00         |                     |               |
| 1440           | 7.63                        | 3.461     | 0.660                                     | 2.8                     | 45%                            | Inadequate | 4.40         | 125.93              | Increase Area |
| 2160           |                             | 0.000     | 0.000                                     | 0.0                     |                                | OK         | 0.00         |                     |               |
| 2880           | 4.41                        | 4.001     | 1.319                                     | 2.7                     | 47%                            | Inadequate | 4.22         | 145.57              | Increase Area |
| 3600           |                             | 0.000     | 0.000                                     | 0.0                     |                                | OK         | 0.00         |                     |               |
| 4320           |                             | 0.000     | 0.000                                     | 0.0                     |                                | OK         | 0.00         |                     |               |

## Infiltration Calculation - Modular Tank

**Project:** 152870  
**Site Address:** Terrace Views, Stage 3D  
**Date:** 24/01/2019



### System Calcs

|                               |       |                |
|-------------------------------|-------|----------------|
| Catchment Area                | 100   | m <sup>2</sup> |
| Volumetric Runoff Coefficient | 0.9   |                |
| Soil K <sub>h</sub>           | 43.2  | mm/hr          |
| Width of Infiltration Area    | 1.224 | m              |
| Length of Infiltration Area   | 3.425 | m              |
| Depth of Storage              | 1.72  | m              |
| Porosity                      | 0.95  |                |
| Base Area                     | 4.19  | m <sup>2</sup> |

### Area Calculation

|                                  | Include |                     |
|----------------------------------|---------|---------------------|
| Base Infiltration Area           | Yes     | 4.19 m <sup>2</sup> |
| Effective Side Infiltration Area | No      | 0 m <sup>2</sup>    |

### Infiltration Requirements

|                                   |                     |
|-----------------------------------|---------------------|
| Total Effective Infiltration Area | 4.19 m <sup>2</sup> |
| Effective Volume                  | 6.85 m <sup>3</sup> |

### Atlantis Matrix Quad System

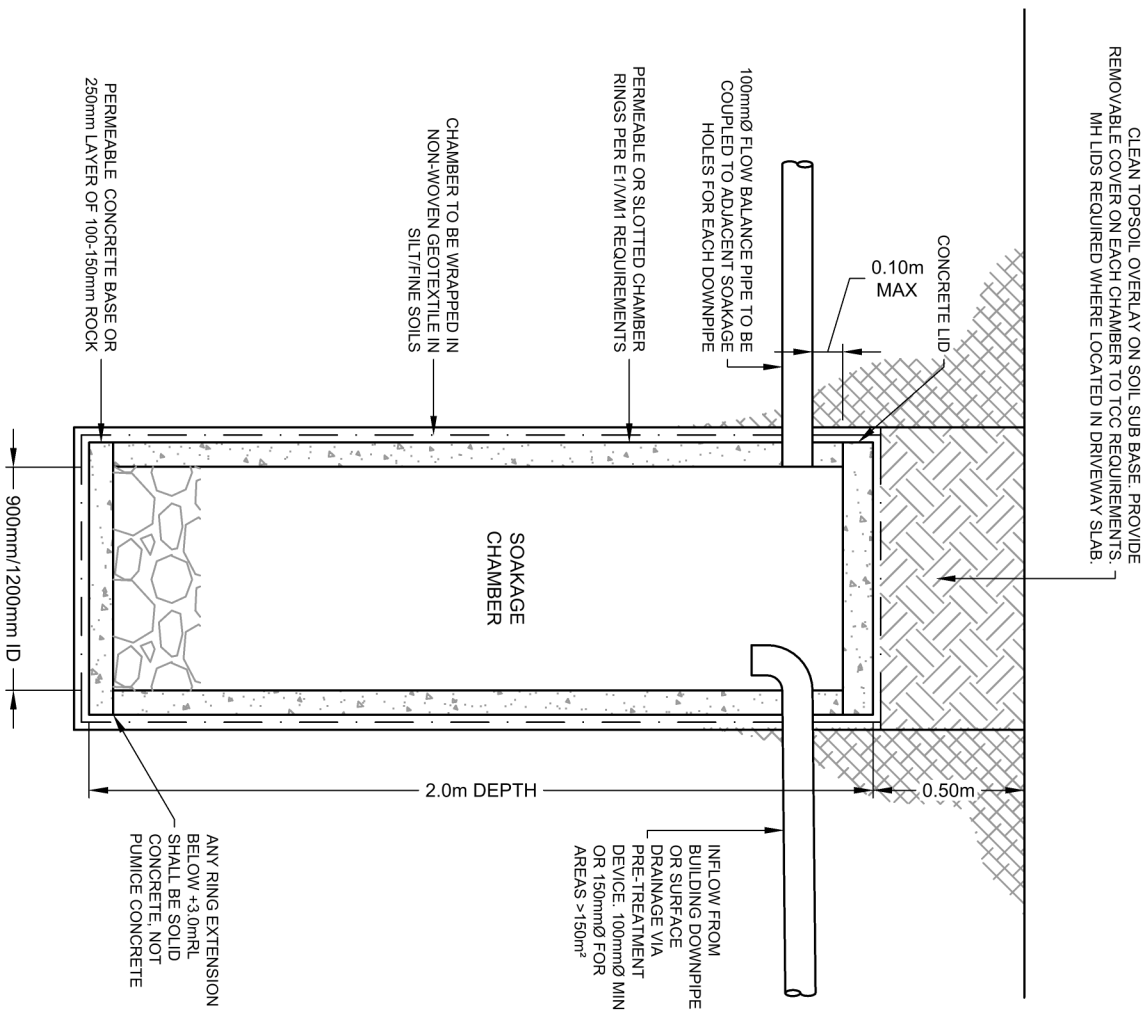
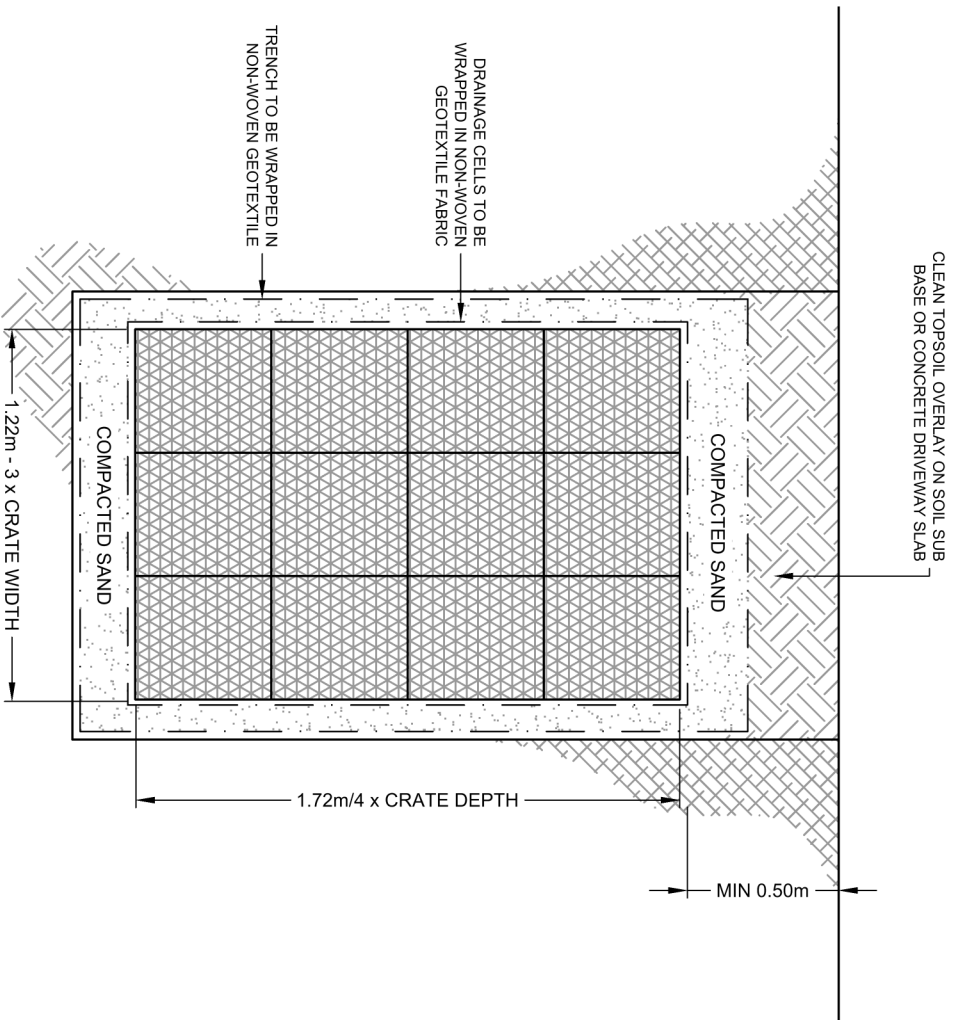
|   |   |       |
|---|---|-------|
| w | 3 | 0.408 |
| l | 5 | 0.685 |
| h | 1 | 1.72  |

|              |                           |
|--------------|---------------------------|
| Soakage rate | 0.72 L/min/m <sup>2</sup> |
|              | 43.2 L/hr/m <sup>2</sup>  |
|              | 43.2 mm/hr                |

| Storm Duration | Storm Mean Intensity (10yr) | Volume in         | Volume out (during storm duration period) | Storage Volume Required | Percentage of Storage provided | Test       | Actual Depth | Emptying Time (hrs) | Check         |
|----------------|-----------------------------|-------------------|-------------------------------------------|-------------------------|--------------------------------|------------|--------------|---------------------|---------------|
| (minutes)      | (mm/hr)                     | (m <sup>3</sup> ) | (m <sup>3</sup> )                         | (m <sup>3</sup> )       | %                              |            |              |                     |               |
| 6              |                             | 0.000             | 0.000                                     | 0.000                   |                                | OK         | 0.00         |                     |               |
| 10             | 126                         | 1.890             | 0.030                                     | 1.860                   | 368%                           | OK         | 0.47         | 10.44               | OK            |
| 20             | 99                          | 2.970             | 0.060                                     | 2.910                   | 235%                           | OK         | 0.73         | 16.40               | OK            |
| 30             | 88                          | 3.960             | 0.091                                     | 3.869                   | 177%                           | OK         | 0.97         | 21.87               | OK            |
| 45             |                             | 0.000             | 0.000                                     | 0.000                   |                                | OK         | 0.00         |                     |               |
| 60             | 65                          | 5.850             | 0.181                                     | 5.669                   | 121%                           | OK         | 1.42         | 32.30               | OK            |
| 90             |                             | 0.000             | 0.000                                     | 0.000                   |                                | OK         | 0.00         |                     |               |
| 120            | 45                          | 8.100             | 0.362                                     | 7.738                   | 89%                            | Inadequate | 1.94         | 44.73               | OK            |
| 180            |                             | 0.000             | 0.000                                     | 0.000                   |                                | OK         | 0.00         |                     |               |
| 240            |                             | 0.000             | 0.000                                     | 0.000                   |                                | OK         | 0.00         |                     |               |
| 300            |                             | 0.000             | 0.000                                     | 0.000                   |                                | OK         | 0.00         |                     |               |
| 360            | 22                          | 11.880            | 1.087                                     | 10.793                  | 63%                            | Inadequate | 2.71         | 65.60               | Increase Area |
| 480            |                             | 0.000             | 0.000                                     | 0.000                   |                                | OK         | 0.00         |                     |               |
| 600            |                             | 0.000             | 0.000                                     | 0.000                   |                                | OK         | 0.00         |                     |               |
| 720            | 13.2                        | 14.256            | 2.173                                     | 12.083                  | 57%                            | Inadequate | 3.03         | 78.72               | Increase Area |
| 840            |                             | 0.000             | 0.000                                     | 0.000                   |                                | OK         | 0.00         |                     |               |
| 960            |                             | 0.000             | 0.000                                     | 0.000                   |                                | OK         | 0.00         |                     |               |
| 1080           |                             | 0.000             | 0.000                                     | 0.000                   |                                | OK         | 0.00         |                     |               |
| 1200           |                             | 0.000             | 0.000                                     | 0.000                   |                                | OK         | 0.00         |                     |               |
| 1320           |                             | 0.000             | 0.000                                     | 0.000                   |                                | OK         | 0.00         |                     |               |
| 1440           | 7.63                        | 16.481            | 4.346                                     | 12.134                  | 56%                            | Inadequate | 3.05         | 91.00               | Increase Area |
| 2160           |                             | 0.000             | 0.000                                     | 0.000                   |                                | OK         | 0.00         |                     |               |
| 2880           | 4.41                        | 19.051            | 8.693                                     | 10.358                  | 66%                            | Inadequate | 2.60         | 105.20              | Increase Area |
| 3600           |                             | 0.000             | 0.000                                     | 0.000                   |                                | OK         | 0.00         |                     |               |
| 4320           |                             | 0.000             | 0.000                                     | 0.000                   |                                | OK         | 0.00         |                     |               |

## NOTES

1. ALL DIMENSIONS IN METERS UNLESS NOTED OTHERWISE.
2. ALL WORKS TO COMPLY WITH TCC INFRASTRUCTURE DEVELOPMENT CODE, BOPRC REQUIREMENTS, THE NZ BUILDING CODE AND GOOD CONSTRUCTION PRACTICES.



## ATLANTIS FLO-TANK SYSTEM

NOT TO SCALE

## SOAKAGE RING

NOT TO SCALE

[illegible]

## Infiltration Calculation - Soakage Hole 1200mmØ

**Project** 152870  
**Address** Terrace Views, Stage 3E  
**Date** 24/01/2019



### System Calcs

|                               |                     |
|-------------------------------|---------------------|
| Catchment Area                | 29 m <sup>2</sup>   |
| Volumetric Runoff Coefficient | 0.9                 |
| Soil K <sub>h</sub>           | 43.2 mm/hr          |
| No. of Wells                  | 1                   |
| Well Diameter                 | 1.2 m               |
| Depth of Storage              | 1.50 m              |
| Porosity                      | 1                   |
| Base Area                     | 1.13 m <sup>2</sup> |

### Area Calculation

|                                  | Include |                     |
|----------------------------------|---------|---------------------|
| Base Infiltration Area           | Yes     | 1.13 m <sup>2</sup> |
| Effective Side Infiltration Area | No      | 0.00 m <sup>2</sup> |

Soakage rate 0.72 L/min/m<sup>2</sup>  
 43.2 L/hr/m<sup>2</sup>  
 43.2 mm/hr

### Infiltration Requirements

|                                   |                     |
|-----------------------------------|---------------------|
| Effective Side Area Factor        | 0%                  |
| Total Effective Infiltration Area | 1.13 m <sup>2</sup> |
| Effective Volume                  | 1.70 m <sup>3</sup> |

| Storm Duration | Storm Mean Intensity (10yr) | Volume in         | Volume out (during storm duration period) | Storage Volume Required | Percentage of Storage provided | Test       | Actual Depth | Emptying Time (hrs) | Check         |
|----------------|-----------------------------|-------------------|-------------------------------------------|-------------------------|--------------------------------|------------|--------------|---------------------|---------------|
| (minutes)      | (mm/hr)                     | (m <sup>3</sup> ) | (m <sup>3</sup> )                         | (m <sup>3</sup> )       | %                              |            |              |                     |               |
| 6              |                             | 0.000             | 0.000                                     | 0.0                     |                                | OK         | 0.00         |                     |               |
| 10             | 126                         | 0.548             | 0.008                                     | 0.5                     | 314%                           | OK         | 0.48         | 11.22               | OK            |
| 20             | 99                          | 0.861             | 0.016                                     | 0.8                     | 201%                           | OK         | 0.75         | 17.63               | OK            |
| 30             | 88                          | 1.148             | 0.024                                     | 1.1                     | 151%                           | OK         | 0.99         | 23.50               | OK            |
| 45             |                             | 0.000             | 0.000                                     | 0.0                     |                                | OK         | 0.00         |                     |               |
| 60             | 65                          | 1.697             | 0.049                                     | 1.6                     | 103%                           | OK         | 1.46         | 34.72               | OK            |
| 90             |                             | 0.000             | 0.000                                     | 0.0                     |                                | OK         | 0.00         |                     |               |
| 120            | 45                          | 2.349             | 0.098                                     | 2.3                     | 75%                            | Inadequate | 1.99         | 48.08               | Increase Area |
| 180            |                             | 0.000             | 0.000                                     | 0.0                     |                                | OK         | 0.00         |                     |               |
| 240            |                             | 0.000             | 0.000                                     | 0.0                     |                                | OK         | 0.00         |                     |               |
| 300            |                             | 0.000             | 0.000                                     | 0.0                     |                                | OK         | 0.00         |                     |               |
| 360            | 22                          | 3.445             | 0.293                                     | 3.2                     | 54%                            | Inadequate | 2.79         | 70.51               | Increase Area |
| 480            |                             | 0.000             | 0.000                                     | 0.0                     |                                | OK         | 0.00         |                     |               |
| 600            |                             | 0.000             | 0.000                                     | 0.0                     |                                | OK         | 0.00         |                     |               |
| 720            | 13.2                        | 4.134             | 0.586                                     | 3.5                     | 48%                            | Inadequate | 3.14         | 84.62               | Increase Area |
| 840            |                             | 0.000             | 0.000                                     | 0.0                     |                                | OK         | 0.00         |                     |               |
| 960            |                             | 0.000             | 0.000                                     | 0.0                     |                                | OK         | 0.00         |                     |               |
| 1080           |                             | 0.000             | 0.000                                     | 0.0                     |                                | OK         | 0.00         |                     |               |
| 1200           |                             | 0.000             | 0.000                                     | 0.0                     |                                | OK         | 0.00         |                     |               |
| 1320           |                             | 0.000             | 0.000                                     | 0.0                     |                                | OK         | 0.00         |                     |               |
| 1440           | 7.63                        | 4.779             | 1.173                                     | 3.6                     | 47%                            | Inadequate | 3.19         | 97.82               | Increase Area |
| 2160           |                             | 0.000             | 0.000                                     | 0.0                     |                                | OK         | 0.00         |                     |               |
| 2880           | 4.41                        | 5.525             | 2.345                                     | 3.2                     | 53%                            | Inadequate | 2.81         | 113.08              | Increase Area |
| 3600           |                             | 0.000             | 0.000                                     | 0.0                     |                                | OK         | 0.00         |                     |               |
| 4320           |                             | 0.000             | 0.000                                     | 0.0                     |                                | OK         | 0.00         |                     |               |

## Infiltration Calculation - Soakage Hole 900Ø

**Project** 152870  
**Address** Terrace Views, Stage 3E  
**Date** 24/01/2019



### System Calcs

|                               |            |
|-------------------------------|------------|
| Catchment Area                | 16 $m^2$   |
| Volumetric Runoff Coefficient | 0.9        |
| Soil $K_h$                    | 43.2 mm/hr |
| No. of Wells                  | 1          |
| Well Diameter                 | 0.9 m      |
| Depth of Storage              | 1.50       |
| Porosity                      | 1          |
| Base Area                     | 0.64 $m^2$ |

### Area Calculation

|                                  | Include |            |
|----------------------------------|---------|------------|
| Base Infiltration Area           | Yes     | 0.64 $m^2$ |
| Effective Side Infiltration Area | No      | 0.00 $m^2$ |

Soakage rate 0.72 L/min/ $m^2$   
 43.2 L/hr/ $m^2$   
 43.2 mm/hr

### Infiltration Requirements

|                                   |            |
|-----------------------------------|------------|
| Effective Side Area Factor        | 0%         |
| Total Effective Infiltration Area | 0.64 $m^2$ |
| Effective Volume                  | 0.95 $m^3$ |

| Storm Duration | Storm Mean Intensity (10yr) | Volume in | Volume out (during storm duration period) | Storage Volume Required | Percentage of Storage provided | Test       | Actual Depth | Emptying Time (hrs) | Check         |
|----------------|-----------------------------|-----------|-------------------------------------------|-------------------------|--------------------------------|------------|--------------|---------------------|---------------|
| (minutes)      | (mm/hr)                     | ( $m^3$ ) | ( $m^3$ )                                 | ( $m^3$ )               | %                              |            |              |                     |               |
| 6              |                             | 0.000     | 0.000                                     | 0.0                     |                                | OK         | 0.00         |                     |               |
| 10             | 126                         | 0.302     | 0.005                                     | 0.3                     | 320%                           | OK         | 0.47         | 11.00               | OK            |
| 20             | 99                          | 0.475     | 0.009                                     | 0.5                     | 205%                           | OK         | 0.73         | 17.29               | OK            |
| 30             | 88                          | 0.634     | 0.014                                     | 0.6                     | 154%                           | OK         | 0.97         | 23.05               | OK            |
| 45             |                             | 0.000     | 0.000                                     | 0.0                     |                                | OK         | 0.00         |                     |               |
| 60             | 65                          | 0.936     | 0.027                                     | 0.9                     | 105%                           | OK         | 1.43         | 34.06               | OK            |
| 90             |                             | 0.000     | 0.000                                     | 0.0                     |                                | OK         | 0.00         |                     |               |
| 120            | 45                          | 1.296     | 0.055                                     | 1.2                     | 77%                            | Inadequate | 1.95         | 47.16               | OK            |
| 180            |                             | 0.000     | 0.000                                     | 0.0                     |                                | OK         | 0.00         |                     |               |
| 240            |                             | 0.000     | 0.000                                     | 0.0                     |                                | OK         | 0.00         |                     |               |
| 300            |                             | 0.000     | 0.000                                     | 0.0                     |                                | OK         | 0.00         |                     |               |
| 360            | 22                          | 1.901     | 0.165                                     | 1.7                     | 55%                            | Inadequate | 2.73         | 69.16               | Increase Area |
| 480            |                             | 0.000     | 0.000                                     | 0.0                     |                                | OK         | 0.00         |                     |               |
| 600            |                             | 0.000     | 0.000                                     | 0.0                     |                                | OK         | 0.00         |                     |               |
| 720            | 13.2                        | 2.281     | 0.330                                     | 2.0                     | 49%                            | Inadequate | 3.07         | 83.00               | Increase Area |
| 840            |                             | 0.000     | 0.000                                     | 0.0                     |                                | OK         | 0.00         |                     |               |
| 960            |                             | 0.000     | 0.000                                     | 0.0                     |                                | OK         | 0.00         |                     |               |
| 1080           |                             | 0.000     | 0.000                                     | 0.0                     |                                | OK         | 0.00         |                     |               |
| 1200           |                             | 0.000     | 0.000                                     | 0.0                     |                                | OK         | 0.00         |                     |               |
| 1320           |                             | 0.000     | 0.000                                     | 0.0                     |                                | OK         | 0.00         |                     |               |
| 1440           | 7.63                        | 2.637     | 0.660                                     | 2.0                     | 48%                            | Inadequate | 3.11         | 95.95               | Increase Area |
| 2160           |                             | 0.000     | 0.000                                     | 0.0                     |                                | OK         | 0.00         |                     |               |
| 2880           | 4.41                        | 3.048     | 1.319                                     | 1.7                     | 55%                            | Inadequate | 2.72         | 110.91              | Increase Area |
| 3600           |                             | 0.000     | 0.000                                     | 0.0                     |                                | OK         | 0.00         |                     |               |
| 4320           |                             | 0.000     | 0.000                                     | 0.0                     |                                | OK         | 0.00         |                     |               |

## Infiltration Calculation - Modular Tank

**Project:** 152870  
**Site Address:** Terrace Views, Stage 3E  
**Date:** 24/01/2019



### System Calcs

|                               |       |                |
|-------------------------------|-------|----------------|
| Catchment Area                | 100   | m <sup>2</sup> |
| Volumetric Runoff Coefficient | 0.9   |                |
| Soil K <sub>h</sub>           | 43.2  | mm/hr          |
| Width of Infiltration Area    | 1.224 | m              |
| Length of Infiltration Area   | 4.11  | m              |
| Depth of Storage              | 1.31  | m              |
| Porosity                      | 0.95  |                |
| Base Area                     | 5.03  | m <sup>2</sup> |

### Area Calculation

|                                  | Include |                     |
|----------------------------------|---------|---------------------|
| Base Infiltration Area           | Yes     | 5.03 m <sup>2</sup> |
| Effective Side Infiltration Area | No      | 0 m <sup>2</sup>    |

### Infiltration Requirements

|                                   |                     |
|-----------------------------------|---------------------|
| Total Effective Infiltration Area | 5.03 m <sup>2</sup> |
| Effective Volume                  | 6.26 m <sup>3</sup> |

### Atlantis Matrix Triple System

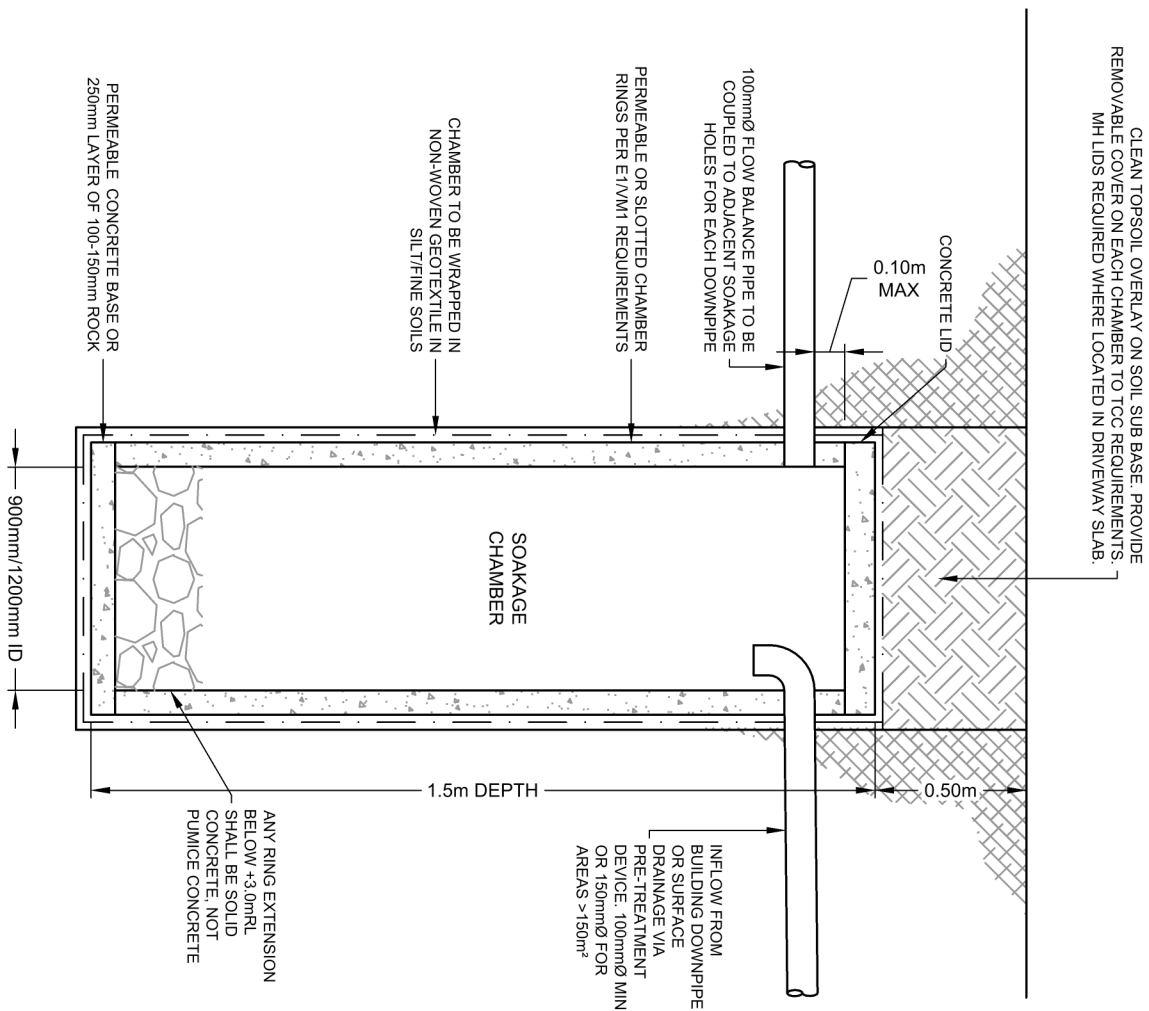
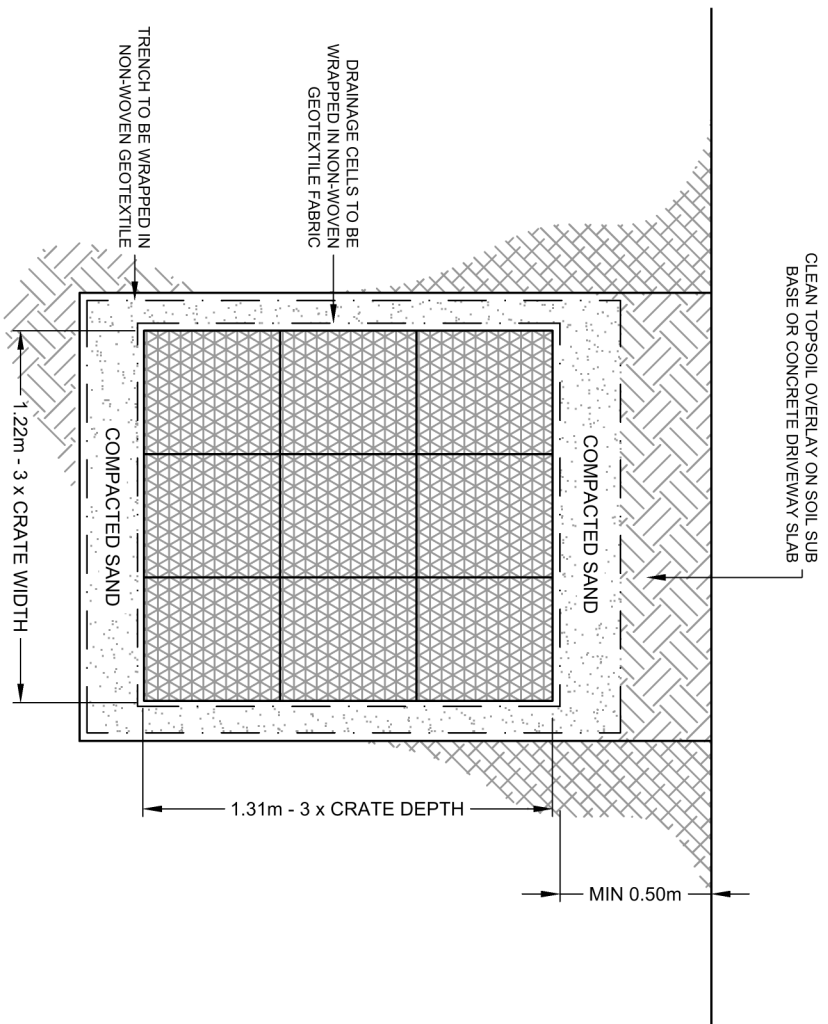
|   |   |       |
|---|---|-------|
| w | 3 | 0.408 |
| l | 6 | 0.685 |
| h | 1 | 1.31  |

|              |                           |
|--------------|---------------------------|
| Soakage rate | 0.72 L/min/m <sup>2</sup> |
|              | 43.2 L/hr/m <sup>2</sup>  |
|              | 43.2 mm/hr                |

| Storm Duration | Storm Mean Intensity (10yr) | Volume in         | Volume out (during storm duration period) | Storage Volume Required | Percentage of Storage provided | Test       | Actual Depth | Emptying Time (hrs) | Check         |
|----------------|-----------------------------|-------------------|-------------------------------------------|-------------------------|--------------------------------|------------|--------------|---------------------|---------------|
| (minutes)      | (mm/hr)                     | (m <sup>3</sup> ) | (m <sup>3</sup> )                         | (m <sup>3</sup> )       | %                              |            |              |                     |               |
| 6              |                             | 0.000             | 0.000                                     | 0.000                   |                                | OK         | 0.00         |                     |               |
| 10             | 126                         | 1.890             | 0.036                                     | 1.854                   | 338%                           | OK         | 0.39         | 8.70                | OK            |
| 20             | 99                          | 2.970             | 0.072                                     | 2.898                   | 216%                           | OK         | 0.61         | 13.67               | OK            |
| 30             | 88                          | 3.960             | 0.109                                     | 3.851                   | 163%                           | OK         | 0.81         | 18.22               | OK            |
| 45             |                             | 0.000             | 0.000                                     | 0.000                   |                                | OK         | 0.00         |                     |               |
| 60             | 65                          | 5.850             | 0.217                                     | 5.633                   | 111%                           | OK         | 1.18         | 26.92               | OK            |
| 90             |                             | 0.000             | 0.000                                     | 0.000                   |                                | OK         | 0.00         |                     |               |
| 120            | 45                          | 8.100             | 0.435                                     | 7.665                   | 82%                            | Inadequate | 1.60         | 37.27               | OK            |
| 180            |                             | 0.000             | 0.000                                     | 0.000                   |                                | OK         | 0.00         |                     |               |
| 240            |                             | 0.000             | 0.000                                     | 0.000                   |                                | OK         | 0.00         |                     |               |
| 300            |                             | 0.000             | 0.000                                     | 0.000                   |                                | OK         | 0.00         |                     |               |
| 360            | 22                          | 11.880            | 1.304                                     | 10.576                  | 59%                            | Inadequate | 2.21         | 54.67               | Increase Area |
| 480            |                             | 0.000             | 0.000                                     | 0.000                   |                                | OK         | 0.00         |                     |               |
| 600            |                             | 0.000             | 0.000                                     | 0.000                   |                                | OK         | 0.00         |                     |               |
| 720            | 13.2                        | 14.256            | 2.608                                     | 11.648                  | 54%                            | Inadequate | 2.44         | 65.60               | Increase Area |
| 840            |                             | 0.000             | 0.000                                     | 0.000                   |                                | OK         | 0.00         |                     |               |
| 960            |                             | 0.000             | 0.000                                     | 0.000                   |                                | OK         | 0.00         |                     |               |
| 1080           |                             | 0.000             | 0.000                                     | 0.000                   |                                | OK         | 0.00         |                     |               |
| 1200           |                             | 0.000             | 0.000                                     | 0.000                   |                                | OK         | 0.00         |                     |               |
| 1320           |                             | 0.000             | 0.000                                     | 0.000                   |                                | OK         | 0.00         |                     |               |
| 1440           | 7.63                        | 16.481            | 5.216                                     | 11.265                  | 56%                            | Inadequate | 2.36         | 75.84               | Increase Area |
| 2160           |                             | 0.000             | 0.000                                     | 0.000                   |                                | OK         | 0.00         |                     |               |
| 2880           | 4.41                        | 19.051            | 10.432                                    | 8.620                   | 73%                            | Inadequate | 1.80         | 87.66               | Increase Area |
| 3600           |                             | 0.000             | 0.000                                     | 0.000                   |                                | OK         | 0.00         |                     |               |
| 4320           |                             | 0.000             | 0.000                                     | 0.000                   |                                | OK         | 0.00         |                     |               |

## NOTES

1. ALL DIMENSIONS IN METERS UNLESS NOTED OTHERWISE.
2. ALL WORKS TO COMPLY WITH TCC INFRASTRUCTURE DEVELOPMENT CODE, BOPRC REQUIREMENTS, THE NZ BUILDING CODE AND GOOD CONSTRUCTION PRACTICES.



## ATLANTIS FLO-TANK SYSTEM

NOT TO SCALE

## SOAKAGE RING

NOT TO SCALE

[illegible]