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Optimal Ref: 21N74

Don Vary
Project Manager, Turf One

Dear Don

# TECHNICAL MEMORANDUM (UPDATED 3.2.23)

***Review of Stormwater Management System (Hydraulic Assessment)***

Optimal Stormwater has completed an independent review and hydraulic analysis of the existing and proposed stormwater system at Norman Griffiths Oval.

## Summary

The hydraulic analysis confirms the proposed stormwater system meets Council's requirements for stormwater management. Hydrologic and hydraulic assessment of the proposed underground On-Site Detention (OSD) shows a neutral or beneficial impact compared with the existing above-ground detention basin.

In the 100-year storm event (1% AEP), excess flow is conveyed along the overland flow path around the Norman Griffiths Oval to Quarry Creek. The depth and velocity of overland flow is considered safe, and the flow path does not require turf reinforcement.

In the 100-year storm event, the OSD reaches ~90% capacity (2.4ML) and effectively reduces the peak flow.

Hydraulic Assessment of Existing Stormwater System (using DRAINS)

The existing field at Norman Griffiths Oval functions as a playing field and detention basin during major storm events. In major storm events, excess flow surcharges into Norman Griffiths Oval via a culvert connecting to the upstream stormwater network.

The dual function results in regular closure of the playing field due to frequent saturation.

A hydrologic and hydraulic assessment of the stormwater network at Norman Griffiths Oval was modelled using the DRAINS software to investigate the impact of the proposed stormwater management changes.

The peak flows for the catchment were calculated using DRAINS software assuming the 17-hectare catchment was 55% impervious (based on aerial photography and site visits).

In addition to the catchment information, the following assumptions were used in the DRAINS model for both existing (pre-development) and proposed (post-development) models:

- The time of concentration for the catchment was determined using the kinematic wave equation.
- Stormwater pit loss coefficients were determined in accordance with AR&R guidelines.
- The outlet of the downstream pipe was assumed to be free flowing.
- The water infiltration into the subsoil was not considered.
- A Manning's roughness coefficient of 0.013 was adopted for flow within concrete pipe (DRAINS User Manual, 2015).
- A Manning's roughness coefficient of 0.02 was adopted for flow within the upstream channel (DRAINS User Manual, 2015).
- The coefficient of the weir assumed as 1.8.
- Headwall entrance loss factor, K(entry), of 0.5 was adopted (DRAINS User Manual, 2015); and,

Based on the above considerations, the existing DRAINS model was run for 1EY AEP (1-year event), 20% AEP (5-year event), 5% AEP (20-year event), and 1% AEP (100-year event) storms.

Results for peak flow rates are presented in Table 1 below.

Table 1. Peak Flows (m³/s) for existing stormwater system

| **Peak-Flow Rate (m³/s)** | 5-year | 10-year | 20-year | 100-year |
|---|---|---|---|---|
| Pipe Flow | 2.49 | 3.13 | 3.51 | 3.94 |
| Surcharge Culvert | 0.00 | 0.00 | 0.10 | 0.99 |
| Overland flow from sag pit | 0.00 | 0.01 | 0.05 | 0.29 |

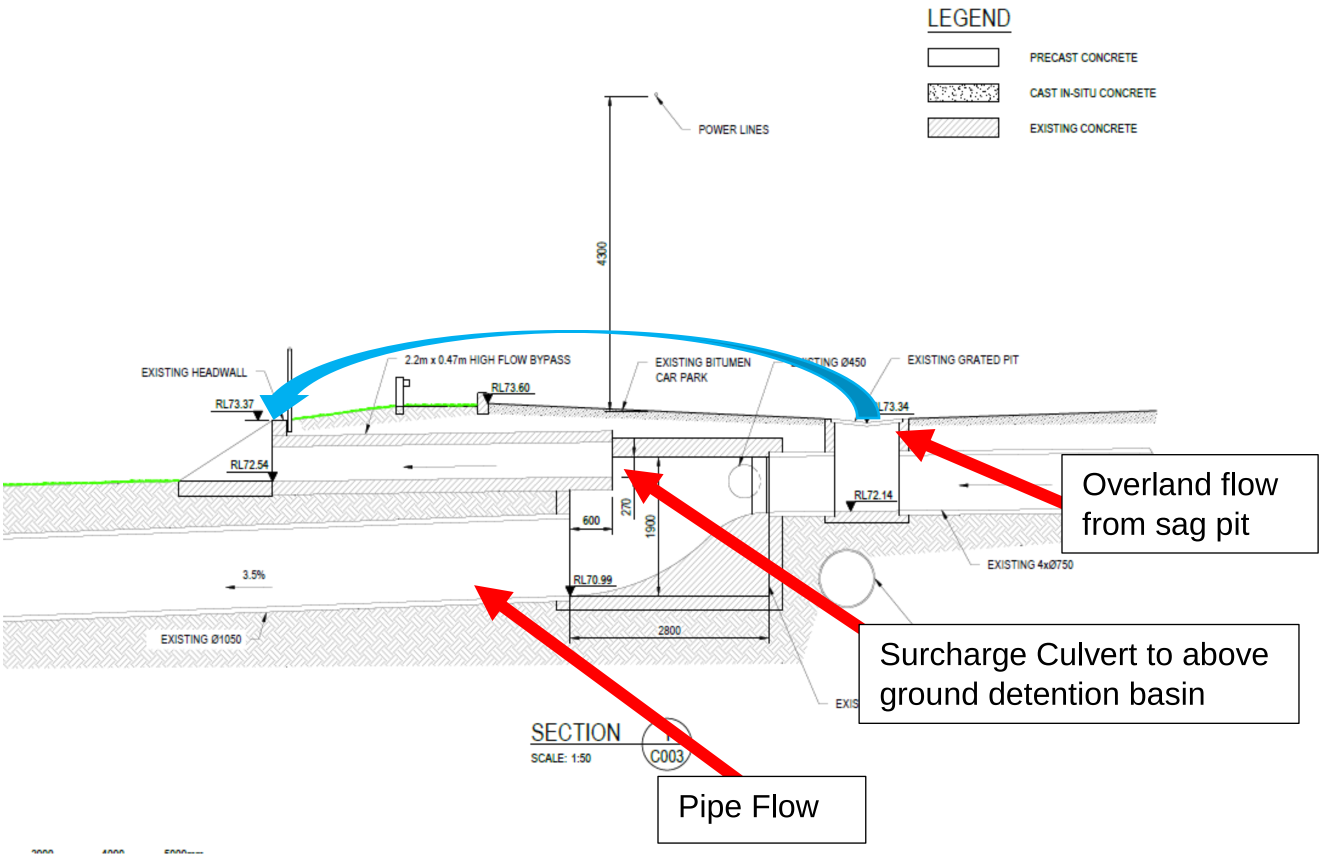


Figure 1. Existing Pit Showing Peak Flow Locations

Based on the DRAINS model for the existing stormwater system at Norman Griffiths Oval, the piped system can convey the 10-year storm event. The above-ground OSD manages flows exceeding the 10-year storm event.

## Hydraulic Assessment of the Proposed Stormwater System

The new synthetic field is unsuitable to function as a detention basin. In replacement of the above-ground detention basin, additional stormwater measures are planned to manage major storm events. These include:

- A Gross pollutant trap (CDS Unit) to reduce maintenance of OSD and improve water quality.
- Underground On-Site Detention system (OSD) to reduce peak storm flows.

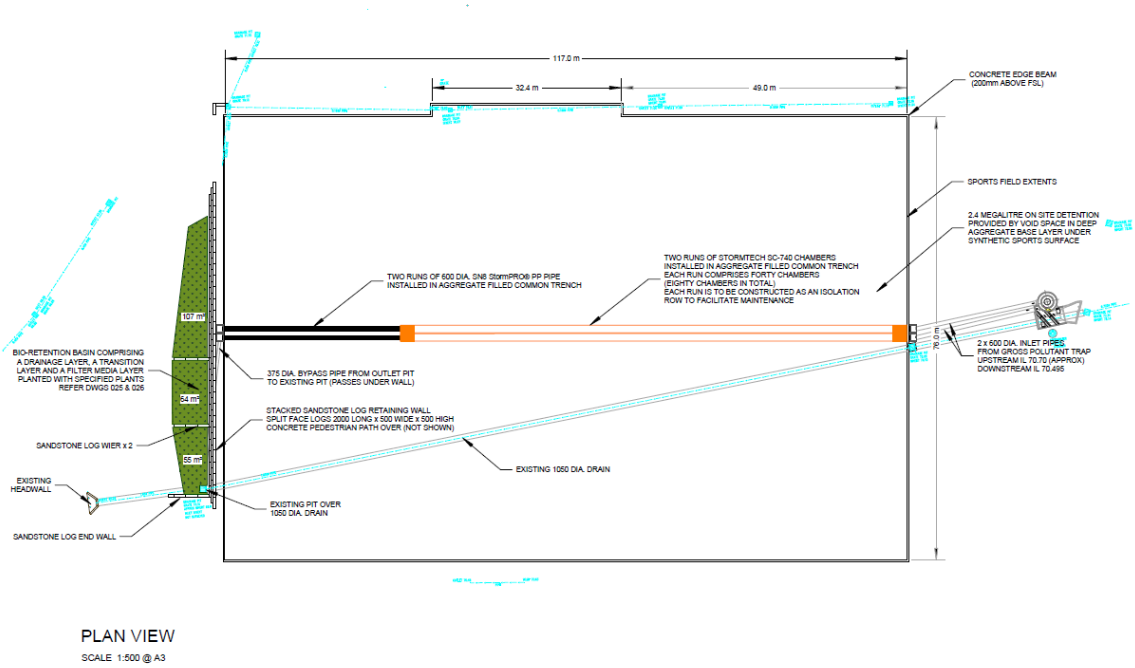


Figure 2. OSD and GPT Arrangement

Using the detention basin tool, the proposed 2.4ML underground OSD system is modelled in DRAINS. Inputs for the 2.4ML are displayed below in figure 3. To account for the 40% void space in aggregate, the OSD length was reduced by 60%.

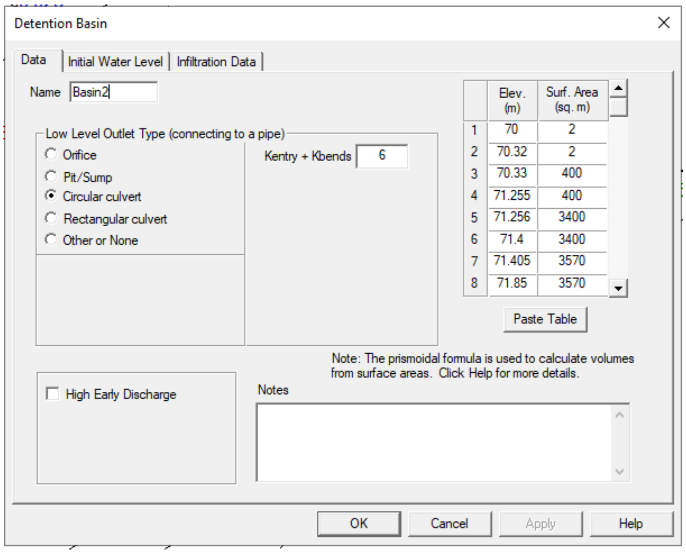


Figure 3. Underground OSD DRAINS inputs

Based on the above considerations, the proposed DRAINS model was run for 20% AEP (5-year event), 10% AEP (10-year event), 5% AEP (20-year event), and 1% AEP (100-year event) storms. Results for peak flow rates are presented in Table 2 below.

Table 2. Peak Flows (m³/s) for proposed stormwater system

| **Peak-Flow Rate (m³/s)** | 5-year | 10-year | 20-year | 100-year |
|---|---|---|---|---|
| Pipe Flow | 1.18 | 1.67 | 2.2 | 3.05 |
| Pipe flow to OSD | 1.38 | 1.42 | 1.46 | 1.79 |
| Overland flow from sag pit | 0.00 | 0.01 | 0.06 | 0.38 |
| Surcharge from diversion chamber | 0.00 | 0.00 | 0.00 | 0.00 |

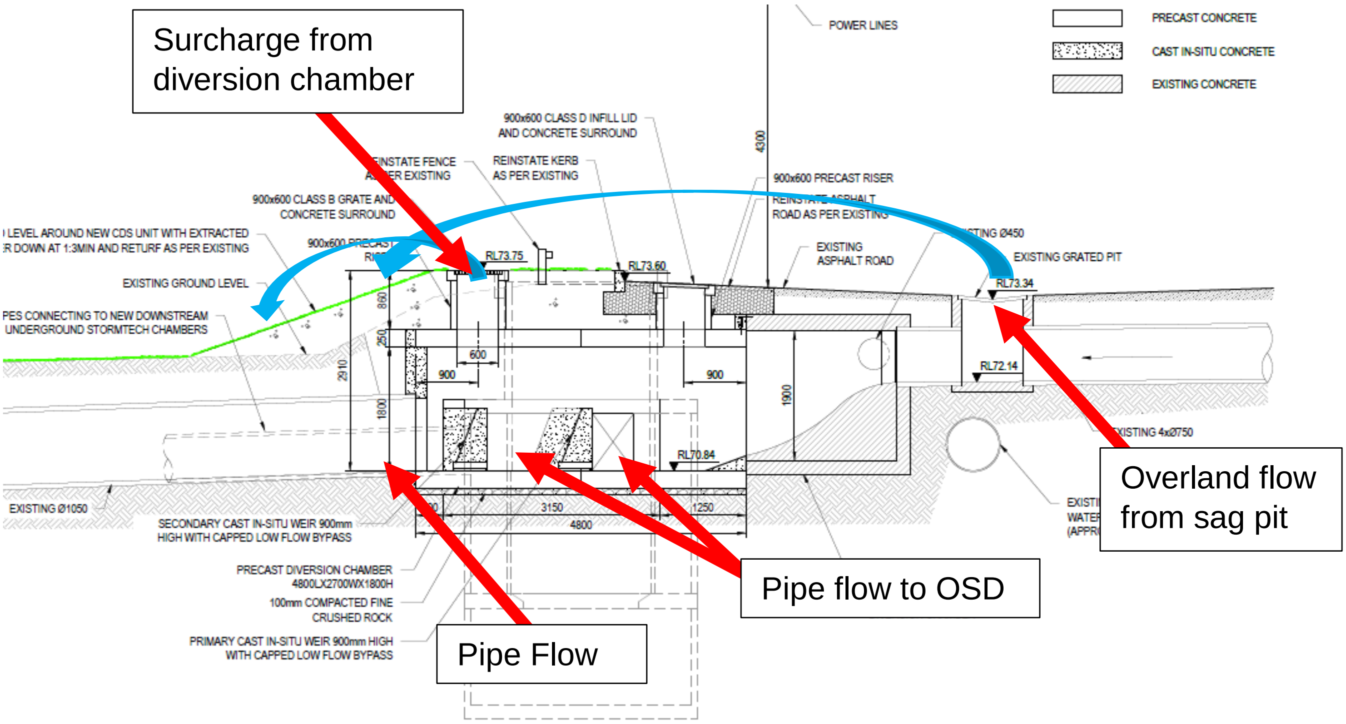


Figure 4. Proposed Pit Showing Peak Flow Locations

Based on the DRAINS model for the proposed stormwater system at Norman Griffiths Oval, the piped system can convey up to the 10-year storm event.

In larger storm events, excess flow is collected by the downstream grate above the existing 1050mm RCP. Once the downstream grate or 1050mm RCP is at capacity, flow is conveyed along the overland flow path around the oval to Quarry Creek. Refer to figure 5 below.

In the 20-year and 100-year storm events, the peak flow rate conveyed by the overland flow path around the field is 0.002m³/s and 0.18m³/s. In the 100-year event, the expected depth x velocity is 0.06m²/s and is considered safe and does not require turf reinforcement (ARR 2019).

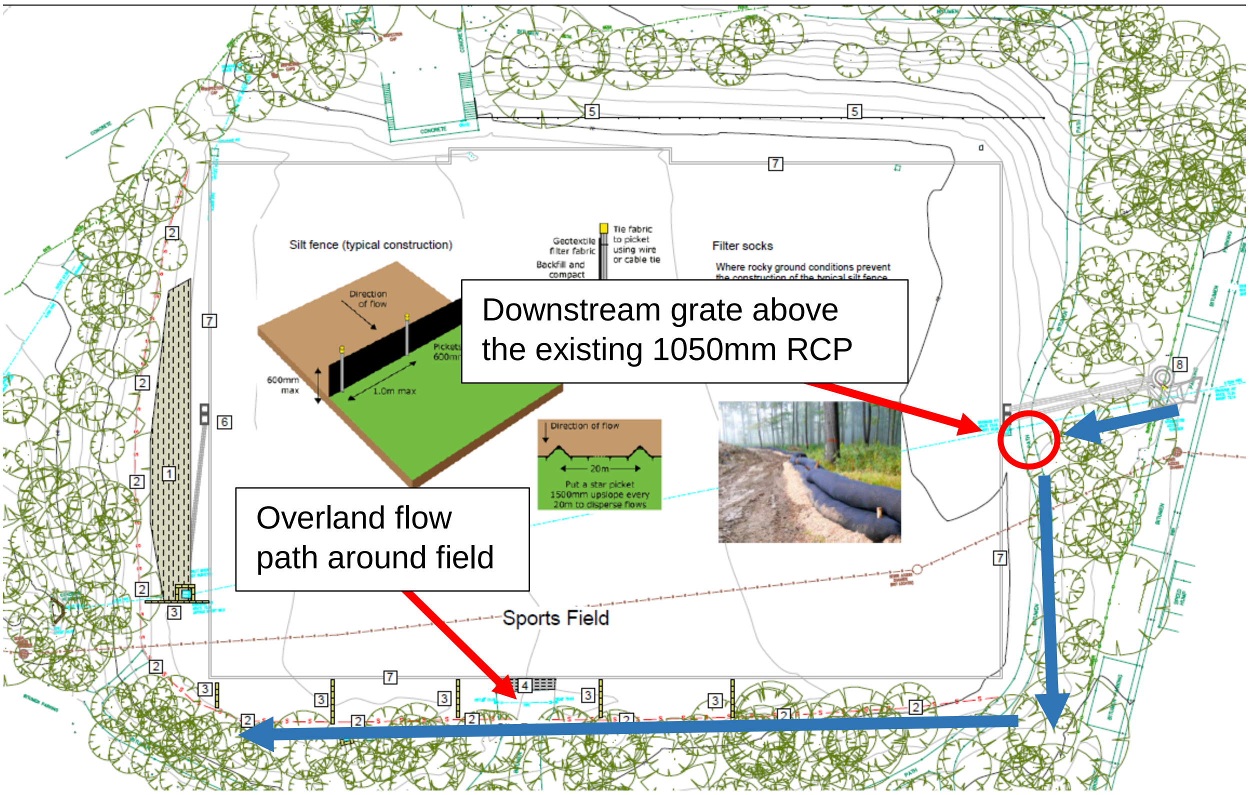

Figure 5. Downstream Grate and Overland Flow Path Location

## Assessment of the Underground On-site Detention (OSD) System

The proposed underground OSD is comprised of two rows of Stormtech chambers covered in aggregate to the base of the field surface. The aggregate has a 40% void ratio and supplies 2.4ML of detention capacity. Figure 6. illustrates the cross sections through the underground OSD.

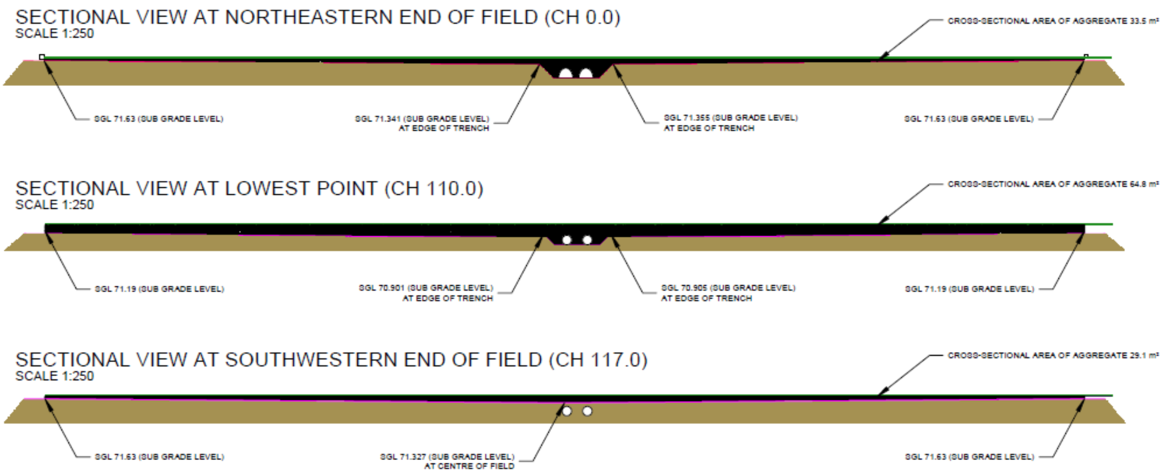

Figure 6. Underground OSD Cross-sections

The proposed underground OSD was analysed under major storm events, including the 5% AEP (20-year event) and 1% AEP (100-year event) storms. Results for peak water levels and storage capacity in the OSD are illustrated in figures 7-10 below.

**5% AEP (20-year event)**

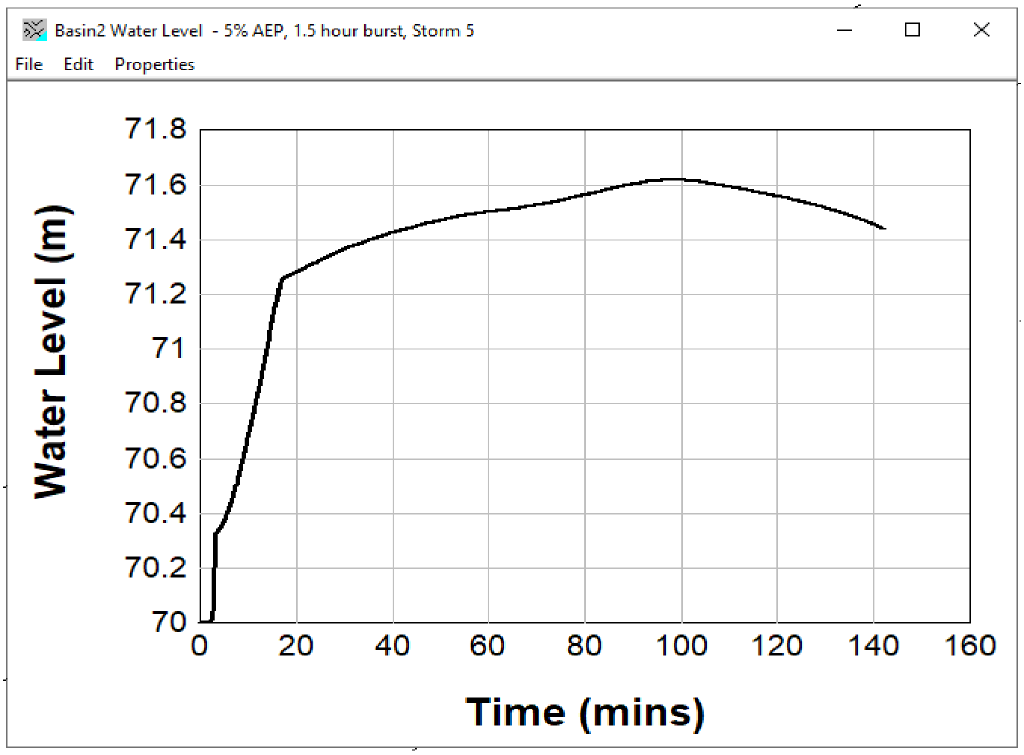


Figure 7. Water level in underground OSD – 20-year event

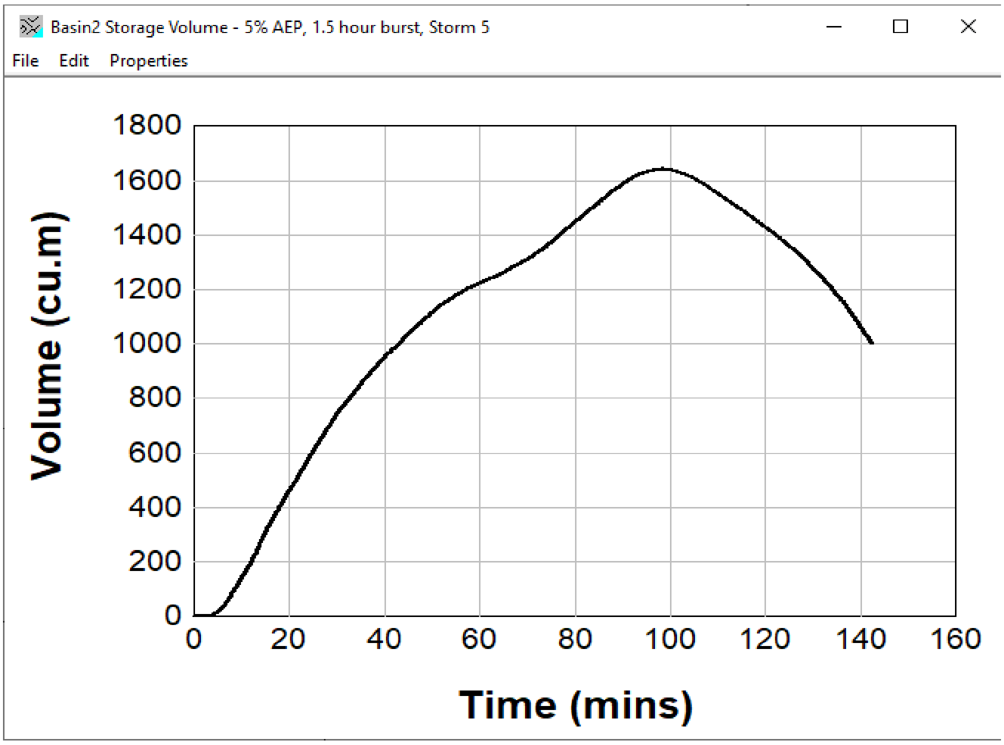


Figure 8. Storage capacity in underground OSD – 20-year event

### 1% AEP (100-year event)

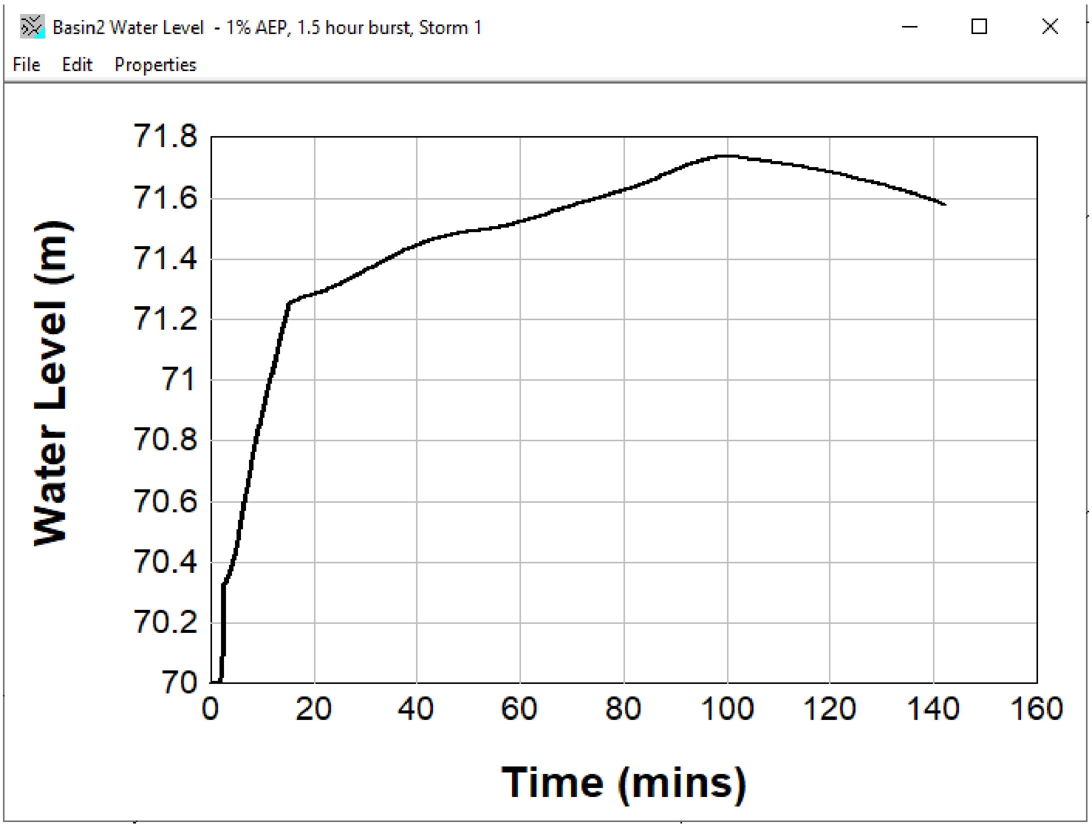


Figure 9. Water level in underground OSD – 100-year event

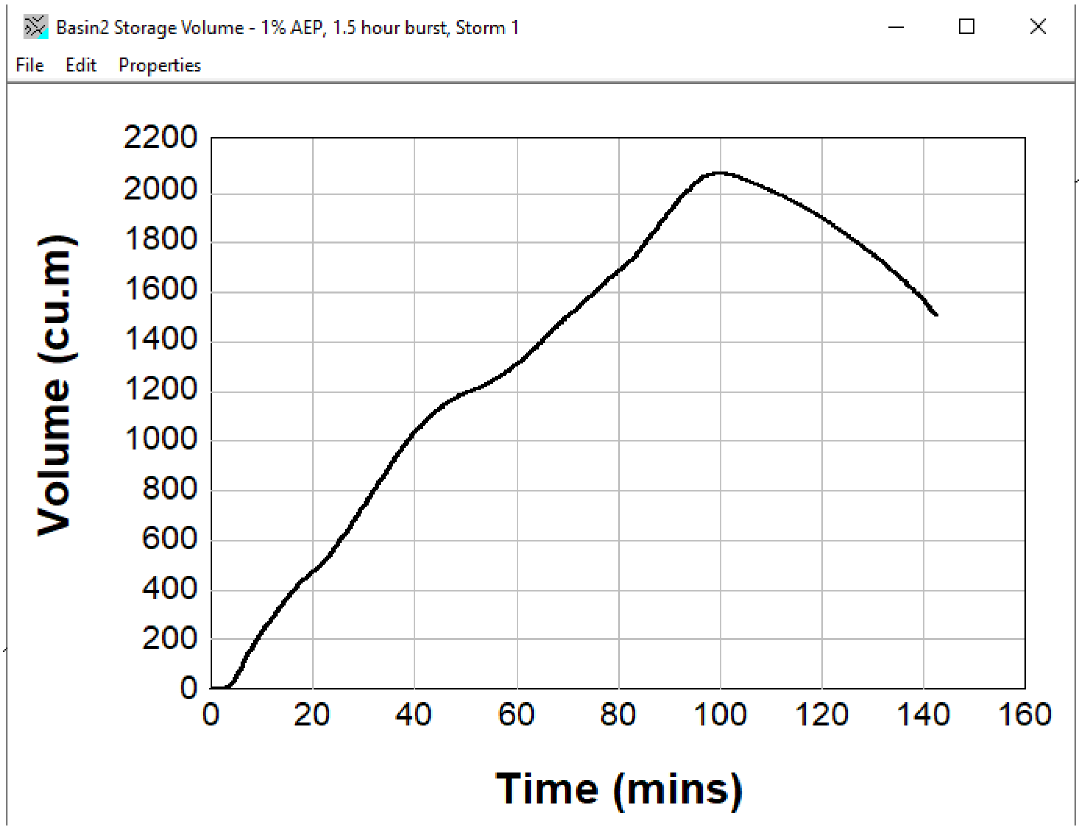


Figure 10. Storage capacity in underground OSD – 100-year event

DRAINS modelling of the proposed underground OSD confirms the capacity is adequate to detain the 100-year storm event. The underground OSD reaches ~90% maximum capacity (2.4ML) in the 100-year event. As the OSD exceeds 100% capacity, the 2x 1200x100mm overflow culverts convey excess flow.

Please contact me should you have any queries.

Yours faithfully

Oscar Bentham
for and on behalf of
Optimal Stormwater Pty Ltd