ACACIA ENGINEERING

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STORMWATER MANAGEMENT REPORT

PROPOSED MULTIRESIDENTIAL DEVELOPMENT
23 CLEBURN STREET, KINGSTON

REF: SR-2024-02-01-01

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PROJECT INFORMATION

Document title	Stormwater Management Report
Project address	23 Cleburn Street, Kingston
Acacia Engineering reference	SR-2024-02-01-01
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DOCUMENT CONTROL

Revision	Date	Revision details	Prepared	Approved
01	18/03/2024	Development Approval	C. Webster	M. Webster

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1 BACKGROUND INFORMATION

1.1 SCOPE OF REPORT

Acacia Engineering is engaged to prepare an On-Site Stormwater Detention (OSD) Strategy in support of a Development Application submission for 23 Cleburn Street, Kingston

This report addresses requirements of the Tasmanian Stormwater Policy Guidance & Standards for Developments.

The following is a summary of the concept stormwater drainage design including sizing of the proposed onsite detention system. This report should be read in conjunction with accompanying hydraulic drawings prepared by Greg Tilley.

1.2 DEVELOPMENT SITE

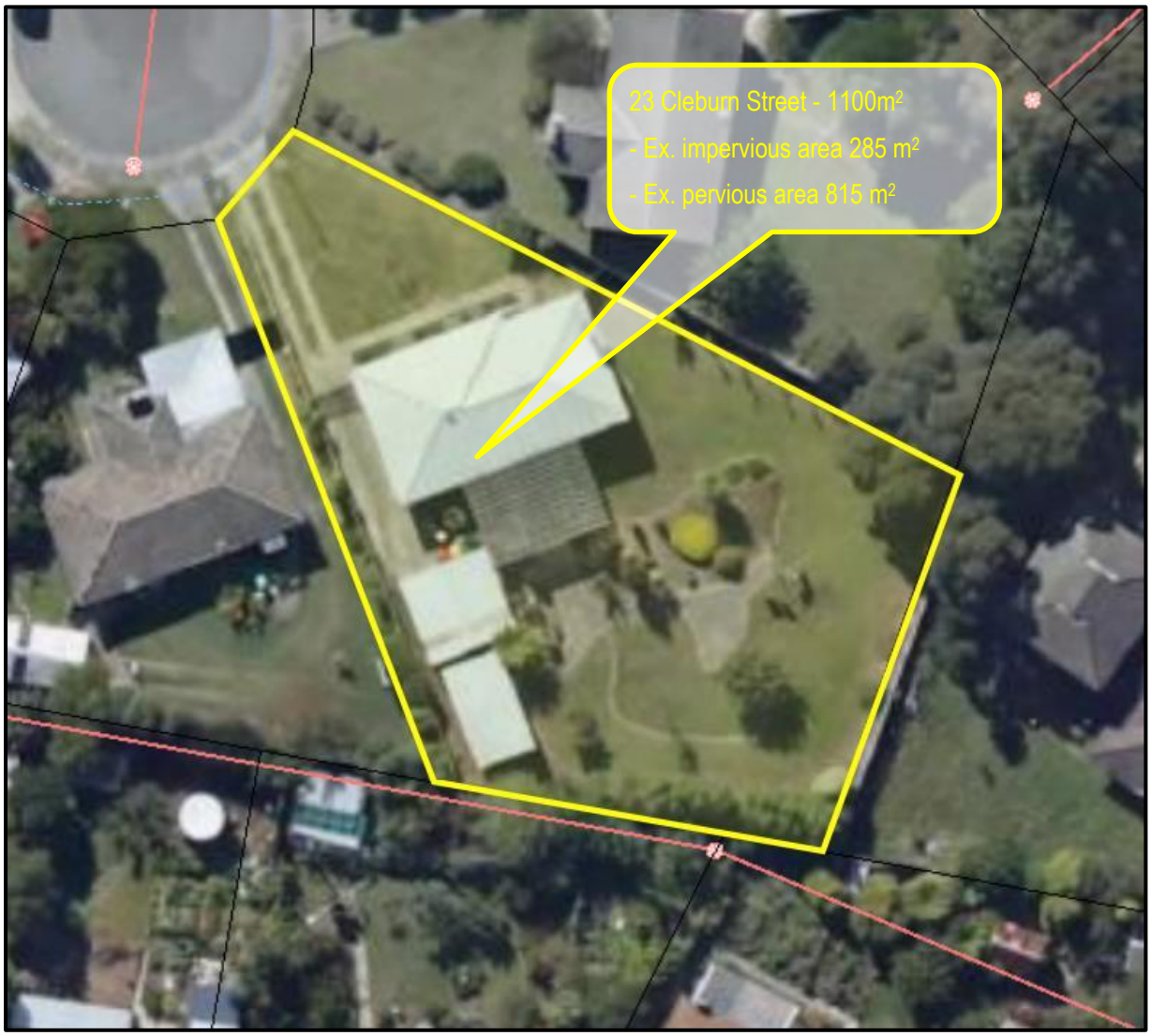

Figure 1.0 Aerial Site Image (Sourced – ListMap 2024)

The site covers an area of 1100m² and is currently occupied by a single storey dwelling and shed. The shed will be demolished to make way for the new development. The site coverage is currently 26% impervious; the new development will render the site 70% impervious.

Existing stormwater discharge from the site is via a kerb connection which will be upgraded to a 150x75 HDG RHS.

An overland flow relief point will be constructed in the top of the detention tanks for storm events exceeding 5% AEP. This will allow surface water, resulting from a blocked stormwater pit or full detention tank, to flow on to the footpath/road.

2 HYDROLOGY

2.1 MODELLING APPROACH

DRAINS software was utilised to calculate the site runoff and to determine the size of the site's stormwater conveyance and detention infrastructure. The Extended Modified Rational Method was applied (in accordance with the Australian Rainfall & Runoff Guide 2019):

- Rainfall depths for the model were sourced from the Bureau of Meteorology website: http://www.bom.gov.au/water/designRainfalls/revised-ifd/?multipoint.
- Temporal patterns and preburst rainfall depths sourced from the ARR Data hub website: https://data.arr-software.org/

Times of concentration for all catchments were determined within DRAINS using the kinematic wave equation. A range of storm durations were considered ranging from 1 minute up to 120 minutes – refer Table 2.2.

2.2 CATCHMENT AREAS

The table below summarises the internal site catchment areas and coefficients of permeability for the pre-development and post-development model scenarios.

Table 2.1: Pre and Post Development Site Catchments

Location	Existing Areas		Proposed Areas	
	m²	Runoff Coeff.	m²	Runoff Coeff.
Detained impervious surfaces (roof)	184	0.9	429	1.0
Detained impervious surfaces (driveway & paths)	101	0.9	242	0.9
Undetained impervious surfaces (driveway)	-	-	98	0.9
Impervious total	**285**	**-**	**769**	**-**
Pervious surfaces	815	0.4	331	0.4
Total	**1100**	**-**	**1100**	**-**

Note that the effective runoff coefficient for the pre-development overall site is calculated as follows:

$$C = \frac{0.9 \times 285 + 0.4 \times 815}{285 + 815} = 0.53$$ .....Eqn 1

2.3 BOM IFD DATA

Rainfall depths relative to the site were obtained from the Bureau of Meteorology website and are shown at Table 2.2.

Table 2.2: IFD Design Rainfall Depths – Kingston Tasmania						
Duration (minutes)	5% AEP	5% AEP	2% AEP	2% AEP	1% AEP	1% AEP
	(mm/hr)	(mm)	(mm/hr)	(mm)	(mm/hr)	(mm)
1	143.0	2.38	175.0	2.92	201.0	3.35
2	114.0	3.80	134.0	4.47	149.0	4.97
3	103.0	5.15	122.0	6.10	137.0	6.85
4	94.8	6.32	114.0	7.60	129.0	8.60
5	88.2	7.35	107.0	8.92	122.0	10.17
10	66.0	11.00	81.3	13.55	93.9	15.65
15	53.5	13.38	65.9	16.48	76.3	19.08
20	45.4	15.13	55.8	18.60	64.5	21.50
25	39.8	16.58	48.8	20.33	56.2	23.42
30	35.7	17.85	43.5	21.75	50.0	25.00
45	28.0	21.00	33.8	25.35	38.5	28.88
60	24.8	24.80	29.7	29.70	33.5	33.50
90	19.9	29.85	23.6	35.40	26.5	39.75
120	17.3	34.60	20.3	40.60	22.7	45.40

2.4 PRE-DEVELOPMENT PEAK RUNOFF CALCULATIONS

Pre-development peak runoff calculations are based on the Modified Rational Method for stormwater run-off:

$$Q_{PSD} = \frac{C \times I \times A}{3600} = \frac{0.53 \times 88.2 \times 1100}{3600} = 14.28\ L/s \qquad \text{.....Eqn 2}$$

Where:
Q = Design Volumetric Flow Rate (L/s)
C = Runoff Coefficient (from Eqn 1)
I = Rainfall Intensity (mm/hr) (from Table 2.2)
A = Sum of all equivalent areas (m^2) (from Table 2.1)

Therefore, the post development peak flow is required to be limited to 14.28L/s or less by the adoption of an on-site detention device. Refer to the following DRAINS output for post-development results.

2.5 CLIMATE CHANGE FACTOR

DRAINS software was set to apply a climate change factor of 1.04 to the design rainfall depths indicated above. This factor is only applied to the post-development peak flow calculation. It is not applied to the pre-development peak flow calculation.

3 ON-SITE DETENTION MODELLING RESULTS

The storm duration producing the highest median peak flow was taken to be the critical duration for each scenario modelled. The following graphs represent the total peak outflows for the combined (dual) tank system.

3.1 PEAK FLOW GRAPHS – 5% AEP

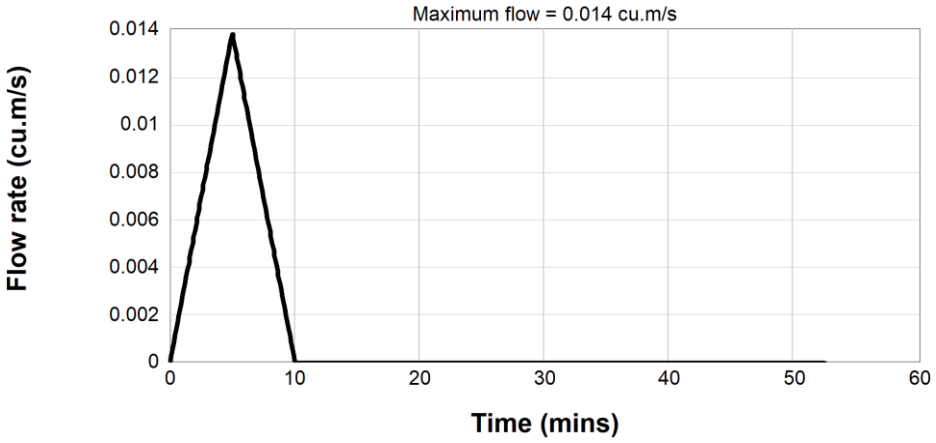

Figure 3.1: Pre-development site runoff

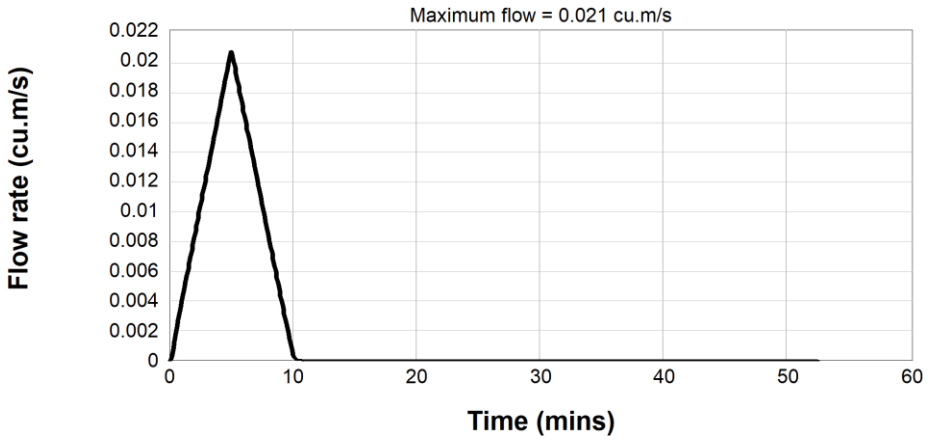

Figure 3.2: Post-development site runoff without OSD

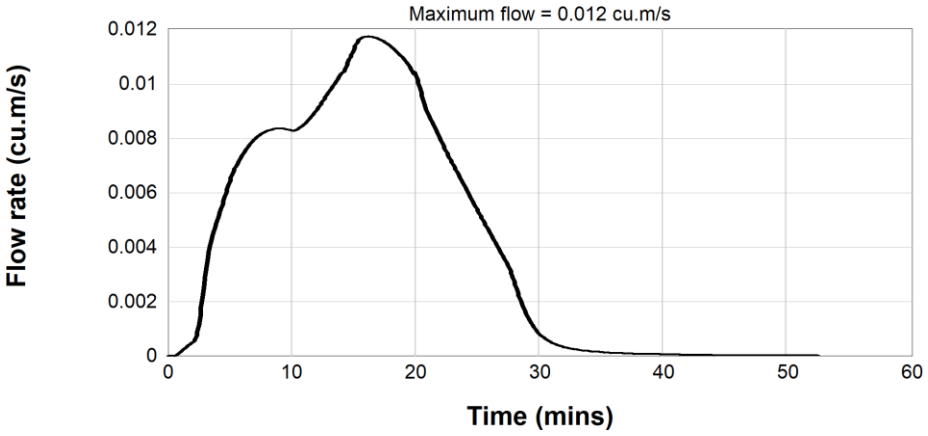

Figure 3.3: Post-development site runoff with OSD

3.2 SITE STORAGE GRAPHS – 5% AEP

The following graphs represent each tank considered separately as part of a combined system.

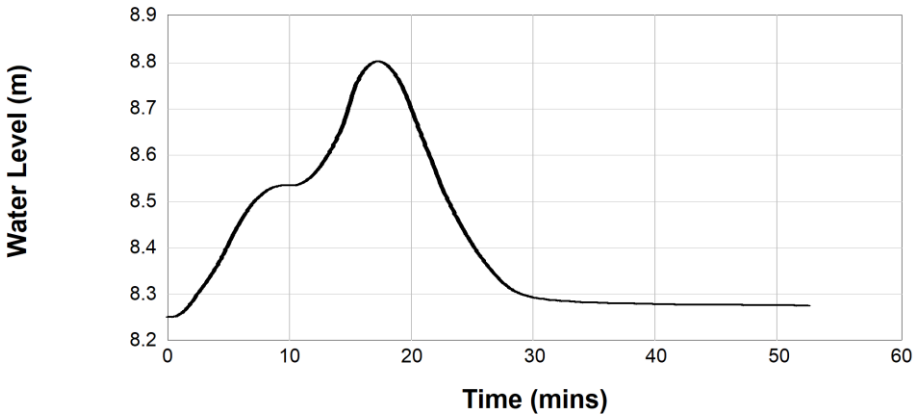

Figure 3.4: Detention Tank Water Level

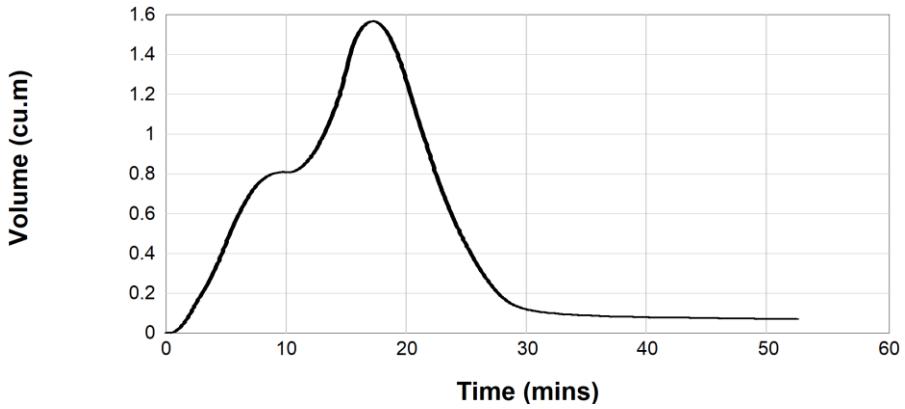

Figure 3.5: Detention Tank Volume

3.3 RESULTS SUMMARY

Table 3.1: Peak Flow Summary – 5% AEP		
Scenario	**Site runoff (L/s)**	**Critical Storm Duration (mins)**
Pre-development flow	14.3	5
Post-development flow - without OSD	21.0	5
Post-development - with OSD	12.1	15

The results demonstrate that a 5% AEP storm event can be controlled without surcharging from the detention device with the adoption of 2x2000L detention storage tanks fitted with 60mm low flow orifices. The post-development peak flow (12.1L/s) due to a 5% AEP storm event (attenuated with OSD) does not exceed the pre-development peak flow (14.31 L/s).

3.4 ON-SITE DETENTION SYSTEM SPECIFICATION

Table 3.2: Detention Tank Parameters		
Tank Description	2x Hudson ST670 precast detention tanks with grated overflows	
Tank Internal Base Area	2.85	m^2
Tank Internal Length	2.28	m
Tank Internal Width	1.23	m
Tank Overall Storage Depth	0.72	m
Orifice Diameter	60	mm
Detention Storage - 5% AEP	2.0	m^3
Retention Storage	0	m^3
Total Storage Provided	2.0	m^3 (per tank)

4 STORMWATER QUALITY

4.1 STORMWATER TREATMENT

Stormwater pits should be fitted with gross pollutant traps.

5 OPERATION AND MAINTENANCE PLAN

To ensure the proposed on-site detention system operates as designed, regular maintenance is required. A draft Operation and Maintenance Plan is included at Appendix A. The cleaning of below ground storage facilities should be conducted in accordance with the requirements and risk control measures specified in AS2865-2009 Confined Spaces.

6 CONCLUSION

This report demonstrates that post-development peak stormwater flow can be adequately detained (without surcharging) to equal or lower than predevelopment level for a 5% AEP storm event.

Note that the detention tanks will surcharge in storm events exceeding 5% AEP, however, the site levels are designed to direct surface flow from such events towards the footpath/gutter and should not pose a risk to adjacent properties.

Installation of the detention system and operation must occur prior to occupation or first use.

Limitations:

No assessment has been undertaken of Council's stormwater infrastructure and its capacity.

It is assumed that the Council stormwater system has capacity to receive the pre-development peak discharge.

It is the responsibility of Council to assess their infrastructure and determine the impact (if any) of altered inflows into their stormwater network.

7 APPENDIX A – OPERATION & MAINTENANCE PLANS

7.1 STORMWATER DETENTION TANK MAINTENANCE

MAINTENANCE ACTION	FREQUENCY	RESPONSIBILITY	PROCEDURE
Outlets			
Inspect & remove any blockage of orifices	Six monthly	Owner	Remove grate & screen to inspect orifice. See plan for location of outlets
Check attachment of orifice plates to wall of chamber and/or pit (gaps less than 5 mm)	Annually	Maintenance Contractor	Remove grate and screen. Ensure plates are mounted securely, tighten fixings if required. Seal gaps as required.
Check orifice diameters are correct and retain sharp edges	Five yearly	Maintenance contractor	Compare diameter to design (see Work-as-Executed) and ensure edge is not pitted or damaged.
Inspect screen and clean	Six monthly	Owner	Remove grate(s) and screens if required to clean them.
Check attachment of screens to wall of chamber or pit	Annually	Maintenance Contractor	Remove grate(s) and screen(s). Ensure screen fixings are secure. Repair as required.
Check screen(s) for corrosion	Annually	Maintenance contractor	Remove grate(s) and examine screen(s) for rust or corrosion, especially at corners or welds.
Inspect walls (internal and external, if appropriate) for cracks or spalling	Annually	Maintenance contractor	Remove grate(s) to inspect internal walls. Repair as required. Clear vegetation from external walls if necessary and repair as required.
Inspect outlet sumps & remove any sediment/sludge	Six monthly	Owner	Remove grate(s) and screen(s). Remove sediment/sludge build-up and check orifices are clear.
Inspect grate(s) for damage or blockage	Six monthly	Owner	Check both sides of a grate for corrosion, (especially corners and welds) damage or blockage.
Inspect outlet pipe & remove any blockage	Six monthly	Maintenance contractor	Remove grate(s) and screen(s). Ventilate underground storage if present. Check orifices and remove any blockages in outlet pipe. Flush outlet pipe to confirm it drains freely. Check for sludge/debris on upstream side of return line.
Check step irons for corrosion	Annually	Maintenance contractor	Remove grate. Examine step irons and repair any corrosion or damage.
Detention Storage			
Inspect storage & remove any sediment/sludge	Six monthly	Owner	Remove grate(s) and screen(s) where required. Remove sediment/sludge build-up.
Inspect internal walls of storage (and external, if appropriate) for cracks, spalling or any other defects (and external, if appropriate) for cracks,	Annually	Maintenance contractor	Remove grate(s) to inspect internal walls if required. Repair as required. Clear vegetation from internal and external walls if necessary and repair as required.

spalling or any other defects			
Inspect & remove any debris/litter/mulch etc blocking grates	Six monthly	Owner	Remove blockages from grate(s) and check if storage is blocked.
Inspect areas draining to the storage(s) & remove debris/mulch/ litter etc likely to block screens/grates	Six monthly	Owner	Remove debris and floatable material likely to be carried to grates.
Compare storage volume to volume approved. (Rectify if loss > 5%)	Annually	Maintenance contractor	Compare actual storage available with Work-as Executed plans. If volume loss is greater than 5%, arrange for reconstruction to replace the volume lost. Council to be notified of the proposal.
Inspect storages for subsidence near pits	Annually	Maintenance contractor	Check along drainage lines and at pits for subsidence likely to indicate leakages.

7.2 STORMWATER QUALITY CONTROL DEVICE MANTENANCE

Maintenance for Ocean Protect Ocean Guards	
Activity	**Frequency**
Minor Service Filter bat inspection and evaluation Removal of capture pollutants Disposal of material	1-6 times annually
Major Service Filter bag replacement Support frame rectification	As required