

Our Reference: NP24.236
SARA Reference: 2606-52701 SRA
RB.MM

24 September 2026

State Assessment and Referral Agency
PO Box 5666
TOWNSVILLE QLD 4810

Via: MyDAS2

Attention: Kellie Galletta – Principal Planning Officer

Dear Kellie,

Response to Information Request**Development Application for Change Application (Other Change) to Development Approval MCU19/0095.01 – Extension to Existing Health Care Services, located at 4 Tyler Street and 79 Nathan Street, Heatly and formally identified as Lot 261 on SP319042 and Lot 57 on RP721044**

Northpoint Planning act on behalf of the Applicant, with respect to the abovementioned development application, and refer to the Information Request issued by the State Assessment and Referral Agency (SARA) on 19 June 2026 (refer **Attachment 1**). The Applicant's response to SARA's Information Request Period was extended by agreement up to and including 25 September 2026. The information included in this correspondence is now provided as the Applicant's full response to the Information Request.

Response to Information Request

The Information Request provided for one request item, for the Applicant to provide a Stormwater Management Plan (SMP), certified by a RPEQ, to demonstrate compliance with PO8-PO14.

In response to this item, please refer attached the SMP prepared by FortisEM Engineers included at **Attachment 2**. The SWMP confirms the following:

- The existing lawful points of discharge will be retained along the Nathan Street, Tyler Street and Laufer Street frontages, consistent with the overland flow paths.
- Peak run off calculations for pre- and post-development conditions have been provided at section 4 of the SMP. The assessment identifies that the combined 1% AEP peak discharge increases from 97.51 L/s to 99.62 L/s prior to detention.
- To mitigate the increase in post-development runoff, the SMP identifies a preliminary active detention storage of 7.716m³ and adopts a minimum of 8m³ (8kL) of usable active detention storage at 79 Nathan Street.
- The SMP provides for two potential detention solutions to ensure peak discharges are equal to or less than pre-development conditions including either an above-ground rainwater tank connected to the proposed building downpipes, or a shallow carpark detention basin. The



final collection arrangements are to be determined as part of detailed design and relevant Operational Work application.

Proceeding

We trust the enclosed information is sufficient for SARA to finalise its assessment of the application. We welcome the opportunity to discuss the application further, should any additional clarification or information be required. Finally, we kindly request a copy of SARA's draft conditions prior to the formal response being issued.

Please do not hesitate to contact the undersigned should you have any queries in relation to this application.

Yours faithfully,

Mary McCarthy

SENIOR PLANNER

Northpoint Planning

Attachment 1 – SARA Information Request

Attachment 2 – Stormwater Management Plan, prepared by Fortisem

cc – Townsville City Council – MCU19/0095.02



Attachment 1

SARA reference: 2606-52701 SRA
Applicant reference: NP24.236
Council reference: MCU19/0095.02

19 June 2026

Heatley Medical & Skin Care Centre
C/- Northpoint Planning
PO Box 4
TOWNSVILLE CITY QLD 4810
hello@northpointplanning.com.au

Attention: Mary McCarthy

Dear Sir/Madam

SARA information request – 4 Tyler Street and 79 Nathan Street, Heatley

(Notice issued under section 12 of the Development Assessment Rules)

The State Assessment and Referral Agency (SARA) has undertaken a preliminary review of the material provided in support of the above referenced application which was deemed properly referred on 9 June 2026.

From this review, SARA has identified a range of matters relating to State Code 1 that it wishes to draw to your attention.

1. Stormwater, Overland Flow and Flooding

In reviewing the application material, it has been noted that the proposed development involves the construction of a new two-storey building and ten (10) additional car parking spaces, resulting in an increase in impervious area across the site compared to pre-development conditions, which may lead to higher peak flow discharges onto the State-controlled road (SCR).

As no stormwater quantity information has been provided in supporting application material for the proposed development, it cannot be confirmed that the proposed development will not worsen stormwater conditions on the SCR.

Given this, the proposed development in its current form is therefore not considered to comply with PO8-PO14 of State code 1: Development in a State-controlled road environment of the *State Development Assessment Provisions – Version 3.6*.

Response requested:

Please provide a Stormwater Management Plan (SMP), certified by a RPEQ, to demonstrate compliance with PO8-Po14.

The SMP must include:

- Identification of all lawful points of discharge.
- Peak runoff calculations for all storm events (63%, 50%, 20%, 10%, 5%, 2% and 1% AEP) for pre- and post-development conditions with a tabulated comparison demonstrating no worsening impact on the SCR.
- Where post-development peak flows exceed pre-development conditions, appropriate mitigation measures including detailed design information such as on-site detention volumes and outlet specifications to ensure peak discharges are equal to or less than predevelopment conditions.
- For all flood events up to 1% AEP, demonstration that the development results in negligible impacts (within +/- 10mm) to existing flood levels, peak velocities and time of submergence within the State-controlled road.

How to Respond

In accordance with section 13 of the Development Assessment Rules (DA Rules), you have three months to respond to this Information Request. The due date of a response to SARA is 21 September 2026.

You can choose to respond to all, some, or none of the matters raised in this notice.

If you decide not to respond to the matters raised, SARA will finalise its assessment on the material provided to date in support of the application.

It would be appreciated if you would provide your response to SARA using the 'manage documents' function in [MyDAS2](#).

If you require further information or have any questions about the above, please contact Kellie Galletta, Principal Planning Officer, North and North-West Queensland, on 07 4758 3423 or via email NQSARA@dsdilgp.qld.gov.au who will be pleased to assist.

Yours sincerely



Peter Mulcahy
Principal Planning Officer

cc Townsville City Council, developmentassessment@townsville.qld.gov.au



Attachment 2

PROVIDING MANAGEMENT, STRUCTURAL ENGINEERING AND CIVIL ENGINEERING SERVICES



STORMWATER MANAGEMENT PLAN

MEDICAL CENTRE EXTENSION

Heatley, QLD, Australia

Heatley Medical & Skin Care Centre

R01A-26486
17 September 2026

Document Revision History

Revision	Prepared By	Description	Date
A	Pending review	QUDM discharge coefficients and detention reassessed	17 Sep 2026

Authorisation

Role	Name	Signature	Date
RPEQ reviewer	William Hutton		21/09/2026

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R01A-26486

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1 INTRODUCTION

This Stormwater Management Plan addresses the stormwater quantity and drainage matters raised in SARA information request 2606-52701 SRA dated 19 June 2026 for the proposed medical centre extension at 4 Tyler Street and 79 Nathan Street, Heatley. Refer to Figure 1 for the site locality plan. The assessment covers pre- and post-development runoff, lawful discharge and detention where required. Flood Impact Assessment is excluded from this scope.

The site comprises Lot 261 on SP319042 and Lot 57 on RP721044, with a combined area reported as 1,805 m². It fronts Tyler Street to the north, Nathan Street to the east and Laufer Street to the west. Nathan Street is a State-controlled road. The existing uses are a medical centre at 4 Tyler Street and a residential house and small shed at 79 Nathan Street.



Figure 1 Subject Site (Source: QLD Globe)

The proposed development includes alterations to the existing medical centre, demolition of the dwelling and shed, a new medical centre and ten additional parking spaces. The April 2026 architectural plans remain current, as confirmed by the client. Vehicle access is proposed through Tyler Street, with the existing Nathan Street crossover removed.

The documents forming the present design basis are summarised in Table 1.

Table 1 Design information

Document	Reference
SARA information request	2606-52701 SRA, 19 June 2026
Development application	Northpoint Planning, NP24.236; Council MCU19/0095.02
4 Tyler Street site plan	The Design House NQ, 2024-340-C, WD02 revision I, 21 April 2026 planning revision
79 Nathan Street site plan	The Design House NQ, 2025-165-C, DD02 revision 12, 21 April 2026
Topographic survey	AME Surveys, 13 August 2026; three PDF sheets and TYLER STREET SURVEY.dwg

2 EXISTING CONDITIONS

2.1 Site topography and surrounding drainage

The AME Survey records existing buildings, concrete surfaces, fences, kerb features and spot levels.

The existing development site fronting Tyler Street generally comprises building works and concrete hardstanding, with overland flows towards Tyler Street and the corner of Tyler Street and Nathan Street. The existing residential block at 79 Nathan Street, comprising an existing residential house and small shed, is relatively flat with falls towards Nathan Street. Refer to Figure 2 for the existing site features.

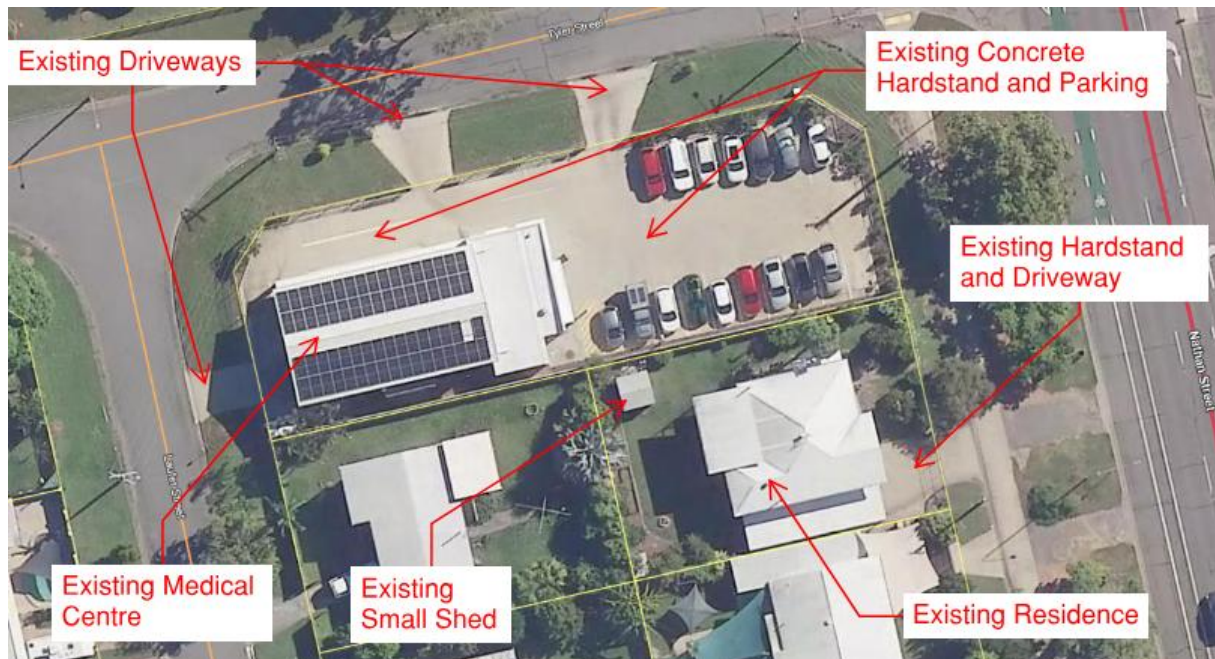


Figure 2 Existing Site Features (Source: QLD Globe; annotations supplied by client)

Figure 3 shows the surrounding site contours and mapped stormwater drainage infrastructure. The mapped contours indicate relatively flat adjoining land. On this basis, major overland flow paths entering the subject site from surrounding properties appear unlikely. This is a qualitative interpretation of the supplied mapping; local inflows and drainage connections are to be checked at detailed design.



Figure 3 Surrounding Site Contours and Stormwater Drainage Infrastructure (Source: TownsvilleMAPS - Community)

2.2 Existing catchments and discharge points

The assessment uses two site catchments in both scenarios: the existing Tyler Street site (1,198 m²) and 79 Nathan Street (607 m²). Detention will collect runoff from the Nathan Street catchment only. No Tyler Street runoff, including the new office roof, will be diverted to storage. The existing Tyler drainage arrangements cannot practicably be modified; all Tyler runoff retains its existing discharge routes. Nathan Street detention allows for the combined development increase through a reduced release target. Refer to Figure 4 for the existing overland flow paths.

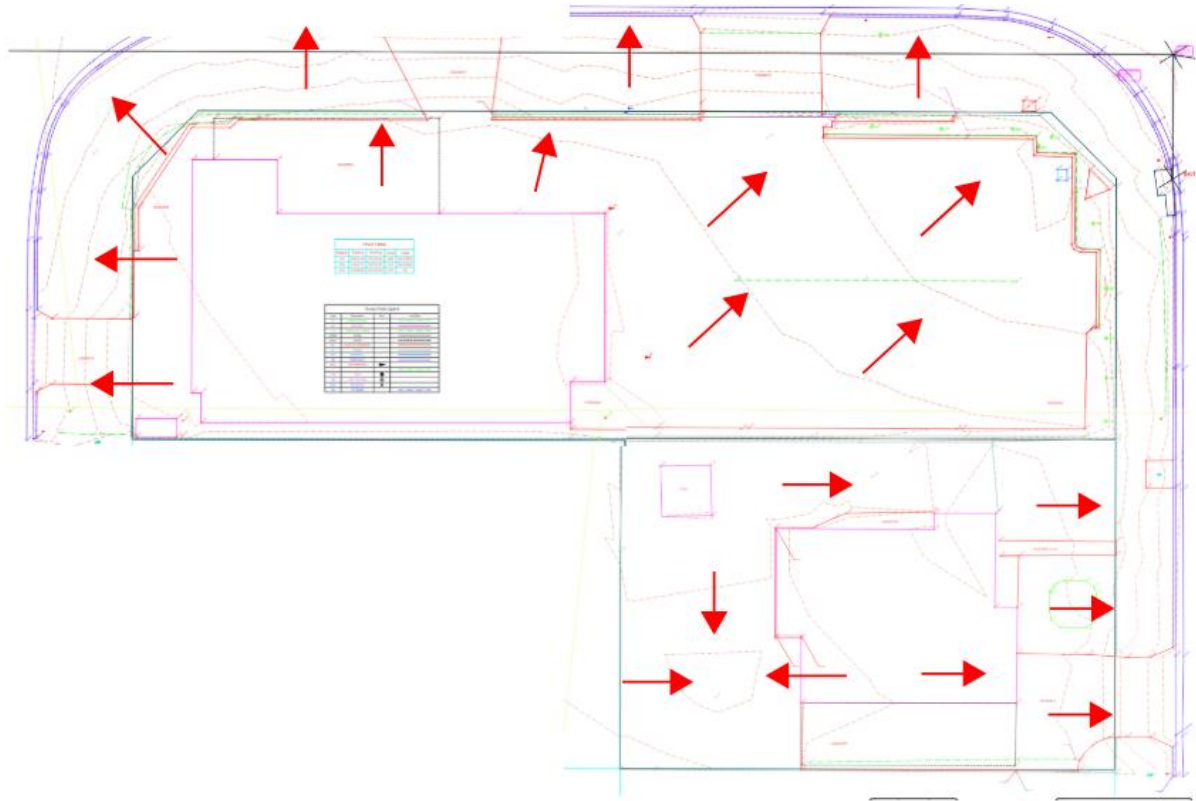


Figure 4 Existing Overland Flow Paths (Source: AME Surveys)

2.3 Lawful point of discharge

The legal points of discharge for the development are the road frontages along the front boundaries at Nathan Street, Tyler Street and Laufer Street. These match the existing overland flow paths.

3 PROPOSED DEVELOPMENT AND DRAINAGE STRATEGY

The proposed development is shown in Figure 5 and changes the overall impervious area.

The Tyler Street works include the pathology and office extension, which is in part constructed over some existing concrete area at the rear of the building. The supplied area measurements give 1,138.00 m² existing and 1,153.10 m² proposed impervious area, a net increase of 15.10 m². This is a 1.33% increase over existing impervious area, equivalent to 1.26% of the lot area. It is considered negligible in the context of the existing developed site, with an approximate 0.28% increase in calculated peak runoff for uncapped events and no increase for 2% and 1% AEP after the QUDM coefficient cap. Existing flow paths remain; no Tyler detention is proposed. Additional attenuation of Nathan runoff allows for the Tyler increase.

At 79 Nathan Street, the residential house, shed and driveways will be demolished and replaced with a medical centre and associated parking. The supplied area measurements give a proposed impervious area of 577.26 m², leaving 29.74 m² pervious area. Runoff will be collected for detention before discharge towards Nathan Street.

The supplied area measurements give an existing impervious area at 79 Nathan Street of 261.22 m², representing 43.03% of the lot. For this assessment, a minimum baseline fraction impervious of 0.65 (65%) is adopted, consistent with the Low density residential value in Townsville City Plan Table SC6.4.9.2. This baseline applies to all pre-development discharge comparisons and detention calculations.

For Tyler Street, the calculated time of concentration is 16.20 minutes for both pre- and post-development catchment flows, based on the supplied roof, gutter, concrete and grass travel path. No detention is proposed within, or connected to, the Tyler Street catchment. The 8.99-minute collection time used for detention inflow applies only to Nathan Street. Additional attenuation at Nathan Street accounts for the small Tyler increase without transferring runoff between catchments.

Medical Centre Extension

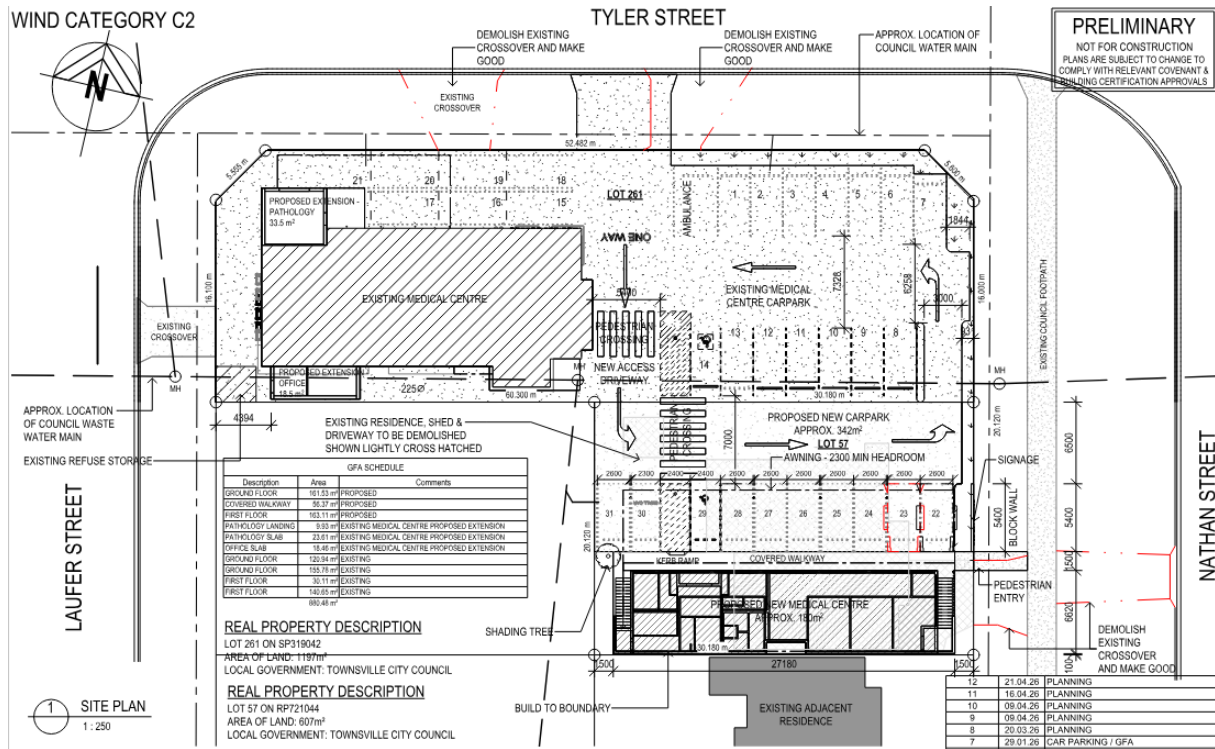


Figure 5 Proposed Development (Source: The Design House, Drawing 2025-165-C-DD-02-12)

4 STORMWATER RUNOFF ASSESSMENT

4.1 Assessment methodology

The stormwater assessment uses the Rational Method to calculate peak runoff from the Tyler Street and 79 Nathan Street catchments. The assessment describes the adopted flow paths, determines pre- and post-development discharges and estimates detention required to manage the increase. The seven assessed events are 63.2%, 50%, 20%, 10%, 5%, 2% and 1% AEP.

For 79 Nathan Street, a pre-development fraction impervious of 0.65 is adopted throughout the discharge and detention assessment. This represents the low density residential planning benchmark in Townsville City Plan Table SC6.4.9.2. It gives 394.55 m² impervious area and 212.45 m² landscaped area over the 607 m² lot. It is the adopted design baseline, rather than a representation of the measured existing surface coverage. The supplied area measurements are the adopted surface-area inputs; earlier survey measurements are superseded.

The proposed Nathan Street impervious area is 577.26 m², giving $f_i = 0.9510$. Tyler Street uses the measured existing area of 1,138.00 m² and the proposed 15.10 m² increase. Discharge coefficients follow QUDM 2016 Section 4.5. The site one-hour 10% AEP intensity is 74.888 mm/h, selecting the 70–90 mm/h row of Table 4.5.3. Linear interpolation in f_i gives $C_{10} = 0.8900$ and 0.8925 for Tyler pre/post, and 0.8300 and 0.8902 for Nathan adopted pre/post.

Peak discharge is calculated as $Q = I \times C_y \times A / 3600$, in L/s for I in mm/h and A in m². QUDM event coefficients are $C_y = \min(1.0, F_y \times C_{10})$. BOM polynomial coefficients evaluate intensity at $T_c = 8.99, 16.20$ and 17.22 minutes. No climate-change uplift is applied.

Table 2 presents the frequency factors (F_y) and the resulting event discharge coefficients (C_y).

Table 2 Frequency factors and event discharge coefficients

AEP	F_y	Tyler pre C	Tyler post C	Nathan pre C	Nathan post C
63.2%	0.800000	0.7120	0.7140	0.6640	0.7122
50%	0.822135	0.7317	0.7338	0.6824	0.7319
20%	0.932714	0.8301	0.8325	0.7742	0.8303
10%	1.000000	0.8900	0.8925	0.8300	0.8902
5%	1.050000	0.9345	0.9371	0.8715	0.9347
2%	1.150000	1.0000	1.0000	0.9545	1.0000
1%	1.200000	1.0000	1.0000	0.9960	1.0000

The 50% and 20% factors are linearly interpolated in equivalent ARI, $T = -1/\ln(1-AEP)$, between QUDM 1–2 and 2–5 year factors. The remaining factors are taken directly from QUDM Table 4.5.2; 63.2% uses the 1-year factor.

4.2 Pre-development flow paths

Tyler Street catchment — The existing development generally comprises roof and concrete surfaces with runoff towards Tyler Street and the Tyler/Nathan Street corner. The adopted representative travel path comprises 6 m of roof at 5° pitch, 6 m of gutter, 32 m across concrete from RL10.00 to RL9.69, followed by 12.6 m across grass from RL9.69 to RL9.28 before reaching the frontage kerb. These path lengths and levels are the project engineer's supplied calculation inputs. The separate Laufer Street frontage discharge identified in Section 2 remains part of the existing drainage regime; no separate Laufer catchment has been quantified in this two-catchment model.

Roof and ground travel times are estimated using Friend's equation, $t = 107nL^{0.333}/S^{0.2}$, with L in metres and S in percent. Horton roughness values of 0.015 for roof/concrete and 0.045 for average grass are adopted. The 0.35-minute gutter contribution is an agreed travel allowance for a 200 × 200 mm gutter at 1:500 fall. Ground sections are treated as sheet flow. Table 3 summarises the adopted pre-development travel paths and times of concentration.

Table 3 Adopted pre-development travel paths

Catchment / segment	Length m	Slope %	Travel min
Tyler roof	6.00	8.749	1.89
Tyler gutter	6.00	0.200	0.35 allowance
Tyler concrete	32.00	0.969	5.12
Tyler grass	12.60	3.254	8.84
Tyler total / adopted Tc	56.60	—	16.20
Nathan grass / adopted Tc	46.70	1.028	17.22

Nathan Street catchment — The existing dwelling, shed and surrounding yard fall towards the Nathan Street frontage. The adopted longest ground flow path is 46.7 m across grass from RL9.80 to RL9.32, giving a fall of 0.48 m and average slope of 1.02784%. Using $n = 0.045$ gives a travel time of 17.22241 minutes, adopted as $T_c = 17.22$ minutes. This flow-path timing is used with the 65% impervious design baseline.

4.3 Pre-development discharge assessment

Table 4 summarises the adopted pre-development catchment parameters and discharges. The Nathan Street baseline is applied consistently to the individual catchment flows, combined-site comparison and detention release targets.

Table 4 Pre-development catchment and flow summary

Parameter	Tyler Street catchment	79 Nathan Street catchment
Catchment area (m ²)	1,198.00	607.00
Impervious area (m ²)	1,138.00	394.55
Landscaped area (m ²)	60.00	212.45
Fraction impervious	0.9499	0.6500
C10 (10% AEP)	0.8900	0.8300
Tc (minutes)	16.20	17.22
Q 63.2% AEP (L/s)	18.02	8.31
Q 50% AEP (L/s)	21.10	9.73
Q 20% AEP (L/s)	32.69	15.07
Q 10% AEP (L/s)	41.06	18.93
Q 5% AEP (L/s)	49.01	22.59
Q 2% AEP (L/s)	60.36	28.48
Q 1% AEP (L/s)	66.12	32.55

The adopted 1% AEP individual catchment peaks are 66.12 L/s for Tyler Street and 32.55 L/s for Nathan Street. These peaks occur at their respective times of concentration and are not directly added to determine the combined coincident peak.

4.4 Post-development flow paths and discharge assessment

Tyler Street catchment — The pathology extension replaces existing concrete hardstand. The latest area measurements include the proposed building, and hardstand works and give a net impervious increase of 15.10 m². Existing frontage flow paths are retained, and Tc = 16.20 minutes applies in both scenarios. All Tyler runoff, including the office roof, bypasses detention. The Nathan release allowance accounts for this full Tyler bypass flow.

Nathan Street catchment — The existing dwelling, shed and driveways will be removed and replaced by the medical centre and associated parking. The adopted developed impervious area is 577.26 m², leaving 29.74 m² of pervious area. Roof water and hardstand runoff will be collected by surface drainage and/or pipes, routed through the proposed detention arrangement and discharged towards the Nathan Street kerb and channel. The adopted continuous path comprises 7.2 m of roof at 5° (8.7489% slope), 6 m of gutter at 1:500 and 46.7 m of concrete at 0.5% grade. Using Friend's equation with n = 0.015 gives roof travel of 2.00713 minutes and concrete travel of 6.63076 minutes. Adding the agreed provisional gutter allowance of 0.35 minutes gives 8.98790 minutes; adopt post-development Tc = 8.99 minutes. Sheet flow is assumed over the concrete. Table 5 summarises the post-development catchment parameters and uncontrolled discharges.

Table 5 Post-development catchment and uncontrolled flow summary

Parameter	Tyler Street catchment	79 Nathan Street catchment
Catchment area (m ²)	1,198.00	607.00
Impervious area (m ²)	1,153.10	577.26
Landscaped area (m ²)	44.90	29.74
Fraction impervious	0.9625	0.9510
C10 (10% AEP)	0.8925	0.8902
Tc (minutes)	16.20	8.99
Q 63.2% AEP (L/s)	18.07	11.28
Q 50% AEP (L/s)	21.16	13.22
Q 20% AEP (L/s)	32.79	20.55
Q 10% AEP (L/s)	41.18	25.85
Q 5% AEP (L/s)	49.15	30.90
Q 2% AEP (L/s)	60.36	38.13
Q 1% AEP (L/s)	66.12	41.83

4.5 Rainfall and discharge calculation breakdown

Tables 6 and 7 show rainfall intensity and discharge for each catchment and event. Event-specific discharge coefficients are given in Section 4.1. Tables 4 and 5 report C10 for reference; their discharge rows use the applicable C_y , including the urban cap of 1.0. The workbook retains unrounded coefficients.

Table 6 Pre-development rainfall and discharge

AEP	Tyler I mm/h	Tyler Q L/s	Nathan I mm/h	Nathan Q L/s
63.2%	76.04	18.02	74.19	8.31
50%	86.64	21.10	84.52	9.73
20%	118.35	32.69	115.45	15.07
10%	138.65	41.06	135.25	18.93
5%	157.61	49.01	153.75	22.59
2%	181.38	60.36	176.94	28.48
1%	198.68	66.12	193.83	32.55

Table 7 Post-development rainfall and uncontrolled discharge

AEP	Tyler I mm/h	Tyler Q L/s	Nathan I mm/h	Nathan Q L/s
63.2%	76.04	18.07	93.92	11.28
50%	86.64	21.16	107.14	13.22
20%	118.35	32.79	146.79	20.55
10%	138.65	41.18	172.25	25.85
5%	157.61	49.15	196.09	30.90
2%	181.38	60.36	226.14	38.13
1%	198.68	66.12	248.10	41.83

4.6 Pre- and post-development comparison

Table 8 compares each catchment using the adopted assessment baseline. Differences are post-development less pre-development and are calculated from unrounded values.

Table 8 Catchment comparison

Parameter	Tyler pre	Tyler post	Change	Nathan pre	Nathan post	Change
Area m ²	1198	1198	0	607	607	0
Impervious m ²	1,138.00	1,153.10	15.10	394.55	577.26	182.71
Tc min	16.20	16.20	0	17.22	8.99	-8.23
Q 63.2% L/s	18.02	18.07	0.05	8.31	11.28	2.97
Q 50% L/s	21.10	21.16	0.06	9.73	13.22	3.50
Q 20% L/s	32.69	32.79	0.09	15.07	20.55	5.48
Q 10% L/s	41.06	41.18	0.12	18.93	25.85	6.93
Q 5% L/s	49.01	49.15	0.14	22.59	30.90	8.31
Q 2% L/s	60.36	60.36	0.00	28.48	38.13	9.65
Q 1% L/s	66.12	66.12	0.00	32.55	41.83	9.28

Tyler Street — Peak runoff increases by approximately 0.28% for the 63.2% to 5% AEP events. At 10% AEP the increase is 0.12 L/s, from 41.06 to 41.18 L/s. At 2% and 1% AEP, both pre- and post-development coefficients reach the QUDM cap of 1.0, so calculated peaks are equal: 60.36 and 66.12 L/s respectively. The 15.10 m² impervious increase represents 1.33% of the existing 1,138.00 m² impervious area ($15.10 \div 1,138.00 \times 100$), equivalent to 1.26% of the 1,198 m² lot area. This increase is considered negligible in the context of the existing site. All Tyler runoff remains undetained and its full post-development peak is included in the Nathan release budget.

Nathan Street — At 1% AEP the uncontrolled peak increases by 9.28 L/s, from 32.55 to 41.83 L/s, or 28.5%. This reflects the adopted impervious coverage and the reduction in Tc from 17.22 to 8.99 minutes. At 2% AEP, which governs detention, the peak increases from 28.48 to 38.13 L/s.

4.7 Combined discharge and mitigation

The combined assessment applies the same uniform storm to both catchments, with contributing fraction $\min(D/T_c, 1)$, and scans common storm durations. It accounts for the differing catchment travel times without adding independent peaks. No additional inter-catchment travel lag is included. A 16.20-minute storm governs the combined peak under the adopted model. Table 9 summarises the combined-site discharge comparison.

Table 9 Combined-site discharge comparison

AEP	Adopted pre L/s	Post uncontrolled L/s	Increase L/s	Increase %
63.2%	26.03	27.20	1.17	4.51
50%	30.47	31.85	1.37	4.51
20%	47.23	49.36	2.13	4.51
10%	59.32	61.99	2.67	4.51
5%	70.80	73.99	3.19	4.51
2%	87.82	90.94	3.12	3.55
1%	97.51	99.62	2.11	2.16

The combined 1% AEP peak increases from 97.51 L/s to 99.62 L/s, an increase of 2.11 L/s, or 2.2%. At 2% AEP the combined peak increases from 87.82 to 90.94 L/s. Post-development increases occur for all assessed events. Section 5 sets out the release allowances and preliminary storage requirement.

This assessment addresses runoff generation and preliminary detention volume. It does not calculate receiving-channel flow depths, velocities or inundation extents. Flood Impact Assessment is excluded from this scope.

5 DRAINAGE DESIGN AND STORMWATER DETENTION

5.1 Detention collection and release targets

Detention is provided at 79 Nathan Street and collects runoff from its 607 m² catchment only, with collection time $T_c = 8.99$ minutes. All Tyler runoff bypasses storage with $T_c = 16.20$ minutes. The Nathan release target allows for the full Tyler post-development peak without physically transferring runoff between catchments.

The permissible peak release from Nathan storage is the lesser of its adopted pre-development peak and the combined adopted pre-development peak less the full Tyler post-development peak. At 2% AEP: $Q_o = \min(28.48, 87.82 - 60.36) = 27.46$ L/s. At 1% AEP: $Q_o = \min(32.55, 97.51 - 66.12) = 31.39$ L/s. Calculations use unrounded values.

5.2 Basha preliminary storage assessment

The preliminary detention storage requirement has been assessed using Basha's (1994) initial-sizing equation with a storm-duration assessment. The method relates the required storage volume to the inflow volume and the reduction in peak discharge:

$$V_s / V_i = r(2 + r) / 3$$

where V_s is the required active detention storage volume (m³); V_i is the estimated inflow volume (m³); Q_i is the post-development peak inflow to storage (L/s); Q_o is the permissible peak release (L/s); and $r = \max[0, (Q_i - Q_o)/Q_i]$ is the reduction ratio. For this development, Q_o includes the allowance for undetained Tyler Street runoff described in Section 5.1.

Storm durations at or above the Nathan Street post-development time of concentration ($T_c = 8.99$ minutes) are assessed to identify the maximum storage requirement for each event. For each duration D , the Rational Method discharge $QR(D)$ is calculated using the rainfall intensity for that duration. The inflow volume is $V_i = QR(D) \times 60D / 1000$, and the equivalent triangular inflow peak is $Q_i = 2QR(D)D / (D + T_c)$, where D and T_c are in minutes and discharges are in L/s. Basha's equation is then applied using the permissible release from Section 5.1. The duration producing the greatest storage volume is adopted as the critical storage duration.

Table 10 shows each event at its critical storage duration; Q_i represents the equivalent storage inflow peak, not the individual catchment peak in Table 5. The supporting calculations are provided in Appendix A.

Table 10 Basha detention requirements at critical durations

AEP	Q_o L/s	Q_i L/s	Ratio r	V_i m ³	V_s m ³	D min
63.2%	7.96	11.15	0.2863	11.37	2.48	25.00
50%	9.32	13.08	0.2873	13.23	2.90	24.75
20%	14.44	20.19	0.2848	20.74	4.50	25.25
10%	18.14	25.34	0.2841	26.22	5.67	25.50
5%	21.65	30.17	0.2823	31.67	6.80	26.00
2%	27.46	37.34	0.2646	38.64	7.72	25.50
1%	31.39	41.30	0.2400	41.19	7.38	24.25

The governing event is 2% AEP at a duration of 25.50 minutes, with $V_i = 38.636 \text{ m}^3$, $Q_i = 37.340 \text{ L/s}$ and $Q_o = 27.462 \text{ L/s}$. Basha's equation gives $V_s = 7.716 \text{ m}^3$. Adopt 8 m^3 (8 kL) of usable active detention storage at Nathan Street. The 1% AEP requirement is 7.380 m^3 and does not govern. Frequency adjustment and the coefficient cap change the governing event.

5.3 Storage provision

The proposed development increases post-development runoff. The Basha duration assessment gives a preliminary active storage requirement of 7.72 m^3 , for which an allowance of 8 m^3 (8,000 L) is adopted at 79 Nathan Street. Two possible detention solutions are identified:

Option 1 — Above-ground rainwater tank. Provide an above-ground rainwater tank connected to the proposed building downpipes, with dedicated detention storage and a controlled discharge to the Nathan Street frontage. The active detention compartment must remain available independently of any rainwater reuse storage. A downpipe-only tank does not collect all carpark runoff; detailed design must account for that bypass and confirm the required storage and release rate for the actual connected area.

Option 2 — Shallow carpark detention. Design the carpark levels and drainage to provide shallow temporary storage with a controlled outlet, whilst maintaining appropriate safe pedestrian access to and from the building. The final grading, storage extent and overflow route are to be established at detailed design.

For either option, the detention storage shall fully discharge over a target period of 12 to 24 hours, with a maximum emptying period of 24 hours following cessation of inflow, to restore capacity before the next likely storm event. Controlled discharge can be achieved by appropriately sized orifice plates on the outlet pipework. Orifice sizing shall satisfy both the permissible release rates and the emptying criterion, allowing for the available hydraulic head and providing access for inspection and maintenance.

Provide at least 8 kL of usable active detention storage for the collection basis assessed in this report. Rainwater reuse storage, sediment allowance and freeboard are additional. A nominal 8 kL tank does not necessarily provide 8 kL of active detention storage; the effective volume depends on the outlet and overflow levels. Final verification shall account for the selected option's inflows, bypass runoff, outlet behaviour and safe overflow route.

The adopted 65% Nathan Street baseline is used consistently for discharge comparisons and release targets. Detailed storage dimensions, gutter design, outlet sizing and receiving-channel hydraulics are outside this volume-only assessment. The selected storage and outlet will require performance verification before certification. Flood Impact Assessment is excluded from this scope.

6 STORMWATER QUALITY

Townsville City Plan SC6.4.8.6, Permanent water quality management, applies the stormwater quality design objectives to the following development:

1. Urban material change of use on premises of at least 2,500 m², where the proposal creates six or more dwellings or impervious surfaces exceed 25% of the net developable area.
2. Urban lot reconfiguration on premises of at least 2,500 m² that creates six or more lots.
3. Urban operational works disturbing at least 2,500 m² of land.

The development at 4 Tyler Street and 79 Nathan Street comprises Lot 261 (1,198 m²) and Lot 57 (607 m²), giving a total premises area of 1,805 m². The medical centre development is therefore below the 2,500 m² premises threshold. The proposal does not create six or more lots, and the on-site works cannot disturb 2,500 m² within the 1,805 m² site.

Accordingly, permanent stormwater treatment measures to meet the SC6.4.8.6 pollutant-reduction objectives are not triggered by the described development. This assessment is based on the stated site and works extent; any associated off-site disturbance or specific approval conditions must also be accounted for.

7 CONCLUSION AND CERTIFICATION

The stormwater assessment adopts two catchments with the existing frontage discharge regime generally retained. Tyler Street uses $T_c = 16.20$ minutes before and after development. Nathan Street uses $T_c = 17.22$ minutes before development and 8.99 minutes after development.

A 65% impervious fraction is adopted for the Nathan pre-development baseline, equivalent to 394.55 m². The proposed impervious area is 577.26 m². Tyler impervious area increases from 1,138.00 to 1,153.10 m², a 15.10 m² increase. The combined 1% AEP peak increases from 97.51 to 99.62 L/s before detention.

The Basha duration assessment gives a maximum requirement of 7.716 m³ at 2% AEP. Adopt 8 m³ (8 kL) of usable active detention storage at 79 Nathan Street. Possible solutions comprise an above-ground rainwater tank connected to building downpipes or a shallow carpark detention basin maintaining safe pedestrian access. The selected collection arrangement, bypass runoff and outlet shall be verified at detailed design. For either option, target complete emptying within 12 to 24 hours, with a maximum of 24 hours following cessation of inflow, using appropriately sized outlet orifice plates. All Tyler runoff retains its existing discharge paths and remains included in the release allowance.

At the detailed design stage, the drainage design shall ensure that existing overland flow paths are maintained or safely diverted so that ponding on adjacent properties does not occur.

8 REFERENCES

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Appendix A Detailed stormwater calculations

Calculation record supporting Sections 3–5. The accompanying presentation workbook contains the live formulas and full duration sweep. Values below are the calculated P14 results.

Table A1 Catchment areas and assessment baseline

1. Site areas and adopted coverage						
Parameter	Tyler Street	Nathan Street				
Site area	1198.00 m ²	607.00 m ²				
Existing impervious area	1138.00 m ²	261.22 m ²				
Proposed impervious area	1153.10 m ²	577.26 m ²				
Existing fraction impervious	94.99%	43.03%				
Proposed fraction impervious	96.25%	95.10%				
Adopted pre-development fi	94.99%	65.00%				
Adopted pre impervious area	1138.00 m ²	394.55 m ²				
Proposed pervious area	44.90 m ²	29.74 m ²				
Impervious area increase	15.10 m ²	316.04 m ²				
Increase / existing impervious	1.33%	120.99%				
Increase / total site	1.26%	52.07%				
2. Assessment areas						
Total development area	1805.00 m ²					
Nathan increase above baseline	182.71 m ²					

The 65% Nathan baseline applies to all adopted pre-development discharge calculations. Actual existing coverage is retained to explain the site condition.

All Tyler runoff bypasses detention. Storage collects only the 607 m² Nathan catchment; Tyler post-development peak discharge is allowed for in the release target.

Appendix A Detailed stormwater calculations continued

Table A2 Time of concentration calculations

1. Adopted travel-time parameters						
Hard surface Horton n	0.015					
Grassed surface Horton n	0.045					
Gutter travel allowance	0.35 min					
Roof pitch	5.0°					
Flow path	Length	Upper RL	Lower RL	Slope (%)	Horton n	Travel time
Tyler roof	6.00 m			8.749	0.015	1.889 min
Tyler gutter	6.00 m			0.2		0.350 min
Tyler concrete	32.00 m	10.00 m	9.69 m	0.969	0.015	5.122 min
Tyler grass	12.60 m	9.69 m	9.28 m	3.254	0.045	8.842 min
Tyler total travel						16.20 min
Tyler adopted pre and post						16.20 min
Nathan existing grass	46.70 m	9.80 m	9.32 m	1.028	0.045	17.222 min
Nathan adopted pre						17.22 min
Nathan proposed roof	7.20 m			8.749	0.015	2.007 min
Nathan gutter	6.00 m			0.2		0.350 min
Nathan concrete	46.70 m			0.5	0.015	6.631 min
Nathan post total travel						8.99 min
Nathan adopted post						8.99 min

Friend equation: $t = 107 n L^{0.333} / S^{0.2}$, where L is metres, S is percent slope and t is minutes. Roof slope = $100 \tan(\text{pitch})$. Segment times are summed and Tc rounded to two decimals.

Roof and ground segments adopt sheet flow. The gutter time is an agreed allowance. The same Tyler travel path applies pre and post development.

Basis: supplied survey levels and client flow-path instructions. Friend equation reference: Autodesk InfoDrainage User Guide, Friend's Equation (Horton roughness).

Appendix A Detailed stormwater calculations continued

Table A3 BOM rainfall coefficients and equations

1. BOM polynomial coefficients						
AEP	a0	a1	a2	a3		
63.2%	0.90597683000	0.87770373000	-0.03517561400	0.00416939890		
50.0%	1.03738750000	0.86905688000	-0.01970753300	-0.00506452660		
20.0%	1.35283100000	0.87185723000	-0.01102023000	-0.01513728900		
10.0%	1.51370190000	0.88606763000	-0.02161306700	-0.01410490700		
5.0%	1.64445410000	0.90437841000	-0.03795819700	-0.01020413700		
2.0%	1.78859380000	0.93056464000	-0.06090156000	-0.00508978590		
1.0%	1.88241510000	0.94896173000	-0.07659555200	-0.00194754650		
AEP	a4	a5	a6			
63.2%	-0.00416544310	0.00072669215	-0.00003604796			
50.0%	-0.00183596040	0.00047600848	-0.00002643619			
20.0%	0.00146832270	0.00007201252	-0.00000974462			
10.0%	0.00203437310	-0.00004132063	-0.00000409885			
5.0%	0.00196526690	-0.00009191774	-0.00000071923			
2.0%	0.00204698300	-0.00019372716	0.00000566419			
1.0%	0.00226135530	-0.00028640809	0.00001110930			

Depth $P(D) = \text{EXP}[a_0 + a_1 \ln(D) + a_2 \ln(D)^2 + \dots + a_6 \ln(D)^6]$. Intensity $I(D) = 60P(D)/D$. D is minutes, depth is mm and intensity is mm/h.

Source: BOM site IFD files supplied 15 September 2026, latitude -19.29, longitude 146.761. No climate-change uplift is applied.

BOM Rainfall IFD Data System help: <https://www.bom.gov.au/water/designRainfalls/revise-ifd/?content=help>

Only the coefficient series used in the report is retained. All rainfall intensities in this workbook are calculated from these unrounded source coefficients.

Appendix A Detailed stormwater calculations continued

Table A4 QUDM discharge coefficients

1. QUDM 2016 coefficient basis						
One-hour 10% AEP intensity	74.888 mm/h					
Fraction impervious	0.2	0.4	0.6	0.8	0.9	1
C10 for 70–90 mm/h	0.74	0.78	0.82	0.86	0.88	0.9
Condition	Tyler pre	Tyler post	Nathan pre	Nathan post		
Fraction impervious	0.949917	0.962521	0.650000	0.951005		
C10	0.889983	0.892504	0.830000	0.890201		
AEP	Fy	Tyler pre C	Tyler post C	Nathan pre C	Nathan post C	
63.2%	0.8	0.711987	0.714003	0.664000	0.712161	
50.0%	0.822	0.731686	0.733759	0.682372	0.731865	
20.0%	0.933	0.830100	0.832451	0.774153	0.830303	
10.0%	1	0.889983	0.892504	0.830000	0.890201	
5.0%	1.05	0.934482	0.937129	0.871500	0.934711	
2.0%	1.15	1.000000	1.000000	0.954500	1.000000	
1.0%	1.2	1.000000	1.000000	0.996000	1.000000	

$C_y = \text{MIN}(1, F_y \times C_{10})$. All adopted fractions lie on the linear $f_i = 0.20$ – 1.00 part of the selected row. The intensity-range guard requires reassessment if rainfall inputs move outside 70–90 mm/h.

50% and 20% AEP factors are interpolated linearly in ARI, using $T = -1/\ln(1-\text{AEP})$. This interpolation is the adopted assessment assumption; the other factors are tabulated.

Source: QUDM 2016 Section 4.5, Tables 4.5.2 and 4.5.3. The coefficient is for peak discharge. Basha storage uses the preliminary inflow approximation described on the Detention sheet.

Appendix A Detailed stormwater calculations continued

Table A5 Pre-development and post-development flows

1. Rainfall at adopted catchment times						
AEP	Tyler intensity	Nathan pre I	Nathan post I			
63.2%	76.043 mm/h	74.194 mm/h	93.920 mm/h			
50.0%	86.640 mm/h	84.525 mm/h	107.138 mm/h			
20.0%	118.355 mm/h	115.451 mm/h	146.793 mm/h			
10.0%	138.653 mm/h	135.251 mm/h	172.252 mm/h			
5.0%	157.614 mm/h	153.752 mm/h	196.094 mm/h			
2.0%	181.377 mm/h	176.941 mm/h	226.144 mm/h			
1.0%	198.679 mm/h	193.826 mm/h	248.104 mm/h			
AEP	Tyler pre Q	Tyler post Q	Nathan pre Q	Nathan post Q		
63.2%	18.017 L/s	18.068 L/s	8.307 L/s	11.278 L/s		
50.0%	21.096 L/s	21.156 L/s	9.725 L/s	13.221 L/s		
20.0%	32.694 L/s	32.787 L/s	15.070 L/s	20.551 L/s		
10.0%	41.064 L/s	41.181 L/s	18.928 L/s	25.855 L/s		
5.0%	49.014 L/s	49.153 L/s	22.593 L/s	30.905 L/s		
2.0%	60.358 L/s	60.358 L/s	28.477 L/s	38.130 L/s		
1.0%	66.116 L/s	66.116 L/s	32.551 L/s	41.833 L/s		
AEP	Combined pre	Combined post	Increase	Increase (%)		
63.2%	26.026 L/s	27.199 L/s	1.173 L/s	4.51%		
50.0%	30.474 L/s	31.847 L/s	1.373 L/s	4.51%		
20.0%	47.228 L/s	49.356 L/s	2.128 L/s	4.51%		
10.0%	59.319 L/s	61.992 L/s	2.673 L/s	4.51%		
5.0%	70.803 L/s	73.993 L/s	3.191 L/s	4.51%		
2.0%	87.820 L/s	90.940 L/s	3.121 L/s	3.55%		
1.0%	97.505 L/s	99.616 L/s	2.110 L/s	2.16%		

$Q = C I A / 3600$ (L/s), with area in m² and intensity in mm/h. Combined peaks are assessed at a common duration: $\text{sum}[C I(D) A \times \text{MIN}(D/T_c, 1)] / 3600$. They are not the sum of separate catchment maxima.

Appendix A Detailed stormwater calculations continued

Table A6 Release targets and Basha storage calculations

1. Nathan release allowance						
AEP	Nathan pre	Combined pre	Tyler post	Balance	Adopted Qo	
63.2%	8.307 L/s	26.026 L/s	18.068 L/s	7.958 L/s	7.958 L/s	
50.0%	9.725 L/s	30.474 L/s	21.156 L/s	9.318 L/s	9.318 L/s	
20.0%	15.070 L/s	47.228 L/s	32.787 L/s	14.441 L/s	14.441 L/s	
10.0%	18.928 L/s	59.319 L/s	41.181 L/s	18.138 L/s	18.138 L/s	
5.0%	22.593 L/s	70.803 L/s	49.153 L/s	21.650 L/s	21.650 L/s	
2.0%	28.477 L/s	87.820 L/s	60.358 L/s	27.462 L/s	27.462 L/s	
1.0%	32.551 L/s	97.505 L/s	66.116 L/s	31.389 L/s	31.389 L/s	
AEP	Critical D	Qi	Qo	Reduction r	Inflow Vi	Storage Vs
63.2%	25.00 min	11.150 L/s	7.958 L/s	0.286258	11.370 m ³	2.480 m ³
50.0%	24.75 min	13.075 L/s	9.318 L/s	0.287331	13.235 m ³	2.899 m ³
20.0%	25.25 min	20.192 L/s	14.441 L/s	0.284787	20.741 m ³	4.499 m ³
10.0%	25.50 min	25.337 L/s	18.138 L/s	0.284110	26.216 m ³	5.671 m ³
5.0%	26.00 min	30.167 L/s	21.650 L/s	0.282340	31.667 m ³	6.802 m ³
2.0%	25.50 min	37.340 L/s	27.462 L/s	0.264558	38.636 m ³	7.716 m ³
1.0%	24.25 min	41.301 L/s	31.389 L/s	0.239987	41.185 m ³	7.380 m ³
2. Required active storage						
Governing calculated volume	7.716 m ³					
Storage rounding increment	1.00 m ³					
Adopted active storage	8.00 m ³		Equivalent volume	8000 L		

$Q_o = \text{MIN}(\text{Nathan adopted pre-development peak, combined adopted pre-development peak} - \text{full Tyler post-development peak})$. Tyler runoff bypasses storage.

Basha (1994): $V_s = V_i \times r(2+r)/3$; $r = \text{MAX}(0, 1 - Q_o/Q_i)$. For $D \geq T_c$: $Q_R = I(D) C A / 3600$; $V_i = Q_R \times 60D/1000$; $Q_i = 2Q_RD/(D+T_c)$. Flows are L/s, volumes m³ and times minutes.

$T_c = 8.99$ min for Nathan storage inflow. Critical duration is the duration giving the largest V_s for each event. The full duration calculation is retained in the Duration scan sheet.

Basis: Basha ratio and duration-dependent triangular inflow approximation. Detailed storage geometry, outlet design and routing are outside this initial-sizing assessment.

The full duration sweep includes quarter-minute steps from 1 to 180.75 minutes, one-minute steps to 360 minutes, five-minute steps to 1,440 minutes and hourly steps to 10,080 minutes, together with the adopted catchment times. Storage is assessed only for $D \geq 8.99$ minutes. Maximum results for all seven events are shown above.