# SQIDEP (v1.3)
# Independent Evaluators
# Joint Report
# *Atlan Stormsack*

August 2024

Dr Baden Myers

# DOCUMENT VERIFICATION

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### Document History

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| | | | | |
| | | | | |

### Version History

| VERSION | COMMENT |
|---|---|
| **1** | Final Report |
| | |
| | |

### Climate Change Statement

A wide range of sources, including but not limited to the IPCC, CSIRO and BoM, unanimously agree that the global climate is changing. Unless otherwise stated, the information provided in this report does not take into consideration the varying nature of climate change and its consequences on our current engineering practices. The results presented may be significantly underestimated; flood characteristics shown (e.g. flood depths, extents and hazards) are may be different once climate change is taken into account.

### Disclaimer

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# 1. Introduction

This document reports on the independent evaluation of an application by Atlan Stormwater (hereafter Atlan) to have Stormwater Australia approve the Atlan Stormsack under the requirements included in Stormwater Quality Improvement Device Evaluation Protocol (SQIDEP) v1.3 (hereafter referred to as SQIDEP) published in 2019 by Stormwater Australia. SQIDEP v1.3 is available on Stormwater Australia's website at the time of reporting.

This is a joint report prepared by Independent Evaluators, Dr Baden Myers and Mark Liebman, a Director of Sustainability Workshop. The Independent Evaluators were engaged by Stormwater Australia on a fee for service basis to carry out an independent evaluation of the Atlan Stormsack installed at Griffith University, Parkland Campus in Southport, Queensland.

## Evaluators Independence Declarations

It is declared that both evaluators, Mark Liebman and Baden Myers, are completely independent and neither Independent Evaluator has any conflict of interest with respect to this engagement.

It is declared that Mark Liebman, in his capacity as a Council engineer, working for Blacktown City Council has previously assessed and evaluated a laboratory study and field study on behalf of Blacktown City Council. Baden Myers, in his capacity as a Research Fellow, has previously been involved with laboratory testing of other Atlan products.

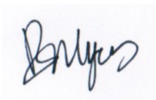
We jointly declare that:

*We are not, nor have we ever been employed or commissioned by the Applicant, Atlan Stormwater.  We have not been involved in the design or development or monitoring of the Atlan Stormsack.  We have undertaken this assessment without prejudice and in good faith.*

*Signed:  Mark Liebman*

*Signature:* 

*Signed: Baden Myers*

*Signature:* 

## Background

Stormwater Australia published the Stormwater Quality Improvement Device Evaluation Protocol (SQIDEP) in January 2019. The SQIDEP process seeks to *"provide a uniform set of criteria to which stormwater treatment measures can be field-tested and reported. These criteria should guide and inform field monitoring programs seeking to demonstrate pollutant removals for stormwater treatment measures included in pollutant export modelling software. Future revisions of the protocol are anticipated to also include laboratory testing."* (Stormwater Australia, 2019).

The SQIDEP process is shown below in Figure 1. Two pathways for evaluation exist under the protocol and this application involved a local field test submission following the earlier submission of a Quality Assurance Project Plan (QAPP). The QAPP was reviewed and accepted by the evaluators in early 2024. It is noted that the Independent Evaluators reviewed the QAPP during the monitoring period of the Atlan Stormsack (i.e. the QAPP was submitted, evaluated and accepted but Atlan had already commenced field monitoring with their sub-contractor).

## Review Documents

The following documents form the basis of this independent evaluation:

1. Stormsack detailed performance report (Stormsack DPR) (Issue 2)

Drapper, D., Waldron, S., & Nyakas, L. (2024). SQIDEP Detailed Performance Report – Stormsack (Issue 2), Drapper Environmental Consultants, Crestmead, Queensland, Australia

2. Hydraulic Performance (Treatable Flowrate) Lab Testing report (Issue 1), 5 July 2024

Drapper, D., Nyakas, L. (2024). Hydraulic Performance (Treatable Flowrate) Lab Testing report (Issue 1), Drapper Environmental Consultants, Crestmead, Queensland, Australia

3. ATLAN Stormsack Device Lab Testing Report (Issue 3), 5 July 2024

Drapper, D.; Nyakas, L. ATLAN Stormsack Device Lab Testing Report (Issue 3); Drapper Environmental Consultants: Crestmead, Queensland, Australia, 2024.

4. StormSack Performance Assessment, Report Number: MHL2325, Manly Hydraulics Laboratory, November 2014.

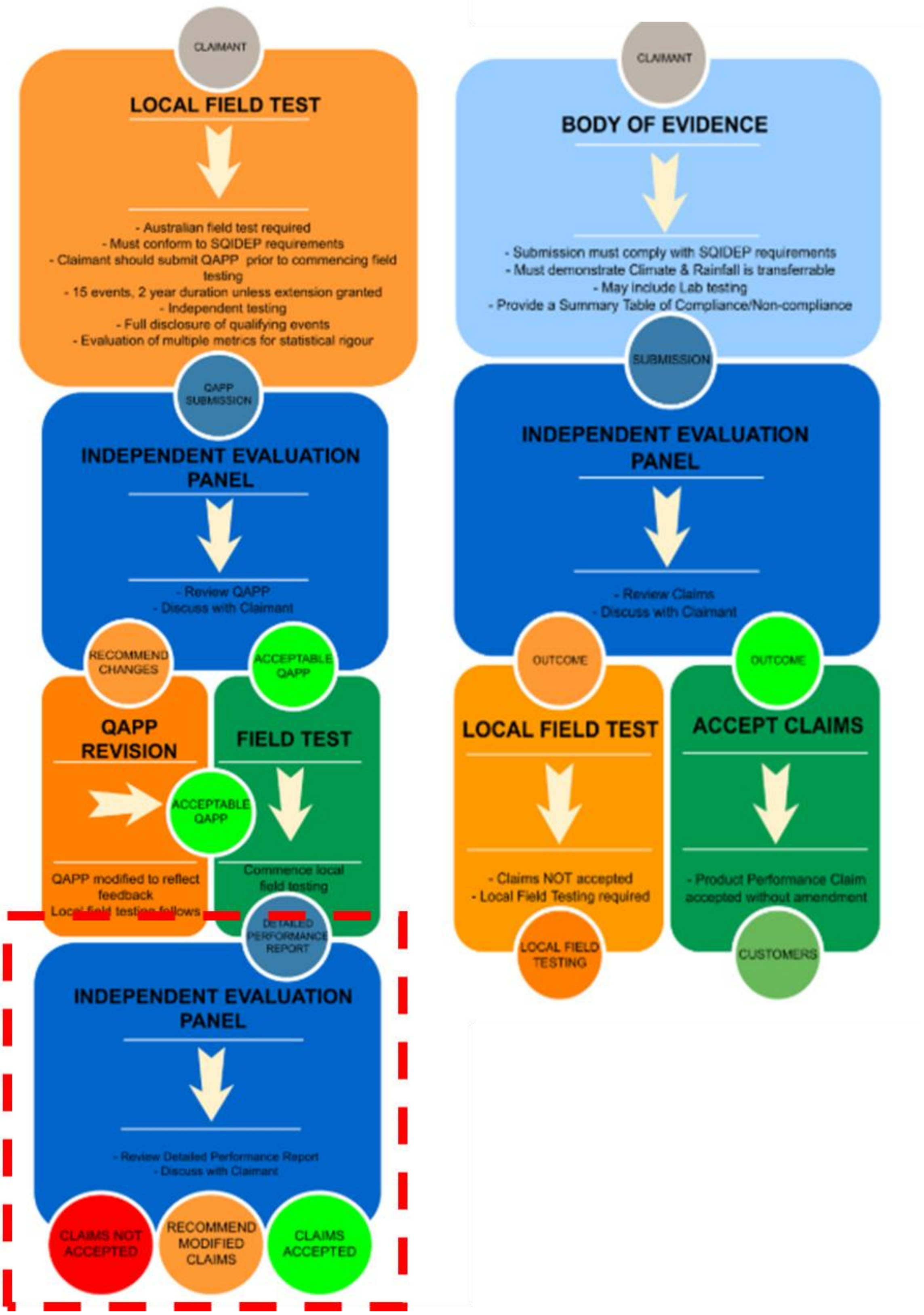



Figure 1: SQIDEP Pathways, as presented by SQIDEP v1.3. This report specifically relates to the section boxed in dashed red – the independent evaluation panel assessment of a claim following acceptance of a QAPP.


Figure 2: Image of the Stormsack extracted from the Stormsack brochure

## Atlan Stormsack Description

The following description has been extracted from the DPR:

The Stormsack (200) is housed within a precast concrete chamber. The Stormsack (200) bag is fabricated from a polyethylene fabric with a nominal 200 micron aperture. This aperture has been advised by the fabric supplier (Tencate). The bag hangs from the aluminium mounting frame on aluminium carabiners. A HDPE flange is fitted to the aluminium frame to seal against the pit walls and ensure flow enters the Stormsack (200). Larger bags (from 600mm x 600mm upwards) are supported by a polyethylene strap and steel mesh.

Stormsack comes in different sizes.

## Atlan Stormsack Performance Claim

A performance claim has been submitted on the SQIDEP submission form. The performance claim for the Stormsack is shown in Table 1.

Table 1: Performance claim for the Stormsack

| Parameter | Performance claim (% removal) or otherwise as noted |
|---|---|

| | |
|---|---|
| **Total suspended solids (TSS)** | 45 |
| **Total phosphorous** | 41 |
| **Total nitrogen** | 21 |
| **Gross pollutants** | 100 |
| **Treatment flow rate** | 39 L/S |

The Local Field Test application did include specific evidence and an agreed method relating to the monitoring of gross pollutants.

It is noted that after reviewing the Detailed Performance Review, the reviewers were not satisfied the treatable flow rate (TFR) claim could be justified and requested additional laboratory analysis to test the TFR with an agreed preloading of a mix of gross pollutants and sediment. The additional testing was undertaken and subsequently assessed and the results of this additional testing are incorporated into our findings and recommendations.

## Atlan Stormsack Field Site Background and Assumptions

The field testing for the ATLAN Stormsack (200) was carried out at Griffith University, carpark H, Parkland Campus, Griffith Way, Southport, QLD, 4215.

The catchment area draining to the device is shown in Figure 3 and was reported to be 1,181 $m^2$ directly connected to the Stormsack. The catchment was reported to be 66% impervious with the remainder including a eucalyptus forested area which drains to the Stormsack.

It has been reported that during the field monitoring, a retaining wall and grass swale was constructed within the vegetated area and from the monitoring results it is clear that this deposited significant construction loads of sediment into the Stormsack causing it to be blinded with sediment on at least one occasion. The reviewers have taken this construction loading of TSS into account when requesting additional laboratory testing.


Figure 3: Extracted from the DPR which shows the car park and catchment

A review of the site and catchment conditions is shown below. A photograph of the monitoring system is shown in Figure 4 and a drawing of the monitoring system setup is shown in Figure 5. The field monitoring claims to have met all the criteria of the SQIDEP protocol, and this claim is evaluated in this report.

Figure 4: Showing the Atlan Stormsack monitoring equipment and the catchment behind in yellow.

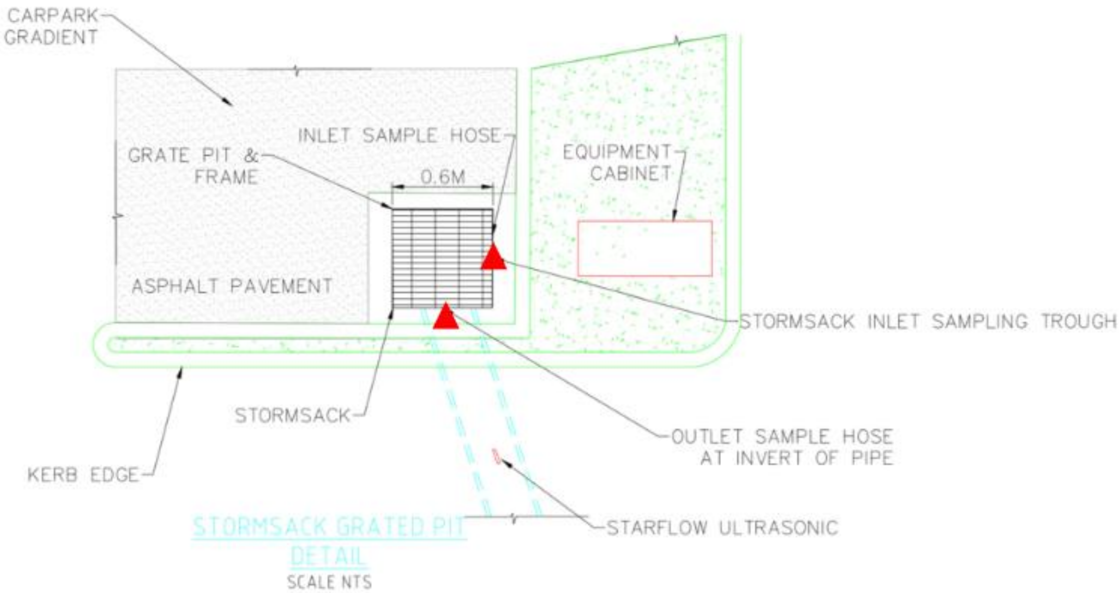



Figure 5: Showing the Atlan Stormsack monitoring arrangement

# 2. Approval of the Quality Assurance Project Plan

A review of the QAPP information was conducted between November 2023 and April 2024 and included two workshops (27th November 23 and 6th March 24) with representatives of Stormwater Australia, Atlan Stormwater and Drapper Environmental Consultants.

A key part of the workshops and evaluation of the QAPP was the assessment of gross pollutants. As a gross pollutant monitoring method is not included in SQIDEP a method was agreed with Atlan. This included

- the use of a camera with images included in *Formitise* records which were shared with reviewers
- a digital switch to record if an overflow event had occurred and
- seeding the litter baskets with marked grtoss pollutant materials to ascertain if scour has occurred.

The QAPP did define how flow rates would be tested including the preloading of Atlan Stormsack products. This included preloading of gross pollutants – natural and anthropogenic.

During the evaluation of the DPR it was subsequently realised by reviewers that this method, which did not initially include preloading of sediment, should be revised to include preloading of sediment combined with the preloading of the gross pollutants with a second round of testing agreed to and undertaken by Atlan Stormwater.

The findings of the QAPP review are summarised in Table 2.

Table 2: Review of QAPP

| | IEP comments |
|---|---|
| **Data quality objectives** | Defined. |
| **Organisation roles & responsibilities** | Was clearly defined (QAPP, Figure 9) |
| **Description of test site** | Defined. |
| **Measuring rain fall** | Described use of rain gauge and gauge characteristics. |
| **Storm events sampled** | Described intention to sample 15 or more events. |
| **Flow monitoring** | Were to use a flow gauge located at the downstream pipeline – Starflow QSD Ultrasonic AV meter.<br><br>QAPP noted that if the design TFR is not achieved in the monitoring period then reliance on lab data would be made. |
| **Sampling location** | Defined – inlet sampling trough and outlet sampling hose. |
| **Sampling equipment** | Defined in QAPP (ISCO GLS Auto-samplers). |
| **Sampling methodology** | Defined in QAPP. |
| **Sampling quality assurance and quality control** | Defined in QAPP. |
| **Laboratory analysis** | Defined in Section 4.9 of QAPP. |
| **Laboratory quality assurance and quality control** | As above. |
| **Data management** | Shown in QAPP, Figure 9 |
| **Reporting** | As above. |

# 3. SQIDEP Compliance

The key criteria for testing are listed in Table 3 of SQIDEP v1.3 (*Minimum data and qualifying event requirements for assessment)* (Stormwater Australia, 2019), with additional details provided throughout the protocol. Table xx provides a summary of the review of field testing criteria for rainfall events in the performance claim. Table 3 below presents the review of the Atlan Stormsack performance claim in accordance with the key requirements of SQIDEP v1.3 based on a performance review template developed by Stormwater Australia in 2024.

Table 3: SQIDEP Criteria and Compliance

| Field Testing Criteria for Sampling Events | | |
|---|---|---|
| | **Criteria** | **IEP comments** |
| **Minimum number of events** | The greater of:<br>a. 15 events, and<br>b. Sufficient events to achieve 90% confidence interval, as determined by defensible statistical method (e.g. ANOVA, t-test) that examines influent and effluent pairs. This may vary between target pollutants (based on catchment variability). In this event, statistical analysis can be undertaken separately for each species of interest. | There were 31 events presented in the Atlan Stormsack Detailed Performance Report (DPR) (Stormsack DPR, Table 7).<br><br>The performance claim is based on those events retained after removing events considered non-compliant based on SQIDEP requirements – this left 22 compliant events in the claim.<br><br>The significance of the difference between influent and effluent pairs for these 22 events was detailed in the Stormsack DPR Section 7.2 to 7.5.<br><br>Statistical analysis was repeated for all TSS, TP and TN results with minor deviations in the numerical results likely due to rounding errors. In all cases, the difference between inflow and outflow concentrations remained significant. |
| **Minimum rainfall depth** | Sufficient to collect minimum sample volume (based on laboratory analytical requirements). | Quoting:<br><br>'Sampling was triggered by 0.6 mm rainfall within a rolling 30-min window, measured onsite by a 0.2 mm tipping bucket rain gauge (pluviometer). Since there is essentially no retention time through the Stormsack, and runoff from the catchment is observed after ~0.6 mm, samples are triggered at both the inlet and outlet simultaneously. Additionally, a flow volume of ~1,000 L past the flow meter location at the outlet is required to initiate subsequent sample collection. All subsamples collected during a runoff event were composited within the sampler in a 9 L bottle'. |

<table>
<tr><td></td><td></td><td>(Stormsack DPR, Section 4.6)</td></tr>
<tr><td>Recommended inter-event time</td><td>Min 6 hours[3]</td><td>A minimum inter-event period of 6 hours was adopted.<br><br>(Stormsack DPR, Table 5)</td></tr>
<tr><td>Device size</td><td>Full Scale (where a ‘family’ of devices are being included as part of the claim sizing relationships must be provided for evaluation along with any basis of justification).</td><td>A full scale device was investigated. It was a 600 × 600 mm (length × width) device. The performance claim is based on an inflow of 39 L/s.<br><br>‘Drawings for the Stormsack (200) installed at Griffith University Carpark H are presented in Figure 2. The device is installed in a 600 mm x 600 mm grated inlet in the University carpark. The pit is roughly 1800mm deep, and a 375 mm diameter pipe drains the invert of the pit.’<br>Stormsack DPR, Section 2.3)<br><br>The device is part of a family of devices. The sizing of these devices is shown below:<br><br>
<table>
<tr><th>Size of Stormsack (Pit dimensions) (mm)</th><th>Bag size ( L x W X D) (mm)</th></tr>
<tr><td>450 x 450</td><td>270 x 270 x 260</td></tr>
<tr><td>600 x 600</td><td>500 x 500 x 305</td></tr>
<tr><td>600 x 900</td><td>430 x 800 x 305</td></tr>
<tr><td>900 x 900</td><td>700 x 700 x 305</td></tr>
<tr><td>1200 x 900</td><td>1000 x 700 x 305</td></tr>
<tr><td>1200 x 1200</td><td>1000 x 1000 x 305</td></tr>
</table>
<br>‘The ATLAN Stormsack (200) has been designed according to standard pit dimensions. A scaling relationship that estimates the Flow rate at which</td></tr>
</table>

| | | |
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| | | bypass commences is based on the area of the Stormsack (200) bag side walls and the flow rate of 45.88 L/s/m$^2$ of fabric identified in the lab testing on a Stormsack bag filled to 50% capacity. This conservatively assumes the base of the bag is 100% obstructed and the side walls provide flow passage.'<br><br>(Stormsack DPR, Section 2.7)<br><br>The scaling and model designs are presented in Table 2 and Appendix F of the DPR.<br><br>The sizing relationship is considered reasonable. |
| **Runoff characteristics** | Target pollutant profile of influent and effluent | The Stormsack DPR, Section 4.1, describes the catchment as a carpark at Griffith University, Parkland Campus, Southport, Queensland. The catchment area is ~1,181 m$^2$, which is 66% impervious, the remainder being eucalypt forest at the crest of the catchment.<br><br>Monitoring is presented over the period from September 2022 through to January 2024. There were some anomalies that were managed.<br><br>Quoting:<br><br>'In November 2023, earthworks commenced on a retaining wall and swale between the forest area and the carpark. For ~4 months, the works resulted in high sediment and organic loads onto the carpark. This occasionally produced inlet concentrations above the upper limit specified by Table 1 of SQIDEP. Where this occurred, the results are excluded from the "qualifying" data.'<br><br>Stormsack DPR, Section 4.1.<br><br>Based on the events presented to support the performance claim in the Stormsack DPR (Table 9), the mean levels of TSS, TP and TN in the claimed inflow samples was 193 mg/L, 0.1 mg/L and 1 mg/L. These concentrations comply with acceptable mean values for SQIDEP (see SQIDEP Table 1) and also within range of expectations from other stormwater quality literature (e.g. Duncan, 2006). |

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| **Runoff volume or peak flow** | At least 2 events should exceed 75% of the design water quality volume/ TFR and 1 event greater than 100% of the TFR. | The TFR claim is 39 L/s.<br><br>Based on a review of the available data including:<br>- Stormsack DPR v1<br>- Hydraulic Performance (Treatable Flowrate) Lab Testing report (Issue 1)<br>- ATLAN Stormsack Device Lab Testing Report (Issue 3)<br><br>a TFR claim of 25 L/s – as originally proposed - was considered acceptable by the reviewers.<br><br>We note that 75% of TFR is 18.75 L/s.<br><br>Based on the event claim in the Stormsack DPR (Table 9), there were two events which reached/exceeded 75% of the TFR on 31/12/2023 (19.8 L/s) and 01/01/2024 (25.2 L/s).<br><br>These events had some complications however when examined:<br><br>- Neither event was captured fully in the water quality monitoring. Water quality sampling of both events (31/12/2023 and 01/01/2024) only captured a period of flow with a maximum flow rate of approx. 7 L/s, with sampling ceasing prior to the occurrence of the peak flow.<br>- There was no recorded overflow condition for these events – however, overflow was observed to occur for the event on 25/12/2023 (one week prior), and this overflow occurred with an event peak flow rate of 11.2 L/s.<br>- An examination of the *Formitize* site records indicated that the condition of the Atlan Stormsack after the event on 25/12/2023 was similar to the condition one week later. It appears blinded and retaining water after the events on both 31/12/2023 and 01/01/2024.<br><br>Due to these concerns over flow rate, it was recommended that flow capacity testing be undertaken to verify the claim, Laboratory data has been submitted to support the TFR claim of the device - see the Hydraulic Performance (Treatable Flowrate) Lab Testing report (Issue 1). |

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| | | Based on the information in this later report, the reviewers accept the claimed performance up to 25 L/s. This flow rate was the result of lab limitation rather than a limitation of the Stormsack. |
| **Sampling Procedures and Techniques** | | |
| **Automated sampling** | Composite samples on a flow-(preferred) or time-weighted basis | Sampling was via composite samples on a flow weighted basis (Stormsack DPR, Table 5 and Section 4.4.2). |
| **Minimum number of aliquots** | 80% of field test collections should have at least 8 per event. Notwithstanding aliquots should be collected to provide hydrograph coverage of rising and falling limbs. | Complies – all complying events had at least 8 aliquots. |
| **Hydrograph coverage** | At least 50% of qualifying storms should include the first 70% storm. | Complies. |
| **Grab Sampling** | Hydrograph coverage (or, for storms longer than 8 hours, capture of the first 8 hours). Programs should aim to capture full hydrographs for all events, but flexibility will be considered for large volume, long duration events. | Not applicable. |
| **Sampling Location** | Dependent on catchment and rainfall patterns, multiple peaks should be accounted for (at least 1 occurrence). | There were several events which exhibited multiple peaks. These included:<br>- Event 2, 16/09/2022 (2 peaks, approx. 1.6 L/s)<br>- Event 20, 25/03/2023 (3 peaks, approx. 2 L/s)<br><br>Event numbering here is based on the Stormsack DPR, Table 9. |
| **Chemical and Physical analytes** | As identified and agreed in the submitted QAPP. | The analytes in the QAPP were agreed to by the independent evaluators during the QAPP phase. |
| **Minimum and maximum (influent)** | Minimum concentrations: exclude if below limit of detection. | Water quality testing was undertaken by ALS Global. Limit of reporting is provided by the ALS Certificate of analysis for each event. Comparing inlet |

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| **pollutant** | | sample concentrations in the claim from the Stormsack DPR, Table 9, with these limits:<br><br>TSS limit of reporting = 5 mg/L; all composite inlet samples were greater than 5 mg/L.<br><br>TP limit of reporting = 0.01 mg/L; all composite inlet samples had TP greater than or equal to 0.01 mg/L. Note that inflow to Event 5 was 0.01 mg/L, and it has been included with an outflow of the same concentration resulting in a 0% TP reduction which has a conservative impact on the performance claim.<br><br>TN limit of reporting = 0.1 mg/L; all composite inlet samples had TN greater than 0.1 mg/L. |
| **concentrations for qualifying events** | Maximum: mean+2SD for any single event, and mean +1SD in the aggregate dataset. Refer Table 1. | Comparing inlet sample concentrations in the claim (from Stormsack DPR, Table 9) with the maximum and mean inflow concentrations in SQIDEP v1.3 Table 1:<br><br>**<u>TSS</u>**<br>Maximum concentration for any individual event = 591 mg/L<br>Adopted maximum average = 371 mg/L<br><br>The claim is compliant.*<br><br>**<u>TP</u>**<br>Maximum concentration for any individual event = 1.1 mg/L<br>Adopted maximum average = 0.71 mg/L<br><br>The claim is compliant.*<br><br>**<u>TN</u>**<br>Maximum concentration for any individual event = 4.4 mg/L<br>Adopted maximum average = 3.09 mg/L<br><br>The claim is compliant.*<br><br>* It is noted that events that were non-compliant were removed from the dataset – the concentration of these events is presented in the Stormsack |

<table>
<tr><td></td><td></td><td>DPR, Table 7.<br><br>Three sets of results are presented:<br><br>Table 7 – All potentially qualifying events with water quality data<br><br>Table 8 – Same as Table 7 but excluding all events with concentrations too high according to SQIDEP Table 1<br><br>Table 9 – Same as Table 8, but also excluding events with less than 70% hydrograph coverage, less than 8 aliquots in the composite sample or other reasons to question compliance.<br><br>The impact on the performance claim is summarised below follows:<br><br>
<table>
<tr><td></td><td colspan="3">Performance claim (%) for each table</td></tr>
<tr><td></td><td>Table 7</td><td>Table 8</td><td>Table 9</td></tr>
<tr><td>TSS</td><td>29</td><td>45</td><td>45</td></tr>
<tr><td>TP</td><td>36</td><td>37</td><td>47</td></tr>
<tr><td>TN</td><td>21</td><td>22</td><td>25</td></tr>
</table>
</td></tr>
<tr><td colspan="3">Requirements</td></tr>
<tr><td>Flow Measurement Location</td><td>Inlet, Outlet and Bypass, as applicable. Based on relevant accepted measurement protocols for flow type (e.g. open channel, in pipe)</td><td>Inflow was not measured. Only outflow was measured. This was considered acceptable by reviewers during the QAPP assessment process because:<br>- It is acknowledged that it would be difficult to measure inflow, typically in the form of sheet flow, to a pit basket device<br>- Forcing some form of measurement would change the nature of flow into the device and potentially impact performance.<br>- There is no reasonable expectation of retention or detention occurring in the Stormsack.<br><br>Bypass was not directly measured. Occurrence was recorded via two systems (Stormsack DRP< Section 2.6):</td></tr>
</table>

| | | |
|---|---|---|
| | | - A camera in the base of the pit monitoring overflow<br>- A bypass switch, which when flooded, would record bypass had occurred. |
| **Precipitation Measurement** | Automatic rain gauge (pluviometer) | A pluviometer was used to measure rainfall (Stormsack DPR, Section 4.4, Table 5). |
| **Recording Intervals** | 5 minutes or less | Pluviometer recorded rainfall in 0.2 mm increments, and rainfall records are kept with a 5 min. interval or less. |
| **Rainfall Recording Increments** | No greater than 0.25mm | Rainfall recording increment was 0.2 mm (Stormsack DPR, Section 4.4, Table 5). |
| **Rain Gauge Calibration** | Twice during monitoring period | The monitoring period in the claim lasted from 09/09/2022 to 01/01/2024.<br><br>Calibration of the pluviometer occurred on site on 01/09/2022 and 17/08/2023 (Stormsack DPR, Section 4.10 and records in Appendix B). |
| | | |
| **Performance Indicators** | Based on the Performance Claim stated in Detailed Performance Report. (Can include but not limited to TSS, Metals, TPH, TP & TN). The target pollutants and testing rationale must be described in the QAPP & Detailed Performance Report.<br>Where a device is claiming total reductions of a particular pollutant, it is not necessary to include speciation. If speciation is not undertaken, then reductions of sub-species cannot be claimed. | The performance claim is currently TSS, TP, TN and gross pollutants.<br><br>Speciation of TN is detailed in the Stormsack DPR Section 8 for information only and does not affect the performance claim for SQIDEP at this time. |
| **Performance Indicators Calculation** | Concentration Removal Efficiency (CRE) (See Section 6.4.3) (Arithmetic average and median. If difference is 10% or greater, inspect data set closely) | Based on the data in the Stormsack DPR (Table 9):<br><br>Average CRE (TSS) = 37%<br>Median CRE (TSS) = 36% |

| | | |
|---|---|---|
| | | Difference between mean and median CRE for TSS is not greater than 10%.<br><br>Average CRE (TP) = 20%<br>Median CRE (TP) = 20%<br><br>Difference between mean and median CRE for TP is not greater than 10%.<br><br>Average CRE (TN) = 14.3%<br>Median CRE (TN) = 17.1%<br><br>Difference between mean and median CRE for TN is not greater than 10%. |
| **Performance Variability Schematics** | Mass Removal Efficiency (MRE) (See Section 6.4.4) (Arithmetic average and median. If difference is 10% or greater, inspect data set closely) | Based on the data in the Stormsack DPR (Tables 6 and 9), it was not possible to determine MRE because inflow is equal to outflow, and MRE is the same as CRE in this case. The device has no significant retention/detention capacity. |
| **Statistical Significance Testing** | Relative Achievable Efficiency (RAE) (See Section 6.4.5) (Arithmetic average and median. If difference is 10% or greater, inspect data set closely | Based on the data in the Stormsack DPR (Table 9):<br><br>Average RAE (TSS) = 38%<br>Median RAE (TSS) = 37%<br><br>Difference between mean and median RAE for TSS is not greater than 10%.<br><br>It was not possible to determine RAE for TP using the recommended background concentration in SQIDEP (Table 2) of 0.06 mg/L because both inflow and outflow concentrations from the field study were regularly below the recommended C*. Adopting a C* slightly below the observed minimum outflow concentration (0.009 mg/L):<br><br>Average RAE (TP) = 20%<br>Median RAE (TP) = 24% |

| | | |
|---|---|---|
| | | Difference between mean and median RAE for TP (with modified C* reflecting site conditions) is not greater than 10%.<br><br>It was not possible to determine RAE for TN using the recommended background concentration in SQIDEP (Table 2) of 1 mg/L because both inflow and outflow concentrations from the field study were regularly below the recommended C*. Adopting a C* slightly below the observed minimum outflow concentration (0.39 mg/L):<br><br>Average RAE (TN) = 16%<br>Median RAE (TN) = 33%<br><br>Difference between mean and median RAE for TP (with modified C* reflecting site conditions) is greater than 10%.<br><br>Investigating the data, it is apparent that the mean is heavily influenced by some negative RAE values. Removing these events of concern resolved this problem but it is recommended they be left in because these events, which have negative CREs and ERs, reduce the performance claim for TN and contribute to a conservative performance claim. |
| **Sizing Methodology** | Summation of loads (SoL) (See Section 6.4.6) (Arithmetic Average and median. If difference is greater than 10% inspect dataset closely) | Based on the data in the Stormsack DPR (Tables 6 and 9), it was not possible to determine summation of loads because inflow is equal to outflow, and SoL is effectively the same as CRE in this case. The device has no significant retention/detention capacity. |

## Compliance Summary

A summary of the study compliance is provided in Table 4.

Table 4: SQIDEP Summary of Compliance

<table>
<tr><th colspan="2">Technology Information</th></tr>
<tr>
<td>Applicant’s Verified Performance Claims</td>
<td>
<table>
<tr><th colspan="2">Parameter</th></tr>
<tr><td>Total suspended solids</td><td>45%</td></tr>
<tr><td>Total phosphorus</td><td>47%</td></tr>
<tr><td>Total nitrogen</td><td>25%</td></tr>
<tr><td>Total petroleum hydrocarbons</td><td>Not claimed</td></tr>
<tr><td>Gross pollutants</td><td>100 %</td></tr>
</table>
IEP’s comments: Nil.
IEP’s recommendations: All performance claims are considered compliant up to the treatment flow rate for the applicable device. Verified flow rates are included in the table below:
<table>
<tr><th>Size of Stormsack (Pit dimensions) (mm)</th><th>TFR for MUSIC modelling – high flow bypass in litres per second</th></tr>
<tr><td>450 x 450</td><td>10</td></tr>
<tr><td>600 x 600</td><td>25</td></tr>
<tr><td>600 x 900</td><td>32</td></tr>
<tr><td>900 x 900</td><td>39</td></tr>
<tr><td>1200 x 900</td><td>50</td></tr>
<tr><td>1200 x 1200</td><td>65</td></tr>
</table>
</td>
</tr>
</table>

<table>
<tr><td>Maintenance performed during monitoring</td><td>IEP’ comments: Maintenance was performed during monitoring due to the excessive sediment loads that occurred because of construction.<br><br>IEP’s recommendations: Accept that the device performance was not overstated because of the maintenance that occurred.</td></tr>
<tr><td>Verified method to model in MUSIC</td><td>IEP’s comments: A revised TFR for the family of devices has been adopted.<br><br>IEP’s recommendations: A generic node is to be used in MUSIC with a high flow bypass set to the applicable TFR for the size of the Atlan Stormsack proposed and with inlet and outlet concentrations as follows:<br><br>
<table>
<tr><th>Pollutant</th><th>Inlet concentration</th><th>Outlet Concentration</th></tr>
<tr><td>TSS</td><td>100</td><td>55</td></tr>
<tr><td>TP</td><td>100</td><td>53</td></tr>
<tr><td>TN</td><td>10</td><td>7.5</td></tr>
</table>
<br>
<table>
<tr><th>Size of Stormsack (Pit dimensions) (mm)</th><th>TFR for MUSIC modelling – high flow bypass in litres per second</th></tr>
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<tr><td>1200 x 1200</td><td>65</td></tr>
</table></td></tr>
<tr><td>Conditions</td><td>IEP’s comments: Nil.<br><br>IEP’s recommendations: None.</td></tr>
</table>

# 4. Discussion

Our independent evaluation finds that:

- As shown in Table 3, the testing regime and results comply with SQIDEP protocol requirements.
- The field study appears to be a scientifically sound study and would be repeatable under similar conditions which it is noted are deemed representative.
- The independent evaluators would recommend that SQIDEP be revised to include a protocol for monitoring gross pollutants. The lesson learnt during this evaluation was to specify preloading of a litter basket or device using a “percentage full” rather than by specifying a mass of pollutants. In the absence of a protocol and at the direction of Stormwater Australia a protocol for sampling gross pollutants and testing of treatable flow rates was developed with and agreed to by the independent evaluators.
- In some circumstances litter baskets can be blinded with sediment and users should be maintaining baskets following construction within the catchment.

# 5. Conclusions

It is recommended that Stormwater Australia grant an approval to the Stormsack family of devices in accordance with the recommendations in Table 4.