SQIDEP independent evaluators joint report:

ATLAN Bafflebox

DesignFlow & Manly Hydraulic Laboratory

20 January 2025

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1 INTRODUCTION

This document reports on the independent evaluation of an application by ATLAN for performance verification of the Bafflebox device by Stormwater Australia. The independent evaluation has been undertaken following the requirements of the Stormwater Quality Improvement Device Evaluation Protocol (SQIDEP) V1.3 (Stormwater Australia, 2018).

ATLAN have requested evaluation under the 'Detailed Performance Report' pathway set out by SQIDEP, based on local field testing of a site in Tarneit, Victoria.

1.1 Evaluators Declaration of Independence

It is declared that the evaluators, Robin Allison and Andrew Judge, are completely independent and have no conflict of interest with respect to this engagement. They have not been involved in the design or development or monitoring of the Bafflebox system. They have undertaken this assessment without prejudice and in good faith.

Dr Robin Allison

Mr Andrew Judge

Document Control

Issue/ Revision	Author	Reviewer	Approved for Issue	
			Name	Date
1	R Alliison (DesignFlow) Andrew Judge (MHL)	A Joyner (MHL)	Ed Couriel (MHL)	06 Dec 2024
2	R Alliison (DesignFlow) Andrew Judge (MHL)	A Joyner (MHL)	Ed Couriel (MHL)	20 January 2025

2 BACKGROUND

2.1 Review documents and data

The following documents were relied upon for this evaluation report:

- Revised Quality assurance project plan, Issue 3, 9 February 2024
- SQIDEP Detailed Performance report - Bafflebox, Issue 2, 29 November 2024, Drapper Environmental Consultants
- Statutory Declaration by Drapper Environmental Consultants, 5 October 2024 and Harry Mcalpin, 18 September 2024.
- Hydrographs of compliant and partially compliant events at the Tarneit site showing inflow, outflow, rainfall and samples collected (25 items)
- Laboratory Chain of Custody forms, Quality Control reports, QC Compliance Reviews & Certificates of Analysis, Formitize Site Record forms
- Scope of work documents relating to the monitoring.

2.2 Quality assurance project plan

The QAPP (Drapper Environmental Consultants, 2024) was reviewed and signed off on in March 2024, with an additional requirement to install a downstream screen to capture gross pollutant existing the device and fitted to an outfall as per drawing "Outfall as per MW STD DWG 7251-08-103" to assist in the assessment of gross pollutants downstream of the Bafflebox.

2.3 Bafflebox at Tarneit monitoring site

Description provided by (Drapper Environmental Consultants, 2024).

The ATLAN Bafflebox is a concrete (or fiberglass) structure containing a series of sediment settling chambers separated by baffles. The primary function of the ATLAN Bafflebox is to remove sediment, suspended particles, and associated particulate pollutants from stormwater. The ATLAN Bafflebox also contains trash screens and skimmers to capture larger materials, trash, and floatable items.

The ATLAN Bafflebox removes pollutants by slowing the velocity and changing the flow path of water as it flows through the box, allowing the sediment to settle at the bottom. Stormwater enters the box and fills the first chamber where larger sized particles settle to the bottom. Stormwater then overflows into subsequent chambers further decreasing flow velocities allowing the remaining smaller sized particles to settle out. Floating litter and leaf matter is directed to the internal cage, fabricated from 09-16A Expanded Mesh with an aperture size of 19 x 5 mm, to remove it from the flow, and store it dry above any standing water see Figure 1.

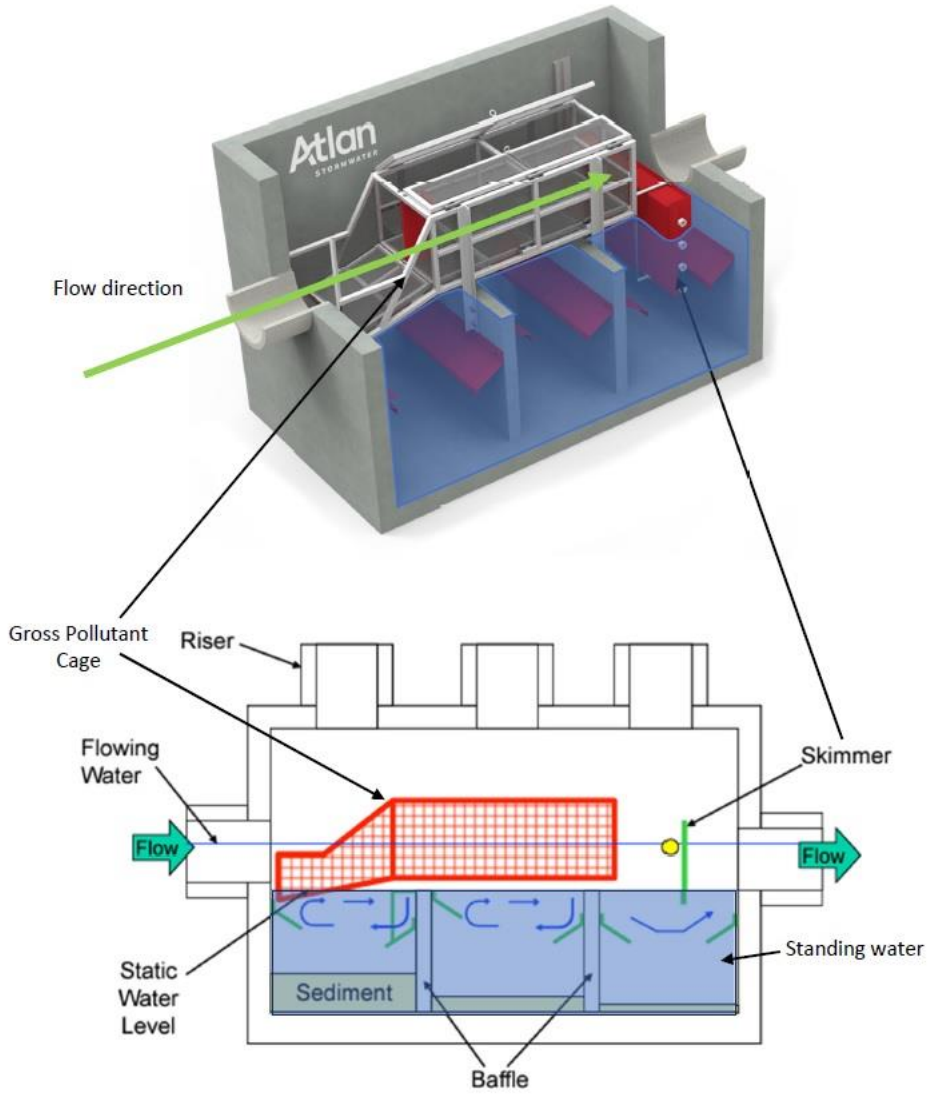

Figure 1 - Bafflebox flow pathway

The Bafflebox contains no media filtration that would provide a chemical adsorption or precipitation function, therefore, it is anticipated that the performance for removal of dissolved nutrients will be minimal. Flow is not bypassed around the ATLAN Bafflebox, as it is an online system that treats the entire flow through the treatment chamber.

Dimensions of the installation at Tarneit monitoring site are described in (Drapper Environmental Consultants, 2024).

The monitoring site in Tarneit (in Melbourne's west) is a recently developed urban residential area. The upstream catchment from the Bafflebox has an area of approximately 23 hectares and was assessed as having approximately 76% impervious surfaces (Figure 3).

The Bafflebox is installed on-line with a 1050mm stormwater pipe. The catchment area is shown in Figure 2 and the site parameters are shown in Figure 3.

Figure 2 Tarneit Bafflebox monitoring site

Parameter	Description
Address	Parkland, Cnr 16 Homebush Drive, Tarneit, VIC
Catchment area	~22.81 ha
Impervious percentage (%)	76%
Land use	Urban residential
Pre-treatment	Nil
Nearest BOM rainfall station	Laverton RAAF VIC BoM ID 087031
Mean annual rainfall	535.4 mm (@087031)
Claimed Design Flowrate (Q3mth)	**253 L/s**
Inlet pipe diameter	DN1050
Outlet pipe diameter	DN1050
Make, model and capacity of treatment device;	Bafflebox (SBB-6-12-84)

Figure 3 Tarneit monitoring site parameters

Monitoring was conducted following the SQIDEP protocols by monitoring rainfall, flow rates and collecting water quality samples at the inflows and outflows of the Bafflebox. Flow monitoring involved Starflow ultrasonic flow meters that measure flow depth and velocities and water depths were measured in the chamber determine whether water levels exceeded the obvert of the outlet pipe (and hence whether the floating boom allow release of captured material).

Water quality samples were flow weighted automated samples, with at least eight aliquots collected per event from inflow and outflows.

In addition to the water quality samples, evaluation of gross pollutant and microplastics were undertaken.

Gross pollutant evaluation was undertaken by installing a basket on the outflow pipe (6mm mesh). The contents of the outflow basket was then compared with collected gross pollutants in the chamber (as described in (Drapper Environmental Consultants, 2024)). This occurred later in the monitoring program and therefore was not available for all monitored events.

Collected water samples were evaluated for microplastics by sieving, removing organic materials with oxidation and then filtering the supernatant, drying and identifying microplastics components using a LED microscope (Drapper Environmental Consultants, 2024). This work was performed at RMIT University.

The configuration of the monitoring site is shown in Figure 4.

Figure 4 Tarneit monitoring site layout

2.4 Performance claims

The Body of Evidence states the following performance claims for water quality improvement, see Table 1

Table 1 Performance claims

Parameter	Removal Claim (up to 253 L/s)
Total Suspended Solids (TSS)	73%
Total Phosphorus (TP)	59%
Total Nitrogen (TN)	39%
Gross Pollutants	99%
Other – Microplastics	66%

These claims use the mean efficiency ratio method for compliant monitored events and are applicable up to a treatment flow rate of 253 L/s at this site.

In addition, there is a stated claim of 66% removal of microplastics.

2.5 MUSIC node claims

The applicant proposes the following approach to modelling ATLAN Bafflebox in MUSIC (for SBB-6-12-84 model):

1. Use a generic node with the reduction pollutant reduction shown in Figure 5 and have a high flow bypass of 253 L/s at the device.

Table 19. Summary of MUSIC Node Pollutant Concentration Inputs

Pollutants	Inlet Concentration	Outlet Concentration	Claim (%)
Total Suspended Solids, TSS (mg/L)	1000	270	73
Total Phosphorus, TP (mg/L)	5	2.05	59
Total Nitrogen, TN (mg/L)	50	30.5	39
Gross Pollutants, GP (kg/ML)	1000	10	99

Figure 5 Claimed MUSIC node parameters

3 SQIDEP COMPLIANCE

3.1 SQIDEP assessment

The minimum requirements from SQIDEP are reproduced below in Table 1 where they are evaluated against the data provided with the applicant's submission.

Table 2 SQIDEP Compliance

Criteria	Requirement	Evaluation finding	Compliance Status
Organisational Roles and Quality Assurance			
Organisational Roles and Responsibilities	The claimant, sampling organisation, analytical laboratory and reporting organisation shall be clearly identified (especially in confirming independence requirements	Organisational chart provided; ALS nominated laboratory.	Compliant
Sampling QA and Quality Control	Operation and maintenance schedules for sampling equipment shall be provided. Chain of custody documents identifying sample, collection agency, collection time, preservation used and laboratory receipt of sample and sample condition shall be provided.	All defined.	Compliant
Reporting	By independent organisation	Reported by Drapper Environmental Consultants	Compliant
Sampling Events			
Type of Event	Rainfall Events	Real storm events were sampled	Compliant
Minimum Number of Events	The greater of: a. 15 events, and b. Sufficient events to achieve 90% confidence interval.	25 qualifying and partially-compliant events over 18 months. Follow evaluation of the events, it was agreed qualifying events to use in the analysis are: 19 for TSS, 18 for TP & 20 for TN)	Compliant
Measuring Rainfall	Rainfall shall be measured by a rain gauge capable of sampling at intervals of 5 minutes or less, and in increments no greater than 0.25mm	Minimum storm duration of 5 minutes recorded by a 0.2mm tipping bucket pluviometer	Compliant
Minimum Rainfall Depth	Sufficient to collect minimum sample volume (based on laboratory analytical requirements).	All qualifying events had sufficient aliquots.	Compliant
Recommended Inter-event Time	Min 6 hours	Continuous distribution of rainfall events over 18 months with at least six hours between events	Compliant
Device Size	Full scale	Device is full scale.	Compliant
Runoff Characteristics	Target pollutant profile of influent and effluent	They are representative	Compliant

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.	Of the 25 events two events were above 75% of the claimed TFR. None were higher than the claimed TFR. This was agreed with reviewers to be sufficient.	Compliant
Sampling Procedures and Techniques			
Automated Sampling	Composite samples on a flow- (preferred) or time-weighted basis	Samples were collected on a flow-weighted basis and were composited before being split into sub-samples for analysis	Compliant
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.	Number of aliquots significantly exceeds 8 for all events Events where significant parts of the hydrograph were missed were not included in the analysis.	Compliant
Hydrograph coverage	At least 50% of qualifying storms should include the first 70% storm 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. Dependent on catchment and rainfall patterns, multiple peaks should be accounted for (at least 1 occurrence).	The sampling covered a suitable range of events including multiple peaked hydrographs.	Compliant
Seasonality	Events to be distributed to capture seasonal influences	All seasons are covered by the data set	Compliant
Grab Sampling	Only for constituents that transform rapidly, require special preservation or adhere to bottles, or where compositing can mask the presence of some contaminants through dilution.	NA	NA
Sampling Location	As identified and agreed in the submitted QAPP.	Sampling undertaken at influent and effluent using suction lines. Locations appear to be appropriate and representative. Gross pollutant monitoring involved a basket fitted to the outlet pipe.	Compliant
Sampling Procedures and Techniques			
Chemical and Physical analytes	As identified and agreed in the submitted QAPP.	Dissolved nutrients as well as totals were analysed. Microplastics were also analysed.	Compliant
Minimum and maximum (influent) pollutant concentrations for qualifying events	Minimum concentrations: exclude if below limit of detection. Maximum: mean+2SD for any single event, and mean +1SD in the aggregate dataset. Refer SQIDEP Table 1.	All influent concentrations (for compliant events) are below the maximum concentrations permitted.	Compliant

Analytical Methods	NATA accredited sample handing and analytical methods. Refrigerated autosamplers may be required to adequately preserve samples.	Laboratory is NATA accredited and COC forms provided.	Compliant
Requirements			
Flow Measurement Location	Inlet, Outlet and Bypass, as applicable. Based on relevant accepted measurement protocols for flow type (e.g. open channel, in pipe)	Flow measurement locations are appropriate.	Compliant
Precipitation Measurement	Automatic rain gauge (pluviometer)	Tipping-bucket rain gauge used	Compliant
Recording Intervals	5 minutes or less	Complies	Compliant
Rainfall Recording Increments	No greater than 0.25mm	Complies	Compliant
Rain Gauge Calibration	Twice during monitoring period	Report states that calibration was performed by Drapper Environmental Consultants	Compliant
Data Analysis and Reporting			
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. 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 claims relate to TSS, TP, TN and Gross Pollutants which were included in the suite of parameters plus dissolved nutrient species. Microplastics were also analysed and reduction claimed.	Compliant
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) Mass Removal Efficiency (MRE) (See Section 6.4.4) (Arithmetic average and median. If difference is 10% or greater, inspect data set closely) Relative Achievable Efficiency (RAE) (See Section 6.4.5) (Arithmetic average and median. If difference is 10% or greater, inspect data set closely Summation of loads (SoL) (See Section 6.4.6) (Arithmetic Average and median. If difference is greater than 10% inspect dataset closely) Efficiency Ratio (ER) (See Section 6.4.7) (Arithmetic Average and median. If difference is greater than 10% inspect dataset closely)	Sufficient data analysis was presented for Concentration Removal Efficiency and Efficiency Ratios, however no mass balance was presented (as overflow from the device was not presented). The data presented are considered adequate to assess the performance claims.	Compliant

	Flow Based Variability (FBV) (See Section 6.4.8), including a plot of one of the above performance measures against the 25, 50, 75, 100 and 125 percent of the treatable flow rate. Provide details on the selected curve and the associated R^2 value.		
Performance Variability	Box and Whisker Plots of inlet and outlet EMCs.	Provided.	Compliant
Statistical Significance Testing	Log-transformed inlet and outlet paired samples at 90% confidence level.	Provided.	Compliant
Sizing Methodology	A sizing methodology must be provided that allows an evaluation of performance of other devices in a 'family' to be reviewed. This should include relationships established under defensible theoretical/ modelled conditions or testing undertaken under either field or laboratory conditions.	Sizing approach using MUSIC was provided.	Compliant

3.2 Monitoring of flow rates

The Bafflebox is an on-line system with all flows passing through the device. There is no high flow bypass system.

The monitoring included flow rates into the device. As there is no bypass the applicant is claiming the highest monitored flow rate (for a compliant event) to be the treatment flow rate for the Bafflebox. This was discussed and agreed by the reviewers.

An example hydrograph from the monitoring is presented in Figure 6

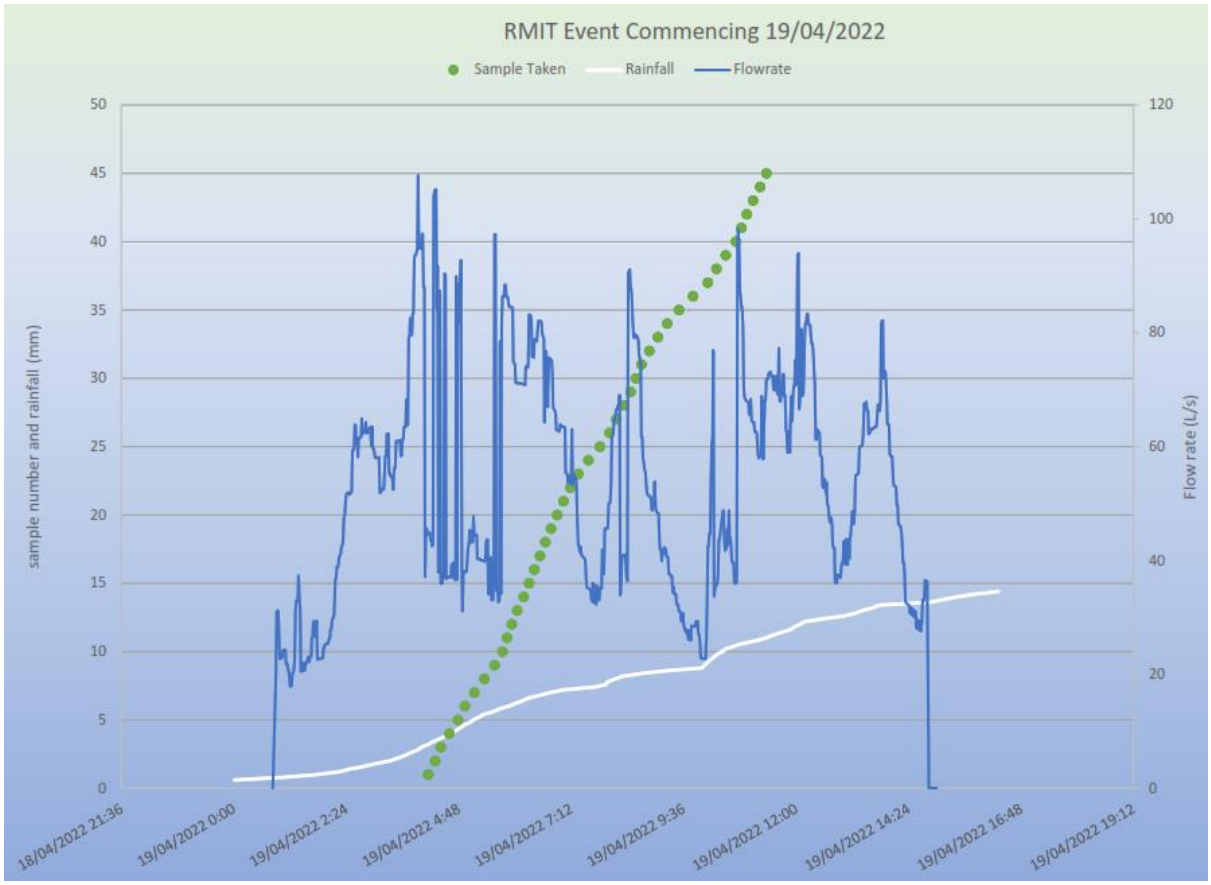

Figure 6 Example monitored hydrograph from the Tarneit site

3.3 Pollutant removal and statistical analysis

A review of local field trial data submitted in the Body of Evidence suggests the analysis and approach taken was robust and the reviewers have no objection to what is presented nor to the claims of water quality improvements for flows up to the treatable flow rates.

4 DISCUSSION

4.1 Overall performance assessment

The assessors were generally comfortable with the approach to the monitoring program, the installation of the field site, the number and variation of flow events monitored and the data analysis. It is noted there were several logistical issues with sample collection and change of personnel and this resulted in many events being missed (in fact most of the winter of 2023). The practicalities and limitations with field monitoring are however acknowledged by the reviewers and it was agreed reasonable efforts to conduct the monitoring were undertaken.

It is our opinion this program does reflect the field performance of the Bafflebox on the residential site in Tarneit in Victoria.

4.2 MUSIC node inputs

The proposed method of modelling the performance of the Bafflebox in MUSIC by the proponent is supported. Note that the treatable flow rates will vary with different models of Bafflebox.

This includes:

1. Using a generic treatment node
2. Having a by-pass flow rate of 253 L/s (for SBB-6-12-84 model)
3. TSS removal of 73% up to the bypass rate
4. TP removal of 59% up to the bypass rate
5. TN removal of 39% up to the bypass rate
6. Gross pollutant removal of 99% up to the bypass rate.

5 CONCLUSION

This assessment has considered local field trial data submitted within a Body of Evidence because testing had commenced prior to the approval of the QAPP for the purposes of assessing a Bafflebox (model SBB-6-12-84).

The outcome of this assessment is general agreement with the approach and execution of the monitoring program as a fair assessment of the field performance of the ATLAN Bafflebox. The pollutant reduction factors claimed, the treatable flows rated proposed and the MUSIC modelling proposed are agreed with.

In addition, it should be acknowledged that there was also significant reductions in microplastics observed and that these reductions may benefit the water quality of stormwater passing through the device.

6 REFERENCES

Atlan Stormwater. (2024). *Detailed Performance Report (DPR) Submission form - Atlan BaffleBox.*

Drapper Environmental Consultants. (2024). *Revised Quality Assurance Project Plan (QAPP).*

Drapper Environmental Consultants. (2024). *SQIDEP Detailed Performance Report – ATLAN Bafflebox, at Homebush Drive, Grand Central estate, Tarneit, VIC.* Drapper Environmental Consultants.

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