STORMWATER
AUSTRALIA

SQIDEP Independent Evaluators' Joint Report

OceanGuard

December 2023

Background

The initial evaluation of the Ocean Protect OceanGuard device was undertaken by two members of the Independent Evaluation Panel (IEP), Andrew Allan and Andrew Judge. Once individual reports were finalised, the independent evaluators worked together to develop a Joint Report. The Joint Report identified a number of points that required additional advice from the SQIDEP Technical Review Panel and/or Governance Panel. The additional advice was required because SQIDEP either did not specify the requirements in sufficient detail to answer the Evaluator's questions or the wording was able to be interpreted in different ways. To ensure consistency for all applications, the Governance Panel was required to make a ruling on comparability of devices (old vs new device), the application of inter-event timing and subsequent minimum number of events for compliance..

After the significant time involved in assessing this device, the Applicant requested that a 'Conflict Resolution process' be triggered. The SQIDEP Conflict Resolution process requires that a third independent Evaluator be appointed to reassess the application and make a ruling on any contentious issues. . Subsequently, a third Independent Evaluator was appointed, being Baden Myers. Baden's role was to review all previous assessment material, any additional supplementary information provided, rule on any contentious issues and provide a summary report of his findings.

The third-party evaluation verified the claims for the OceanGuard device, subject to a number of conditions. This report combines the third-party evaluation and also includes the original joint evaluation report, as follows:

Part A: Third Party Report - Baden Myers

Part B: Initial Joint Verification Report - Andrew Allan and Andrew Judge

PART A: Third Party Report - Baden Myers

Baden Myers, PhD BE DipEngPrac
7 Schuit Crescent, Pooraka, South Australia 5095
Ph: 0409 986 042
baden.myers@gmail.com

Jega Jegatheesan
Chair, SQIDEP Governance Panel, Stormwater Australia
Ph: 07 5407 0451
secretary.gp@stormwater.asn.au

21 December 2023

Re: Stormwater Australia Stormwater Quality Improvement Device Evaluation Protocol – Application for the Ocean Protect OceanGuard

Dear Cath,

Thank you for the opportunity to review and comment on documentation relating to the Stormwater Australia Stormwater Quality Improvement Device Evaluation Protocol (SQIDEP) application from Ocean Protect (OP) relating to their OceanGuard product. Based on your request for this review to myself by email on 1 September 2023, the review was to focus on the following items:

1. *Review the recent letters issued by the Governance Panel regarding key issues raised in the two Evaluation reports (being international data, inter-event timing and similarity of old vs new devices).*
2. *Based on those letters, assess the available data and build on the existing reports to determine the following:*
    a. *with the ruling on the inter-event time, international data and agreed comparability of old vs new devices, do both devices meet the minimum compliant dataset requirements?*
    b. *as per above list, adding the additional data into the data analysis, are the two devices SQIDEP compliant or not? If not, what is required for them to be compliant?*
    c. *any other comments?*

I understand that the 'recent letter' referred to above refers to a letter from the Stormwater Australia SQIDEP Governance Panel to OP dated 28 July 2023. It details a response for the assessment of the OP OceanGuard and OP StormFilter. Note that the review here refers explicitly to the OP OceanGuard and the OP StormFilter will be addressed separately. The letter from Stormwater Australia to OP addresses four points of concern that have so far prevented verification of the performance claim of the OP OceanGuard. In addition, there were several concerns raised by independent evaluators in a draft version of a joint report relating to the OP OceanGuard. These issues and a summary of how they may be resolved are presented in Table 1. Note that this table also includes reference to Attachments 1 to 7 of this letter which discuss each matter in greater detail. There is one final attachment (Attachment 8) which shows a list of all referred documents and publications used in this review process.

Table 1: Summary of responses to concerns relating to the OP OceanGuard; further information on each concern is provided in the listed attachments

Attach-ment	Concern	Source	Summary finding
1	Six-hour limit between Qualifying Storm Events	Letter*	Relevant only to the OP StormFilter evaluation. There was a minimum six-hour duration between all sample events in the data presented for the OP OceanGuard.
2	Use of ER/CRE Ratio to Disqualify Events	Letter*	I agree with the statement from the letter. ER/CRE ratio should not disqualify events based on SQIDEP v1.3 requirements. The total number of events is greater than or equal to 15, and acceptable.
3	Use of combined data for OceanGuard and Enviropod (Mark 1) assessment	Letter*	I agree with the statement from the letter. Additional test results presented for the Enviropod (Mark 1) are considered acceptable. This is particularly relevant in the assessment of the claimed treatment flow rate.
4	Use of Overseas Data	Letter*	Relevant only to the OP StormFilter evaluation. No impediment to OP OceanGuard verification.
5	The temperature and holding time of water samples on receipt by the water quality analysis laboratory.	Draft report**	While there are some concerns noted regarding the impact of holding time and temperature on the concentration of nutrients, this is less likely to affect the total concentrations of nitrogen or phosphorous. SQIDEP v1.3 does not state mandatory requirements for temperature of samples prior to collection. However, this investigation indicated that exclusion of the total nitrogen component of one event, WSU-210319, could be excluded from the dataset as an outlier.
6	Uncertainty over the treatment flow rate of the OP OceanGuard.	Draft report**	The field assessment has provided inadequate data to appropriately address the matter of treatment flow rate in accordance with SQIDEP v1.3. Field flow rates were all less than the claimed treatment flow rate. Since the device is simple in design, laboratory test results may be considered appropriate to supplement the field data. The claimed treatment flow rate is conservative compared to laboratory results and the treatment flow rate claim is acceptable.
7	Removal of gross pollutants	Draft report**	There was no data provided for gross pollutants in the field study. The claim of gross pollutant removal is conceded here based on laboratory testing, but acceptance of this may set a precedent for other claims.

* Letter from Stormwater Australia to OP dated 28 July 2023

** OP OceanGuard Independent Evaluators Joint Report (Allan and Judge, 2023)

Based on the overview of key issues provided in Table 1, it is recommended that the OP OceanGuard submission data be considered to comply with SQIDEP requirements. A summary of the recommended performance claim is shown in Table 2, noting that the values differ from the original performance claim for the OP OceanGuard due to the exclusion of tot total nitrogen component of event WSU-210319 which was considered an outlier.

Table 2: Summary of the performance claim

Pollutant	OP Performance claim (% removal)	Verified performance claim (% removal)
Total Suspended Solids	51.6	51.6
Total Phosphorous	64.7	64.7
Total Nitrogen	40.9	24.9
Gross Pollutants	100	100*

* The gross pollutant performance claim is based on independent laboratory testing

During this review of the available information, there were some conditions apparent that should be accompany any verification of the OP OceanGuard. These may be summarised as follows:

- The OP OceanGuard filter bag is the only treatment mechanism applied by the device. The field results for the OP OceanGuard were for a device with a 200-micron filter bag. The current version of the OP OceanGuard website[1] indicates that the OceanGuard is available with 'Multiple filtration bags from 200 micron opening'. It is important that any verification certificate presented for the OP OceanGuard indicates that the Stormwater Australia SQIDEP results were specific to a 200 micron bag. It is reasonable to anticipate that bags with larger filter sizes will have reduced filtration performance and should be assessed separately.
- The OP OceanGuard is a relatively simple device for water quality improvement and is wholly dependent on filtration for improving water quality. For this reason, it is suggested that a caveat be placed on this device – *and any similar device dependent on filtration* – that performance is largely dependent the nature of pollutants entering the device and frequency of maintenance to empty the device. In particular, capture of nutrients is wholly dependent on how well the nutrient fractions at the site consist of, or bind to, solid particles.
- Further to point 2 above, it is noted that there are several similar devices available on the Australian market which have performance data available in the public realm. Due to the similarity of such devices when all fitted with bags with identical pore size, and performance claims should be carefully considered where they differ significantly from that listed here for the claimed treatment flow rate.

Yours sincerely

Baden Myers, PhD BE DipEngPrac

[1] https://oceanprotect.com.au/oceanguard/ (accessed 14 October 2023)

Attachment 1 - Six-hour limit between Qualifying Storm Events

This matter is relevant only to the OP StormFilter and is addressed separately.

The recommended requirements for interevent time in SQIDEP (Stormwater Australia, 2018) (Table 3) appear to have been met for the OP OceanGuard. According to the latest version of the OP OceanGuard Independent Evaluators Joint Report (Allan and Judge, 2023) (Table 3, page 19), the interevent period for the OP Ocean Guard was appropriate for all claimed samples.

Attachment 2 - Use of ER/CRE Ratio to Disqualify Events

This matter is relevant to the OP OceanGuard application. According to the 28 July 2023 letter from Stormwater Australia to OP:

The SQIDEP 1.3 Protocol provides some test procedures for evaluating data validity; however, it makes no reference to the use of ER/CRE ratios. Given that the ratio is not mentioned in SQIDEP, its use is not supported in the formal assessment of data for SQIDEP. Section 5.4.1 of the Protocol refers to the comparison of mean and median CRE values desirably being within 10%. Section 5.4.3 of the Protocol again references the comparison of mean and median CRE values. The Protocol indicates that:

- *If median and average CRE values are greater than 10% different, the data set should be inspected for the presence of an extreme value(s), which may need further investigation or explanation.*

The Protocol does not offer advice on how to respond to the extreme value(s); however, these tests are valid. If an outlier event is identified through these analyses, the outlier event concentrations should be tested against the expected concentration ranges provided in Table 1 (for a maximum individual event). If the concentration is within the general expected range, the event would be accepted, if outside, the event would be rejected for performance acceptance. If multiple outlier events are identified, only one event can be accepted under the maximum concentration outlined in Table 1.

According to the latest draft of the OP OceanGuard Independent Evaluators Joint Report (Allan and Judge, 2023) (Table 3, page 24) and with reference to the dot point quoted above:

These ratios meet the required 10% for TSS[2], fall marginally outside allowances for TP[3] and do not meet requirements for TN[4].

This draft report states further on Page 25:

Several samples stand out as contributors to a high CRE/ ER ratio, and are summarised below

- *WSUOG-200325 and WSUOG-200920 showed a negative result for TN. It may be notable that one of these was the first sample in the program.*
- *WSUOG-210212 showed a zero reduction for TP. In all other instances there were generally corresponding orders of magnitude in reductions for TN and TP.*
- *WSUOG-210319 showed an excessively large treatment effect for both TP and TN.*

Ideally these results should have an underlying explanation, but none has been offered.

Based on a review of the letter, draft report and data provided in the OP OceanGuard application[5], I agree with the statement from the letter. The analysis is based on SQIDEP (Stormwater Australia, 2018) Section 5.4.3 which discusses the determination of 'Average and Median Concentration Removal Efficiency' as reported by the original claim from OP for the OceanGuard. On p.25 SQIDEP states that a quality check can be undertaken to evaluate if extreme events affect the performance claim. It suggests that where 'variation < 10% between the median and average CRE indicate that the overall statistic is not influenced by an extreme event/s'.

SQUIDEP also states that this difference refers to the 'difference between the arithmetic average CRE and the median CRE' – it is not a percentage difference between the two values, but an arithmetic difference. The results of this analysis based on all claimed events are presented in Table 3. An arithmetic difference and a percentage difference are presented.

[2] TSS = Total suspended solids
[3] TP = Total phosphorous
[4] TN = Total nitrogen
[5] Dalrymple and Wicks 2022. 'Oceanguard WSU SQIDEP Compliance 211207 .xlsx',

Table 3: Arithmetic difference and percentage difference between the average CRE and median CRE

	TSS	TP	TN
Median CRE, %	55.7	59.4	20.9
Average CRE, %	52.8	54.9	23.2
Difference (Arithmetic)	2.8	4.5	2.3
Difference (%)	-5.3	-8.1	10.0

The results for TSS a show a small difference of little concern based on the SQIDEP requirement. It is not expected that TSS would be impacted by holding time or temperature effects. The results for TP and TN also show a small (less than 10%) difference which may be considered of little concern based on the SQIDEP requirement, although the TN component of event WSU-210319 has been considered an outlier (see attachment 5). It should be noted that the TP and TN values may be impacted by adverse holding times, as is noted Independent Evaluators Joint Report (Allan and Judge, 2023), but it is expected that this is less of an issue for the TP and TN values, and can mainly affect the contributing compounds to these totals. This matter is also further discussed in Attachment 5.

Attachment 3 - Use of combined data for OceanGuard and Enviropod (Mark 1) assessment

This matter is relevant to the OP OceanGuard application. According to the 28 July 2023 letter from Stormwater Australia to OP:

Having considered the design and information provided, the GP is satisfied that OceanGuard and Enviropod (Mark 1) are the same physical devices, although they are currently marketed as different devices. As a result, the GP supports the combination of data sets for the two devices in order for Evaluators to undertake assessment of the OceanGuard. It is noted that Enviropod (Mark 2) is a different device and will not considered within this assessment.

I accept that the OP OceanGuard and the Enviropod (Mark 1) device are the same device. Perhaps the most important point to note here is that the primary treatment mechanism of the OP OceanGuard is the filter bag. According to the latest version of the OP OceanGuard independent evaluation report (Allan and Judge, 2023) (Table 3) the filter used in the Australian field testing was a '200 micron bag'. It is noted that the current version of the OP OceanGuard website[6] indicates that the OceanGuard is available with 'Multiple filtration bags from 200 micron opening'. It is important that any verification certificate presented for the OP OceanGuard indicates that the Stormwater Australia SQIDEP results were specific to a 200 micron bag. It is reasonable to anticipate that bags with larger filter sizes will have reduced filtration performance. Such a measure should also ensure that appropriate bags are fitted during construction and maintenance activities.

[6] https://oceanprotect.com.au/oceanguard/ (accessed 14 October 2023)

Attachment 4 - Use of Overseas Data

This matter is relevant only to the OP StormFilter and is addressed separately for that device. Overseas data has little impact on the assessment of the OP OceanGuard, except for the consideration of data from Auckland, New Zealand, in considering the claimed treatment flow rate of the device and the interception of gross pollutants in Attachments 6 and 7.

Attachment 5 - Temperature and holding time of water samples.

The draft report from the independent evaluators (Allan and Judge, 2023) indicated that some water samples were submitted outside of the required holding times and the receipt of water samples outside the required temperature range. It is accepted that both storage time and temperature can affect the water quality of a water sample. Overall, the issue of holding time is considered to have minor impact on the remaining samples in the claim. This agrees with the latest draft of the OP OceanGuard Independent Evaluators Joint Report (Allan and Judge, 2023) (p. 25) which notes that the evaluators 'interpret that the adverse holding time report as being based on the speciation'. The latest draft of the evaluation report (page 25) noted that of the 16 samples submitted, six arrived with temperatures above the required 6°C. Of these, two were marginally above, three were several degrees above and one was not logged.

The water quality analysis undertaken in the field study included TN, TP and contributing compounds such as nitrate and nitrite nitrogen, and dissolved phosphorus. Adverse holding times noted by the water quality laboratory may generally be considered important where speciation is considered. TP and TN values have a 28-day holding time according to current Australian standards (AS/NZS 5667.1:1998 Water quality - Sampling) provided that samples are preserved by reducing the pH and refrigerated to less the 4°C. While circumstances may vary, the acid preservation is particularly effective for preserving TP and TN based on studies into the longevity of TP and TN in field water samples of similar range to that presented in the OP OceanGuard claim (Kotlash and Chessman, 1998, Maher and Woo, 1998). Temperature on delivery to an analytical laboratory is also unlikely to have a significant impact on TP and TN when compared to a larger unknown in all SQIDEP field studies – that being the temperature at which samples are stored immediately after sampling and prior to collection and delivery to an analytical laboratory. SQIDEP notes that 'refrigerated autosamplers may be required to adequately preserve samples' (SQIDEP, Table 3) but it is open to interpretation and as such this may affect any performance claim. As such, based on the lack of clarity, providing the overall time between the sampling and delivery to the accredited laboratory was reasonable (not weeks) then this should not disqualify events based on the current wording of SQIDEP.

To explore this matter further, I have reviewed the time from the start of each claimed storm and the sample receipt and a summary is provided below in Table 4. Note that the storage time of water samples ranges from 0.7 to four days, with two samples exceeding a storage time of three days. Of these samples, one in particular, WSU-210319, shows some unusually high values – it has the highest concentration of TN of all claimed events and plots as an outlier on the boxplots of inflow concentrations provided by OP (4.1 mg/L, 3.5 times higher than the overall mean influent TN of all events, but still below the SQIDEP maximum of 4.4 mg/L for any individual event). This event also showed the highest removal of TN, at 99%. This unusual result warrants further investigation as a potential outlier. The TN removal performance for this event is very high compared to that of all other events – the remaining TN CRE values ranged from -48 to 51%. The CRE was also high compared to the individual event CREs reported by Drapper and Hornbuckle (2015) (see their Table 2), who reported on the performance of a filter basket style device marketed by SPEL Stormwater, which was also fitted with a 200 µm mesh filter. However, Pooya Nejad and Zecchin (2021) also reported on the field performance data for an Ecosol filter basket device with a 200 µm filter. Their field study had a lower efficiency ratio for TN than the OP OceanGuard claim (17% for the Ecosol device based on the data presented in their Table 7, compared to the 41% claimed for the OP OceanGuard). However, the event with the highest TN concentration reported by Pooya Nejad and Zecchin (2021), at approximately 3.8 mg/L, does appear to have a TN removal of approximately 90% (see their Figure 10). On this basis, very high removal rates seem possible with high inflow concentrations, but the claimed TN performance of the OP OceanGuard does appear to be influenced by this one event.

As such, it is reasonable to conclude that the CRE for TN of event WSU-210319 is suspicious, and removal from the dataset may be suitable. To examine further whether WSU-210319 should be removed from the dataset, the events are assessed based on the statistical techniques presented in Section 5.4.1 of SQIDEP (Stormwater Australia, 2018). There are four assessments described:

1. *Ensure that the 90% Confidence Interval of the arithmetic average is provided*

Based on a comparison of the log transformed data using Microsoft Excel, a statistical significance of 90% is achievable both with and without Event WSU-210319 included in the data.

2. *Measure the spread of the effluent data by analysing the distance of the lowest and upper most point from the 1st and 3rd quartile values (effluent EMCs) against the inter-quartile range (IQR). Within 1.5 times IQR is desired.*

Based on all 16 samples, the TN effluent IQR is equal to 0.53, and the range of data is 2.09. Thus the range of data is 3.9 times that if the IQR, more than the IQR. If we exclude WSU-210319, the TN effluent IQR is 0.47 and the range of data is 1.941, so the range is 1.9 times the IQR. Both cases are not desirable, but not explicitly unacceptable for consideration based on SQIDEP. However, excluding WSU-210319 does bring the TN effluent EMC values closer to the desirable outcome.

3. *Calculate the arithmetic mean above and below the standard deviation (CRE and/or MRE). Within one standard deviation is desirable.*

Based on all 16 samples, the standard deviation of the TN CRE values is 32%. The mean of CRE values below this is 5% and the mean of CRE values above the standard deviation is 53%. The difference is 49%, greater than the standard deviation. When WSU-210319 is removed from the dataset for TN, the standard deviation of the TN CRE values is 26%. The mean of CRE values below this is 3% and the mean of values above is 42%. The difference is 39%, greater than the standard deviation. Both cases are not desirable, but not explicitly unacceptable for consideration based on SQIDEP. However, excluding WSU-210319 does bring the TN CRE values closer to the desirable outcome.

4. *Calculate the difference between the arithmetic average and the median (CRE and/or MRE). Within 10% is desired.*

Based on all 16 samples, the difference between the average CRE for TN (23%) and the median CRE for TN (21%) is 2%. If we discard WSU-210319, the difference between the average CRE for TN (18%) and the median CRE for TN (20%) is 2%. Thus the removal of the event makes little difference in this case.

Overall, removing the TN component of event WSU-210319 from the dataset is warranted to improve the quality of the dataset presented. Doing this does reduce the claimed performance of the device for TN. Importantly, removing this event still achieves the requirement for a minimum of 15 event EMC samples and the performance claim is still statistically significant, with at least 90% confidence for TN performance. TP and TSS values for this event will be retained.

Table 4: Summary of claimed event samples, corresponding event start date/time, sample delivery time and duration of storage

Sample	Event start	Sample collection date	Analysis commenced	Storage time (days)	Total suspended solids			Total phosphorous			Total nitrogen		
					In*	Out#	CRE^	In*	Out#	CRE^	In*	Out#	CRE^
WSU-200326	2020-03-25 14:33:00	2020-03-26 14:30:00	26/03/2020	1.00	26	8	69%	0.070	0.040	43%	0.400	0.500	-25%
WSU-200403	2020-04-03 15:56:00	2020-04-06 11:00:00	6/04/2020	2.79	16	11	31%	0.050	0.020	60%	0.440	0.230	48%
WSU-200429	2020-04-29 18:35:00	2020-04-30 13:16:00	30/04/2020	0.78	92	72	22%	0.500	0.150	70%	0.610	0.480	21%
WSU-200621	2020-06-21 03:16:00	2020-06-22 14:00:00	22/06/2020	1.45	250	108	57%	0.420	0.170	60%	1.570	0.880	44%
WSU-200807	2020-08-07 11:42:00	2020-08-10 17:00:00	10/08/2020	3.22	11	10	9%	0.100	0.010	90%	1.030	0.500	51%
WSU-200904	2020-09-04 16:31:00	2020-09-07 14:30:00	7/09/2020	2.92	102	74	27%	0.120	0.100	17%	2.690	2.140	20%
WSU-200920	2020-09-20 03:42:00	2020-09-21 15:05:00	21/09/2020	1.47	52	32	38%	0.060	0.050	17%	0.420	0.620	-48%
WSU-201221	2020-12-21 14:17:00	2020-12-22 17:30:00	22/12/2020	1.13	19	6	68%	0.190	0.020	89%	0.590	0.510	14%
WSU-210128	2021-01-28 19:30:00	2021-01-29 15:00:00	29/01/2021	0.81	62	12	81%	0.090	0.060	33%	1.380	1.010	27%
WSU-210201	2021-02-01 21:45:00	2021-02-04 12:00:00	4/02/2021	2.59	22	10	55%	0.260	0.020	92%	0.280	0.250	11%
WSU-210212	2021-02-12 19:47:00	2021-02-15 16:10:00	15/02/2021	2.85	31	10	68%	0.080	0.080	0%	1.230	1.040	15%

Sample	Event start	Sample collection date	Analysis commenced	Storage time (days)	Total suspended solids			Total phosphorous			Total nitrogen		
					In*	Out#	CRE^	In*	Out#	CRE^	In*	Out#	CRE^
WSU-210216	2021-02-16 07:27:00	2021-02-17 16:30:00	17/02/2021	1.38	12	2.5	79%	0.060	0.030	50%	0.280	0.270	4%
WSU-210311	2021-03-11 19:29:00	2021-03-12 16:05:00	13/12/2021	0.86	22	9	59%	0.14	0.050	64%	1.060	0.950	10%
WSU-210319	2021-03-19 11:52:00	2021-03-23 13:30:00	23/03/2021	4.07	62	7	89%	0.320	0.010	97%	4.030	0.055	99%
WSU-210407	2021-04-07 10:40:00	2021-04-08 17:00:00	9/04/2021	1.26	91	42	54%	0.270	0.110	59%	1.010	0.590	42%
WSU-210616	2021-06-16 21:10:00	2021-06-17 14:15:00	17/06/2021	0.71	61	37	39%	0.160	0.100	38%	1.570	0.970	38%
			Minimum	0.71									
			Maximum	4.07									
			Mean	1.83									

* Inflow concentration, mg/L; # = Outflow concentration, mg/L; ^ = Concentration reduction efficiency, %

Attachment 6 - Uncertainty over the treatment flow rate.

According to the application by OP for the OceanGuard device, the treatment flow rate (TFR) of the device is 20 L/s. The maximum peak runoff rates reported by OP from the Australian field study data were however roughly half the claimed TFR, including two events where inflow of 10.28 L/s was measured. The average flow rate was approximately 3 L/s from all 16 events, equating to 15% of the TFR. Based on the dataset provided, this does not comply with SQIDEP. SQIDEP (Stormwater Australia, 2018) (Table 3) requires that 'At least 2 events should exceed 75% of the design water quality volume/ TFR and 1 event greater than 100% of the TFR'. On this basis, the data does not comply with SQIDEP, and events with a higher flow rate are required.

Given the simplicity of the device, however, I would consider it reasonable to accept that the TFR of the device be reported from other studies if available. It is noted that OP discuss this matter in their review document supporting the OP OceanGuard application (Dalrymple and Wicks, 2021). According to this summary, the flow claim can be traced to testing by Butler et al. (2001) (a reference provided by OP with an uncertain origin, but with a corresponding reference by the same authors from 2004 available online) and from results reported by White and Pezzaniti (2002).

The testing reported by Butler et al. (2001) indicates that field and laboratory testing was undertaken on a number of catch basin insert products including what is now called the OP OceanGuard. The field testing was qualitative, and cannot be used to support a flow claim. Laboratory testing was also conducted on the devices with sediment dosing of flow up to a specific size range. Flow testing was conducted up to a flow rate of 20 L/s on the device, matching the claim for the OP OceanGuard. There was no pre-loading of the device with litter or sediment. No comment was made on the flow capacity of the devices, but it can be inferred that the device captured flow up to 20 L/s in clean condition.

The testing reported by White and Pezzaniti (2002) provided more substantial support for a 20 L/s flow performance claim. This study indicated that the OP OceanGuard (then called the Enviropod) was:

'capable of collecting and retaining considerable amounts of pollution at flow rates up to 320 L/sec. Resuspension of pollution occurred at flows above 100 L/sec, however the unit still retained up to 70% of pollution at 1% longitudinal slope at an approach flow of 320 L/sec. The Enviropod basket affected the hydraulic capture capacity of the gully pit at 12% grade due to blockage caused by litter trapped in the overflow outlet.'

Based on these reported results, a treatment flow rate of 20 L/s is considered appropriate. While it is not supported by field data, the device has been hydraulically tested and the performance claim is suitably conservative compared to the flow ceiling values of 100 L/s where resuspension was noted to occur in lab tests.

Attachment 7 – Performance claim for gross pollutants

The OP performance claim for gross pollutant removal was 100% treatment in the submission to Stormwater Australia. There was no monitoring related to gross pollutants undertaken in the field study and as such the gross pollutant treatment claim should strictly speaking not be considered to be a verified part of the claim.

There was however laboratory testing data provided with the application which may be considered to demonstrate the performance of the device. This included two independent tests, including the information from Butler et al. (2001) and White and Pezzaniti (2002).

Butler et al. (2001) provided results of a qualitative field investigation which made useful observations of performance for filter basket devices. These were not specific to any type of device referred to in the study, and therefore cannot support the claim. The laboratory testing component of the study looked at the performance of an OP OceanGuard when subjected to sediment in flowing water and had no gross pollutants. Interestingly, testing was conducted at varying inflow rates spiked with four sediment concentrations (50 mg/l, 150 mg/l, 250 mg/l, 400 mg/l) and four particle sizes (<100 µm, 100-500 µm, 500-1000 µm, 1000-10000 µm), as well as a water spiked with harvested street sediment. The results showed almost 100% removal for sediment fractions of 100-500 µm, 500-1000 µm and 1000-10000 µm when subjected to flows up to 20 L/s. These results provide further support for the existing sediment performance claim.

White and Pezzaniti (2002) conducted laboratory testing subjecting an OceanGuard device to flows of up to 320 L/s on a full scale road runoff test rig. The interception of gross pollutants was conducted in this case using a synthetic mixture including 80% organics (leaves) and 20% paper, plastic and sediment. The results of the testing were as follows:

The Enviropod basket is capable of collecting and retaining considerable amounts of pollution at flow rates up to 320 L/sec. Resuspension of pollution occurred at flows above 100 L/sec, however the unit still retained up to 70% of pollution at 1% longitudinal slope at an approach flow of 320 L/sec.

And

During the initial tests, all of the litter (10L) was captured with approach flow set at 25L/sec. It was decided to increase the amount of litter until bypass occurred. 30L of litter was collected (at 25L/sec) before bypass.

The results of this testing provide evidence that could be used to support a reasonable claim for gross pollutant interception at flow rates lower than the TFR, and retention of gross pollutants at up to 100 L/s. As such, the claimed TFR does appear to be reasonable.

Attachment 8 - References used in this letter

ALLAN, A. & JUDGE, A. 2023. OceanGuard Independent evaluators joint report (v2, June 2023). Afflux Consulting for Stormwater Australia.

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Part B: Joint Verification Report

Andrew Allan and Andrew Judge

Non compliance

Date	14 June 2023
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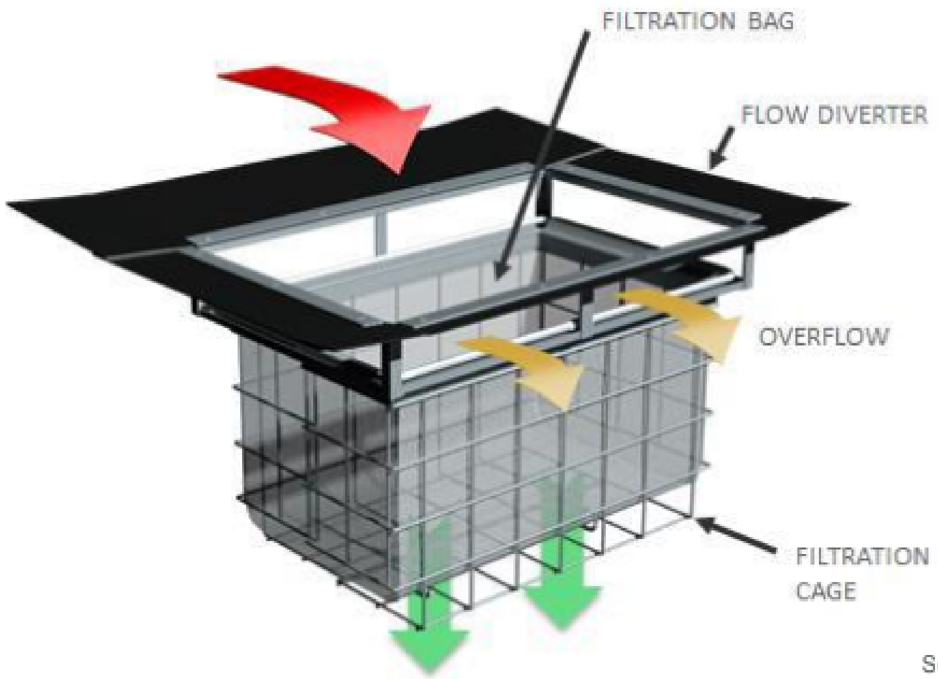

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Revision:

Distribution:

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.

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1. Introduction

This document reports on the independent evaluation of an application by Ocean Protect to have Stormwater Australia approve a OceanProtect OceanGuard 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, Andrew Allan and Andrew Judge under the auspices of Manly Hydraulic. As part of our internal Quality Assurance process the report has been reviewed by Chris Beardshaw of Afflux Consulting.

The Independent Evaluators were engaged by Stormwater Australia on a fee for service basis to carry out an independent evaluation of an OceanGuard device which is described as a gully pit insert/ blanket capable of capturing pollution entering into stormwater drains and which can be installed within new and existing stormwater pits.

Evaluators Declaration of Independence

It is declared that both evaluators, Andrew Allan and Andrew Judge, are completely independent and neither Independent Evaluator has any conflict of interest with respect to this engagement.

We jointly declare that:

We are not, nor have we ever been employed or commissioned by the Applicant, Ocean Protect. We have not been involved in the design or development or monitoring of the OceanGuard device and have undertaken this assessment without prejudice and in good faith.

Name- Andrew Allan	Name- Andrew Judge
Signature	Signature

Background

The application submitted by Ocean Protect provided a history of the device origins (formerly it was known as the EnviroPod), current and previous testing as well as a range of supporting documents in the form of manuals and separate reviews taken out by others.

Initially the reviewers had concerns about the completeness of the data provided, and in particular that the procedural requirements of SQIDEP had been adhered to. These issues were raised and subsequently discussed at a meeting convened by Stormwater Australia and with relevant parties present. The issues and outcomes are outlined as follows:

The application made by Ocean Protect was for review under the 'Body of Evidence (BoE)' Pathway provided by the SQIDEP process.

Under the BoE process a submission

- Must comply with SQIDEP requirements
- Demonstrate that climate and rainfall is transferable
- Can include lab testing

- Provide a summary of compliance/ non-compliance

Once submitted an Independent Evaluation Panel will review claims and discuss whether or not to accept outcomes with the claimant.

If the panel determines not to accept claims, a Local Field test is the required outcome which sets off a process to implement a program of local (i.e. Australian) field evaluation over a sufficient period to collect data to satisfy the requirements of SQIEDP (which includes a requirement to prepare a Quality Assurance Project Plan (QAPP).

The Stormwater Australia website indicates that the BoE process is available for devices for which Australian field testing had commenced prior to 31 December 2018.

The submission included various field testing information which dated back over approximately 20 years and related to the EnviroPod precursor device. The most recent testing was conducted at Western Sydney University over a period between March 2020 until June 2021 (for field collection and analysis of collected samples). Ocean Protect indicated that the time required to selects a suitable testing site should be considered relevant.

Under the requirements of the QAPP there should be a level of independence between the field testing and the commissioning organisation. While the analytical component of testing was undertaken at independent NATA registered facilities, Ocean Protect staff were responsible for collection of the samples and the operation of the equipment during that time. Statutory declarations have been provided to cover aspects relating to these activities.

With this background the evaluators had concerns about progressing their assessment without procedural clarification. A meeting was held with Ocean Protect, representatives the Stormwater Australia SQIDEP Governance Panel and the evaluators.

For a review to proceed the outcomes of this meeting were as follows:

- For Ocean Protect to provide a response to a typical QAPP relevant to field testing at the WSU site. A template QAPP was provided to assist with consistency with reviews of other products.
- Minor corrections to tabulated data provided in spreadsheet format to assist in correctly identifying analytical test results
- Additional Statutory Declarations to support a position of 'independence' for collection of field samples (i.e. through integrity of process).

Ocean Protect provided additional information in response to these requests, and as such the review was able to continue.

With this background the focus of the remainder of the review on the field data collected at the WSU site between March 2020 and July 2021 and our own independent assessment of this.

It should be noted that while various supporting documents have been provided, they have not been given any weight unless they satisfy a specific requirement of SQIDEP. It is acknowledged that Ocean Protect may have commissioned additional reports to provide themselves with a level of assurance on adequacy of data collected.

Independence of Monitoring Scientist(s)

Ocean Protect employees were responsible for the installation, operation and maintenance of the sampling equipment.

For samples collected between March and September 2020 Ocean Protect employees were responsible for sample retrieval, system reset and sample submittal to analytical labs (ALS).

After 4th September 2020 ALS appear to have had a greater level of responsibly for sample collection and submittal to their own analytical facilities.

In these circumstances true 'independence' is difficult to establish. To allow the evaluation to progress Statutory declarations were requested from relevant Ocean Protect employees and are summarised as follows.

Statutory Declaration	Summary	Comments
Michael Wicks **Dated- 12 August 2021**	Described his role as co-author of report submitted to support application (along with Brad Dalrymple). Described the role of both he and Brad Dalrymple in relation to Ocean Protect Described Ocean Protect role in relation to Ocean Guard	
Blake Allingham **Dated- 18 February 2022**	Confirmed particulars around the test site location, installation dates and maintenance in accordance with typical requirements Elaborated on specifics of maintenance activities, including dates, activities and observations on samples collected	Further clarification was requested to attest to independence of Ocean Protect employees in relation to sample collection
Blake Allingham **Dated- 21 October 2022**	Blake's previous statutory declaration was updated to include additional clauses Stating his role with Ocean Protect as Research and Development engineer Stating qualifications as a degree qualified Civil engineer That collected sample were not 'tampered' with	This additional information satisfies specific requests from evaluators.
Brad Dalrymple **Dated 7 February 2023**	Describes particulars of the installation of the test site and the purpose of the installation Confirms role in data analysis ad reporting for the site Confirms role with OceanProtect and qualifications	This was requested as par of the review process.
Warren Jones **Dated 7 February 2023**	Describes particulars of the installation of the test site and the purpose of the installation Confirms role in data analysis ad reporting for the site Confirms role with OceanProtect and qualifications	This was requested as par of the review process.

To allow the subsequent evaluation the suitability of these Statutory Declarations have been provided, with initial submissions augmented after specific requests were made through the review process.

The following comments are noted.

- The statutory declarations are factual and limited to specifics around testing location and purpose, roles of the individuals and qualifications.
- Much of the information contained is known from the other information provided (e.g. the test site and purpose)

- It would have greatly assisted with clarity if these had made definitive statements that attested to the integrity of process (i.e. independence).
- No statutory declarations have been received from ALS however wouldn't be expected as the role they are playing is independent of the interests of any specific outcome from the testing.

2. Assessment

Stormwater Australia published the Stormwater Quality Improvement Device Evaluation Process (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).

Review Documents

The following documents form the basis of this independent evaluation:

- Ocean Protect (Mr Michael Wicks and Mr Brad Dalrymple), A review of the application of OceanGuard® in Australia, August 2021
- Ocean Protect, Oceanguard WSU SQIDEP Compliance 211207.xlsx, viewed online and updated
- Chain of Custody documentation, Storm Reports and ALS Results certificates for the duration of the monitoring periods
- Statutory Declarations made as described in sections above
- Calibration and Maintenance Reports (Ocean Guard)- sampling system
- Calibration and Maintenance Reports (Ocean Guard)
- Ocean Protect response to typical QAPP filled in using a pro forma template provided as part of the review
- Additional responses to further questions raised regarding sample preservation, involvement of Western Sydney University and the set up of the sampling system
- Sample Receipt Notifications provided by ALS (also requested as part of the review process)

Ocean Protect OceanGuard

The Ocean Protect OceanGuard was submitted for evaluation against the SQIDEP protocol on 31 January 2022. Operation and testing of an OceanGuard device installed at Western Sydney University was conducted over the period from March 2020 to July 2021 Ocean Protect, however after October 2020 sample collection was jpintly undertaken with ALS laboratories. ALS laboratories undertook all chemical and particle size testing of samples once delivered.

The field testing was undertaken without a Quality Assurance Project Plan having been reviewed by Stormwater Australia evaluators.

The role of Ocean Protect agents involved in the reporting and sampling process has been described by Statutory declarations provided by personnel involved in the process.

According to the claim as submitted the OceanGuard *' The OceanGuard technology is a gully pit insert / basket designed to capture pollution that runs into stormwater drains. It can be installed within new and existing stormwater pits.*

The OceanGuard installation is on a carpark at Western Sydney University's Penrith Campus. The carpark is located next to the School of Humanities & Communication Arts building in the south of the campus.

Particulars on the catchment area, characteristics and design and installation of the OceanGuard and sampling equipment is contained in reference documents provided for review.

Source: *Ocean Protect*

Figure 1. *OceanGuard test location*

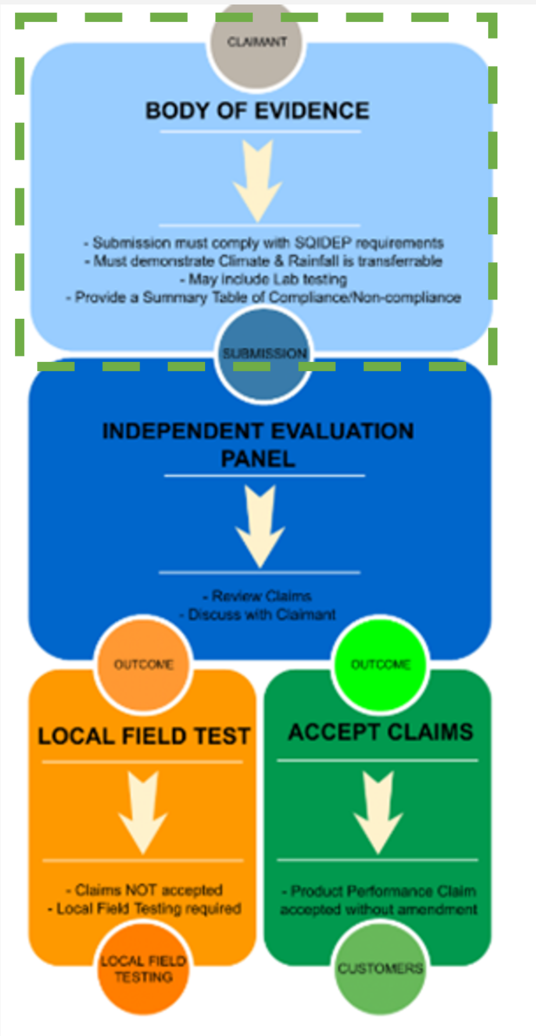
Source: *Ocean Protect*

Figure 2. *OceanGuard Pit insert*

Source: *Ocean Protect*

Figure 3. *OceanGuard sample collection station*

Under the SQIDEP protocol there are separate pathways to demonstrate whether a device is able to achieve pollutant reduction under field conditions. This claim is being assessed under the Body of Evidence pathway which includes an assessment of field testing/ monitoring across a range of storm events, and independent evaluation of claims as indicated in Figure 4.



Source: Stormwater Australia

Figure 4. *SQIDEP Pathway- Body of Evidence*

Performance Claim

The performance claim is stated in the application and are shown below in Table 1.

For the purposes of assessment the data provided from the Western Sydney University site will be reviewed to see if it satisfies the requirements of SQIDEP.

It should be noted that these claims are contingent on the device being sized (designed) and installed correctly, and with appropriate maintenance undertaken.

Table 1. *Ocean Protect OceanGuard pollution reduction claim*

Pollutant	Removal claim (BoE application)
Total Suspended Solids (TSS)	51.6%
Total Phosphorous (TP)	64.7%
Total Nitrogen (TN)	40.9%
Gross Pollutants	100%

It is noted that gross pollutants were not tested, however the claim is made for a substantial reduction in this pollutant category. Based on the physical nature of the device and its mode of operation (i.e. water passing through a filter media is treated) it is expected that gross pollutants will be removed from the treated effluent stream and prima facie this could be considered a legitimate claim.

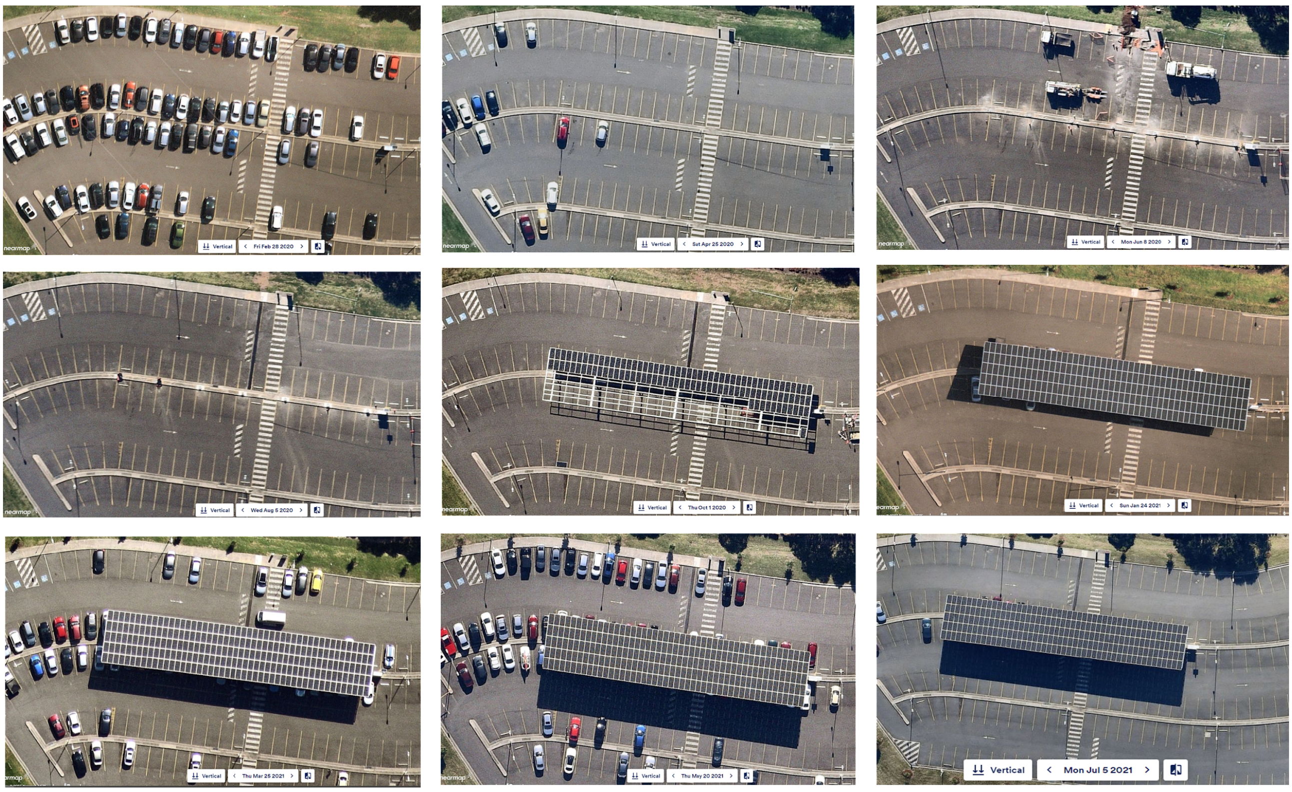
As a gully pit collecting debris it is not possible to determine the behaviour of the device in relation to Gross Pollutants in higher flow/ bypass. It could be imagined in some instances material will remain trapped in the pit, in other circumstances and if a result of blockage floatable material may be remobilised.

Based on a strict interpretation of the protocol the reviewers have formed the view that Gross Pollutant removal should not be claimed based on the evidence presented.

It remains a separate consideration if the product is marketed for gross pollutant removal but to retain integrity of the SQIDEP process, any promotional material should avoid implying that compliance has been achieved.

Site Background and Assumptions

The catchment is a carpark located at the Western Sydney University (Penrith Campus). We have reviewed available aerial imagery and have located the monitoring site. Aerial photographs confirm the that the carpark was constructed well before the monitoring period commenced, however for a significant portion of the monitoring period it appears that civil works were occurring in the carpark area and as such it was not being utilised.



SQIDEP intends that the 'use' of the testing area should have similar characteristics to the ultimate intended market for the product being tested. Noting the unique circumstances that occurred during the monitoring period (e.g. COVID19 restrictions expecting to limit the patronage of the University) the evaluators are of the view that the carpark would be expected to be less polluted, and therefore lower influent potentially concentrations making it harder to demonstrate a treatment effect, and a higher degree on sensitivity in paired samples at close to detection limits. These factors should manifest in the variability of results and will be addressed in the statistical analysis.

3. SQIDEP Compliance

Quality Assurance Project Plan

A Quality Assurance Project Plan was not provided as part of the initial submission. The intent of the QAPP is two-fold. It provides guidance on the design and implementation of a field evaluation program, and if agreed upfront prior to field work commencing, provides a template for collection and assessment of data.

The QAPP description and a template have been available in the SQIDEP version published in 2019 prior to the commencement of field testing for the OceanGuard.

A QAPP template was subsequently provided by the evaluation panel and for response by Ocean Protect. Table 2 is the completed response as received from Ocean Protect with evaluators' comments against each item.

Table 2. *QAPP submitted and evaluator comments*

Performance Claim Requirement	Commentary	Ocean Protect Response	Evaluator Response
Data Quality Objectives	Data quality objectives are not explicitly mentioned in the QAPP but are effectively covered in the Testing Protocol described under Section 4.3.1 which details sample collection and analytical methodologies.	I think you guys mean Section 4.1 "Data Quality Objectives" (not 4.3.1 - as there is no section 4.3.1)? The WSU Report demonstrates that accurate and relevant data has been collected for the OceanGuard to assess Ocean Protect's performance claim for the OceanGuard. Device does not provide quantity control, although concentration and mass/load is considered and reported. The study was for a 16 month-monitoring period, with 16 qualifying events for 'real world' conditions, for a range of pollutant types and rainfall/ runoff events.	Response is satisfactory. Evaluation of performance is against target pollutant requirements.
Organisational roles and responsibilities	Describe the organisational role, and relationship between the applicant, data collection and analysis.	As per page D-5 of the WSU report, Ocean Protect personnel were responsible for the installation, operation, and maintenance of the sampling equipment. Ocean Protect personnel provided sample retrieval, system reset, and sample submittal activities for all events up to and including 4 September 2020, whilst ALS were responsible for these tasks for subsequent events. Water sample processing and analysis was performed by ALS.	Statutory declarations are the only method to support assessment of independence. The attestations provided meet minimum requirements. Statutory declarations have now been supplied for all key (Ocean Protect) personnel involved in aspects of the testing. No declarations have been received from ALS, but as a third party contractor it is reasonable to assume independence.

	Where there may be doubt as to the independence between parties any further information to attest to this (i.e. statutory declaration) would be useful as evidence		
Description of test site	Describe the test site, and its influence on generating pollutants that will be claimed. In part this characterisation will be used in the assessment to determine what sites would be suitable for commercial application.	Site description given on pages D-1 to D-4 of Report. As per this, site is a 400m2 100% impervious carpark, which is appropriate as majority of applications for device will be highly impervious areas with high vehicular traffic (e.g. car parks, roads, industrial, commercial, high density residential). Maximum pollutant concentrations as specified in Table 1 of SQIDEP have been applied. As per Table 4 in "Oceanguard WSU SQIDEP Compliance 211207.xlsx", no qualifying events have concentrations above these values.	On prima facie the test site looks suitable, however a review of aerial photographs during the monitoring period suggest that it was not being utilised as a 'typical carpark.' Responses from Ocean Protect indicate that the carpark may still have remained in use for periods where testing occurred, but there is no way to verify. OceanProtect also indicate that testing was suspended while Civil woks occurred in the carpark, and this gap is evident in sampling dates and correlates with aerial photos. Lower utilisation will likely lead to reduced pollutants, and therefore make it difficult to demonstrate a treatment effect. The use as a carpark makes it reasonable to claim performance in comparable situations.

Measuring rainfall	Data on how rainfall is to be recorded. Any additional data sets that may be useful for independently verifying the rainfall data (e.g. BoM stations or nearby gauges)	As per page D-5 of WSU report, rainfall was measured at 1-minute intervals using two 0.25mm resolution ISCO 674 tipping bucket-type rain gauges Figure D-1 of the WSU report shows the location of the monitoring equipment. Rain gauge is located on post on cabinet (shown in Figure D-3 of WSU report). There is also a backup rainguage within 100m from this site, which data could be compared to. From discussions with evaluators, comparisons have also been made to data from nearby BOM stations.	The resolution and frequency of tipping bucket rain data appears suitable for intended purpose. Spot checks of rainfall against historical radar will be undertaken as part of assessment as additional quality assurance.
Storm events sampled	Describe how storm events will be sampled such as manual sampling, automated sampling and any trigger for taking samples (e.g. flow response, rainfall depth), and whether the samples will be composited etc. Also, any decision framework for determining which samples are selected for analysis and device 'reset' process.	Refer to pages D-4 to D-6 of WSU report.	The method of sample collection appears consistent with providing a flow weighted composite samples with coverage across a significant portion of the storm. A high level review of storm durations, aliquots collected and storm coverage obtained from individual storm reports supports this assessment in the majority of events. From the description provided it is understood that sampling program was 'updated' prior to an event occurring once specific information became available on the expected storm intensity and duration. It is presumed that these changes to sample 'pacing' were enacted remotely.

As per page D-5, Influent and effluent water quality samples were collected using individual ISCO 6712 Portable Automated Samplers configured for 9.5 litre wide-mouth carboy bottles with disposable sample liners for sample collection. The samplers were connected to one 12V DC battery recharged with a solar panel mounted to the roof of the shipping container. The influent sampler was equipped with an ISCO 730 Bubbler Weir module, connected directly to the ISCO 6712 sampler, and installed within a preconfigured and calibrated 152mm diameter Thel-mar Weir (in accordance with manufacturers instructions) for influent flow measurement and sample pacing. The ISCO 6712 effluent sampler was setup as a “slave” and triggered from pulses received from the influent sampler at specific flow volumes pre-determined for every storm event.

Samples were retrieved manually post storm event. Additional information was requested to determine how samples were delivered to laboratory (i.e. within holding times) and preserved (i.e. ice). Subsequently Sample Receipt Notifications (SRN) from ALS were provided and have been used in our assessment process. Calibration and Maintenance records for sampling equipment indicate that at least one sample blank was collected by no analytical results are provided.

Samplers were programmed to enable the sampling program to trigger on flow. Once enabled, the samplers collected flow-proportional samples allowing the specified pacing volume to pass before taking a sample. The sample collection program was a one-part program developed to maximize the number of water quality aliquots/samples collected as well as the coverage of the storm event for an anticipated rainfall depth. Influent and effluent sample collection programs were configured to collect a minimum of eight aliquots per bottle. Due to the variability among predicted precipitation events, the sample pacing specifications were varied (flow pacing and aliquot volume) in consultation with the most up-to-date precipitation forecasts and programmed by Ocean Protect personnel prior to every storm event. Following a precipitation event, Ocean Protect personnel communicated with the automated sampling equipment to confirm sample collection and then dispatch personnel to retrieve the samples and reset the automated sampling equipment. Samples where then split using the appropriate Bel-Art's Churn Splitter – one for the influent and one for the effluent to reduce the likelihood of contamination and to provide subsamples in accordance with the manufacturer's guidelines.

		As per page D-4 of WSU report, framework was in accordance with the Project Plan developed by Ocean Protect in consultation with both City of Gold Coast's (2016) Development Application Requirements and Performance Protocol for Proprietary Devices and Stormwater Australia's (2018) Stormwater Quality Improvement Device Evaluation Protocol Field Monitoring. 'WSU Storm Sequence Log' sheet in "Oceanguard WSU SQIDEP Compliance 211207.xlsx" also describes rationale for any exclusions (e.g. pollutant concentrations too high, low hydrograph coverage, pit flaking). Device maintenance activities described on page D-4 of WSU report, although no 'reset'/ replacement of device was undertaken. Device maintenance reports also provided in "WSU OceanGuard maintenance reports" folder.	
Flow monitorin g	How will flow monitoring be undertaken, any calibration etc. This should apply both to the inlet and outlet, especially if there a losses through the device or alternate outlet streams.	As per page D-5 of WSU report, influent flow measured every minute using a calibrated 152mm diameter Thel-mar Weir (in accordance with manufacturers instructions). Hydrographs provided within Individual Storm Reports (provided in "WSU OceanGuard COCs, ISRs" folder).	The procedure for monitoring flow appears suitable based on the device and in accordance with manufacturer instructions. Additional information was requested to understand the sample setup and has been provide for review (AJ) Hydrographs for individual storms will be reality checked against radar as part of additional quality assurance through evaluation.

	If bypass is expected, the relationship between flow monitoring and treated effluent should also be established.	As per page D-5 of WSU report, bubblers were regularly checked for calibration by submersing the weir in water and confirming/setting the depth of water on the sampler with the bubbler module to the depth measured. The tables for the flow against height are provided by Thel-mar LLC and input into the samplers. Equipment was maintained in accordance with manufacturers specifications. On-site Storm Report (OSR) is conducted after most events to log an issues and help schedule corrective maintenance. Flow monitoring undertaken at inlet only. No losses anticipated through device. As per page D-6 of WSU report, cameras were installed in the pit to additionally confirm the presence of bypass flows for all storm events. No byass of flows was observed or evident.	Based on the nature of the device operation and the claims made there is little value in testing to determine bypass flow around the device.

Sampling location	Description of sampling location and information to verify they are able to collect 'reference' samples of influent and treated effluent, and ensure a correlation between these two flows.	Refer to "Figure D-1 Aerial photo of the site, catchment & equipment" in WSU report, and associated 'sampling design' description on pages D-5 and D-6 of WSU report.	Initial aerial photograph in report did not allow sample setup to be fully appreciated. A schematic was provided as part of additional information requests and appears to be suitable to collect representative samples, hoawevr it is not clear how bypass flows are accounted for. There are no images of the system 'as installed' and therefore have to rely on the descriptions and assume that the device was installed and operating as intended.
Sampling equipment	Sampling equipment used, with reference to appropriate maintenance etc throughout the testing period. If the sampling equipment has supporting manufacturing information this would be useful, along with compliance with recommended operational procedures.	See pages D-5 & D-6 of WSU report for description of sampling equipment. Equipment maintained in accordance with manufacturer's recommendations. Maintenance reports given in "WSU OceanGuard monitoring equipment calibration & maintenance reports" folder.	The sampling device appears suitable for the collection of liquid samples. The operating instructions for the sampling device include reference to the provision of ice into the areas around the sampling bottles to assist in preservation. In our interpretation of the sampling procedure it appears that effort was made to configure sampling parameters (i.e. how much. How long) and sample retrieval was conducted as a separate exercise some time after the event occurred. No such mention is made of site preservation through chilling. Additional information was requested to assist in understanding the condition of the samples upon arrival at the laboratory. This was provided in the form of SRNs. The sampling setup (e.g. cabinets) is identified as an Ocean Protect installation designed to eliminate issues such as confined entry, but doesn't mention preservation. The particular sampling device (ISCO 6712) does not allow for refrigeration in the basic model.

Sampling methodology	How are samples to be collected, any limits on data to be collected relative to storm duration. Any information on composite samples and how these are weighted during a storm.	See pages D-5 & D-6 of WSU report for description of sampling methodology. Also, see above response for "Storm events sampled".	See responses above
Sampling Quality Assurance and Quality Control	Information on standards governing sample collection, preparation/ preservation, handling and transport relevant to the analytical methods used.	See pages D-4 to D-6 of WSU report. As per page D-4, the equipment and sampling techniques used for this study were in accordance with the Project Plan developed by Ocean Protect in consultation with both City of Gold Coast's (2016) Development Application Requirements and Performance Protocol for Proprietary Devices and Stormwater Australia's (2018) Stormwater Quality Improvement Device Evaluation Protocol Field Monitoring. Samples were delivered to ALS (a NATA-accredited laboratory) on ice (<4o C) and accompanied by chain-of-custody documentation.	There is little information on Sample Quality assurance in the report. Additional information was requested to assist in the interpretation of sample condition upon arrival at the laboratory. Specifically, in the absence of automatic refrigeration, confirmation that the samples were 'chilled' prior to arrival. The laboratory Sample Receipt Notices provided are able to confirm arrival temperature and whether ice is present. From the sample numbering protocols and delivery dates it is possible to calculate delivery times, and whether there have been any non-compliances with regard to preservation or holding times. Where elevated sample temperature occurs it is cautioned that this may affect the interpretation of results. Analysis of the significance of any deviations from sample protocol will occur in subsequent sections, however the statement on sample delivery as provided in the report is not substantiated by the evidence provided.

Laboratory analysis	Analytical information on tests etc. If a contracted laboratory is used this does not need to be overly detailed, just to provide an assurance that the tests are appropriate for expected concentration etc and are being undertaken using defensible methods.	See page D-6 of WSU report. NATA-accredited laboratory (ALS) undertook analyses. Refer to "Table D-2 Water quality analytical parameters and methods for the site"	All samples have been tested in a NATA registered laboratory that is expected to have appropriate certification for the tests undertaken. The Limits of Reporting for the analytical methods appear appropriate for the assessments.
Laboratory Quality Assurance and Quality Control	Most laboratories undertake their own QA processes, and is likely to be suitable as long as a linkage between samples arriving in a fit and proper condition for analysis, holding times are appropriate and if any issue is identified at the laboratory that corrective measures are implemented.	See page D-6 of WSU report. NATA-accredited laboratory (ALS) undertook analyses. Refer to "Table D-2 Water quality analytical parameters and methods for the site"	Inspection logs for the sampling equipment mention that DI blanks were collected, but no results have been provided. The analytical results provided do not contain any information relating to internal laboratory quality control, but it is noted that the SRNs from the laboratory indicated the level of Quality Control to be used for the analysis (i.e. NEPM 2013 B3 & ALS QC Standard). The use of a NATA registered laboratory with developed Quality Control processes provides a level of assurance around testing once samples have been received.

			We have only been supplied summary laboratory information, and have not been able to review quality assurance protocols that are expected to have been reported as a matter of course in the along with analytical testing results.
Data management	Data management is an area that should provide assurance that data collected is stored appropriately, labelled and dated for appropriate identification and that there is a process for aligning different datasets (e,g. sample collection to rainfall records) to assist in analysis.	Refer to Chain of custody documentation for sample identication convention (in "WSU OceanGuard Supporting Info\WSU OceanGuard COCs, ISRs" folder) and associated results given in "Oceanguard WSU SQIDEP Compliance 211207.xlsx".	Data management is reasonable, however additional information needed to be requested from the clamant. From CoC naming convention it is possible to determine date of sample collection and analysis required. Upon receipt of additional information (after request) there remains some doubt around aspects of the data that is at odds with statements provided. The materiality of these discrepancies will be determined.
Reporting	The process for reporting to provide clarity that the elements contained in the QAPP are able to be identified throughout the report.	Refer to "Oceanguard WSU SQIDEP Compliance 211207.xlsx" for relevant information, including analytical results and event details (e.g. rainfall duration, intensity, flow rates/ volumes, hydrograph coverage).	Laboratory data is well presented in summary tables with statistical analysis also provided. Initial issues with identification of results (i.e. Naming columns) has been rectified. Random spot checks will be undertaken on data points, and statistical analysis will be independently confirmed as part of the assessment process.

	Ideally the QAPP provides a suitable structure to assemble data and report against the headings required in the SQIDEP.		

SQIDEP Assessment

The SQIDEP provides a structured framework in which to present evidence and information. Compliance with all elements of SQIDEP Table 3- Minimum data and qualifying event requirements for assessment (SA, 2019) can be used as a basis for determining if the BOE test has been met. Following receipt if supplementary information Table 2 provides a status against each of the Performance criteria.

Note that while the initial USC testing included events that subsequently did not meet qualifying event criteria the data collected is none the less useful as it adds to the robustness of the entire dataset. As such, and where appropriate this has been referenced.

Table 3. *SQIDEP Assessment*

Performance Criteria	Performance requirement	Monitoring action or result	Outcome
Min number of events	15 or enough to achieve 90% confidence interval	16 storms have been claimed as being compliant. The validity of these storms to provide admissible results will need to be determined based on holding times and preservation requirements. One event of over 7 hours duration recorded only 15minute of sample collection for 89 aliquots and will need to be reviewed.	Not achieved While there have been 15 sets of results several of these have discrepancies in the sample preservation (and to a lesser degree hoding times) that cast doubt as to whether they should be included.
Min rainfall depth	Sufficient to collect minimum sample volume for lab testing.	No minimum rainfall depth has been specified. However the purpose of setting a minimum depth was to avoid sampling inconsequential (i.e. short duration) events. Events sampled ranged between 22 minutes to over 2 days.	Compliant
Inter event period	Minimum 6 hours dry	Review of hydrograph coverage and selected storms indicates this is achieved. We have included events samples but not summitted for assessment in our analysis. Time between events ranged from 3-51 days.	Compliant
Device Size	Single pit	A single 900 x 600mm pit.	Non-compliant.

		200 micron bag up 300mm device with treatable flow rate of 20 l/s from 400m2 of collection area. Likely can be scaled to suit different catchment sizes. Confirm if there are maximum sizes for pits. Include commentary to ensure devices can be appropriately sized in practice.	Comments on the flow rate capacity, treatable flow rate and actual flow rates teste make it difficult to draw clear conclusion. Claims should be conditional on sizing advice provided and relate to flow rates tested in the field in compliance with SQIDEP requirements.
Runoff Characteristics	Target pollutant profile of influent and effluent	Site chosen to be typical of carpark. Regulated pollutants chosen for basis of claim and appropriate considering the intended application. Operation of carpark during testing period was not 'typical' insofar as there were periods of low usage as evidenced by historic imagery.	The device was tested in a carpark site and would appear suitable for similar situation and loading rates. Claim should include information in documentation about intended applications.
Runoff volume or peak flow	At least 2 events should exceed the 75% of the TFR and 1 event greater than the TFR. The TFR for the device is claimed to be 20 l/s for a single pit of 900 x 600m size.	Reference to Flow and Sampling data spreadsheet provided indicates that maximum peak runoff rates are roughly half the Treatable Flow Rate with the average flow around 15% of the TFR	Non-compliant This is not substantiated by test data. Claim should be suitably derated, or additional testing occurs to meet compliance.
Automated sampling	Composite samples on a flow or time weighted basis	Samples collected using an automated sampler capable of adjusting sample composition in response to predicted storm parameters. Aliquots for submitted storms ranged from 6-80. Time between collection of storm aliquots ranged from 30 seconds to one hour. While generally shorter duration storms had a higher sampling rate this was not always the case. Longer duration storms with reduced sampling rates may have reduced representation.	Compliant

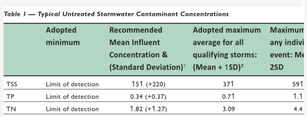
Minimum number of aliquots	80% of field test collections should have at least 8 per event.	Minimum number of aliquots is 5. 93.75% of storms submitted meet requirement.	Compliant
Hydrograph coverage	At least 50% of qualifying storms should include the first 70% storm coverage	Further interrogation of sampling logic will be required to verify this. However, on prima facie there does seem to be a correlation between longer storm duration and increased aliquots. Storm reports suggest sample duration which equates to 'storm coverage' and indicated over 80% compliance	Compliant
Hydrograph coverage	Multiple peaks should be accounted for (at least 1 occurrence).	Need to review these	Compliant
Grab sampling	Not applicable		N/A
Sampling locations		There was no clear diagram indicating sampling locations. Making it difficult to determine if they are appropriate to collect influent and effluent samples. Subsequently a schematic of the sampling set up was provided and satisfies requirements.	Compliant
Chemical and physical analytes	As identified in QAPP	Analytes identified in QAPP response. While data collected on speciation of pollutants has been included it will not be assessed as it falls outside the SQIDEP remit in terms of listed claim.	Compliant Any claim will be limited to TSS, TP and TN.
Min and Max concentrations within range	Refer to Table 1 SQIDEP repeated below 	The inflow parameters for all assessed pollutants are below values indicated in SQIDEP. TSS is around one third recommended mean influent concentration, but satisfies the range criteria. The adopted average and individual maximum values meet compliance.	Generally compliant. May need to consider the representative of the site compared with intended use. It is should also be noted that generally other assessments have indicated values lower than some published data.

Table 1 — Typical Untreated Stormwater Contaminant Concentrations

	Adopted minimum	Recommended Mean Influent Concentration & (Standard Deviation)[1]	Adopted maximum average for all qualifying storms: (Mean + 1SD)[2]	Maximum any indivi event: Me 2SD
TSS	Limit of detection	151 (+220)	371	591
TP	Limit of detection	0.34 (+0.37)	0.71	1.1
TN	Limit of detection	1.82 (+1.27)	3.09	4.4

		TSS is around half the recommended mean influent concentration, but satisfies the range criteria. The adopted average and individual maximum values meet compliance. TSS is around 70% the recommended mean influent concentration, but satisfies the range criteria. The adopted average and individual maximum values meet compliance. While the implication could be that the site is 'cleaner' than average and would be supported by low utilisation this needs to be offset against any concerns around sample representativeness with poor preservation.	
Analytical methods	NATA accredited sample handling and analytical methods	No details on sample preservation relative to delivery processes. Australian Standard reference appropriate for sample handling. Sample Receipt Notification documentation provided indicates elevated sample temperatures at time logging into laboratory.. . Several samples indicated holding time breaches.	Non-Compliant Sample receipt information indicate that 6 samples arrived at ‘above recommended temperatures’. While 2 of these could be regarded as trivial, laboratory notes indicated that extra interpretation is required for results that depart from recommended parameters. As evaluators we are not qualified to consider these issues and feel that it would be better to err on the side of caution.
Flow measurement location	Inlet, outlet and bypass as applicable	Flow locations described and appropriate for analysing effluent passing through the treatment zone. Bypass is not possible given nature of device capturing sheet flow.	Compliant
Precipitation measurement	A pluviometer is required	Dual tipping bucket rain gauges at 0.25mm increments used and measured at 1 minute increments.	Compliant

Rainfall recording interval	5 minutes or less	From storm reports there appears to be reasonable resolution in rainfall recording, however some events indicated stepwise recording, but trend is evident and sample collection continued.	Compliant
Rainfall recording increments	0.25mm adopted		Compliant
Pluviometer calibration	To be calibrated twice during the monitoring period.	Claimed to be factory calibrated and only field maintenance to clear debris during deployment. A second rain gauge is installed to improve confidence if both devices report similar results. Although this is indicated in the report no data has been provided for scrutiny. Spot checks of rainfall against available radar rainfall indicating the presence of storms of similar duration and intensity to correspond with hydrographs and considered sufficient to corroborate.	Confirm
Performance indicators	The target pollutants and testing rationale must be described in the QAPP and Detailed Performance Report.	A response to a typical QAPP was provided and has been evaluated above. Subsequently further information was requested to clear outstanding issues. Ideally a QAPP template and methodology would have been available prior to the commencement of field testing.	Partially compliant While it is true that a QAPP was provided it was not developed up front in the process and agreed before testing was commissioned. Responses to typical QAPP indicate areas of concern which should have ideally been addressed in monitoring design. There are some deficiencies in some data that requires additional information, and likely supplementary sampling to address deficiencies.

Performance indicators	ER and CRE*. If CRE average and median > 10% difference inspect dataset.	These ratios meet the required 10% for TSS, fall marginally outside allowances for TP and do not meet requirements for TN.	Specific samples contributing to the effect need to be considered and their influence on overall results.

*Consideration of these metrics such as these provides a useful flag to undertake further checking of data.

In summary, there are areas of concern around compliance with SQIDEP v1.3 which should be resolved through additional (supplementary) sampling before claims are able to be accepted.

These are summarised below.

Sample preservation

Of the 16 samples that have been submitted 6 arrived at the laboratory with elevated temperatures (as per ALS recommendation that these be 6 degrees or below). These have not flagged as a non compliance at the ALS end it is noted that care should be exercised in interpreting the analytical results.

Of the 6 samples, 2 were only marginally over, with 3 being several degrees over and one with no temperature details logged.

While the delivery time to the laboratory is not known it would be expected that samples that had been laid on ice for a sufficiently long enough time would have equilibrated to a low temperature, and would suggest late addition of ice.

Holding times.

ALS documentation includes a report indicating whether the samples have been delivered to the laboratory within holding times, and is generated through their systems. Of the 16 samples, 4 had an adverse holding time report.

From our review of the recommended holding times and preservation for water based samples 28 days is allowed for Total Nitrogen and Total Phosphorus, however this reduces significantly for if particular species are being requested for analysis.

We interpret the adverse holding time report as being based on the speciation. Therefore this is less of an issue for the claims for TN and TP.

While we have determined only to consider the specific regulated pollutants, we note the initial request for species specific interpretations and draw attention to the issues raised by preservation and holding time anomalies.

Outliers

One sample exhibited a significantly larger influent results for TN than the remainder of the dataset. While this is within the expected range of variability for Nitrogen there was an associated significantly large treatment effect that should be satisfactorily explained if it is likely to skew the overall results

Statistical analysis

A statistical analysis has been undertaken on the dataset excluding the samples that do not have compliant laboratory temperatures on delivery and concludes that the results are not sufficiently statistically significant enough to warrant the claim.

Including these data points brings the data set to just within compliance, however it is not possible to say with certainty if errors introduced through sample handling would have made the difference.

CRE/ ER Ratio

Several samples stand out as contributors to a high CRE/ ER ratio, and are summarised below

- WSUOG-200325 and WSUOG-200920 showed a negative result for TN. It may be notable that one of these was the first sample in the program.
- WSUOG-210212 showed a zero reduction for TP. In all other instances there were generally corresponding orders of magnitude in reductions for TN and TP.
- WSUOG-210319 showed an excessively large treatment effect for both TP and TN.

Ideally these results should have an underlying explanation, but none has been offered.

Comparison of Inflow Concentrations

Influent concentrations are impacted by a range of factors including antecedent conditions and catchment activity. Antecedent conditions allow accumulation of pollutants between events and it is possible to examine reported influent concentrations to identify indicative trends.

The inflow concentrations from this study were compared to previous studies of road catchments for cross-reference. In particular, the pollutant concentrations of TSS, TP and TN were extracted from Duncan (1999) which examined 42 (road) sites across Australia. The range of concentrations reported in previous SQUIDEP assessments completed by Afflux Consulting has also been included for comparison[7].

The influent pollution concentration range falls within the ranges reported by Drapper and Lucke (2015) and those indicated in other SQIDEP assessments that have been completed by Afflux and published through Stormwater Australia. At the he lower end, inflow concentrations observed in that study were higher than the results of Duncan (1999), but at the upper end fell within range.

We also note mean TSS influent concentrations, at 58.2mg/L are about25% of default MUSIC road EMC values but not untypical for a new well sealed road, mean TN concentrations at 1.16 mg/L are around MUSIC default values at 2.2 mg/L while the TP loads were considered to be about 40% of default MUSIC values for a sealed road. At the lower end, all influent results are below the reported concentration used in MUSIC.

We conclude that the influent concentrations are considered realistic, but it highlights the difficulty of quantifying pollutant runoff parameters, and consequently, modelling inflows and the challenges that may occur in modelling performance.

Table 4. *Typical pollutant concentrations for road catchments*

	Duncan (1999) study	Drapper and Lucke (2015) study	Previous SQIDEP Assessments completed	Current study –OceanGuard	MUSIC (Sealed Road)
TSS (mg/L)	60 – 700 (n=42)	1.45 – 5800 (n=325)	15 – 357 (n=25)	11 – 250 (n=16)	129- 562 (mean 269)
TP (mg/L)	0.1 – 0.8 (n=25)	0.08 – 26 (n=325)	0.04 – 0.49 (n=25)	0.05– 0.5 (n=16)	0.28- 0.89 (mean 0.5)
TN (mg/L)	1 – 9 (n=17)	0.38 - 8.5 (n=325)	0.3-4.0 (n=20)	0.28-4.03 (n=16)	1.41- 3.39 (mean 2.19)

[7] It would be useful for Stormwater Australia to summarise the aggregated data that is provided through multiple SQIDEP assessments to supplement other available information on runoff composition.

Pollutant removal and statistical analysis

The statistical analysis and methodology for determining significance was reviewed. It was found that the steps taken follow standard procedures for evaluating stormwater data. Typically stormwater concentration data is not normally distributed, as denoted from a Shapiro-Wilk normality test. Log_{10} transformation does result in normality of the data. Paired Student T-test can be used on the transformed dataset to test significance between data sets.

As part of this review we have undertaken our own Paired Student T-test and results are provided in Appendix A

Conclusions that follow are:

- While the full set of samples were within the 90% confidence interval for demonstrated reduction this was only a marginal conclusion.
- Removing samples with elevated laboratory arrival temperature resulted in the 90% confidence limit not being achieved.
- This confirms the importance of high-quality data for confidence in interpretation,

Reported Concentrations Analysis

While the performance of the device is based on changes between influent and effluent concentrations as reported and elsewhere the influent concentrations are examined (see above) for representativeness of the recommended installation type, it is considered worthwhile to examine the influent concentrations with respect to antecedent conditions to gain an understanding of how the catchment is behaving.

Pollutant concentrations in runoff are influenced by a range of conditions that include the type, intensity and timing of catchment activity, and can be influenced by specific events that add to loadings, and detailed analysis is beyond a simple correlation with antecedent dry weather (ADW) conditions.

In general, it is expected that

- prolonged ADW will lead to increased pollutant concentrations; and
- some pollutants (e.g. Total Suspended Solids) will exhibit a more definitive correlation with ADW.

Influent concentrations are listed in Table 2 for three ranges of ADW. While there is an average increase in concentration for TSS corresponding to longer ADW this is not the same with other pollutants. There is a slight increase for TP in the middle range, and a downward trend in TN.

From the examination of aerial photographs we are aware that the carpark area had low levels of utilisation through a significant portion of the monitoring time, and that there was specific civil activity during this period. Further information provided by OceanProtect confirmed that testing was suspended while these activities occurred and in consistent with the observed trends in TSS, however the trends in TSS could also be interpreted is consistent with low overall utilisation rates (e.g. as a result of decreased activity during COVID)

Overall, the results are generally consistent with expected conditions, but confidence would be increased with additional data.

Table 5. *Comparison of Concentrations and Antecedent Conditions*

	Sample Designation	Antecedent Dry Period (days)	TSS (mg/l)	TP (mg/l)	TN (mg/l)
SHORT ADWP (<10 days)	WSUOG-210201	4	22	0.26	0.28
	WSUOG-210216	4	12	0.06	0.28
	WSUOG-210319	8	62	0.32	4.03
	WSUOG-200403	9	16	0.05	0.44
	AVGE		**28**	**0.173**	**1.258**
MEDIUM ADWP (10 days– 1 month)	WSUOG-210212	11	62	0.32	4.03
	WSUOG-200920	17	31	0.08	1.23
	WSUOG-210407	19	52	0.06	0.42
	WSUOG-210311	23	91	0.27	1.01
	WSUOG-200429	26	22	0.14	1.06
	WSUOG-200904	28	26	0.07	0.4
	AVGE		**65**	**0.195**	**1.170**
LONG ADWP (>11 month)	WSUOG-210128	38	62	0.09	1.38
	WSUOG-200807	47	11	0.1	1.03
	WSUOG-200621	53	250	0.42	1.57
	WSUOG-210616	70	61	0.16	1.57
	WSUOG-201221	91	19	0.19	0.59
	WSUOG-200325	-	26	0.07	0.4
	AVGE		**71.5**	**0.172**	**1.090**

Sensitivity

In previous assessments sensitivity testing has been conducted to determine how robust the data is to to variations in included results.

Two sensitivity tests have been undertaken and are shown in Table 6.

Table 6. *Sensitivity Assessment summary*

Sensitivity test undertaken	Description	Change	Implication
Removal of results with less than optimal laboratory arrival condition	Samples with temperatures more than 2 degrees above recommended arrival temperature were omitted	90% confidence requirement not met. Reported removals generally increase Reduces result pool to 12	Imparts the importance of full dataset with good quality assurance
Removal of 'outlier' events for specific pollutants	One sample ((WSUOG-210319)) had a significant treatment effect relative to others and was removed to test sensitivity	Reported reductions for all pollutants reduce with TN reduced by around half.	Indicates importance of ensuring results are not skewed by significant results without explanation

The design of the SQIDEP included a recognition that different performance metrics, may result in slight changes in overall assessment, but that it was important that across all performance metrics there was an observable trend to have confidence in the interpretation of results.

Sensitivity analysis indicates that confidence intervals and overall interpretation of results can change with inclusion of different combination of results and suggests further sampling would assist in improving confidence.

With regard to the outlier, while the influent concentrations were with expected range it was the treatment effect that warranted further scrutiny. In the absence of a satisfactory explanation we would recommend the data be removed from the compliance data set.

Rainfall Review

The monitoring site was equipped with a tipping bucket rainfall gauge to assist with identification of qualifying storm events (depth/ duration), determination of antecedent dry weather periods and to assist with determination of required sampling frequency (i.e. number of aliquots).

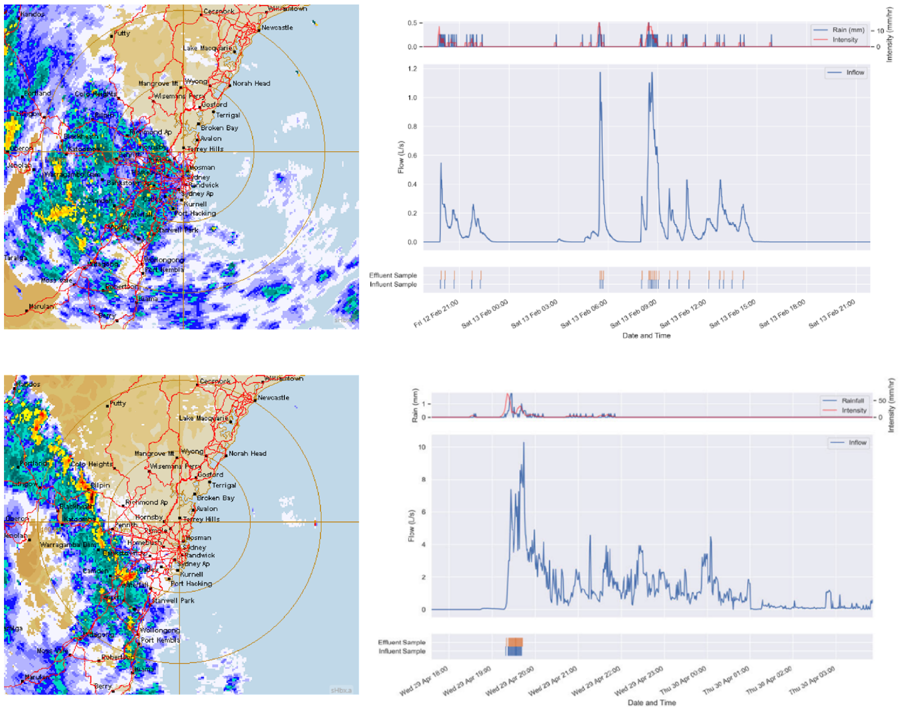
This information is presented in the report in the form of storm hydrographs accompanying the laboratory receipts.

From previous reviews the following comments are relevant.

In general terms:

- Higher rainfall intensities should manifest as higher peak flows through the device:
- Flow peaks through the device should match altered intensity as a storm front passes; and
- The duration of an event (from start to finish) should match the radar record.

A spot review of two storms on the 29 April, 2020 and 13 February 2021 (Figure 5) has been undertaken against radar records and concludes that there is a sufficient degree of correlation to have confidence in the pluviography observations.



Storm 13 February 2021. Radar shows a large area of low intensity storms with intermittent cells of moderate intensity from the west passing over the Sydney area. The storm duration is similar in length to the pluviography record

Storm 29 April 2020. Radar shows storm crossing over the Sydney area from he south west. An initial high intensity gives way to a period of lower intensity rainfall that intermittently reduced and becomes patchy over several hours.
low intensity storms with The storm duration is similar in length to the pluviography record

Figure 5. *Rainfall verification*

With this check in place there can be greater confidence in the representativeness of pluviograph data.

Cherry Picking of Storm Events

SQIDEP v1.3 does not explicitly require that sequential storm events be monitored and reported.

We have reviewed the provide data and have observed that there is a period when sampling frequency reduced to coincide with lower levels of activity on the carpark and to avoid sampling misrepresentative catchment use.

We have also observed possible outlier events in the data, and identified issues with supporting information and sample preservation.

We are of the opinion that the claimant has not ‘cherry picked’ events. In fact, the presentation of all data is to be commended and it is only through this independent evaluation that issues have been raised.

MUSIC Node

MUSIC (Model for Urban Stormwater Improvement Conceptualisation) is an industry standard software program that is widely used in Australia for the sizing and conceptual design of stormwater treatment trains.

As such it is appropriate that some guidance is provided to enable the proposer inclusion of OceanProtect OceanGuard in a stormwater quality treatment design.

We feel it is premature to provide any conclusion with regard to the MUSIC node provided, but are happy to provide feedback.

- The typical node construction is to provide a ;straight line’ reduction for each pollutant class up to the levels that have been verified.

- The upper flow rate should be consistent with that that is substantiated by testing.

Evaluation of Enduring Performance

The Independent Reviewers have endeavoured to consider the long term enduring performance of the OcenGuard device.

The device is described as a filter and as such provides physical removal of pollutants, and will continue to do so as long as it remains essentially unblocked or is not compromised with tearing or holes.

The accumulation rate within the device for larger pollutants will be obvious, and over time sediments and materials trapped are expected to enhance the pollution capture.

From the description of its deployment, the device will dry out after a storm event provided it is installed above the hydraulic operation grade of the pit and the pit remains unblocked and free draining.

The accumulation of material should be easy to ascertain through visual inspection, and the device can be removed for ease of cleaning.

In the absence of damage to the device it should continue to operate as designed.

As such we would recommend that product specification, operational ad marketing material provide guidance on inspection, clean out and ongoing condition assessments as part of a commitment to ongoing device performance.

Given that maintenance is potentially the most important factor in devices working after installation, in other evaluations we have undertaken analysis around the sensitivity for modelled device performance in limited bypass or partial blockage scenarios. Generally we have found that devices are able to accommodate some level of degraded performance without substantially reducing the majority of treatment effect.

We would expect something similar in this case, but would need a verified MUSIC node to undertake this assessment and would be premature at this stage.

Discussion

Our independent evaluation finds that:

While a significant portion of the field study is of a sufficient quality to support an assessment we feel that:

- There are concerns around the impact of analytical testing where sample preservation is less than optimal
- In the absence of a satisfactory explanation, outlier events as determined by treatment effect are also of concern

The net effect of these concerns is to reduce the confidence in the claim to the extent it cannot be accepted

- The treatable flow rate claim is excessive and is not supported by field results
- Generally we feel that the absence of a an upfront Quality Assurance Project Plan has been a contributing factor in some of the shortcomings above
- There have been some shortcomings in the factual reporting that have only become apparent as a result of this evaluation
- The claimant has been provided with opportunities to correct some of these. While requests have been responded to with explanations there has been no attempt to rectify the source reports.
- The Statutory Declarations provided are considered a minimum standard and do not properly attest to the required level of independence that should be demonstrated

We have considered the possibility of other options to provide pathway forward (e.g. interim acceptance, derated performance) and feel this is not a viable path for the following reasons.

- Given the fundamental flaw is the absence of an upfront and robust QAPP to accept a suboptimal outcome would send a 'wrong signal,' compromise the integrity of subsequent reviews and draw into contention the SQIDEP process.
- There is an existing site that has been configured for testing, and a substantial number of potentially compliant samples. A supplementary set of tests with due regard to Quality Assurance would be a preferred path.
- Some of the supporting documentation, its factual basis and confirmation of independence is below a standard we would consider ideal. To accept a less than optimal outcome with this background would also lead to a reduction in confidence in the process.

As such we are recommending supplementary sampling be completed. We feel that subsequent reporting of a full dataset would benefit from the evaluation contained in this report,.

Table 7. *OceanProtect OceanGuard performance claim*

Pollutant	Outcome	Recommendation
Total Suspended Solids (TSS)	Not verified	Further testing required
Total Phosphorous (TP)	Not verified	
Total Nitrogen (TN)	Not verified	
Gross Pollutants	Not verified	

3.1. Limitations of Acceptance

Nil

Conclusions

OceanProtect have submitted for assessment a body of evidence (BOE) to demonstrate that performance claims for the OceanGuard proprietary device have been tested within a trial compliant SQIDEP Version 1.3. This trial was completed in a carpark at Western Sydney University between March 2020 and June 2021.

Based on the results presented and the analysis shown in this report, the authors not in a position to verify the claims made and recommend supplementary sampling be undertaken to produce a fully compliant dataset.

4. References

Stormwater Australia, Stormwater Quality Improvement Device Evaluation Protocol v 1.3, Stormwater Australia, 2018

Appendices

Appendix A - Statistical analysis and confirmation

For information on this report:

Afflux Consulting Pty Ltd
PO Box 457 Emerald VIC 3782

03 9036 2530

info@afflux.com.au

afflux.com.au