

18 September 2020

RE: HOW SQID PROPRIETORS WILL EXAGGERATE STORMWATER TREATMENT PERFORMANCE CLAIMS VIA SQIDEP

Thank you for registering for the webinar *How SQID proprietors will exaggerate stormwater treatment performance claims via SQIDEP*, hosted by Ocean Protect on 19 August 2020. The webinar is now publicly available via YouTube¹. The presentation slides used in the webinar are also provided with this correspondence.

As promised, this document provides detail in relation to the items discussed in the webinar and will be provide to all webinar registrants.

Please contact me if you have any questions or would like to discuss anything further.

Yours faithfully,



Michael Wicks
Technical
Director

Attached: Presentation slides from *How SQID proprietors will exaggerate stormwater treatment performance claims via SQIDEP*, presented by Michael Wicks, Ocean Protect, 19 August 2020

¹ Webinar – *How SQID proprietors will exaggerate stormwater treatment performance claims via SQIDEP*, presented by Michael Wicks, Ocean Protect, 19 August 2020, <https://youtu.be/h7vzeX-UYiw>

Background

The Stormwater Quality Improvement Device Evaluation Protocol (SQIDEP) aims to provide a uniform set of criteria against which stormwater quality improvement devices (SQIDs) can be field-tested and their treatment performance reported. SQIDEP was released in 2018 by Stormwater Australia, and its development was initiated approximately seven (7) years ago by Stormwater Australia, Ocean Protect and some other SQID manufacturers.

Ocean Protect is committed to protecting the health of our oceans and waterways and subsequently fully supports a national protocol for evaluating stormwater treatment measures. Ocean Protect staff members had been involved in, and support, the development of a national SQID protocol for the betterment of the industry, with the aim of removing misleading and unfounded claims by manufacturers and reducing undue pressure on local government authorities in meeting water quality design objectives..

Whilst it must be acknowledged that no standard will ever be perfect, in our opinion that SQIDEP (in its current form) has significant deficiencies which, if allowed to remain without amendment (and subsequently utilized), will produce exaggerated or over-estimated treatment performance results for SQIDs – and subsequently significantly under-sized and/or allow the inappropriate application of SQIDs and, ultimately, lead to reduced ‘actual’ protection of the health of our waterways and increased maintenance and life-cycle costs.

Other key stakeholders and regulators within the stormwater industry have also identified deficiencies within Stormwater Australia’s SQIDEP (and associated verification program). These include submissions to Stormwater Australia from Stormwater NSW² and Stormwater Queensland³. More recently, other stakeholders have met to discuss their shared views and plan a way forward for SQIDEP⁴.

Unfortunately, we consider that the endeavours of Ocean Protect and other industry stakeholders to amalgamate policy and promote best practice have been met with resistance from Stormwater Australia, ranging from outright refusal and dissemination of misinformation, to, in some cases, what Ocean Protect considers to be an attack on the reputation of our brand.

Commercially, all manufacturers stand to gain from having a national framework for evaluating technologies. The larger players in the market, including Ocean Protect, that have been field testing for quite some time, stand to gain a commercial advantage in seeing SQIDEP being endorsed in its current form. Ethically, however, we understand that this may not be the best outcome for the environment. Consequently, we have chosen to outline the facts of the situation to the industry and provide you with information to assist you to make an informed and balanced decision on your organisation's application or otherwise of SQIDEP.

² Stormwater NSW, *Stormwater NSW comments and advice on SQIDEP* (sent to Stormwater Australia, 14 August 2019), <https://stormwaternew.asn.au/wp-content/uploads/2019/09/Stormwater-NSW-Comments-and-Advice-on-SQIDEP.pdf>

³ Stormwater Queensland, *Stormwater Queensland submission on the Stormwater Quality Improvement Evaluation Protocol* (sent to Stormwater Australia, 12 March 2020), <http://stormwaterqueensland.asn.au/wp-content/uploads/2020/03/SQ-SQIDEP-Submission-Final.pdf>

⁴ Stormwater Queensland, *A Way Forward for SQIDEP*, 26 June 2020, <http://stormwaterqueensland.asn.au/way-forward-sqidep/>

Key issues

Key issues have been previously identified and documented by both Stormwater NSW and Stormwater Queensland in their submissions to Stormwater Australia^{5,6}. As identified by both these groups (and other key industry stakeholders), the key issues within SQIDEP that will allow SQID manufacturers to over-state their performance claims via SQIDEP are:

- No need for sequential events, enabling ‘cherry picking’ of data
- No minimum requirement for dissolved inorganic nitrogen
- No minimum performance standards for (i) number of aliquots and (ii) hydrograph coverage.

These are described further below and highlighted in the extract from SQIDEP given in Figure 1.

Please note that, in our opinion, the above items are not an exhaustive list of the technical deficiencies of SQIDEP itself and do not relate to the various issues that exist regarding how this technical standard is used (see verification program) in obtaining a performance verification standard. There are several other items which need adequate attention, which can be found within the aforementioned Stormwater NSW and Stormwater QLD submissions to Stormwater Australia. To the best of our knowledge, an adequate written response from Stormwater Australia has not been supplied.

⁵ Stormwater NSW, *Stormwater NSW comments and advice on SQIDEP* (sent to Stormwater Australia, 14 August 2019), <https://stormwaternew.asn.au/wp-content/uploads/2019/09/Stormwater-NSW-Comments-and-Advice-on-SQIDEP.pdf>

⁶ Stormwater Queensland, *Stormwater Queensland submission on the Stormwater Quality Improvement Evaluation Protocol* (sent to Stormwater Australia, 12 March 2020), <http://stormwaterqueensland.asn.au/wp-content/uploads/2020/03/SQ-SQIDEP-Submission-Final.pdf>

Table 3 – Minimum data and qualifying event requirements for assessment

Sampling Events	Field Testing Criteria
Type of Event	Rainfall Events ²
Minimum Number of Events	The greater of: a. 15 events, and b. Sufficient events to achieve 90% confidence interval, as determined by defensible statistical method (e.g. ANOVA, t-test) that examines influent and effluent pairs. This may vary between target pollutants (based on catchment variability). In this event, statistical analysis can be undertaken separately for each species of interest.
Minimum Rainfall Depth	Sufficient to collect minimum sample volume (based on laboratory analytical requirements).
Recommended Inter-event Time	Min 6 hours ³
Device Size	Full Scale (where a 'family' of devices are being included as part of the claim sizing relationships must be provided for evaluation along with any basis of justification).
Runoff Characteristics	Target pollutant profile of influent and effluent
Runoff Volume or Peak Flow	At least 2 events should exceed 75% of the design water quality volume/ TFR and 1 event greater than 100% of the TFR.
Sampling Procedures and Techniques	
Automated Sampling	Composite samples on a flow- (preferred) or time-weighted basis
Minimum Number of Aliquots	80% of field test collections should have at least 8 per event ⁴ . Notwithstanding aliquots should be collected to provide hydrograph coverage of rising and falling limbs.
Hydrograph coverage	At least 50% of qualifying storms should include the first 70% storm hydrograph coverage (or, for storms longer than 8 hours, capture of the first 8 hours). Programmes should aim to capture full hydrographs for all events, but flexibility will be considered for large volume, long duration events. Dependent on catchment and rainfall patterns, multiple peaks should be accounted for (at least 1 occurrence).
Grab Sampling	Only for constituents that transform rapidly, require special preservation or adhere to bottles, or where compositing can mask the presence of some contaminants through dilution.
Sampling Location	As identified and agreed in the submitted QAPP.
Sampling Procedures and Techniques	
Chemical and Physical analytes	As identified and agreed in the submitted QAPP.
Minimum and maximum (influent) pollutant concentrations for qualifying events	Minimum concentrations: exclude if below limit of detection. Maximum: mean+2SD for any single event, and mean +1SD in the aggregate dataset. Refer Table 1 .
Analytical Methods	NATA accredited sample handling and analytical methods. Refrigerated autosamplers may be required to adequately preserve samples.
Requirements	
Flow Measurement Location	Inlet, Outlet and Bypass, as applicable. Based on relevant accepted measurement protocols for flow type (e.g. open channel, in pipe)
Precipitation Measurement	Automatic rain gauge (pluviometer)
Recording Intervals	5 minutes or less
Rainfall Recording Increments	No greater than 0.25mm
Rain Gauge Calibration	Twice during monitoring period

No need for sequential events, enabling 'cherry picking' of data

No minimum requirement for dissolved inorganic nitrogen

No minimum performance standards

Inconsistencies & difficulties with current practice

Figure 1 Extract from Stormwater Australia's SQIDEP V1.3 (with key issues shaded for ease of reference)

No need for sequential events, enabling ‘cherry picking’ of data

SQIDEP requires data from 15 ‘qualifying events’ or ‘sufficient events to achieve 90% confidence interval’. There is no requirement for any of these events to be ‘sequential’ (i.e. two or more events to be consecutively sampled from the one monitoring site, analysed and included in the data set submitted to review). This allows, by inadequate procedural requirements, SQID manufacturers to ‘cherry pick’ their ‘best’ 15 events (i.e. the 15 events when their device performed the ‘best’ and removed the most pollution and/ or the most for the target pollutant that typically limits the application of their device), excluding the results of any other events.

For example, a SQID manufacturer could collect a very large number of events over many years (and multiple monitoring sites), and simply only include (in their SQIDEP submission) the results from 15 events of their choosing. As illustrated and described in the webinar (see slides 9 and 10), there are examples of even published results from the same site and technology having ‘missing’ and different data. It is therefore not difficult to imagine that SQID proprietary companies (with an obvious commercial interest in reporting the best demonstratable performance of their SQIDs) will similarly ‘cherry pick’ results.

As another example of Ocean Protect data (see slides 10 and 11, for a site monitored for just two years and with results from 26 events available), we know that SQIDEP (and associated no need for sequential events) would allow Ocean Protect to exaggerate the removal of total nitrogen (typically the key limiting pollutant determining the size/ number of our SQIDs) by approximately 50%. Obviously, with more results from more non-sequential events, we could further exaggerate the performance of this same device with a view of under sizing the technology to obtain a commercial advantage.

Recommended change: Introduce a requirement for sequential complying storms.

No minimum requirement for dissolved inorganic nitrogen

As described in the webinar (see slides 13 and 14), nitrogen is present within stormwater runoff in a variety of forms. The dissolved inorganic portion of nitrogen includes ammonia/ ammonium and nitrate/nitrite, and this dissolved inorganic nitrogen (DIN) is the portion that is known to be incorporated rapidly by phytoplankton and contribute to the eutrophication in waterways. Stormwater runoff is also known to contain elevated levels of DIN^{7,8,9,10}. Whilst DIN is present within stormwater and contributes to eutrophication in waterways, it is also more difficult to remove than say particulate nitrogen by passive stormwater treatment technologies. The removal of DIN relies on cation exchange, and anion exchange and denitrification (which takes considerable time). Given these reasons, a minimum requirement for influent DIN is recommended for SQID monitoring and associated performance claims.

⁷ Drapper D, Lucke T (2015). Characterisation of Stormwater Pollutants from Various Catchment types in South-east Queensland. Presented at the 2015 WSUD & IECA Conference.

⁸ Parker, N. (2010). Assessing the Effectiveness of Water Sensitive Urban Design in Southeast Queensland. Thesis submitted towards Masters of Engineering. Queensland University of Technology.

⁹ Hunt, W., Jarrett, A. R., Smith, J. T., & Sharkey, L. J. (2006). Evaluating Bioretention Hydrology and Nutrient Removal at Three Field Sites in North Carolina. *Journal of Irrigation and Drainage Engineering*, 132(6), 600-608.

¹⁰ 12. Taylor G D, Fletcher T D, Wong T H F, Breen P F, Duncan H P, Nitrogen Composition in Urban Runoff – Implications for Stormwater Management. *Water Research*, 2005, Vol 39, pp 1982-1989.

As an example, the City of Gold Coast (2015) protocol “*Development Application Requirements and Performance Protocol for Proprietary Devices*”¹¹ cited that DIN is typically 70-85%, and required a minimum DIN of 60% for any qualifying data set. This requirement was relaxed in a later version of the protocol to a minimum requirement of 40% DIN.

Nitrogen is also present within stormwater runoff as particulate-bound (i.e. bound to particles like sediment, and not in a dissolved form) nitrogen. Particulate bound nitrogen is significantly easier to remove by stormwater treatment technologies – utilizing physical (and relatively simple and fast acting) treatment mechanisms, such as sedimentation and filtration.

In the absence of any minimum DIN requirement for qualifying events, SQID manufacturers are able to:

- Identify (via baseline monitoring) and undertake SQID performance monitoring on sites with high levels of particulate nitrogen (and low levels of DIN); and/ or
- Include results from events with high levels of particulate nitrogen (and low levels of DIN).

The results from these events (again, likely the best 15) can subsequently be included in the suite of qualifying events for review under SQIDEP.

As per the example scenario (see slide 15), ‘real world’ SQID monitoring data from two sites (with the same technology) shows how total nitrogen removal rates can be substantially higher for one site (59% removal, with 15% of the total nitrogen being DIN) relative to another site (37% removal, with 46% DIN despite the flow rate being half that of the first site).

Recommended change: Add a requirement that test sites have a minimum level of Dissolved Inorganic Nitrogen (DIN):

- We consider this would be desirable so as not to overestimate technology performance claims obtained from sites with high levels of particulate forms of nitrogen;
- We recommend a minimum DIN requirement of 25 to 40%, to be consistent with protocols for SQIDS enacted by the City of Gold Coast and other councils within the Sydney metropolitan area. As a comparison, the City of Gold Coast (2015) protocol “*Development Application Requirements and Performance Protocol for Proprietary Devices*” requires a minimum DIN of 40%.

No minimum performance standards for (i) number of aliquots and (ii) hydrograph coverage

SQIDEP requires “80% of field test collections should have at least 8 (aliquot samples) per event” – but includes no minimum number of aliquots required for the remaining 20%. The wording here is ‘should’ and not ‘must’ or ‘shall’. However, even if it was a mandatory requirement, up to 20% of included events could have less than 8 aliquots sampled (e.g. 1 of 2) – and subsequently up to 20% of events can be ‘junk data’ (or data that at least may not be representative of the sampled event). For context, what we mean by ‘junk data’ is data that does not meet a minimum performance standard that does not provide an accurate representation of water run-off quality that is simply included in the data set as it provides favourable performance outcome.

¹¹ DesignFlow (2015). *Development Application Requirements and Performance Protocol for Proprietary Devices on the Gold Coast*. Prepared for the City of Gold Coast (August 2015). Originally Prepared by DesignFlow. Peer Reviewed and Amended by E2DesignLab.

Similarly, for hydrograph coverage, SQIDEP requires that “at least 50% of qualifying storms should include the first 70% storm hydrograph coverage (or, for storms longer than 8 hours, capture of the first 8 hours).” Again, the wording here is ‘should’ and not ‘must’ or ‘shall’, and means that up to 50% of events (or more) could have less than 30% coverage (e.g. 1 or 2% coverage) – and again could be ‘junk data’.

This is particularly important when considering that the ability of any SQID to remove pollution is dependent on the flow rate entering (or flowing through) the SQID. Generally, the ability of any SQID to remove pollution increases with decreasing flow rate (and associated more time/ ability to remove pollution via treatment processes within the SQID). The documented laboratory test of a SQID shown in the webinar (see slides 17 and 18¹²) demonstrates this – with treatment performance increasing with decreased flow rate.

In the absence these (and other) minimum standards (combined with no requirement for sequential storm events), SQID manufacturers can readily select the results from events that, whilst indicate high stormwater treatment performance, may not be representative of the included event and ultimately real-world performance.

Recommended change: Change some sampling criteria to ensure minimums are met, including: (i) 100% compliance with minimum storm coverage; (ii) minimum of 50% hydrograph coverage; and (iii) minimum of eight aliquots per storm:

Additional recommended changes to SQIDEP

Other key recommended changes to SQIDEP include the following:

- Order the performance metrics in an appropriate hierarchy:
 - This is recommended to ensure that manufacturers cannot simply choose or argue the performance metric method for a particular data set that provides them the best result.
 - We recommend that if the ‘efficiency ratio’ (ER) and median ‘concentration reduction efficiency’ (CRE) differ by more than 10%, then use average ER and median CRE; and
- Add requirements and reporting for maintenance to ensure there is not a disconnect between system sizing and associated maintenance frequencies that can disproportionately skew performance claims.

¹² Climate (2017), NJCAT *Technology Verification Quality Assurance Project Plan Hydrosystem – Stormwater: Filtration Device*, <https://www.climateincorp.com/wp-content/uploads/2018/03/Climate-Hydrosystem-Quality-Assurance-Plan.pdf>

Verification & Governance

In Ocean Protect's view, technical changes to SQIDEP, the determination of the verification program, and the setting of application fees have not been undertaken in thorough consultation with either regulators or manufacturers. Ocean Protect understands Stormwater Australia's Secretary and President have elected to make these decisions themselves.

Again, submissions to Stormwater Australia from Stormwater NSW¹³ and Stormwater Queensland¹⁴ have requested conflicts of interest to be appropriately declared. However, to the best of our knowledge, this is yet to occur.

In these circumstances, in the course of critically evaluating the SQIDEP and its potential improvement, Ocean Protect encourages you to consider whether an actual or perceived conflict of interest exists for Stormwater Australia executives in the making of their decisions relating to the SQIDEP. Relevant enquiries might be:

- whether or not a Stormwater Australia executive owns an interest in a company that develops SQIDs; and
- whether or not a Stormwater Australia executive has previously provided professional advice or services in relation to field testing for any SQID manufacturer – and, if so, the content of that advice and to whom and when that advice was provided.

It is Ocean Protect's view that, in the interests of transparency and good corporate governance, Stormwater Australia's President and Secretary must disclose any circumstances that do or might give rise to an actual or perceived conflict of interest relevant to the development and implementation of the SQIDEP.

Consistent with the Washington State *Technology Assessment Protocol - Ecology* (TAPE program¹⁵) better known as the TAPE program, an appropriate validation framework is also required to support SQIDEP, including:

- **Scoring/weighting system** to discount/ reduce (if necessary) any non-compliances with given protocol (or other) requirements
- **Disclosure of reporting to competitors** allowing other SQID manufacturers to access reporting of SQID performance, recognising these individuals/ groups often have the necessary technical expertise and resources to review the reporting of other SQID manufacturers.
- **Thorough grievance process**, with documented procedures clearly outlining the actions/ steps that proponents can make if they are unhappy with the outcome from the review process.

¹³ Stormwater NSW, *Stormwater NSW comments and advice on SQIDEP* (sent to Stormwater Australia, 14 August 2019), <https://stormwaternew.asn.au/wp-content/uploads/2019/09/Stormwater-NSW-Comments-and-Advice-on-SQIDEP.pdf>

¹⁴ Stormwater Queensland, *Stormwater Queensland submission on the Stormwater Quality Improvement Evaluation Protocol* (sent to Stormwater Australia, 12 March 2020), <http://stormwaterqueensland.asn.au/wp-content/uploads/2020/03/SQ-SQIDEP-Submission-Final.pdf>

¹⁵ State of Washington Department of Ecology, *Emerging stormwater treatment technologies (TAPE)*, <https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Stormwater-permittee-guidance-resources/Emerging-stormwater-treatment-technologies>

Any verification statements provided as an output of the review process must also outline key items, including appropriate flow rates and efficiencies (and how these are appropriately modelled) and necessary maintenance requirements.

Clear advice is also required in relation to the validity period of the verification statement and what 'grandfathering' steps are required. For example, what happens to performances approved and determined under the existing protocol version if/ when subsequent versions are released (e.g. with minimum DIN or sequential storm requirements) ? To date, no information has been provided in this regard.

Does it really matter ?

Allowing the performance of SQIDs to be exaggerated will have a significant impact for the following reasons:

- Reduced size/ number of SQIDs required to achieve given stormwater pollution removal targets
 - This will also increase the hydraulic and pollutant load on these SQIDs, and subsequently increased likelihood of not functioning as per their original design intent.
- Increased pollution loads discharged to downstream waterways – as the SQIDs will simply provide a stormwater treatment function lower than claims approved under SQIDEP.

As an example, an example scenario by Ocean Protect was described (see slide 21, and illustrated in Figure 2, In this scenario, the number of StormFilter cartridges is changed to achieve local State Planning Policy pollutant load removal targets – with the number of cartridges required changing with varying claimed total nitrogen removal rates.

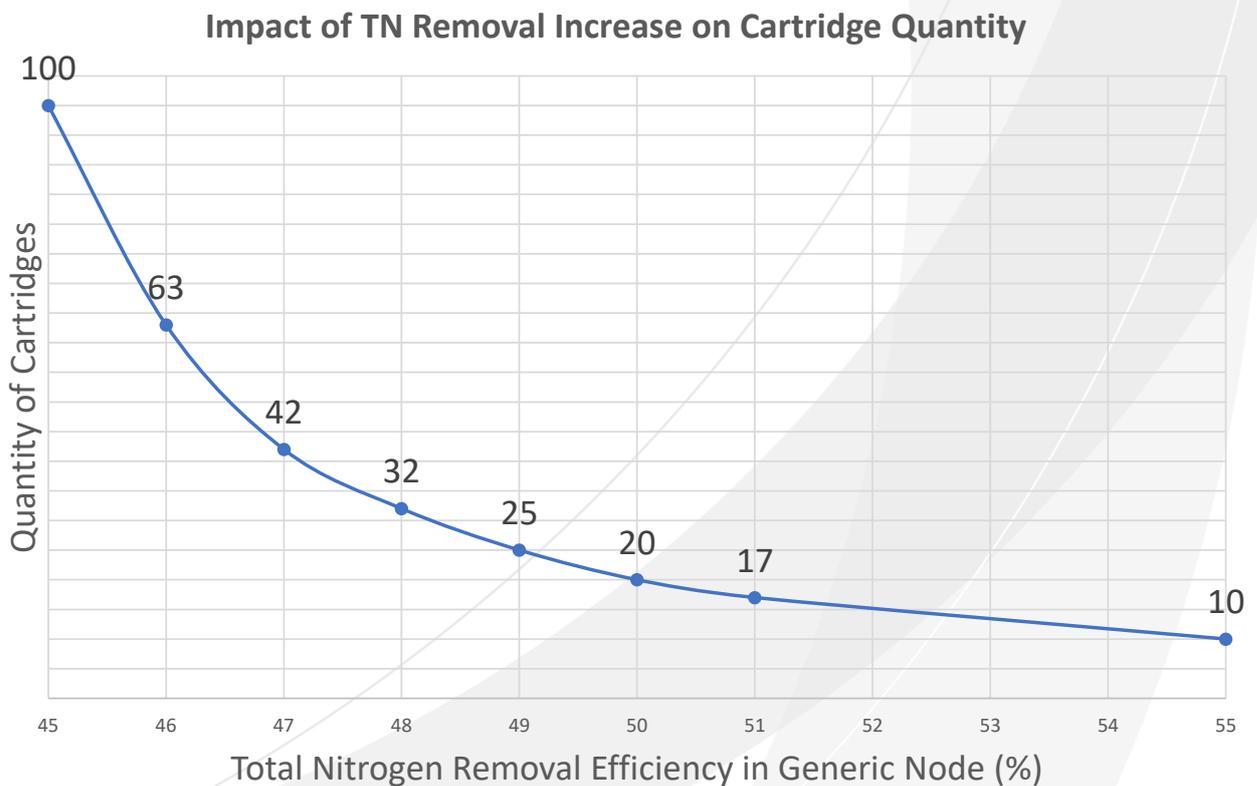


Figure 2 Graph of example scenario demonstrating how changes in total nitrogen removal efficiency would impact the number of StormFilter cartridges required to achieve State Planning Policy pollutant load removal targets

As described (in slide 21 and illustrated in Figure 2), the number of cartridges required decreases by 90% with only a 10% increase in assumed total nitrogen removal within the cartridge.

Where to from here ?

Stormwater NSW, Stormwater Queensland, Stormwater NSW, Healthy Land and Water, Melbourne Water, WaterNSW and a major local council have met to discuss their shared views and plan a way forward for SQIDEP¹⁶. This group has written to Stormwater Australia requesting to meet. However, to date, it is our understanding that Stormwater Australia has refused the requests of this group to meet and discuss.

In the absence of an appropriate protocol for the evaluation of SQIDs, our recommendation is to not utilise SQIDEP in its current form.

If you are reviewing the performance claims of SQID manufacturers, we recommend requesting the following information (with no distribution restrictions):

- Storm sequence log
- Individual storm reports
- Chain of custodies
- Lab reports
- Conflicts of interest declarations from all personnel involved (e.g. peer reviewers)

We recommend this information be reviewed by suitably qualified personnel, and Ocean Protect are happy to assist in this regard (recognizing that we have an obvious conflict of interest).

If you are a staff member from a regulator (e.g. local government), Ocean Protect also recommend your organisation consider adopting Blacktown City Council's SQID review process.

Blacktown City Council is Sydney's biggest Council and is recognised as an industry leader in stormwater management, and has developed various Council guidelines that are adopted by many other councils in NSW, many of which are available from their *Developers toolkit for water sensitive urban design*¹⁷.

Blacktown City Council has its own SQID review process, which is generally recognised as being typically appropriately thorough and fair and supported by suitably qualified personnel within Council, with the results (and associated SQID performance claims) adopted by many other Councils in NSW. Blacktown City Council is also the only Council in Australia that utilises the MUSIC-link module (within eWater's MUSIC software) that provides MUSIC treatment nodes for proprietary SQIDs, with performance claims as approved by Blacktown City Council – allowing proprietary SQIDs to be easily modelled in MUSIC by stormwater professionals (in accordance with their approved performance claims) and easily reviewed by regulatory authorities.

¹⁶ Stormwater Queensland, *A Way Forward for SQIDEP*, 26 June 2020, <http://stormwaterqueensland.asn.au/way-forward-sqidep/>

¹⁷ <https://www.blacktown.nsw.gov.au/Plan-build/Stage-2-plans-and-guidelines/Developers-toolkit-for-water-sensitive-urban-design-WSUD>