PFAS National Environmental Management Plan Version 2.0
All non-confidential submissions received

DEVELOPED BY THE NATIONAL CHEMICALS WORKING GROUP (NCWG) OF THE

HEADS OF EPAs AUSTRALIA AND NEW ZEALAND (HEPA)

List of submissions

Note that some formatting such as letterheads may not appear in this compilation.

Submission

31 May 2019

National Chemicals Working Group (NCWG)
of the Heads of EPAs Australia and New Zealand

Via email: PFASstandards@environment.gov.au

Dear Sir/Madam

Re: Consultation on Draft of Version 2 of the PFAS National Environmental Management Plan

The Queensland Farmers' Federation (QFF) is the united voice of intensive, semi-intensive and irrigated agriculture in Queensland. It is a federation that represents the interests of peak state and national agriculture industry organisations, which in turn collectively represent more than 13,000 farmers across the state. QFF engages in a broad range of economic, social, environmental and regional issues of strategic importance to the productivity, sustainability and growth of the agricultural sector. QFF's mission is to secure a strong and sustainable future for Queensland farmers by representing the common interests of our member organisations:

- CANEGROWERS
- Cotton Australia
- Growcom
- Nursery & Garden Industry Queensland (NGIQ)
- Queensland Chicken Growers Association (QCGA)
- Queensland Dairyfarmers' Organisation (QDO)
- Australian Cane Farmers Association (ACFA)
- Flowers Australia
- Pork Queensland Inc.
- Queensland United Egg Producers (QUEP)
- Queensland Chicken Meat Council (QCMC)
- Bundaberg Regional Irrigators Group (BRIG)
- Burdekin River Irrigation Area Irrigators Ltd (BRIA)
- Central Downs Irrigators Ltd (CDIL)
- Pioneer Valley Water Cooperative Ltd (PV Water)
- Theodore Water Pty Ltd.

QFF welcomes the opportunity to provide comment on the consultation draft (Version 2) of the PFAS National Environmental Management Plan. We provide this submission without prejudice to any additional submission from our members or individual farmers.

Background

In Australia, per- and poly-fluoroalkyl substances (PFAS) have been used for a long time in both consumer products and industrial applications and there are now PFAS contaminated sites resulting from these various uses, including from the use of firefighting foams that contained PFAS. Over time, the chemicals have worked their way across and through the soil to contaminate surface and groundwater and have migrated into adjoining land areas. PFAS are also present in our landfills and wastewater treatment facilities and more broadly in the environment. However; where, and at what concentrations is not well understood.

QFF understands that the consultation scope is restricted to the significant updates (shown in the draft document in yellow highlights).

Feedback

PFAS are a group of 'emerging contaminants' that, due to their chemical structure are resistant to biodegradation, atmospheric photooxidation, direct photolysis, and hydrolysis. PFAS are added to reduce the surface tension of various substances, which can also enhance their mobility in the soil and, as a consequence, increase the speed at which these compounds reach the groundwater (faster than any other hydrocarbon contaminants).

The persistence of PFAS in the environment, their surfactant properties and their moderate solubility means that they can be transported over long distances and effectively transfer between different media.

This current consultation draft unfortunately did not focus on the length of the Poly Fluoridated Compounds (PFC), which is a critical consideration as short chains are highly mobile (including in groundwater), while long chains have higher potential of bio-accumulation and sorption.

This draft considered the 're-use' of PFAS in solid materials such as soil. Soil is a complex matrix which is more complicated than a water or liquid environment. The PFAS NEMP must take this into account. As texture and organic matter content are critical factors affecting the containment or transfer of these organic pollutants, so the soil or solid material must be divided as 'Heavy' and 'Light' texture within the range of Organic Matter.

The type of plant or crop is important as some types of crop are counted as hyper or low accumulation and they may adsorb PFCs. In the absence of clear identification of PFC chains, soil texture, or organic matter, it may be problematic for farmers to beneficially use or re-use these materials (such as biosolids) in their soils. These are basic properties that must be accounted for across the Environmental Values within the plan.

QFF acknowledges the issues detailed in the 'Risk Sources' section (5.1, page 90), noting that it is easier to control the pollution at source rather than once distributed through another media. However, this raises concerns regarding the continued, permitted import and use of PFAS substances in Australia. This is despite recommendations from the Australian Government stating that "analysis suggests that ratification of the Stockholm Convention listing of PFOS and banning of all non-essential uses of PFOS would deliver the greatest net benefit to Australia"[1], acknowledging that this does not cover all PFAS materials.

Biosolids contain useful quantities of organic matter, and nutrients such as nitrogen (N), phosphorus (P) and potassium (K), and lead to improvements in soil characteristics such as improved microbial activities and oxygen consumption. They are an appropriate beneficial use of a resource, closing the 'nutrient

[1] Australian Government (2017). National phase out of PFOS Ratification of the Stockholm Convention amendment on PFOS: Regulation Impact Statement for consultation. Department of the Environment and Energy. October 2017. See Regulation Impact Statement summary, p3.

loop'. In the face of declining stocks of inorganic (rock) phosphate, biosolids will become an increasingly important source of fertiliser for the agricultural sector.

Queensland example

The End of Waste Framework provisions are contained under Chapter 8 and Chapter 8A of the *Waste Reduction and Recycling Act 2011* and aims to promote resource recovery opportunities and to transform the perception of waste from being waste to being valued as a resource.

The Queensland Government is currently reviewing its End of Waste Code for Biosolids. However, an early draft highlighted the confusion and interpretative differences between biosolids applications to land and biosolids use in composting.

The draft Code originally proposed testing requirements specifically for Total Organic Fluorine (TOF), related to the concerns around PFAS, reducing the required quality parameters from 19 to 16 (removing testing of Heptachlor, HCB and BHC). However, the reduction of TOF from 0.39mg/kg to 0.005mg/kg (a factor of 78 times reduction in limit) for maximum allowable soil concentrations is not appropriate and would immediately preclude the beneficial use of biosolids in agriculture.

For soils that already have PFAS contamination, which is widely unclassified and unknown, the low limit would have immediately excluded the use of biosolids on this land. Research has identified background levels of PFAS, particularly in agricultural soils adjoining development sites (commercial and housing) or where bushfires have occurred. The Queensland Government has acknowledged that 'PFAS are commonly found in the environment at low levels due to their wide-spread use in consumer and speciality products over many decades'.

Given the inadequacy of research and data in this area it is unlikely that biosolids will meet Grade A or B contaminant grade originally proposed by the Queensland Government. QFF has been advised by ALS Laboratories that their limit of detection for TOF is 0.05mg/kg – ten times higher than the proposed initial limit resulting in all biosolids and soils considered to be in excess of the TOF limit even if there is no actual fluorine present.

In contrast, biosolids sent for co-composting may be subject to Environmental Authority conditions (under Queensland's *Environmental Protection Regulation 2008*) which do not require the testing for PFAS and upon cessation of the composting process only have to meet Australian Standard 4454 which does not include testing requirements for these compounds.

QFF continues to work with the Queensland Government to find a workable solution to beneficially use biosolids and composts in agriculture as appropriate. However, it is QFF's position that the control of pollutants must be at point source (import and use, and discharge to sewer) rather than allowing the contamination of a large volume of beneficial resource which is becoming increasingly vital to restore soils and soil nutrients. This is simply dilute and disperse.

QFF also notes that whilst Perfluorooctane sulfonate (PFOS) and Perfluorooctanoic acid (PFOA) have not been banned in Australia, but rather phased-out and replaced by 'newer' chemicals with increased degradation times, we must be vigilant to ensure that these new compounds and their intermediary products do not adversely impact human and environmental health. If there are any queries on this submission, please do not hesitate to contact Dr Georgina Davis at georgina@qff.org.au.

Yours sincerely

Travis Tobin
Chief Executive Officer

AUSTRALIAN AIRPORTS ASSOCIATION

PFAS NEMP Coordinator
c/o Emerging Contaminants Section
Department of the Environment and Energy
GPO Box 787
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Via email: PFASstandards@environment.gov.au

Re: Draft NEMP 2.0 Consultation Feedback

The Australian Airports Association (AAA) welcomes the opportunity to provide feedback to both the Department of Environment and Energy (DoEE) and the National Chemicals Working Group (NCWG) on the Draft PFAS National Environment Management Plan (NEMP) version 2.

The AAA is the national industry voice for airports in Australia. The AAA represents the interests of more than 300 airports and aerodromes Australia wide; from local country community landing strips, to major international-gateway airports. The AAA's members include not just the major capital-city airports, but also those airports and aerodromes dotted throughout regional Australia.

As the DoEE and NCWG will be aware, issues arising from the historical use of PFAS are of concern to members of the public, areas of government at all levels, airlines and, naturally, Australian airport operators. For the purposes of this submission, the AAA's main concern is the impact of PFAS matters on its airport members.

This submission seeks to highlight common issues among airports in the application of the NEMP, as well as provide an illustration of the overarching context in which the NEMP operates from an airport perspective. While the latter does not address the Draft NEMP directly, it needs to be acknowledged that the NEMP does not operate in a vacuum. That context needs to inform the NEMP, just as much as its content affects the environment it operates in.

CONTEXT

By way of establishing some of that context, the AAA has worked closely with its members over several years to gain an understanding of how airports are managing and responding to PFAS issues. Through the course of this engagement it has become clear that airports are taking a very proactive role in addressing PFAS issues, most notably in the absence of a clear regulatory framework and satisfactory action from responsible polluters.

While airports are not the responsible polluters that have caused historical PFAS contamination, they recognise the genuine stakeholder concerns for human health and environmental impacts. This has seen airports act upon their social and corporate responsibilities to undertake activity such as; extensive PFAS

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Against that background, airports have increasingly; been compelled to adopt PFAS management plans into their Master Plans (MPs) and Major Development Proposals (MDPs); needed to be vigilant for changes in PFAS-level-environmental-significance triggers; been left to determine PFAS management strategies for adoption by their tenants; and, with assistance from the AAA, sieve through a confusing regulatory environment in search of certainty and remedy.

It also needs to be acknowledged that changes to the NEMP have the potential to harbour significant impacts in airport's operational and management requirements for their construction and maintenance activities. Additionally, due to the variance in airport locations, their environmental settings and the character of their surrounding areas, several airports are subject to numerous potential off-airport PFAS contamination sources travelling onto airport sites. Some of those surrounding areas are those that have existing levels of PFAS; some of which may be significant.

Common Issues

The NEMP provides guidance on critical parts of an airport's environment strategies, as well as on their compliance with legislation and regulation. The NEMP has become the primary source of guidance for PFAS management at a national level. Some of the AAA's members report, however, that the application of the NEMP is inconsistent across jurisdictions.

The NEMP regularly refers to the need to engage, or consult with, the relevant environmental regulator for guidance. That can be problematic where jurisdictional regulators have limited experience and / or knowledge in relation to PFAS management; including site assessment, risk assessment and waste management. This is particularly relevant for soil reuse on Commonwealth land, as there is no other potential source for an 'unrestricted use' criterion, for which the NEMP refers back to state-based guidance, which is not applicable to Commonwealth regulated land.

In that connection, some of the AAA's members also report that there is a lack of clarity in the advice regarding soil re-use, with some contradictions and / or requirements that are not reasonable or practicable. For example, the NEMP requires a risk assessment for all situations where soil is being disturbed and the soil leachate is above the 99 per cent species protection criteria. In most cases that is not reasonable, or practical, in the context of the works being undertaken.

The AAA suggests that consideration be given to adopting the 95 per cent species protection criteria as triggering a risk assessment for soil leachate. Also, the ability to re-use soils in areas where the material has PFAS concentrations (in soil or leachate) that are equal to, or lower than, the destination-site soils needs to be clarified as being acceptable, without the need to conduct a risk assessment.

Noting the above, the AAA also suggests that the NEMP could be improved by providing further guidance and clarity on the classification -- and subsequent implications on the potential for reuse – of PFAS contaminated materials.

The AAA also recommends that the National Chemicals Working Group publish the detailed assumptions and calculations used to develop the human health and ecological guidelines presented in NEMP 2.0. Doing so would assist airports in implementing NEMP by clarifying land use activities, exposure scenarios and assumptions used in developing those guideline values.

While the NEMP allows for consideration of background concentrations, it would also be useful to include further guidance on typical background levels in urbanised settings. Users of NEMP 2.0 would benefit from guideline values that consider ambient PFAS concentrations in urban catchment areas, in addition to clearer details on the process or method to be applied to incorporate ambient concentrations in the development of site-specific criteria.

Conclusion

The AAA acknowledges the value that the NEMP provides by being a primary source of national guidance on PFAS management for a range of stakeholders. However, in a broader policy context, the AAA believes the NEMP would benefit from better reflecting an awareness of the practicalities and realities of how airports (and other key impacted industries) are impacted by various aspects of the plan. This is particularly relevant for the 21 airports across Australia that operate on leased Commonwealth land, which provides for the added complexity of managing both Commonwealth and State environmental obligations. The AAA fully supports a more closely integrated national solution to managing PFAS, which acknowledges and addresses the current regulatory complexities.

I would welcome the opportunity to discuss any of these issues with you further and should you have any questions, please do not hesitate to contact me via Colin Duckworth (Policy Manager, AAA) on 02 6230 1110 or cduckworth@airports.asn.au.

Yours sincerely,

[redacted]

Caroline Wilkie

Chief Executive Officer

21 June 2019

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Via email: pfasstandards@environment.gov.au

QANTAS SUBMISSION TO THE PFAS DRAFT NATIONAL ENVIRONMENTAL MANAGEMENT PLAN – VERSION 2

Qantas Airways Limited (Qantas) appreciates the opportunity to provide comment on the Heads of EPAs Australia and New Zealand (HEPA) Per-and polyfluoroalkyl substances (PFAS) National Environmental Management Plan (NEMP), version 2 consultation draft. The following comments reflect Qantas' experience with managing historical aqueous film-forming foam (AFFF) stocks and residual PFAS issues.

As a representative of industry, it is Qantas' opinion that the PFAS Draft NEMP version 2 would benefit from further discussion related to residual PFAS within containment vessels and/or associated pipe work (potential secondary sources of PFAS). It is noted that Section 12 of the PFAS NEMP version 2 provides guidance on the re-use of PFAS-contaminated materials, particularly soil and water. Qantas believes this section would benefit from pragmatic guidance on residual PFAS assessment and treatment options to promote the minimisation of waste (in line with the waste hierarchy) and adoption of non-PFAS containing solids, liquids or foams within industry.

Section 8.2.3 of the PFAS Draft NEMP version 2 discusses the potential development of default guidelines for specific catchments. Are there plans for background concentration data to be published by regulators and incorporated into future versions of the PFAS NEMP? Qantas considers the publications of background concentration data to be beneficial to industry for the assessment of risk and to provide a context for future PFAS site assessment.

Section 12.1 of the PFAS Draft NEMP version 2 indicates that the re-use of PFAS soil must meet both the total and leachable concentrations outlined in Tables 2, 3 and 5. The limit of reporting (LOR) of commercial laboratories are currently higher than the interim fresh and marine water guideline for Perfluorooctane sulfonate (PFOS) of 0.00023 µg/L (99% species protection). Therefore, the decision tree outlined in Section 12.1.1 would never permit the re-use of soils, whether they contain PFAS or not, as compliance with guideline values cannot be determined. Qantas recommends that this guidance is revisited to take into account the limitations of commercial laboratories, while ensuring that human health and the environment are protected.

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Section 14.6 of the PFAS Draft NEMP version 2 discusses the use of Australian Standard Leaching Procedure (ASLP) for waste classification. While the section acknowledges that the approach individual jurisdictions take may differ, Qantas suggests that the PFAS NEMP version 2 should discuss the implications of using either ASLP and/or Toxicity Characteristics Leaching Procedure (TCLP) to classify waste. As an example, Qantas understands that the New South Wales Environment Protection Authority require TCLP analysis for waste classification, whilst the PFAS Draft NEMP version 2 provides ASLP guidelines only.

Section 15 of the PFAS Draft NEMP version 2 indicates that further guidance will be developed for wastewater. It is Qantas' opinion that the development of trade waste criteria is completed as a priority to provide industry with clarity around disposal options and costs regardless of jurisdiction and/or waste collection provider.

Your sincerely,

[redacted]

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Qantas Airways Limited

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28 June 2019

PFAS NEMP Coordinator
c/o Emerging Contaminants Section
Department of the Environment and Energy

PFASstandards@environment.gov.au

cc. Ms Pip Spence
Deputy Secretary
Department of Infrastructure, Transport, Cities and Regional Development

Pip.spence@infrastructure.gov.au

To Whom it May Concern

Submission on PFAS Draft NEMP Version 2

I refer to the *PFAS National Environmental Management Plan Version 2.0 Consultation Draft* (PFAS NEMP) which is open for public consultation and thank you for the opportunity to comment on this instructive guideline.

At Canberra Airport, we routinely refer to the PFAS NEMP. The historical use of PFAS containing fire-fighting foams by Airservices and its predecessors has meant PFAS is now listed on our contaminated site register at Airservices' leased sites. The Australian Government has also pushed for investigations regarding PFAS to be undertaken more broadly across the airport site, and indeed we understand the ACT and NSW Governments consider the whole airport site to be contaminated with PFAS.

Our PFAS investigations, whether for water monitoring or soil assessments for on-airport developments has revealed conflicting or inconsistent interpretations of the PFAS NEMP and tolerances for PFAS levels by governments. Unfortunately, as a result of this ambiguity there has often been the requirement of high cost and time-consuming risk assessments, the only outcome of which has been the required "acceptance of risk" on the part of the airport for on-airport stockpiling.

The first PFAS guidance was released by Airservices in 2015 *Managing PFC Contamination at Airports*, and also in 2015 the then Department of Infrastructure and Regional Development released the *Guideline for Environmental Management – PFC*. It was the case then and it remains the Australian Government approach to require risk assessment.

Since this time meaningful Australian Government PFAS guidance has failed to progress in two key areas, the actual known and agreed human and ecological risk of PFAS, and secondly clear and agreed pathways to reusing or disposing soil with PFAS trace. There is still no evidence that an ecological criterion should be more stringent than a human health criterion, and there is no evidence presented that in the 40 years since PFAS was first introduced to Australia it has amounted to an adverse impact on the environment.

Canberra Airport Pty Limited ABN 14 080 361 568
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The focus remains on case-by-case risk assessment. Risk assessments by environmental experts, for reuse, for stockpiling and risk assessments for the signoff by regulators. Risk assessments can be costly, time consuming and it is uncertain if they achieve the right outcome (or in some cases any outcome!). We all need firm guidance.

Waste classification and disposal of soil with PFAS trace is the pointy end of infrastructure projects, and where disposal is available it is insanely expensive. Further work needs to be done on bringing the price down and opening up additional waste facilities that accept soil with PFAS trace. To help this along it would be useful for all jurisdictions to require uniform PFAS testing in soil, or in the alternative national acceptance of land uses where PFAS testing is not required.

Regardless of testing results the ACT Government will not accept soil from the airport site, leaving only high cost transfer to NSW waste facilities as an option for export which even for small jobs, and trace detections of PFAS, adds hundreds of thousands of dollars to a project. Just to reiterate, the ACT Government will not accept any soil from the airport even if no PFAS has been detected!

The PFAS NEMP touts the support of each state and territory environment protection authority (EPA) in Australia and therefore that it provides national guidance, and yet it is clear in practice no EPA agrees entirely with its provisions. This is a big public interest problem which is causing increasing uncertainty about how and where soil from development projects will be managed, rising significant costs and time delays and jeopardising infrastructure investment.

Canberra Airport contends that all soil on the airport site is not polluted or contaminated. It is actually likely, considering the historical use(s) of the airport and our PFAS soil results, that (aside from those areas leased by Airservices) airport soil is no more contaminated with PFAS than other developed areas of our city and region. Yet little is known about the levels of PFAS in soil in surrounding jurisdictions. For instance, Capital Property Group (of which Canberra Airport is a related body corporate) is currently constructing two large office developments in Canberra City known as "Constitution Place".[1] However bulk excavation at Constitution Place has not been required to undergo PFAS investigation.

There is no evidence to support the general assumption of regulators that the Canberra Airport site is polluted or contaminated with PFAS. Indeed, no soil tested across the airport site for PFAS (with the exception of the Airservices leased sites) has exceeded the existing NEMP interim soil ecological indirect exposure guidance value for industrial/commercial land use PFOS 0.140mg/kg. The hundreds of soil results gathered from landside and airside locations range from non-detect to the single highest reading of PFOS 0.083mg/kg (PFOA has not been found above 0.005mg/kg).

[1] Constitutionplace.com.au

To achieve some perspective on actual likely "pollution" - as opposed to detection - we recommend the closer coupling of the PFAS NEMP with the National Environment Protection (Assessment of Site Contamination) Measure 1999 (NEPM) be explored, in particular in respect of Schedule A of the NEPM and triggers for assessment (both on and off an airport site).

Human Health & Ecological Guideline Values

We note the proposal in the PFAS NEMP to decrease the ecological indirect exposure guidance value from the existing PFOS 0.140mg/kg for industrial/commercial land uses, to PFOS 0.01mg/kg for all land uses. We note further the provision in the PFAS NEMP to consider this revised guidance value in terms of the potential degree of indirect exposure, possibly with a view to returning the guidance value back to PFOS 0.140mg/kg. As is currently proposed the onus is on, in our case the airport operator, to make the case (how and to whom is not clear) that the existing value or assumedly somewhere in between is more relevant for the site. It should therefore be made clear in Table 3 of the PFAS NEMP that the guidance value PFOS 0.01mg/kg is in fact not applicable to all land uses, but rather to ecologically sensitive environments and provide examples (i.e. non-urban areas), and the industrial/commercial level should remain at PFOS 0.14mg/kg. We need more clarity, not less.

We seek confirmation to be reflected in the PFAS NEMP that a land use soil result for industrial/commercial sites below PFOS+PFHxS 20mg/kg for human health is deemed to be not polluted or contaminated.

Disposal & Stockpiles

Canberra Airport will soon run out of space for on-airport stockpiling.

Table 6 of the PFAS NEMP specifies landfill acceptance criteria for unlined and lined facilities ranging from 20mg/kg (leachable component 0.7µg/L) to 50mg/kg (leachable component 7.0µg/L) PFOS+PFHxS. In contrast to these levels however, the ACT and NSW Governments do not permit PFAS materials at landfill facilities anywhere near what is provided by the PFAS NEMP and we believe this should be clarified and corrected.

We note the newly proposed stockpiling provisions in section 10 of the PFAS NEMP specify that the stockpiling of soil with a PFAS component below 50mg/kg should be "proportionate to the level of risk." Timeframes for storage and volumes of soil are offered as relevant in determining the level of risk for a stockpile (and associated mitigation treatments) however considering the relevant broad range from 0.01mg/kg to 50.00mg/kg we would suggest that it is also relevant to consider the actual level of PFAS detected. More guidance about determining the level of risk for stockpiling specifically (as opposed to reuse or land use) needs to be provided to avoid varied interpretations and instances where stockpiles are unreasonably required to adopt extensive design criteria.

It is also important to point out on the matter of stockpiling and PFAS management, there is a great inconsistency between treatment of stockpiling of soil on- airport and off-airport, which is exampled by the varied requirements between jurisdictions to test for PFAS in the first instance.

In terms of water, we have in the past asked for criterion for stormwater and irrigation water, and we would value an update on progress in this regard please. Further, in September 2018 we supported the National Health and Medical Research proposal to increase the recreational water criterion from 0.7µg/L to 2µg/L, and we would appreciate your insight into how this is progressing.

In summary, Canberra Airport makes the following comments about the PFAS NEMP:

- There is no evidence presented that an ecological criterion should be more stringent than a human health criterion. Accordingly, soil conditions (likely or known) below the industrial/commercial human health level PFOS+PFHxS 20mg/kg should be deemed not polluted or contaminated for industrial/commercial land uses.

- There is no evidence presented that in the 40 years since PFAS was first introduced to Australia it has amounted to an adverse impact on the environment. In any case, the PFAS NEMP should specify that soil conditions below PFOS 0.140mg/kg for commercial/industrial land uses are not polluted or contaminated.

- All jurisdictions should require uniform testing of PFAS in soil or in the alternative national acceptance of land uses where PFAS testing is not required. The PFAS NEMP should be more closely aligned with the NEPM, particularly in terms of triggers for assessment. Further, soil disposal should be more widely available and reasonably priced, but in any event the PFAS NEMP should only provide landfill and waste standards as accepted by EPAs.

- Stockpiling design requirements and the "risk" measure should be clarified in the PFAS NEMP. Pragmatism towards extraneous elements of stockpiling design should be encouraged.

- Please share further information about the pathway to clarity and finalising PFAS direction nationally and locally.

Should you wish to discuss this submission I can be contacted on (02) 6275 3366 or via email at m.thomson@canberraairport.com.au.

Yours sincerely

[redacted]

Michael Thomson
Head of Aviation

06 June 2019

PFAS NEMP Coordinator
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Via email: PFASstandards@environment.gov.au

Dear PFAS NEMP Coordinator

Re: Draft NEMP 2.0 Consultation Feedback

On behalf of Sydney Airport, we would like to acknowledge the National Chemicals Working Group (NCWG) for its efforts in preparing the PFAS National Environmental Management Plan (PFAS NEMP). The PFAS NEMP provides important guidance to support a consistent approach to the management and regulation of the emerging contaminant PFAS. We appreciate the opportunity to provide feedback on the Version 2.0 Consultation Draft of the NEMP (the PFAS NEMP 2.0).

1. Sydney Airport

Sydney Airport is located approximately eight kilometres south of Sydney's central business district on a 907 hectare site owned by the Australian Government. Sydney Airport represents one of Australia's most important pieces of infrastructure, acting as Australia's primary international gateway, an essential part of the country's transport network, and making a significant contribution to the local and national economies.

Sydney Airport is the airport lessee company under the Commonwealth *Airports Act 1996* and is responsible for operating and managing activities at Sydney Airport to deliver a world-class airport experience for customers. Sydney Airport's priority is to deliver the highest levels of safety for our staff, passengers, contractors, stakeholders and the community, and to ensure that Sydney Airport is operated sustainably by minimising impacts on the local environment. To achieve these goals Sydney Airport is committed to working collaboratively with our tenants, stakeholders, regulators and the local community to ensure that PFAS contamination at Sydney Airport is safely managed. Sydney Airport has adopted the precautionary principle in respect of the use and management of PFAS-containing products at Sydney Airport, including by requiring tenants to phase out the use of PFAS-containing products and chemicals, undertaking a comprehensive analysis of PFAS contamination at the airport, and requiring polluters to develop plans for remediation. Further information regarding Sydney Airport's expectations regarding the management of PFAS is available via: https://www.sydneyairport.com.au/corporate/sustainability/environment/managingpfasatsydneyairport.

2. Importance of PFAS NEMP

As with most major airport and aviation facilities, known sources of PFAS contamination exist at Sydney Airport, largely resulting from the historical storage and use of PFAS-containing fire-fighting foams and other products by tenants of the airport. In addition, heavily urbanised and industrialised areas such as Botany Industrial Park and Port Botany, and major waterways such as the Cooks River and the Alexandra Canal that surround Sydney Airport, represent other potential sources of PFAS contamination.

As the airport operator, Sydney Airport recognises its responsibility in working with its tenants, stakeholders, the local community and the State and Commonwealth Governments on a long-term management strategy for PFAS contamination at Sydney Airport. Within this context, the PFAS NEMP provides the necessary basis for a transparent and consistent approach to managing PFAS contamination across multiple jurisdictions and amongst a rapidly developing scientific understanding.

To meet the needs and demands of those who use the airport, Sydney Airport and its tenants undertake an ongoing program of building and construction, and facilities maintenance and upgrade works. These works often involve ground disturbance and water management activities that require consideration of potential impacts to human health and the local environment. To effectively evaluate, assess and manage such impacts, Sydney Airport has a formal approvals process for construction and development activities that have the potential to impact the environment. This development approvals process, described in the Sydney Airport Environmental Strategy 2019-2024 (available via: https://www.sydneyairport.com.au/corporate/planning-and-projects/master-plan), provides Sydney Airport with the opportunity to assess the health, safety and environmental impacts from construction and development activities at Sydney Airport, including consideration of PFAS contamination. Sydney Airport has adopted and implemented the PFAS NEMP and its guiding principles in its development approvals process to ensure PFAS contamination is considered, and, where present, managed in accordance with the PFAS NEMP.

3. Opportunities

The PFAS NEMP provides a transparent and consistent basis for the management and regulation of PFAS contamination throughout Australia. The PFAS NEMP also provides Sydney Airport with sound guidance to support our environmental strategy and meet our commitments and regulatory obligations. Given its importance, Sydney Airport has identified the following opportunities for consideration by the NCWG in the finalisation of the PFAS NEMP 2.0 that would further assist Sydney Airport, and other major landowners and operators of critical infrastructure, to ensure the appropriate management of PFAS contamination.

- **Derivation of Guideline Values**

  Sydney Airport requests that NCWG publish the detailed assumptions and calculations used to develop the human health and ecological guideline values presented in the PFAS NEMP 2.0. Such information would assist Sydney Airport in implementing the PFAS NEMP by clarifying the land use activities, exposure scenarios and assumptions used in developing the guideline values, allowing Sydney Airport to determine the relevance and applicability of these values to Sydney Airport and the need (or otherwise) to undertake site-specific assessments.

- **Background PFAS Contamination**

  Acknowledging the need to provide guidance and guideline values for the full spectrum of site settings and land use scenarios, many users of the PFAS NEMP are responsible for managing and regulating PFAS contamination in urbanised and developed areas where PFAS is present as a result of numerous diffuse and point sources. Due to its location, environmental setting and the character of surrounding areas, Sydney Airport is subject to numerous potential upgradient and catchment-wide PFAS contamination sources.

  Whilst the PFAS NEMP allows for consideration of background concentrations, Sydney Airport requests that further guidance be provided regarding typical background levels of PFAS in urbanised settings in order to appropriately evaluate and manage the impacts of PFAS contamination. Users of the PFAS NEMP 2.0 would benefit from guideline values that take into account ambient PFAS concentrations in urban catchment areas, and/or clearer details on the process or method to be applied to incorporate ambient concentrations in the development of site-specific criteria.

- **Classification and Re-use of PFAS-contaminated Materials**

  The PFAS NEMP 2.0 could be improved by providing further guidance and clarity on the classification, and subsequent implications on the potential for re-use, of PFAS-contaminated materials. The relationship between trace concentrations of PFAS in soils, and the definitions of Virgin Excavated Natural Material (VENM) or Excavated Natural Material (ENM) that are commonly adopted in construction and development projects, requires clear definition to be of use for landowners, managers, contractors, consultants and regulators. As currently written, strict application of the PFAS NEMP 2.0 is likely to render all excavated materials, regardless of their source location and likelihood for PFAS to be present, to be considered PFAS-contaminated and unavailable for re-use. In particular:

    - Sydney Airport requests that the PFAS NEMP 2.0 include clear guidance as to whether the presence of PFAS (as detected by an analytical laboratory) in soils, in leachate from soils, or in groundwater known to be in contact with soils, automatically disqualifies the soils from being classified as VENM or ENM. The classification of spoil as PFAS-contaminated, VENM or ENM, and the criteria used to determine such classification, has significant implications on construction and development activities at Sydney Airport, and potentially on construction and development projects throughout Australia.

    - Taking into account the freshwater and interim marine default guideline values for PFOS (0.00023 μg/L for 99% species protection), and the acknowledged limitation for analytical laboratories to report such concentrations, all materials would be classified as PFAS-contaminated. In the absence of improved laboratory detection limits, the decision tree presented in Figure 1 of Section 12.1.1 would never permit re-use of soil materials, regardless of whether PFAS is detected in soil samples or not, as the leachate criteria would always be exceeded.

    - The decision tree presented in Figure 1 of Section 12.1.1 does not correlate with the preceding paragraph that states ‘a preliminary screening risk

assessment may be acceptable… where PFAS concentrations in the material can be demonstrated to be lower than background concentrations of PFAS in and around the proposed re-use location.' The decision tree does not consider background concentrations of PFAS (decision 4D) until after assessment against the human health and ecological guideline values (decisions 3A, 3B and 3C). As a result, no site with background PFAS concentrations that exceed the human health and ecological guideline values provided in the PFAS NEMP 2.0 would be able to accept PFAS-contaminated materials for re-use, even if PFAS concentrations in the re-use material were below those in the destination location. This outcome does not align with the stated principle that re-use of PFAS-contaminated materials must not lead to 'an increase in the level of risk at or near the location in which it is used' (Section 12, PFAS NEMP 2.0).

- Given the scenarios described in the previous dot points in relation to the decision tree presented in Figure 1 of Section 12.1.1, Sydney Airport considers these outcomes not to be practical or reasonable for a risk-based evaluation of the suitability of PFAS-contaminated materials for re-use.

- **Review Program**

  The PFAS NEMP 2.0 indicates that a formal review of the plan will be undertaken every five years, with more frequent informal reviews to be undertaken as needed. Recent stakeholder engagement sessions on the PFAS NEMP 2.0 also identified that further development of the plan will take place throughout 2019.

  Changes to the PFAS NEMP may have significant impacts on operational and management requirements for construction and maintenance activities at Sydney Airport, including time and cost implications for major investment decisions such as facility and infrastructure upgrades. The PFAS NEMP 2.0 included revisions to selected environmental guidelines values for PFOS, PFOA and PFHxS that were not nominated in the future work section of PFAS NEMP 1.0. Such unexpected updates to guideline criteria will have significant impacts on Sydney Airport's strategic and long term planning requirements, including investment programs and cost forecasting, in a similar manner to other major landowners and infrastructure operators. Sydney Airport would appreciate if the NCWG could provide clearer guidance on the planned frequency and scope of the informal reviews identified in Section 21 of the PFAS NEMP 2.0.

  The PFAS NEMP 2.0 adopts the precautionary principle, however, currently lacks guidance on the development of triggers and goals for remedial works or management actions. The review program should incorporate remedial planning guidance in future versions, particularly as new and emerging remedial technologies become available. Sydney Airport would support further clarity on site prioritisation for remediation through the development and inclusion of framework in future versions.

As noted above, Sydney Airport supports the development and implementation of the PFAS NEMP to provide a transparent and consistent basis for the management of PFAS contamination in Australia. We appreciate the opportunity to provide comment on the PFAS NEMP 2.0, and the willingness of the NCWG to consider the opportunities identified herein to provide further information and guidance.

Yours sincerely

Hugh Wehby
Chief Operating Officer

cc: Julie Coughlan, Airport Environment Officer, Aviation and Airports DIRDC
Lachlan Phillips, Director PFAS Taskforce, Aviation and Airports DIRDC

Queensland Airports LIMITED

Draft NEMP 2.0 Consultation Feedback
PFAS NEMP Coordinator
c/o Emerging Contaminants Section
Department of the Environment and Energy
GPO Box 787
Canberra ACT 2601Department of the Environment and Energy
Via email: PFASstandards@environment.gov.au

21/06/2019

Draft PFAS National Environmental Management Plan 2.0 – Queensland Airports Limited Submission

To whom it may concern,

Thank you for the opportunity for Queensland Airports Limited (QAL) to provide feedback on the 'PFAS National Environmental Management Plan Version 2.0 Consultation Draft' dated March 2019 as published by the Heads of EPA Australia and New Zealand (HEPA), herein referred to as the 'NEMP 2.0'.

QAL operates Gold Coast, Townsville, Mount Isa and Longreach airports. Feedback provided in this correspondence reflects the key points affecting operation and development at these airports.

This submission has been prepared by QAL staff with input from Arcadis Australia Pacific Pty Ltd (Arcadis) who are recognised both nationally and globally for their expertise in the management of PFAS.

Arcadis staff having provided input into this submission include:

- Victoria Lazenby, Associate Technical Director – Specialist in risk assessment and site investigations for PFAS; and
- Peter Storch, Associate Technical Director – Specialist in remediation and management of PFAS.

QAL supports the review process being undertaken by the National Chemicals Working Group on behalf of HEPA and recognises the progress made to address gaps in the management framework for PFAS contamination.

The science-based approach adopted in developing the NEMP is largely supported. However, its application for managing soil and fill containing trace concentrations of PFAS requires review as it is not practicable and poses a significant administrative and financial burden. This is a key focus of the comments below and in the attached.

Key points regarding the NEMP 2.0 in relation to impacts to airport operations and development are provided below. Detailed comments are provided in Attachment 1.

1. Risk Assessment – the term 'risk assessment' is used continuously throughout the NEMP 2.0, often in the context of variable types of risk assessment (e.g. qualitative vs quantitative). There is little accompanying explanation regarding the expectations related to each type of risk assessment. Definitions for each type of risk assessment (e.g. site-specific, preliminary, preliminary screening, etc) required to avoid confusion. Further detail regarding the scale of the risk assessment works required at each stage should also be provided.

   As the NEMP 2.0 currently stands it requires a risk assessment for all situations where soil leachate is above 99% species protection criteria. When applied, a risk assessment is required for most maintenance and construction activities involving soil disturbance posing a significant administrative and logistical burden on QAL and impacts the financial viability and timely delivery of airport projects.

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This in turn impacts on the local economy, airport users and the community.

A more reasonable position should be adopted to limit this financial, administrative and economic impact. This includes considering adoption of the 95% species protection criteria as triggering risk assessments for soil leachate.

Also, application of the NEMP is often inconsistent across jurisdictions further impacting the financial viability and competitiveness of development on airport sites vs off airport sites.

2. Soil Re-use – there is lack of clarity in the advice regarding soil re-use, with some contradictions and / or requirements that are not reasonable or practicable. The comments attached provide further specific detail, and the following key points are emphasised:
   i) As noted under item 1, the NEMP requires a risk assessment for all situations where soil is being disturbed and the soil leachate is above 99% species protection criteria. In most cases this is not reasonable or practicable in the context of the works being undertaken.
   ii) Also noted under item 1, consideration should be given to adopting the 95% species protection criteria as triggering a risk assessment for soil leachate. The ability to re-use soils in areas where the material has PFAS concentrations (in soil or leachate) that are equal to or lower than the destination site soils should also be clarified as acceptable without a risk assessment.

   The need for a reasonable and practicable process for managing soil reuse, including establishing clean fill criteria, was a key item raised in QAL's submission on the 'PFAS National Environmental Management Plan – Consultation Draft, August 2017' and still remains as a key issue needing to be addressed in the NEMP 2.0.

3. Environmental regulators – the NEMP regularly refers to the need to engage with or consult the relevant environmental regulator. This may be problematic where regulators have limited experience and/or knowledge in relation to PFAS management including site assessment, risk assessment and waste management.

The NEMP is therefore the primary source of guidance for PFAS management in these cases and it is emphasised that the NEMP needs to be clarified to avoid any ambiguities that are dependent on regulator advice. This is particularly relevant for soil reuse on Commonwealth land as there is no other potential source for an 'unrestricted use' criterion, for which the NEMP refers back to state-based guidance that is not applicable to a Commonwealth regulated land.

I hope the above and attached feedback is useful and trust it will be given due consideration in finalising NEMP 2.0.

Please contact Norbert Benton, Gold Coast Airport Environment Manager, on 07 5589 1108 / [redacted] if you have any questions or require any further information.

Thank you again for the opportunity to provide comment. We would be pleased to engage further on the matter if required.

Yours sincerely,

[redacted]

Chris Mills
Chief Executive Officer

Attachments: Appendix A - PFAS National Environmental Management Plan Version 2.0 Consultation Draft, Queensland Airports Limited Detailed Submission.

Appendix A

Queensland Airports Limited
Detailed Submission

PFAS National Environmental Management Plan
Version 2.0 Consultation Draft

SECTION	PAGE	NEMP V2 STATEMENT	COMMENT	RECOMMENDED CHANGE
Section 8				
8.0			There is still a desire for the NEMP to provide guidance and a criterion to identify soils which contain low or background levels of PFAS and could be considered as 'unrestricted' or suitable for fill. Whilst this may be provided elsewhere in some jurisdictions, the airport regulator (or any Federal government land regulator) relies solely on the NEMP as the guidance for assessment and management of PFAS impacted soil and water. Currently soil with a PFAS concentration above LOR is treated as contaminated waste, even if below all HBGVs and EGVs.	The HEPA should consider setting guidelines for placement or movement of soil in low risk scenarios, to provide national consistency and assist Federal land regulators. Minimum requirements for low risk scenarios could be based on site specific factors such as background concentrations, depth to groundwater, surface runoff, etc.
8.0	24	The following guideline values represent a nationally-agreed suite that should be used to inform site investigations.	Why is this simply informing site investigations, do these values not also inform risk assessments and site management?	Should read: The following guideline values represent a nationally-agreed suite that should be used to inform site investigations and management.
8.1.1		Table 1 - 'Sum of PFOS+PFHxS	The 'Sum' or '+' is superfluous.	This should read - 'PFOS + PFHxS'; - Sum of PFOS, PFHxS; - Sum of PFOS and PFHxS; or - ∑(PFOS,PFHxS)
8.1.2	26	These human health based soil guidance values (Table 2) should only be used to assess potential human exposure through direct soil contact.	By definition, the HBGV for Residential with garden/accessible soil also make an allowance for dietary exposure associated with home grown produce making up to 10% of daily intake.	Should read: These human health based soil guidance values (Table 2) should only be used to assess potential human exposure through direct soil contact and dietary exposure associated with home grown produce, where applicable.
8.1.2	26	The guideline values for Residential with garden/accessible soil… are considered higher reliability than the values they replace.	No specific information has been provided about the derivation of the previous or current health screening values, so the reliability is difficult to assess and accept.	Provide the full derivation of the criteria for public comment.
8.1.2	26	This criterion may not be protective where PFHxS concentrations are significantly greater than PFOS concentrations. … [and] site-specific risk assessment would be recommended.	Current guidance suggests that PFHxS is less toxic than PFOS, with the adoption of the 'Sum of PFOS and PFHxS' screening approach highly conservative as it assumes equivalent toxicity to PFOS. It is unclear why this statement has been made as it contradicts current scientific evidence.	Clarify approach to screening level assessment, to note that based on current evidence the presence of more PFHxS than PFOS would result in a conservative screening assessment.
Table 2	27	Health screening levels	New numbers have been provided, however the derivation has not, making it difficult to check the assumptions behind the numbers and preventing the development of site-specific risk assessments.	Provide the full derivation of the criteria for public comment or cite the specific studies included to allow a review of the primary literature.
8.2	28	These criteria are not remediation values and instead are intended to inform an overall assessment of the significance of PFAS concentrations for wildlife.	Requires clarification regarding how the criteria should be used.	Would be beneficial to clarify the role of the Guideline Values (GV) to assist with managing material that has concentrations below GV. Despite the approach adopted here, another level of conservatism is endorsed in Section 12.
8.2.1	28	Use of higher criterion (up to 0.14 mg/kg)	Why is there an upper cap on the criterion that may be used as a screening criterion? What happens if more than one of the listed considerations apply? Does this remove the provision for modified screening criteria that is often used in site-specific risk assessment?	Clarify use of modified screening criterion and method of adjustment
Table 3	29	No PFOA criterion is supplied for indirect exposure		Please supply a PFOA criterion for indirect exposure
Table 4	30	Reference to an additional uncertainty factor for the Bird egg ww value.	No data is provided on what uncertainty factor was applied or why.	Please justify values so that the criteria can be appropraitely applied and understood.
Tables 3,4 & 5	29-31	No sediment guideline values are provided	Sediment guideline values would be highly applicable from an ecological perspective and sediments are more likely to be sampled than biota (given ethical and permit considerations).	Develop appropriate sediment screening values as a priority.

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SECTION	PAGE	NEMP V2 STATEMENT	COMMENT	RECOMMENDED CHANGE
Table 5 & 9.1.5.1	31	Note 3 - ...99% of protection be used for slightly to moderately disturbed systems.	Unclear when 95% species protection guideline value would be applicable for PFAS as it bioaccumulates. Is there any purpose in identifying a 95% species protection criteria given that Note 3 advises the use of the 99% species protection criteria? It is also widely acknowledged that the generic rule to adopt the 99% value for chemicals which bioaccumulate was established prior to PFAS being identified as an issue. Further, it is also known in the industry that the current 99% values for PFOS are flawed due to issues with the species sensitivity distribution (SSD) model as applied to the available PFOS data. Given the above, and as the management of PFAS has resulted in a dedicated PFAS management document in the NEMP, it is unclear why chemical specific advice cannot be developed (e.g. the use of the PFOS 95% criteria is appropriate for assessment of slightly to moderately disturbed systems).	Given the widespread acknowledgement that the 99% value is problematic, the NEMP should provide appropriate and technically accurate guidance on which criteria to use, and should not propose generic approaches that were developed for other chemicals or scenarios.
Section 10				
10.0		This section covers storage, stockpiling and containment that is not intended to be permanent.	This section seems to be silent on instances where sites are already contaminated. PFAS is already costing the industry a significant amount of money and in many instances, the proponents managing the contamination did not cause the contamination. This chapter dives into removing environmental risk through containment, immobilisation, etc. Where is the consideration for sites that are already contaminated and the shifting of material onsite does not lead to an increased environmental risk?	Include consideration of permanent onsite reuse/ containment where reused/ contained soils have similar concentrations to surrounding undisturbed soils. As such, there is no change in risk from relocating soils on the same site.
10.1	38	Temporary storage … is required for PFAS-contaminated material with a PFOS, PFOA, or PFHxS content below 50	Does this include material with concentrations less than the health and/or ecological screening criteria? Using <50 mg/kg does not provide for material that does not represent a risk.	Suggest rewording to ''may be required … for materials up to 50 mg/kg'
10.1	38	It is generally expected that materials will be removed for environmentally sound treatment or destruction	This is difficult with soils as commercial treatment options are not well-established and destruction is not practical, particularly for larger volumes.	Add 'disposal' to list of removal options.
10.1	38	Where the volume of material is minimal (for example, less than 10 m^3) and the proposed storage is temporary (that is, less than 48 hours and rain is not predicted), then a practical approach to managing the material may be considered.	What do the HEPA consider a 'practical approach'? The example provided is not considered practical in an industrial or commercial setting. From a large operational facility perspective, delivery of 80 m^3 is a minor maintenance activity.	Where the volume of material is minimal (for example, less than 40 m^3) and the proposed storage is temporary (that is, less than 4 days and rain is not predicted), then staging with fewer or no additional controls may be appropriate. We propose setting soil minimas value at 40m3 for temporary staging of impacted soil for less than 4 days and rain is not predicted. Seven days would allow for time to containerise for offsite disposal or transfer to an onsite constructed storage facility
10.1	38	regualtors may have specific regulatory requirements (e.g. re: licencing, approvals, notifications, etc.)	This does not work particularly well on Commonwealth land where 'the regulator' is federal. No overarching federal contamination legislation exists.	
10.3.3	42	Sizing of bunds	Bunding sizing used for flammable and combustible liquids in AS1940:2017 is 110% of the largest container or 25% of the total capacity of all containers, whichever is greater. This definition may be of more practical use to end users than 'sufficient size to retain a major spill'	Clarify suggested sizing of bund
10.3.5		The following considerations are relevant for selection of storage or stockpile sites, noting that a risk assessment, undertaken by an appropriately qualified person, may be required if potential exposure pathways to sensitive receptors are present: … community and stakeholder interest and concerns	There is a rsk that ultra conservative authorities would require community consultation a condition precedent to the endorsement of a risk assessment or approval to place a stockpile. While community consultation is a fantastic way to inform a project, given the complexity of PFAS contamination and the political climate, this requirment seems overly onerous for guidance on stiockpile placment.	Suggest removing 'community' and list as 'stakeholder interests and concerns', which may include the community at times but does not automatically include the wider community when there is no need. Also move this item further down the list to be grouped with land ownership as it is one of the later considerations after assessing suitability of location

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SECTION	PAGE	NEMP V2 STATEMENT	COMMENT	RECOMMENDED CHANGE
10.3.6		The facility should not be located within floodplains with less than a 1:100 year Annual Exceedance Probability (that is, < 0.01 AEP).	Where the majority of the document is less prescriptive, and relies on the proponent performing its own risk assessment, it is confusing that the prescription of <0.01 AEP is prescribed here. Has this AEP been based on anything? There are undoubtedly whole sites that are impacted by this statement which are all currently contaminated and stockpiling of that material, if stabilised, does not increase the overall contamination risk if appropriately stabilised.	Remove the prescription of 1 in 100 years but require that the risk of flood events is considered in the risk assessment.
10.3.13	47	List of concerns has safety, but not health	Safety and human health are separate issues. The concerns listed appear to be concerned with environmental and immediate safety hazards. While the jury is still out on the human health effects of PFAS, a preventative approach is best and health should also be included.	Amend first concern to 'health and safety'
Section 11				
11.1	48	PFAS-contaminated materials are considered to be Dangerous Goods Class 9.	While this infromation may be relevant for EPA tracking, it is in contravention of labelling requirements of the ADG Code. For Class 9 dangerous goods, they **also** have to be shipped as dangerous goods, which means UN numbers, not waste codes, and proper shipping names (i.e. UN3077 'Environmentally Hazardous Waste, Solid, N.O.S.' for PFAS-contaminated soil). There should be two sets of documents for shipping soil: EPA docket **and** dangerous goods transport document, with the transport document and placarding on the truck is required if the load is over 1,000 kg (a 'placard load'). Additional controls come into place if the material is concentrated PFAS such as AFFF concentrate.	Expand Section 11 to include reference to ADG Code
Section 12				
12.1	49	The concept of reuse without a risk assessment	The concept of reuse without a risk assessment is supported, however it is unlikely that any material with PFAS in soil that is >LOR would have leachable concentrations below the 99% species protection DGVs, triggering a risk assessment in most cases. As per the issues that have arisen in WA with the Forrestfield Airport Link, it is expected that leachate concentrations will be above the 99% species protection DGV in nearly all soils across urban areas of Australia.	Leachate values should be increased to a more realistic target concentration, such as the 95% species protection DGV.
12.1	49	The application of this decision tree should therefore be done in consultation with the relevant regulatory authority.	There is not a 'relevant regulatory authority' for Federal lands with the necessary experience and expertise in managing PFAS impacted soils to support this process.	The decision tree and soil re-use process needs to be presented in a way which provides more definitive guidance for managing PFAS impacted soils on Federal lands.
12.1	49	A principle that must inform consideration of unrestricted or blanket reuse values for soil is that the levels of PFAS must be sufficiently low that they will not pose an increased…risk	Requires further clarification as it implies that any 'increased risk' is unacceptable, whereas in some circumstances the difference between no detection and very low detection (i.e. orders of magnitude below guideline values) is conservatively an increased risk.	Clarify text to note that re-used PFAS impacted soil will not increase the overall site risk profile, or result in unacceptable risks.
12.1	49	Thus to be suitable for unrestricted reuse, materials must meet the criteria for both total concentration and leachable concentration.	These statements contradict each other, as re-use of impacted soils in areas with higher existing levels would likely result in re-use of materials that exceed leachable criteria.	Specify that 'unrestricted reuse' assumes similar background level of PFAS in area of re-use as in source area
12.1	49	Adding material with low levels of PFAS to areas that have even lower or no levels of PFAS should be considered carefully … Where re-use is proposed for areas with higher levels of PFAS, then the decision-tree permits re-use without assessment of risk.		

Appendix A

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SECTION	PAGE	NEMP V2 STATEMENT	COMMENT	RECOMMENDED CHANGE
12.1	49	preliminary screening risk assessment	What is a preliminary screening risk assessment in the context of previous statements? In relation to this point, it is noted that the term 'risk assessment' is often used in the NEMP in relation to different types and stages of risk assessment, which may cause confusion amongst readers.	Consider rephrasing to: Sampling and assessment of materials would be required to confirm whether PFAS concentrations in the material are at or below the relevant health and ecological assessment criteria, or where PFAS concentrations in the material can be demonstrated to be lower than background concentrations of PFAS in and around the proposed reuse location. A decision tree outlining the process for such a screening level assessment is presented below.
12.1	49	A preliminary screening risk assessment may be acceptable in instances where PFAS concentrations in the material are at or below the relevant health and ecological assessment criteria **OR** where PFAS concentrations in the material can be demonstrated to be lower than background concentrations of PFAS in and around the proposed reuse location.	Noted not "**AND**". This statement is contradictory to the flow chart (Figure 1), which indicates a risk assessment will be required if either the HBGV/EGVs are exceeded, or the receiving environment has lower concentrations.	Please clarify
Figure 1	50	C. Do any of the soil leachate … exceed … 99% species protection DGVs?	It is highly unlikely that any material sourced from urban areas or which have been subject to any human interference will ever respond 'No' to this step (for example, see results from the Forrestfield Airport Link PFAS investigations in WA). If it is known that this is unachievable in the majority of circumstances, it should be revisited to establish a realistic yet acceptable leachate value.	Please clarify
Figure 1	50	Note 5. The PFAS NEMP guideline values are not default acceptance values or remediation values.	Need further clarity regarding what they mean, as much of the supporting text in the NEMP implies that any PFAS impacts above the guideline values is unacceptable or requires management. The NEMP lacks clarity regarding management expectations for material with PFAS levels below these.	Please clarify
Figure 1	50	The proposed reuse at destination sites may be acceptable without further assessment of risk…	To address this decision tree, all material movements will require representative PFAS sampling for soil and leachate, and, where leachate is above the 99% species protection level, to: *undertake further assessment of the destination location soil/water, *undertake assessment of PFAS in groundwater and surface waters nearby * complete a risk assessment This would create significant administrative / management burden for all parties, particularly for soil re-use of materials which are minimally impacted and are being re-used in areas with known background impacts for PFAS. Another, less controlled example, relates to compost material or topsoil bought in smaller quantities by residential or commercial operators. Preliminary data from these industries indicates widespread occurrence of PFAS above the 99% DGV in leachate. It is unclear who would take responsibility for this level of assessment for such marginally impacted materials potentially used in small volumes.	Please clarify
12.2.1	52	Fill or burial less than 2.0 metres above the seasonal maximum groundwater level	What is this value informed by?	Provide rationale behind distance selected, as this is potentially limiting for sites with shallow groundwater.
12.2.1	52	Reuse within 200 metres of a surface water body or wetland area	What is this value informed by?	Provide rationale behind distance selected, as this is potentially limiting for some sites.
Section 15				
15	p. 61	The NWQMS and the Guidelines provide detailed guidance on the development and application of criteria to protect environmental values, also known as community values or beneficial uses. Default guideline values for water quality for PFOS and PFOA are being developed in accordance with the scientific process set out by the Guidelines.	What party is currently developing these guidelines? Is there a timeframe?	Recommend changing text to be more specific in the current development of guidelines and possible sources of additional information.

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SECTION	PAGE	NEMP V2 STATEMENT	COMMENT	RECOMMENDED CHANGE
Section 19				
19.2	71	Total Oxidisable Precursor Array (TOPA) analysis can be used where the US EPA method may not adequately measure all the PFAS likely to be present. Examples include contamination where the PFAS product composition is unknown, where the known PFAS composition extends beyond the US EPA suite or where PFAS may have been subject to transformation, such as in wastewater treatment and in the wider environment. In an immediate spill, TOPA provides information on whether precursors are present and informs risk management, e.g. considerations such as whether the environment is oxidative; and whether remediation might transform them.	Also suggest referencing the recent findings of the ALGA Research & Development Grant: 'Improving Measurement Reliability of the PFAS Top Assay,' 2019, which highlights the benefits and limitations of the method.	Suggest referring to Total Oxidisable Precursor (TOP) Assay as "TOP Assay" and not TOPA, as TOP Assay is becoming the international standard terminology.
Appendix D				
Appendix D, 6.1		The Example Jurisdiction EPA guidance requires testing for a standard set of 28 analytes comprising perfluoroalkyl acids (PFAAs) and selected PFAA precursors at a level of resolution relevant to the environmental values being protected. In addition summative measures and holistic analytical methods, such as Total Oxidisable Precursor Assay (TOPA) and non-target analysis, are used as required by regulators and to build a weight of evidence understanding of total PFAS loads and associated transformation within the sewage network.	Agree with the statement, although caution should be provided on the importance of understanding the impact of the many co-contaminants encountered in wastewater that can interfere with PFAS analysis and interpretation of results.	
Appendix D, 5.1 Risk Sources		Consequently, the identification and prioritisation of risk sources is an important step in focusing control efforts on significant and readily actionable sources. At present there is limited evidence on the sources of PFAS in wastewater.	Agree that there is limited evidence on the source of PFAS in wastewater, however, there is sufficient evidence to show that landfill leachate and historic use of AFFF in aviation and industrial applications are significant sources that must be considered by utilities such as EW. Strategies to control these sources should be a priority by utilities.	
Appendix D, 7.1		In addition, temporal and spatial fluctuations in PFAS levels above this level, including peak events, can occur due to the use or handling of PFAS-containing products such as foam suppressants or aqueous film forming foam (AFFF) [1] by specific businesses.	PFAS mass loading rate as measured by TOP Assay, rather than concentration alone, should be a standard measure for sewer acceptance criteria.	Recommend changing text to read: "In additional, temporal and spatial fluctuations in PFAS mass loading rates , including peak events, can occur due the use, handling, and accidental release of PFAS-containing products such as aqueous film forming foam (AFFF) used for fire suppression."

Draft NEMP 2.0 Consultation Feedback
PFAS NEMP Coordinator
c/o Emerging Contaminants Section
Department of the Environment and Energy
PFASstandards@environment.gov.au

20 June 2019

Dear PFAS NEMP Coordinator

RE: Submission on PFAS Draft NEMP version 2

Brisbane Airport Corporation (BAC) is submitting feedback regarding the PFAS NEMP version 2.0 (both summarised below and in the attached feedback template). In summary, BAC wishes to raise the following points:

1) There needs to be clarity in enforcement of the PFAS NEMP in environmental regulation across state and federal boundaries. This is to ensure that a fair and reasonable application of the NEMP is being applied on a level playing field regardless of jurisdiction.

2) For projects that trigger the PFAS NEMP, the process does not differentiate between primary source (high risk) sites and sites impacted by low levels of diffuse PFAS contamination from unknown sources. As a result, regulatory focus is skewed away from higher risk sites to low risk sites. A focus on higher risk sites would lead to greater environmental protection outcomes and would reduce the financial impacts on projects where no material environmental benefits can be realised.

   To illustrate: a project to build an at-grade car park at Brisbane Airport to reuse stockpiled fill material with a PFAS concentration of 0.0002 mg/kg. Due to the detection of PFAS, the regulator required further risk assessment to comply with the NEMP although no additional management measures were ultimately required. BAC was one day away from incurring financial penalties from contractor delays and lost revenue due to the car park not being open in time for the peak period. This degree of regulatory burden is excessive given the low PFAS levels detected and the low risk it presents from the site.

3) The PFAS NEMP requires consultation with environmental regulators in **all** decision making. As a result, projects are subjected to time delays and extra costs in order to ensure strict adherence to the NEMP. A risk-based approach to the level of engagement and oversight by the regulator would

not always require this level of input and would save time and resource for both the project and the regulator.

4) Where appropriate, use of suitably qualified persons will assist with timely application of the process, and provide more certainty to business and enable PFAS to be managed in a business as usual matter. HEPA should be encouraged to run a series of state-based information/ training sessions for NEMP users, including third party consultants, to improve the understanding and intent of the NEMP by way of case studies on multiple (reasonable and practical) applications of the NEMP. These could be used to inform how regulators intend to assess submitted investigation reports/risk assessments.

5) The decision tree for the reuse of soil materials is impractical in its application as it reverts to the 99% species protection guideline value in most instances, meaning that any detection of PFAS will be considered 'contamination'. This is onerous and conflicts with the principles of sustainable development and is inconsistent with a risk-based approach.

   A reasonable and practical alternative is to enable projects to undertake a cost/benefit analysis to determine how close they can get to the appropriate species protection guideline value based on its size and cost. It needs to be recognised that the 99% species protection level will be unachievable in most instances, particularly for many airports that are operating in low lying coastal areas.

   Guidance is recommended around cost/benefit analysis to enable projects to demonstrate a reasonable and practical application of the guideline values. This could include a separate section in the NEMP addressing how cost/benefit analysis can be undertaken for PFAS based on a project's cost and size and ability to meaningfully improve environmental outcomes.

6) The definition of a 'PFAS waste' requires clarification in reference to the *Environmental Protection (Regulated Waste) Amendment Regulation 2018* (Qld) because it implies that any detection of PFAS will be considered a waste. It is impractical and against the principles of pragmatic regulation and sustainable development to consider **all** fill materials as a PFAS waste.

7) The NEMP uses the terms 'elevated levels' and 'contaminated' interchangeably. A glossary is preferred.

8) With regard to the containment of PFAS-containing solid waste (e.g. sediment) the NEMP is impractical in relation to maintaining the hydraulic capacity of stormwater and tidal drainage systems impacted by PFAS contamination already present in the environment. Allowance needs to be made for emergency and maintenance works such as flood mitigation in drainage systems. Many coastal airports in low lying areas have drainage systems designed to enable the rapid movement of surface water offsite to prevent flooding during catchment events. Without cleaning out sediment and other debris (e.g. mangrove pneumatophores) from drains on a semi-

regular basis, operational risks to critical infrastructure, people and property can occur through flooding. Guidance around suitable management measures would be beneficial.

9) With regard to trade waste, it should be noted that the emitter(s) of PFAS contamination may not always be the trade waste license holder/customer of the wastewater treatment provider. Remediating PFAS contamination in sewer networks presents an unfair regulatory cost burden on the customer/entity responsible for the trade waste license if it covers a precinct-scale site and various industrial operators are emitting PFAS into the sewer network. The wastewater treatment plant operator should also be liaising directly with the entities responsible for the contamination, and not just the license holder/customer.

BAC has attached the response template with detailed feedback on various elements of the PFAS NEMP version 2.0 due to the Corporation's knowledge and experience in applying the framework. The response feedback specifically addresses concerns with the following chapters:

a) Chapter 8 - Environmental guideline values;
b) Chapter 10 - On-site storage, stockpiles, and containment;
c) Chapter 12 - Reuse of PFAS-contaminated materials; and
d) Appendix D - Example PFAS Management Framework for a Wastewater Utility.

We would welcome the opportunity to discuss these matters with you.

Yours sincerely

Raechel Paris
Executive General Manager Governance, Safety & Sustainability
Brisbane Airport Corporation

ATTACHMENTS:

(1) BAC Feedback Response Form (PFAS NEMP V2)

Draft PFAS NEMP Version 2 – Written Submission Cover Sheet

Name (optional): Wendy Weir

If applicable – Organisation: Brisbane Airport Corporation

Address (optional): 11 The Circuit, Brisbane Airport, Qld, 4008

Position (optional): Head of Environment and Sustainability

Email (optional): wendy.weir@bne.com.au

Confidentiality

(i)	Confidentiality requested?	No
(ii)	If so, does part of your submission include confidential or sensitive information?	No
	Have you provided confidential or sensitive information in a separate attachment	*No*
	Have you provided a redacted version	*No*

Draft PFAS National Environmental Management Plan Version 2 sections

If you have specific comments or suggested text changes, please clearly identify the extract of the relevant part of the NEP on which you are providing feedback.

8. Environmental guideline values

Chapter	Page	Statement in NEMP v2	Feedback
8. Environmental guideline values	24	The selection of guideline values should have regard to the specific environmental values and characteristics of the site, drawing on relevant guidance in consultation with the environmental regulator.	The PFAS NEMP requires consultation with environmental regulators in all decision making. As a result, projects are subjected to time delays and extra costs in order to ensure strict adherence to the NEMP. A risk-based approach to the level of engagement and oversight by the regulator would not always require this level of input and would save time and resource for both the project and the regulator.
	24	Paragraph 4 – "… an exceedance of the screening values should trigger further investigation such as site-specific risk assessment to refine the likely degree of possible risk".	If screening values are not exceeded there should be no cause for an environmental regulator to require further investigation.

8.1 Human health guidance values

Nil feedback.

8. Environmental guideline values

8.2 Ecological guideline values

Chapter	Page	Statement in NEMP v2	Feedback
8.2.1 Soil criteria – ecological guideline values	28	Paragraph 5 – "At sites where the potential degree of indirect exposure is significantly limited, the site characteristics could be carefully considered to assess whether a higher criterion (up to 0.140 mg/kg) may be used to trigger a detailed site specific investigation of risk".	This statement seems erroneous. The intent of the statement is supposed to enable a higher criterion to be applied without the need to undertake a detailed site specific investigation of risk if the area of soil impacted is too small to have an impact on food chain transfer to secondary consumers.
8.2.2. Terrestrial biota guideline values	30	Table 4 – ecological exposure protective of birds eggs (0.2 µg/L for sum of PFOS + PFHxS)	Under which circumstances would this scenario need to be applied? Please provide examples e.g. is this for activities or historical contamination on/adjacent to a known bird rookery?
8.2.3 Aquatic ecosystems: freshwater and marine water guideline values	31	Table 5 – Note 3 states that the Australian Water Quality Guidelines (WQG) advise that the 99% level of protection be used for slightly to moderately disturbed systems.	This is onerous and conflicts with the exposure scenario provided in Table 5 that enables a 95% species protection value for such systems. Highly disturbed systems should not be held to the highest species protection level in all situations.

10. On-site storage, stockpiles, and containment

10.1 Storage, stockpiles, and containment

Nil feedback.

10. On-site storage, stockpiles, and containment

10.2 Design considerations

Chapter	Page	Statement in NEMP v2	Feedback
10.2 Design considerations	39	… storage and containment [of PFAS-containing sediment] should be designed with a whole of life approach that: - Detect, monitor, and collect any PFAS-contaminated liquid (leachate) generated during the storage. - Ensure that the migration of leachate from sumps and other detention storages does not occur. - Prevent seepage of leachate into the groundwater or surface water environment. - Avoid systems which may release PFAS-contaminated sediment through erosion.	Regarding the containment of PFAS-containing solid waste e.g. sediment - this section is impractical for maintaining the hydraulic capacity of stormwater or tidal drainage systems that have any concentration of PFAS contamination. Without cleaning out sediment and other debris (e.g mangrove pneumatophores) from such drains on a semi-regular basis, operational risks to critical infrastructure and property can occur through flooding. There needs to be allowance for emergency maintenance activities to occur without addressing the NEMP otherwise operational risks will increase. Guidance around suitable management measures would be beneficial.

10. On-site storage, stockpiles, and containment

10.3 Guidance note - On-site storage and containment

Chapter	Page	Statement in NEMP v2	Feedback
10.3 Guidance note – onsite storage and containment	41	This Guidance note applies to the temporary, short and medium term storage of PFAS containing wastes during projects relating to investigation, remediation, and construction… containment may include immobilising, capping or covering…	It needs to be recognised that PFAS is diffuse in domestic and non-domestic environments, therefore PFAS are often found in very low concentrations in fill material, even if there is no known source of PFAS contamination. The definition of a 'PFAS waste' requires clarification in reference to the Environmental Protection (Regulated Waste) Amendment Regulation 2018 (Qld) because it implies that any detection of PFAS will be considered a waste. It is impractical and against the principles of pragmatic regulation and sustainable

Chapter	Page	Statement in NEMP v2	Feedback
			development to consider all fill materials as a PFAS waste.
10.3 Guidance note – onsite storage and containment	41-47		This section (requiring the containment of PFAS impacted materials) should only need to apply for highly impacted sites – not for diffuse, low levels of PFAS contamination that are present in the environment in ambient conditions. Otherwise it is too onerous and costly to manage for sites with low levels of contamination from unknown sources and takes away the focus that should be applied to primary source sites of PFAS contamination.
10.3.5 and 10.3.6 Siting and location	43		These sections refer to exclusion of flood plain areas unless the areas are above Q100 flood levels. Projects located in such areas will have to demonstrate that they are above inundation from floods and not just groundwater impacts. This will be unachievable and financially unviable for projects located in undeveloped and developed areas of flood prone areas.
10.3.12 Maintenance and management of stockpile and containment facilities	46	This section is regarding the environmental management, maintenance and operating plan for containment and stockpile facilities.	The definition of a containment and stockpile facility needs to outlined. For example, low lying sites need to import fill material and surcharge land prior to development. Is this guideline implying that every stockpile (if it is identified to contain low levels of PFAS contamination from unknown sources) needs to be considered as contamination and require the degree of management that this section outlines? It is impractical and should not need to apply to general, uncontaminated sites even if fill materials are imported. An impractical approach to environmental regulation could see this level of management required which is concerning, particularly because the NEMP requires consultation with the regulator for all decision making.

12 Reuse of PFAS-contaminated materials

Chapter	Page	Statement in NEMP v2	Feedback
12 Reuse of PFAS contaminated materials	49	Materials with elevated levels of PFAS may be considered by environmental regulators for reuse under some circumstances.	What is 'elevated'? Is it considered anything above detection? A glossary is preferred. As some environmental regulators may be opposed to the reuse of PFAS impacted materials it presents even more regulatory uncertainty on PFAS management than already exists - particularly when the

Chapter	Page	Statement in NEMP v2	Feedback
			NEMP requires consultation on every decision with regulators. It is too open ended and does not give industry enough certainty.

12.1 Reuse without a risk assessment

Chapter	Page	Statement in NEMP v2	Feedback
12.1 Reuse without a risk assessment	49	The application of the decision tree should be done in consultation with the relevant regulatory authority.	The NEMP is requiring consultation on all decisions regarding reuse of PFAS contaminated materials with regulators This extends project timelines and does not give industry enough self regulation and keeps PFAS management as a non BAU/ reactive issue. For projects that trigger the PFAS NEMP, the process does not differentiate between primary source (high risk) sites and sites impacted by low levels of diffuse PFAS contamination from unknown sources. As a result, regulatory focus is skewed away from higher risk sites to low risk sites. A focus on higher risk sites would lead to greater environmental protection outcomes and would reduce the financial impacts on projects where no material environmental benefits can be realised.
12.1.1 Decision tree for reuse of soil materials	50	Point 3C in the decision tree states "Do any of the soil leachate concentrations exceed any of the ADWG HBGVs or the WQG freshwater 99% species protection DGVs?"	The decision tree for the reuse of soil materials is impractical in its application as it reverts to the 99% species protection guideline value in most instances, meaning that any detection of PFAS will be considered 'contamination'. This is onerous and conflicts with the principles of sustainable development and is inconsistent with a risk-based approach. A reasonable and practical alternative is to enable projects to undertake a cost/benefit analysis to determine how close they can get to the appropriate species protection guideline value based on its size and cost. It needs to be recognised that the 99% species protection level will be unachievable in most instances, particularly for many airports that are operating in low lying coastal areas. Guidance is recommended around cost/benefit analysis to enable projects to demonstrate a reasonable and practical application of the guideline values. This could include a separate section in the NEMP addressing how cost/benefit analysis can be undertaken for PFAS

Chapter	Page	Statement in NEMP v2	Feedback
			based on a project's cost and size and ability to meaningfully improve environmental outcomes.
	50	Note 5 - "the PFAS NEMP guideline values are not default acceptance values or remediation values"	It is recognised that the knowledge and understanding of suitably qualified persons may need to improve (on PFAS matters) to ensure the guideline values in the PFAS NEMP are not incorrectly used as default acceptance values or remediation values, given this is not the intention of the NEMP. If reports were submitted to the regulator to the standard required in the NEMP it would result in less time delays and costs for projects and result in a better outcome for industry Where appropriate, use of suitably qualified persons will assist with timely application of the process, and provide more certainty to business and enable PFAS to be managed in a business as usual matter. HEPA should be encouraged to run a series of state-based information/ training sessions for NEMP users, including third party consultants, to improve the understanding and intent of the NEMP by way of case studies on multiple (reasonable and practical) applications of the NEMP. These could be used to inform how regulators intend to assess submitted investigation reports/risk assessments
	50	The final statement in the decision tree states "the proposed reuse must not proceed without a further assessment of risk, which may include the consideration of additional management measures at the destination site, in consultation with the relevant regulator".	This should only be required for moderate to highly contaminated sites. Otherwise any detection of PFAS, regardless of the site's location, land use and ambient PFAS concentrations, will be treated as contaminated. It is too costly and is not reasonable and practical. A risk-based approach to the level of engagement and oversight by the regulator would not always require this level of input and would save time and resource for both the project and the regulator.
12.2 reuse with a risk assessment	51	The most important pathways posing a risk to human health or the environment are … bioaccumulation in plants and animals, in particular, those consumed by humans and animals.	If plants are not going to be consumed by humans or animals, even if those plants are located on a primary site of PFAS contamination, there should be no reason to require compliance with the PFAS NEMP if those plants require trimming, mulching etc.
	51	The following factors should be considered when assessing the potential	Section 12.1 states that PFAS impacted material can be placed on sites with higher levels of PFAS contamination, and

Chapter	Page	Statement in NEMP v2	Feedback
		for reuse of PFAS contaminated materials: - Potential for pre-existing 'background' PFAS impacts at the destination site and potential to add to the overall mass of PFAS in the receiving area. - If the receiving environment already contains PFAS, whether the addition of more PFAS to that system increases the potential for harm.	yet this section seems to indicate this may not be the case. How can you do both?
12.2.1 Reuse requiring consultation with the environmental regulator	52	Contact with the environmental regulator must be made before any proposal for the following uses is made: - Fill 2m above the maximum groundwater level - Reuse within 200m of a surface water body or wetland - Reuse of soil in areas identified as a MNES, and other areas of environmental significance - Fill or reuse in areas potentially affected by future rises in groundwater or sea level, or near stormwater drains	This section describes every coastal airport in Australia since airports were deliberately sited on low lying areas. Therefore, many airports require drainage systems to move surface water offsite to prevent flooding. This will mean that the environmental regulator will need to be consulted about every decision – it is too onerous and does not enable any degree of self-regulation.

15. Wastewater treatment

15.1 PFAS Management Framework

Nil feedback.

15. Wastewater treatment

15.2 Additional management tools

Nil feedback.

Appendix D. Example PFAS Management Framework for a Wastewater Utility

Chapter	Page	Statement in NEMP v2	Feedback
Appendix D 7.1 Trade waste controls	94	The risk of accidental PFAS contamination events, discharging significantly elevated levels of PFAS in the wastewater system, is not covered by the routine control measures described above. Consequently, EW also requires all trade waste customers who use or generate substances high in	It should be noted that this may require wastewater treatment providers to liaise directly with the emitter of PFAS contamination, and not the trade waste customer as these could be separate legal entities.

Chapter	Page	Statement in NEMP v2	Feedback
		PFAS, such as fume suppressants, AFFF concentrate, foam and associated firewaters, to have measures in place to prevent these substances entering the wastewater system. A range of enforcement measures are employed to ensure compliance with these conditions, such as unannounced site visits and effluent sampling. EW will work with its customers, experts and regulators to identify risks associated with accidental PFAS contamination events and ensure measures are implemented to anticipate and manage any issues in this regard.	It is also a regulatory cost burden on the customer/entity responsible for the trade waste license if it covers an entire site and various industrial/commercial operators are emitting PFAS into the sewer network. The wastewater treatment plant operator should also be liaising directly with those entities directly responsible for the contamination, and not just the license holder/customer. If the license holder is required to clean/remediate/eliminate PFAS from a sewer network, it is a cost burden on that entity when they are not responsible for its contamination. There needs to be recognition that the party held responsible for the contamination may not be the license holder.
Appendix D 7.2 Domestic controls	94	The role of domestic wastewater as a vector for PFAS, mainly from consumer products, is also recognised. However, in the short term, there is limited opportunity for EW or its domestic customers to identify or control PFAS in consumer products. The manufacturers and suppliers of consumer products, and the manufacturers and suppliers of the chemicals included in these products, bear the primary responsibility for taking action to reduce the levels of PFAS reaching domestic wastewater.	The same principle could be applied to PFAS in the industrial context if there is no/limited opportunity for industrial customers to identify or control PFAS in industrial products. Therefore, manufacturers and suppliers of industrial products and chemicals should still be held responsible for taking action to reduce/eliminate PFAS from their products.
Appendix D 9.2 effluent discharged to aquatic ecosystems	96	Consistent with the PFAS NEMP, EW aims to reduce the concentration and load of PFAS in effluent as low as possible and, in the long term, below the limit of detection.	It needs to be recognised that there are ambient, background concentrations of PFAS in domestic and non-domestic biosolids and effluent that will take time to be eliminated due to its widespread presence in various applications. There needs to be recognition that the background concentrations of PFAS at an STP can be used as the interim guideline level for PFAS if an entity is required to commit to an improvement plan to reduce PFAS from trade waste and/or sewer network. It is impractical and impossible in many cases to eliminate PFAS from a sewer network particularly if there are multiple sources of PFAS impacted groundwater and/or stormwater getting into a system that is not under the control of the trade waste license holder. Therefore, the ambient levels of PFAS should be used as the interim guideline level in these instances.
Appendix D 9.3 Recycled Water	97	Entire section	This section is written from the perspective of one wastewater treatment

Chapter	Page	Statement in NEMP v2	Feedback
			provider only and does not represent all scenarios. It needs to be amended as a number of precincts in Queensland are already using recycled water purchased from wastewater treatment providers for various applications (e.g. in cooling towers, construction and irrigation). Therefore, it is retrospective for such facilities to assess the risk of PFAS if they are already using recycled water.

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Australian Government
Department of Infrastructure, Transport, Cities and Regional Development

Response to the PFAS National Environmental Management Plan (NEMP) version 2.0 consultation draft

Introduction

The Department of Infrastructure, Transport, Cities and Regional Development (Infrastructure) is pleased to have the opportunity to provide this submission on the PFAS NEMP version 2.0. Infrastructure recognises the importance of having a nationally consistent approach to the assessment, remediation and management of PFAS contamination and acknowledges that the PFAS NEMP version 2.0 provides a framework for this to occur. Feedback from our stakeholders has also indicated that it is important to them that any approach for the ongoing management of PFAS contamination is applied consistently, regardless of jurisdiction, and this is reflected in the objective of the PFAS NEMP version 2.0.

Acknowledging the complex nature of the subject matter, Infrastructure considers that the document is easy to read, particularly for a non-technical audience, which enhances its useability.

Overall, Infrastructure considers that the PFAS NEMP 2.0 is an important document that will benefit all stakeholders. However, Infrastructure notes the overly conservative theme throughout, which may affect the practical implementation of the document at the site level. This is discussed in more detail below.

The outside-in approach

The PFAS NEMP version 2.0 advocates for an outside-in approach to the assessment and management of PFAS contamination. Infrastructure generally agrees with this view, however, there appears to be significant expectations that individual site owners/operators who are seeking to develop, will undertake large-scale, catchment-wide assessments to meet these requirements. Infrastructure considers there are a number of issues that need to be resolved for this approach to be most effective and to reflect stakeholders' concerns and demonstrated reluctance to support this approach, based on:

- In urban and industrialised settings there are likely to be a range of point and diffuse sources of PFAS contamination, which may or may not be well understood.
- The individual corporation who undertakes assessment and identifies PFAS contamination in the environment surrounding their site has an implied responsibility and liability for that contamination, including perception of the local community.
- Significant cost associated with extensive, catchment-wide assessment, including biota as advocated in the PFAS NEMP version 2.0. There is no process to recoup these costs if multiple sources of contamination are found and/or if others benefit from that wider assessment.
- It is unclear how the results of any large-scale investigation would be tied back to a particular site or individual polluter, especially in a highly disturbed

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system. The lack of understanding of the contribution contamination from each site is making to the mass of PFAS in the environment compounds the impression that those undertaking the testing are ultimately responsible for any contamination identified.
- It is also unclear how the results of these assessments would be shared, if at all, which may lead to a duplicating of effort and cost.

In summary, the approach appears to disproportionately impact on entities who are required to undertake testing, for example, to obtain approval for development, while long-term or dormant polluters are not required to undertake any additional work.

Infrastructure considers that it may be appropriate for investigations on a catchment-wide basis to be undertaken by the environmental regulator for that jurisdiction, with contributions from all potential polluters (industrial sites, wastewater treatment plants, landfills, etc). This work could be undertaken in conjunction with the development of ambient or background monitoring programs (including biota), the results of which would also inform the assessment of risk from individual sites.

Infrastructure acknowledges that a number of jurisdictions have commenced background monitoring programs and encourages those results to be made public when available.

Environmental guideline values

The proposed environmental guideline values presented in the PFAS NEMP version 2.0 are low and are unlikely to enable a meaningful level of assessment on most sites. For example, the suggested adoption of a 'detect' threshold for PFAS in freshwater and marine water, due to current limitations of laboratory analytical methods, is impractical to implement particularly when used to assess leachate (i.e. the majority of samples would likely be found to exceed this value, leading to potentially costly groundwater remediation and soil being deemed unsuitable for re-use or off-site disposal even at very low concentrations of PFAS).

Infrastructure accepts the science and risk profile behind the derivation of the guideline values, and notes the need for a degree of conservatism due to the nature of PFAS and the uncertainty surrounding human health effects. Balancing this, Infrastructure considers it is important that a national management plan such as the PFAS NEMP takes into account the practical ability of entities and regulators to implement and comply with the plan's requirements.

Currently, application of the proposed levels would essentially force entities to capture soil and water with no means to deal with it, but with a requirement to ensure the waste creates no further harm. It is questionable whether soil and water removed as part of a project would create an increased or unacceptable risk if returned to the same site. In practice, we are seeing increasing stocks of PFAS waste trapped on-site, which is not sustainable and increases the risk of perverse environmental outcomes (such as the mass release of stored water, etc). There are also substantial costs and liabilities associated with ongoing management of stored wastes on commercial sites and a full assessment of the costs and benefits of this, even as a temporary solution, should be undertaken.

Further clarification of the 'interim soil – ecological indirect exposure' guideline value is requested. It is unclear why such a low concentration would be applicable on sites within urban settings or with a high proportion of hard surfaces, etc., particularly when it is identified that the criteria do not consider transport of soil, or PFOS/PFOA from soil and therefore do not address impacts on aquatic biota/wildlife in the surrounding environment.

Risk-based decision making

The PFAS NEMP version 2.0 acknowledges that regulatory decisions are risk-based, however, all subsequent advice relates to the minimisation, rather than management, of risk. There is little opportunity for decision makers to consider contextual information, alternative forms of compliance or other approaches, such as clean-up to the extent practicable (CUTEP), which may offer viable solutions in some situations.

There are several references to the use of site-specific risk assessment, which Infrastructure considers appropriate, particularly given the low screening levels (discussed above) and the potential for ambient concentrations of PFAS to exceed these levels.

Infrastructure considers that the PFAS NEMP 2.0 would benefit from more detailed discussion on the practical application of site-specific risk assessment (potentially in the form of a case study), including:

- How site-specific remediation or clean-up levels could be derived and agreed with environmental regulators.
- Consideration of ambient or background concentrations of PFAS in the environment, particularly in urban or industrialised catchments, and how the catchment-wide level of PFAS contamination influences the human health and environmental risk arising from individual sites.
- How a risk based approach could be used to balance the level of remediation or management response against the actual benefit achieved. Infrastructure considers that it is critical that individual entities are not required to pursue conservative remediation targets in isolation from the wider catchment and/or without significant improvement in overall environmental values.

On-site management of PFAS contamination

The level of detail provided in Section 10 'On-site storage, stockpiles and containment' assists with the practical implementation of on-site management strategies, which is very relevant given the lack of off-site remediation and management options currently available for PFAS impacted materials. Infrastructure notes that on-site storage of PFAS contaminated materials has become commonplace on Commonwealth sites due to a lack of alternatives and substantial costs associated with current remediation technologies. However, on-site storage is rarely the preferred solution (temporary, short, medium or long-term):

- On-site storage of PFAS impacted materials on commercial and operational sites increases the risk of unintended outcomes, such as spills, leaks, exposure to workers, etc.
- Liabilities associated with on-site storage can be prohibitive and can limit a sites potential for development.
- There is often limited space that can be dedicated to the storage of PFAS (or any other) contaminated material, without impacting on the operational

capacity and/or development potential, and therefore the economic growth, of a site.

The PFAS NEMP version 2.0 states that on-site containment (and off-site disposal to landfill) is only appropriate for materials with PFOS, PFOA and PFHxS content below 50 mg/kg and that materials exceeding this concentration require treatment. Although it is acknowledged that treatment options are limited, the document would benefit from a discussion on the practical management of contaminated materials above this threshold (Infrastructure notes that Section 14.6 does not provide further information, as stated).

Reuse of PFAS contaminated materials

The decision tree for reuse of PFAS impacted soils indicates that leachate results are to be assessed against the 99% species protection guidelines value. As noted above, this guideline (or a 'detect' threshold if the laboratory cannot achieve the required level of sensitivity) is considered extremely conservative and may render soils with very low PFAS concentrations unsuitable for re-use, even on PFAS contaminated sites, without individual risk assessment and additional management measures.

The additional step of assessing leachate results against background concentrations also requires further discussion, including how background concentrations would be determined in the absence of published information.

In consideration of these steps, the decision tree does not appear to align with the statement that *"where re-use is proposed for areas with higher levels of PFAS, then the decision tree permits re-use without assessment of risk"*.

Wastewater treatment

Infrastructure considers that this section would benefit from a discussion from the users, rather than the operators, point of view, for example. For example, what are the implications on trade waste agreements and how will contaminated infrastructure be managed?

Conclusion

Infrastructure considers that the consultation process for the PFAS NEMP version 2.0 has been comprehensive for government agencies, including environmental regulators. For future versions of the PFAS NEMP, consultation could include a broader range of industry participants, for example, relevant industry associations, as well as individual corporations.

Infrastructure looks forward to continuing to work closely with all its stakeholders to progress a nationally consistent framework for managing PFAS contamination in a practical and sustainable way.

Please direct any questions regarding this submission to Lachlan Phillips, Director – Airports PFAS Taskforce, at Lachlan.Phillips@infrastructure.gov.au.

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21 June 2019

Draft NEMP 2.0 Consultation Feedback
PFAS NEMP Coordinator
C/- Emerging Contaminants Section
Department of the Environment and Energy
GPO Box 787
Canberra ACT 2601

By email: PFASstandards@environment.gov.au

RE: PFAS National Environmental Management Plan (NEMP 2.0)

Airservices Australia welcomes the opportunity to provide comments on the draft of version 2 of the PFAS National Environmental Management Plan (NEMP 2.0).

If you have any questions or require further information, please contact me on (02) 6268 4379 or at robyn.elphinstone@airservicesaustralia.com.

Yours sincerely

[redacted]

Robyn Elphinstone
PFAS Program Manager (A/g)

Draft PFAS National Environmental Management Plan Version 2 sections

If you have specific comments or suggested text changes, please clearly identify the extract of the relevant part of the NEMP on which you are providing feedback.

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1. Scope

1.1 An introduction to PFAS

Page 11, General comment regarding the section in blue - PFAS will adsorb to soil as well, so the migration of PFAS in water once desorbed from impacted soil is not as absolute as currently stated.

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5. PFAS Monitoring

5.1 Design of monitoring program

Page 17, At present, the implementation of the NEMP by EPAs discounts any other potential sources (despite the words written into the NEMP) and requires known sources that have come forward ‘publicly’ (usually Commonwealth sources) to manage all of it. As such, monitoring programs are needing to be larger in scale than needed to manage the known source and result in being larger than those with which EPAs are routinely involved. The consequences of this is for example, adverse implications for the management of non-Commonwealth sources that are being identified. There is also an issue of interpretation, with several jurisdictions requiring <LOR PFAS otherwise sampling results considered to be ‘high risk’ and monitoring unresolved.

5.2.1 Ambient monitoring programs

Page 18, spelling mistake - "assess" not "asses"

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6. PFAS Inventory

At present, the only inventories seemingly being undertaken are of AFFF, ignoring all of the other possible sources in Appendix B.

Reference to Appendix C should be Appendix B. (p20)

Reference to Appendix C should be Appendix B. (p21)

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8. Environmental guideline values

The NEMP is non-prescriptive by indicating 'guideline values should have regard to the specific environmental values and characteristics of the site' and then elsewhere saying you must use the 99% protection levels regardless. (p24)

8.1 Human health guidance values

P26, Reference to: "*The PFOS + PFHxS criterion for Residential with garden/accessible soil land use assumes equal concentrations of PFOS and PFHxS in the soil. This criterion may not be protective where PFHxS concentrations are significantly greater than PFOS concentrations. In such a case, site-specific risk assessment would be recommended*"

Response: It would appear this criterion is based on the supposed toxicity of PFOS (i.e. the TDI for PFOS). Solely on the basis of equivalent levels of detection of PFOS and PFHxS in the environment, it was recommended that this criterion also be applied to the sum total of these two species (irrespective of which is more abundant) until better understanding of the toxicity of the shorter chain species was established. In other words, PFOS and PFHxS are treated as equals, not that there are equal concentrations. Thus, this implies that HEPA is indicating that PFHxS is more toxic than PFOS, and as far as Airservices is aware, no-one has ever stated this possibility. It does not matter if it is shown that there is greater uptake of PFHxS by plants than PFOS, since the TDI would be applied to the summed total in the plant regardless.

8. Environmental guideline values

8.2 Ecological guideline values

Section 8.2.1, Table 3 - indirect exposure soil criteria. The comments mention 'accompanying text'. There appears to be no accompanying text.

Section 8.2.3, p31, Table 5. Notes for Freshwater
Note 3 states that the 99% level of protection be used for slightly to moderately disturbed systems. If this is the case, then it is difficult to understand in what circumstances the 95% protection level will be allowed.
Note 3 of the Freshwater guideline, it states that Regulators may specify or environmental legislation may prescribe, the level of species protection required, rather than allowing for case-by-case assessments. Would this potentially mean, a site auditor's decision may be overturned by regulators, if a regulator was to opt for the most conservative approach.

9. Contaminated site assessment

9.1 Guidance note – Contaminated site assessment

9.1.1, p31, Site investigation, Reference to Appendix C should be Appendix B

9.1.4, Transformation, currently the only risk presented by PFAS is attached to the regulated PFAS, being PFOS, PFHxS and PFOA. The way this section is written however, would potentially indicate that the entire PFAS load represents risk. By corollary, this would mean exposure to any PFAS poses a risk. Should there be regulatory criteria for all PFAS? Perhaps this section on Transformation, needs to apply only to situations where remediation is being actively pursued, and not in consideration of site assessment.

9.1.5.1, p35, footnote 17. This footnote could potentially allow an EPA to ignore any guidance and simply indicate that they would adopt 99% protection for everything. The problem of testing biota when water levels are below LOR is that any detection in biota cannot be attributed to a source. So in such instances, any biota testing, and public notification and advice, should be done by State agencies not the polluter (given there is no evidence of pollution).

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10. On-site storage, stockpiles, and containment

10.1 Storage, stockpiles, and containment

Temporary storage, generally in temporary stockpiles, or short term storage (in constructed stockpiles) and medium to long term containment (in engineered containment facilities) is required for PFAS-contaminated material with a PFOS, PFOA, or PFHxS content below 50 mg/kg . If ongoing containment presents unacceptable risks or unsustainable management requirements, it is generally expected that materials will be removed for environmentally sound treatment or destruction. (p38)

This could potentially prompt investigation around existing stockpiles to better understand if any of the existing stockpiles are unacceptable. However, the current options for material treatment and destruction are limited, and especially challenging for remote areas.

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10. On-site storage, stockpiles, and containment

10.2 Design considerations

No comment.

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10. On-site storage, stockpiles, and containment

10.3 Guidance note - On-site storage and containment

Containment, (p41)

The implementation of this guidance effectively requires lots of resources simply to maintain and monitor stockpiled materials, making much of it impracticable. If containment is impracticable, then disposal or destruction options must be made simpler (and that does not mean easier).

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12 Reuse of PFAS-contaminated materials

12.1 Reuse without a risk assessment

12.1.1, p50, Decision Tree for Soil re-use

This could potentially set up a situation where soil could be re-used containing KNOWN carcinogens, but not be allowed for re-use because of the presence of PFAS, that has no PROVEN health impacts.

The decision tree stated that any soil leachate concentrations that exceed the ADWG or the 99% Species protection guideline values will not be considered for reuse, which basically excludes any soil with the slight detection of PFAS from reuse.

14. Landfill disposal

14.3 PFAS Management Framework

Leachate management, p57,

Reference to Chapter 14 should be Chapter 15

14. Landfill disposal

14.6 Landfill acceptance criteria

The NEMP appears to ignore the fact that there are very few possible methods of destroying PFAS above 50mg/kg in Australia. Until this issued is resolved, the current cap imposed for landfill acceptance makes it very difficult to manage impacted sites since the guidance effectively states this material cannot be stockpiled either (p58).

Table 6, NEMP 2.0 provides landfill acceptance criteria based on the ASLP and total results, however, TCLP is more widely used by landfill facilities when doing waste characterising based on their facility license requirements. NEMP 2.0, should provide advice as to whether there are any differences between the use of ASLP and TCLP results for PFAS analyses, and whether ASLP criteria are to be applied to TCLP results. Alternatively, NEMP 2.0 should consider amending the words in this section to include TCLP requirements.

15. Wastewater treatment

Wastewater (p61).
As there are significant numbers of sites connected to sewer that have residual PFAS issues, whereby PFAS-impacted waste goes to sewer, what ideally needs to happen is that sewage treatment plants are upgraded to remove PFAS from their effluent, while bio-solids are prevented

from ANY re-use (just as is the case in Switzerland). This would take a lot of the uncertainty out of the management of residual PFAS.

15.1 PFAS Management Framework

There would appear to be the need for a trade waste characterisation guideline developed across the country due to the importance of the issue.

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15. Wastewater treatment

15.3 Case Study

No comment.

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16. Data sharing

Duplication of effort is not a factor here, given that all sites require site specific assessment irrespective of whether someone else has done a similar assessment. As no two sites are the same, someone else's efforts will only inform the efforts of others, not preclude it.

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18. PFAS sampling

18.3 Guidance note - sampling

18.3.2, p67, Prevent sample contamination. There are many exposures to PFAS that can cause detectable cross-contamination. The latter actually exceeds the guidance values so therefore, using the same logic being applied in this NEMP, must be considered a risk to public health, the same way as PFAS in the environment is. The intent of Appendix B is unclear, if fire fighting foams are the sole consideration when establishing management controls.

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19. PFAS analysis

19.2 TOPA Analysis

Currently only PFOS, PFHxS and PFOA are regulated as these are the only PFAS deemed to pose a risk to health. Transformation of PFAS by natural processes, if it occurs, occurs within weeks. TOPA of legacy environmental contamination have not shown any significant change to the regulated PFAS (small changes, within the scale of measurement errors may be observed, and often lead to a reduction in observed PFOS). As applied to site assessments, the TOPA process over-estimates any transformation, so results in an over-statement of risk. The only use for TOPA is when a site is to be remediated, to understand PFAS load and assess whether a chosen remediation process would transform PFAS species, and its use should be restricted to all such circumstances. TOPA should not be used in other investigations. (p71)

Appendix C. Treatment technologies potentially available in Australia

While those listed might be viable technologies, their application is constrained. More needs to be done on management actions for PFAS. For example, Plasma Arc can destroy PFAS but the only facilities that are operating cannot meet effluent disposal criteria for PFAS. Moreover, many of the listed technologies are NOT at a commercial application yet, but are instead still in proof of concept and field trial stages. As well, those technologies that are 'proven' may not address the cause, just the symptoms (e.g., pump and treat). Hence the management guidance (e.g. on landfilling) has to take this into consideration rather than being written as if the availability of these technologies is a given fact. (p88).

Appendix D. Example PFAS Management Framework for a Wastewater Utility

In practice, because of the way the NEMP is being applied, water/sewer authorities are simply indicating they will not receive any trade waste containing PFAS, even though there is acknowledgement that stopping PFAS impacted trade waste does not mean they stop receiving PFAS in the wastewater from impacted water/sewer infrastructure, general industry and domestic households. (p89)

Draft PFAS NEMP Version 2 – Written Submission Cover Sheet

Name (optional):

If applicable – Organisation: The State of Western Australia, submitted by the Department of Water and Environmental Regulation (DWER) on behalf of the State Government.

Address (optional): Locked Bag 10, Joondalup DC, WA 6919

Position (optional):

Email (optional):

Confidentiality

(i) Confidentiality requested? Yes / No

(ii) If so, does part of your submission include confidential or sensitive information? Yes / No

Have you provided confidential or sensitive information in a separate attachment *Yes / No*

Have you provided a redacted version *Yes / No*

Draft PFAS National Environmental Management Plan Version 2 sections

If you have specific comments or suggested text changes, please clearly identify the extract of the relevant part of the NEMP on which you are providing feedback.

Four Western Australian agencies provided comment on the draft PFAS NEMP V2.0: Department of Biodiversity, Conservation and Attractions (DBCA); Department of Health (DoH); Department of Fire and Emergency Services (DFES); Public Transport Authority (PTA). Comments from the Water Corporation (WC) are also included. The ChemCentre provided a 'no comment' submission.

8. Environmental guideline values

8.1 Human health guidance values

No.	Section	Agency	Comment	Action
1.	8.1.1 Table 1	DoH	Note that NHMRC are close to releasing new guidance on per-fluoroalkyl and polu-fluoroalkyl substances (PFAS) in recreational water and it would be useful to include the new guidance in this version of the NEMP. The consultation document is available here: https://consultations.nhmrc.gov.au/public_consultations/pfas-rec-water	Note
2.	8.1.2	DoH	Using chemical specific information for PFOS and PFHxS during the various stages of detailed site investigations and human risk assessment is supported. Results data and exposure factors for the two substances can be evaluated separately until final addition of exposure concentrations, where comparison against guideline is required, i.e. similar to assessment of other chemicals with additive effects. Use of chemical specific information throughout the evaluation/assessment may improve the robustness of conceptual site models and assist in developing remediation/management options.	Note

3.	8.1.2, 4th para	DBCA	Is it reasonable to assume that PFOS and PFHxS would be in equal concentrations in soils within the environment? These compounds rarely seem to be in equal concentrations in surface waters. Furthermore, given the apparent similarity in the toxicity of PFOS and PFHxS, it is unclear why this statement only applies to higher concentrations of PFHxS?	This statement may need to be clarified and/or further justification provided.
4.	8.1.2, pg 26 (and referring to Table 2, pg27)	WC	'These human health based soil guidance values (Table 2) should only be used to assess potential human exposure through **direct** soil contact.' However, Table 2 indicates that the residential criteria consider **secondary** exposure through home grown produce, specifically with 10% of fruit and vegetable intake with no poultry/egg.	Clarify.
5.	Table 2, pg 27	DBCA	The change in the PFOA guideline value from 0.1mg/kg to 0.3mg/kg is significant, however, the text in the 'comments and source' section of Table 2 justifying the derivation of the value remains unchanged.	Further clarification of a three-fold increase of the PFOA guideline value may be required.

8. Environmental guideline values

8.2 Ecological guideline values

No.	Section	Agency	Comment	Action
6.	8.2.1, Table 3 – land use column	WC	It would be useful if the 'land use' column of the table referenced the NEPM land uses in brackets after the text (i.e. HIL-A; HIL-B; HIL-C and HIL-D). Refer to Schedule B7 Section 3 of the NEPM in the footnote for detailed definitions.	Note
7.	8.2.1, Table 3, row for 'Interim soil –	WC	'For intensively developed sites with no secondary consumers and minimal potential for indirect ecological exposure, a higher criterion of up to 0.140mg/kg may be appropriate as outlined in the accompanying text.' Was this value adopted from the Canadian guidelines for industrial/commercial? If so, this was the soil criterion for protection of	Clarify

	ecological indirect exposure' - comments column		freshwater life and does not relate to direct or indirect soil exposure. The text in the NEMP clearly indicates that these interim guidelines are not intended to be protective of groundwater transport pathways, making the 0.140mg/kg irrelevant as an upper threshold. The upper value for soil exposure would be significantly higher under a land use scenario that does not support multiple trophic levels in a restricted foraging area.	

10. On-site storage, stockpiles, and containment

10.1 Storage, stockpiles, and containment

No.	Section	Agency	Comment	Action
8.	10.1, first para, 2nd dot point	WC	All municipal solid waste will likely contain PFAS due to its ubiquity in domestic products and packaging.	Note
9.	10.1, 2nd para	WC	'Temporary storage, generally in temporary stockpiles, or short term storage (in constructed stockpiles) and medium to long-term containment (in engineered containment facilities) is required for PFAS-contaminated material with a PFOS, PFOA or PFHxS content below 50mg/kg.'	Given the universal presence of PFAS at low concentrations in municipal solid waste (due to domestic use), a minimum value requiring management should be set (e.g. concentrations below 1mg/kg does not require special waste considerations).
10.	10, 1st para	DoH	Suggested amendments to assist in interpretation of text.	This section covers storage, stockpiling and containment of material that has been assessed to be PFAS containing or PFAS contaminated at sites that are not licenced or intended for permanent storage or disposal. Additional information relevant to aspects of managing PFAS in storage, stockpiles and containment facilities is provided in Section 14 on landfill disposal.

11.	10.1, 2nd para, 4th sentence	DoH	Suggested amendments to assist in interpretation of text.	If ongoing containment presents unacceptable risks of release to the environment or unsustainable management requirements, it is generally expected that materials will be removed for environmentally sound treatment or destruction.
12.	10.3, 3rd para	DoH	Suggested amendments to assist in interpretation of text.	Storage, stockpile and containment facilities should be designed in a manner that is proportionate to the level of assessed risk of release to the environment. The provision of storage, stockpile and containment should consider: • The volume of material • The period over which the material will be held/stored • The concentration and distribution of PFAS contamination through the material. The key design criterion is to reduce or eliminate pathways for migration of PFAS contamination. A proportionate and practical approach to managing the material may be considered where the volume is low, storage is temporary and/or the concentration and distribution of PFAS contamination through a material are low. For example where there are minimal volumes of material being held in transient stockpiles, before further transport, particularly when rain is not predicted, general good practice for stockpile management may be sufficient.
13.	10.1, 4th para, 4th sentence	DoH	Suggested amendments to assist in interpretation of text.	There may also be requirements to immediately notify the environmental regulator if a leak of liquid materials is detected.
14.	10.1, 5th para, 1st sentence	DoH	Suggested amendments to assist in interpretation of text.	Depending on the types of PFAS-contaminated materials, on-site encapsulation within engineered containment facilities may include treatment of the material such as chemical binding and immobilisation processes.
15.	10.1, 5th para, 2nd sentence	DoH	Suggested amendments to assist in interpretation of text.	While there is limited information on the long-term effectiveness of these immobilisation techniques, if the source site is hydrogeologically appropriate, and the facility is appropriately designed and engineered, chemical immobilisation and on-site

				containment with ongoing monitoring should acceptably manage on- and off-site risks of release to soils, surface water, groundwater, and to direct and indirect receptors.
16.	Sections 10 and 12	PTA	Distinguishing between PFAS-containing and PFAS-contaminated will assist those who implement the guidance in the NEMP. For example, the NEMP does not provide clarity on when the requirements of Section 10 apply compared to the requirements of Section 12. It is not clear if a land developer who detects low levels of PFAS (comparable to background) in soil or soil leachate should reuse the soil as per the guidance in Section 12 or manage the soil as per the requirements of Section 10. This is exasperated by statements such as that included on page 38 which states that 'Temporary storage, generally in temporary stockpiles, or short term storage (in constructed stockpiles) and medium to long term containment (in engineered containment facilities) is required for PFAS-contaminated material with a PFOS, PFOA, or PFHxS content below 50 mg/kg'.	Recommend that the NEMP makes a distinction between 'PFAS containing products' and 'PFAS contaminated materials'. These terms should also be defined.

10.2 Design considerations

No.	Section	Agency	Comment	Action
17.	10.2, 1st para	DBCA		Editorial amendment: 'Infiltration through~~, though~~ some liners~~,~~ such as clay and geosynthetic liners…'.
18.	10.2, 2nd paragraph, 2nd dot point	WC	'Detect, monitor and collect any PFAS-contaminated liquid (leachate generated during storage (the collected liquid should be extracted from the sumps for separate treatment or destruction).' This will be problematic in remote locations with limited treatment options and no destruction facilities.	Further advice on alternative management options may be required to prevent illegal discharge or disposal of leachates.

19.	10.2, 2nd para, 2nd sentence	DoH	Suggested amendments to assist in interpretation of text.	The goal is to provide a robust interim storage solution until a more effective treatment or disposal solution becomes available.
20.	10.2, 2nd para, 3rd sentence	DoH	Suggested amendments to assist in interpretation of text.	Accordingly, storage and containment for PFAS contaminated materials should be designed with a whole-of-life approach that ensures the site is constructed, operated, and decommissioned to:
21.	10.2, 2nd para	DoH	Suggested amendments to assist in interpretation of text.	Move all nine dot points from the second paragraph to the PFAS contaminated stockpile information.
22.	10.2, 3rd para	DoH	Suggested amendments to assist in interpretation of text.	In designing the storage facility for both PFAS containing and PFAS contaminated materials, consideration should be given to requirements for:

10.3 Guidance note - On-site storage and containment

No.	Section	Agency	Comment	Action
23.	10.3, Heading	DoH	Suggested amendments to assist in interpretation of text.	**10.3 Guidance note - On-site storage and containment of PFAS containing waste**
24.	10.3, 2nd para	DoH	Suggested amendments to assist in interpretation of text.	In the medium to long-term, particularly where ongoing containment presents unacceptable risks of release to the environment, contained material should be removed for environmentally sound management or destruction.
25.	10.3	DoH	Suggested amendments to assist in interpretation of text.	Addition of a third paragraph: The selection of suitable on site storage and containment facilities should be based on a site-specific assessment that considers the potential for PFAS to be released into the surrounding environment and the control measures required to prevent such a release. The assessment may be simple and straightforward where risks are low and more

				structured and detailed where there is a significant risk of PFAS release to the environment. The implemented control measures should be validated and routinely monitored to ensure their ongoing effectiveness. The design of storage, stockpile, and containment facilities should include consideration of: • the estimated mass, volume, distribution and characteristics of PFAS contamination (and co-contamination, if it exists) in the material to be stored • the type of PFAS-contaminated material(s) to be stored at the site.
26.	10.3.1, 1st para	DoH	Suggested amendments to assist in interpretation of text.	The key design criterion is to reduce or limit the pathways for migration of PFAS. This may require consolidation of the impacted materials in an engineered or otherwise designed facility. Where co-contamination by other hazardous, non-PFAS contaminants is discovered or known, the design of the facility should consider the properties of each known contaminant.
27.	10.3.1, 2nd para, 2nd sentence	DoH	Suggested amendments to assist in interpretation of text.	Engineered facilities for storage, stockpiling, and containment of PFAS wastes should be designed to:
28.	10.3.2	DoH	Suggested amendments to assist in interpretation of text.	Removal of 10.3.2:
29.	10.3.3, Heading	DoH	Suggested amendments to assist in interpretation of text.	Re-number due to last section being removed: **10.3.2 Storage and stockpiles**
30.	10.3.2, 2nd para, 1st sentence	DoH	Suggested amendments to assist in interpretation of text.	PFAS-contaminated materials or PFAS liquid wastes should be stored above ground in appropriate containment vessels such as covered intermediate bulk containers (IBCs) and isotainers in bunded areas.

31.	10.3.2, 3rd para, 1st sentence	DoH	Suggested amendments to assist in interpretation of text.	Storage and stockpiling of PFAS-contaminated materials and wastes should be undertaken in such a way that contamination cannot migrate into the surrounding soil or water and all runoff should be monitored for PFAS.
32.	10.3.4, Heading	DoH	Suggested amendments to assist in interpretation of text.	Re-number due to last section being removed: **10.3.3 Containment**
33.	10.3.3, 1st para, 1st sentence	DoH	Suggested amendments to assist in interpretation of text.	Key considerations for on-site containment include the site assessment outcomes; the type of material that needs to be contained; the duration of storage; the PFAS chemicals present in the contamination; their concentration, mass, distribution and volume; ongoing storage requirements; and the relevant approvals required by regulators.
34.	10.3.5, Heading	DoH	Suggested amendments to assist in interpretation of text.	Re-number due to last section being removed: **10.3.4 Siting and location**
35.	10.3.5, 1st para	DoH	Suggested amendments to assist in interpretation of text.	The following considerations are relevant for selection of storage or stockpile sites, following a site specific risk assessment, undertaken by an appropriately qualified person, to identify potential exposure pathways to sensitive receptors:

12 Reuse of PFAS-contaminated materials

12.1 Reuse without a risk assessment

No.	Section	Agency	Comment	Action

36.	12.1, 2nd para	WC	'Thus, to be suitable for unrestricted use, materials must meet the criteria for both total concentration and leachable concentration.' What leachate assessment (pH) is required? Neutral or multiple? Noting that some PFAS compounds have reported increased sorption in acidic conditions.	Clarify
37.	12.1 and Figure 1 (12.1.1)	DFES	A key principle for re-use of soil material without risk assessment is that material meets the criteria for both total concentration and leachable concentrations. In Figure 1, Step 4D of the decision tree it states the following "Do any of the soil leachate concentrations exceed corresponding background concentrations in relevant groundwater/surface water receptors?" There is currently very limited information on the background soil leachate concentrations of PFAS in the relevant groundwater and surface water receptors at a number of DFES impacted sites, particularly in remote/regional areas. It is very difficult to assess whether the material is lower or above background concentrations.	Further clarity is sought on what the appropriate decision process is during circumstances when there is no information on the leachate background concentrations at relevant groundwater/surface water receptors and how it will impact the re-use of material on a site.
38.	12.1.1, Figure 1	DBCA	The decision tree may need to be reconsidered if/when guideline values are revised to concentrations that significantly exceed background concentrations. In such a scenario, leachate from contaminated soil that is below revised guidelines may still result in an unacceptable increase in background concentrations in the environment.	Note
39.	12.1.1, Figure 1	WC	Given the entire decision tree for reuse of PFAS soil materials hinges on leachate not exceeding 99% ecological protection (i.e. LOR), the figure seems superfluous. Furthermore, the statement regarding leachate concentrations exceeding background concentrations in the relevant groundwater/surface water receptors makes no contingency for distance to receptor and dilution factor.	Consider replacing the decision tree with a statement indicating that any possible reuse will require a detailed assessment demonstrating site leachate will not exceed background concentrations (i.e. Note 2).
40.	12.1.1, Figure 1	WC	Regarding Note 7. The link does not provide any guidance on aquatic ecosystems (WQGs) as it is still a draft document and not published on this site.	Note.

41.	12	PTA	The re-use of PFAS containing material without a risk assessment is supported. The process described in Section 12.1 will not result in an outcome whereby PFAS-containing material can be reused without a risk assessment. This is because soil leachate results for PFOS will always exceed the WQG freshwater 99% species protection GDV of 0.00023 micrograms per litre. This is evidenced by the following testing commissioned by the PTA: • Testing of soil from non-PFAS containing land uses (i.e. car parks, bushland, road reserve) across the Perth metropolitan area which indicated that 136 of 150 samples (91%) exceeded the WQG freshwater 99% species protection GDV for PFOS in soil leachate. • Testing of 'clean' samples which the PTA obtained from NMI in which PFOS was detected in soil leachate by four (of four) different laboratories at concentrations greater than the WQG freshwater 99% species protection GDV. The 'clean' samples were leftovers from the recent Proficiency Testing program run by NMI. • Testing of bricks purchased at a local hardware store which detected PFOS in leachate at concentrations greater than the WQG freshwater 99% species protection GDV in 9 out of 9 samples. • Testing of soil from non-PFAS containing land uses (i.e. road reserve) which returns non-detect results for mass (<0.0002 mg/kg) and leachate concentrations which would require disposal in a double composite lined landfill (i.e. >0.7 ug/L). Further, the current decision tree is applicable to residential land uses in an environmentally sensitive area. Flexibility is required to allow soil to be reused without a risk assessment in other land use scenarios. For example, a decision tree could be developed that is applicable to industrial land use in a non-environmentally sensitive area. The decision tree could utilise the human health based guidance values for industrial/commercial land use and the WQG freshwater 95% species protection GDV.	Recommend that additional decision trees based on different land uses are included in the NEMP.

15. Wastewater treatment

15.1 PFAS Management Framework

No.	Section	Agency	Comment	Action
42.	15	WC	This is the primary issue of concern with the updated guidance. Many of the new recommended controls listed are determined based on materials being considered 'impacted', 'contaminated' or 'PFAS-containing'. It is not clear whether this is any material containing PFAS, or concentrations above the relevant ecological protection criteria. The latter would still be problematic for liquid wastes and leachates, where the current PFOS ecological protection guideline is effectively set at the level of detection. If any detection is considered 'contaminated', 'impacted' or 'PFAS-containing', this will lead to significant additional expenditure on controls and disposal across municipal and industrial wastes.	Workable thresholds for waste materials requiring PFAS management need to be established.
43.	15	WC	Tigger values – It needs to be acknowledged in the national guidance that this is a community-wide issue, with ongoing domestic use. The import and use of [domestic] products has not been regulated and needs to be acknowledged in this guidance. Most urban or built up areas will have PFOS concentrations above the 99% aquatic protection values and setting unrealistic thresholds for interim management while the compound and precursors are still being phased out of use will lead to significant expenditure that is unlikely to be aligned with the associated risk. It is agreed that PFAS contributions to the environment should be as low as practicable due to the bioaccumulative and persistent properties, but the ongoing wide-spread domestic contribution needs to be taken into consideration when setting these targets. The cost of investigations also needs to be considered. Detailed assessments for PFAS are costly, with simple sites costing $100,000 and progressing upwards of $1 million just for investigation on sites with complex interactions.	Acknowledge in the guidance that PFAS can also be introduced into the environment via domestic sources.

			The current framework directs most urban/industrial site investigations into justifying the existing site groundwater concentrations compared to background, which is expensive and unlikely to lead to any direct action at these low concentrations, due to both cost and limitations of existing remediation technologies in managing this diffuse impact. Based on the evidence seen to date for existing sites and water utilities managing the ongoing domestic input, the 95% ecological protection criteria would be a more appropriate interim target requiring direct action, aimed at providing a triage response to immediate environmental risks while sustainable mitigation strategies and remediation technologies are developed. It is considered that new industries and sites not associated with waste management should still be regulated against the 99% aquatic species protection criteria to promote adequate mitigation controls.	
44.	15	WC	The NEMP is primarily focused on contaminated sites but it also impacts on regulation of drinking water and wastewater quality. It needs to be recognised that the guideline targets are not only being used for a once-off clean up and instead should be considered for ongoing asset operation and the life of the asset. Especially with regard to the unavoidable ongoing baseline domestic wastewater concentrations that are left for water utilities to resolve in the current framework. Further to the point above, setting trigger values at the level of detection for PFOS undermines the risk based approach and tiered response. If all wastewater sites trigger the requirement for detailed assessment, high risk sites requiring immediate action will take longer to identify and respond to during phase out of PFAS use.	It is recommended that the NEMP outlines a risk management framework/hierarchy which indicates that human health based impacts (HBGV) should be responded to first, followed by immediate ecological impact (direct exposure – 95% species protection) and finally long-term ecological impacts (bioaccumulation – 99% species protection).
45.	15	WC	Wastewater recycling in regional Western Australia provides significantly better environmental outcomes than discharging to small inland surface waters or to groundwater. This reuse also provides significant community benefit by irrigating public open space and sporting facilities. There are no alternative disposal mechanisms in many inland towns and PFAS treatment is both highly cost prohibitive and creates concentrated PFAS wastes that requires disposal that is currently unavailable in the	Clarify

			regions. It is considered that overly prescriptive criteria preventing reuse will lead to net negative environmental outcomes. Dilution for biosolids and reuse water should be considered a suitable mitigation option, given the alternatives would still ultimately result in discharge to the environment but provide no additional environmental benefit.	
46.	15.1, 3rd dot point	WC	'wastewater outputs (e.g. effluent discharged to the environment, effluent used as recycled water, biosolids used for soil conditioning, and biosolids disposed to landfills or other waste disposal pathways)'.	Consider including grit and screenings disposal in the framework.
47.	15.1, pg 62, 2nd dot point	WC	It is unlikely that reasonable costs could be recovered. Acceptance of any PFAS materials leads to significant investigation costs under the current framework, definitely not something that could be cost per kilo. However, often there are no other options available, such as accepting dewatering for critical projects	Note

15. Wastewater treatment

15.2 Additional management tools

No.	Section	Agency	Comment	Action
48.	15.2, 1st dot point	WC	Research across WWTPs in Western Australia has indicated that low level diffuse impact from PFAS is present across all catchments, likely due to domestic inputs given there was no significant variance between domestic and industrial catchments. The framework guidance in this section seems tailored to the wastewater industry identifying sources and mitigating/removing the input. It doesn't	Clarify

			really seem to consider the baseline reality that domestic inputs exceed the 99% aquatic protection criteria that we are expected to meet. Upgrading WWTP to treat for PFAS is economically unviable, especially in regional locations. The primary source of these inputs in Australia, being import and use of domestic products containing PFOS, PFOA, PFHxS and their precursors, needs to be addressed as the first priority.	

Appendix D. Example PFAS Management Framework for a Wastewater Utility

No.	Section	Agency	Comment	Action
49.	App. D	WC	While acknowledging it is an example framework, the guidance within does not appear to appropriately consider the significant impacts to wastewater treatment at a state or regional utility level of service, and the constraints associated with managing larger volumes of wastewater.	With no wastewater/biosolids-specific criteria being introduced in this version of the NEMP, it is recommended that this section is put on hold until the proposed consultation with the water utilities through the Water Services Association of Australia is undertaken and feasible controls for larger treatment facilities and volumes are appropriately considered.
50.	Section 5.1, Heading	DoH	Suggested amendments to assist in interpretation of text.	**5.1 PFAS sources**
51.	Section 5.1, 1st para	DoH	Suggested amendments to assist in interpretation of text.	PFAS enters the EW wastewater plant through the release of PFAS into the EW sewage network.
52.	Section 5.1, 2nd para, 2nd sentence	DoH	Suggested amendments to assist in interpretation of text.	Consequently, the identification and prioritisation of PFAS sources is an important step in focusing control efforts on significant and readily actionable controls at the source.

53.	Section 5.1, 2nd para, 5th sentence	DoH	Suggested amendments to assist in interpretation of text.	Relevant activities are discussed below in the section on management actions to address PFAS in relation to trade waste.
54.	Section 5.1, 3rd para,2nd sentence	DoH	Suggested amendments to assist in interpretation of text.	Day-to-day flows are the key sources of PFAS.
55.	Section 5.1, 3rd para, 4th sentence	DoH	Suggested amendments to assist in interpretation of text.	The resulting additional quantities may impact the effectiveness of biological treatment processes and other aspects of WWTP operations, and lead to environmental risks associated with the release of an increased mass load of PFAS (and potentially an increased PFAS concentration, depending on the management measures applied).
56.	Section 5.1, 3rd para, 5th sentence	DoH	Suggested amendments to assist in interpretation of text.	An important consideration in relation to all PFAS is the significant uncertainties regarding the behaviour of PFAS, including the scientific evidence that PFAS precursors in WWTP influent may transform into persistent PFAS end products in effluent.
57.	Section 5.1, 4th para, 1st sentence	DoH	Suggested amendments to assist in interpretation of text.	The geographical distribution of PFAS use is an important consideration in identifying sources within individual sewerage catchments.
58.	Section 5.2, Heading	DoH	Suggested amendments to assist in interpretation of text.	Re-number due to repetition: **5.3 Risk prevention**
59.	Section 5.2 Risk Prevention, 2nd sentence	DoH	Suggested amendments to assist in interpretation of text.	The primary focus of risk prevention activity will be on minimising the key source of PFAS identified above, i.e. the release of PFAS into the EW sewage network.

60.	Table 1, pg 91	DoH	Under 'consequence' there should be a reference to a consequence, rather than a reference to 'risk'.	E.g. change 'potential health risk' to 'harm to health' (similar to 'environmental harm').
61.	Section 7 and 7.1	WC	These controls are reasonable for ensuring appropriate trade waste agreements, but given our understanding of PFAS sources being primarily domestic, will be unlikely to result in any significant mitigation of our current risk.	Note
62.	Section 9.3, 2nd para	WC	At present, EW does not direct significant quantities of treated effluent to beneficial use as recycled water. In WA, wastewater recycling in regional areas provides significantly better environmental outcomes than discharging to small inland surface waters, or to groundwater. This reuse also provides significant community benefit by irrigating public open space and sporting facilities. There are no alternative disposal mechanisms in many towns and PFAS treatment is both highly cost prohibitive and creates concentrated PFAS wastes that require disposal that is currently unavailable in our region. Overly prescriptive criteria preventing reuse will lead to net negative environmental outcomes.	Note
63.	Section 9.4, 2nd para	WC	It is also highly likely in most receiving environments that a proportion of sedimentary particles from the biosolids will be transported offsite and these are likely to carry adsorbed PFAS and other contaminants. Existing management controls for biosolids applications mean that this is not 'highly likely'. Further research is being undertaken to confirm.	Note

Comments out of scope			
No.	**Section**	**Agency**	**Comment/Action**
64.	Section 6, para 2	WC	'Appendix C provides…'. This should be Appendix B. Check other reference to the correct Appendix in the document.
65.	Section 7, 4th para	DoH	Possible editing error – believe the word 'consequence' in the fourth paragraph should be likelihood as the listed items relate to the possibility and extent of exposure that may occur under conditions/scenarios, pathways and routes of exposure. The fifth paragraph is correct as it describes the consequences/severity of effects that can occur.
66.	19.5.2, 5th para, pg 75	DoH	Suggest change to text: Conversely, if the percentage of other PFAS is high, there is more uncertainty about the PFAS present and the potential effects. ~~and a greater potential risk to manage.~~
OOS	Section 2	WC	'If Australia decides to ratify the listing of PFOS, its salts and PFOS-related chemicals on the Stockholm Convention on Persistent Organic Pollutants, or future listings of other PPFAS,…' Water Corporation strongly supports the ratification of the convention for all three chemicals to minimise impact on wastewater services.
OOS	Section 5	WC	It would be useful to include guidance in a future NEMP specific to the water industry on best practice monitoring for drinking water and wastewater, to ensure uniformity across the industry.
OOS	Section 5, note 3	WC	'This may include determining whether precursors are present'. There are thousands of PFAS compounds and not all can be analysed by laboratories. Information on precursors and transformation is still the subject of ongoing research so precursor screening is not easily to risk for public health or the environment. While precursor assessment is an interesting field requiring further development, as suggested in Table 7, it is semi-quantitative and doesn't distinguish between daughter compounds. The rates and factors driving these transformations in-situ are also poorly understood and the concentrations are unlikely to represent real world conditions. Therefore Water Corporation considers the use of TOPA/TOFA as a regulatory instrument a bit premature. Standardised analytical methodology and relevant criteria should be developed before TOPA/TOFA is put forward as an appropriate analytical method for site assessment.
OOS	5.2.2	DoH	Introduce advice in this section (as a lead into the advice provided in section 9.1.2) on early point of use monitoring of potentially impacted water, soil, and/or other media, for collecting exposure data on sensitive receptors/end-user. This will assist in having

			information available to aid development of precautionary advice and address the main concerns likely to be raised by the local community and other stakeholders.
OOS	Section 8, 6th para	WC	'Due to the persistent and bioaccumulative nature of PFAS, the use of mixing zones, sometimes known as exclusion zones, is not appropriate.' While the bioaccumulative effects of PFAS are acknowledged, consideration should also be given to ubiquitous urban background concentrations from domestic use and wastewater. Utilising the 99% aquatic ecological protection value is not considered practicable for developed area drainage and wastewater based on baseline urban concentration observations to date. The 95% protection criteria would be a better interim focus on high risk mitigation as a triage response while effort is directed into reducing domestic and commercial loading of PFAS compounds into urban waterways and downgradient marine receptors.
OOS	Section 8	WC	Request further guidance on the recommended response and contingencies for the detection of PFAS in drinking water or within source catchments, especially at lower concentrations not exceeding health based guidance values.
OOS	8.1.1, pg 25	DBCA	While 90% of intake attributed to other exposure pathways may be appropriate for primary and secondary contact in recreational waters, it may not be appropriate for drinking water, particularly in cases where groundwater is contaminated by PFAS and the primary water source at the site is bore water. If the 90% value only applies to recreational water, then the text may need to be clarified.
OOS	8.2.1, table 3	WC	In reference to 'Land use' public open space. This criterion would not be unique to public open space, consistent with the rationale for having one criterion for all land uses for indirect exposure. The land use column could be deleted unless specific land use criteria are developed (i.e. industrial/commercial criteria only protective of groundwater pathways to surface water – adjusted from Canadian guideline assumptions using Australian criteria).
OOS	8.2.1 (reference to 2nd para and table 3)	DBCA	Is a statement required to acknowledge that, while the human health guideline has been used as an Interim soil – ecological direct exposure value in the absence of an appropriate published value, this value is orders of magnitude higher than the indirect exposure value and, as such, is unlikely to be protective of organisms within the soil?
OOS	8.2.3	DBCA	'In short, default guideline values may be developed for specific catchments based on reference sites, subject to the proviso that the concentrations at the reference site are unlikely to be causing adverse impacts on environmental values'. Further clarification may be required for the above statement. If the guideline values developed for a specific catchment are higher than those provided in Table 5, what is the accepted process to justify that concentrations at a reference site are unlikely to cause adverse environmental impacts?
OOS	8.2, Table 5, pg 31	DFES	The current 99% species protection guideline values for freshwater are very conservative and it is likely that ambient PFOS concentrations, particularly in disturbed systems (i.e. industrial/commercial areas) where the majority of DFES affected sites are

			likely to have PFOS concentrations higher than the current value of 0.00023ug/L. What is the expected timing for the completion of the review of the guideline values for PFAS and are they likely to be increased to a more reasonable value?
OOS	Section 11	WC	A minimum threshold for material considered PFAS-contaminated needs to be set due to the widespread nature of the contaminant, otherwise urban soils and municipal wastes will also require special attention.
OOS	Section 14.4	WC	Technically all municipal landfills accept solid PFAS-contaminated materials, unless a minimum threshold is set.
OOS	Section 15.3, 2nd dot point	WC	'Turning of pump stations to prevent further PFAS being released downstream'. This control would likely result in overflows of raw wastewater into the environment and is not considered a feasible management option.
OOS	Section 15.3, 3rd dot point	WC	'Extraction of material from the affected sewers and the pipework cleaned'. This is not a feasible management option, due to the long time periods that the collection system would be offline, as per comment for the second dot point.
OOS	Section 15.3, 4th dot point	WC	'Diversion and collection of sewage that would normally flow through the system'. Our larger treatment plants can treat up to 180ML/d so this would not be a practicable option. Options for diversion in emergency situations are fairly limited by volumes.
OOS	Section 15.3, 7th dot point	WC	'Disposal of affected biosolids to a landfill capable of receiving PFAS-contaminated materials'. Only one landfill in WA is currently approved to dispose of PFAS-contaminated materials. This would be a significant financial burden for remote sites.
OOS	Section 15.3, 9th dot point	WC	'Treatment of the PFAS-contaminated material to meet relevant criteria, including thermal destruction of the PFAS concentrates'. There are no facilities in WA capable of treating large quantities of PFAS-contaminated waste.
OOS	Section 19.6, pg 77	WC	'noting greater leniency may be applied for samples where PFAS were detected ≤10 times LOR.' Which LOR exactly? The 'general' 0.01 to 0.05 above? Or ultra-trace?
OOS	Section 19.7 Section 9.1.5.1 Table 5	WC	The advice in these sections/table is conflicting. The guidance should be prescriptive in saying that ultra-trace is required and specify the minimum required LOR for aquatic receptors. • Section 19.7 states that the general limit of reporting is 0.01 – 0.05µg/L for PFOS in water. • Section 9.1.5.1 indicates 'a water concentration of PFAS below an LOR of 0.001µg/L should not be assumed to mean that there is minimal risk to aquatic ecosystems and does not mean that there is no need to sample aquatic biota'.

			• Table 5 goes on to say that detect can be used instead of 99% species protection.
OOS	General	WC	To date, the ANZECC calculations for freshwater protection have not been made public, making site specific assessment within the Australian framework difficult. It is not known to environmental practitioners which studies were selected as representative of Australian ecological risk, or the associated factors, assumptions and calculations. Given that these draft values have been adopted in this national guidance document, it would be responsible to share the working for this criterion in the Appendices of this document, along with other adopted criteria (although these are typically covered in the source material, i.e. Canadian guidelines). It is understood that these criteria are being considered further and there have been changes to the way these criteria are derived, but while these are adopting it as interim guideline criteria the assumptions and workings behind these values should be transparent and open to the public.

Draft PFAS NEMP Version 2 – Written Submission Cover Sheet

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Confidentiality

(i) Confidentiality requested? / No

(ii) If so, does part of your submission include confidential or sensitive information? / No

Have you provided confidential or sensitive information in a separate attachment */ No*

Have you provided a redacted version */ No*

Draft PFAS National Environmental Management Plan Version 2 sections

If you have specific comments or suggested text changes, please clearly identify the extract of the relevant part of the NEP on which you are providing feedback.

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8. Environmental guideline values

8.1 Human health guidance values

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8. Environmental guideline values

8.2 Ecological guideline values

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10. On-site storage, stockpiles, and containment

10.1 Storage, stockpiles, and containment

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10. On-site storage, stockpiles, and containment

10.2 Design considerations

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10. On-site storage, stockpiles, and containment

10.3 Guidance note - On-site storage and containment

12 Reuse of PFAS-contaminated materials

12.1 Reuse without a risk assessment

15. Wastewater treatment

There is an issue of scale in this section. The guidance focuses on "*sewerage networks managed by water utilities and authorities*". It also identifies issues relevant to "*organisations responsible for managing on-site sewage management and treatment of wastewater and trade waste*"

This is a very broad range and at the extremes will cover very different organisations in terms of capability, resourcing and operational/regulatory oversight. It is apparent the management framework could not be implemented by a smaller water utility due to the level of complexity and resourcing required.

It is important to note that many of the smaller utilities serve disadvantaged communities, discharge into inland river systems and reuse a high proportion of the treated effluent. It is important to recognise the challenges presented by utility size and capability and tailor the management approach to achieve a positive outcome all levels. As a suggestion:

- Large municipal utilities – Management framework
- Local Water Utilities - Best Practice Guidelines, trade waste management (source control), community/customer education
- Local regulatory authorities (on-site sewage management) – community education (source control)

The PFAS NEMP appendices identifies sources of PFAS discharges from commercial laundries (due to washing of fabrics containing PFAS), healthcare sector (due to various uses listed in Appendix A), car retailers/dealers and vehicle wash businesses due to use of surface treatment products and various other processes. These activities are typical small businesses in regional centres. Sampling and monitoring of these activities is expensive, impractical and may only reflect the products in use at the time of sampling. It is imperative that the National Environmental Plan has the right balance to minimise overregulation and burden on small businesses while achieving intended outcomes

It should be noted that product labelling often does not include detailed composition or a substance list. Small businesses and the public may not be aware whether the product includes PFAS.

Market control preventing products containing PFAS from everyday use (cleaning/polishing products) at the National level would provide an effective and reliable way of reducing PFAS contaminated wastewater entering to a Utilities' sewerage systems and the environment. This approach would have limited impact on local water utilities and is likely to provide a much improved and broader outcome over management planning alone.

The following recommendations are summarised from the above:

1. Acknowledge the differences in scale and challenges in implementing a management framework for small water utilities
2. Introduce labelling of products, introduce a common terms like *'PFAS Free'.* This will assist the consumer when selecting products for use as well as in the regulation of Liquid Trade Waste.
3. Restrict products containing PFAS entering the market for domestic and non-essential purposes

15.1 PFAS Management Framework

As indicated above, the management framework needs to be appropriate for the size of utility, resources available and capability

In NSW there is a delegation of environmental regulation to local government for privately owned sewage management system below a size threshold (<2,500EP). It is important the regulatory burden on local government is not excessive or overly optimistic. ie clear regulatory guidance is prepared for local government.

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15. Wastewater treatment

15.2 Additional management tools

As indicated above, the management framework needs to be appropriate for the size of utility, resources available and capability

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Appendix D. Example PFAS Management Framework for a Wastewater Utility

Sewage treatment is a high risk activity. It differs from a manufacturing process in that the input material (raw sewage) is difficult to control. The quality and volume is affected by activities in the catchment, domestic, commercial, industrial and illegal discharges, and environmental effects such as rain and temperature. Consequently utilities focus their attention on source control activities to achieve treatment objectives.

Similarly the management framework needs to focus on source control from commercial/industry (ie regulation of trade waste) and domestic sources rather than monitoring and treatment options. Section 7.2, Domestic Controls, recognises the '*limited opportunity'* for control. This is essentially a do-nothing approach and potentially creates a future liability for the utility, ie a possible future upgrade. A precautionary approach of restricting non-essential PFAS products in the market would be more effective.

NSW Government Office of Environment and Heritage

Science - Contaminants and Risk

Comment on the terrestrial guideline values:

Table 4 in the Draft NEMP 2.0 refers to the sum of PFOS + PFHxS in the second column. As these are ecological screening values from the Canadian guidelines, this should refer to PFOS only. Any associated text, e.g. the notes under the table would need to be amended as well. We note this is probably a typo/error transferred from NEMP 1.0.

		Hazardous Materials Unit - Comments on PFAS NEMP V2.0 - consultation draft - May 2019		
Issue #	**Page #**	**Document Ref.**	**Issue**	**Recommendation**
1	18	5.2.1 - last dot point	It is unclear what is meant by 'options for air sampling are currently limited in Australia'. Options for sampling of particles in air are not limited. Methods are available and routine used in Australia. Options may be limited however for analysis of the typical small volume particles sampled (also with low concentration of PFAS) to the levels required.	Requires clarification and amendment.
2	38	10. On-site storage, and containment. 10.3.4 Containment	The containment referred to in this chapter and s10.3.4 appears to be mainly focused on ex-situ containment, however in-situ containment should be considered and may be the preferred containment method, especially where short term in-situ containment is required as an interim remedial action to prevent the spreading of contaminants thereby reducing risk to the environment and human health. The text could refer to or state the components of in-situ waste containment including passive systems: vertical barrier, bottom barrier and surface cap or cover, and active systems: sub-surface drainage and pumping wells to contain groundwater contamination.	Include specific reference to ex-situ and in-situ methods as both should be clearly provided as containment options.
3	38	10. p38 - last paragraph	Chemical binding and immobilisation may be beneficial in the management of the material while in containment, however it could be noted that this may be deleterious afterwards by for example: creating more waste, waste in a form that is problematic or difficult to manage, or preventing treatment or destruction of PFAS in the waste by the methods available at that time.	Amend text to note this.
4	48	11.1 Waste code for PFAS contaminated materials	With respect to the requirement to use a single a waste code for PFAS: NSW does not regulate waste based on waste codes, rather it uses waste descriptions in its legislation. This assists in the understanding and thus management of wastes. For example with respect to the transport of waste and its risks, waste descriptions are more tangible to people such as first responders who may not be not familiar with waste codes though may have to deal with related impacts resulting from transport related incidents (including spill, leaks and discharge).	Amend text to note this.
			The requirement to use a single waste code for PFAS waste may result in misrepresenting the characteristics of the waste when it counts. For example fire wash waters or contaminated soil may contain only trace amounts of PFAS, while containing large amounts of asbestos or higher concentrations of other contaminants with more potentially and likely more significant, acute, chronic or other environment or human health risks.	""
			NSW environmental management framework (such as for waste classification and transport) is based on regard to human and environmental health risks. The general principles use to select and codify hazardous waste require the code be chosen based on the contaminant of higher potential hazard. This principle has wide (including accepted) application.	""
			The requirement for the PFAS waste description/code to take precedence over other contaminants where multiple contaminants are present and multiple waste codes potentially applicable for these contaminants which may be of significantly higher risk, is inconsistent with sound waste and risk management (with respect to waste transport, handling, treatment and disposal). The arbitrary assigning of the PFAS description to mixed waste should therefore be reconsidered.	""
			To address the above, tracking systems should be designed and implemented in a way that enables the effective tracking of waste with multiple contaminants (waste codes), so that invidual contaminants (or waste types, groups or sources) can be readily identifed, and individually reported if need.	""
			NSW has numerous waste descriptions that are used to track PFAS contaminated wastes as appropriate, such as: fire wash waters, surface active agents, halogenated organic solvents, contaminated soils, and others.	""
5	48	11.1 Waste code for PFAS contaminated materials	The text states "PFAS-contaminated materials, including waste PFAS-containing products, are considered to be Dangerous Goods Class 9". This statement should clarify who considers this, and provide justification for this. EPA notes the way this is written it appears there is no concentration threshold below which PFAS-contaminated materials are not DG, which is incorrect.	Requires clarification and amendment.

			DG Comment: Under the DG regulations, only a DG competent authority can formally determine a material to be dangerous goods. The text regarding dangerous goods in the NEMP therefore carries no weight under the DG regs and is unenforceable. Classification criteria for inclusion as UN 3077 (ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S.) or 3082 (ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S.) are based on ecotoxicity testing, which is not feasible or economic for waste materials. There is a power under the DG Regs for a determination to be made classifying certain materials as DG (e.g. materials with a PFAS concentration above x mg/L or mg/kg). The relevant thresholds should be based on available evidence and subject matter expertise. A workable solution would be for the NEMP to include a cutoff, above which it is determined that the waste is classified as UN 3077 or UN 3082 (as appropriate). This can then be used as formal guidance by the DG regulators to make a determination that these materials must be transported as dangerous goods.	Amend text to clarify thresholds
6	49	12. Reuse of PFAS-contaminated materials	The classification of PFAS-contaminated materials as DG may severly limit their reuse for the purpose of resource recovery (such as reuse of PFAS contaminated soils for engineering purposes).	For noting
7	48	11.2 Considerations for transport	The last paragraph on decontamination is very relevant in the context of transport considerations. The rest of the (earlier) text relates to authorisations and approvals which are relevant though could be included in another (eg approvals) section for this. This section should include information on and/or note: 1. Issues related to preventing or mitigating spills, leaks and inappropriate discharge (which are not mentioned or addressed, but should be). Also covering of loads to prevent air/dust emissions for PFAS contaminated soils/dusty waste. 2. Drivers should be appropriately trained on the above. 3. Transport companies have incident management plans etc in place for the transport of PFAS contaminated materials. 4. Load should also be appropriately packaged/contained and restrained. 5. The transporter may be required to be licenced for the transport of the waste. (in approvals section) 6. PFAS contaminated materials/wastes need to be characterised, classified and determined if they are trackable. 7. If the material is DG other licensing and othe requirements (eg DG Code) may apply. (some in approvals section)	Amend text to notes this.
8	49	12 Reuse of PFAS-contaminated materials. and 12.1 Reuse without a RA	The text refers to the waste hierarchy and resource recovery (s12) and reuse (s12.1) in accordance with this. For persistent organic pollutants under the Stockholm Convention, wastes must be preferentially destroyed or irreversibly transformed… (as per Section 14.6 p57). Clarification of or a reference to the waste hierarchy being used should be provided to assist with determining when it is appropriate and acceptable for resource recovery and reuse of PFAS contaminated materials (solids and liquids).	Clarify in text.
9	51	12.2 Reuse with a RA, last dot point.	PFAS leachability is noted as needing to be considered for PFAS reuse as a contruction material. It is noted that other aspects and other potential emissions will also require consideration.	Amend text to notes this.
10	52	12.2.2	Reuse of PFAS must not result in an unaccetpable of increased risk to human health and/or the environment. It is noted that it is likely there will be some increased risk with the reuse of PFAS - though it may not be considered significant.	Clarify in text.
11	54	13. Treatment and remediation.	Include 'on-site management' in the heading to clarify this is covered in this chapter - as this is not remediation or treatment. Otherwise create a new chapter for 'On-site management strategy'.	Amend text.
12		13. Treatment and remediation, point 2	With respect to immobilisation, consideration must be given to not only its apparent efficacy, but also to potential long term aspects - such as to treat and detroy PFAS. See comment #3.	Consider including this in the text.
13		13. Treatment and remediation, point 2	On-site encapsulation will also require leachate mitigation and management (as per dot point 3).	Consider including this in the text.

14	54	13.1, dot point 2.	The polluter should monitor and report … for the duration of the active and beyond until risks associated with the contamination are acceptable.	Amend text.
15	55	13.1	This section is missing a heading before "Before choosing a remediation…" - as the text is not related to onsite management strategy.	Add heading.
16	55	13.1	"If information regarding a particular approach is unavailable, seek details from the technology provider including the efficiency and effectiveness of the process and which other contaminants the process will treat" or impact the treatment.	Amend text.
17	56	14.1	Landfill siting and must also give regard to the wastes being received.	Add to text.
18	57	14.2 Landfill operation	Waste should be tipped at the tipping face where possible. The handling and movement of the waste should be minimised to mitigate or prevent the generation of air emissions, vehicle movements, plant usage, etc.	Add to text.
19	57	14.2, dot point 2	The need to use an appropriate intermediate cover should also be mentioned, in addition to daily cover.	Add to text.
21	57	14.3	a) Where volatile PFAS are present in the leachage, the potential for PFAS air emissions should be taken into consideration. b) "… to prevent PFAS distribution to the environment". Also need to eliminate leachate recycling. ie. from the leachate being reinjected and recirculated through the landfill, resulting in ongoing contamination of leachate and the promotion of further leaching of PFAS.	Consider including this in the text.
22	57	14.5	a) Closure considerations also must consider the integrity of the landfill, including the landfill liner and other parts. b) Landfill gas condensate is not monitored, rather landfill gas (which will include vapour and consensate) is monitored. c) The area around leachate dams and ponds should also be assessed due to the potential for spills around these areas. d) For closed landfills other monitoring as well as PFAS monitoring should be considered, as leakage of the landfill is likely to be determined more reliably using other chemical parameters.	Consider including this in the text.
23	58	14.6	a) Considerations in determining whether a landfill will be suitable to accept solid waste include the design of the landfill liner (not only its performance). Also climate, as high rainfall significantly increases leachate generation. c) last dot point on p58 "whether treatment of leachate occurs prior to release".	Add to text.
24	59	14.6, last dot point	more stringent requirements will apply to also prevent dust emissions, offsite impacts, tracking of PFAS, etc	Add to text.
25	59	14.6, last sentence	Work is also being done on the permeability of liners with respect to PFAS in order to develop more effective liners.	Consider including this in the text.
26	60	Table 6.	Refer to the Basel low content limit to clarify this.	Add to text.
27	61	15. Wastewater treatment	Chapter 15's focus is on wastewater treatment facilities that are water utilities, not wastewater treatment facilities run by industry. Suggest the title include reference to utilities eg. "Wastewater treatment at water utilities", or "Sewage wastewater treatment" so it is clear who and what this section will refer to.	
28	61	15. third paragraph	a) "Criteria for environmental contaminants " it is unclear if this is referring to untreated or treated water. b) Criteria are not established by a water authority in partnership with the envionmental regulator in all jurisdictions. Or at least in all/most cases. This the statement referring to this is not correct.	Amend text.
29	61	15.1	The PFAS management framework presented is for waste water treatment plant and should include this in the heading to clarify this.	Amend text.
30	61	15.1, first sentence	in addition to criteria, impacts are also unknown.	Amend text.
31	61	15.1, 2nd dot point	biological and other treatment processes	Amend text.
32	61	15.1, fourth dot point	separate compliance with the PFAS, so it does not appear to be a legal or regulatory requirement. Number dot points so it is clear which are the first three outcomes.	Amend text.
33	62	15.1, last dot point	The costs for treatment and disposal should also be appropriately understood.	Amend text.
34	85-87	Appendix B	Headings arrangement is unclear. Needs better arrangement/formatting.	Amend table.

35	88	Appendix C	Table C1 could be separated into 3 methods/areas being: 1) Destruction, 2) concentration/separation, and 3) stabilisation/immobilisation.	Amend table.

Ministry for the Environment - Manatū Mō Te Taiao

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Comments on the PFAS National Environmental Management Plan VERSION 2.0 CONSULTATION DRAFT

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Australian and New Zealand EPAs have prepared the NEMP. Therefore, in New Zealand, the NEMP acts as a primary source of guidance for regulators and environmental professionals. The NEMP 2.0 creates a foundation document for the regulation and management of PFAS, both products and wastes, as well as PFAS contaminated soil.

The document will guide regulation and management decisions about PFAS, and it is for this reason that the document needs to reflect both Australia's and New Zealand's context. This context is apparent for Australia, but the New Zealand context is largely absent. This includes reference to New Zealand central and local government structures, legislation and legislative instruments and processes, such as the authorisation of activities through the resource consent process and the Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011 (NES-CS).

Whilst resolving this issue is out-of-scope for this revision of the NEMP, the Ministry for the Environment is working with the New Zealand EPA on providing more New Zealand specific content for the next version. As such, only limited input in this regard is included in the comments. Once the incorporation of New Zealand context has been completed, we will submit the proposed changes to the working group for consideration in a future version or update of the NEMP.

More relevant to our comments on this version of the NEMP is the technical content, from Chapter 8 onwards. Given the NEMP's role as both a guidance and regulatory tool ensuring that it provides easily understood, clear and unambiguous guidance is fundamental to this document achieving its objectives.

Chapter 10 in particular is unclear and has a great deal of repetition. Not comprehensively addressing each of the three activities individually (storage, stockpiling and containment) results in a general lack of clarity. Anyone seeking guidance would need to read the whole section thoroughly before being able to extract the relevant requirements for one particular activity. There are also contradictions that add to the confusion. Throughout this chapter, there are instances where a single bullet point addressed more than one point/issue. We recommend that in these instances that you split the bullet points and address each point/issue individually, to assist with clarity and readability.

In order to provide proactive feedback, we have compiled two tables as examples of possible checklists or frameworks for anyone contemplating storage, stockpiling or containment facilities. To provide broader consistency there is potential for these or similar checklists/frameworks to be appended to the NEMP. Please note that these checklists/frameworks are intended to be an example of the concept, rather than a fully-fledged solution. We would be happy to work with you on further developing this concept should you wish to include it in this, or a later, revision.

We consider that the use of technical specifications for management measures or controls whilst detailed in parts of the document, are inconsistent with other guidelines covering similar activities. Bunding specifications, for instance, address the distance that containers can be stored from the bund itself, but fail to use or specify the use of crest locus calculations that exist in other (Australian) guidance.

We also have concerns that the lack of specificity in some of the guidance may cause regulatory or compliance issues. Examples include:

- no specification around transmissivity is included for impermeable surfaces or liners. This does not set clear expectations for environmental managers planning or developing these facilities, nor for regulators considering what constitutes appropriate protection when assessing compliance
- The use of terms such as ‘significant’ and ‘in close proximity’ are also unhelpful in guidance. From experience, these terms can cause issues when regulators are faced with possible non-compliances and are required to initiate enforcement.

Table 1 (appended) provides more specific comments on the NEMP2.

Table 1 –Comments and Remedies Sought

Paragraph	Comment	Remedy Sought
Section 8	Readability: The specific ECCC Guideline titles or exposure scenarios are not particularly clear, and it would be helpful if these were italicised to make them stand out from the rest of the text.	Italicise the exposure scenarios referred to in the text. If possible, add hyperlinks to the ECCC website. For example: …PFOS criterion for soil – indirect exposure based… vs …PFOS criterion for *soil – indirect exposure* based…
Section 8	This section contains some long sentences, and lists with bullet points that can easily be split into 2 or more sentences or points.	Sentences are often long and could be split to assist with clarity. To assist with clarity and ease of reading bullet points covering more than one point/issue should be split so that each bullet addresses only one point/issue.
8.1.2	The use of the word 'significantly in the quote from this section does not give regulators certainty. "The PFOS + PFHxS criterion for Residential with garden/accessible soil land use assumes equal concentrations of PFOS and PFHxS in the soil. This criterion may not be protective where PFHxS concentrations are **significantly** greater than PFOS concentrations. In such a case, site-specific risk assessment would be recommended."	The use a numeric value or ratio here, or defining 'significantly' as objectively as possible (for example, "more than 1.5 times greater than…" will provide readers with greater clarity on expectations and avoid doubt or conflict, and greatly facilitate interpretation by regulators.
8.2.1	"The indirect exposure guideline values (Table 3)" Table 3 is Soil criteria for investigation – ecological guideline values. Table 2 is Soil criteria for investigation – human health based guidance values.	These tables appear to have been incorrectly labelled. Please check and rectify the references to tables.
8.2.1	The first bullet point example about hard surface coverage is confusing. • The site is intensively developed with the percentage of the surface area covered by hard surfaces higher than 80 per cent of each hectare (to be applied separately to each hectare).	Consider replacement with the following: • The site is intensively developed with more than 80% of each hectare of the site covered by hard surfaces (to be applied separately to each hectare).

Paragraph	Comment	Remedy Sought
8.2.1	Long and ambiguous sentences: "These interim criteria do not consider the transport of soil, or of PFOS or PFOA from soil, into groundwater, surface water or onto adjacent sites and therefore do not cover impacts on aquatic biota, or on wildlife that consume aquatic biota, associated with PFOS or PFOA transported into surface water. It is also important to note that site specific data should be considered wherever possible, as the transport, distribution and concentration of PFAS due to variable environmental transport processes may lead to locally elevated ecological risks."	Consider splitting the sentence to improve readability and clarity, in accordance with the author's original intent.
8.2.1	The statement that advice is provided by the regulator does not apply in New Zealand.	Provided for information only – this can be addressed later following our work on the inclusion of the New Zealand context. In New Zealand, advice is generally provided by the Ministry for the Environment and the Environmental Protection Authority (central government).
Table 4	It is not immediately clear in Table 4 that birds' eggs need to be sampled to determine the PFAS level present. No clear methodology to do this is available – i.e. is the egg sampled as a whole, or only the albumin or yolk, or, how is a partially developed embryo sampled?	Specify that the sampling and analysis of birds' eggs as an indicator of avian exposure, as this is not immediately apparent. Perhaps the column "Description" could be changed to "Medium to be Sampled" and the descriptions of each cell expanded to provide more clarity.
Table 4	Some affected birds may be endangered species, of whose eggs could not be removed for sampling purposes. These populations would need to rely on samples of other species, which may occupy a different ecological niche, and thus not be representative of the endangered species.	This may require more consideration for future versions of the NEMP. In the interim, a statement to this effect should be included.
9.1.1	This is white text (**not** within the scope of the update), but contains a conflict with other parts of the NEMP, as to whether WWTP's are primary sources (9.1.1) or secondary sources (as per 6.1, which is blue text)	Resolve this conflict by stating that a WWTP is either a primary or secondary source or define in which situation a WWTP is a primary source and in which situations it is a secondary source.

Paragraph	Comment	Remedy Sought
10	Section 10 covers three activities – storage, stockpiles and containment. Each activity is distinctly different in purpose and form. The result of combining all 3 and covering short, medium and long-term for each activity makes for confusing section.	This section should be split into separate subsections, one for each activity, storage, stockpiles and containment. Whilst there may be some repetition, it will ensure anyone undertaking an individual activity can clearly identify all the relevant regulation, methods and resources required to undertake this activity and assist regulators assess compliance.
10	Non-quantifiable terms make interpretation, application and regulation of the guidance difficult.	Give consideration to the use of phrases such as 'significantly slower', and the specification of a numerical value for permeability, if possible.
10	The guidance does not emphasise the importance of runoff management to minimise the generation of contaminated water. See 10.2, where this is addressed partially.	Place more emphasis on preventing rainwater and runoff from becoming contaminated by PFAS from stockpiles or storage areas. This is particularly important in New Zealand, where rainfall significantly exceeds evaporation for most areas. Keeping rainfall and clean runoff off out of stockpiles where it can become contaminated is very effective at reducing the volume of contaminated water, and the overall costs associated with managing this additional wastewater.
10.1	Conflicting definitions of timeframes related to storage, stockpiling and containment. "Temporary" is defined in this section both as "up to 48 hours" and "up to 6 months".	Resolve the conflicting definitions. Consider adding a term such as 'transient stockpiles' for small loads of soil in the process of being moved to a more permanent location, but for logistical or practical reasons cannot be moved there within hours or days.
10.2	The first bullet point is cumbersome and not worded well.	Replace the point with the following words: • avoid or minimise infiltration by precipitation, surface water, and / or groundwater into the PFAS contaminated materials to the greatest practicable extent
10.2	The 2nd bullet point is long and contains separate ideas. "• detect, monitor, and collect any PFAS-contaminated liquid (leachate) generated during storage (the collected liquid should be extracted from the sumps for separate treatment or destruction)"	Edit 2nd bullet point, splitting into 3 points. • detect, monitor, and collect any PFAS-contaminated leachate generated during storage • leachate that is extracted from the collection system should be sampled for laboratory analysis • contaminated leachate should undergo appropriate treatment or destruction

Paragraph	Comment	Remedy Sought
10.2	The issue of volatile PFAS emissions is not covered as a design consideration.	Consider adding the following wording, or similar: In addition, some PFAS such as fluorotelomer alcohols and ketones are volatile. For these, air emissions need to be considered, noting that the options for sampling and analyses for air sampling of PFAS is currently limited in Australia and New Zealand. Management options to reduce volatilization or capture fugitive emissions may need to be considered.
10.3	Applies to temporary, short- and medium-term storage of PFAS-containing wastes during projects relating to investigation, remediation, and construction, as well as the medium- to long-term containment of PFAS-impacted materials where no other options exist for management."	The semi-permanent or permanent containment part (or, constructed stockpiles and containment structures) need their own section, as this differs significantly from temporary storage in regulatory and compliance; engineering, and management terms.
	Inconsistent technical specifications for liners, leachate management systems, etc. Technical specifications are sometimes included, but not in all cases.	Organise this section and address the technical aspects of each engineering solution in sufficient detail to provide a framework as a reference for managers and regulators. Wherever possible, provide minimum specifications for key attributes, rather than general statements, such as "appropriate" or "sufficient".
10.3.1	The mention of composite liners does not describe this term, and what characteristics constitute an appropriate liner.	Refine and add more detail.
10.3.4	Last paragraph in 10.3.4. Error - missing full stop after 'destroyed'.	Consider replacing paragraph with: "Leachate and contaminated stormwater should be captured, analysed for PFAS, and if necessary, treated, removed and destroyed."
10.3.6	There is concern from regulators in New Zealand that it may not be permissible under regional plan rules to locate any fill on or in flood-prone land.	This section should include a caveat for New Zealand users, to consider regional regulatory requirements, rather than a risk assessment being the principal criteria.

Paragraph	Comment	Remedy Sought
10.3.6	The definition of consultants able to undertake, supervise and sign off PFAS related work needs to be more clearly stated. This is a significant issue when underqualified and/or inexperienced people undertake work and produce unacceptable outcomes, causing significant delays and additional expense, and leading to legal action in extreme cases.	Define the term 'Qualified consultants'. Please clarify the term 'qualified consultant', making reference to specific qualification, relevant prior experience and, if possible, professional registration and standing.
12.1.1	Decision Tree in Figure 1. There is concern among local government agencies that the decision tree will not support the regulatory framework in place in New Zealand.	Consider a caveat statement that this process may not be applicable in New Zealand. A New Zealand specific process diagram will be compiled and provided for inclusion in a later version of the NEMP.

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The following tables have been provided as a means of making the various requirements for storage, stockpiling and containment, covered in section 10 and the guidance note in section 10.3. more clear. The tables represent a checklist or 'table of contents' approach to planning the activities. These are not intended to be complete, and will need to be developed further, if the approach is seen to have merit. Separate tables would be compiled for each activity, and possibly split into the various timeframes as well, giving clarity to those designing PFAS stockpile or containment facilities.

Table 2 – Example of Checklist for Storage of Unused Chemicals containing PFAS

Storage of Unused Chemicals containing PFAS	
Control:	**Achieved?**
Install appropriate signage. *(Insert relevant section of NEMP or reference to other legislation for assistance)*	☐
Store chemicals / unused stocks in accordance with legal requirements.	☐
Wherever possible, store chemicals under a roof or within a building.	☐
Store in approved containers.	☐
Provide appropriate secondary containment.	☐
Prevent rain from entering the bunded area.	☐
Label containers appropriately.	☐
Ensure emergency response documentation is in prepared and in place.	☐
Test Emergency Response Plan.	☐
Verification of controls by authorities or experts.	☐

Table 3 – Example of a Framework Approach for Short-Term Stockpile Management (temporary storage, up to 6 months)

Short-Term Stockpile Management (temporary storage, up to 6 months)	
Risks	**Design Considerations and Management Requirements**
Permitting / authorisation by regulators	Ascertain regulatory status of the proposed activity. Ensure all licences / authorisations have been obtained prior to commencement, including the landowner's permission.
Health and Safety	Determine all exposure pathways for site users and adjacent land users. Ensure adequate space for safe access, loading / unloading and inspection. Height and maximum slope angle of stockpiles. Demarcation / fencing of excavations, confined spaces, etc. Specific Risks present at site, such as excavations, confined spaces, hazardous atmospheres, working at height, machinery guarding, etc.
Contaminant specific risks	Specific properties of PFAS compounds should be considered, including: Transport in soil, water, groundwater Volatility Ability to infiltrate liners or clay Other contaminants present
Levels of contamination in stockpiles	Contaminated material with a PFOS, PFOA, or PFHxS content <50 mg/kg – relevant in term of managing wastes in accordance with the Stockholm Convention on Persistent Organic Pollutants.
Climate Rainfall	Determine whether proposed location is flood prone land. In high rainfall areas, stockpiles should be protected from rainfall at all times. Avoid temporary stockpiles during rainfall, or when rainfall is likely Ensure stockpiles are not in stormwater flow paths
Climate Wind	Establish the wind direction, speed and frequency at the site. Determine whether any sensitive receptors are located adjacent the site, or in close proximity.
Discharge to stormwater drains or waterways	Check as built plans for infrastructure and verify accuracy of the plans. Locate all stormwater drains prior to planning the location of stockpiles. Protect stormwater drains from receiving contaminated runoff.
Risk to groundwater	Prevent contamination of permeable substrate Locate stockpiles away from sensitive groundwater areas
Any additional requirements…	As necessary for each activity.

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19 June 2019

The National Chemicals Working Group
By email to PFASstandards@environment.gov.au

Dear Members

Submission on PFAS Draft NEMP version 2

Thank you for the opportunity to submit feedback on the PFAS draft NEMP version 2. This letter is a summary of the comments from the New Zealand Regional and Unitary Councils' Contaminated Land and Waste Special Interest Group.

General Comments

We welcome a second version of the PFAS NEMP which further clarifies the guidelines set out in version 1. We would seek to apply it in New Zealand *provided* the document sufficiently addresses the New Zealand context. This is not currently the case.

The NEMP version 2 is heavily focused on the Australian experience and situation; this is evident through the lack of direct reference to the New Zealand situation and also in the use of key terminology, such as licensing (Australia) vs consenting (New Zealand). Again, this makes it difficult to apply the document in its current form to New Zealand circumstances.

References and links to New Zealand legislation and regulatory framework are absent throughout the document. We suggest that a different coloured text box is used to detail any points that will be different in a New Zealand context, i.e. linking back to the Resource Management Act and regional plan rules. Other references could be made via an appendix if the information is too large to sit in the main text. The current text risks contradicting guidance released by Ministry for the Environment on their website.

In general, we consider the document highly repetitive and the structure lacks a logical treatment of each section.

The document does not appear to provide any significant discussion or summary of health or environmental effects or provide relevant links.

We also suggest the document needs careful proof reading and editing as many of the references included in the text are incorrect, i.e. page 20, section 6, last paragraph refers to Appendix C, but the correct reference should be to Appendix B.

Our ref: Environment Canterbury file number WSTE/CTS/10/4 - PFAS
Your ref:
Contact: Isla Hepburn isla.hepburn@ecan.govt.nz or Victoria McKay Victoria.McKay@trc.govt.nz

Specific Comments

- *Section 8*

8.1.1 (Page 26)

In developing the guidelines and noting that the methodology used is not yet published, has this been cross-checked with New Zealand Methodology? How can we look at background numbers without a published methodology?

Please clarify the guideline value provided. Is this either the PFOS only, PFOA only or the sum of the two?

8.1.2

Please explain what “Significant” means in paragraph 4?

Page 27 – Table 2

The reference to public open space land use appears to include parkland/ecological areas. Does this sufficiently reflect a difference in the scope of land use categories between Australia and New Zealand? Does this table actually include New Zealand specific receptors?

8.2

Table 4 page 30

Please provide full wording (wet weight?) and definition for “ww”. Please explain what you mean by the uncertainty factor.

8.2.1

Second bullet point on page 29: Please explain what “close proximity” means.

9.1.1

Page 32 paragraph 2

The examples provided of primary and secondary sources are inconsistent in the document, i.e. landfills and WWTP’s are referred to elsewhere as secondary sources.

- *Section 10*

Section 10 has a mixture of headers and subsections and is difficult to understand. It is unclear if short, medium and long term storage is treated significantly differently. This section reads poorly and contains much duplication.

10.3.1

Composite liners are mentioned, but the document does not say what this actually means. Please explain.

10.3.8

This section is very high level, i.e. the document offers things to consider, but no standards are referenced. This approach to risks conflict with New Zealand hazardous substances guidelines e.g. https://worksafe.govt.nz/topic-and-industry/hazardous-substances/guidance/hazardous-substances-cop/.

The land fill cap reference does not give a permeability criteria to design to, i.e. $x10^{-8}$. Please clarify.

10.3.6

The document refers to a facility being located in floodplains. Many regional plan rules in New Zealand do not permit the use of fill in floodplains. The ability to locate contaminated fill may be less achievable in New Zealand given the different climate to Australia. This approach does not appear to align with precautionary principle.

- *Section 12*

12.1

The document is confusing with regard to the reuse of PFAS soils unless below guidelines. This does not fit within the current New Zealand regulatory framework (i.e. consents required).

12.1.1

This decision tree/flow chart loses relevance to NZ and is therefore not applicable. We would recommend that either this is stated in the figure title or else a second flow chart with reference to the New Zealand regulatory environment is inserted as an appendix and referenced at this point.

- *Section 15*

In our experience, wastewater operators do not appear to be monitoring PFAS, with the exception of larger operators such as Watercare in Auckland.

This section shows how advanced Australia is because of their experience in dealing with widespread PFAS contamination issues. This guidance would signal a significant change for New Zealand operators and this may not be an appropriate fit for New Zealand's limited PFAS sources and lower level contamination issues. This chapter implies that detailed, onerous and new work is being required of wastewater processors and regulators.

It is also unclear how the PFAS inventory of specific catchments fits with the functions and duties of regional councils or PFAS monitoring at WWTP's. Territorial Authorities have bylaws which will not accommodate these requirements. This may transfer a lot of risk to New Zealand Territorial Authorities.

- *Appendix 10*

TOPA and TOFA are discussed in the document; this analysis is not currently available in NZ.

Thank you again for the opportunity to submit on this guidance. We very much hope that our feedback encourages a more balanced and relevant approach to the New Zealand context within the document.

If you would like to discuss our submission further, please do not hesitate to contact me.

Yours sincerely

Isla Hepburn
Senior Scientist, Environment Canterbury
Convenor, Contaminated Land and Waste Special Interest Group

CC: Ministry for the Environment

Comment on the NEMP 2.0 for submission to HEPA

Overview

These comments on the PFAS NEMP 2.0 have been prepared by the Australasian Land and Groundwater Association in response to the request from the Australian Environmental Agencies for industry comment.

We note that PFAS are a complex and ill-defined group of chemicals, and the particular PFAS that is often of most importance for contaminated sites, PFOS, is persistent, bioaccumulative, and toxic, and has accordingly been included in the Stockholm Convention. We see this to be appropriate, and that it is important that controls be applied to limit exposure. Because understanding of the effects of PFAS is still evolving, the regulatory approach being taken is to adopt a precautionary approach. While we see this to be appropriate, we see that the critical matter is to achieve the correct balance between the level of precaution, the magnitude of effects that might occur, the likelihood that these effects will occur, and the regulatory response that is therefore accorded. Regulatory responses to such complex problems are necessarily pragmatic and practical and will not address all possible concerns. We consider that, in such a situation, the approach should be to understand the sources of PFAS and to focus on minimising the mass of PFAS released to the environment. This can draw on the principles of Hazard Analysis and Critical Control Points (HACCP), applied widely in the water industry, where the greatest return on investment can be achieved in minimising the risks posed by PFAS.

We believe the appropriate balance in these matters has not yet been achieved in the NEMP, and offer suggestions below for consideration.

In general, the NEMP is a good document, reflects current knowledge, and suggests helpful considerations for assessing PFAS contamination of soil, water, sediment and groundwater, and responding to the contamination. We note that the NEMP 1.0 has been an important and useful guidance document, and is being widely referenced and referred to by the industry.

In preparing these comments, we have particularly considered the practical issues confronting organisations with responsibilities for addressing the contamination. The comments have been assembled in the form of a Table. The comments have not been restricted to just the yellow highlighted sections of the NEMP, as we consider that it is inappropriate to ask for comment on very small sections of a guidance document, as matters need to be seen as a whole and there has been an evolution in understanding since the first PFAS NEMP was released.

Overall, the NEMP has adopted a risk-based approach to the problem, and refers to applying the principles of sustainability. This is appropriate. The NEMP has also set screening levels based on considerations of whether adverse effects might occur, and the overall approach follows Australian regulatory guidance as outlined in the ASC NEPM. This is appropriate. Australia is in the process of establishing guidance on management and remediation of contaminated sites (a draft National Remediation Framework (NRF) has been issued for comment), and this is an evolving area.

The NEMP has sought to draw out the approaches outlined in the NRF, and we see that there is general consistency between the two. It would be helpful to note the NRF in the PFAS NEMP.

We see that the most difficult and serious issue that needs further consideration in the NEMP is how to respond to the unique problems that PFAS raises. Most particularly, these are the very widespread presence of PFAS in the environment at concentrations that exceed the proposed screening thresholds, the uncertainty attached to these thresholds and the setting of very low thresholds that reflect the possibility of effect, the potential for many other PFAS to be present that are not necessarily identified by laboratory analysis and for which we do not have screening criteria, and the fact that the PFAS are persistent and will only slowly attenuate.

This situation conspires to the setting of guidance that is likely to not provide for a practicable and sustainable outcome. In particular, we see:

- In many cases it is very difficult to establish the actual risk posed by contamination that exceeds the thresholds, and whether there is in fact an adverse effect that is unambiguously

attributable to the PFAS contamination. While it might be argued that this is not an uncommon situation when assessing contaminants, the situation is particularly difficult for PFAS in that will not be practical to define the areas where thresholds are exceeded when thresholds are below the level of detection and can be exceeded by ambient contamination. Undertaking a field investigation that seeks to distinguish effects on species abundance and diversity, by way of example, is unlikely to be helpful.

- Additionally, in most cases it is not practical to seek to remediate the receiving environment off site, certainly not to concentrations that are less than the thresholds, and the practical and sustainable response is therefore to seek to reduce the mass flux leaving source areas, where PFAS is present at significant concentrations and can be measured and perhaps controlled. Once appropriate control measures have been implemented, the concentrations in the receiving environment should reduce over time and this can be validated via ongoing monitoring. It could be argued that because most PFAS will degrade only very slowly, attenuation will be very slow. However, where the major historical releases to source areas no longer occur and the mass flux from source areas reduces, attenuation may occur relatively rapidly down gradient as non-contaminated material replaces or covers contaminated material, and through natural dispersion and dilution. During this process, if necessary, controls to protect important receptors may be implemented. We note that the Stockholm Convention has reduced the use of PFAS, and this is perhaps the most important means of reducing PFAS concentrations over time. This has been seen, for example, with other contaminants (such as the decline in chlorinated pesticides in the receiving environment, and also for PFAS in blood serum where we understand concentrations have declined by some 85% over 10 – 15 years.
- The draft is suggesting that it is a key objective to reduce concentrations of PFAS to below threshold levels that are extremely low. This is the case, for example, in proposing that reuse/storage/containment of soil should be on the basis of avoiding exceedance of aquatic ecosystem criteria. Generally in Australia soil reuse has been on the basis of total concentrations, and landfill acceptance has been on the basis of drinking water guidelines (100 x ADWG) rather than on the basis of aquatic ecosystem criteria. This applies, for example for contaminants such as PAHs, B(a)P, pesticides and chlorinated hydrocarbons, and metals such as copper. If soil reuse were to be based on leaching not exceeding aquatic ecosystem criteria, we expect that this would greatly reduce the potential for soil reuse, and would greatly increase the quantity of soil having to be disposed of to landfill. Given the potential to give rise to extreme costs and loss of resources (such as both clean fill, and landfill space, not to mention energy to undertake the necessary works), we consider it would be appropriate to prepare a Regulatory Impact Statement (to determine the costs to Australia that flow from the requirements of the proposed Plan) to understand and justify the requirements that are being proposed.
- Establishing a practical proportionate regulatory response is a key matter – in our view inferring that responses must comply with criteria that are below the level of detection, on a precautionary basis, is not a practical response. There are many cases where pragmatic responses to contaminant concerns have been established in Australia, for example, in the management plans for scheduled wastes (eg in setting quantities of concern for contaminants such as PCBs), in the use of disinfectants and controlling disinfection byproducts in drinking water, and in responding to arsenic contamination. We consider that widespread diffuse contamination that exists over broad areas (such as in airfields) warrants a different approach from areas where concentrated releases have occurred. Developing responses based on (proportionate to) the mass of PFAS to be controlled (and able to be controlled) would be a key matter to be considered.

Section	Topic	Comment to the regulators	Additional comment
5.1	Design of monitoring program	The ideas outlined for the design of a monitoring program are good. However, as recognised, there can be considerable variation (seasonal, rain dependent etc), and to properly characterise this may require considerable sampling and analysis. Instead, consideration should be given to monitoring receptors (particularly receiving waters and sediments, and possibly biota) (rather than attempting to characterise the temporal variation in drainage flows), and to derive from this whether changes are occurring. Notwithstanding this, it is also important to undertake sufficient monitoring to be able to distinguish the relative importance (mass flux and resulting concentration) from particular source areas, so that monitoring can be focussed accordingly. Note that the mass flux in surface water flows are likely to be much more than in groundwater; however, if groundwater is used, then concentration rather than mass flux can be more important. When dealing with surface water transport, the receiving environment is likely to provide an integration of discharges, and this can be less variable and trends can be more easily distinguished.	
5.2.2	Site-specific monitoring programs	The ideas are broadly consistent with previous requirements.	This section emphasises: - Importance of monitoring having the objective of informing the development of a robust Conceptual Site Model - The need for sampling aquatic and other biota and animal/human food (which sometimes can be problematic in view of other sources). - Need to distinguish ambient from site sourced contamination.
6	PFAS inventory	Appears to be appropriate.	
8	Mixing zones	It is noted that the use of mixing zones is inappropriate. We agree that this can be the case for direct toxicity effects; however, where the criteria take into account bioaccumulation (such as the 99% ANZECC values), it may be appropriate to consider the extent of local variations and	While apparently not permitted, it would seem that it may be appropriate to consider the extent of local variations and exceedances and to allow for some localised exceedance.

		exceedances and exposure, to allow for some localised exceedance - which effectively becomes a local mixing zone. Note that if mixing zones are not allowed, then the receiving water aquatic effect threshold may then become the criterion for the discharge – this in turn can then require that all discharges have non-detectable PFOS at the ultra-trace analytical level. While at first this may appear necessary, when the range of discharges that may have PFOS present are considered (such as urban wastewater treatment plants discharging to the marine environment), this may set up the situation where all such discharges require tertiary treatment (eg by GAC or IX). Clearly this would be a great burden to our community and, where such discharges are subject to very high levels of dilution, may not be a wise commitment of resources. Instead, an alternative regulatory response would be to determine the most significant sources of PFAS, and to direct the response to minimising the release from such sources. The application of the Stockholm Convention is one such response.	Reference to not allowing mixing zones should be deleted.
8.1.1	Drinking water and soil criteria	Comments regarding conservative nature of the drinking water criteria are appropriate. It is noted that exceeding drinking water criteria does not necessarily constitute a risk if other pathways are controlled. This is appropriate. The soil criteria have been revised slightly (PFOS increased from 0.009 to 0.01; PFOA increased from 0.1 to 0.3 mg/kg residential); the data on which these have been based is not clear. We consider it is inappropriate to ask for feedback on a document without releasing all of the information that went into the document.	There is now a large dataset for uptake from soil and some data for irrigation water; these have been included and assessed in various reports that are publically available (such as in the form of Defence reports). Uptake criteria should take into account this body of Australian data and the receptors that are important in Australian settings.
8.2	Application of ecological guideline values	Emphasises that the criteria are not remediation values. This is appropriate. However, because of the repeated reference to the need to avoid risk that is referenced to the criteria, the criteria can in many cases become default remediation criteria. In many cases this will not result in a sustainable response. It is recommended that consideration be given to assigning higher default remediation criteria than the	

		aspirational threshold criteria – such as is applied in the USA and the Netherlands.	
8.2.1	Single ecological guideline for soil	It is agreed that the basis for the previously published 0.14 mg/kg value was not strong. However, to set 0.01 mg/kg as the default (although subject to some caveats) is very conservative. Note that where this is exceeded, it will require considerable investigative work (and cost) to resolve the level of risk. It can be expected that 0.01 mg/kg will become the default for organisations with large areas of land, such as Defence, Airservices and larger industrial operations, and areas where wastewater treatment and biosolids reuse or disposal is or has been practised. It is considered that setting this criterion should be justified by a Regulatory Impact Statement that determines the level of cost that results from the setting of this criterion.	
8.2.2	Criterion for birds' eggs	The criterion for birds eggs has been reduced from 1.9 mg/kg, to 0.2 ug/kg. This is the result of applying an additional safety factor to a Canadian value. We have not been able to determine if this is appropriate.	Similar comments apply as for 8.1.1.
9.1.4	Other PFAS	Statement of fact.	Emphasises that the standard analytical suite will not identify the bulk of the PFAS compounds, in some situations.
9.1.5.1	Bioaccumulation and the freshwater criterion	Encourages the use of 0.001 ug/L rather than 0.00023 ug/L for freshwater and marine ecosystems. We consider that the value of 0.00023 ug/L is not well founded, and we understand that the results of other studies are being reviewed. We note that the basis for requiring 99% rather than 95% species protection is based on the adoption of an arbitrary factor to account for bioaccumulation; this has profound implications in terms of cost and may not be justified. Consideration should be given to the practicality of adopting these criteria as the levels above which action is inferred to be necessary. Consideration should also be given to ambient/background concentrations. Note that setting this particular value has implications for many other aspects of the NEMP, and can greatly affect the requirements for management and response to PFAS	Encourages the use of 0.001 ug/L rather than 0.00023 ug/L for freshwater and marine ecosystems, but with quite a few caveats. Notes the CRC CARE marine values are being considered. It is appreciated that the NEMP may simply follow the WQGs, and the WQG process does not require a RIS. Hence there is the concern that undertaking a RIS might be costly and might ultimately not change anything. However, what can be changed is the regulatory response that is required; for example a response framed in terms of the mass of PFAS, or the level of effect and the likelihood that this effect will occur (eg ISO 31000 (Risk Management)). Providing a defined (and relatively simple) approach as to how to

		contaminated sites. It is a critical criterion. Similar to the setting of the soil criterion (0.01 mg/kg), a Regulatory Impact Statement should be carried out to understand the implications and appropriateness of setting such a criterion and the regulatory response that is indicated where exceedances of the criterion occur.	respond to exceedances of the threshold criteria based on the magnitude and likelihood that this will actually occur would be helpful.
10.1	Storage and containment	The text is generally appropriate, although it suggests that waste with a concentration greater than 50 mg/kg must be treated and cannot be temporarily stored. This is quite unrealistic; such material will often need to be stored for a considerable time before appropriate treatment can be organised. It is inappropriate to suggest otherwise. The discussion regarding immobilisation is not clear as to whether this can be applied to material that has a concentration greater than 50 mg/kg (ie meets the requirements for being “irreversibly transformed”). This should be clarified. The examples given about minimal risk (10 m^3 and 48 hours) are unnecessarily restrictive; current practices require relatively large quantities of soil to be stockpiled, for example.	This section provides commentary on temporary, short term and long term storage. It is generally appropriate and reflects good practice. Acknowledges that immobilisation can be considered as a means of reducing the potential for release and as an adjunct to containment. It is not clear whether it is allowing material with greater than 50 mg/kg to be immobilised.
10.2	Design of containment systems	The suggestions appear to be generally appropriate.	There is a lot of guidance provided on the design of containment systems. Generally it seems to reflect good practice. There is a comment that it may be necessary to provide segregated storage depending on the types of PFAS present (eg liquids, solids concentrates etc).
10.3	On-site storage and containment	The suggestions appear to be generally appropriate. It is noted that much of this guidance has been drawn from the requirements for design of landfill systems, which are applied more generally to long term indefinite containment of wastes. Applying this to what might be relatively short term storage can be a very conservative response. Many facilities continue to use AFFF that has some PFAS (generally shorter chain more complex compounds), although generally not PFOS and PFOA. In addition, many existing fire systems have not been fully cleaned of PFAS, and still may	

		include some PFOS. It requires consideration as to whether the requirements relate to such facilities. These various sections appear to repeat matters, and there could be some rationalisation of the sections.	
11	Transport	No comment	General considerations relating to transport and interstate transport are discussed.
12	Reuse	Allowing reuse under appropriate conditions is appropriate.	Section allows for reuse, with stringent requirements and agreement by regulators.
12.1	Reuse without restriction	The discussion on reuse without a risk assessment generally appears appropriate – however, as we read it the decision diagram requires that if the soil leachate concentration exceeds the Water Quality Guideline for 99% protection (0.00023 or 0.001 ug/L PFOS) or the background water concentration, a risk assessment is required. As it seems inevitable that this requirement will not be met, the decision process effectively does not allow reuse of any contaminated soil without a risk assessment, and it begs the question of then why this section would be included. Note, in our experience the relation between PFOS soil concentration and PFOS in a leachate test is X mg/kg (soil) results in 50 X ug/L in the leachate. Hence if the requirement is that the leachate be less than 0.00023 ug/L, then this would require that the soil concentration be less than 0.00023/50 mg/kg – which is clearly not workable. We consider that it would be more appropriate to limit leaching on the basis of the ADWG, noting that in many cases contamination that is below the surface soil will have most significance in terms of direct use of groundwater (eg drinking water) and the resulting flux from deeper soils to surface waters will be small and will not significantly affect surface waters. Hence it follows that the surface layer of soil and leaching and transport of PFAS from this soil into surface water can be the critical consideration. Then factors such as the relative contribution of rainfall runoff from contaminated areas to runoff from the broader catchment becomes important. In view of this, relatively simple measures such as	General guidance on reuse without a risk assessment is provided. Notionally allows reuse of contaminated material in locations with higher contamination (as per guidance to airports), with regulator agreement. A decision tree is provided for reuse of soil. A preliminary risk screening decision process is provided. The outcome of this guidance is that reuse must not proceed without a risk assessment (as per next section) To our knowledge the 100 x drinking water criterion for landfills originated in the USA, and has been adopted in Australia. It is a pragmatic regulatory response that recognises that in most landfills the rate of leachate leakage will be such that it will dilute significantly in the underlying groundwater, and will dilute further on discharge to a receiving water where the aquatic ecosystem criteria apply. That is, the concentration in groundwater external to the landfill or in the receiving water will not be equal to the leachate concentration within the landfill. The question arises as to whether this will apply for PFAS. Since the rate of leachate leakage is likely to depend on faults in liner systems and advective flow, we expect that the principles can apply to PFAS in terms of deciding on a broad regulatory requirement. We note also that setting landfill acceptance criteria on the basis of drinking water rather

		ensuring that contaminated soil with PFAS concentrations (that will not affect the use of groundwater) is covered with a layer of clean soil, or allowing PFAS in surface soils to deplete through rainfall infiltration, especially if the area exposed is small, and allowing acceptance of moderately contaminated soil at depth (ie applying a leaching criterion based on the ADWG), may then be more practical and appropriate responses. .	than aquatic ecosystem criteria is a pragmatic regulatory response and will not protect all circumstances that could be envisaged. In terms of extending this to reuse of soil, we consider that the same principles can apply: leaching from reused soil will dilute in groundwater (and the ADG can be relevant) and then in most cases will further (greatly) dilute in the receiving surface water (where the aquatic ecosystem criterion may apply). While not protective in all situations that can be envisaged, we consider that framing reuse in terms of drinking water criteria to be a pragmatic regulatory response that is broad accord with approaches taken for other situations.
12.2	Reuse with a risk assessment	The requirements relating to risk assessment are noted. The example situations noted where reuse may be appropriate are considered relevant.	Need to consider whether the requirements impose restrictions on current practice or currently accepted practice, and whether such practice needs to be changed.
12.2.1	Unacceptable risk situations	This section now effectively does not allow reuse if any of the constraints apply, whereas it previously indicated that if the constraints applied, the risk needed to be assessed and the regulator consulted. Many of the constraints (particularly those regarding environmental significance) can be limiting for some sites.	.
12.2.2	Reuse of water	Generally appropriate	
13	Treatment and remediation	Generally appropriate	
14	Landfills	Generally appropriate.	
	Table 6	Generally appropriate. We note that criteria are based on drinking water guidelines; this takes the normal approach, and is appropriate.	
15	Wastewater treatment	The approach is generally appropriate. However, we note: - “Compliance with the NEMP” infers the NEMP has statutory standing in various jurisdictions? Note that the application of the aquatic ecosystem criterion is problematic.	This section provides discussion on accepting PFAS contaminated trade waste.

		- In general, the constraints on water reuse and the PFAS concentrations in receiving waters may make the broad requirements unworkable. - The considerations should extend to ambient or background levels of PFAS in both the environment, receiving waters and trade waste; and whether acceptance of PFAS containing trade waste is likely to significantly increase these levels in the receiving environment. Mass loads are an important consideration in this. As an example, this becomes an important consideration in deciding whether leachate from landfills can be accepted by the trade waste system. We had understood that such factors were being considered to determine if landfill leachate could be accepted by the trade waste system, this does not seem to have been considered. We understand that the mass contribution from landfill leachate is small compared with other loads of PFAS to the sewerage system and in urban wastes being disposed of to landfills, and hence that disposal of leachate to the sewerage system is a practical low risk response and should be considered.	
18.3.2	Preventing sample contamination	A very broad range of substances of concern are listed. Not clear that these will all give rise to problems	May raise concerns regarding past practices.
19	Includes commentary on the merit of including TOPA	Appears to be appropriate.	Further encourages the use of TOPA. There is the inference that if the environment is oxidative, precursors revealed by TOPA may transform. Example given with groundwater and use of TOPA reinforces that TOPA is required. Commentary on limits of reporting – need to be considered.
Appendix B		This appendix provides an impressive listing of possible PFAS sources. It would be interesting to compare these with ambient and background levels of PFAS, to determine whether the widespread occurrence of PFAS can be accounted for (eg in agricultural land). It would also be interesting to undertake an estimate of the mass loading that all of these sources contribute to the environment relative to the ongoing contribution that soil contamination sources now	Interesting that there is no reference to usage in agriculture, and hence no accounting for why we might see PFAS in farmland.

		make (recognising that the historic high level use of firefighting foams has now large ceased), so that a proportionate response can be determined.	
Appendix D	Example PFAS Management Framework for a Wastewater Utility	The overall approach outlined in this Appendix accords with the ideals of environmental protection; however, the extent to which this can be realised for all of the water authorities in Australia is questioned. This appendix effectively sets up a situation whereby a water authority can be at risk of non-compliance and regulatory or community action if it has not undertaken the course of action outlined. Note the requirement in Section 8 of the NEMP that does not allow mixing zones, and the implication that this will then require that any discharge of PFOS detectable at the ultra-trace level of analysis is unacceptable. It is not clear that the formulation of this set of requirements has considered the cost of undertaking all of the work outlined, and its practicability. A particular concern is that the risk assessments appear to be firmly anchored against preventing any potential for the aquatic ecosystem criterion to be exceeded; while meritorious, this effectively requires that work be directed to understanding all sources of PFAS (both point source and more diffuse urban contributions) and reducing them to less than the level of detection. Clearly this is impractical. We encourage undertaking a Regulatory Impact Statement to understand the cost of the proposed guidance, and its sustainability, before it is implemented.	Overall, we consider the approach outlined is something that should be undertaken by the industry for a few selected wastewater systems, with a view to disseminating the learnings in the industry, rather than implying that all water authorities should undertake the outlined approach for all their wastewater systems.

Draft PFAS NEMP Version 2 – Written Submission Cover Sheet

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If applicable – Organisation: Australasian Land and Groundwater Association

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Position (optional):

Email (optional):

Confidentiality

(i)	Confidentiality requested?	No
(ii)	If so, does part of your submission include confidential or sensitive information?	No
	Have you provided confidential or sensitive information in a separate attachment	*No*
	Have you provided a redacted version	*No*

Draft PFAS National Environmental Management Plan Version 2 sections

If you have specific comments or suggested text changes, please clearly identify the extract of the relevant part of the NEP on which you are providing feedback.

Proposed human health guideline values for inclusion in the PFAS NEMP

Human health guidance values – Derivation of human health soil screening criteria

Item 1
P2, Section 2, Table 1.
The difference in toxicity reference values between PFOS and PFOA is a factor of 8, whereas the difference in derived criteria is 10. These derived criteria have been rounded to 1 significant figure. This should be stated as a table footnote.

Item 2
P2, Section 2, Table 1.
Industrial / commercial criteria for PFOA is 50 mg/kg with a note that it was set in anticipation of the Stockholm Convention low content limit. No other information has been presented on this. Does the assumptions used to derive this number contradict any of the assumptions used in the derivation of the other criteria?

Item 3
P3, Section 2, last paragraph.
The application of 20% of the TDI for the derivation of PFAS criteria in soil is a reasonable approach given that often other pathways contribute to PFAS exposure, especially exposure to water.
However, it should be noted this differs from the approach taken in the NEPM to derive the HILs. In the development of HILs the "background contribution" of the TDI is based on actual background exposure data from water, diet, air, etc, whereas in this case the 80% contribution is an allowance for multi-pathway exposure. The background exposure for PFOS (ie for non-impacted sites) is approximately 5% of the TDI and for PFOA is less than 1% (Toms et al, 2014).
An additional paragraph in this section is warranted, indicating that when site-specific risk assessments include multi-media and multi-pathway exposure, the true background exposure should be used rather than the 80% allowance, in conjunction with multi-media concentrations and multi-pathway exposure estimates.

Item 4
P6, Section 4, Table 2, "Background intake" and footnote 1.
While this is the same list of parameters in the HIL derivations, for PFAS the "Background intake" is incorrectly labelled as it is not background exposure, rather it is an allowance for multi-pathway exposure, as well as background exposure. This table can be easily misinterpreted to suggest that 80% of the TDI should be used for background exposure in site-specific risk assessments where multi-media and multi-pathway exposures are considered. (See Item 3)

Item 5
P12, Appendix A, last paragraph.
"This variation appears to result largely from a dependence on soil concentration, where higher soil concentrations result in lower TFs. This finding supports the use of the maximum TF for each plant

category, rather than using the mean or median, which would underestimate plant concentrations in less contaminated soils."
There are no soil concentration data in Tables A1 to A4 to justify this statement and whether the maximum TF is more appropriate than the mean.
Also, this statement contradicts a statement in Section 5 (p9) of the report, "Plant uptake of PFAAs, including PFOS, PFHxS and PFOA, is also likely to be influenced by parameters such as organic carbon content, presence of specific minerals such as clays and iron oxides, pH, and major ion concentrations in soils (Li et al. 2018)."

Item 6
P3, Section 2, last paragraph.
"This variation appears to result largely from a dependence on soil concentration, where higher soil concentrations result in lower TFs" – more information on the approximate range of low vs. high soil concentrations is required. Adoption of the maximum TF may be unnecessarily conservative in the situation where uptake is a concern (e.g., at higher soil concentrations, where the TF is lower).

Item 7
General, Tables A3 and A5
Confounding assumptions have been made in the adoption of the derivations for PFOS vs. PFHxS. For example, the transfer factor derivation of PFHxS (Table A5) considers wheat grass, wheat (grain, root and shoots) and cucumber stems and leaves, however these non-edible portions or "vegetative parts" are not considered in the original derivations for PFOS (e.g. Table A3) and PFOA. Therefore, justification should be provided as to why they are included for PFHxS (other than limited available data overall).

Item 8
Tables A1 and A3
Variability in vegetable groupings in tables e.g., carrot, cucumber, radish, potato and lettuce are included in both Tables A1 and A3, but it is unclear why the same vegetable would be in both tables – perhaps this can be more clearly articulated if the transfer factors in Table A3 are representative of non-edible parts (and what these are).

Item 9
Tables A1 and A3
These "other" (Table A5, e.g., cucumber, wheatgrass) plant types, generally had high TFs than edible plant types such as celery, further biasing the TF high for PFHxS.

Item 10
General, Tables A1
A number of highly conservative assumptions are adopted, for example, the potato peel transfer factor adopted for tuber vegetables. This value is 1-2 orders of magnitude higher than other studies/parts and we note that potato peel will constitute a proportionally small amount to the total vegetable dietary intake.

Item 11
Table 3
Consider renaming right column to "Reference concentration" (instead of TRV: Inhalation)

Item 12

General
Information should be included regarding sampling methods for comparative purposes (e.g., was produce rinsed? Was excess soil removed?), and to ensure that this is not contributing to the variable TFs reported.

Item 13
P16, Consideration of PFHxS
"In addition, studies have shown that plants have the potential to uptake PFAA precursors (e.g., PFOSA) and transform these to PFAAs in vivo." – Does this imply that sulfonamides should be considered in the derivation (or that the screening levels should be protective of PFOS+PFHxS+PFOSA exposure)?

Item 14
General
Has consideration been given to deriving distinct criteria for PFOS and PFHxS separately as opposed to the sum of the two analytes?

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8. Environmental guideline values

8.2 Ecological guideline values

General

It is suggested that a value of 0.14 mg/kg should apply for all land uses for intensively developed sites with no secondary consumers and minimal potential for indirect exposure. We consider that this is too conservative. In the case of intensively developed sites with minimal potential for indirect exposure, such as occurs with high density residential, commercial and industrial land, and in some cases medium density residential land, the general trend towards intensive developments where the land is largely covered with buildings, structures and paving creates the situation where the risk posed by PFAS to ecological values is low. In particular, development will often involve stripping of top soil and then covering the remaining material with the buildings, structures and paving. If there is a small percentage of the site where plantings might occur, these will often be structurally and nutritionally unsuitable for plant growth after the site works, and will require as a matter course filling of the particular areas with clean top soil if plantings are proposed. As such, we consider that a value of 0.14 mg/kg to protect this common situation is inappropriate, and should not be set as the default. Instead, there should be commentary that the limiting factor in most intensively developed sites (as described in the text of section 8.2) should be set on the basis of protection of direct contact human health (20 mg/kg). There may also be a need to consider the potential for migration (eg leaching and contamination of groundwater or transport in rainfall surface water runoff); however, in most cases where the site is largely covered with buildings and paving, such transport can be expected to not occur or to be minor.

In general, these comments reflect our concern that, in intensively developed sites, there has been a general trend in the NEPM (ASC) 2013 to require protection of ecological values where the ecological value has been greatly diminished and has very limited value as a result of the nature of the intensive development. Because, as a result of population growth, in general our urban areas are becoming more rather than less intensively developed, it will be more sustainable to not seek to

protect ecological values as the default and instead to require this only where it is envisaged that a less intensive development with large areas of exposed soil are likely. We note that in the early days of soil contamination assessment it was generally not required to protect ecological values on such sites; we consider this was a more sensible and sustainable approach and the PFAS NEMP should reflect a change back to this earlier policy position, rather than defaulting to what will be in most cases unnecessarily stringent and precautionary requirements.

Draft PFAS NEMP Version 2 – Written Submission Cover Sheet

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If applicable – Organisation: **CRC for Contamination Assessment and Remediation of the Environment CRC CARE**

Address (optional): Professor Ravi Naidu

Position (optional): Managing Director

Email (optional): ravi.naidu@crccare.com, Bruce.kennedy@crccare.com

Confidentiality

(i) Confidentiality requested? **No**

(ii) If so, does part of your submission include confidential or sensitive information? **No**

Have you provided confidential or sensitive information in a separate attachment ***No***

Have you provided a redacted version ***No***

Draft PFAS National Environmental Management Plan Version 2 sections

If you have specific comments or suggested text changes, please clearly identify the extract of the relevant part of the NEP on which you are providing feedback.

Footnote 5: Footnote 5 on Bioavailability states "Research shows that the behaviour of PFAS in environmental media – for example sorption in soil (Li et al 2018) and uptake from soil (Bräunig et al 2019) - is variable and relatively unpredictable across a range of spatial scales". Although 'bioavailability' is mentioned in the glossary, only a single reference provided, and there is no further explanation of the consideration of bioavailability in risk assessment in the text of the plan (except for the footnote). Suggest either supplementing references or directly guiding readers to the *CRC CARE 2018, Practitioner guide to risk-based assessment, remediation and management of PFAS site contamination, CRC CARE Technical Report no. 43, CRC for Contamination Assessment and Remediation of the Environment, Newcastle, Australia*. This document provides an understanding of bioavailability considerations (including limitations) for PFOS and PFOA in a way that is useful and applicable for site contamination risk assessment and remediation decision-making. It can be expected that the utilisation of bioavailability will benefit considerably from new research.

8. Environmental guideline values

8.1 Human health guidance values

- Table 1 – title needs to state 'drinking water' (similar to Table 2). Perhaps consider listing TDI separately as that would apply to all environmental matrices.

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8. Environmental guideline values

8.2 Ecological guideline values

- Section 8.2.1; Page 29: The value of 0.140mg/kg "may be used to trigger a detailed assessment…" This value is carried over from NEMP1, but there is little context provided for its use in the text on page 29. It's omission from Table 3 implies that it has no status. Why not include this value in Table 3 with relevant caveats (and thereby provide that appropriate status)?
- Section 8.2.3; Page 31: Table 5: guideline values are currently under review by CRC CARE, utilising the revised ANZGFMWQ process and some new data. When developed, the revised guideline values will be provided to ANZGFMWQ
-

10. On-site storage, stockpiles, and containment

10.1 Storage, stockpiles, and containment

- Section 10.1, Page 39: "…content below 50mg/kg" – presumably this is the Stockholm value (see comments in Table 2). Indicate source.

10. On-site storage, stockpiles, and containment

10.2 Design considerations

- Section 10.2 Page 40: the dot points appear to cover all the requirements, but their sequencing appears to be somewhat haphazard

10. On-site storage, stockpiles, and containment

10.3 Guidance note - On-site storage and containment

- Page 40: 'as first flush systems '– agree with the sentiment, but are there not some similarities with leachate management systems (see last paragraph, p43). Presumably it would not hurt to install a first flush system, but (as indicated) this should not be relied upon.
- co-location with flammable materials – if this is to be allowed, should indicate under what circumstances
- Section 10.3.3: use of IBCs – presumably some account needs to be taken of the material from which the IBCs are fabricated
- Section 10.3.5 and 10.3.6: need for risk assessment – there appears to be a contradiction between the first paragraph in 10.3.5 ("may be required") and 10.3.6.
- Section 10.3.7: presumably this relates to long-term containment systems
- Section 10.3.8: could not see previous reference to 'end-of-life caps'. Should the text make a distinction between caps for storage and stockpiles (presumably temporary) on the one hand, and containment (presumably long term) on the other

12 Reuse of PFAS-contaminated materials

12.1 Reuse without a risk assessment

15. Wastewater treatment

15.1 PFAS Management Framework

15. Wastewater treatment

15.2 Additional management tools

Appendix D. Example PFAS Management Framework for a Wastewater Utility

Other:

References:

- These include CRC CARE Technical Report no 38. That Technical Report has been withdrawn (and is no longer available on the CRC CARE website), and has been replaced with the updated version (correct citation provided):
  - **CRC CARE 2018, Practitioner guide to risk-based assessment, remediation and management of PFAS site contamination, CRC CARE Technical Report no. 43, CRC for Contamination Assessment and Remediation of the Environment, Newcastle, Australia.**

  and supported by (correct citation provided)
  - **CRC CARE 2016, A human health review of PFOS and PFOA, CRC CARE Technical Report no. 42, CRC for Contamination Assessment and Remediation of the Environment, Newcastle, Australia.**

Draft PFAS NEMP Version 2 – Written Submission Cover Sheet

Name (optional): E. Friebel (Reviewer 1), H. Lanza (Reviewer 2), P. Nadebaum, A. Smit, D. Cox

If applicable – Organisation: GHD

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Position (optional):

Email (optional):

Confidentiality

(i)	Confidentiality requested?	No
(ii)	If so, does part of your submission include confidential or sensitive information?	No
	Have you provided confidential or sensitive information in a separate attachment	*No*
	Have you provided a redacted version	*No*

Draft PFAS National Environmental Management Plan Version 2 sections

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8. Environmental guideline values

8.1 Human health guidance values – Derivation of human health soil screening criteria

Review of "Human health soil screening criteria for PFOS, PFHxS and PFOA, Calculation protocols and draft values for potential inclusion in the PFAS National Environmental Management Plan", NSW Government.

Reviewer 1

Item 1
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The difference in toxicity reference values between PFOS and PFOA is a factor of 8, whereas the difference in derived criteria is 10. These derived criteria have been rounded to 1 significant figure. This should be states as a table footnote.

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P6, Section 4, Table 2, "Background intake" and footnote 1.
While this is the same list of parameters in the HIL derivations, for PFAS the "Background intake" is incorrectly labelled as it is not background exposure, rather it is an allowance for multi-pathway exposure, as well as background exposure. This table can be easily misinterpreted to suggest that 80% of the TDI should be used for background exposure in site-specific risk assessments where multi-media and multi-pathway exposures are considered. (See Item 3)

Item 5
P12, Appendix A, last paragraph.
“This variation appears to result largely from a dependence on soil concentration, where higher soil concentrations result in lower TFs. This finding supports the use of the maximum TF for each plant category, rather than using the mean or median, which would underestimate plant concentrations in less contaminated soils.”
There are no soil concentration data in Tables A1 to A4 to justify this statement and whether the maximum TF is more appropriate than the mean.
Also, this statement contradicts a statement in Section 5 (p9) of the report, “Plant uptake of PFAAs, including PFOS, PFHxS and PFOA, is also likely to be influenced by parameters such as organic carbon content, presence of specific minerals such as clays and iron oxides, pH, and major ion concentrations in soils (Li et al. 2018).”

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P3, Section 2, last paragraph.
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Reviewer 2

Item 1
General, Tables A3 and A5
Confounding assumptions have been made in the adoption of the derivations for PFOS vs. PFHxS. For example, the transfer factor derivation of PFHxS (Table A5) considers wheat grass, wheat (grain, root and shoots) and cucumber stems and leaves, however these non-edible portions or “vegetative parts” are not considered in the original derivations for PFOS (e.g. Table A3) and PFOA. Therefore, justification should be provided as to why they are included for PFHxS (other than limited available data overall).

Item 2
Tables A1 and A3
Variability in vegetable groupings in tables e.g., carrot, cucumber, radish, potato and lettuce are included in both Tables A1 and A3, but it is unclear why the same vegetable would be in both tables – perhaps this can be more clearly articulated if the transfer factors in Table A3 are representative of non-edible parts (and what these are).

Item 3
Tables A1 and A3
These “other” (Table A5, e.g., cucumber, wheatgrass) plant types, generally had high TFs than edible plant types such as celery, further biasing the TF high for PFHxS.

Item 4
General, Tables A1
A number of highly conservative assumptions are adopted, for example, the potato peel transfer factor adopted for tuber vegetables. This value is 1-2 orders of magnitude higher than other studies/parts and it we note that potato peel will constitute a proportionally small amount to the total vegetable dietary intake.

This conservativism is further exacerbated given that the PFHxS TF is adopted as a factor of the PFOS TFs which were based upon the maximum reported food group, therefore representing the maximum of a maximum. TFs should be considered independently, noting that the PFHxS data quality is reduced as compared to PFOS.

Item 5
Table 3
Consider renaming right column to “Reference concentration” (instead of TRV: Inhalation)

Item 6
General
Information should be included regarding sampling methods for comparative purposes (e.g., was produced rinsed? Was excess soil removed?), and to ensure that this is not contributing to the variable TFs reported.

Item 7
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Item 8
General
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Draft PFAS NEMP Version 2 – Written Submission Cover Sheet

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Confidentiality

(i) Confidentiality requested? Yes / (No)

(ii) If so, does part of your submission include confidential or sensitive information? Yes / (No)

Have you provided confidential or sensitive information in a separate attachment *Yes / No*

Have you provided a redacted version *Yes / No*

Draft PFAS National Environmental Management Plan Version 2 sections

If you have specific comments or suggested text changes, please clearly identify the extract of the relevant part of the NEMP on which you are providing feedback.

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8. Environmental guideline values

8.1 Human health guidance values

8.1.2 Soil guidance values for direct exposure

In Section 8.1.2 it is stated that "human health based soil guidance values (Table 2) should only be used to assess potential human exposure through direct soil contact". However, the derivation of the residential screening criteria takes into consideration a proportion (10%) of ingestion of home grown produce (i.e. secondary contact). Suggest that the text be modified to:

These human health based soil guidance values (Table 2) should only be used to assess potential human exposure through direct soil contact *with minimal (10%) home produce ingestion*.

Table 1. Health based guidance values for use in site investigations in Australia

Note that both of the terms "Human Health based Guidance Values" and "Human Health Based Guidance Values" are used in the heading and content of Table 1. Could the terminology for these values please be consistent?

Soil – human health screening value: Residential with garden/accessible soil

In relation to the Human health soil criteria for PFOS, PFHxS and PFOA (OEH 2019) for residential with garden/accessible soil land use (Table 2):

- It would be useful to have a separate criterion for PFOS and PFHxS because:
    - It is unlikely that any site will have a 50:50 ratio of PFOS and PFHxS (which is the assumption behind the derived residential soil screening / guidance values)
    - The guideline assumes 80% background, so it may not be necessary to sum PFOS and PFHxS
- Plant uptake factor should be for edible plant tissue:
    - PFOS and PFOA transfer factors (Table A1 and A2 respectively) are in part based on a value for "potato peel"; it is considered unlikely that people will only consume the peel (independently of the potato)
    - PFHxS transfer factor (Table A5) included consideration of "stems/leaves" of cucumbers which are not typically consumed and wheat (grain, root/shoot) which is not typically grown in a home garden setting.
- The geometric mean of the maximums of the ratio of transfer factors from soil to plants of 6.9 can only be replicated with the data presented if the ratio transfer factor of 25 for wheat grass is retained in the calculation.
    - As a footnote to table A5 it is stated that "the TF for wheat grass grown at a firefighting training group (TF=78) was excluded, as the soil concentrations (13,400

µg/Kg PFOS and 450 µg/kg PFHxS) were deemed not relevant to residential situations".
    - If the 25 is excluded from the geometric mean of the maximums of the ratio transfer factors the result is 5.7 instead.
- It is difficult to validate the calculation of the transfer factor ratios based on the information provided in the Table A1, A2, and A5). It would be appreciated if the values used to calculate the transfer factors were presented in the OEH document, rather than consultants needing to go back to original literature.

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8. Environmental guideline values

8.2 Ecological guideline values

8.2.1 Soil criteria for investigation – ecological guideline values

Table 3: Soil Criteria for investigation – ecological guideline values

Interim soil – ecological direct exposure

The use of the human health screening value for public open space as an interim soil value for the protection of direct exposure of ecological receptors is considered inappropriate. In accordance with the National Environment Protection (Assessment of Site Contamination) Measure (2013) (ASC NEMP 2013) screening guidance values for the protection of ecological receptors should be based on a species sensitivity distribution (where sufficient data is available) or an assessment factor approach. The adoption of a human health screening value for protection of ecological receptors is inconsistent with both of these methods.

In addition, the adoption of the human health screening value prohibits the meaningful interpretation of screening level exceedances. The human health open space screening criteria for PFOS is based on 20% of the FSANZ TDI, which in turn is based on decreased parental and offspring body weight gain in a reproductive toxicity study in rats (FSANZ 2017). Based on the guidance in the PFAS NEMP (V.2) this screening guidance value is intended to identify a potentially unacceptable risk to soil dwelling organisms such as earthworms and plants. However, it is unclear how weight loss in rats can be related to ecologically relevant effects of PFOS on soil dwelling organisms such as earthworms and plants. Similar issues exist for PFOA.

Furthermore, it is considered unlikely that there are land use scenarios where it is appropriate to routinely exclude the potential for secondary exposure. Even in a commercial/industrial setting, where habitat may be limited for ecological receptors, if plants and soil dwelling invertebrates are present it is likely that there will also be birds and small terrestrial mammals. Therefore, it is expected that the "ecological indirect exposure" criterion would be applied in the first instance, with risks subsequently discussed in terms of a conceptual site model that considers factors such as the location of the site within surrounding areas, the ecological value of areas of open soil, and the potential for ecological species to obtain a high proportion (or all) their food from the site.

Interim soil – ecological indirect exposure

The commercial/industrial soil criterion for PFOS of 0.140 mg/kg from CCCME described in the "comments and source" information of Table 3 (Row 2) is not considered to be appropriate for an Australian context. This soil criterion is the concentration required in soil so that migration of PFOS through groundwater and into a surface water body does not exceed the Canadian freshwater PFOS criteria of 6.8 µg/L. The issues with this approach include:

- The methodology used to derive the 0.140 mg/kg PFOS soil criterion is inconsistent with Australian Guidance (ASC NEMP 2013, ANZECC and ARMCANZ 2000; ANZG 2018).
- It is preferable to evaluate risk to freshwater ecological receptors by comparing concentrations from water samples to the Draft Australian PFOS water quality guidelines, rather than making assumptions about transport pathways and leaching from soil.
- The 0.140 mg/kg PFOS soil criterion from CCME may not be adequately protective of aquatic receptors: The Canadian freshwater guidance value of 6.8 µg/L is five orders of magnitude higher (i.e. less conservative) than the draft ANZG (2018) guidance for PFOS currently available (0.00023 µg/L) for 99% species protection and one order of magnitude above the 95% protection value of 0.13 µg/L.
- There is significant uncertainty regarding the representativeness of the soil parameters used by CCME for the modelled migration of PFOS for Australian Conditions.

Based on these issues, it is recommended the 0.140 mg/kg is not included in PFAS NEMP Version 2.0.

8.2.2 Terrestrial Biota Guideline Values

The use of the word "terrestrial" in the title to Section 8.2.2 and the title to Table 4 is considered inappropriate as this section / table applies to both terrestrial and aquatic species. Aquatic birds such as grebes and aquatic mammals such as the Australian water rat (*Hydromys chrysogaster*) may be receptors of interest on a site and this section applies equally to both aquatic and terrestrial receptors.

Table 4. Terrestrial biota guideline values

Ecological Direct Exposure for Wildlife Diet

In Table 4, the use of the word "aquatic" to describe biota consumed by mammals and birds is unnecessarily restrictive for the application of the criteria. In accordance with the ECCC 2018 the guidelines are based on conventional toxicological feeding studies; for mammals from the minimum observed tolerable daily intake of 1.1 µg/kg bw.day for rats from a two-year chronic toxicity diet study, and for birds the low observe adverse effect level does rate in northern bobwhite of 722 µg/kg bw.day which resulted in reduced check survival post exposure. Therefore it is considered appropriate to apply these criteria to both aquatic and terrestrial food sources.

Ecological exposure protective of birds

The "additional uncertainty factor" used to calculate the Sum(PFOS+PFHxS) criterion for ecological exposure protective of birds (bird eggs) shown in Table 4 should be specified and a rationale provided for its selection. It appears as through an uncertainty factor of 10,000 has been applied: the ECCC (2017) value is 1.9 µg/**g** ww and the value presented in Table 4 of the NEMP (version 2.0) is 0.2 µg/**kg** ww or 0.0002 µg/**g** ww.

8.2.3 Aquatic Ecosystems: Freshwater and marine water guideline values

Table 5: Freshwater and marine guideline values

Note 3 to table 5 specifies that "the 99% level of protection be used for slightly to moderately disturbed systems". There is some confusion in the industry about the application of the water quality guidelines for PFOS and PFOA for slightly to moderately disturbed systems (Table 5). A number of consultants have reported that bioaccumulation and biomagnification of PFOS / PFOA in aquatic systems (which is a consideration for these compounds) can be accounted for by undertaking biota sampling, therefore a 95% species protection level (that protects "direct exposure" of aquatic receptors) can be applied for "slightly to moderately disturbed ecosystems". The outcome of this approach is that the 99% species protection levels are not applied to "slightly to moderately disturbed" systems.

This approach is inconsistent with the ANZECC and ARMCANZ (2000) and ANZG (2018) guidance regarding the bioaccumulative and biomagnifying chemicals and has the following limitations:

- Bioaccumulation is an increased body burden of the toxicant following uptake from ambient media and/or food.
- Direct toxicity and effects due to bioaccumulation of the toxicant occur simultaneously in the exposed organism i.e., direct toxicity includes some degree of effect following bioaccumulation (noting the potential for bioaccumulation effects increases with the duration of receptor exposure).
- Bioaccumulative effects are not just limited to birds and mammals, but can occur in the exposed organisms themselves, and in higher order aquatic invertebrates, amphibians, reptiles and fish.
- Although the default approach of increasing the level of protection for bioaccumulative compounds has no biological basis, there is no other method endorsed in Australian guidelines to account for bioaccumulation in exposed receptors.
- The biota guideline values (in Table 4) used for the assessment of potential adverse effects to air-breathing (mammals and birds) higher order organisms (following bioaccumulation and biomagnification in food items). For example, collection of fish tissue and analysis for PFAS does not provide information as to potential effects from bioaccumulation on the fish themselves, or higher order fish.

We suggest that further clarification in Note 3 of Table 5 to ameliorate the confusion in the industry about the appropriate use of the 99% species protection level.

10. On-site storage, stockpiles, and containment

10.1 Storage, stockpiles, and containment

No comment

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10. On-site storage, stockpiles, and containment

10.2 Design considerations

No comment

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10. On-site storage, stockpiles, and containment

10.3 Guidance note - On-site storage and containment

No comment

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12 Reuse of PFAS-contaminated materials

12.1 Reuse without a risk assessment

No comment

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15. Wastewater treatment

15.1 PFAS Management Framework

No comment

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15. Wastewater treatment

15.2 Additional management tools

No comment

Appendix D. Example PFAS Management Framework for a Wastewater Utility

No comment

Other comments:

9. Contaminated Site Assessment

9.1.4 PFAS Transformation

TOPA and TOFA have been provided as examples of 'advance analytical techniques'. We would suggest that these methods are not especially 'advanced'; they are at a lower level of technical development and rigour compared to more standard analytical methods. Therefore, we suggest TOPA and TOFA are more correctly identified as 'emerging' or 'non-selective screening' methods. There is some perception in the industry that these are highly technical and definitive techniques, which is incorrect and should not be enforced in the NEMP Version 2.0.

19. PFAS analysis

As Section 19 is titled "PFAS Analysis" and the majority of that section is concerned with TOPA and TOFA, this implies a degree of importance of these analysis methods in the wider assessment of PFAS. Whilst some of the limitations and cautions regarding these methods are stated, there is currently a perception in the industry that these methods are 'required' and of high value in all assessments. We suggest either including a clear and definitive statement that these methods are (currently) additional screening techniques that may be of use in some assessments, or balance the discussion of TOPA and TOFA with an equally lengthy (and probably unnecessary) discussion on the other methodologies covered in Table 7.

18. PFAS Sampling

18.3.1 Quality assurance and quality control

The rate of QAQC samples specified in the NEMP version 2 should generally be in line with the *Standard guide to the investigation and sampling of sites with potentially contaminated soil* (AS4482) and ASC NEMP Schedule B2 (2013). Laboratory reporting on the standard suite of PFAS in environmental media has improved in rigour and reproducibility, therefore it is no longer necessary to obtain blind, split and rinsate blanks at a rate of one for every 10 primary samples. In accordance with *The Australian Standards* (AS4482) QAQC samples should be collected a rate of 1 in 20 primary samples.

Draft PFAS NEMP Version 2 – Written Submission Cover Sheet

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Confidentiality

(i) Confidentiality requested? ~~Yes~~ / No

(ii) If so, does part of your submission include confidential or sensitive information? Yes / No

Have you provided confidential or sensitive information in a separate attachment *Yes / No*

Have you provided a redacted version *Yes / No*

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If you have specific comments or suggested text changes, please clearly identify the extract of the relevant part of the NEP on which you are providing feedback.

General Comments:

A. Battelle Bioremdiation and Sustainable Engineering Symposium – BioSymp2019 (Baltimore, April 2019).

Site safety on PFAS sites adopting personal PPE is paramount. Chuck Neslund (Eurofins Lancaster) confirmed the ITRC course goal that field sampling and contractor safety is of primary importance, followed by compliant SAQP procedures to manage potential cross contamination risks.

- The draft Australian #NEMP (V2) could consider adding such a qualifying statement to sections: 18.1, 18.2, Guidance Note, Handling & Processing.

B. BioSymp2019 - Chuck Neslund also presented an overview of laboratory methods adopted in the US for PFAS determinations. Of note was the obvious contradiction between:

- Established USEPA method 537 V1, 2018 (drinking water) prescribing whole sample plus sample bottle rinse through SPE with internal standard quantitation LC-MS/MS (including Isotope Dilution specified by US DoD/DoE QSM 5.2 App.B Table B15, 2018),
- In comparison, the new draft USEPA SW846 for solid waste (environmental) method is proposing sample dilution in methanol (1:1) with direct injection on LC-MS/MS and quantitation using external standards (only).

  - Why is the draft solid waste method adopting sample preparation and quantitation procedures which are different to the drinking water method USEPA 537 and which may complicate Data Quality Indicator (DQI) comparison when input in a conceptual site model? The Battelle panel answered that USEPA comprises various groups who provide technical direction for many projects. This emphasised the ridiculous circumstance where a high level quality method is prescribed by one group and an alternative method (nominated as a screen only method by other jurisdictions) can be put into the market for data users who do not understand the difference.
  - I propose that the NEMP (V2) prescribe the minimum analytical method requirements to prevent labs from offering a high level method for Defence projects and a low quality level method for non-Defence projects.

C. BioSymp2019 - Dora Chiang (CDM Smith) presented an informative session on #TOPA-PFAS emphasising the screening status of this method and that it should only be used to help identify source areas including characterisation for the potential presence of PFAA precursors that may convert to terminal end-point compounds having adopted criteria.

  - Commentary on the development of a biological oxidation method by Queensland University could also be described here.

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8. Environmental guideline values

8.1 Human health guidance values

8. Environmental guideline values

8.2 Ecological guideline values

10. On-site storage, stockpiles, and containment

10.1 Storage, stockpiles, and containment

I would like to suggest that the term “Containment Cell” also be defined as a “Containment and Treatment Cell” where the vertical walls and base material has been engineered to withstand emerging destruction technologies that the ARC funding grants are initiating June 2019 for completion in 2021/2022. For example, the UNSW/ MU/ OPEC Systems Soil Liquifractionation to examine if a high pressure water/ aeration lance can liquify a sandy/ coarse soil and foam PFAS to the surface for vacuum and concentration into a low volume/ high concentration waste.

ARC Project ID: SR180100021

Link: https://rms.arc.gov.au/RMS/Report/Download/Report/a3f6be6e-33f7-4fb5-98a6-7526aaa184cf/198

Remediation strategies using Containment cells are being considered at present, and if there is no consideration for cell material selection and engineering strength, then research outcomes in 2021/ 2022 may be an opportunity lost.

10. On-site storage, stockpiles, and containment

10.2 Design considerations

10. On-site storage, stockpiles, and containment

10.3 Guidance note - On-site storage and containment

12 Reuse of PFAS-contaminated materials

12.1 Reuse without a risk assessment

15. Wastewater treatment

15.1 PFAS Management Framework

15. Wastewater treatment

15.2 Additional management tools

Appendix D. Example PFAS Management Framework for a Wastewater Utility

Draft PFAS NEMP Version 2 – Written Submission Cover Sheet

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Confidentiality

(i) Confidentiality requested?	No
(ii) If so, does part of your submission include confidential or sensitive information?	No
Have you provided confidential or sensitive information in a separate attachment	No
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Draft PFAS National Environmental Management Plan Version 2 sections

If you have specific comments or suggested text changes, please clearly identify the extract of the relevant part of the NEP on which you are providing feedback.

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8. Environmental guideline values

8.1 Human health guidance values

Regarding the updated 'Residential with garden/accessible soil' guidance value, Senversa considers that the approach of deriving a single screening level for PFOS + PFHxS reduces the usefulness and practical application of the screening level.

Given the different soil to plant transfer factors identified for PFOS vs. PFHxS (and the associated different screening levels that would be derived for these compounds if they were considered separately), it is considered more appropriate and transparent to derive separate screening levels for PFOS and PFHxS, noting that the assumed background intake (80%) and other conservative elements of the derivation are likely to still be protective even allowing for cumulative exposure.

Please see our more detailed comments on the supporting documentation presented at the end of these comments.

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8. Environmental guideline values

8.2 Ecological guideline values

Senversa agrees that the revised ecological guideline values (and accompanying discussion) are improved from NEMP 1.0.

The discussion in the document could benefit, however, from acknowledgement that the PFOS guideline for indirect exposure (0.01 mg/kg) is for the most conservative species group (insectivorous mammals) and that the Canadian guidance provides other screening levels which may be applicable where such receptors are absent.

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10. On-site storage, stockpiles, and containment

10.1 Storage, stockpiles, and containment

It is unclear whether the NEMP is supportive of containment when there are different messages embedded in the guidance. For example, the sentence "*If ongoing containment presents unacceptable risks or unsustainable management requirements, it is generally expected that materials will be removed for environmentally sound treatment or destruction*". This could be misinterpreted that the containment solution developed for a particular site issue has not considered those risks in the siting, design, construction quality assurance and aftercare phases of

works proposed to address a PFAS source. It is suggested that this sentence be removed or recrafted to emphasise its intent.

The use of a combination of on-site encapsulation and chemical binding and immobilisation is not supported by current studies. We have been involved in one independent study of proprietary and off the shelf amendments (e.g. GAC, PAC, amended clays, etc.) and this did not demonstrate complete immobilisation such that some form of hydraulic separation (i.e. cover/capping) was not also required. As such the expense and effort in applying stabilisation amendments is not indicated or supported where separation of the contaminant from the environment will still be required. Further, Appendix C refers to a 'grab-bag' of potential options, some of which are highly experimental and without vendors to supply and therefore the technology list is not considered realistic in setting expectations around PFAS treatment . The entire Appendix should be reconsidered.

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10. On-site storage, stockpiles, and containment

10.2 Design considerations

As an overarching comment the Conceptual Site Model (CSM) should set the scene for determining the key contaminant transport pathway(s) and receptors being managed. More background on this is required such that the dot points listed are not taken out of context where they may not apply (e.g. there is multiple reference to leachate, and in some containment solutions, there is no requirement for a leachate detection, collection or monitoring system). The structure of this section could benefit from a thematic discussion around the CSM, siting and design considerations.

It is not clear that the use of covers (e.g. tarpaulins) is a recommended measure for temporary stockpiles. The sentence "*wherever practicable, a roof or other impervious cover should be placed over bunded area*"*.*

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10. On-site storage, stockpiles, and containment

10.3 Guidance note - On-site storage and containment

Refer above comment on the importance of understanding the key contaminant transport pathways via the development of the CSM. It is not a requirement on all sites to consider basal lining and leachate leak detection. Side wall lining and capping together with a perimeter groundwater monitoring well network may suffice in the suitable hydrogeological setting.

The guidance could be more streamlined to discuss the process of: development of the design intent in a design report; establishing the design through the technical specification and drawings; and presenting the construction quality assurance plan – the process and document used to

confirm construction to the design. This information is packaged into a Construction Report, detailing the works. Following this an Environmental Management Plan (including aftercare inspection regime, monitoring of the environment, responsibilities for upkeep, etc).

Section 10.3.1, 10.3.4 and 10.3.7 contain similar information with different emphasis and may therefore be misinterpreted when considering key design requirements such as basal lining and capping versus capping alone. Consideration should be given to consolidating these sections and being clear on definitions of 'containment facility'. It would not be correct to define a cap/cover arrangement in the same way that a fully engineered repository is viewed (i.e. a containment facility).

Section 10.3.10 it should be clearly stated that a sump collection system is for collection and that defined levels/volumes it is pumped out to an enclosed tank. The use of open leachate ponds should be avoided, to minimise future transference to other environmental media (e.g. air from aerosols, or into the food web via bioaccumulation through e.g. birds habiting the pond). Active evaporation needs to be defined such that it specifically excludes measures such as fogging/misting which would transfer PFAS to the air environment.

12 Reuse of PFAS-contaminated materials

Senversa notes that there is still some ambiguity between Section 12 (Re-use of PFAS-contaminated materials) and Section 10 (On-site storage, stockpiles and containment). More specifically:

1. The NEMP implies that Section 10 pertains to the on-site temporary storage, but also permanent containment of PFAS impacted materials. Whereas Section 12 appears to pertain to off-site reuse, but remains silent on this matter largely due to differing environmental regulatory considerations.
2. "Reuse with a risk assessment" outlines a practical approach for on-site reusing PFAS impacted materials that may be generated during construction activities. However, in Senversa's experience this practical risk assessment approach has not been considered by some Regulators, particularly in states where landfill disposal is prohibited. Instead, practical on-site reuse options have been reviewed by the regulator with consideration to Section 10 and have essentially defaulted to minimum landfill containment cell specifications outlined in the *EPA Victoria, 2015, Siting, design, operation and rehabilitation of landfills (pub. 788.3-2015),* with consideration to Table 6 landfill acceptance criteria.

Taking into consideration the above, the NEMP would benefit on further clarity about the definition of on-site reuse vs permanent on-site containment, and potentially linkages that need to be considered between Section 10 and Section 12. In many instances, low-level PFAS impacted soils can be generated during construction works and be practically reused in the same area, in line with the risk assessment approach in Section 12 and provide an improved environmental outcome without the need for landfill specification requirements. It does seem counterproductive, that landfill specification requirements are being imposed for the reused low-level PFAS impacted soils, when other contaminants (i.e. Victorian Category B & C contaminated level soil) can be re-used on-site with consideration to the site Conceptual Site Model and removing the exposure pathway (e.g. permanent hard stand surfaces).

12.1 Reuse without a risk assessment

Figure 1 ('Decision Tree for reuse of soil materials') appears to be inconsistent with the text description of the process, which states:

> *'A preliminary screening risk assessment may be acceptable in instances where PFAS concentrations in the material are at or below the relevant health and ecological assessment criteria, **or** where PFAS concentrations in the material can be demonstrated to be lower than background concentrations of PFAS in and around the proposed reuse location.'* (emphasis ours).

However, despite the text stating that reuse may be acceptable where PFAS concentrations are lower than background concentrations (even if concentrations exceed relevant screening levels), Step 3C still triggers a more detailed risk assessment if any leachable concentrations of PFOS above the 99% species protection (0.00023 µg/L) are detected. Step 4 of the decision tree (Comparison to background concentrations) is only triggered if leachate concentrations are at or below relevant health and ecological assessment criteria. As a result, the decision-tree only leads to reuse without a risk assessment if PFAS concentrations are below relevant criteria AND below background levels. This contradicts the description of the process (see above) which indicates that reuse can occur if concentrations are below criteria OR below background levels.

In addition:

- The requirement to meet the 99% species protection level should be better clarified. Because the current 99% protection DGV is below typical laboratory detection limits, it is unclear whether non-detect results should be interpreted as potentially exceeding the DGV, or whether only results above the detection limit are considered to exceed the DGV.
- The decision-tree does not include a pathway for comparison of total soil concentrations to background levels in soil. This should be added to the decision-tree, to be considered as well as comparison of leachable concentrations to background levels in surface water and groundwater.

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15. Wastewater treatment

15.1 PFAS Management Framework

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15. Wastewater treatment

15.2 Additional management tools

Appendix D. Example PFAS Management Framework for a Wastewater Utility

Supporting Documentation: Human health soil screening criteria for PFOS, PFHxS and PFOA

Given the difference in soil to plant transfer characteristics between PFOS and PFHxS (and the associated difference in screening levels that would be derived for these compounds if they were considered separately), Senversa considers that the approach of deriving a single screening level for PFOS + PFHxS reduces the usefulness and practical application of the screening level.

It is considered more appropriate and transparent to derive separate screening levels for PFOS and PFHxS, noting that the assumed background intake (80%) and other conservative elements of the derivation are likely to still be protective even allowing for cumulative exposure (see further discussion in below bullet points).

This is based on the following considerations:

- While the toxicity of these compounds is assessed to be the same, the plant transfer characteristics are very different, and the relative concentrations of these compounds in the environment can vary significantly from site to site. Deriving a single screening level based on a default assumption that PFOS and PFHxS will be present at equal concentrations is therefore not appropriate.
- Utilising the transfer factors presented in the document to develop separate screening levels for PFOS and PFHxS, the following values are derived:
  - PFOS: 0.04 mg/kg
  - PFHxS: 0.006 mg/kg

These values are noted to be an order of magnitude different, with the overall screening level (0.01 mg/kg) four times lower than the screening level derived for PFOS, and therefore four times lower than a screening level appropriate for sites where PFOS is the dominant PFAS (which is common). While the difference between 0.01 mg/kg and 0.04 mg/kg may not seem very large, from Senversa's experience on multiple PFAS projects, the soil concentrations measured in residential backyards in the vicinity of source sites are commonly within this range. On this basis, even where further risk assessment can be later used to demonstrate risks are low and acceptable, the difference between these values could have significant impact in (unnecessarily) raising potential concerns for many residents on such properties.

- The methodology adopted to develop the combined screening level is not particularly transparent or clear. The adjustment is presented at the transfer

factor stage, as opposed to deriving screening levels separately for PFOS + PFHxS, and then combining these to develop an overall screening level (which considers cumulative risks based on a known composition). Such an adjustment could be undertaken on the following basis:

$$Screening\ level_{PFOS+PFHx} = \frac{1}{\frac{Fraction_{PFOS}}{Screening\ level_{PFOS}} + \frac{Fraction_{PFHxS}}{Screening\ level_{PFHxS}}}$$

Presenting the derivation in this way would result in the same overall screening level (for the default 50:50 composition assumed in the derivation document), but would provide greater clarity, and would make adjustments based on site specific composition more straightforward. However, Senversa considers there are still limitations with this approach:

- There are limitations with the selection of a single screening level for PFOS+PFHxS based on an assumed composition. The ratio between PFOS and PFHxS can be highly variable, and a single screening level (derived based on an assumed ratio) will rarely be applicable. It will be overly conservative on sites where PFOS dominates (and may result in unnecessary concerns where assessors do not identify at an early stage that adjustment can be undertaken), and may offer inadequate protection on other sites.
- Given other areas of conservatism in the screening levels (in particular the assumption of 80% of the TDI from other sources), Senversa considers that derivation of separate screening levels for PFOS and PFHxS, and separate application of these would be adequately conservative, and would have the benefit of being clearer and more transparent regarding the potential risks associated with PFOS and PFHxS.
- If the approach of separate screening levels is considered inadequately conservative to account for the potential cumulative risks, an alternative approach could be to present the individual screening levels, together with guidance that a hazard index assessment should be undertaken where the concentrations of PFOS and PFHxS approach the screening levels. The hazard index can be checked as follows:

$$HI = \frac{Concentration_{PFOS}}{Screening\ level_{PFOS}} + \frac{Concentration_{PFHxS}}{Screening\ level_{PFHxS}}$$

Where the HI is less than 1.0, the cumulative risks are assessed to be low and acceptable.

Appendix A

The following comments relate to our review of the transfer factors presented in Appendix A.

PFOS transfer factors

- For PFOS, the selected value for **green vegetable** (0.2) is for celery, even though there is data for lettuce (specified by the NEPM as a type example of green vegetable), and (with

reference to FSANZ) the consumption rates of leafy vegetables (such as lettuce) are higher than stem vegetables (such as celery) such that the transfer factors for lettuce are likely to be of greater relevance.
- Onion is listed as a "green vegetable" in Table A1, though in line with the NEPM, this is a type example of a root vegetable, and should be included in this section of the table.
- For **tuber vegetables**, a higher transfer factor for potato peel is selected, even though this is 10 times higher than the TFs for potato flesh, which are likely to be more representative in estimating overall produce concentrations. Even if potato peel is eaten, it represents a very small proportion of tuber vegetable intake. A weighted average approach, or the adoption of a high-end value for potato flesh may be more appropriate.
- For fruit, the HIL considers consumption of tree fruit specifically (i.e. this is the basis of the consumption rate). It is unclear that the data for peas is relevant to estimate a TF for fruit. Peas are legumes (not fruit) and may be more accurately included in the green vegetable assessment,
- For fruit, it is noted that data from Blaine 2014a for tomato is excluded, presumably because the PFOS concentration in tomato was at the LOQ. This data could also be considered, as an upper bound TF can be estimated for this data and considered together with the other TFs in defining the value to be selected. It is noted that the Blaine 2014a tomato data could also provide an additional data point in estimating the fruit TF for PFHxS.

PFOA transfer factors

- The selected value for **root vegetable** (0.15) is for radish, even though it is considered likely that consumption rates of carrot would be greater and the carrot TF may therefore be more relevant.
- For **tuber vegetables**, a higher transfer factor for potato peel is selected, even though this is higher than the TFs for potato flesh, which are likely to be more representative in estimating overall produce concentrations. Even if potato peel is eaten, it represents a very small proportion of tuber vegetable intake. A weighted average approach, or the adoption of a high-end value for potato flesh may be more appropriate
- For fruit, the HIL considers consumption of tree fruit specifically (i.e. this is the basis of the consumption rate). It is unclear that the data for peas is relevant to estimate a TF for fruit. Peas are legumes (not fruit) and may be more accurately included in the green vegetable assessment,

Derivation of composite PFOS + PFHxS transfer factors

It is unclear that the adopted methodology (where the ratio of TFs for PFOS and PFHxS is used to provide an adjusted TF for both PFOS and PFHxS is the most robust approach; in particular it is considered that this approach (as opposed to assessing PFHxS separately, and noting the limitations) is not particularly transparent or clear. While the limited data available for PFHxS is acknowledged, the adopted approach has several limitations:

- Even where a ratio approach may be required to estimate transfer factors for some groups (e.g. tuber vegetables), it is unclear why this method is used in preference to directly measured transfer factors for those vegetable groups where data is available.
- Due to the different transfer factors, and different consumption rates, the screening level will be driven more by uptake into particular produce groups, and will therefore be more

sensitive to changes in the transfer factor for these specific groups. If the TFs were instead derived separately for each vegetable group, there will be greater clarity/transparency that the most robustly defensible TF for each group has been adopted. It is acknowledged that for some groups (e.g. tuber vegetables) there is insufficient data to select a measured PFHxS TF

- It is not considered appropriate to use the **maximum** ratio from each study to estimate the ratio of TFs. This approach is considered to introduce a level of bias; estimating the central tendency ratio (based on average TFs for PFOS and PFHxS for each study) would be more appropriate. Use of a central tendency ratio would more realistically account for sampling and analytical variability, while still providing a conservative assessment because the ratio would be applied to the upper bound PFOS transfer factor.
- The extent to which the adjustment factor is driven by individual outlier values is not clear.
- It is unclear whether the highest TF ratio (for wheat grass) is relevant. There are PFHxS transfer factors for green vegetables (lettuce, celery) so it is unclear why data for a wheat grass would be given equal weighting in the TF estimation, when this species is likely to be of less importance/relevance for a pathway of home produce consumption. It is additionally noted that a higher TF ratio for wheatgrass (from Bräunig, 2018) was excluded on the basis that the soil concentrations (13.4 mg/kg PFOS, 0.45 mg/kg PFHxS) are unlikely to be relevant for residential scenarios. It is unclear that the TF ratio of 25 from this study which was selected is any more relevant, as it is for similarly impacted soils (2.2 mg/kg PFOS. 0.123 mg/kg PFHxS) which are also considered unlikely to be representative of most residential soils. It is also noted that this result may have been confounded by the presence of precursors. It is therefore unclear that this value should be included in the estimation of the overall transfer factor.
- The adopted approach actually reduces the data which can be used. If instead PFHxS TFs are estimated directly, the dataset will not be censored to exclude those studies for which there are TFs for PFHxS but not PFOS (for example, for Blaine 2014a there is a TF for PFHxS into tomato available (0.17) which could be adopted directly.
- It is unclear that the data for peas is relevant to estimate a TF for fruit. Peas are legumes (not fruit), and the HIL considers consumption of **tree fruit** specifically. It may be more relevant to include this data point under green vegetables.

Despite these limitations, Senversa notes that preliminary refinement of the TFs along these principles (i.e. selecting TFs for PFHxS where available, and using an adjusted PFOS value for tuber vegetables) resulted in a very similar PFHxS screening level, i.e. even though the transfer factors for the different produce groups were different, the overall screening level remained largely the same.

From: Ruth Jarman
To: PFASstandards
Subject: Submission on PFAS Draft NEMP version 2
Date: Thursday, 23 May 2019 8:59:15 AM

Hi guys,

Thanks for your hard work and efforts in putting together both NEMP version 1 and version 2. The NEMP fills an important gap in Australian guidance for site contamination, and ongoing updates to this document are important as knowledge about PFAS increases.

I work for enRiskS, am the chair of the ALGA emerging contaminants interest group and also sit on the ACLCA-Vic risk assessment sub-committee. These comments are my personal comments, however are based on my experience in the industry.

My comments on version 2, for consideration, are as follows:

1. Version 2 does not provide details of the assumptions adopted to derive the revised soil guideline for residential with garden/accessible soil (Table 2). It is acknowledged that version 1 did not do this either, however at the time version 1 was released the Draft NSW OEH guidance document with the assumptions used was available. It is not possible to review or provide technical comment on the revised guideline in NEMP version 2 without information on the assumptions (with appropriate justification) that were used. It has been indicated that a background document is pending however it has not yet been released. Releasing the guideline without the background document containing the assumptions is not particularly useful as it only provides some of the information that is needed. It is not clear if doing things in this way constitutes full consultation.
    a. It is suggested that HEPA extend the consultation period for an appropriate period of time following the release of the background document. A extension of 3 weeks with notice following the release of the background document is suggested, to allow people who wish to provide comment to prioritise this work.
    b. The background document should also include the details/justification in relation to the revised ecological guidelines for soil. This is useful work that has been completed and should be available for review and comment during the consultation period, and for industry use moving forward.

Happy to discuss if further clarification is required, my contact details are below.

Best Regards,

Ruth Jarman (MAppSci Toxicology; RACTRA)
Senior Consultant

Environmental Risk Sciences Pty Ltd (enRiskS)
Mobile: [redacted]
[redacted]

Email: ruth@enrisks.com.au

www.enrisks.com.au

From: Ruth Jarman
To:
Cc: PFASstandards
Subject: RE: Submission on PFAS Draft NEMP version 2 [SEC=OFFICIAL]
Date: Friday, 31 May 2019 3:35:29 PM

Hi

Further to my e-mail below, we have picked up a typo in NEMP ver 1 which has been carried through to NEMP ver 2:

- The heading for Table 4 (Terrestrial Biota Guidelines) is listed as PFOS + PFHxS where it should only be PFOS, consistent with all the other ecological guidelines.

By way of background, we can across this the other day as a result of a comment on one of our reports, and the table heading didn't look correct to us, as the Canadian guidelines are for PFOS only. So we got in touch with NSW OEH today, who confirmed it is a typo. They requested we send this comment through to you guys formally, so the NEMP could be amended.

Cheers,

Ruth Jarman

Environmental Risk Sciences Pty Ltd (enRiskS)
Mobile: [redacted]
ruth@enrisks.com.au
[redacted]

From:
Sent: Thursday, 23 May 2019 1:34 PM
To: Ruth Jarman <ruth@enrisks.com.au>
Cc: PFASstandards <PFASstandards@environment.gov.au>
Subject: RE: Submission on PFAS Draft NEMP version 2 [SEC=OFFICIAL]

Hi Ruth

Thanks for providing this input and suggesting an extension of the closing date for consultation.

We are happy to confirm that, in response to stakeholder requests, the closing date is being extended to Friday 21 June. This will be reflected on EPA Victoria's NEMP 2.0 consultation web page shortly.

The updated consultation web page will also provide additional information, such as:

- the proposed NEMP future work program
- the background document for the human health soil guidance values as soon as this is published on the NSW OEH website – which is expected to be in the next day or so.

As you would recall, the interim ecological guideline value for soil from the first version of the NEMP has been retained in the draft NEMP 2.0. Consequently, there is no National Chemicals Working Group-endorsed background document on this topic being released as part of the

consultation on the draft NEMP 2.0. However, further work on soil guideline values is a high priority for the National Chemicals Working Group in the next phase of work on the NEMP.

The National Chemicals Working Group recognises that industry views, expertise and experience are essential and looks forward to working with the industry, including though ACLCA and ALGA, to progress this work.

Please don't hesitate to get in touch with any further comments or queries.

From: Ruth Jarman [mailto:ruth@enrisks.com.au]
Sent: Thursday, 23 May 2019 8:59 AM
To: PFASstandards <PFASstandards@environment.gov.au>
Subject: Submission on PFAS Draft NEMP version 2

Hi guys,

Thanks for your hard work and efforts in putting together both NEMP version 1 and version 2. The NEMP fills an important gap in Australian guidance for site contamination, and ongoing updates to this document are important as knowledge about PFAS increases.

I work for enRiskS, am the chair of the ALGA emerging contaminants interest group and also sit on the ACLCA-Vic risk assessment sub-committee. These comments are my personal comments, however are based on my experience in the industry.

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with notice following the release of the background document is suggested, to allow people who wish to provide comment to prioritise this work.

b. The background document should also include the details/justification in relation to the revised ecological guidelines for soil. This is useful work that has been completed and should be available for review and comment during the consultation period, and for industry use moving forward.

Happy to discuss if further clarification is required, my contact details are below.

Best Regards,

Ruth Jarman (MAppSci Toxicology; RACTRA)
Senior Consultant

Environmental Risk Sciences Pty Ltd (enRiskS)
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From: Kylie Sheppard
To: PFASstandards
Subject: Submission on PFAS Draft NEMP version 2
Date: Wednesday, 19 June 2019 4:12:00 PM
Attachments: image001.jpg
image002.jpg

Good afternoon,
Thank you for the opportunity to submit these comments on the PFAS Draft NEMP version 2:

- Section 10.1 Storage, Stockpiles, and Containment: for completeness, suggest adding "groundwater" to the list of PFAS-contaminated liquids in the 4th dot point.
- Section 10.2 Design Considerations:
  - unclear what it meant by "soil-based materials" – could this be rephrased to make the intended meaning clear?
  - "In addition, some PFASs are volatile…" – to enhance the usability of this document, could a cross reference be inserted here to the section the reader can turn to, to check whether 'their' PFAS (the one they're working with) is volatile or not?
  - "Account for local climatic, fire, flood…" – could "geotechnical" be added to this list too (this would capture earthquake risk).
- The link between Section 10.2 Design Considerations, Section 10.3 and Section 10.3.1 is not clear. These sections appear to duplicate each other. Could they be restructured for clarity, and edited to remove duplication?

Thank you for considering these comments.
Regards,

Dr Kylie Sheppard [BEng Env., PhD]
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Draft PFAS NEMP Version 2 – Written Submission Cover Sheet

Name (optional):
Dr Martin Lourey

If applicable – Organisation:
BMT Western Australia Pty Ltd

Address (optional):
Level 4/20 Parkland Road
Osborne Park WA 6017

Position (optional):
Principal, Marine Biogeochemist

Email (optional):
Martin.Lourey@bmtglobal.com

Confidentiality

(i)	Confidentiality requested?	No
(ii)	If so, does part of your submission include confidential or sensitive information?	No
	Have you provided confidential or sensitive information in a separate attachment	*No*
	Have you provided a redacted version	*No*

Draft PFAS National Environmental Management Plan Version 2 sections

If you have specific comments or suggested text changes, please clearly identify the extract of the relevant part of the NEP on which you are providing feedback.

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8. Environmental guideline values

8.2 Ecological guideline values

8.2.3 Aquatic ecosystems: freshwater and marine water guideline values

The updated NEMP (Table 5) refers to the Freshwater guideline as "Australian and New Zealand Guidelines for Fresh and Marine Water Quality – technical draft default guideline values for PFOS and PFOA". This is not true. The freshwater guidelines are currently (as at 20 May 2019) "proposed" and not "draft". The NEMP should not imply that the freshwater guidelines have any standing as Australian and New Zealand Guidelines for Fresh and Marine Water Quality DGV, even in a draft capacity. The freshwater guideline should also be considered to be interim until such time as they (or an alternative) are formally accepted as an Australian and New Zealand Guidelines for Fresh and Marine Water Quality DGV.

For the marine guideline, the NEMP (Table 5) states that "Freshwater values are to be used on an interim basis until final marine guideline values can be set using the nationally-agreed process under the Australian and New Zealand Guidelines for Fresh and Marine Water Quality". This logic is flawed. The freshwater guidelines themselves have not been set using the nationally agreed process. The freshwater guidelines are no further advanced in the assessment process than the proposed marine guideline (both are proposed). The freshwater guidelines should not be considered to be reliable enough serve as a marine guideline even in an interim capacity.

The NEMP (Table 5) ignores the marine guidelines derived by the CRC CARE using the ANZECC & ARMCANZ (2000) protocols and submitted to the same assessment process as the freshwater guidelines. The NEMP states that the "marine guideline values developed by CRC CARE are under consideration through the nationally-agreed water quality guideline development process". Because the marine guidelines have been submitted for assessment under the same process as the Freshwater Guideline they should be afforded the same status as the freshwater guideline. There being no scientifically valid reason to exclude them from the NEMP, the CRC CARE guideline should be applied as the interim marine guidelines until such time as they (or an alternative) have been formally accepted as Australian and New Zealand Guidelines for Fresh and Marine Water Quality DGVs.

PFAS NEMP 2.0 SUBMISSION

Anthony Amis

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ajamis50@gmail.com

PFASstandards@environment.gov.au

Consultation on the draft second version of the PFAS National Environmental Management Plan

Friends of the Earth Australia (FoEA) would like to submit the following information into the second version of the PFAS National Environmental Management Plan.

As an Environmental Non-Government Organisation FoEA is receiving a number of queries regarding on going concerns about PFAS issues from around Australia.

These concerns are primarily regarding health concerns, but some attention is now being focussed on how wide spread these substances are in the environment.

A national PFAS map has been created with 200-300 visits coming to the site each day since it started in July 2019. https://pfas.australianmap.net/

The map, whilst having many limitations is very useful in determining the extent of PFAS issues across the country. Interestingly, the Australian site is receiving some attention from the United States: https://pfasproject.com/pfas-contamination-site-tracker/

One wonders why no similar map has been created by Australian authorities and why this job has been left to a largely volunteer organisation?

The PFAS Nemp 2.0 provides new guidance on environmental guideline values, soil reuse, wastewater management and on-site containment.

In June 2019, Friends of the Earth published:
https://www.foe.org.au/pfas_and_other_chemicals_released_back_into_the_environment_via_recycled_water_and_biosolids

This has been read with interest from a number of our members.

"…Recent research has highlighted issues concerning waste water and other products from waste water treatment facilities which contain a range of contaminants including PFAS (Per- and poly-fluoroalkyl substances).

A large portion of waste water and biosolids are applied to agricultural crops. For instance, recycled water from the Western Treatment Plant in Victoria is used on vegetable crops at Werribee South, including a large proportion of Victoria's cauliflower, broccoli and lettuce.

Similarly the Bolivar Waste Water Treatment Plant near Adelaide supplies water to irrigate edible crops/market gardens at Virginia. PFAS tainted water is also reinjected back into the aquifer as well as released to the environment.

It is estimated that Australia produced 327,000 tonnes of biosolids in 2017. 75% of this total amount is then used for agricultural as fertiliser. Some PFAS chemicals can bioaccumulate and therefore enter the food chain.

Regular monitoring is likely never to have occurred at many waste water facilities across the country for a range of potential pollutants in waste water including PFAS, Brominated Flame Retardants, Pharmaceutical's, Benzotriazoles etc.

If testing is done, and if the chemical is detected at below Australian Drinking Water Guidelines then the contaminants are assumed by water authorities to be "safe", despite their ability to bioaccumulate.

Recent letters to three of Australia's largest supermarket chains, Woolworths, Coles and Aldi in regards to testing produce for PFAS contamination on food stuffs have not been sufficiently answered, with all Supermarket chains apparently completely unaware of the issue.

Friends of the Earth is not opposed to the use of recycled water or biosolids but believe as an act of urgency that the best treatment available should be used as a means of reducing risks associated with micro-pollutants."

In terms of reducing the impacts of PFAS from waste water treatment plants (WWTP's), it appears that the best filtration systems are Granular Activated Carbon and Reverse Osmosis, yet how many WWTP's across Australia utilise this technology?

Shouldn't the NEMP also be exploring options for the costs of rolling out such technology at WWTP's across Australia, rather than adopting guidelines which may in a few years time be obsolete?

Not only is recycled waste water being used on agricultural crops, but it is also being used to "replenish" ground water. In some regions such as Adelaide, recent decisions have meant that Reverse Osmosis in WWTP's was initially recommended, but then not implemented by the State Government. What is the true extent of using inappropriately treated waste water on crops and ground water which in some cases has been used for decades?

There is currently no effective treatment that exists to remove PFAS chemicals from biosolids or soils. The best option is source control, which according to Friends of the Earth would mean significant improvements in filtration at WWTP's including GAC and or Reverse Osmosis.

Friends of the Earth is aware that due to increasing costs, there is increased pressure to divert biosolids from landfill, however such diversions make it difficult to determine what are adequate and safe levels of emerging contaminants eg PFAS, once again due to political pressure.

What long term risks are not being fully explored by allowing such practices to continue throughout Australia? These risks might include risks of selling agricultural crops to international markets and bioaccumulation through the food chain?

PFAS contaminated farms fertilised with sewerage sludge has recently made the news in the United States and it is highly likely that similar issues will gain coverage in Australia. Whilst this contamination issue is well known amongst the water industry, it has received little attention (so far) in the Australian media.
https://theintercept.com/2019/06/07/pfas-chemicals-maine-sludge/

"All sewage sludge recently tested by the Maine Department of Environmental Protection was contaminated with PFAS chemicals… The state tested the sludge, solid waste that remains after the treatment of domestic and industrial water, for the presence of three "forever chemicals": PFOA, PFOS, and PFBS. Of 44 samples taken from Maine farms and other facilities that distribute compost made from the sludge, all contained at least one of the PFAS chemicals. In all but two of the samples, the chemicals exceeded safety thresholds for sludge that Maine set early last year.

In March, the state announced that it would temporarily halt the land application of sludge and begin the testing, after milk from a dairy farm in Arundel, Maine, was found to be contaminated with PFAS that had likely come from sludge that the farmers had spread on their land as fertilizer. These results, which have not yet been published or reported, are from the first round of testing. An additional 28 samples were collected but the results of their testing are not yet available.

While Maine is leading the nation by setting limits for the chemicals and testing sludge to see if it meets them, local environmentalists fear that the state's levels 2.5 parts per billion for PFOA, 5.2 ppb for PFOS, and 1,900 ppb for PFBS may not be stringent enough. "They're probably about 10 times weaker than they should be," said Mike Belliveau, executive director of the Environmental Health Strategy Center in Portland. "Even low parts-per-billion levels of PFAS in sludge can threaten the health of the food supply…."

Similar issues have already created a dilemma in Queensland where there is pressure to reuse biosolids on land. Some local governments are opposing new biosolid measures, set at the

same minimum detection levels for PFAS in soils as those published by the National Measurement Institute and have lobbied the Queensland Government to postpone new biosolid measures for a year. Where else in Australia is this scenario going to play out?

This could also be a problem for waste recycling and compost companies where the problem has been recently discussed in a scientific paper. Please note that the NEMP Guidelines do not have guideline levels for short chain PFAA's. Why not?

"Results are similar to what Drs. Lee and Mashtare's research groups found for commercially available nonbiosolid-based composts and significantly lower than found in pre-2015 biosolids composts; PFAA levels in biosolids composts were generally 2 to 10 times higher. Research by Blaine, Higgins, et. al (2013) with 1:10 biosolid/soil mixes showed that shorter chain PFAAs were taken up by lettuce and tomatoes in pot studies, but not significantly in pilot or full scale field trials. Gottschall, Topp et al. (2017) noted leaching to tile drains of PFAAs from compost-amended crop production fields at low parts per trillion levels. The concern about leaching to groundwater or stormwater needs further quantification." **Evaluating Perfluoroalkyl Acids in Composts with Compostable Food Serviceware Products in their Feedstocks** Linda S. Lee, Professor in the Department of Agronomy, College of Agriculture, Purdue University Heather Trim, Zero Waste Washington

Contaminated PFAS "compost" in Queensland has been the source of several media articles since June 2018.

A "composting blanket" sprayed beside one of Queensland's major highways had to be scraped off after it was found to contain unsafe levels of chemicals used in toxic firefighting foam. The composting material was supplied by waste-recycling company Nugrow, now under investigation for receiving nearly a million litres of sludge and stormwater contaminated with per- and poly-fluoroalkyl substances (PFAS) from a Queensland air force base…But the company issued a statement saying its compost was "absolutely safe and meets Australian standards, and state and national guidelines"…In 2017, the company was hit with an environmental protection order after receiving 940,000 litres of stormwater from the RAAF base at Amberley, about 45km southwest of Brisbane…Nugrow also faced allegations the material was mixed into compost destined for sale to the public despite containing the chemicals. The Australian Feb 25 2019

"Queensland Environment Minister Leeanne Enoch has confirmed the Queensland government is investigating allegations a major compost manufacturer at Swanbank used contaminated water from the Amberley RAAF Base containing toxic firefighting chemicals to feed its compost….It claimed NuGrow planned to use the contaminated water containing the firefighting foams (called PFAS) as fertilizer for its compost. Brisbane Time July 4 2018

"Soil supplied by a waste-recycling company that took water contaminated with toxic firefighting chemicals from a military base has been withdrawn from sale by one of Queensland's largest landscaping outlets…Centenary Landscaping confirmed it has stopped selling its Econo Soil product which had been made from soil supplied by Nugrow Metro a waste recycler and composter facing action over its handling last year of water contaminated with perfluoroalkys, or PFAS, substances from Amberley air base, west of Brisbane….It also alleged NuGrow could not dispose of the water by diluting the compost. NuGrow has disputed the department's claims and launched legal action to appeal against the order." The Australian June 20 2019

"Council-owned sites across Brisbane including parks and playgrounds could be at risk of contamination from toxic firefighting chemicals originating from Amberley Air Base. Brisbane City Council has launched an investigation into whether suppliers sourced soil or compost from a waste company facing action over its handling of material contaminated with the perfluoroalkyls (PFAS) substances from the air base, west of Brisbane last year. The company, NuGrow Metro, has been hit with sanctions from the Queensland Environment Department over its alleged unauthorised receipt of 940,000 litres of toxic stormwater due to be mixed into compost

Queensland's Environment Department also blocked the release of mulch by green recycler Wood Mulching Industries after PFAS were detected in compost about to be sold to the public. The contaminated material was detected during an investigation by state regulators that has involved spot-testing for the chemicals at six compost facilities in southeast Queensland..." The Australian July 17 2018

In terms of the proposed Biosolids Value, FoEA thoroughly rejects the proposed ANZBP guideline. FoEA would also like some clarification regarding the NEMP proposed Biosolids Value. Is this value relevant only for one application of biosolids on a particular piece of land? Does this value incorporate continuous applications of biosolids over the same area for lengthy amounts of time? Given that PFAS chemicals are being called the "Forever Chemicals", how does the guideline take into account PFAS build up (bioaccumulation) in soils over a number of years?

Perhaps these questions are also interest in residential areas, where compost containing PFAS contaminants may add substantially to existing PFAS levels in soils. As has already been noted, PFAS in compost had already caused a number of problems in Queensland. Where else will this occur? It appears strange that NEMPS proposed guidelines for Residential with garden/accessible soils have increased, particularly so with PFOA. Friends of the Earth remains sceptical that these guideline proposals are adequate. Friends of the Earth also questions the 10% fruit and vegetable consumption assumptions, used to calculate the proposed NEMP guideline. Many home gardeners would aim to be almost self sufficient in a number of vegetables and the figure could by as high as 90% for some people.

It is also troubling that information used to derive soil to plant transfer factors for PFOS, PFHxS and PFOA was based on overseas data (included in a NSW Government report), with limited access to Australian data, based on Australian conditions and soil types.

To appropriately resolve these issues, political decisions need to be made, that take into account the full extent of the problem.

This recent article: https://theintercept.com/2019/06/18/pfoa-pfas-teflon-epa-limit/ suggests that the safety threshold for PFOA should be as low as 0.1 parts per trillion, particularly relevant to risks of developing pancreatic cancer. If this suggestion is correct, then all NEMP recommendations will be inadequate.

Another recent report from the United States: https://www.jdsupra.com/legalnews/fifteen-states-and-state-associations-42150/ reveals issues that several states have requested by included in the EPA's draft PFAS guidance. Several of these concerns are also relevant for the PFAS NEMP 2.0

These include:

“EPA should address and include other per- and polyfluoroalkyl substances (PFAS), a group of man-made chemicals that includes PFOA, PFOS, GenX, and many other chemicals manufactured and used in a variety of industries since the 1940s, beyond PFOA and PFOS, in the guidance document.

EPA should coordinate with other federal agencies to assess, address, and remove or prevent PFAS from entering the environment.”

Why is the NEMP only focussing on guideline levels for PFOS, PFHxS and PFOA?

It is already known that typical WWTP concentrations in Australia include PFBA, PFHpA, PFNA, PFPeA, PFHxS, PFOS, PFBS, 6-2 FTS, PFDA, PFHxA, PFOA, PFPeS, PFHpS. Shouldn’t NEMP guidelines also extend to each of these chemicals?

Anthony Amis

Friends of the Earth Australia

June 21 2019

Submission

Draft
PFAS National Environmental Management Plan
Version 2

Mr Warren Godson

wgodson86@gmail.com

Confidentiality No
redacted version No

Draft PFAS National Environmental Management Plan Version 2

Contents

Draft PFAS National Environmental Management Plan Version 2

Summary
Per- and Poly-Fluoro Alkyl Substances (PFASs) have been identified as a major issue for water utilities in Australia (PFASs (PFOS, PFOA, etc). They are highly water soluble and resistant to degradation (bioaccumulate) and hence widely present in our environment, resulting in PFAS contamination of our groundwater, soil, drinking water, recycled water, all of which have a marked impact on human health and the environment (irrigated edible crops).

The few PFAS studies[5] that been conducted in Australian *conventional* Waste Water Treatment Plants (WWTP) show measurable levels PFOA and PFHxA wastewater effluent/recycled water and that these PFAS concentrations can increase during *conventional* wastewater treatment due to precursor degradation .Moreover WWTPs tend to concentrate high levels of PFAS from various sources and as a result technology treatment commonly employed in conventional WWTP is insufficient for complete PFAS removal from wastewater/biosolids.

The draft PFAS NEMP 2.0, proposes re- use of PFAS contaminated waste water/biosolids for agriculture purposes etc, but provides no evidence of how they intend to reduce current PFAS emissions from *conventional* WWTP.

A PFAS NEPM should include new technology[1] measures to upgrade our *conventiona*l WWTP in order to prevent PFAS contaminated recycled water/biosolids being applied to land e.g. to irrigate edible crops. These *conventional* WWTP* are already suppling recycled water to irrigate edible crops. An upgrade of our *conventional* WWTP will ensure that PFAS levels in our drinking water, wastewater, groundwater, biosolid are well below PFAS detection limits, and not pose an unacceptable risk to our health / environment/ aquatic ecosystems.
* Refer exls Supplement. *PFAS data SA Water Bolivar WWTP*

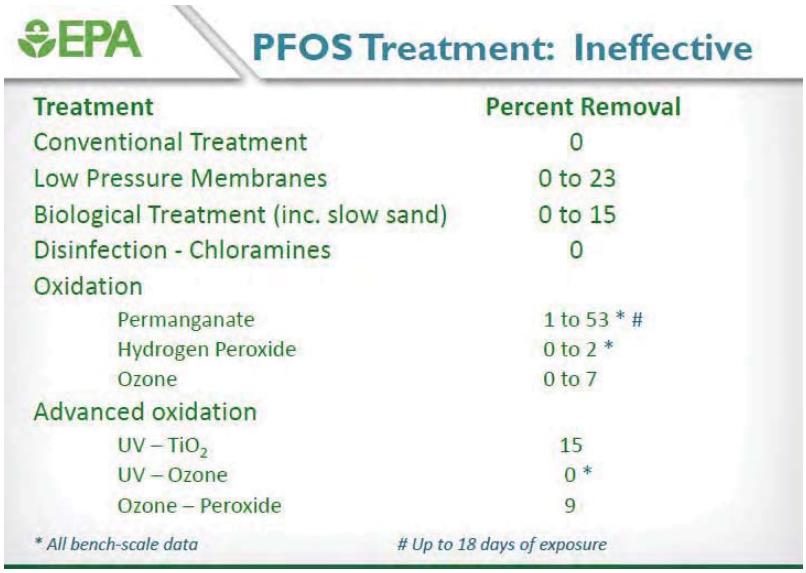
There are considerable long-term risks of health/ environmental harm from PFAS exposure if this NEMP decides to approves/allows Water Utilities and other Industries to reuse recycled water/biosolid etc containing PFAS for agriculture purposes etc, as these risks outweigh any short monetary benefits gained by Water Utilities and other Industries recycling PFAS waste products

Draft PFAS National Environmental Management Plan Version 2
15.Wastewater treatment
1.#15.1 PFAS Management Framework /15.2 Additional management tools.
Upgrades to conventional Waste Water Treatment Plants

One of the measures to reduce PFAS from our environment pressing is to upgrade '*---wastewater processing (e.g. infrastructure and biological treatment processes) wastewater outputs (e.g. effluent discharged to the environment,* ***effluent used as recycled water, biosolids used for soil conditioning****, and biosolids disposed to landfills or other waste disposal pathways)'.* Source Draft NEMP v2 page 61-15.1

To completely remove PFAS from wastewater /recycled water /biosolids. new treatment technologies will need to be implemented to provide a safe environment, as conventional Waste Water Treatment Plants in Australia are not equipped (ineffective) as shown in table 1 to prevent /remove high levels of PFAS in treated effluent (recycled water) from being reused for agriculture purposes e, g. edible crops.

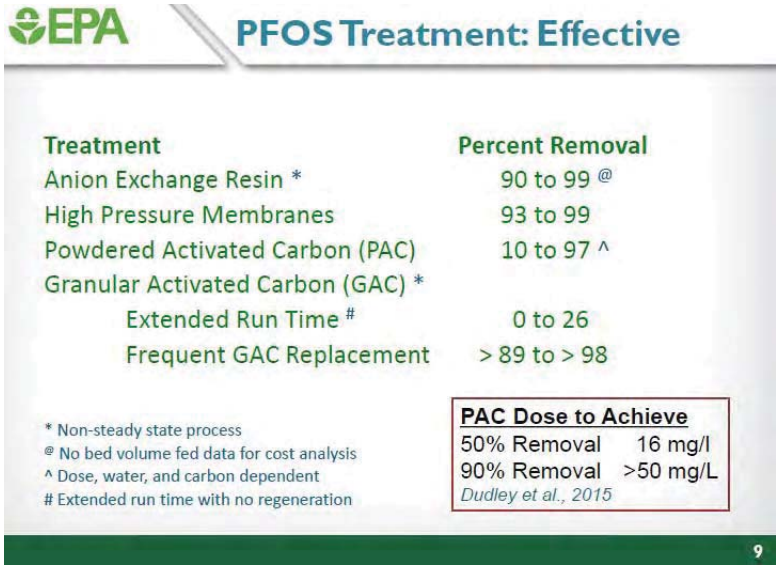
Table 1 PFOS treatment Ineffective[1]



Source: PP slide 8. *PFAS Drinking Water Treatment* 'March 2018 US EPA, Office of Research and Development, NRMRL, Water Systems Division, IO Thomas F. Speth, Rajiv Khera, Jonathan Pressman, Pat Ransom, Craig Patterson, Matthew Magnuson

The US EPA has suggested effective technologies (shown in table 2) to remove PFAS from water. These include activated carbon treatment, ion exchange resins, high pressure membranes, nanofiltration and reverse osmosis. However, with each of these technologies, costs and operational feasibility would need to be evaluated up prior to installation in a WWTP. e.g. Anion exchange [2]

Table 2: PFOS treatment effective [1]



Source PP Slide 9: PFAS Drinking Water Treatment March 2018 US EPA, Office of Research and Development, NRMRL, Water Systems Division, IO Thomas F. Speth, Rajiv Khera, Jonathan Pressman, Pat Ransom, Craig Patterson, Matthew Magnuson

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2.Comments on statements made in Appendix D.: Example PFAS Management Framework for a Wastewater Utility.
(1)9.3 Recycled water used in the built environment or in products, discharged to storm water systems, applied to terrestrial ecosystems or injected into groundwater, states that:
"Adequate trials will be conducted before water recycling is rolled out at scale. This will include testing of receiving soils, groundwater and downstream environments for PFAS contamination before the ***application of recycled water****, testing of recycled water, and testing of receiving soils, groundwater and downstream environments after the application of recycled water across several years----------The use of recycled water in the built environment (i.e. residential, commercial and industrial settings) and* ***the discharge of recycled water*** *to stormwater and* ***groundwater (i.e. aquifer recharge****) are not known to occur in EW's management area*'.
This statement is misleading as:
•.SA Water Bolivar *conventional* Waste Water Treatment Plant in Adelaide has been providing (on a broad scale) significant amount of treated wastewater contaminated with PFAS since 1999 serviced market gardens at Virginia to **irrigate edible crops, any surplus recycled water injecting groundwater i.e. aquifer recharge.** However, it was not until 2016 -17 that Bolivar WWTP recycled water was first tested for PFAS, resulting in detectable levels found in treated wastewater. No further PFAS monitoring has taken place at SA Water Bolivar WWTP because SA health has deemed that as PFAS levels are below Australian Drinking Water Guidelines 70ng/l no further PFAS testing is required. Moreover, there is no information to say that receiving soils / groundwater at Virginia have been tested for levels of PFAS. Refer Supplement material xlsx file PFAS detections Bolivar WWTP 2016-17
•For decades recycled water from Werribee *conventional* Wastewater Treatment plant (WWTP) located west of Melbourne, used recycled water to irrigate edible crops. RMIT studies[3] (et al Zarbo 2018) conducted in 2017 and 2018, sampled groundwater from Werribee South, and found that:
" ***twenty PFAS compounds (Σ20PFASs) for all sites in the study ranged from 0.03 to 74 ng/L (n = 28) and the highest levels of which were observed in the centre of the irrigation district.-------***
"Perfluorooctanesulfonic acid (PFOS) was the most detected compound overall (96%) with a mean concentration of 11 ng/L (b0.03–34 ng/L), followed by perfluorobutanesulfonic acid (PFBS; 86%, 4.4 ng/L), perfluorooctanoicacid (PFOA; 82%, 2.2 ng/L) and perfluorobutanoic acid (PFBA; 77%, 6.1 ng/L). Concentrations of PFASs found in this study are greater than background levels of PFASs detected in groundwater and are in the range of concentrations typically detected in wastewater effluent.
This study presents evidence that the use of recycled water can be a source of PFAS contamination to groundwater*.*

(2). **9.4 Biosolids applied to terrestrial ecosystems or in products**
(a). **Biosolids reuse improve soil properties in agriculture e.g. edible crops**
The properties of biosolids are of concerns as they present a *'pollutant sink'*, particularly from organic chemical residues. The current guidelines for contaminants in biosolids are not effective for emerging hazards and pollutants of concern which are likely to be present, typically persistent, bio-accumulative, toxic (often to aquatic environments) such as such perfluorooctane sulfonic acid (PFOS) a Persistent organic pollutants (POPs).
majority of PFASs entering WWTPs are not removed by deposition into the biosolids, WWTPs are a point source of these chemicals returning back into the environment via the dis-charge of effluent.

The Institute for Sustainable Futures[4] have raised such risks to the public and environmental health of biosolids waste streams containing PFAS saying that "*While data on Australian biosolids concentrations of these contaminants is very limited, Gallen et al. (2016)*[5] ***shows that PFOS (as a minimum) could be present in Australian biosolids above levels of concern, noting that if maximum allowable concentration regulatory limits similar to the UK or Germany were adopted in Australia in the future, as many as 7 out of the 16 sites assessed would have biosolids sufficiently contaminated as to be unfit for management by land application****. For the most contaminated material, such a scenario could turn a current water industry resource into a future hazardous waste, with strict limitations on the nature of infrastructure that could manage it."*

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(2). 9.4 Biosolids applied to terrestrial ecosystems or in products (Cont.)

(b) **The Harmonised Australian Retailer Produce Scheme (HARPS)[6]**

HARPS are a group retailer consisting of: ALDI Coles Supermarkets, Costco, Metcash and Woolworths have not permitted their growers to use biosolids to their land for growing of edible crops. Refer HARPS Standard Version 1.0 October 2016 Page 11 –12.

14 Growing

1.Treated and untreated fertilisers and soil additives made from human effluent or Biosolids are not permitted for use on growing sites or potential growing sites. Raw sewage flow into irrigation water sources is not permitted.

1X. Water sourced from recycled sources and schemes (i.e. class A recycled water) shall be identified and tested at a frequency defined by a risk assessment.

(c) **PFAS Guidelines levels for biosolids**

There is a paucity research in Australia relating to PFAS plant uptake from biosolid amended soil in particular investigating the health risk of PFAS uptake by edible plants. However, the document *End of Waste Code Biosolids (ENEW07359617) Waste Reduction and Recycling Act 2011*[7] produced by Waste and Contaminated Land Assessment, Department of Environment and Science Queensland has adopted allowable PFAS levels for biosolids' listed in 7.21 in Table 6.

'Maximum allowable soil contaminant concentrations, lists *Total Organic Fluorine* * *0.005 mg/kg*

* Where TOF analysis is not available, the sum of oxidisable precursors (Total oxidisable precursor assay, i.e., TOPA C4 – C14) plus perfluoroalkyl sulfonates (PFBS, PFHxS, PFOS, PFOSA, PFDcS) is taken to be a surrogate for TOF.

"The UK's limit for PFOS in biosolids used for land application purposes is 46 ng/g (dry weight), and in Germany the combined limit for both PFOA and PFOS ranges from 100 to 200 ng/g (dry weight) [78,79]. Applying these guide-lines to the results of this[Australian] *study, the biosolids produced at 7 of the16 sites exceed the UK guidelines, and four of the 16 sites exceed the German guidelines*." Gallen et al 2016

[78] J. Seow, Fire Fighting Foam with Perfluorochemicals − An Environmental Review, Department of Environment and Conservation, Western Australia,2013. [79] United Nations Environment Programme: National Implementation Plan Germany. 2012; Available from: http://chm.pops.int/Implementation/NIPs/NIPSubmissions/tabid/253/Default.aspx.

[79] United Nations Environment Programme: National Implementation Plan Germany. 2012; Available from: http://chm.pops.int/Implementation/NIPs/NIPSubmissions/tabid/253/Default.aspx

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1.Thomas F. Speth, Rajiv Khera, Jonathan Pressman, Pat Ransom, Craig Patterson, Matthew Magnuson *'PFAS Drinking Water Treatment*.' March 2018 US EPA, Office of Research and Development, NRMRL, Water Systems Division, IO

2.Dolly N. Kothawala, Stephan J. Köhler, Anna Östlund, Karin Wiberg, Lutz Ahrens. *'Influence of dissolved organic matter concentration and composition on the removal efficiency of perfluoroalkyl substances (PFASs) during drinking water treatment'* Water Research Volume 121, 15 September 2017, Pages 320-328 https://doi.org/10.1016/j.watres.2017.05.047

3. Szabo D, Timothy L. Coggan, Timothy C. Robson, Matthew Currell, Bradley O. Clarke *'Investigating recycled water use as a diffuse source of per- and polyfluoroalkyl substances (PFASs) to groundwater in Melbourne, Australia*' Science of the Total Environment 644 (2018) 1409–1417https://doi.org/10.1016/j.scitotenv.2018.07.048

4.Fam D, Turner A, Latimer G, Liu A, Guirco D, & Starr P '*Convergence of the waste and water sectors: risks, opportunities and future trends – discussion paper'* 2017 http://www.isf.uts.edu.au/ prepared for the Department of the Environment and Energy, Australian Government, by the Institute for Sustainable Futures, University of Technology Sydney

5.C. Gallen, G. Eaglesham, D. Drage, T. Hue Nguyen, J.F. Mueller '*A mass estimate of perfluoroalkyl substance (PFAS) release from Australian wastewater treatment plants'* Chemosphere 208 (2018) 975e983 https://doi.org/10.1016/j.chemosphere.2018.06.024

6. '*HARPS Harmonised Australian Retailers Produce Scheme Standard*' 1.0 October 2016

7. Waste and Contaminated Land Assessment, Department of Environment and Science Queensland *'End of Waste Code Biosolids' (ENEW07359617) Waste Reduction and Recycling Act 2011,* \. 2019

Other References

State of NSW and Office of Environment and Heritage *'Human health soil screening criteria for PFOS, PFHxS and PFOA Calculation protocols and draft values for potential inclusion in the PFAS National Environmental Management Plan'*.2019

Coggan T.L, Szabo D. 1, Moodie D., Shimeta J., Crosbie N.D. 2, Fernandes M., Lee E and Clarke B.O. '*Investigation of the levels of PFAS in aqueous matrices from Nineteen Australian wastewater treatment plants'* WIOW Symposium Canberra, 29 - 31 October 2018

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Appendix A

Convergence of the waste and water sectors: risks, opportunities and future trends – discussion paper
2017 Fam D, Turner A, Latimer G, Liu A, Guirco D, & Starr P prepared for the Department of the Environment and Energy, Australian Government, by the Institute for Sustainable Futures, University of Technology Sydney http://www.isf.uts.edu.au/
Selected extracts from Page 6-7

4.2 THE LEGACY OF 'TRADITIONALLY' CONTAMINATED BIOSOLIDS STOCKPILES

The majority of biosolids produced in Australia come from WWTPs and are applied to land, mostly for agriculture but also for land rehabilitation purposes. Those biosolids contaminated above guideline levels (typically in heavy metals) cannot be used for this purpose and may be stockpiled awaiting an alternative fate. Such has been the case historically at Melbourne's Western (sewage) Treatment Plant, where approximately 1,500,000 'dry tonnes' of biosolids (equivalent to 7,500,000 tonnes on an average dewatered basis of 21% solids) are stockpiled, known to be contaminated with heavy metals such as mercury, cadmium and lead, 'traditionally' recognised and well-regulated pollutants. If this stockpile were managed in a similar fashion to contaminated soil, it would exceed Victoria's fill material upper limits and be classified as Category C contaminated soil. Similarly, if it were managed in Victoria's solid waste framework, it would be classified as probably Category C prescribed industrial waste (PIW), with some potential for Category B depending on leach-ability testing. Either categorisation brings biosolids contaminated above guideline levels into the realm of the waste (and potentially hazardous waste) industry, a type of convergence not necessarily solicited by the water industry nor driven by market demand for recovery of the material.

4.3 EMERGING CONTAMINANTS IN BIOSOLIDS

There are a number of emerging pollutants of concern that are likely to be present in Australian biosolids, due to concerns about the 'pollutant sink' properties of biosolids, particularly from organic chemical residues. These include:

• Persistent organic pollutants (POPs) such as perfluorooctane sulfonic acid (PFOS) due to its tendency (compared to the other POPs) for high water-mobility and extreme water-species ecotoxicity – 0.00023 µg/L is the environmental water guideline value for 99% species protection[7] which is close to limits of laboratory detection.
• Other persistent organic chemicals used in personal care and household products including:
o chlorophenols such as triclosan, used as a bactericide in personal hygiene products
o 'polycyclic musks' such as galaxolide, a commonly used ingredient found in household cleaning products, cosmetics and perfumes that is responsible for 'musky' odours.
o Endocrine disrupting chemicals (EDCs)
• Dioxins and furans and polycyclic aromatic hydrocarbons (PAHs) such as Benzo[a]pyrene (B(a)P)
• A long list of pharmaceuticals and steroid hormones (via human excretion) also have the potential to be hazardous when applied to land.

Many of the above pollutants are EDCs.

There are existing guidelines for contaminants in biosolids but they are not effective for emerging hazards and pollutants of concern which are likely to be present, typically persistent, Bio-accumulative, toxic (often to aquatic environments) and either known or suspected of containing EDCs. This makes for a vastly wider set of contaminant questions for regulators to consider, that current biosolids management guidelines do not, given their focus on a narrow list of 'mainstream' contaminants such as heavy metals and some historically relevant organochlorine pesticides.

7: Australian Government Department of the Environment and Energy, DoEE (2016), Commonwealth Environmental Management Guidance on Perfluorooctane Sulfonic Acid (PFOS) and Perfluorooctanoic Acid (PFOA) draft, available from:
https://www.environment.gov.au/system/files/pages/dfb876c5-581e-48b7-868c-242fe69dad68/files/draft-environmental-mgtguidance-pfos-pfoa.pdf (accessed 6.02.17).

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Appendix A (Cont.)
4.3.1 POPs in biosolids & wastewater

Several new chemicals were added to the Stockholm Convention on POPs in 2013. Amongst these were: polybrominated diphenyl ethers (PBDEs), also known as POP-BDEs, hexabromocyclododecane (HBCD) and perfluorooctane sulfonate & perfluorooctane sulfonic acid (PFOS).

POPs are hazardous and environmentally persistent substances which can be transported between countries by the earth's oceans and atmosphere. Their use has typically been in high concentration applications such as flame retardancy of plastics, foams and building materials, and firefighting foams. Both in use and end of life, these substances can find their way into soil and water environments via leakage from landfill, via domestic sewer input, from sewage treatment effluents and, potentially, through land application of biosolids. McGrath et al. (2016)[8] sampled surface soil from 30 sites across Melbourne and analysed them for various PBDEs, finding "widespread contamination of the urban environment, including locations where direct sources to soil are not clear." **The Australian Government is yet to ratify these new additions to the Stockholm Convention, but ratification assessment processes are well-progressed**.

While data on Australian biosolids concentrations of these contaminants is very limited, Gallen et al. (2016)[9] shows that PFOS (as a minimum) could be present in Australian biosolids above levels of concern, noting that if maximum allowable concentration regulatory limits similar to the UK or Germany were adopted in Australia in the future, **as many as 7 out of the 16 sites assessed would have biosolids sufficiently contaminated as to be unfit for management by land application**. For the most contaminated material, such a scenario could turn a current water industry resource into a future hazardous waste, with strict limitations on the nature of infrastructure that could manage it

8 McGrath T.J., Morrison P.D., Sandiford C.J., Ball A.S., Clarke B.O. (2016), *Widespread polybrominated diphenyl ether (PBDE) contamination of urban soils in Melbourne, Australia,* Chemosphere 164 (2016) 225-232.

9 Gallen C et al. (2016), *Occurrence and distribution of brominated flame retardants and perfluoroalkyl substances in Australian landfill leachate and biosolids*, Journal of Hazardous Materials 312 (2016) 55–64.

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Appendix A (Cont.)

5.3 ADAPTIVE MANAGEMENT AND REGULATION OF EMERGING POLLUTANTS

Page 18 Selected extract

Biosolids have a strong management regime in place in Australia, in the form of various guidelines applied throughout Australian jurisdictions. In addition to contaminant and pathogenic assessment grading, these guidelines also place controls on placement of biosolids near sensitive land areas and water resources via buffer distances, and generally require limiting of re-application or at least soil testing prior to doing so. However, the weakness of this regime is two-fold:

• the scope of contaminants it considers is too narrow - a suite of heavy metals and organochlorine pesticides does not address the risks that a near-future set of concerns will pose

• there is insufficient biosolids analysis data available to gauge the level of risk that an emerging set of pollutants could pose to the industry's current management practices.

Australian governments have identified environmental management of PFOS and associated guidance as a priority issue, as evidenced by the October 2016 release of the draft Commonwealth Environmental **Management Guidance on Perfluorooctane Sulfonic Acid (PFOS) and Perfluorooctanoic Acid (PFOA).[40] Land application of biosolids is caught in the middle of this emerging area of study**. **More extensive testing and subsequent modernisation of the biosolids management framework, considering PFOS at a minimum, is growing in urgency.**

40 Australian Government Department of the Environment and Energy, DoEE (2016), *Commonwealth Environmental Management Guidance on Perfluorooctane Sulfonic Acid (PFOS) and Perfluorooctanoic Acid (PFOA) draft*, available from: *https://www.environment.gov.au/system/files/pages/dfb876c5-581e-48b7-868c-242fe69dad68/files/draft-environmental-mgtguidance-pfos-pfoa.pdf* (accessed 6.02.17)

Resu ts in ng/L

Lab	Sample code	WW P	Sample type	Location	Notes	Date	Month sampled	PFBA	PFPeA	PFBS	PFHxA	PFPeS*	PFHpA	PFHxS*	6 2 F S	PFOA	PFHpS*	PFNA	PFOS*
RMIT	WWTP -L1-1	Bolivar	INFLUENT	001		8/06/2017	JUNE	1 8	5.7	.2	7.3	1.6	2 2	15.7	6.0	5.5	<0.2	<0.2	28.6
RMIT	WWTP -L1-2	Bolivar	INFLUENT	001		8/06/2017	JUNE	10 5	3.9	3.	6.7	1.2	2 6	13.6	5.	.3	<0.2	<0.2	25.0
RMIT	WWTP -L1-3	Bolivar	INFLUENT	001		8/06/2017	JUNE	5.1	2.3	5.3	6.1	1.7	2 6	12.7	.7	.1	<0.2	<0.2	25.3
RMIT	WWTP -L2-1	Bolivar	PRIMARY_EFFLUENT	002		8/06/2017	JUNE	19 8	0.2	3.8	9.9	<LOD	2 7	11.5	.3	3.5	<0.2	<0.2	2 .8
RMIT	WWTP -L2-2	Bolivar	PRIMARY_EFFLUENT	002		8/06/2017	JUNE	9	0.2	.2	6.9	1.3	2 8	13.0	6.2	.9	<0.2	<0.2	27.7
RMIT	WWTP -L2-3	Bolivar	PRIMARY_EFFLUENT	002		8/06/2017	JUNE	15 7	0.2	3.8	6.3	1.2	2.1	13.1	5.0	3.9	<0.2	<0.2	2 .5
RMIT	WWTP -L3-1	Bolivar	SECONDARY_EFFLUENT	00		8/06/2017	JUNE	5.8	1.9	2.7	9.2	1.0	2 9	10.0	7.0	6.8	<0.2	<0.2	13.1
RMIT	WWTP -L3-2	Bolivar	SECONDARY_EFFLUENT	00		8/06/2017	JUNE	7.3	3.2	2.7	12 6	1.0	2 8	10.2	6.5	6.0	<0.2	<0.2	1 .
RMIT	WWTP -L3-3	Bolivar	SECONDARY_EFFLUENT	00		8/06/2017	JUNE	11 7	2.1	2.2	1 .	0.8	2 6	9.0	6.5	7.	<0.2	<0.2	16.1
RMIT	WWTP -L -1	Bolivar	F NAL_EFFLUENT	007		8/06/2017	JUNE	9	.7	2.7	1 0	0.7	6 9	9 8	3.2	8.1	1.0	1.0	16.
RMIT	WWTP -L -2	Bolivar	F NAL_EFFLUENT	007		8/06/2017	JUNE	9.2	2.8	3.	13 0	1.0	9.1	12.3	2.9	10.0	1.0	1.0	20.2
RMIT	WWTP -L -3	Bolivar	F NAL_EFFLUENT	007		8/06/2017	JUNE	12	2.7	3.7	18 5	0.9	6 9	10.7	3.3	9.2	0.7	0.8	16.7
RMIT	WWTP -L5-1	Bolivar	RECYCLED_WATER	DAFF p ant		8/06/2017	JUNE	6.6	2.3	3	13 8	1.2	7	9 8	6.1	7.9	<0.2	<0.2	7.2
RMIT	WWTP -L5-2	Bolivar	RECYCLED_WATER	DAFF p ant		8/06/2017	JUNE	5.1	3.	3 8	1 8	0.9	2	8 6	5.	7.	<0.2	<0.2	6.5
RMIT	WWTP -L5-3	Bolivar	RECYCLED_WATER	DAFF p ant		8/06/2017	JUNE	9	3.9	3.5	15.	<LOQ	0	9 0	5.2	7.1	<0.2	<0.2	6.7
RMIT	WWTP -L6-1	Bolivar	RECYCLED_WATER_CHL	DAFF after ch orine		8/06/2017	JUNE	5.8	3.3	.1	1 8	1.0	3	10.7	6.2	7.5	<0.2	<0.2	6.
RMIT	WWTP -L6-2	Bolivar	RECYCLED_WATER_CHL	DAFF after ch orine		8/06/2017	JUNE	5.6	3.7	.8	1 5	1.1	2	9 7	5.9	7.0	<0.2	<0.2	5.5
RMIT	WWTP -L6-3	Bolivar	RECYCLED_WATER_CHL	DAFF after ch orine		8/06/2017	JUNE	6.5	3.0	3.9	15.1	1.2	7	10.9	6.5	8.7	<0.2	<0.2	6.8
RMIT	WWTP -L1-1	Bolivar	INFLUENT	001		22/03/2017	MAR	7.5	7.6	5.5	8.9	3	2 6	28.6	3.6	5.9	1.8	1.6	33
RMIT	WWTP -L1-2	Bolivar	INFLUENT	001		22/03/2017	MAR	9.9	10.1	2.3	8.9	3	2 6	23.2	.1	5.2	1.8	1.9	33.6
RMIT	WWTP -L1-3	Bolivar	INFLUENT	001		22/03/2017	MAR	2.6	6.9	2 6	8.6	2.	2 3	2 .2	.1	5.7	2	1.8	31
RMIT	WWTP -L2-1	Bolivar	PRIMARY_EFFLUENT	002		22/03/2017	MAR	5.6	13.5	10.9	7.6	1.5	2 8	12.7	.	5.2	1.8	2.1	20.2
RMIT	WWTP -L2-2	Bolivar	PRIMARY_EFFLUENT	002		22/03/2017	MAR	5.7	20.2	17.5	8.3	2.0	3.1	12.2	5.0	.6	1.2	1.9	19.5
RMIT	WWTP -L2-3	Bolivar	PRIMARY_EFFLUENT	002		22/03/2017	MAR	3	18.1	.1	8.1	2.3	2 6	1 .2	5.1	5.	1.	1.8	21.
RMIT	WWTP -L3-1	Bolivar	SECONDARY_EFFLUENT	00		22/03/2017	MAR	6	.2	5.5	13 8	3.2	2 6	11.5	5.1	7.6	1.1	1.5	20.5
RMIT	WWTP -L3-2	Bolivar	SECONDARY_EFFLUENT	00		22/03/2017	MAR	9	.5	2.7	12 3	1.3	2 6	10.	.	8.7	1.2	1.7	19.5
RMIT	WWTP -L3-3	Bolivar	SECONDARY_EFFLUENT	00		22/03/2017	MAR	6.1	3.5	5.	10 6	1.9	2.	10.	5.2	8.8	1.2	2.0	17.3
RMIT	WWTP -L -1	Bolivar	F NAL_EFFLUENT	007		22/03/2017	MAR	5.	3.	12.6	18 5	3.	5 7	<LOQ	10.1	22 3	<0.2	<0.2	
RMIT	WWTP -L -2	Bolivar	F NAL_EFFLUENT	007		22/03/2017	MAR	7.6	2.8	30.7	23 5	1.0	9 8	<LOQ	8.1	20 3	<0.2	<0.2	11.0
RMIT	WWTP -L -3	Bolivar	F NAL_EFFLUENT	007		22/03/2017	MAR	5.3	.	9.2	5.2	3.9	.1	<LOQ	9.9	32.5	<0.2	<0.2	1 .7
RMIT	WWTP -L5-1	Bolivar	RECYCLED_WATER	DAFF p ant		22/03/2017	MAR	13.	2.7	10.2	<LOQ	.2	3.	<LOQ	11.9	1 .	0.9	<0.2	
RMIT	WWTP -L5-2	Bolivar	RECYCLED_WATER	DAFF p ant		22/03/2017	MAR	10.	2.7	7.7	<LOQ	1.7	7 3	<LOQ	12.2	15.2	<LOQ	<0.2	19.8
RMIT	WWTP -L5-3	Bolivar	RECYCLED_WATER	DAFF p ant		22/03/2017	MAR	7.5	1.8	1.8	<LOQ	1.7	8 3	<LOQ	12.	19.6	<LOQ	<0.2	19.6
RMIT	WWTP -L6-1	Bolivar	RECYCLED_WATER_CHL	DAFF after ch orine		22/03/2017	MAR	25 6	6.7	3.	17 6	2.	0	12.2	9.6	7.8	1.1	1.3	13.6
RMIT	WWTP -L6-2	Bolivar	RECYCLED_WATER_CHL	DAFF after ch orine		22/03/2017	MAR	25	.8	2.8	17.	2.	3 8	11.8	11.0	7.7	1.0	1.	1 .1
RMIT	WWTP -L6-3	Bolivar	RECYCLED_WATER_CHL	DAFF after ch orine		22/03/2017	MAR	21.1	5.1	2.5	15 0	2.7	3	12.5	10.	7.2	1.1	1.7	17.8
RMIT	WWTP -L2-3	Bolivar	PRIMARY_EFFLUENT	002		11/12/2017	DEC	.6	2.0	1.9	7.3	<LOD	2 2	8 7	20.1	.6	<LOD	0.	30.1
RMIT	WWTP -L1-1	Bolivar	INFLUENT	001		11/12/2017	DEC	10.	2.6	2.	7.7	2.3	2 5	1 .0	16.9	.	0.8	0.	20.5
RMIT	WWTP -L1-2	Bolivar	INFLUENT	001		11/12/2017	DEC	12	2.7	1.6	7.9	2.0	2 7	10.6	1 .9	.5	0.7	0.5	22.5
RMIT	WWTP -L1-3	Bolivar	INFLUENT	001		11/12/2017	DEC	3 3	3.3	2.0	7.6	2.1	3 7	13.9	21.0	5.2	0.8	0.5	27.3
RMIT	WWTP -L -1	Bolivar	F NAL_EFFLUENT	007		11/12/2017	DEC	5	9.9	1.9	1 7	1.6	5 0	13.9	7.8	7.0	1.0	0.8	13.7
RMIT	WWTP -L -2	Bolivar	F NAL_EFFLUENT	007		11/12/2017	DEC	3	7.3	1.9	17 5	1.6	3	15.7	9.7	9.8	1.0	1.2	17.2
RMIT	WWTP -L -3	Bolivar	F NAL_EFFLUENT	007		11/12/2017	DEC	6.1	9.2	2.1	15 7	1.8	.1	16.1	8.9	8.8	1.0	1.1	16.0
RMIT	WWTP -L3-1	Bolivar	SECONDARY_EFFLUENT	00		11/12/2017	DEC	.	10.8	1.3	15 3	1.	2 7	1 .0	3.5	6.7	1.2	0.9	28.
RMIT	WWTP -L3-2	Bolivar	SECONDARY_EFFLUENT	00		11/12/2017	DEC	7.7	6.	1.0	8.7	1.3	2 7	16.9	3.5	6.1	1.3	0.6	20.1
RMIT	WWTP -L3-3	Bolivar	SECONDARY_EFFLUENT	00		11/12/2017	DEC	.8	7.3	1.2	12 0	1.2	2.	16.	3.6	7.1	1.1	0.8	26.8
RMIT	WWTP -L2-1	Bolivar	PRIMARY_EFFLUENT	002		11/12/2017	DEC	7.8	2.	0.7	7.	2.	2.1	9.1	17.9	3.5	0.7	0.	25.3
RMIT	WWTP -L2-2	Bolivar	PRIMARY_EFFLUENT	002		11/12/2017	DEC	.5	1.8	1.6	5.0	2.3	2 3	9 5	16.5	3.8	0.6	0.5	18.6
RMIT	WWTP -L5-1	Bolivar	RECYCLED_WATER	DAFF p ant		11/12/2017	DEC	3.	8.8	2.1	1 .1	1.0	.	9 9	.9	6.2	0.5	0.	7.1
RMIT	WWTP -L5-2	Bolivar	RECYCLED_WATER	DAFF p ant		11/12/2017	DEC	2.3	6.6	1.3	1 3	1.	2	8 5	.3	5.	0.	0.	7.6
RMIT	WWTP -L5-3	Bolivar	RECYCLED_WATER	DAFF p ant		11/12/2017	DEC	3.9	8.9	2.1	13 3	1.2	5 2	10.5	5.	6.6	0.6	0.	9.
RMIT	WWTP -L6-1	Bolivar	RECYCLED_WATER_CHL	DAFF after ch orine		11/12/2017	DEC	7.6	7.6	1.8	13 3	1.3	6 0	9.	5.7	6.5	0.5	<LOQ	7.7
RMIT	WWTP -L6-2	Bolivar	RECYCLED_WATER_CHL	DAFF after ch orine		11/12/2017	DEC	6.2	9.0	2.0	1 0	1.2	5 5	10.	5.9	7.0	0.5	0.	8.1
RMIT	WWTP -L6-3	Bolivar	RECYCLED_WATER_CHL	DAFF after ch orine		11/12/2017	DEC	8.6	10.2	2.6	1 .	1.1	5 6	11.7	5.5	6.	0.5	<LOD	7.
RMIT	WWTP -L1-1	Bolivar	INFLUENT	001		31/08/2017	AUG	3.7	2.	7.1	6.9	1.8	<LOD	1 .6	9.6	.7	1.0	<LOD	27.3
RMIT	WWTP -L1-3	Bolivar	INFLUENT	001		31/08/2017	AUG	7.8	2.6	1.0	5.6	<LOD	<LOD	12.2	9.1	.5	0.7	<LOD	26.6
RMIT	WWTP -L3-1	Bolivar	SECONDARY_EFFLUENT	00		31/08/2017	AUG	7.2	5.1	3.8	13 6	1.	2 6	13.	5.	12 2	0.6	0.7	1 .1
RMIT	WWTP -L3-2	Bolivar	SECONDARY_EFFLUENT	00		31/08/2017	AUG	3.	6.1	3.7	1 8	1.2	3.	1 .1	5.2	11.9	1.0	0.8	22.1
RMIT	WWTP -L3-3	Bolivar	SECONDARY_EFFLUENT	00		31/08/2017	AUG	5.6	5.8	3.5	12 5	1.1	2	13.8	.8	13 0	0.6	0.8	17.1
RMIT	WWTP -L2-1	Bolivar	PRIMARY_EFFLUENT	002		31/08/2017	AUG	1.2	3.3	6.	6.8	2.0	3 7	1 .7	7 9	.5	<LOD	0.	25.9
RMIT	WWTP -L2-2	Bolivar	PRIMARY_EFFLUENT	002		31/08/2017	AUG	2.6	2.7	5.8	7.7	1.6	3 2	1 .1	82.6	.1	<LOD	0.	2 .8
RMIT	WWTP -L2-3	Bolivar	PRIMARY_EFFLUENT	002		31/08/2017	AUG	5.1	3.0	5.9	6.0	2.0	3 0	1 .3	66 8	.1	<LOD	0.3	23.7
RMIT	WWTP -L -1	Bolivar	F NAL_EFFLUENT	007		31/08/2017	AUG	6.	11.5	2.1	20 7	1.6	8.1	17.5	5.1	1 8	0.8	1.	22
RMIT	WWTP -L -2	Bolivar	F NAL_EFFLUENT	007		31/08/2017	AUG	6.	12.2	2	22.1	1.5	7 9	1 .6	5.2	13 5	0.9	1.	27.2
RMIT	WWTP -L -3	Bolivar	F NAL_EFFLUENT	007		31/08/2017	AUG	6.7	15.2	2	22	1.9	8 9	17.3	.7	13	0.9	1.1	2 .6
RMIT	WWTP -L5-1	Bolivar	RECYCLED_WATER	DAFF p ant		31/08/2017	AUG	7.1	6.7	2	18 9	1.3	6 7	6.8	.	7.6	<LOQ	0.5	.9
RMIT	WWTP -L5-2	Bolivar	RECYCLED_WATER	DAFF p ant		31/08/2017	AUG	7.8	7.5	1.8	19 9	1.1	7	6.5	.2	7.3	<LOQ	<LOQ	
RMIT	WWTP -L5-3	Bolivar	RECYCLED_WATER	DAFF p ant		31/08/2017	AUG	8.3	6.8	1.8	18 8	1.2	5.1	7.	3.7	6.7	<LOD	0.3	.9
RMIT	WWTP -L6-1	Bolivar	RECYCLED_WATER_CHL	DAFF after ch orine		31/08/2017	AUG	11	7.6	2.	19 6	1.3	7 2	8	6.2	7.7	<LOD	0.3	5.5
RMIT	WWTP -L6-2	Bolivar	RECYCLED_WATER_CHL	DAFF after ch orine		31/08/2017	AUG	9.3	9.8	1.8	19 3	1.6	6 6	8.9	5.5	8.2	<LOD	0.5	6.7
RMIT	WWTP -L6-3	Bolivar	RECYCLED_WATER_CHL	DAFF after ch orine		31/08/2017	AUG	11 2	7.	2.6	20	1.2	6 2	8	6.1	7.3	<LOD	0.5	5.5
ALS	2016-002-9960	Bolivar	INFLUENT	001	SP not reported, inferred	18/06/2016	JUNE								6	6			30
ALS	2016-003-000	Bolivar	RECYCLED_WATER_CHL	DAFF after ch orine	SP not reported, inferred	16/06/2016	JUNE								5	8			8
ALS?	2017-002- 57	Bolivar	F NAL_EFFLUENT	007		21/03/2017	MAR								5	10			0
ALS?	2017-002- 56	Bolivar	INFLUENT	001		21/03/2017	MAR								5	<10			0
ALS?	2017-002- 58	Bolivar	RECYCLED_WATER_CHL	637		16/03/2017	MAR								5	10			20
ALS	2016-002-999	Bolivar HS	INFLUENT		SP not reported, inferred	18/06/2016	JUNE								5	7			70
ALS	2016-002-9997	Bolivar HS	F NAL_EFFLUENT	281	SP not reported, inferred	18/06/2016	JUNE								28	8			62
																			5.1
																			0.2

Sample code	Month sampled	9Cl PF3ONS#	8 2 F S	PFDA	PFDS	PFUDA	11Cl PF3ONS#	PFDoA	PF rA	PF eA	3:3 Acid	PFHxPA	4:2 F S	HPFO A	5:3 Ac d
WWTP -L1-1	JUNE	<LOD	n.d	<0 2	0.2	<0.2	<LOD	<0.2	<0.2	<0 2					
WWTP -L1-2	JUNE	<LOD	n.d	<0 2	<0.2	<0.2	<LOD	<0.2	<0.2	<0 2					
WWTP -L1-3	JUNE	<LOD	n.d	<0 2	<0.2	<0.2	<LOD	<0.2	<0.2	<0 2					
WWTP -L2-1	JUNE	<LOD	n.d	<0 2	<0.2	<0.2	<LOD	<0.2	<0.2	<0.2					
WWTP -L2-2	JUNE	<LOD	n.d	<0 2	0.2	<0 2	<LOD	0.2	<0.2	<0 2					
WWTP -L2-3	JUNE	<LOD	n.d	<0.2	0.2	<0 2	<LOD	0.2	<0.2	<0.2					
WWTP -L3-1	JUNE	<LOD	n.d	1.0	0.2	<0 2	<LOD	0.2	<0.2	<0 2					
WWTP -L3-2	JUNE	<LOD	n.d	1.2	0.2	<0 2	<LOD	0.2	<0.2	<0 2					
WWTP -L3-3	JUNE	<LOD	n.d	1.2	<0.2	<0.2	<LOD	<0.2	<0.2	<0 2					
WWTP -L -1	JUNE	<LOD	n.d	1.0	0.2	<0 2	<LOD	<0.2	<0.2	<0 2					
WWTP -L -2	JUNE	<LOD	n.d	1.2	0.2	<0 2	<LOD	0.2	<0.2	<0.2					
WWTP -L -3	JUNE	<LOD	n.d	1.1	0.2	<0 2	<LOD	0.2	<0.2	<0 2					
WWTP -L5-1	JUNE	<LOD	n.d	<0.2	0.2	<0 2	<LOD	0.2	<0.2	<0.2					
WWTP -L5-2	JUNE	<LOD	n.d	<0.2	0.2	<0 2	<LOD	0.2	<0.2	<0.2					
WWTP -L5-3	JUNE	<LOD	n.d	<0.2	0.2	<0 2	<LOD	0.2	<0.2	<0 2					
WWTP -L6-1	JUNE	<LOD	n.d	<0.2	0.2	<0 2	<LOD	0.2	<0.2	<0 2					
WWTP -L6-2	JUNE	<LOD	n.d	<0.2	0.2	<0 2	<LOD	0.2	<0.2	<0.2					
WWTP -L6-3	JUNE	<LOD	n.d	<0.2	0.2	<0 2	<LOD	0.2	<0.2	<0.2					
WWTP -L1-1	MAR	<LOD	n.d	1.7	0.2	<0 2	<LOD	0.2	<0.2	<0 2					
WWTP -L1-2	MAR	<LOD	n.d	1.8	0.2	<0 2	<LOD	0.2	<0.2	<0 2					
WWTP -L1-3	MAR	<LOD	n.d	1.7	0.2	<0 2	<LOD	0.2	<0.2	<0 2					
WWTP -L2-1	MAR	<LOD	n.d	2.1	0.2	<0 2	<LOD	0.2	<0.2	<0 2					
WWTP -L2-2	MAR	<LOD	n.d	1.9	0.2	<0 2	<LOD	0.2	<0.2	<0 2					
WWTP -L2-3	MAR	<LOD	n.d	1.9	0.2	<0 2	<LOD	0.2	<0.2	<0 2					
WWTP -L3-1	MAR	<LOD	n.d	1.7	0.2	<0 2	<LOD	0.2	<0.2	<0.2					
WWTP -L3-2	MAR	<LOD	n.d	2.1	0.2	<0 2	<LOD	0.2	<0.2	<0 2					
WWTP -L3-3	MAR	<LOD	n.d	2.2	0.2	<0 2	<LOD	0.2	<0.2	<0 2					
WWTP -L -1	MAR	<LOD	n.d	<0 2	0.2	<0 2	<LOD	0.2	<0.2	<0 2					
WWTP -L -2	MAR	<LOD	n.d	<0 2	<0.2	<0 2	<LOD	0.2	<0.2	<0 2					
WWTP -L -3	MAR	<LOD	n.d	<0.2	0.2	<0 2	<LOD	0.2	<0.2	<0 2					
WWTP -L5-1	MAR	<LOD	n.d	<0.2	0.2	<0 2	<LOD	0.2	<0.2	<0.2					
WWTP -L5-2	MAR	<LOD	n.d	<0.2	0.2	<0 2	<LOD	0.2	<0.2	<0.2					
WWTP -L5-3	MAR	<LOD	n.d	0.3	0.2	<0 2	<LOD	0.2	<0.2	<0.2					
WWTP -L6-1	MAR	<LOD	n.d	0.9	<0.2	<0.2	<LOD	0.2	<0.2	<0.2					
WWTP -L6-2	MAR	<LOD	n.d	<LOQ	0.2	<0 2	<LOD	0.2	<0.2	<0.2					
WWTP -L6-3	MAR	<LOD	n.d	1.8	<0.2	<0.2	<LOD	0.2	<0.2	<0.2					
WWTP -L2-3	DEC	<LOD	1.0	0.6	LOD	<LOD	<LOD	0.7	<LOQ	<LOD	<LOD	8	<LOD	<LOD	0.5
WWTP -L1-1	DEC	<LOD	<LOQ	0.7	LOD	<LOD	<LOD	0.5	<LOD	<LOD	<LOD	19	<LOD	<LOD	1
WWTP -L1-2	DEC	<LOD	0.6	0.6	LOD	<LOD	<LOD	0.6	<LOD	<LOD	<LOD	16.	<LOD	<LOD	1
WWTP -L1-3	DEC	<LOD	0.7	0.8	LOD	<LOD	<LOD	0.6	<LOD	<LOD	<LOD	1 .5	LOD	<LOD	0.9
WWTP -L -1	DEC	<LOD	<LOD	1.0	LOD	<LOD	<LOD	<LOQ	<LOD	<LOD	<LOD	10.3	<LOD	<LOD	<LOD
WWTP -L -2	DEC	<LOD	<LOD	1.2	LOD	<LOD	<LOD	0.3	<LOD	<LOD	<LOD	1 .3	<LOD	<LOD	<LOD
WWTP -L -3	DEC	<LOD	<LOD	0.9	LOD	<LOD	<LOD	LOD	<LOD	<LOD	<LOD	11.1	<LOD	<LOD	LOD
WWTP -L3-1	DEC	<LOD	<LOD	1.3	LOD	<LOD	<LOD	LOD	<LOD	<LOD	<LOD	6.9	<LOD	<LOD	LOQ
WWTP -L3-2	DEC	<LOD	<LOD	1.0	LOD	<LOD	<LOD	LOD	<LOD	<LOD	<LOD	7.2	<LOD	<LOD	LOQ
WWTP -L3-3	DEC	<LOD	<LOD	1.1	LOD	<LOD	<LOD	LOD	<LOD	<LOD	<LOD	6.7	<LOD	<LOD	LOD
WWTP -L2-1	DEC	<LOD	0.7	0.7	LOD	<LOD	<LOD	0.7	<LOD	<LOD	<LOD	16.1	<LOD	<LOD	0.3
WWTP -L2-2	DEC	<LOD	0.7	0.7	LOD	<LOD	<LOD	0.6	<LOD	<LOD	<LOD	16	<LOD	<LOD	0.5
WWTP -L5-1	DEC	<LOD	<LOD	<LOQ	LOD	<LOD	<LOD	LOD	<LOD	<LOD	<LOD	8.5	<LOD	<LOD	LOD
WWTP -L5-2	DEC	<LOD	<LOD	<LOQ	LOD	<LOD	<LOD	LOD	<LOD	<LOD	<LOD	6.5	<LOD	<LOD	LOD
WWTP -L5-3	DEC	<LOD	<LOD	<LOQ	LOD	<LOD	<LOD	LOD	<LOD	<LOD	<LOD	7	<LOD	<LOD	LOD
WWTP -L6-1	DEC	<LOD	<LOD	0.5	LOD	<LOD	<LOD	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	LOD
WWTP -L6-2	DEC	<LOD	<LOD	0.6	LOD	<LOD	<LOD	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	LOD
WWTP -L6-3	DEC	<LOD	<LOD	0.5	LOD	<LOD	<LOD	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	LOD
WWTP -L1-1	AUG	<LOD	0.3	0.	LOD	<LOD	<LOD	LOD	<LOD	<LOD	<LOD	<LOD	LOD	<LOD	0.7
WWTP -L1-3	AUG	<LOD	0.3	0.	LOD	<LOD	<LOD	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	0.5
WWTP -L3-1	AUG	<LOD	<LOD	2.2	LOD	<LOD	<LOD	<LOQ	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	0.7
WWTP -L3-2	AUG	<LOD	<LOD	.	LOD	<LOD	<LOD	<LOQ	<LOD	<LOD	<LOD	5.	<LOD	<LOD	2.5
WWTP -L3-3	AUG	<LOD	<LOD	3.	LOD	<LOD	<LOD	<LOQ	<LOD	<LOD	<LOD	.	<LOD	<LOD	0.8
WWTP -L2-1	AUG	<LOD	0.3	0.6	LOD	<LOD	<LOD	0.7	<LOD	<LOD	<LOD	9.1	<LOD	<LOD	LOQ
WWTP -L2-2	AUG	<LOD	<LOQ	0.6	LOD	<LOD	<LOD	0.7	<LOD	<LOD	<LOD	12.2	<LOD	<LOD	LOQ
WWTP -L2-3	AUG	<LOD	0.	0.6	LOD	<LOD	<LOD	0.5	<LOD	<LOD	<LOD	15.2	<LOD	<LOD	0.3
WWTP -L -1	AUG	<LOD	<LOD	1.7	LOD	<LOD	<LOD	LOD	<LOD	<LOD	<LOD	12.3	<LOD	<LOD	LOD
WWTP -L -2	AUG	<LOD	<LOD	1.9	LOD	<LOD	<LOD	LOD	<LOD	<LOD	<LOD	6.5	<LOD	<LOD	LOQ
WWTP -L -3	AUG	<LOD	<LOD	1.8	LOD	<LOD	<LOD	LOD	<LOD	<LOD	<LOD	9.2	LOD	<LOD	LOQ
WWTP -L5-1	AUG	<LOD	<LOD	0.	LOD	<LOD	<LOD	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	LOQ
WWTP -L5-2	AUG	<LOD	<LOD	0.3	LOD	<LOD	<LOD	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	LOQ
WWTP -L5-3	AUG	<LOD	<LOD	<LOQ	LOD	<LOD	<LOD	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	LOQ
WWTP -L6-1	AUG	<LOD	<LOD	<LOQ	LOD	<LOD	<LOD	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	LOQ
WWTP -L6-2	AUG	<LOD	<LOD	0.3	LOD	<LOD	<LOD	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	LOQ
WWTP -L6-3	AUG	<LOD	<LOD	0.3	LOD	<LOD	<LOD	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	LOQ
2016-002-9960	JUNE		<5										<5		
2016-003-000	JUNE		<5										<5		
2017-002- 57	MAR		<5										<5		
2017-002- 56	MAR		<5										<5		
2017-002- 58	MAR		<5										<5		
2016-002-999	JUNE		<5										<5		
2016-002-9997	JUNE		<5										<5		

Sample code	Month sampled	FHUEA	FOUEA	7:3 Acid	FOSAA	MeFOSA	N EtFOSA	FOSA	FDUEA	10 2 F S	6:6 PFPi	PFDoS	N EtFOSE	N MeFOSA	N MeFOSI	6:2 d PAF	6:8 PFPi	N EtFOSA	2 8:2 diPA	8:8 PFPi	8:2 diPAF	diSAmPAI	PFNS
WWTP -L2-3	DEC	LOD	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	1.5	LOD	<LOD	0.3	<LOD	<LOD	<LOD	<LOQ
WWTP -L1-1	DEC	LOD	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	LOD	<LOD	0.3	<LOD	<LOD	<LOD	1	LOD	<LOD	<LOQ	<LOD	<LOD	<LOD	<LOD
WWTP -L1-2	DEC	LOD	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	LOD	<LOD	0.5	<LOD	<LOD	<LOD	1	LOD	<LOD	<LOQ	<LOD	<LOD	<LOD	<LOD
WWTP -L1-3	DEC	LOD	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	LOD	<LOD	0.6	<LOD	<LOD	<LOD	1	LOD	<LOD	0.5	<LOD	<LOD	<LOD	<LOD
WWTP -L -1	DEC	LOD	LOD	<LOD	<LOD	0.	<LOQ	<LOD	<LOD	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	LOD	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
WWTP -L -2	DEC	LOD	LOD	<LOD	<LOD	0.	0 3	<LOD	<LOD	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	LOD	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
WWTP -L -3	DEC	LOD	LOD	<LOD	<LOD	0.	<LOQ	<LOD	<LOD	LOD	<LOD	<LOD	<LOD	<LOD	0.6	LOD	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
WWTP -L3-1	DEC	LOD	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	LOD	<LOD	<LOD	<LOD	<LOD	LOQ	LOD	LOD	LOD	<LOD	<LOD	<LOD	<LOD	<LOD
WWTP -L3-2	DEC	LOD	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	LOD	LOD	LOD	<LOD	<LOD	<LOD	<LOD	<LOD
WWTP -L3-3	DEC	LOD	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	LOD	<LOD	<LOD	<LOD	<LOD	LOQ	LOD	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
WWTP -L2-1	DEC	LOD	LOD	<LOQ	<LOD	<LOD	<LOD	<LOD	<LOD	LOD	<LOD	0.5	<LOD	<LOD	<LOD	2.1	LOD	<LOD	0.5	<LOD	<LOD	<LOD	<LOD
WWTP -L2-2	DEC	LOD	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	LOD	<LOD	0.5	<LOD	<LOD	<LOD	1.3	LOD	<LOD	<LOQ	<LOD	<LOD	<LOD	<LOD
WWTP -L5-1	DEC	LOD	LOD	<LOD	<LOD	<LOQ	<LOD	<LOD	<LOD	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	LOD	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
WWTP -L5-2	DEC	LOD	LOD	<LOD	<LOD	<LOQ	<LOD	<LOD	<LOD	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	LOD	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
WWTP -L5-3	DEC	LOD	<LOD	<LOD	<LOD	<LOQ	<LOD	<LOD	<LOD	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	LOD	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
WWTP -L6-1	DEC	LOD	<LOD	<LOD	<LOD	<LOQ	<LOD	<LOD	<LOD	LOD	<LOD	<LOD	<LOD	<LOD	LOD	LOD	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
WWTP -L6-2	DEC	LOD	<LOD	<LOD	<LOD	<LOQ	<LOQ	<LOD	<LOD	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	LOD	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
WWTP -L6-3	DEC	LOD	<LOD	<LOD	<LOD	<LOQ	<LOD	<LOD	<LOD	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	LOD	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
WWTP -L1-1	AUG	LOD	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	1.1	LOD	<LOD	0.6	<LOD	<LOD	<LOD	<LOD
WWTP -L1-3	AUG	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	1.6	LOD	<LOD	0.6	<LOD	<LOD	<LOD	<LOD
WWTP -L3-1	AUG	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	LOD	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
WWTP -L3-2	AUG	LOD	LOD	0.9	<LOD	<LOQ	<LOD	<LOD	<LOD	LOD	<LOD	<LOD	<LOD	<LOD	LOQ	LOD	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
WWTP -L3-3	AUG	LOD	<LOD	<LOD	<LOD	<LOQ	<LOD	<LOD	<LOD	LOD	<LOD	<LOD	<LOD	<LOD	LOQ	LOD	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
WWTP -L2-1	AUG	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	LOD	<LOD	0.8	<LOD	<LOD	<LOD	2.2	LOD	<LOD	0.9	<LOD	<LOD	<LOD	<LOD
WWTP -L2-2	AUG	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	LOD	<LOD	0.8	<LOD	<LOD	<LOD	2.1	LOD	<LOD	0.9	<LOD	<LOD	<LOD	<LOD
WWTP -L2-3	AUG	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	LOD	<LOD	0.6	<LOD	<LOD	<LOD	3.8	LOD	<LOD	1.5	<LOD	<LOD	<LOD	<LOD
WWTP -L -1	AUG	LOD	<LOD	<LOD	<LOD	<LOQ	<LOQ	<LOD	<LOD	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	LOD	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
WWTP -L -2	AUG	LOD	<LOD	<LOD	<LOD	<LOQ	<LOQ	<LOD	<LOD	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	LOD	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
WWTP -L -3	AUG	LOD	<LOD	<LOD	<LOD	<LOQ	<LOQ	<LOD	<LOD	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	LOD	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
WWTP -L5-1	AUG	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	LOD	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
WWTP -L5-2	AUG	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	LOD	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
WWTP -L5-3	AUG	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	LOD	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
WWTP -L6-1	AUG	LOD	<LOD	<LOD	<LOD	<LOQ	<LOD	<LOD	<LOD	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	LOD	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
WWTP -L6-2	AUG	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	LOD	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
WWTP -L6-3	AUG	LOD	<LOD	<LOD	<LOD	<LOQ	<LOD	<LOD	<LOD	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	LOD	LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
2016-002-9960	JUNE									5													
2016-003-000	JUNE									5													
2017-002- 57	MAR									5													
2017-002- 56	MAR									5													
2017-002- 58	MAR									5													
2016-002-999	JUNE									5													
2016-002-9997	JUNE									5													

*An asterisk ind ca es that sum branched plus linear concentra ion was reported for that specific compound (It s only for the larger sulfonates).

Draft PFAS NEMP Version 2 – Written Submission Cover Sheet

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Confidentiality

(i) Confidentiality requested? Yes / **No**

(ii) If so, does part of your submission include confidential or sensitive information? Yes / **No**

Have you provided confidential or sensitive information in a separate attachment *Yes / **No***

Have you provided a redacted version *Yes / **No***

Draft PFAS National Environmental Management Plan Version 2 sections

If you have specific comments or suggested text changes, please clearly identify the extract of the relevant part of the NEP on which you are providing feedback.

General Comments:

The PFAS NEMP uses PFAS to indicate a requirement to manage a broad suite of > 4700 compounds, when in reality, the only guidelines that have been developed are for PFOS, PFHxS, or PFOA. However, the interchangeable “PFAS” contamination in the text, implies management is required for all components of the PFAS suite (even though labs can only measure 34 of the 4700+).If this is truly the case, then there should be a national ban on the manufacture and importation of all per and poly fluorinated substances rather than devolving the responsibility for management to the water and wastewater utility.

The NEMP is written in a way that implies a regulatory desire to consider all PFAS, hence the section on TOF and TOPA analyses, which at this time are still in development and not widely commercially available – that makes it difficult and expensive for the end of chain utility to try to comply with the NEMP. Further, there is significant evidence that the TOPA analysis is highly operationally dependent on the oxidation conditions (and matrix effects) and therefore inconsistent and unreliable. If the intent is to manage all, then guidance needs to be urgently developed for TOPA and TOF, not for 3 of 4700+ compounds.

In our view, the PFAS NEMP has taken an overly conservative, and in cases of very low-level contamination, impractical position to management of PFAS. The management strategy does not provide guidance on appropriate management, rather it seeks to exclude all potential contamination. This is not possible in the absence of a national ban on all PFAS.

The major concern we have with the NEMP 2.0 is that individual studies that demonstrate possible impacts have been used in isolation to develop conservative values for environmental protection. However, the only way that PFAS can be managed appropriately will be holistically, which this NEMP does not achieve.

For example, as PFAS is an anthropogenic compound, when detected it is always above background, and by definition in the NEMP, contaminated. The NEMP then requires contaminated materials to be managed in particular ways. Is there a detectable level below which PFAS is not a concern? This is critical guidance that needs to be developed – otherwise there is little limitation to the extent of contaminated materials captured under the NEMP.

There is also no detail regarding the requirement for remediation by a polluter. While it is acknowledged that interjurisdictional differences make this a challenge, there needs to be specific indications that the polluter is obliged to contribute to the management costs. In our council, there is contamination of an aquifer used for drinking water (believed to be due to historical training exercises using AFFF). In this case, it appears that QFES is responsible for the contamination – the NEMP does not provide clear guidance to require that QFES remediates or compensates for subsequent management of this issue.

Specifically, as this drinking water aquifer has PFOS +PFHxS slightly lower than the health guideline value (0.07 μg/L), it can be legitimately used in the drinking water supply. This water is then used for domestic use and hence travels through to the wastewater treatment plant. The 99% species

protection value for PFOS +PFHxS is 0.00023 μg/L –300 times less than the drinking water value. Even though the contaminated bores are a small proportion of total supply, the wastewater will inevitably be contaminated –restricting Councils ability to discharge wastewater. Thus the NEMP allows for the use of "contaminated" water, but does not consider that the process is a cycle, and that "contamination" has to go somewhere. While a simple option for council is to develop a new bore field to prevent this contamination, the reason for the need to change the drinking water supply is the QFES generated contamination. The NEMP should assist council in ensuring that Council is compensated by the State for this expensive management option.

An alternative to discharge to waters would be treated effluent recycling, but where could the contaminated water be used? Recent publications demonstrate that PFAS in recycled water bioaccumulates in Silver Perch, and migrates into groundwater. (For example, in the irrigation scheme at Werribee, the groundwater has concentrations of PFOS to 34 ng/L). Historically, recycling of water for beneficial reuse (e.g. to food crops) is a method whereby a wastewater treatment plant can better meet current environmental licences (the N and P benefit crops, and are then not released to waters) – but bioaccumulation of PFAS appears to now rule this out too. The NEMP implies that this is a likely future change – is it reasonable to rule out recycling?

The PFAS NEMP ought to provide specific guidance as to the preferred management heirarchy for wastewater effluent. Can it be discharged to a high ecological value water body (as is common current practice, and represents much of Queensland where discharge is into the Great Barrier Reef Lagoon), or can it be used for irrigation – if so, what crops are appropriate? This is the type of guidance that needs to be provided as it is not possible to eliminate PFAS contamination while it is still in general use.

As another example of the broad definition of contamination causing problems: Section 14.2 Landfill management potentially applies to a waste stream containing fast food wrappers. Without a minimum definition of what constitutes "contamination" there is no limit to the application of this guidance. The guidance needs to be specific, but without being universal in the approach.

8. Environmental guideline values

8.1 Human health guidance values

The guideline values have not changed – however, there are statements that the values are now higher reliability. This cannot be verified. We are concerned that the technical review used to justify these results is unpublished, and therefore not subject to wider peer review. As indicated below for bird eggs, errors have been made, which can only be picked up if the original source data can be reviewed. Guidance that references unpublished and unavailable information is not transparent, and should not be relied upon to establish significant policy positions.

8. Environmental guideline values

8.2 Ecological guideline values

Interim ecological direct exposure for wildlife diet: Canadian mammalian and avian guidelines have been adopted. This is reasonable.

Interim ecological exposure protective of birds: The Canadian guidelines for bird eggs is 1.9 μg/**g** whole egg (see https://www.canada.ca/en/environment-climate-change/services/evaluating-existing-substances/federal-environmental-quality-guidelines-perfluorooctane-sulfonate.html#toc12) compared to 0.2 μg/**kg** in the PFAS NEMP 2.0, nearly 10 000 times more conservative.

Why? This is not scientifically justified in the information provided, or in our opinion justifiable.

This appears to be a significant error in transcribing units from grams to kilograms.

If not, the PFAS NEMP is proposing the value stated: The most relevant studies that led to the Canadian guideline are the maternal transfer pathways (as opposed to direct injection of PFAS into eggs, or field studies with numerous confounding factors). Note: The Canadian guideline uses the LOAEL with a safety factor of 10.

If the proposed value is intended, the authors have disregarded concerns about Custer *et al* 2012, (it was excluded in the derivation of Canadian guidance as the variation in eggs within clutches, and in hatch success between seasons was too great and therefore deemed unreliable). Even if this study was accepted as reliable, the value that is potentially detrimental to hatching success was 0.15 μg/g, which is still ~1000 times greater than the value in the PFAS NEMP.

What is the scientific justification for such vastly different guidelines?

There is no information as to the derivation of these guidelines, and if there is not an error in transcribing units, then there needs to be a detailed justification.

Section 9.1.5.1

We understand that clarifications are not intended to be up for review: however, the "clarification" sentence *"A water concentration of PFAS below an LOR of 0.001 μg/L should not be assumed to mean that there is minimal risk to aquatic ecosystems and does not mean that there is no need to sample aquatic biota"*

This effectively imposes a requirement that aquatic biota must always be sampled for PFAS regardless of analytical results that may demonstrate that the point source (a WWTP) is not polluting to the best scientific knowledge. Given than a large number of small council waste water treatment plants discharge to waterways, this is onerous and unacceptable. When written in this way, the NEMP is becoming an information gathering exercise by the heads of environment, but the costs are devolved to local councils.

10. On-site storage, stockpiles, and containment

10.1 Storage, stockpiles, and containment

Is the list of potential materials too broad – for example, why are rock, rubble, concrete included? There is no direct linkage to industries in Appendix B? Does this suggest that these types of waste should be checked to determine if they are contaminated?

Biosolids stockpiling and management needs to be separated out to clarify management options. Biosolids are generally stockpiled at WWTPs prior to removal to either beneficial reuse (land application) or to landfill. If assessed against a "soil" contamination guideline, then most municipal biosolids will almost certainly be considered contaminated unless there is an alternative mechanism proposed for management.

Currently in Queensland, the End of waste code defines biosolids as regulated waste above 0.39 mg/kg TOF, and cannot be disposed to land if the concentration will be above 0.005 mg/kg TOF in the soil. Essentially, the implication of this is that if biosolids are just under the regulated waste level, a single application to land will result in the soil concentration reaching the trigger level. Effectively this means that the only option for biosolids management is to dispose to landfill. While the Queensland interpretation is not written into the NEMP, it is because of the NEMP that this position has been taken.

Do the Heads of EPA believe that disposal to landfill is the most appropriate use of biosolids?

If not, can the NEMP provide national guidance on these questions?

Use of "Temporary" in the second paragraph of 10.1 Temporary is defined as 6 months, as in the glossary. Yet in the following paragraph, temporary is used to mean less than 48 hours. As this document is intended to inform regulators, precision of language is paramount, and ambiguities such as this are critical flaws.

10. On-site storage, stockpiles, and containment

10.2 Design considerations

Are these considerations specific for PFAS or is this a generic design requirement? As the PFAS NEMP, the guidance should be PFAS specific. Why for example, on p21 is steel introduced as a new type of (inferred) PFAS contaminated waste? What is the mechanism for contaminating steel?

The PFAS NEMP should be restricted to advice about management of PFAS, and not used as a surrogate guidance document to describe other best practice management of landfills. In so doing, the specificity to management of PFAS is lost, and the actual management options specifically pertaining to PFAS become diluted.

10. On-site storage, stockpiles, and containment

10.3 Guidance note - On-site storage and containment

The containment section indicates that it is relevant to both short and medium storage, and medium to *long term containment if there is no other option*.

Landfill is described in Chapter 14 as disposal – what is the difference to long term containment with no other management option? As such, why is Chapter 14 separated from Chapter 10 when there is shared information between the two? If the intent of Chapter 10 is for storage/stockpiling and containment prior to an alternate end solution, then they need to be separated, and the management of the contaminants should be distinct.

If long term containment is a proxy for disposal, then this section is better placed into Chapter 14.

10.3.3 the language used is not precise enough. For example: “PFAS contaminated materials, particularly liquids, should be stored above ground in appropriate containment vessels, such as IBCs”. Clearly biosolids are not going to be stored in IBCs. The statements are intended to be generic, but in so doing do not provide guidance as to management of common contaminated substances.

10.3.6 – is a floodplain with 1:100 AEP an appropriate location for PFAS contaminated material appropriate? Townsville recently experienced a 1:1000 – 1:2000 AEP event. Should this refer to relevant state planning instruments? (as is effectively captured within footnote 22). Have climate change scenarios been considered sufficiently such that management options put forward are sufficiently robust?

10.3.8 dot point 4 – PFAS impacted material – this terminology is being used interchangeably with “contaminated”. Suggest the text is simplified.

12 Reuse of PFAS-contaminated materials

12.1 Reuse without a risk assessment

This section title needs to be specific – the text refers specifically to reuse of contaminated soil – not to other materials. This distinction is critical for ease of use of the document. The discussion at the Qld NEMP 2.0 workshop implied that biosolids should be considered within this same framework. If this is the case, state it, if it is not, clearly define the scope.

15. Wastewater treatment

15.1 PFAS Management Framework

The NEMP is written in a way that reads as if it is pre-empting further tightening of the guidance.

This is not appropriate.

While there is a rapid advancement of the science, there are currently no rapid advances in appropriate cost effective, holistic management options. This is supposed to be a management plan and therefore should provide achievable management options.

The heads of EPA should be identifying a nationally consistent framework that provides specific guidance as to appropriate management of waste streams. At present, the PFAS NEMP requires local councils to develop strategies themselves, effectively in isolation, when the regulators themselves do not have the answers.

For example, historical usage of PFAS has resulted in significant amounts of contamination of various waste streams and landfill leachate is a known PFAS source. Leachate management in landfill is a critical concern – historically, an authorised management option has been to treat through the WWTP. What is the management plan suggesting a council managing leachate through a WWTP does? Is there a solution?

Gallen et al have shown that Australian leachate is heavily contaminated (mean concentrations of PFOS 310 ng/L, range 13-2700 ng/L, PFHxS mean 1200 ng/L, range 56 – 16000 ng/L, PFOA mean 690 ng/L range 17- 7500 ng/L). Historically, this has been managed by treatment through WWTPs as there are no other cost effective treatment options.

The PFAS NEMP indicates that dilution is not an option for management, and that mixing zones cannot be used. The implication of this is that treated wastewater must be below the relevant species protection value (0.23 ng/L if 99% protection). Such a value is exceptionally low, and likely unachievable given the ubiquitous nature of PFAS contamination.

15. Wastewater treatment

The PFAS management framework is a generic statement about addressing inputs, process and outputs, and then states that the PFAS NEMP is complied with, and that ecosystem function, biodiversity and amenity are protected.

This is admirable, but how? If we are considering low concentrations and diffuse sources, (not point source contamination), how is this achieved? If the management is intended to only address point sources, that should be articulated. Given that recent evidence suggests the PFAS load in stormwater is greater than from WWTP effluent, is it appropriate to devolve responsibility to a local council to manage diffuse pollution into wastewater?

15.2 Additional management tools

The additional management tools are potentially reasonable for high level contamination, but are onerous for trace PFAS – but there is no distinction provided. Where there is significant contamination (and this needs to be specifically defined), then the tools may be appropriate.

It is inappropriate for all utilities to have to comply with these tools (remembering the ubiquitous nature of PFAS).

Is it possible to define a level below which, a provider can operate under current management regimes?

19.2 TOPA analysis

This section is slightly modified but needs addressing as per the general comments above.

The PFAS NEMP implies that management of all PFAS is required, but the only regulated guidance is for 3 specific PFAS -PFOS, PFHxS and PFOA. The precautionary statements imply that a provider should be considering the wider PFAS, but there are no robust methods for doing so.

TOPA analysis is analytically an operationally defined method (as acknowledged by “Laboratories find it helpful if the nature of the sample can be advised”). (An operational definition means that the final result is dependent on the initial conditions – in this case, the extent of oxidation). As such, TOPA is generally not appropriate for a regulatory limit without stating the specific analytical conditions required for analysis of different materials.

There are 2 options for TOPA:

1) Exclude it from the NEMP as it is insufficiently developed method to be considered reliable
2) Provide specific guidance on
    a. how to undertake a TOPA analysis (matrix dependence needs to be discussed)
    b. interpretation of the analytical result – e.g. should the TOPA analysis just be assessed against the specific PFOS, PFHxS and PFOA guidance?

If there is insufficient confidence in the method to establish how the result should be interpreted, it is premature to include it in the NEMP and it should be excluded. (Similar arguments apply to TOF analysis).

Appendix D. Example PFAS Management Framework for a Wastewater Utility

Burdekin Shire Council strongly disagrees with the framing of the example framework. The example document is utopian, and impractical. If it is expected that a provider will implement such a framework, it should appropriately consider PFAS risks in the context of all other potential contaminants in effluent. There is also no consideration of the sustainability of these recommendations.

The draft management framework acknowledges that wastewater results in chronic release of low level PFAS. This indicates that the NEMP is intended to apply to all WWTPs at all times. This is onerous and places the management responsibility in the hands of small utilities.

These frameworks should only apply to short term increased PFAS loads (e.g. point sources such AFFF spills), not to the chronic levels that are expected to be present at all times as to try to capture the low level ubiquitous contamination of persistent compounds that have been in use for 50 years will not be possible.

If PFAS is so deleterious at low chronic concentrations, a national ban on all PFAS and precursors is the only way in which long term effects can be avoided.

3. Purpose. The stated purpose “Sustainable management” is completely untrue. There is nothing sustainable about the onerous requirements placed on a small utility to manage PFAS at low levels that this framework puts forward. It should also not be the requirement of a small utility to anticipate knee jerk reactions by overly cautious regulators and impose costs on the community that will have no benefit to them or the environment.

Statements such as “anticipating” emerging changes in PFAS regulation and management are not appropriate for a utility. If these issues could have been anticipated, why are these compounds authorised for use?

It is noted that there is an intent to produce outputs acceptable for disposal and reuse. Where in the NEMP are suitable standards for disposal and reuse stated? How is this able to be achieved?

There needs to be definitive guidance whereby the acceptable concentrations of PFAS for discharge of effluent, reuse of effluent, beneficial reuse of biosolids are stated. This requires the heads of EPAs to actually determine a whole of cycle management strategy, as opposed to a suite of unachievable targets with no alternative management options identified.

The challenge for the NEMP is to identify appropriate management of individual waste streams. At present, the NEMP simply indicates that there is no acceptable holistic management strategy.

5.1 Risk sources

There needs to be a distinction between the regulated PFAS and all other PFAS, taking into consideration the analytical methods being utilised. For example, stating that the PFAS concentration increases through treatment is an oversimplification that implies that wastewater treatment is a source of PFAS. This is completely untrue.

This is a simplification based on an analytical anomaly that only terminal PFAS are being measured. What is occurring is that there is a transformation of some terminal PFAS precursors *that have not been quantified* into forms that are being quantified. This is where TOPA may be

useful *if it is demonstrated to be a sufficiently reliable technique in a difficult analytical matrix*– it would potentially demonstrate that there is no increase in concentration through WWTP processes, merely a change in speciation of the PFAS.

Table 1 The risk assessment provided is not a risk assessment and should not be represented as such. Further, the types of items identified exacerbate the problem with PFAS management. The very first item indicates that there is a hazardous event with staff being exposed to elevated PFAS in a wastewater treatment plant and indicates a health and psychological risk. This is ridiculous and poorly considered. Wastewater treatment plant operators do not consume the products, and there is no realistic pathway for significant exposure. Stating that there is a psychological risk to wastewater treatment plant operators from PFAS in national guidance suggests that there is a real reason to be concerned. There is not – the NEMP should not "fan the flames" of hysteria.

6 Monitoring and analysis

There needs to be a threshold in this management plan below which further investigations of upstream contributions are not considered necessary.

The implication of the sampling strategy is that 24 hr influent samples are a routine requirement, and that this is also undertaken at specific pump stations to isolate the contributions of industrial/ non-domestic/ domestic sources. This is onerous. There is an implication that the monitoring is both specific for 24 PFAS, plus TOPA/TOF, and that this data is shared in a way that informs wider industry. This may be appropriate for very large providers where this is not a significant change in cost of operation, but this would be onerous for a smaller provider.

From this perspective, the wastewater management plan is defining a research problem, not providing a management strategy. While research may be required, it should not be up to individual councils to undertake such research – in fact, incorrect sampling techniques could in fact complicate the situation by falsely representing the problem.

Trade waste

PFAS containing waste should not be accepted as trade waste. There are almost no treatment plants that can remove PFAS, therefore the appropriate guidance from the NEMP should be that significant PFAS containing wastes (e.g. specific contamination sources, not diffuse sources) should not be accepted.

Domestic controls – as indicated the domestic PFAS are unable to be managed at the household level. Rather than indicate that the wastewater utility will actively consider new technologies, the better option is for source control at a federal level – e.g. ban all of these compounds from use.

8 Processing stage – this again suggests the responsibility for PFAS management lies with the utility, and that each utility should be considering technologies to remove PFAS, but there is no discussion about acceptable levels for discharge. This leaves every providers in an untenable situation – especially as the NEMP intimates further tightening of guidance.

Outputs stage

The implication of this strategy is that all effluent aims to achieve the 99% species protection value prior to discharge; that recycled water will not be used until sufficient research is undertaken to

prove that there is no bioaccumulation, and that all areas of discharge are documented to such an extent as to make recycled water unviable.

Biosolids are effectively unable to be used, and the only option is landfill or incineration.

In summary:

The PFAS NEMP 2.0 does not provide management options, it instead identifies issues without providing solutions. As such, it is not a management strategy, but a document that complicates operations for councils.

The major requirements of the NEMP are disproportionately devolved to local utilities. This is an example where the regulation has failed to appropriately consider the science, and failed to identify appropriate pathways.

Draft PFAS NEMP Version 2 – Written Submission Cover Sheet

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Confidentiality

(i)	Confidentiality requested?	No
(ii)	If so, does part of your submission include confidential or sensitive information?	No
	Have you provided confidential or sensitive information in a separate attachment	*No*
	Have you provided a redacted version	*No*

Draft PFAS National Environmental Management Plan Version 2 sections

If you have specific comments or suggested text changes, please clearly identify the extract of the relevant part of the NEP on which you are providing feedback.

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8. Environmental guideline values

8.1 Human health guidance values

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8. Environmental guideline values

8.2 Ecological guideline values

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10. On-site storage, stockpiles, and containment

10.1 Storage, stockpiles, and containment

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10. On-site storage, stockpiles, and containment

10.2 Design considerations

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10. On-site storage, stockpiles, and containment

10.3 Guidance note - On-site storage and containment

12 Reuse of PFAS-contaminated materials

12.1 Reuse without a risk assessment

15. Wastewater treatment

15.1 PFAS Management Framework

15. Wastewater treatment

15.2 Additional management tools

Appendix D. Example PFAS Management Framework for a Wastewater Utility

With regards to managing input stages and trade waste controls (Section 7 and 7.1) septage and septic tank waste should be included as a potential source of PFAS. In the Clarence Valley Council area there are approximately 9000 on site sewage management systems. These systems cater for both domestic and commercial/industrial sites. It would be problematic to monitor the source of each load of septic tank waste that is delivered to the sewage treatment plant to determine whether the load could contain PFAS or not. How

to manage the risk of receiving a PFAS contaminated tanker load of septage and septic tanks waste at the sewer treatment plant effectively, efficiently and economically requires consideration.

Furthermore, the process for identifying significant sources of pfas in the waste stream is not a viable solution for control in that the industries which are considered high risk for contributing pfas into the waste stream are then required to manage its safe disposal. This creates a financial burden on the industry which would be met with non-compliance and as such a regulatory burden on the utility where there may not be effective tools to manage it. It also creates potential for 'accidental' pfas events of discharge into the waste stream that are more difficult to detect considering continuous sampling is impractical. Should there be a detection of pfas, the burden then lies with Council to conduct an investigation to prove the source of the pfas beyond a reasonable doubt. This would be extremely difficult given the relative ubiquity of pfas across industrial and residential waste contributors.

Clarence Valley's experience is that PFAS at detectable levels in biosolids is present in purely residential sewage, which supports the findings by Darvodelsky & Hopewell (2018) that PFOS and PFOA were detected in 92 out of 109 biosolids samples from 13 different Australian Sewage Treatment Plans. Council had a common effluent drainage scheme (CEDS) comprising 38 residential properties (i.e. no commercial or industrial input) which operated from 1988 to 2009. As a CEDS primary settlement occurred at each dwelling in a septic tank (with the septage pumped out and disposed at a different Sewage Treatment Plan), although there was some carryover of solids to the lagoon treatment facility. When the lagoon was rehabilitated in 2018, PFAS was detected in the sludge at the bottom of the pond.

Once pfas is detected at the WWTP, the burden then lies with the utility to process the waste water to a point where the existing recycled water and biosolids users can continue to use it. The expense of using recycled water and biosolids would then become too great and beneficial reuse would be forced to decline. Some industries that rely on recycled water and biosolids would ultimately suffer the impact directly while the cost of processing the pfas out of the biosolids or disposing of it in a suitable manner becomes a burden on the rates payer.

Due to the widespread use of pfas across many different industries, it is more critical to focus attention on the production of pfas products and its importation into Australia. Similar to asbestos, the problem with pfas will not be effectively addressed until such time as an industry wide ban on its use is implemented. Should the science indicate that long term exposure to pfas is a threat to public health, more needs to be done to address it from the source to prevent it from eventually ending up in the waste stream. The longer it takes to remove it from the production/importation stream, the greater the burden on the waste stream and public health as a whole.

While public health implications have not been demonstrated to date, the Clarence Valley Council acknowledges the potential of pfas and its associated compounds and supports the following recommendations in Darvodelsky & Hopewell:

- That PFOS be routinely measured in biosolids
- Where PFOS is <0.3mg/kg dry weight of biosolids, unrestricted use of biosolids be permitted and that were PFOS is <4.2mg/kg dry weight of biosolids that agricultural reuse be permitted.
- That PFOA not be routinely measured in biosolids

Darvodelsky, P. & Hopewell, K. (2018). *Assessment of emergent contaminants in biolsolids – Recommended PFOS and PFOA levels in biosolids for land application*. Water e-Journal, ISSN 2206-1991, Vol. 3 No. 3.

City of Busselton
Geographe Bay

PFAS ENVIRONMENTAL MANAGEMENT PLAN

Version 2.0 Consultation Draft

A submission by City of Busselton to The Australian Heads of EPA's

1. Introduction

The City of Busselton ("the City") is a local government authority in the South West of Western Australia.

The City is undertaking ongoing groundwater investigations in the Vasse area, associated with legacy contamination associated with a former waste disposal site. PFAS are part of the range of contaminants of potential concern under investigation in this project.

Based on available information, in addition to the former waste disposal site, there is likely at least one other contributing source of PFAS within the area of investigation and PFAS seems to be a prevalent contaminant across the State, at least within developed areas.

While acknowledging that the consultation scope is restricted to the significant updates highlighted in the document, the City is very concerned about escalating costs and questionable benefits to the Community of further regulatory action (for example, triggered by the hardly measurable interim marine guideline level of 0.23 ng) and potential prospective remedial action, and is, therefore, submitting this paper in order to raise those concerns with the appropriate authorities – in this case, the Heads of EPAs.

By submitting this contribution the City does not purport to have scientific specialist knowledge in respect to the matters covered by the NEMP, but intends to highlight the practical concerns associated with the application of the guidelines in the context of environmental regulation, and a critical outlook in regards to the actual benefit to the Community as a result of these guidelines.

2. NEMP and environmental regulation of PFAS

According to the consultation document the PFAS National Environmental Management Plan (NEMP) under consultation is designed to achieve a clear and nationally consistent approach to the environmental regulation of PFAS.

The NEMP has been prepared to guide environmental regulators, among other activities, in their regulation of PFAS contaminated sites. It is, therefore, a standard regulatory instrument to apply across all Australian environmental regulators.

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Given the detailed guidance provided by the NEMP, it is the City's concern that this document will be used by regulators without any consideration for particular/local circumstances and priorities, despite the fact that this need is acknowledged by the NEMP itself.

Further, it is the City's concern that this meta-regulatory instrument is applied without prior Regulation Impact Assessment or similar analysis framework, as further discussed below.

3. On the use of the precautionary principle

One of the most important guiding principles of the NEMP is the "precautionary principle", which, in the NEMP version "states that where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation." Within this definition, the NEMP further clarifies that "in the application of the precautionary principle, private and public decisions should be guided by: careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment: and an assessment of the risk-weighted consequences of various options."

In the City's understanding, the key part of this concept, as presented – if it is to be used as a decision-making principle, is "wherever practicable". However, from a practical stand point we believe that even this qualification is not enough to support the application of the precautionary principle as the basis to establish the requirements for action concerning regulatory activities in the current context.

First, it is a vague formulation of the precautionary principle, in that it does not lay out the specific criteria that would make up a "serious" damage, not to mention that a damage can be irreversible without being serious, and that such a harm could, arguably, be acceptable from an environmental policy perspective.

Secondly, although this definition does not constitute an imperative to act (but a permission to act only "wherever practicable"), it also does not qualify any other conditions that should be relevant in respect to the expected regulatory impact/burden imposed.

The City contends that the definition of precautionary principle here should include a reference to "cost-effective measures" (as opposed to just "measures") as the type of action reasonably expected from relevant parties to prevent environmental degradation.

Thirdly, the application of the precautionary principle, as defined, does not allow for consideration of trade-offs and risk prioritisation. One important element of our experience in managing ongoing contaminated site investigations is that the investigation process itself, and the affected community member's perception about the mere presence of PFAS, is a source of (psychological) stress and anxiety – the risk of which is not necessarily taken into consideration.

Psychological stress and anxiety are known health risk factors and it is certainly questionable the extent to which regulations and regulatory authorities should pursue/promote actions that greatly increase stress and anxiety within the community, like highly visible remedial actions (clean-up, water use restrictions, etc.), in the face of poorly substantiated (or even totally absent evidence of the) actual risks of exposure to the contaminants themselves. A practicable response would, in this case, be a response proportional from the standpoint of risk-benefit considerations.

Paradoxically, while this precautionary principle instructs us to avoid "postponing measures to prevent environmental degradation", that avoidance may itself cause harm in the form, for example, of lost opportunities to prevent disease (for instance, by preventing people from consuming their edible

produce, such as vegetables, irrigated with water containing trace levels of PFAS, discouraging consumption in general – with consequent emergence of nutritional imbalances). Thus, in order to prevent this harm the precautionary principle would instruct us to refrain from implementing itself. At a minimum, this can be interpreted as extreme conservatism, leading potentially to an increase rather than a reduction in harm.

Given all of the above, the City would request that the precautionary principle is replaced by a full Regulatory Impact Assessment of the guidelines. Australia is recognised internationally for its regulation impact assessment arrangements. It helps agencies to develop efficient and effective regulation that addresses a clear need in the community, and provides assurance to the Government and stakeholders that a proper assessment of options has occurred.

4. On site prioritisation

The City strongly supports the application of the NEMP guideline to site prioritisation. We understand that in WA alone there are more than 60 sites known to be affected by PFAS, in addition to others, like fire stations, waste disposal sites, waste water treatment sites and defence bases.

It is surprising, for the City, that the former waste disposal site operated by a regional local government (albeit located in a major regional centre), where PFAS levels in groundwater are just above drinking water guidelines in its vicinity, has been practically treated as a priority site.

5. Concerning PFAS guideline values

In order to gather consistent evidence that the proposed PFAS guideline values actually provide the greatest benefit to the Community, this aspect – as well as the whole NEMP – should be assessed as part of a regulation impact assessment arrangement (under the Council of Australian Governments' (COAG) Best Practice Regulation: A Guide for Ministerial Councils and National Standard Setting Bodies.

[redacted]

Mike Archer
Chief Executive Officer

31 May 2019

Draft PFAS NEMP Version 2 – Written Submission Cover Sheet

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Date: 21 June 2019

Confidentiality

(i) Confidentiality requested? No

(ii) If so, does part of your submission include confidential or sensitive information? No

Have you provided confidential or sensitive information in a separate attachment *No*

Have you provided a redacted version *No*

City of Rockingham

Submission on the PFAS National Environmental Management Plan (NEMP) 2.0

Background

The City of Rockingham (COR) is located in Perth's outer southern suburbs, about 40 kilometres south-west of the Perth CBD.

The City encompasses a total land area of approximately 260 square kilometres, including significant areas of coastline and parkland and has a rapidly developing residential area with the population of approximately 140,000 people.

The City has a Class III Landfill Facility that is both owned and operated by the council.

This submission is made on behalf of the City of Rockingham Millar Road Landfill Facility (the Facility).

Millar Road Landfill Facility

The City of Rockingham has been operating the Facility since 1992. The Facility provides an essential waste disposal service for its residents, the surrounding commercial, industrial areas, and in particular the Kwinana Industrial Strip.

The Facility currently accepts approximately 220,000 tonnes of waste annually and has a potential future operational life span of over 30 years.

The Facility is located on 98.7 Hectares at Lot 2170 Millar Road West, Baldivis.

The Facility is licensed by the Department of Water and Environment Regulation (DWER) with the following prescribed premises categories,

Category	Description	Capacity
62	Solid waste depot	Up to 20,000 tonnes per year
64	Class II or III putrescibles landfill site	Up to 450,000 tonnes per year per cell

In 2015 the Department of Water and Environmental Regulation (DWER) issued a Works Approval, W5914/2015/1, for the construction of landfill Cells 16 to 19. The landfill cells were constructed

using a composite liner system made up of Geosynthetic Clay Liner (GCL), 2.0 mm HDPE and a geosynthetic cushion layer.

The Class III landfill cells have been constructed in compliance with the *Siting, design, operation and rehabilitation of landfills*, August 2015, Victorian EPA. This document is referred to by the Landfill Regulator the DWER.

The landfill has recently obtained a DWER premises licence amendment to allow the facility to accept Special Waste Class 3 including Per- and poly-fluoroalkyl substances (PFAS).

Draft PFAS National Environmental Management Plan (NEMP) Version 2.0 Consultation Draft

The Facility acknowledges the PFAS National Environmental Management Plan as providing a clear, effective and coherent approach to understanding and managing PFAS in Australia. Furthermore the Facility recognises the National Chemists Working Group (NCWG) as an established group of professionals with extensive combined knowledge in the PFAS area. The NEMP Version 2.0 is well written, uses evidence based approaches, contains understandable scientific terminology and builds well on the previous NEMP Jan 2018.

As users of the previous NEMP Jan 2018 there were several gaps and areas that could have been improved and these have been addressed well in the NEMP Version 2.0

The improvements noted as significant for the Facility as a document user are:

1) **Section 12.1 Re-use without Risk Assessment** – contaminated materials – *the clarity re the reuse of soils and in particular where there is low levels of PFAS is excellent. The decision trees for reuse is very helpful.*
2) **Section 8.2 Ecological guideline values**– *the increased detail is good.*
3) **Section 10 On-site storage Stockpiles & containment**- t*his section addresses a clear previous gap.*
4) **Section 15. 0 Wastewater management** – *provides guidance for the management of PFAS in waste water.*

Further details on the noted improvements noted are:

1. Section 12.1 Re-use without Risk Assessment

The PFAS NEMP document amendments now provide sufficient guidelines and methodology for the reuse of PFAS contaminated soil. The decision tree for Reuse without Risk Assessment (Figure 1, pg50) is a valuable tool that provides confidence to make decisions about PFAS affected and contaminated soil materials.

2. Section 8.2 Ecological guideline values

The increased information provided in this section is seen as very valuable for better assessment and management PFAS impacted areas.

3. Section 10 On-site Storage, Stockpiles & Containment

The details in this section are excellent guidance on how to manage the storage and containment of PFAS contaminated materials to help mitigate further negative PFAS impacts.

4. Section 15. 0 Wastewater management

The inclusion of details on the management of PFAS in waste water streams is a valuable inclusion.

Summary

In summary the Facility finds that the PFAS NEMP Version 2.0 document is a well written and professional document from a trusted foundation. The updated changes informative and further enable improved structure to the management of PFAS within the premises.

Draft PFAS NEMP Version 2 – Written Submission Cover Sheet

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Confidentiality

(i) Confidentiality requested? ~~Yes~~ / No

(ii) If so, does part of your submission include confidential or sensitive information? Yes / No

Have you provided confidential or sensitive information in a separate attachment *Yes / No*

Have you provided a redacted version *Yes / No*

Draft PFAS National Environmental Management Plan Version 2 sections

If you have specific comments or suggested text changes, please clearly identify the extract of the relevant part of the NEP on which you are providing feedback.

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8. Environmental guideline values

8.1 Human health guidance values

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8. Environmental guideline values

8.2 Ecological guideline values

While there is a statement that these are not remediation values, much of the document appears to lead to this being the default.

The proposed interim soil - ecological indirect exposure guideline value appears overly conservative for urbanised and industrial lands where there is minimal potential for indirect exposure and will drive a level of investigative effort that is disproportionate to the risks. Industrial lands are often highly disturbed, paved or built up where the risk posed by PFAS to ecological values is low (exceptions within large parcels of land can utilise the proposed value, where ecological values are not considered to be low). Setting this criterion, which may also default as remedial value, could lead to extraordinary expense to landowners.

The Direct contact human health guideline would be more appropriate.

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10. On-site storage, stockpiles, and containment

10.1 Storage, stockpiles, and containment

It is not clear whether material with greater than 50mg/kg may be immobilised, and it seems unrealistic to expect that such material would not be stored for some significant duration while appropriate treatment is procured. The limitation on storage/stockpiles or containment for materials only less than 50mg/kg suggests that responsible management would not occur for higher concentrations and should be trucked to a landfill presumably – which would still take time to plan. This restriction might cause delay to the removal of such material from a potentially more risky scenario. It would be better to acknowledge appropriate storage to minimise ongoing risks. We may also regret in the future sending so much material to landfill.

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10. On-site storage, stockpiles, and containment

10.2 Design considerations

Page 40: "*leachate management systems should be incorporated into the design*"

This bullet point suggests all future secondary containment designs to include leachate recovery systems. A risk-based approach to the design of future secondary containment should be considered.

Suggestion: “leachate management systems should be incorporated into the design for future tank farms where practicable with consideration of human-health and environmental sensitivity and risk.”

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10. On-site storage, stockpiles, and containment

10.3 Guidance note - On-site storage and containment

10.3.4 states that leachate and contaminated stormwater “cannot be released to stormwater drains, sewerage, groundwater recharge….”. Surely this should be subject to testing and risk-based. Some sites have trade-waste arrangements with PFAS limits, and the management of such waters should be appropriate and agreed with regulators. It should be covered in the planning stage for containment.

On-site storage and containments should be designed in a site-specific, risk-based way. In some cases the landfill design approach may be overkill for the proposal.

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12 Reuse of PFAS-contaminated materials

12.1 Reuse without a risk assessment

It appears from the Decision tree that there is a logical question about whether receptors would be affected by the reuse, but this is then followed by the leachate question C such that if leachate exceeds 0.00023 or 0.01ug/L PFOS then it cannot be reused. This question should be considered in question B about whether the destination location will support it. There may be no leachate generation, or no potential receptors. This would seem to mean that there are unlikely to be any reuse opportunities without risk assessment as the concentrations would be impossibly low. Therefore this decision tree seems redundant if all reuse will logically lead to a risk assessment.

The more common criterion of 100x drinking water for landfill leachate would be more pragmatic for the decision tree, as well as questioning the destination location’s suitability.

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15. Wastewater treatment

15.1 PFAS Management Framework

Compliance with the NEMP” infers the NEMP has statutory standing in various jurisdictions.

The constraints on water reuse and the PFAS concentrations in receiving waters may make the broad requirements unworkable.

The considerations should extend to ambient or background levels of PFAS in both the environment, receiving waters and trade waste; and whether acceptance of PFAS containing trade waste is likely to significantly increase these levels in the receiving environment. Mass loads are an important consideration in this.

15. Wastewater treatment

15.2 Additional management tools

Appendix D. Example PFAS Management Framework for a Wastewater Utility

The overall approach outlined in Appendix D appears to infer that a water authority can be at risk of non-compliance if it does not follow this framework. Due to the requirement in Section 8 of the NEMP that does not allow mixing zones, and the application of the aquatic ecosystem value, the implication is then that any discharge of PFOS detectable at the ultra-trace level of analysis is unacceptable. This will translate back up the pipe to industries with trade waste arrangements with water authorities, as the onus is tightened. Surely a wastewater treatment plant is a good place to treat the problem.
It is questioned whether the requirements have considered the cost of undertaking the work outlined, and its practicability and consequences. What is the full impact of this part of the guidance? Is it even practical and sustainable?

An assessment of the impact of this proposed guidance, and its sustainability, should be considered before it is implemented

Additional comments:

There should be an assessment of the impact that this guidance will have on landowners and the community at large. It is questioned whether the burden that this places on some industries could drive unsustainable actions with limited justifiable benefit. Primary concerns should be held for leading to a lack of soil re-use, increased volumes to landfill, and additional resources and energy used to treat waters to trace levels, when the greatest improvements will occur naturally from removal of the primary sources and addressing the worst source areas. Elimination seems impractical and unsustainable, but reductions in mass flux will continue to lead to environmental improvement.

Section 8 adds clarification on the topic of mixing zones. The effect of not allowing for any mixing zone will be that the receiving water aquatic effect thresholds may then become the criteria for the discharge waters, i.e. non-detectable PFOS at the ultra-trace analytical level. This does not seem reasonable or pragmatic, especially when the receiving water quality may not achieve that standard, and would place a hefty burden on some parties to pre-treat discharges to meet this criteria.

Instead, an alternative regulatory response would be to determine the most significant sources of PFAS, and to direct the approach to minimising the release from such sources affecting the aquatic ecosystems.

Draft PFAS NEMP Version 2 – Written Submission Cover Sheet

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Confidentiality

(i)	Confidentiality requested?	No
(ii)	If so, does part of your submission include confidential or sensitive information?	No
	Have you provided confidential or sensitive information in a separate attachment	*No*
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Draft PFAS National Environmental Management Plan Version 2 sections

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Section: *5.1 Design of monitoring program*

In the first paragraph of this section, a statement is made that "PFAS are mobile, persistent and bioaccumulative".

Our comment on this statement is that whilst some PFAS are bioaccumulative, not all PFAS are bioaccumulative. The more accurate statement is that all PFAS are mobile and persistent, and that some PFAS are bioaccumulative. This should therefore be restated in this section 5.1 and throughout other sections of the document, including sections 5.2.2, 8, 9.1.5.1, 9.2.

Section 8.2.1 Soil criteria for investigation – ecological guideline values

The proposed use of a single *Interim soil – ecological indirect exposure* criterion as the default value applicable to all land use scenarios (verses splitting into separate residential criterion and commercial/industrial criterion per NEMP1.0) is considered overly conservative. We consider that the adoption of the single criterion for all land use settings will have the unintended result of creating significant additional work for industry, consultants and regulators to not only justify what criterion should apply or not, but will also generate additional field sampling activity for any sites where there are any detections above the lower default criterion. We note that other criterion used throughout the NEMP have not been treated in this manner (i.e. residential criterion are split out from industrial/commercial criterion). We consider that the approach proposed here is unnecessarily adding another level of additional complexity to an already complex and costly process of investigating sites. We therefore support retention of the separate default criterion (0.140mg/kg) for *Interim soil – ecological indirect exposure* for commercial/industrial sites as it is currently documented in NEMP 1.0.

We have reviewed the changes to the guideline values (section 8) and consider that the revisions may impact the interpretation of the nature and extent of offsite investigations undertaken in the past, as well as those that are required to be undertaken in the future. This will add significant additional cost to industry, consultants and regulators in terms of reviewing past reports and amending assessment plans for future planned works. Of some further concern to industry is how the guidance in section 9.1.2 on off-site investigations is being applied and interpreted by regulators. The guidance recommends that "*following the identification of a credible source or sources of PFAS, priority should be given to early investigation of risks to sensitive off- site receptors".* For PFAS compounds, our experience is that the assessment of actual risks posed by a potential PFAS source site to an off-site receptor can pose a real (often impossible) challenge in urbanised areas given the ubiquitous nature of PFAS within the urban environment. The challenge in these situations is also defining just how far "off-site" an investigation of risks to sensitive off site receptors can realistically be expected to be taken (there is no clear guidance on this in the NEMP2.0), particularly where there are often numerous other sources of PFAS in proximity or downgradient of a source facility. It is our view that the NEMP 2.0 should clearly document (for

all) that whilst early investigation of risks to sensitive off- site receptors should be an objective, for many sites, this is not going to be practicable or achievable, especially for localities where there may be multiple sources of PFAS impact. It is also our experience that the “classic” detailed site investigation approach to characterise on-site sources of PFAS followed by delineation of the contamination extent in affected media off-site is in most circumstances practical and appropriate, and provides a more systematic way of determining if there is a linkage between a source and receptor.

19.2 TOPA analysis

NEMP 2.0 does not provide clear guidance on when collection of TOPA analysis is required, which has lead to some significant confusion between industry, consultants and state regulators on expectations for work scopes and reporting outcomes on sites. Our view is that TOPA can be useful to understand the estimate of source mass, but questions remain about the relative value of this data in understanding the actual risks posed. Some very clear statements on the expectations for sampling and interpretation of laboratory analytical data for PFAS in the NEMP 2.0 would be beneficial for industry, consultants and regulators.

Draft PFAS NEMP Version 2 – Written Submission Cover Sheet

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Position (optional):

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Confidentiality

(i) Confidentiality requested? Yes / No

(ii) If so, does part of your submission include confidential or sensitive information? Yes / No

Have you provided confidential or sensitive information in a separate attachment *Yes / No*

Have you provided a redacted version *Yes / No*

Draft PFAS National Environmental Management Plan Version 2 sections

If you have specific comments or suggested text changes, please clearly identify the extract of the relevant part of the NEP on which you are providing feedback.

5. PFAS monitoring

5.1 Design of monitoring program

It is very subjective to say that PFAS are “known to exhibit relatively unpredictable behaviour” especially if there are only two research references provided.

Why is “distal” used here when it has a specific geological meaning? Strictly speaking the term should be removed and replaced with “downstream” or “adjacent”. However, the use of the term outside of its usual anatomical and geological context is not significantly deleterious to the meaning of the text to warrant change.

The use of the term “sink” suggest that PFAS is trapped, which may not be an appropriate term. The text refers to temporary or permanent sinks and appears to be in the correct context. In environmental science a ‘Sink’ is a reservoir able to capture and store chemicals of interest. See also Section 5.2.1 where sediment are described as temporary or permanent sinks although this statement is not justified or explored further.

Air transport does not generally occur via ‘emissions’ as the main PFAS of concern are not volatile but rather air transport more commonly occurs via dust or vapour droplets. Therefore are ‘emissions’ the relevant mode of air transport that should be considered here?

Footnote 35 makes the comment “Over the past two decades, a widespread transition away from the use of PFAS-containing AFFF has taken place” – this should read “PFOS-containing AFFF”.

Need to be clear with reference to AFFF – fluorine free foams are not film forming and therefore are not Aqueous Film Forming Foams (AFFF). Further, not all PFAS-containing foams are AFFFs.

6. PFAS inventory

The additional text infers that there is benefit in collecting PFAS inventory information on a local, jurisdictional and national basis. How is this information going to be collected and used at a local, jurisdictional and national level? Based on the case study in 6.2, how is confidence in data going to be assured?

8. Environmental guideline values

8.1 Human health guidance values

It is important for transparency that, if the soil guidance values for direct exposure are proposed to be changed as a result of a technical review, then that technical review should be publicly available.

The context of justification for change needs to be clear. If single study, how does that sensitivity relate to other studies in this area?

8.2 Ecological guideline values

The derived 99% value of 0.00023 µg/l in Table 5 continues to have no real-world application. The draft NEMP seems to reflect that reality by making reference to an LOR of 0.001 µg/l but then contradicts that view by asserting that that does not mean minimal risk to aquatic ecosystems.

The numbers are recognised as not being suitable for remediation values but no alternative remediation numbers are derived. This then prompts a risk assessment for any incidence where the ecological guidelines are exceeded. As noted above, the 99% species protection numbers are not practicable and would trigger a risk assessment in all cases. Consideration should be given to revising these numbers in the NEMP V2.0.

The NEMP notes that the ecological exposure guideline values protective of birds are adopted from the ECCC values but then an extra level of conservatism is added, presumably to account for local biota and conditions. Would it be more relevant and practicable to determine an Australian number without adapting the Canadian numbers but still following the principles outlined by ECCC?

Additional comment regarding the values reflect guidance for further assessment rather than remedial or action values.

Based on current understanding of “background levels” in water supply, receiving waters and other water bodies, consideration should be given to amend the 99% values. It places unrealistic expectations which will drive site specific risk assessment in the majority of cases.

10. On-site storage, stockpiles, and containment

Why does the first sentence in this section say that it covers storage, stockpile and containment “*that is not intended to be permanent”*. What is meant by “permanent” in this context? Why should it not be permanent? The subsequent text describes long term storage and containment of “greater than 5 years”.

Should include definition of long term storage and applicability, as this will be critical in most cases.

10.1 Storage, stockpiles, and containment

This sub-section makes reference to "on-site storage, stockpiling and containment". How does this differ from sub-section 10.3 "Guidance note – On-site storage and containment"? Why does section 10.3 state that contained material should be removed in the medium to long-term, when sub-section 10.1 explicitly provides for such medium and long term arrangements?

Some additional guidance on potential risk and where mitigations should be included would be helpful

10.2 Design considerations

This sub-section and sub-section 10.3.1 "Key design criteria" overlap and contradict.

10.3 Guidance note - On-site storage and containment

10.3.1 This sub-section and sub-section 10.2 "Design considerations" overlap and contradict.

10.3.7 On-site containment

10.3.7 Guidance is in relation to new containment - what about the case where there is existing containment, is there a requirement to go back and review/upgrade?

11.2 Considerations for transport

The new text states "*Decisions regarding authorisations for the transport of PFAS contaminated materials, including interstate transport, must consider whether the receiving facility can lawfully receive these materials in relation to all the physical and chemical characteristics*". Why is transport the only area singled out for special mention regarding compliance with the law?

12 Reuse of PFAS-contaminated materials

12.1 Reuse without a risk assessment

The third paragraph states that "*A second principle is the application of the waste hierarchy whereby reuse of low level PFAS contaminated soil off-site only occurs after all other options have been considered first*." What does "considering" all other options mean and how does it relate to "practicability"? The proposed flowchart in 12.1.1. Step 3.C has as one criterion exceedance of the WQG freshwater 99% species protection DGVs – does this mean exceedance of 0.00023 µg/l in which case any measure above LOR will result in a "YES" answer.

15. Wastewater treatment

15.1 PFAS Management Framework

When are the wastewater criteria mentioned in this section including the default guideline values for water quality for PFOS and PFOA scheduled for release?

This section includes a statement "*All relevant legal and regulatory requirements are met including compliance with the PFAS NEMP*". The PFAS NEMP is not in itself a compliance requirement. Need to be clear on the point above, otherwise these type of comments set precedence.

16. Data sharing

Second dot point – what is the process for determining that there is "no reason" that data cannot be made public? Who will such data be shared with – other regulators, the general public?

18.3.2 Preventing sample contamination

It is understood that Teflon no longer contains PFAS.

19.2 TOPA Analysis

Good to see recognition of the difference between laboratory derive conditions and environmental conditions.

Appendix D. Example PFAS Management Framework for a Wastewater Utility

What is the 'background level' of PFAS mentioned in Appendix D, *5.1 Risk Sources* and is there a suitable concentration number for Key PFAS that provides a base level above which wastewater disposal criteria can be set?

The National Chemicals Working Group

Email: pfasstandards@environment.gov.au

21 June 2019

Dear Sir/Madam

Re: PFAS NEMP 2.0

Background

Thank you for the opportunity to provide feedback on the PFAS NEMP 2.0. The Waste Management and Resource Recovery Association of Australia (WMRR) is the national peak body for all stakeholders in the waste and resource recovery industry. We have over 2,000 members across the nation, representing a broad range of business organisations, the three tiers of government, universities, and NGOs.

Our members are involved in a range of important waste management and resource recovery activities within the Australian economy, including community engagement and education, infrastructure investment and operations, collection, manufacturing of valuable products from resource recovered materials, energy recovery, and responsible management of residual waste.

Treatment and PFAS management framework

In April 2018, an independent expert health panel established by the Federal Government concluded that there is

> *"mostly limited, or in some cases no evidence, that human exposure to per- and poly-fluoroalkyl substances (PFAS) is linked with human diseases. Importantly, the panel concluded that there is 'no current evidence that suggests an increase in overall cancer risk'[1]."*

However, the panel noted that given PFAS continues to persist in humans and the environment, exposure to these chemicals should be minimised and future research should focus on long-term studies.

WMRR understands the need to take a precautionary approach towards PFAS, however WMRR believes that the NEMP as it is currently drafted, leaves the reader with the impression that PFAS is far more dangerous and toxic than what is reflected in current findings, which is also inconsistent with

[1] Expert Health Panel for PFAS report, Australian Government, Department of Health, April 2018. https://www.health.gov.au/internet/main/publishing.nsf/Content/C9734ED6BE238EC0CA2581BD00052C03/$File/summary-panels-findings.pdf

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its continuing non-monitored production and use in consumer goods and building products which are the primary source of these compounds in the waste stream.

WMRR strongly believe that EPAs and Government need to influence the producers and suppliers of significant PFAS inputs to the Australian market, rather than the current approach that is a very linear end of pipe approach to policy development. Landfills (like wastewater treatment plants) have no control over the materials that society produces and disposes of (whereas Government does).

WMRR advocates that:

- ***product manufacturers, importers and suppliers need to be made to take ownership of the end of life management of materials they produce and supply to consumers and the economy; and***
- ***Government must provide strong leadership in requiring greater Extended Producer Responsibility, relieving the focus on end of pipe solutions and lower order use of materials as a result of manufacturer introduced contamination and barriers to resource recovery***

Amongst the changes to the NEMP are two (2) new sections – one on on-site storage, stockpiles, and containment, and the other on wastewater treatment, as well as Appendix D, an example of the proposed PFAS Management Framework.

The proposed framework outlines an extensive assessment and monitoring strategy and describes a range of tools that may be used by water authorities to manage inputs from trade waste, including refusal of receival. However, no measures are recommended for sources other than trade waste. While manufacturers and suppliers of consumer products are considered to bear the primary responsibility for acting to reduce the levels of PFAS reaching domestic wastewater, there are no actions or controls identified to force producers and suppliers to reduce PFAS concentrations in their products.

WMRR notes that the next revision is intended to benefit from work on the resource recovery and waste management theme and considers it appropriate given that the issue is already affecting the waste and resource recovery sector, that the NEMP in this revision provides guidance that a mixed response is required to achieve appropriate environmental outcomes.

Recommendation: That the NEMP provide guidance stipulating that in addition to the current guidance contained in the NEMP, further regulatory and economic responses by Government may be required.

Recommendation: That one recommendation to Government to take an Extended Producer Responsibility approach for PFAS in consumer goods as a trade matter if the concentrations present in domestic waste, landfill and wastewater treatment plant operators are of sufficient concern.

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Management of Diffuse PFAS Sources

WMRR believes it is impractical to apply the current guidance to loads of mixed and general solid waste streams received at landfills. It is completely unrealistic to expect landfills to reject loads that contain household products, textiles, and packaging wastes that are coated in chemicals containing PFAS? How would this be done and where would that rejected waste be disposed of?

Recommendation: WMRR requests that the NEMP clarifies the intended scope of application of landfill acceptance criteria to specific waste streams.

Available Solutions for Treatment of Landfill Leachate

Industry is exploring existing treatment technologies currently applied to groundwater remediation at several sites across Australia. Current water treatment technologies being used for PFAS contaminated water are essentially separation processes, which produce a water stream with a reduced (very low level) of PFAS, and a solid or liquid waste by-product that contains a very high concentration PFAS that requires high temperature incineration of concentrated by-products to destroy the PFAS removed. Alternatives in suitable climates that result in bioaccumulation or concentration in evaporation ponds similarly require by-product disposal.

Treatment technologies generate a concentrate requiring further a treatment of residues involving high temperature destruction of PFAS compounds.

The cost of treating PFAS contaminated water, including landfill leachate, is not cheap. Current rates offered by industry vary from $10 to $40 per kL (excluding costs for disposal of the concentrated by-product). Therefore, a landfill discharging 500kL of treated leachate to sewer per day would incur additional costs of $5,000 to $20,000 per day (or $1.8 million to $7.3 million per year) plus the cost of concentrate disposal.

Please note that WMRR is unaware of any commercialized near-term technologies that offer economies of scale or alternative approaches to minimize these costs.

Treatment and disposal costs are recurrent over a typical 20- 30-year operational life and continue for a further 20-30 years minimum after landfill closure. There are more than 30 large and medium sized currently discharging to leachate to sewer in Australia. Sydney alone has three (3) major landfills in addition to smaller sites that receive more than 500,000 tonnes of waste annually; they treat and discharge in excess of 2ML of leachate to sewer per day.

Bans or restriction on the discharge of treated leachate to sewer will have a significant impact on these landfills and their leachate management systems. These costs need to be passed on to the community through higher landfill charges for operating landfills. This form of cost recovery may be an option for some operating landfills with significant remaining life. It may also result in the pre-mature closure or restrictions on acceptance of waste where alternative disposal options are not available.

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At closed landfills and those near closure, the costs associated with specific systems for PFAS removal and disposal are not included in existing financial provisions or current funding arrangements for their leachate management.

Unintended consequences are likely to result from restrictions on leachate sewer discharges, including potentially the premature closure, reduced operating capacity or abandonment of landfills resulting in simple displacement residual waste containing trace concentrations of PFAS and precursor materials to less desirable disposal pathways, and the environment.

Acceptance of Leachate to Sewer

While the NEMP strives to provide a consistent point of reference for environmental regulators and a consistent framework and approach to the management of PFAS, with respect to landfill and leachate, each State EPA and Sewerage Authority actions and decisions have varied considerably.

WMRR members have observed:

- Queensland Urban Utilities PFAS source management plan (February 2019) includes acceptance limits for trade waste, which were below the concentrations in the leachate from some landfills. There is an expectation that landfills treat leachate prior to disposal to sewer to reduce PFAS concentrations to 'acceptable' levels, although the treatment solutions are not readily available, if they exist.
- Sydney Water has not imposed any discharge criteria but commenced testing incoming leachate for PFAS. The NSW EPA advises that it is undertaking further work to ensure a balanced approach to the management of PFAS that does not negatively impact any one part of what is an interconnected wastewater system that includes a range of stakeholders, including landfills.
- Melbourne Water have advised a major Victorian landfill of the imposition of a 1ug/l discharge limit. This is an effective ban on acceptance since as of 26 Australian landfill leachates tested, 21 had PFAS levels higher than 1 ug/L. Victoria's climate dictates that virtually every landfill south of the divide is dependent at least in part on sewer disposal of leachate, this represents a major issue.
- In WA and SA, where the climate is drier, landfills are generally not as reliant on sewer disposal to date, have not been impacted by PFAS regulation. Disposal options for residuals from evaporation ponds may become a concern.

Leachate discharges to sewer are a point source, an easy target for control and/or exclusion.

PFAS compounds continue to be prevalent in a range of readily available common household products, including food packaging, aerosols, non-stick cookware, textiles and fabric, and which fall outside bans and regulatory controls, the current NEMP is draws into focus their presence in landfill and leachate. The emitted PFAS loads have been monitored and *"the mass of PBTs in leachate discharged to WWTPs*

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contributing to the mass accumulated in biosolids was small in comparison to domestic sources."[2] The effective or precautionary general exclusion of landfill leachate discharges from sewer are in themselves therefore unlikely to solve any significant exceedance of criteria by a Wastewater Treatment Plant biosolid or effluent.

WMRR believes that it is undesirable and poor policy to implement low and precautionary discharge limits to WWTP where the contributed load is small. This has the potential to:

- ***Increase the economic costs beyond the benefits given the focus on this small contributor of PFAS load to the sewer;***
- ***Impose a significant financial burden to operating and closed landfills across Australia, potentially resulting in early closure or abandonment of landfills;***
- ***Simply displacing PFAS materials to less desirable disposal pathways and/or continued diffuse emissions to the environment.***

Recommendation: That the NEMP provide guidance on timeframes for planned implementation discharge limits or improvements that are supported by scientifically demonstrated risks and reflect available and commercialized technology options. Current requirements for investigations, design, approvals and implementation suggest that a minimum timeframe of five (5) years would be required to implement substantial alternative measures where it is feasible to do so.

Just as the impacts of PFAS on human and environmental health are not completely known at this stage and research is ongoing, the treatment technology space is also evolving. Industry expects treatment technology to improve – both in terms of cost efficiency and efficacy – but these changes take time.

WMRR believes it is both consistent with the Chemical Working Group's charter (under HEPA), and helpful to water authorities (who must have regard to broader environmental outcomes), that the NEMP provide scientifically-based guidance on the management of landfill leachate having regard to its relative contribution to sewerage, the significance of its exclusion from a broader environmental perspective, and the lack of technically developed and effective alternatives available for implementation. We believe this guidance is necessary to provide a clearer framework for decision making and to avoid unintended or perverse environmental and financial outcomes.

Recommendations:
The National Chemical Working Group place priority in the short term on providing a policy position regarding the continued acceptance of trade waste discharges of leachate to sewer where its effect is marginal or incremental, and not scientifically demonstrated to be driving non-compliance or risk-based outcome to the management of biosolids.

[2] Occurrence and distribution of brominated flame retardants andperfluoroalkyl substances in Australian landfill leachate and biosolids. Gallena,∗, D. Dragea, S. Kaserzona, C. Baduela, M. Gallena, A. Banksa, S. Broomhallb,J.F. Mueller, Journal of Hazardous Materials 312 (2016) 55–64.

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The National Chemical Working Group works with the waste and resource recovery industry to determine interim acceptable levels of PFAS in leachate for acceptance to sewer as part of ongoing improvements to the NEMP.

WMRR supports best practice landfills and technological advancements to drive greater protection of human and environmental health. However, the NEMP as it is, squarely and unjustifiably places the responsibility for managing the PFAS problem on landfills (linear thinking), which gives water authorities the ability to withdraw trade waste services and provides in-principle justification for water authorities to refuse landfill leachate. This is a risky situation because it undermines the viability of landfills, which play an integral role in waste management, and provides an essential service by managing residual waste flows within the economy.

As such, WMRR urges the working group to continue working with all stakeholders to manage PFAS in the environment and to advice against imposing limitations and regulations without further investigation.

Continued Consultation

As the National Chemical Working Group starts working on NEMP 3.0, which will look at resource recovery and waste management and includes the "sampling of unusual matrices including those found in construction waste, WMRR encourages the group to consider where these materials may end up if unrealistic limits and expectations are set, and to continue to consult with industry. For instance, the Westgate Tunnel boring project has turned up two (2) million tonnes of spoil, which may contain PFAS. Landfills will be less inclined to take this contaminated soil considering the unknowns industry is currently facing. WMRR acknowledges that NEMP 2.0 covers new guidance developed in 2018 only, and the NEMP is scheduled for a full review in 2023. WMRR is also aware that work beyond NEMP 2.0 has commenced, comprising activities under six (6) themes that include resource recovery and waste management.

WMRR looks forward to consulting with the National Chemicals Working Group on its future work on the NEMP resource recovery and waste management and related themes.

Please do not hesitate to contact the undersigned to further discuss WMRR's submission.

Yours sincerely

[redacted]

Gayle Sloan
Chief Executive Officer
WMRR

[redacted]

Paul Lightbody
Chair, National Landfill Division
WMRR

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Submission

To	The National Chemicals Working Group email: PFASstandards@environment.gov.au
From	Colin Sweet, CEO Australian Landfill Owners Association
Date	21 June 2019
Subject	**Submission on PFAS Draft NEMP version 2**

The Australian Landfill Owners Association (ALOA) was formed in late 2008. It is an incorporated entity with members from across Australia.

Modern landfills are an essential element in today's integrated waste management infrastructure as landfills:

- Offer cost effective and reliable disposal of recycling and processing residues and unsorted wastes;
- Manage greenhouse gas emission by methane collection and combustion;
- Provide a source of renewable energy;
- Have the flexibility to accept variable waste volumes; and
- Are reliable last resorts for the acceptance of large volumes of 'disaster' waste.
- Member landfills provide services to the general public, local government, industry, property developers, mining and agriculture.

ALOA members receive and safely manage the disposal of almost three quarters of the waste landfilled in Australia.

Since its inception ALOA has defended the interests of its members in national and state issues. In particular, ALOA campaigned for fairer treatment under the 'carbon' tax and worked closely with the Australian Local government Association (ALGA) to develop the Voluntary Waste Industry Protocol to utilise collected carbon tax monies.

ALOA is governed by a 'national' board and has state 'chapters' in each of the mainland states.

Submission

Thank you for the opportunity to provide feedback on the PFAS NEMP 2.0.

Our comments are as follows:

1. Status of NEMP and ongoing activities

ALOA acknowledges that NEMP 2.0 covers new guidance developed in 2018 only, and the NEMP is scheduled for a full review in 2023. ALOA is also aware that work beyond NEMP 2.0 has commenced, comprising activities under six (6) themes that include resource recovery and waste management.

ALOA looks forward to consulting with the National Chemicals Working Group in its future work on the NEMP resource recovery and waste management and related themes.

2. Capturing Diffuse PFAS Sources within the Scope of the NEMP

In April 2018, an independent expert health panel established by the Federal Government concluded that there is:

> *"…mostly limited, or in some cases no evidence, that human exposure to per- and poly-fluoroalkyl substances (PFAS) is linked with human diseases. Importantly, the panel concluded that there is 'no current evidence that suggests an increase in overall cancer risk'[1]."*

[1] Expert Health Panel for PFAS report, Australian Government, Department of Health, April 2018.
https://www.health.gov.au/internet/main/publishing.nsf/Content/C9734ED6BE238EC0CA2581BD00052C03/$File/summary_panels_findings.pdf

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However, the panel noted that given PFAS continues to persist in humans and the environment, exposure to these chemicals should be minimised and future research should focus on long-term studies.

While ALOA understands the need to take a precautionary approach towards PFAS, we believe the NEMP is drafted in such a way that it leaves the reader with the impression that PFAS is far more dangerous and toxic than that reflected in current findings and inconsistent with its continuing un-monitored production and use in consumer goods and building products.

Despite PFAS compounds continuing to be prevalent in a range of readily available common household products, including food packaging, aerosols, non-stick cookware, textiles and fabrics, which fall outside bans and regulatory controls, the current NEMP is draws into focus their presence in landfill even though the emitted PFAS loads have been monitored and found to be very low, when compared to emissions from contaminated sites, production facilities and wastewater treatment plants.

ALOA believe that EPAs and Government need to influence the producers and suppliers of significant PFAS inputs to the Australian market, rather than the current and very linear end of pipe approach to policy development. Landfills (like wastewater treatment plants) have no control over the materials that society produces and disposes of (whereas Government does).

ALOA advocates that:

- A requirement for product manufacturers, importers and suppliers take ownership of the end of life management of materials they produce and supply to consumers and the economy should be legislated by Government.
- Government must provide strong leadership in requiring stronger Extended Producer Responsibility, relieving the focus on end of pipe solutions and lower order use of materials as a result of manufacturer introduced contamination and barriers to resource recovery.

3. Need for Nationally Consistent Guidance and Market Signals

While the NEMP strives to provide a consistent point of reference for environmental regulators and a consistent framework and approach to the management of PFAS, with respect to landfill and leachate, each State EPA and Sewerage Authority actions and decisions have varied considerably.

ALOA has observed:

- Queensland is by far the most conservative jurisdiction; a Queensland Urban Utilities presentation on sewer acceptance from a utility operator's perspective at WMRR's 2019 Australian Landfill and Transfer Stations Conference in March highlighted new limits on PFAS concentrations for trade waste, which were below the concentrations in the leachate from some landfills. Queensland's response is to have landfills treat leachate prior to disposal to sewer to reduce PFAS concentrations to 'acceptable' levels. Should Queensland Urban Utilities decide to act in this manner, the Queensland landfill industry will shut down overnight and there will be no alternative waste disposal option for the citizens of Queensland.
- In NSW, the EPA has informed industry that unlike Queensland, Sydney Water has not imposed any discharge criteria. However, Sydney Water has tested incoming leachate for PFAS so future decisions on additional limits on the discharge of leachate to sewer should not be discounted.

  Sydney alone has three (3) major landfills in addition to smaller sites that receive more than 500,000 tonnes of waste annually; they treat and discharge in excess of 2ML of leachate to sewer per day. Thus, a ban or restriction on the discharge of treated leachate to sewer is expected to have a significant impact on these landfills and their leachate management systems, to the extent that the landfill industry would summarily cease to operate and there will be no alternative waste disposal option for the residents of Sydney. The NSW EPA advises that it is undertaking further work to ensure a balanced approach to the management of PFAS that does

not negatively impact any one part of what is an interconnected wastewater system that includes a range of stakeholders, including landfills.

- In WA and SA, where the climate is drier, landfills are generally not as reliant on sewer disposal to date, have not been impacted by PFAS regulation.
- In Victoria, where the Victorian EPA regulates the guidance of the PFAS NEMP, the messages have been mixed and ALOA understands that Victorian water authorities are taking a more cautious approach. Melbourne Water have advised a major Victorian landfill of an effective ban on discharge of leachate through the imposition of a 1ug/l discharge limit. Of 26 Australian landfill leachates tested, 21 had PFAS levels higher than 1 ug/L. Given Victoria's climate dictates that virtually every landfill south of the divide is dependent at least in part on sewer disposal of leachate, this represents a major issue.

Leachate discharges to sewer are a point source, an easy target for control and/or exclusion. However, a study by the University of Queensland (Gallen et al, 2017) indicates that leachate is generally a small contributor of PFAS to the total wastewater treatment plant load, and minor compared to domestic wastewater sources[2]. As a consequence, the exclusion of typical leachate discharges to sewer are in themselves unlikely to solve any exceedance of criteria in the WWTP biosolids or effluent.

ALOA believes that to signal inconsistent discharge limits to WWTPs where the contributed load is small has the potential to:

- Increase the economic costs beyond the benefits given the focus on this small contributor of PFAS load to the sewer;
- Impose a significant financial burden to operating and closed landfills across Australia, potentially resulting in early closure or abandonment of landfills;
- Simply displace PFAS materials to less desirable disposal pathways to the environment.

4. Need for Interim Guidance to Industry and Sewerage Operators

ALOA believes it is both consistent with the Chemical Working Group's charter (under HEPA), and helpful to water authorities (who must have regard to broader environmental outcomes), for the NEMP to provide scientifically-based guidance on the management of landfill leachate having regard to its relative contribution to the total volume of sewage, the significance of its exclusion from a broader environmental perspective, and the lack of technically developed and effective alternatives available for removing PFAS from leachate. We believe this guidance is necessary to provide a clearer framework for decision making and to avoid unintended or perverse environmental and financial outcomes.

Recommendations:

- The National Chemical Working Group should work with the waste industry to determine acceptable levels of PFAS in leachate for acceptance to sewer as part of ongoing improvements to the NEMP.
- The National Chemical Working Group place priority on forming a short-term policy position regarding the acceptance of trade waste discharges of leachate where its effect is marginal or incremental, and not scientifically demonstrated to be driving non-compliance or risk-based outcome to the management of biosolids.

5. Treatment and PFAS management framework

Amongst the changes to the NEMP are two (2) new sections one on on-site storage, stockpiles, and containment, and the other on wastewater treatment, as well as Appendix D, an example of the proposed PFAS Management Framework.

[2] C. Gallen, D. Drage,, G. Eaglesham, S. Grant, M. Bowman, J.F. Mueller, 2017. Australia-wide assessment of perfluoroalkyl substances (PFASs) in landfill leachates. Journal of Hazardous Materials 331 (2017) 132–141

The proposed framework outlines an extensive assessment and monitoring strategy and describes a range of tools that may be used by water authorities to manage inputs from trade waste, including refusal of receival. However, no measures are recommended for sources other than trade waste. While manufacturers and suppliers of consumer products are considered to bear the primary responsibility for acting to reduce the levels of PFAS reaching domestic wastewater, there are no actions or controls identified to force producers to reduce PFAS concentrations in their products.

ALOA notes that the next revision is intended to benefit from work on the resource recovery and waste management theme and considers it appropriate given that the issue is already affecting the waste and resource recovery sector, that the NEMP in this revision provides guidance that a mixed response is required to achieve appropriate environmental outcomes.

Recommendations:

- That the NEMP provide guidance stipulating that in addition to the current guidance contained in the NEMP, further regulatory and economic responses by Government may be required.
- That the NEMP provides guidance and recommendation to Government to take an Extended Producer Responsibility approach for PFAS in consumer goods as a trade matter if the concentrations cause issues for landfill and wastewater treatment plant operators.

Industry has explored existing treatment technologies and has undertaken groundwater remediation at several sites across Australia. Current water treatment technologies being used for PFAS contaminated water are essentially separation processes, which produce a water stream with a reduced (very low level) of PFAS, and a solid or liquid waste by-product that contains a very high concentration PFAS that requires high temperature incineration of concentrated by-products to destroy the PFAS removed. Alternatives in suitable climates that result in bioaccumulation or concentration in evaporation ponds similarly require by-product disposal.

The cost of treating PFAS contaminated water, including landfill leachate, is considerable. Current rates offered by industry vary from $10 to $40 per kilolitre (excluding costs for disposal of the concentrated by-product). A landfill discharging 500kL of treated leachate to sewer per day would incur additional costs of $5,000 to $20,000 per day (or $1.8 million to $7.3 million per year). These costs are significant and would need to be passed onto the users of the landfill, i.e. the community. For one (1) landfill in Sydney, there would be a need to increase landfill disposal fees by $30 per tonnes depending on the actual additional leachate treatment costs.

Just as the impacts of PFAS on human and environmental health are not completely known at this stage and research is ongoing, the treatment technology options are also evolving. Industry expects treatment technology to improve both in terms of cost efficiency and treatment efficiency but these changes take time.

Recommendation:

That the NEMP provide guidance on timeframes for planned implementation or improvements **that** reflect scientifically demonstrated and commercialised technologies. Current requirements for investigations, design, approvals and implementation suggest that a minimum timeframe of five (5) years would be required to implement substantial alternative measures where it is feasible to do so.

6. Acceptance criteria

ALOA requests that the NEMP clarifies the intended scope of application of landfill acceptance criteria to specific waste streams. ALOA believes it is impractical to apply the current guidance to loads of mixed and general solid waste streams received at landfills. It is unreasonable to expect landfill operators to reject loads that contain household products, textiles, and packaging wastes that are coated in chemicals containing PFAS. Firstly, it is impractical as most waste is contained in a sealed truck and secondly, the subsequent disposal of the PFAS material would impose a high penalty on the landfill operator.

7. The next iteration

As the National Chemical Working Group starts working on NEMP 3.0, which will look at resource recovery and waste management and includes the "sampling of unusual matrices including those found in construction waste, ALOA encourages the group to consider where these materials may end up if unrealistic limits and expectations are set, and to continue to consult with industry. For instance, the Westgate Tunnel boring project has turned up two (2) million tonnes of spoil, which may contain PFAS. Landfills will be less inclined to take this contaminated soil considering the unknowns industry is currently facing.

ALOA supports best practice landfills and technological advancements to drive greater protection of human and environmental health. However, the NEMP as it is, squarely and unjustifiably places the responsibility for managing the PFAS problem on landfills (linear thinking), which gives water authorities the ability to withdraw trade waste services and provides in-principle justification for water authorities to refuse landfill leachate. This is a risky situation because it undermines the viability of landfills, which play an integral role in waste management, and provides an essential service by managing residual waste flows within the economy.

As such, ALOA urges the working group to continue working with all stakeholders to manage PFAS in the environment and advises against imposing limitations and regulations without further investigation. Please do not hesitate to contact the undersigned to further discuss ALOA's submission.

For further information on this important matter, please contact ALOA.

Yours Sincerely

[redacted]

Colin Sweet
CEO

From:	Dale Watson
To:	PFASstandards
Cc:	Stuart Wilson; Greg Ryan; Sandi Kolbe
Subject:	Submission on PFAS Draft NEMP version 2
Date:	Friday, 21 June 2019 4:30:11 PM
Attachments:	image001.jpg Submission on PFAS Draft NEMP version 2 - WSAA.pdf

To the National Chemicals Working Group.

Thank you for giving us the opportunity to comment on the PFAS NEMP 2.0. Please find attached a response from WSAA members.

The Water Services Association of Australia (WSAA) is the peak body that supports the Australian urban water industry. Our members provide water and sewerage services to over 20 million customers in Australia and New Zealand and many of Australia's largest industrial and commercial enterprises.

WSAA facilitates collaboration, knowledge sharing, networking and cooperation within the urban water industry. The collegiate approach of its members has led to industry-wide advances to national water issues.

A number of WSAA members have submitted responses to the review of the NEMP, either as individual entities, or as part of other group submissions. However, engagement with our members has bought out a number of issues that they consider should be addressed in the review.

In particular, these concerns focus on the need for greater guidance on how to implement the NEMP. While an example management framework is provided, there are still a large number of unknowns.

In particular, these concerns focus on:

- A lack of clarity of the status of the NEMP. There appears to be confusion among members over whether the NEMP2 is a legally binding document or a guideline. While, some of the NEMP addresses responsibilities of environmental regulators and other parts responsibilities of utilities.
- The need for a flexible, risk based, approach to monitoring. There are extensive monitoring requirements irrespective of the level of risk and the size of the entity. A risk based approach should allow for variation in monitoring requirements where risk varies and where capability varies.
- Utilities all manage risk and most have sophisticated risk management approaches and systems. A more efficient approach would be to specify appropriate risk management standards that could integrate with existing systems and be applied more generally to emerging contaminants.
- Our members have asked for more detailed guidance. In particular, more guidance and clear standards are required for acceptance of trade waste.
- More focus should be given to managing PFAS at the source. Products containing PFAS should be more effectively restricted from entering the marketplace and the catchment. Treatment options are expensive and should be the last resort. Water utilities feel that their customers are carrying responsibility for actions of others. Better product labelling has been a suggestion, to help consumers make better choices and to help identify potential sources.
- Utilities come in all sizes. A National Environmental Management Plan must be practical and easy to implement. Our members believe that, as presented, the management framework would be difficult for larger utilities to implement and nearly impossible for smaller utilities.

- Wastewater utilities do not control how PFAS is discharged to the sewer. They also have no currently feasible treatment process to destroy or permanently capture it. Utilities feel that expectations of treatment options for PFAS are unrealistic.

Should you require additional information, please do not hesitate to contact me.

Regards

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Draft PFAS NEMP Version 2 – Written Submission Cover Sheet

Water Services Association of Australia

Address correspondence to Dale Watson (dale.watson@wsaa.asn.au)

Confidentiality

(i)	Confidentiality requested?	**No**
(ii)	If so, does part of your submission include confidential or sensitive information?	Yes / No
	Have you provided confidential or sensitive information in a separate attachment	*Yes / No*
	Have you provided a redacted version	*Yes / No*

Summary Comments

The Water Services Association of Australia (WSAA) is the peak body that supports the Australian urban water industry. Our members provide water and sewerage services to over 20 million customers in Australia and New Zealand and many of Australia's largest industrial and commercial enterprises.

WSAA facilitates collaboration, knowledge sharing, networking and cooperation within the urban water industry. The collegiate approach of its members has led to industry-wide advances to national water issues.

A number of WSAA members have submitted responses to the review of the NEMP, either as individual entities, or as part of other group submissions. However, engagement with our members has bought out a number of issues that they consider should be addressed in the review,

In particular, these concerns focus on the need for greater guidance on how to implement the NEMP. While an example management framework is provided, there are still a large number of unknowns.

In particular, these concerns focus on:

- A lack of clarity of the status of the NEMP. There appears to be confusion among members over whether the NEMP2 is a legally binding document or a guideline. While, some of the NEMP addresses responsibilities of environmental regulators and other parts responsibilities of utilities.
- The need for a flexible, risk based, approach to monitoring. There are extensive monitoring requirements irrespective of the level of risk and the size of the entity. A risk based

approach should allow for variation in monitoring requirements where risk varies and where capability varies.

- Utilities all manage risk and most have sophisticated risk management approaches and systems. A more efficient approach would be to specify appropriate risk management standards that could integrate with existing systems and be applied more generally to emerging contaminants.
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- More focus should be given to managing PFAS at the source. Products containing PFAS should be more effectively restricted from entering the marketplace and the catchment. Treatment options are expensive and should be the last resort. Water utilities feel that their customers are carrying responsibility for actions of others. Better product labelling has been a suggestion, to help consumers make better choices and to help identify potential sources.
- Utilities come in all sizes. A National Environmental Management Plan must be practical and easy to implement. Our members believe that, as presented, the management framework would be difficult for larger utilities to implement and nearly impossible for smaller utilities.
- Wastewater utilities do not control how PFAS is discharged to the sewer. They also have no currently feasible treatment process to destroy or permanently capture it. Utilities feel that expectations of treatment options for PFAS are unrealistic.

General comments from utilities.

The management of PFAS requires a highly collaborative approach between regulators, industry, water utilities and land and waterway managers. The focus should be on problem definition, source identification, pathway mapping and problem solving (including funding mechanisms for industry or legacy sites).

Many utilities have management and monitoring arrangements in place for preventing contaminants of concern from adversely impacting human health and the environment. This includes arrangements in relation to water supply, sewage treatment discharges, resource recovery and waste management. The contaminants of concern for each business activity is relative to product use and the receiving environment. As human health and environmental toxicology understanding is uncertain and evolving, greater focus should be on improving knowledge to inform the basis for any implementation of treatment.

Water utilities are heavily regulated and existing frameworks should be used to prioritise contaminants for attention over long timeframes to prevent system shock. It is inefficient to have a separate plan or expectation of treatment for every chemical of concern, as technology has limitations and costs are passed on to the community.

It is recommended that a net environmental lifecycle assessment or regulatory impact statement been considered for the NEMP 2.0 to help identify and attribute costs.

With heat treatment limitations in some jurisdictions, it is possible that the proposed obligations will preclude reuse of sewage sludge and biosolids which will prevent beneficial agricultural reuse to close the nutrient cycle and increase landfill demand.

Water utilities are just one part of the solution for managing PFAS. Water utilities do not routinely treat PFAS, nor are there current treatment technologies that would make it a viable option to routinely treat.

As these contaminants are emerging and regulator and industry knowledge is still growing, industry partners are mostly unware of the potential risk associated with these contaminants - which further adds to uncertainty and an ability to identify treatment options.

There is a disconnect between potential hotspot sources in a catchment and ability to detect anything at treatment facilities especially where there are long networks that receive significant dilution.

Our utilities are asking that additional measures be considered to control potential human health and environmental impacts; such as regulation on chemical imports, chain of custody tracking and mass balance accounting of such chemicals and a requirement to disclose pollution events by the user of these chemicals (including discharge to sewer).

Water utility networks and treatment facilities are only one pathway for routing flows through catchments. Consideration must be given to all routes and the focus should be on source control. Water utility customers should not be financially burdened with addressing the PFAS legacy issue when products are still being actively sold, used and permitted. With approximately 45,000 PFAS compounds, banning only long chain compounds may lead to more use of short chain compounds which may be less toxic but more mobile and just as persistent. If water utilities are expected to target trade waste customers or deal with inflow and infiltration from legacy environmental contamination, it is unclear who should bear this financial burden.

What activity is occurring to limit the PFAS levels in stormwater and waterways that are not related to wastewater utility activities? If most legacy inputs are entering wastewater through inflow and infiltration, then reducing this through leak tight systems will mean that the groundwater contaminated sources could just route through stormwater systems.

Draft PFAS National Environmental Management Plan Version 2 sections

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8. Environmental guideline values

8.1 Human health guidance values

Our members have asked for a technical report on the derivation of the human health guideline values. In particular, they would like greater clarity on the derivation of soil to plant transfer factors.

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8. Environmental guideline values

8.2 Ecological guideline values

As mentioned above, a technical report on the derivation of the ecological health guideline values is strongly requested.

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10. On-site storage, stockpiles, and containment

10.1 Storage, stockpiles, and containment

No comments

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10. On-site storage, stockpiles, and containment

10.2 Design considerations

No comments

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10. On-site storage, stockpiles, and containment

10.3 Guidance note - On-site storage and containment

No comments

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12 Reuse of PFAS-contaminated materials

12.1 Reuse without a risk assessment

The draft PFAS NEMP 2.0 appears to be biased towards managing the risks associated with the use of biosolids contaminated with PFAS compared to the use of recycled water for irrigation or discharge to aquatic ecosystems. While the majority of PFAS partition to the biosolids they are generally applied only once to a site compared with the long term use of recycled water for irrigation or discharge to aquatic ecosystems. There needs to be more research to understand the relative environmental and human health risks from the use of PFAS contaminated biosolids and recycled water to understand the cost benefits of any preventative or remediation strategy. Treatment is a longer term option and probably the least preferred option that may not be of greatest benefit to the community.

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15. Wastewater treatment

15.1 PFAS Management Framework

Trade waste and legacy hotspots appear to be the main sources of PFAS entering the sewerage network. There needs to be more guidance on trade waste acceptance standards to assist with controlling PFAS at the source.

Further, there needs to be guidance for industry on synergistic impacts (i.e. mixing of different waste types), and available treatment options, including infrastructure development, that can be used to reduce concentrations of PFAS, prior to discharge.

There are significant cost implications of sending additional biosolids to landfill and for some utilities this is not even an available option.

In addition, utilities also have tens of thousands of tonnes of residuals (e.g. grit) that is removed from treatment processes.

There is an issue of scale in this section. Water utilities come in a variety of scales from very small local government responsibilities to major urban utilities. And within this range organisations vary in terms of capability, resourcing and operational/regulatory oversight. Feedback from our members is that the management framework could not be implemented by smaller water utilities due to the level of complexity and resourcing required.

It is important to note that many of the smaller utilities serve disadvantaged communities, discharge into inland river systems and reuse a high proportion of the treated effluent. It is important to recognise the challenges presented by utility size and capability and tailor the management approach to achieve a positive outcome all levels.

The PFAS NEMP appendices identifies sources of PFAS discharges from commercial laundries (due to washing of fabrics containing PFAS), healthcare sector (due to various uses listed in Appendix A), car retailers/dealers and vehicle wash businesses due to use of surface treatment products and various other processes. These activities are typical small businesses in regional centres. Sampling and monitoring of these activities is expensive, impractical and may only reflect the products in use at the time of sampling. It is imperative that the National Environmental Plan has the right balance to minimise overregulation and burden on small businesses while achieving intended outcomes

It should be noted that product labelling often does not include detailed composition or a substance list. Small businesses and the public may not be aware whether the product includes PFAS.

Market control preventing products containing PFAS from everyday use (cleaning/polishing products) at the National level would provide an effective and reliable way of reducing PFAS contaminated wastewater entering to a Utilities' sewerage systems and the environment. This approach would have limited impact on local water utilities is likely to provide a much improved and broader outcome over management planning alone.

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15. Wastewater treatment

15.2 Additional management tools

No comments

Appendix D. Example PFAS Management Framework for a Wastewater Utility

The proposed sampling strategy in the example PFAS Management Framework for a Wastewater Utility (Appendix D) doesn't appear to consider the overall risk and balance against cost in the way that utilities would consider it. The use of environmental guideline values in Section 8 of the draft NEMP 2.0 strongly suggests that a risk-based approach is being advocated. This is reinforced in many places in the draft NEMP 2.0, including the description of the Precautionary Principle (Section 3, point 2a), which notes that the principle is risk-weighted. However, there are statements in the draft NEMP 2.0 that suggest that the aim is nil discharge of PFAS to the environment, presumably in anticipation of Australia ratifying the Stockholm Convention covering PFAS (yet even then, the section on management of contaminated soils notes that the Stockholm Convention and the Basel Convention have an acceptable limit of 50 mg/kg). Section 3.1 discussing contaminated waste, states that 'Dilution is not acceptable for example in soil, compost or other products', which would seem to contradict a risk-based approach. This is reinforced by the draft Framework for a Wastewater Utility (Appendix D, Section 9.2), which suggests advising stakeholders that the aim is to move to nil detectable discharge of PFAS to the environment based on the current uncertainty about the long-term impacts of these chemicals on human and environmental health (Section 9.2). This would seem to involve an unwarranted ongoing expenditure given that the levels of discharge now are likely to be small compared to the legacy contamination accumulated prior to restrictions on their use in the early 21st century.

If the level in the treated wastewater (and other products) is low and below guideline levels then there is no need to have a detailed management plan, including regular monitoring across the system, for that system. This is how a utility would respond to a risk assessment that indicated low risk. This needs to be made clear up front.

If new knowledge demonstrates that the risk assessment requires updating and perhaps that further monitoring is required, this can be done when that knowledge is available. Is the NCWG able to develop a risk based decision tree to guide action at the right level based on risk?

The cost to implement the monitoring program outlined in the Framework for a Wastewater Utility will be exorbitant. Much of it seems like a data gathering exercise which should not be part of the NEMP2.0. The monitoring design is also flawed in achieving some of the desired outcomes such as source tracking monitoring where the end-of-pipe may well be below LOR with few input sources. This method relies on a reliable indicator. While achievable for analytes like ammonia, this is not possible for PFAS.

There is a lot of emphasis on remediation as opposed to source control. Controlling the issue at the source is more cost effective and proactive.

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VicWater
Collaborating for Extraordinary Industry Performance

20 June 2019

National Chemicals Working Group (NCWG) of the Heads of EPAs Australia and New Zealand (HEPA)
Draft NEMP 2.0 Consultation Feedback
PFAS NEMP Coordinator
c/o Emerging Contaminants Section
Department of the Environment and Energy
GPO Box 787 Canberra ACT 2601

Email: PFASstandards@environment.gov.au

Dear PFAS NEMP2 Coordinator

Re: VicWater PFAS Draft NEMP2 submission

Thank you for the opportunity to contribute to the PFAS Draft National Environmental Management Plan Version 2 (PFAS NEMP2).

On behalf of our members, the Victorian Water Industry Association (VicWater) is hereby providing comments relating to the Federal government's PFAS NEMP2 consultation.

VicWater is the peak body for the Victorian water industry, with its membership constituted of Victoria's 19 statutory water corporations. Those corporations are responsible for the provision of urban water and wastewater services, rural water supply including irrigation and related drainage services. Some water corporations also operate reticulated recycled water schemes and manage waterways and drainage systems.

The comments and recommendations of this submission are based on a water industry workshop held on 15 May 2019 with 19 Victorian water corporation professionals, representing 12 (of 19) water corporations. All corporations had additionally been invited to provide comments directly to VicWater for a joint inclusion in this submission.

Our industry is committed to managing environmental risks through the provision of water, sewerage and recycled water services, including PFAS. We applaud the NEMP2's aim to protect communities, ecosystems and other environmental values from risks associated with PFAS. We support EPA Victoria's precautionary approach to PFAS and its associated adaptive plan as well as the use of a PFAS management framework in the NEMP inclusive of wastewater inputs, processing and outputs. The Victorian water industry acknowledges the uncertainty with regard to the behaviour of PFAS, including PFAS precursors in wastewater treatment process and supports additional research in this area.

The NEMP2 recognises that while water corporations have an important role to play in managing PFAS risk, they are neither responsible for generating the PFAS which enters their wastewater treatment plants nor influence where the sources of PFAS enter the catchment.

Water corporations are currently embarking on a collaborative process with EPA Victoria to deliver the periodic license review, including a broad-based risk assessment of all emerging contaminants at each

Victorian water corporation's wastewater treatment plant. The results of this review will identify priority risks – on a site-by-site basis – for water corporations to address in the coming years. Of critical importance is that depending on the results of this risk assessment, the action plan for an individual site may or may not prioritise specific actions relating to PFAS above actions to address other risks. A preferred approach would see water corporations manage PFAS risks in the context of other emerging contaminants and apply the General Environmental Duty (GED) holistically.

Victorian Water Industry Specific Challenges & Suggested Recommendations

1. PFAS sampling is expensive and resource intense; the distribution of PFAS in the landscape is diffuse and questions arise relating to the usefulness of a sampling regime. Baseline measurements might prove challenging, given most PFAS sampling would likely contain legacy leachate/background levels; progress based on new initiatives would hence be difficult to measure.

    - *It is suggested NEMP2 include:*
        - *Guidance as to where and how to sample for PFAS.*
        - *An inventory of potential point-source pollution sources of PFAS, which could assist with this task and would include engagement of the various industries.*

2. Monitoring and risk assessments: currently, the expectations seem unclear and questions arise as to whether to only sample PFAS or a range of emerging contaminants. There seems to be unclear expectations relating to the magnitude and breadth of a new sampling regime. If sampling and risk assessments are undertaken as a 'learning experience', processes should be in place to share learnings effectively across various industries and stakeholders. A risk-based approach is not applicable for monitoring, recycled water, biosolids, licences and groundwater due to cost and resource intensity.

    - *It is suggested that EPA Victoria establish a sampling protocol for water corporations to undertake a PFAS monitoring program all at the same time, and analysed at the same lab, to gain a snapshot picture of status quo. Based on this information, EPA Victoria could gain an understanding of current PFAS levels in effluent and recycled water in order to help develop risk-based guidelines.*

3. The General Environmental Duty (GED) is future rather than legacy focused; this provides challenges to the water industry as it is at the receiving end of the catchment with little reach to influence PFAS contamination into its receiving waters.

    - *It is recommended that EPA Victoria work with industry and water corporations beyond compliance.*

4. Licence agreements and their associated current review include a broad-based risk assessment of all emerging contaminants (which may or may not prioritise PFAS).

    - *It is recommended that EPA Victoria adopt an approach which would see water corporations manage PFAS risks in the context of other emerging contaminants and apply the General Environmental Duty (GED) holistically.*

5. Beneficial reuse of biosolids and recycled water will require a holistic and health-centric approach, which will need to be articulated more clearly. There is a current dichotomy between the current mandate to encourage beneficial reuse of biosolids and recycled water, versus the (as yet unknown) risk of PFAS potentially impacting human health. Biosolids applications on land could potentially lead

to future health impacts and landfilling causes potential detrimental leachate. Clear expectations relating to the disposal and/or treatment of PFAS are needed.

- *It is suggested that federal and state governments:*
  - *Support further research to understand the environmental and human health risks from the use of PFAS contaminated biosolids and recycled water.*
  - *Articulate a holistic and health-centric approach, and incentivise and appropriately resource solutions to develop new innovative solutions to treating and disposing of PFAS.*

6. Guidance: There appears to be confusion over whether the NEMP2 is a legally binding document or a guidance document (a standard). Questions were raised as to whether there are transition plans in place to support water corporations towards reducing PFAS levels. Further, the document states that "further work, in collaboration with the water industry, will be undertaken to establish criteria and guidance for water authorities and environmental regulators based on current science" (Section 15, Wastewater Treatment, p.61), without stating a timeframe.

   - *It is recommended that:*
     - *Clearer water industry specific guidance and information (State of Knowledge - SoK) relating to the application of NEMP2 is produced, including sampling regimes, treatment of influent, effluent and reuse points.*
     - *NEMP2 transition arrangements are spelt out and a transition plan developed to support industries towards reducing PFAS levels; including the application of the precautionary principle.*
     - *A suitable government body or association is identified to disseminate national and international best practice and scientific knowledge (SoK) for distribution to the Australian water industry, including national and international case studies.*
     - *Water-industry specific working groups are established (nationally and state-wide) – convened by the suitable industry bodies and/or associations to contribute to the SoK and collaborate with state EPAs to develop industry specific proposals and submissions relating to risk reduction/minimisation.*
     - *A timeframe is communicated for providing criteria and guidance to the water industry.*

7. Customer willingness to pay: the Victorian Essential Services Commission's (ESC) PREMO approach stipulates extensive customer consultation to determine a water corporation's future expenditure. In light of PFAS sampling and treatment resource intensity, uncertainty around surrounding research findings and potential health impacts, this approach could prove challenging. If water corporations were to reduce PFAS during its treatment processes, the cost of upgrading and/or changing infrastructure would be substantial. Consultation relating to PFAS has been undertaken with industry; not with the broader community (yet), which will be of a sensitive nature.

   - *It is suggested that:*
     - *EPA Victoria consult with the ESC as to next steps relating to willingness-to-pay consultation and/or potential incorporation into the Statement of Obligations (SoO).*
     - *A concise community message plan be developed, including watching briefs.*

8. Other comments:
   - *EPA Victoria needs to play a crucial role in reducing PFAS at the source, where a reduction of PFAS entering the catchment can be achieved through education and enforcement (rather than regulating the waste treatment plant operator). An EPA education-heavy approach will likely not result in large-scale PFAS reductions; it is recommended that EPA Victoria map polluters and focus on point-source pollution prevention efforts to stop PFAS entering the catchments in the first place (through regulation and fines). It is also*

recommended that EPA Victoria conduct more regular auditing of trade waste customers who may be discharging PFAS.

- *Data from a previous PFAS assessment pilot program with specific focus on wastewater treatment plants should be shared with stakeholders.*
- *Appendix D, Section 9.3 (p.97) could include an example around the use of recycled water within 200m of a waterway (as recycled water is typically reused in close proximity to wastewater plants and historically, wastewater treatment plants are sighted near waterways).*
- *The case study listed in Section 15.3 – PFAS contamination of a wastewater treatment system (p.62) - is not practicable as there are no PFAS approved disposal facilities in the region.*

On behalf of our members, VicWater is looking forward to further engagement with EPA Victoria and contributing to the dissemination of emerging knowledge about PFAS and understanding how the NEMP will be applied (beyond an Interim Position Statement).

For further information, please contact our Manager, Policy & Regulation, James Cleaver, at james.cleaver@vicwater.org.au or call 03 9639 8868.

Yours sincerely

Peter Morison
CEO
VicWater

Melbourne Water
Enhancing Life and Liveability

11 June 2019

EPA Victoria
200 Victoria Street,
Carlton VIC 3053
PFASstandards@environment.gov.au

Submission on PFAS Draft National Environment Management Plan version 2

Thank you for the opportunity to provide comments on the revised PFAS National Environment Management Plan (NEMP) version 2 provided on the EPA website.

Emerging contaminants are gaining more attention and the National Environment Management Plan provides the regulatory oversight to collectively manage these risks. PFAS have emerged as compounds of environmental interest owing to their persistence through soil and water. The changes in the revised NEMP version 2 are largely focused on the role of wastewater systems in managing the environment and public health risks.

The Melbourne Water Sewerage Strategy (2018) sets the direction for Melbourne's sewerage system. It highlights the importance of integrated water management and shifts the focus from waste disposal to resource recovery. Putting too much onus on the sewerage system to manage contaminant groups such as PFAS rather than alternate management approaches (e.g. at source control) will significantly increase the challenge of reusing wastes to the point of being prohibitive and risks shifting the cost burden from polluters to the general community.

Melbourne Water acknowledges that important reforms such as the National Environment Management Plan are challenging and our comments seek to support the EPA in the development of a robust regulatory arrangement that effectively balances competing priorities. Melbourne Water considers the following inter-related elements as important to ensuring the success of this reform:

Feasibility of end-of-pipe treatment solutions – Sewage contaminants such as PFAS are normally considered as non-treatable at municipal sewage treatment plants. Treating for PFAS is expected to be energy intensive, very high cost, and technically challenging. This solution is unlikely to be feasible.

Risks to resource recovery from the sewerage system – The current levels of PFAS in the sewerage system and stringent limits that are being proposed present a critical risk to recycling and reusing products from the sewerage system including recycled water and biosolids.

Setting clear and practical standards – An economic assessment needs to be undertaken of the proposed approach, such as a cost benefit analysis or Regulatory Impact Statement (RIS). This would provide for clarity around potential financial implications on industry, regulators and customers.

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VICTORIA State Government

Avoiding perverse outcomes – Regulation in one area (i.e. drinking water supply) does not adversely impact on another without due consideration (i.e. wastewater sector).

Effective implementation - Sources of PFAS are diffuse and ubiquitous. Setting hard limits at the end of the wastewater system will require a combination of different mitigation measures, such as changes in treatment systems, potential capacity upgrades, upstream source control or stronger limits on industry.

Clear and transparent changes to the NEMP over time - The submission identifies that ongoing revisions may be required as new science or new data is discovered.

Submissions are made for each of these elements in the table attached to this document.

We recognise that the management of sewage is integral to what we do and supports our contributions to:

- **Healthy People:** Strengthening the wellbeing of the community.
- **Healthy Places:** Co-creating the world's most desirable places to live.
- **Healthy Environment:** Enhancing the natural environment.

There are a number of pathways for PFAS and their precursors to enter Melbourne's sewage network and wastewater products including trade waste, emergency discharges and also illegal inputs. The four Melbourne metropolitan water organisations, City West Water, Yarra Valley Water, South East Water and Melbourne Water have adopted a collaborative framework for identifying and managing potential sewage quality risks to the Metropolitan sewerage system through the use of an Integrated Sewage Quality Management System (ISQMS). This ISQMS has identified PFAS as a parameter of concern and the industry is undertaking measures to quantify this threat and manage it accordingly.

Overall, Melbourne Water supports the in-principle the direction taken in the revised National Environment Management Plan version 2 and particularly, the introduction of a risk based approach to setting limits for the wastewater sector.

The focus on alternative water sources in the Melbourne Sewerage Strategy 2018 and the Melbourne Water System Strategy 2017 provide a strategic approach to targeting intervention. The growing evidence base and understanding of emerging contaminants are an urgent priority. Melbourne Water would be pleased to work with the EPA to provide further advice on any of the points raised in this response.

Should you have any queries or want to discuss this matter further, please contact Simon Pickard, Team Leader, Sewage and Stormwater Quality Planning on 9679-7521 or at simon.pickard@melbournewater.com.au

Regards,

Michael Wandmaker
Managing Director

Issue	Commentary
Implementation	It is well recognised that effective consultation and engagement can support effective policy and the credibility of the outcomes are enhanced when it is the product of an open and transparent engagement process. An important element of introducing new regulation is demonstrating that the overall benefits to the community outweigh the costs. Given the potential for significant costs on Melbourne Water, it is submitted that a cost-benefits analysis suitable to form the basis of a Regulatory Impact Statement (RIS) be undertaken. Guidance provided by the Commissioner for Better Regulation indicates that the RIS should be informed by effective engagement that allows stakeholders to comment on the detailed analysis, evidence and judgements presented to the Government. Currently it is unclear how the PFAS NEMP v2 will impact on business, community and regulators. Depending on the final adopted metrics, the water industry may be burdened with financial costs. If HEPA is not undertaking a RIS, then it is submitted that a Cost Benefit Analysis will assist regulators, the water industry and the community to better understand the distributional effects for water industry stakeholders (e.g. Waste to Energy plants, retail water companies, wholesalers and private landfill operators that discharge leachate to the sewer system). Undertaking an economic assessment, or more formally a RIS, will help reduce unnecessary regulation and appropriately outline the distribution of the costs and benefits associated with changing limits. **Melbourne Water therefore recommends:** • Set a timeframe of when a Cost Benefits Analysis or Regulatory Impact Statement is to occur to ensure that the water industry is able to appropriately plan, fund and implement changing limits for PFAS.
Cost and Benefit	The current pricing signals for compounds entering the sewer system for tradewaste are based around the traditional treatable parameters that wastewater plants are designed to treat for (i.e. Flow, Biological Oxygen Demand [BOD], Suspend Solids [SS], and Total Kjeldhal Nitrogen [TKN]). PFAS is among contaminants considered not treatable by typical municipal wastewater treatment plants. PFAS treatment at municipal wastewater treatment plants is expected to require very high cost and treatment solutions with significant technical risk. While it is possible to create a cost recovery charge for PFAS in principle, this wouldn't be achievable before Melbourne Water's next price submission for 2021 and is expected to be prohibitively high. **Melbourne Water wishes to highlight to the EPA:** • It is possible for a PFAS cost recovery charge to be created, but the timing of the PFAS NEMP v2 does not allow a suitable lead time to be included in the next Melbourne Water price submission (2021 – 26).

Issue	Commentary
Proposed metrics and application	Setting a standard for PFAS will involve trade-offs. One main concern with the proposed metric is that the current PFOS freshwater and marine guidelines in the NEMP v2 could be very difficult for Wastewater Treatment Plants to meet. The current guidelines in the PFAS NEMP v2 have the potential to set very challenging conditions to meet due to very low guideline limits – in some cases the limits are set to below detection limit. PFAS is a bio-accumulative compound - which under the State Environment Protection Policy (SEPP) results in a 99% protection level needed and; the SEPP also requires that mixing zones are not able to be used for a bio-accumulative compounds. The rationale of the limit needs to be clear, unambiguous and align with changing SEPP guidelines is critical to ensure implementation is successful. The very low guidelines imposed are likely to drive very large capital investment at treatment plants – such upgrade investment may be disproportionate in cost vs the environmental benefit. Alternatively it may drive similar hard targets for industrial trade waste customers which may lead to less collaboration and issue resolution. The revised NEMP indicates that wastewater utilities need to fully understand sources of PFAS (residential, industrial, landfills) and an understanding of the catchment-wide PFAS contamination. This will provide valuable information for water utilities and support mitigation measures and conversations with trade waste regulators (ESC) and the broader community **Melbourne Water highlights:** • PFAS source characterization is a costly exercise and funding sources are obtained through our pricing submission. • This is unlikely to be achievable by Melbourne Water's next price submission (2021).
Background levels	A key concept of the general environmental duty is to foresee and manage risks to the environment and public health. This duty needs to apply to both sewerage treatment plants and also inputs. It is unclear how the new arrangements will limit PFAS being manufactured and used prior to being input to the sewerage system. **Melbourne Water seeks clarification and response to:** • The NEMP v2 does not comprehensively address all sources of PFAS in the environment. • The NEMP v2 should address how compliance be assessed in circumstances where background levels of PFAS exceed the proposed limits in sewerage systems that are primarily residential. • The NEMP v2 should seek to minimize the amount of PFAS by driving a ban on the manufacturing, importation, or use of PFAS products (in Australia).

Issue	Commentary
Operational Issues	Traditionally. wastewater treatment plants are designed and constructed to remove bulk contaminants from wastewater. Bulk sewage includes residential and trade waste (from commercial and industrial activities) and wastewater treatment plants systems/processes/prices are based on bulk sewage. Recently and on an increasing basis, industrial fires occur and during these major disaster events firewater and fire suppressant foams are used by emergency response teams to extinguish the fires. Some of these fires may occur on land outside the jurisdiction of EPA Victoria. During the emergency unknown amounts of these products move from containment lines to drains, sumps and then enter the storm water system, eventually flowing to wetlands and waterways. During many of these events Melbourne Water is required to prevent further environmental damage to natural waterways. Due to the vast amounts of contaminated firewater, initial containment and discharge to nearby sewers is often the only feasible option, but poses significant PFAS risks to the sewerage system. **Melbourne Water seeks clarification and response to:** • The risk owners for PFAS discharged to the sewerage system during emergencies that are directed by the EPA to go to sewer (i.e. firewater incidents). • How the NEMP v2 will addresses PFAS risks outside of the jurisdiction of the EPA (e.g. airports, defense force sites, RAAF).
Trade Waste Agreements	The NEMP v2 asks for tradewaste agreements to be setup for tradewaste customers. Currently there are no tradewaste standards for PFAS. Without specific tradewaste standards to refer to, it is challenging to create tradewaste agreements with industry. This is further made complicated when (and in the case of PFAS): • Background levels are not well understood (non-industrial) • Effective treatment options are not well known • Endpoint impacts are not well defined Any changes to the tradewaste standards will require approval from the ESC. This is a time-consuming process and will require significant effort on the side of Melbourne Water and the three retail water companies (City West Water, South East Water, and Yarra Valley Water) to justify its inclusion and will need to consider the impacts to customers as part of the submission. **Melbourne Water seeks clarification and response to:** • Creation of a PFAS tradewaste standard will require a transition period as part of any implementation. What are the EPAs expectation of customers during this period?

Issue	Commentary
	Knowledge on PFAS is changing as new research becomes available - ranging from analytical measurement technics, new PFAS compounds being identified, endpoint impacts and effective treatment solutions. This makes having a firm grasp on the best management solutions challenging to identify.
New research and science	**Melbourne Water seeks clarification and response to:** • How will the latest relevant science be integrated into the PFAS NEMP v2 in the future, how will the correct research be driven, and what will this mean for already in-place solutions?
PFAS contaminated material	Guidelines for soil criteria are based on combined PFOS and PFHxS. In biosolids PFOS presence in much greater than PFHxS leading to the combined guideline being potentially over protective. This in turn will hinder reuse of biosolids. The concentrations or a concentration that constitutes what a PFAS contaminated material is should be detailed in greater precision. As it stands the definition includes any concentration at all of PFAS, given the prevalence of PFAS this would mean anything and everything. This would have large implications on what then needs to be managed. The statement on storage being required for PFAS containing materials above guideline values until it is treated to remove PFAS includes biosolids and wastewater effluent, this would be unworkable at the scale Melbourne Water operates at. **Melbourne Water therefore recommends:** • Defined criteria for the specific risk of PFOS and PFHxS for soil from the EPA in section 8.1. • References to wastewater effluent and biosolids are removed from section 10.1 of the NEMP.

13th June 2019

EPA Victoria
200 Victoria Street,
Carlton VIC 3053
Via email

PFAS National Environment Management Plan (NEMP, Version 2.0) City West Water Response

Organisational Description

City West Water is a statutory water authority incorporated under the *Water Act 1989*. It is one of the three retail water corporations (with South East Water and Yarra Valley Water) in metropolitan Melbourne, owned by the State of Victoria. City West Water's core business is the supply of water, sewerage, trade waste and recycled water services (where available) to customers in accordance with our Customer Charter. City West Water currently services approximately 444,000 properties across a service area of more than 700 km^2, with over 1 million customers; of which 7,400 are trade waste customers. This represents 51% of metropolitan Melbourne's trade waste.

Annually, City West Water supplies approximately 100 billion litres of drinking water to customers, transferring approximately 94% of sewage and trade waste collected to Melbourne Water's Western Treatment Plant, located at Werribee. The remaining 6% is treated by City West Water's Treatment Plant in Altona.

City West Water's vision is to be an "exceptional service provider that puts customers first and benefits the community".

Endorsement of Melbourne Water Submission

City West Water endorses Melbourne Water's response to the Environmental Protection Authority's (EPA) PFAS National Environmental Management Plan (NEMP), version 2.0. We acknowledge the significant consultation amongst all water retailers within metropolitan Melbourne in the drafting of the Melbourne Water submission. City West Water further re-iterates the importance of the four inter-related elements that are critical in ensuring success of the proposed reform: setting clear and practical standards, ensuring perverse outcomes are avoided, effective implementation, and clear and transparent changes to the NEMP over time.

Impact on our Business

Melbourne Water's response to the PFAS NEMP (version 2.0) provides critical detail of issues that impact City West Water's operation and licensing of the Altona Treatment Plant (and surrounding environmental impacts). These issues are: implementation, cost benefit, proposed metrics and application, background levels, operational issues, new research and science, and consideration to bio solids.

Impact on our Customers

As City West Water collects 51% of total trade waste within metropolitan Melbourne, any and all impacts that the PFAS NEMP (version 2.0) may have on our trade waste customers is a significant priority. These effects to trade waste agreements are detailed within the Melbourne Water response to the PFAS NEMP (version 2.0). In addition, City West Water emphasises the synergistic role that industrial waste treaters have with the wastewater treatment industry, and highlight that consultation with said industry is crucial for an effective environmental reform.

City West Water welcomes and supports continued consultation in respect to the ongoing formulation of the PFAS National Environmental Management Plan. We further emphasise continued support for the previously discussed option to ratify and phase out all non-essential uses of per- and poly-fluoroalkyl substances. This option would provide the ideal outcome for both customers and the business (as detailed in City West Water's previous submission).

Melbourne metropolitan water businesses strongly advocate for the management of risk and safety of our people and our customers. These water businesses have adopted a collaborative industry approach to sewage quality under an Integrated Sewage Quality Management System (ISQMS), as based on the ISO 22000 risk management framework.

For further information on City West Water's endorsement of Melbourne Water's ISQMS submission of the PFAS NEMP (version 2.0), please contact Maree Lang – General Manager Infrastructure & Delivery via email: Maree.Lang@citywestwatercom.au.

Yours sincerely,

Maree Lang
General Manager Infrastructure & Delivery

Yarra Valley Water

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18 June 2019

PFAS Draft NEMP Consultation Feedback
PFASstandards@environment.gov.au
EPA Victoria

Submission for PFAS National Environment Management Plan consultation draft - version 2

Yarra Valley Water welcomes the development of the PFAS NEMP 2.0 consultation draft and recognises the important step this is in the management of an emerging contaminant. We recognise the benefit of a nationally consistent approach to the environmental regulation of PFAS and we also agree that the PFAS NEMP needs to be an adaptive document that will change as information becomes available over time.

We note the reference to wastewater and biosolids as sources of PFAS. Yarra Valley Water jointly with South East Water, City West Water and Melbourne Water have an Integrated Sewage Quality Management System (ISQMS) across the Melbourne metropolitan water industry. This system is assessed against ISO 22000 and has been established to improve the management of the risk that sewage quality poses to the following five key objectives:

- Safety of people
- Protection of assets
- Facilitation of licence compliance
- Facilitation of recycling (biosolids, biogas, recycled water)
- Protection of treatment plant processes

The ISQMS incorporates a protocol for management of emerging contaminants where we undertake investigation to further understand the nature of the issue and options for management. We will openly share information with regards to PFAS within Melbourne's sewerage network as we gather it. Overall, YVW supports in-principle the direction taken in the revised NEMP 2.0, particularly the introduction of a risk-based approach to setting limits for the wastewater sector.

In addition to the feedback provided by Melbourne Water, South East Waster and City West Water, we would like to add the following comments.

As referenced in the VicWater response, it is unclear of the legislative/regulatory standing of this document or whether it is just provided for the intent of industry guidance.

The document has a large focus on the presence, treatment and disposal within the wastewater system. While also touching on other areas, it could be more evenly balanced to include the presence of PFAS within drinking water and stormwater. A holistic integrated water approach across the many responsible authorities is required to ensure outcomes can be achieved.

While the example PFAS management framework provides some guidance, it would be expected that this be covered off as a parameter of concern and integrated into existing drinking water, sewage, treatment and other general environmental management systems and functions rather than generate a specific framework for PFAS alone.

In respect to appendices:

Appendix D- 9.3

"At present, EW does not direct significant quantities of treated effluent to beneficial use as recycled water."

YVW seeks to highlight that beneficial uses of recycled water are a key part of the business. Significant time and money has been spent implementing Class A recycled water schemes, which is delivered via third pipe to over 25,000 homes. In addition, Class B is delivered for various non-residential applications, including municipal and agricultural irrigation.

YVW therefore recommends adding additional text at the beginning of Appendix D to ensure this remains as a guide and does not become the only pathway. It should at least emphasise that this is just one example, and each utility may take its own risk-based approach in line with the General Environmental Duty. This risk-based approach needs to allow provision to undertake a holistic approach to risk assessment in line with corporate risk frameworks, taking into account additional factors such as cost and reputational risk.

Appendix D- 9.3 (and 6.1)

"This will include testing of receiving soils, groundwater and downstream environments for PFAS contamination before the application of recycled water, testing of recycled water, and testing of receiving soils, groundwater and downstream environments after the application of recycled water across several years."

"The sampling strategy targets relevant media in the following locations:
...
• influent in the sewage network, stratified to separately identify sewage from domestic, general non-domestic and industrial catchments
• effluent at critical control points within WWTPs
• treated effluent and any other emissions discharged to the environment
• WWTP products for beneficial reuse prior to sale
• sites where beneficial reuse products have been used in the environment."

YVW seeks to highlight this indicates that with the high cost and sensitive nature of each sample, ongoing sampling at each of the recommended points will be cost prohibitive and will undermine the validity of supplying recycled water. The addition of sampling to the ongoing monitoring program; of the influent, the product (at both class B and A tanks, as well as point of supply), and the receiving environments (groundwater, soil, and waterways), across all our recycled water schemes, would equate to costs five times our existing recycled water monitoring program if samples were taken monthly. This expenditure would require approval by the Essential Services Commission at our next pricing submission in 2023 and would likely be reflected by an increase in customers bills. This financial burden would have a disproportionate impact on smaller utilities, who are unable to spread the costs over a wide customer base.

YVW therefore recommends additional text is included as clarification to allow water utilities to operate with flexibility, adopting their own level of monitoring based on relative risk, size, emerging information, and advancing technologies.

General

YVW seeks to highlight that recycled water has widespread use across our service area, in public open spaces and individual homes, for crop irrigation, and drinking water and fodder for livestock. A rollout of a large scale monitoring program and customer communications package around PFAS in recycled water may lead to a complete rejection of water recycling and reuse, concerns around historic exposure, and large scale cost recovery for the potentially "contaminated" land, including homes we have mandated to connect to recycled water for irrigation, in line with DELWP state policy.

YVW recommends careful consideration is given to public perception, allowing utilities to proceed in a manner they have deemed appropriate. Water utilities will continue to work with each other and their state regulator to address emerging contaminants in a way that ensures the protection of public health and the environment, while continuing to promote recycled water use.

Regards

Steve Lennox
General Manager – Retail Services

South East Water

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20th June 2019

PFAS NEMP Coordinator
Emerging Contaminants Section
Department of the Environment and Energy
GPO Box 787
Canberra 2601

RE: PFAS National Environmental Management Plan Version 2.0 Consultation Draft

Thank you for the opportunity to make a submission to the PFAS National Environmental Management Plan (NEMP) Version 2.0 Consultation Draft. South East Water and the Victorian water industry have been involved in a number of projects, workshops and discussions regarding the impact of PFAS (PFOS, PFHxS and PFOA) on water supply and treatment plant reuse products. A major concern with the proposed NEMP is that there should be a focus on eliminating the source of PFAS through a ban on importation, manufacture and/or use. In the absence of any proactive source control initiatives, PFAS will be an ongoing issue. Additionally, without regulatory oversight and feasible mitigation options for general population and industry customers alike, it will drive an adverse outcome of redirecting PFAS contaminated groundwater and surface water runoff to the sewerage network. This will place additional burden on wastewater treatment utilities and make it impossible for these utilities to achieve the objectives of the EPA's Waste Management Hierarchy, which has been successfully implemented through the use of recycled water and the application of biosolids to land.

It is not possible for a wastewater treatment utility to manage the risk associated with any emerging contaminant in which they have no effective control over its discharge to sewer and no feasable treatment process to destroy or permanently capture it. PFAS are almost certainly in every sewage catchment in Australia and therefore in all biosolids, effluent and recycled water. There is no immediate solution to treat these reuse products and they cannot be stored indefinitely and these products containing PFAS must be reused or dispersed to the environment. This is the reality of the current situation. The PFAS NEMP is idealistic in any suggestion that a wastewater treatment utility can effectively manage PFAS in their reuse products and especially with regard to the guideline value for the 99% species protection of aquatic ecosystems.

If the associated risks to human and environmental health are unacceptable then the only effective management option is ceasing the importation, manufacture and use of products containing PFAS. Source control is the key; however, wastewater treatment utilities do not have any enforceable discharge limit on the concentration of PFAS in trade waste. PFAS is also present in a wide range of domestic products, which limits the efficacy of any trade waste

South East Water Corporation
ABN 89 066 902 547

control. A regulatory impact statement was submitted to the Department of Environment and Energy (Department) in February 2018 and recommended phasing out all non-essential uses, yet no action has been taken. If further information is needed to make an informed decision it is the responsibility of the Department and HEPA to take leadership as a robust risk assessment is a prerequisite to risk management. There needs to be an action plan and not just a management plan.

South East Water wish to work in collaboration with the Department, HEPA and the environmental regulators to take a precautionary but practical approach to managing the risks associated with PFAS. That approach must recognise that the wastewater treatment businesses are not the polluters. They do not provide a service to manage toxic and recalcitrant compounds. The polluters are those using, importing and manufacturing PFAS and it is the responsibility of the environmental regulators to manage those polluters. This is a fundamental change in accountability. The NEMP needs to do a lot more in addressing the critical role of the Department, HEPA and the environmental regulators.

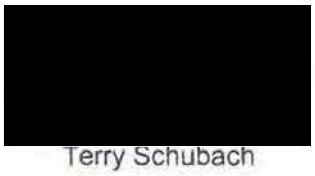
South East Water's specific response to the recent changes in PFAS NEMP 2.0 are attached. If you have any queries or would like to discuss our response in more detail please contact Tara McCormack, Group Manager Product Quality on 0409 180 507.

South East Water Organisational Description

South East Water is a statutory water authority incorporated under the *Water Act 1989*. It is one of the three retail water corporations in metropolitan Melbourne owned by the State of Victoria. South East Water's core business is the supply of water, sewerage, trade waste and recycled water services to customers.

South East Water currently services approximately 760,000 properties across a service area of more than 3,640 km^2 with over 1.79 million customers including some 11,000 trade waste customers. South East Water supplies approximately 140 billion litres of drinking water and collects approximately 130 billion litres of sewage and trade waste every year.

Yours sincerely,



Terry Schubach

General Manager Customer Service Delivery

South East Water Corporation
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8. Environmental guideline values

8.1 Human health guidance values

Table 2 must specify whether results are per dry weight or wet weight of soil. Exactly how have soil to plant transfer factors in the NSW technical review been used to adjust the soil guidance values for direct exposure? The transfer of PFAS (PFOS/PFHxS and PFOA) from soil to plants is expected to decrease the risk to human health. What soil ingestion rates were used from the ASC NEPM HIL A? Please provide a technical report on the derivation of the soil guidance values for direct exposure to answer these questions. Technical reports should be provided for the derivation of all guideline values and the Environment and Climate Change Canada (ECCC) provides good examples of the information that could be provided.

8. Environmental guideline values

8.2 Ecological guideline values

A technical report on the derivation of the ecological health guideline values should be provided. The ECCC guideline values have effectively been adopted in the PFAS NEMP 2.0 after considering the relevance to the Australian environment but exactly what are the details of that review? It is stated that the ecological guidance values may be too conservative where the potential degree of indirect exposure is significantly limited and there are some examples of relevant considerations; however, it would be beneficial to provide some explicit consideration for the land application of biosolids used for agriculture. For example, are agricultural sites considered to be intensively developed and effectively absent from secondary consumers and are they too small to have an impact on the food chain? What needs to be considered in reviewing whether a site is in close proximity to waterways and groundwater, *i.e.*, buffer distances, soil types?

Why have the marine guideline values in CRC Tech Report 43 still not been reviewed in PFAS NEMP 2.0? The CRC Tech Report 43 indicates that the interim use of the freshwater guidelines may be overly conservative by a factor of 1000.

It needs to be made clear that the soil and aquatic ecological guideline values are not effluent limits or "never-to-be-exceeded" values as per the ECCC Federal Environmental Quality Guidelines, which were used to update the PFAS NEMP.

10. On-site storage, stockpiles, and containment

10.1 Storage, stockpiles, and containment

Remove all reference to wastewater treatment plant effluent. SEW cannot store or contain the 130 billion litres of effluent produced every year.

10. On-site storage, stockpiles, and containment

10.2 Design considerations

How do the design considerations for the storage of biosolids containing PFAS differ to the construction guidelines specified by the state and territory environmental regulators? SEW oppose any additional requirements regarding the current and future storage of biosolids.

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10. On-site storage, stockpiles, and containment

10.3 Guidance note - On-site storage and containment

As above.

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12 Reuse of PFAS-contaminated materials

12.1 Reuse without a risk assessment

Figure 1 states that if a soil leachate contains PFOS above the WQG freshwater 99% species protection DGVs a further risk assessment is required in consultation with the regulator before reuse can proceed. As the limit of detection for PFOS is above the WQG freshwater 99% species protection DGVs what action is to be taken if the results are below the limit of detection?

What conditions are to be used to perform the soil leachate test as the ASLP can be performed using different solutions and dilution factors? As mentioned in CRC Tech Report 43, the risk to groundwater from soil leachate needs to consider the relative rates of rainfall and groundwater movement, absorption in soil and the depth of the groundwater. It is overly conservative to apply the WQG freshwater 99% species protection DGVs to a soil leachate result as it will not directly impact the aquatic ecosystem. The pathway of exposure from the movement of PFOS through soil and groundwater should consider a review of the ECCC Federal Environmental Quality Guidelines for soil and groundwater quality. This will provide a more practical approach to the protection of aquatic ecosystems from the land application of biosolids.

If the answer to 3C (Figure 1) is yes there is no consideration of the background concentrations in the groundwater/surface water. If the background concentrations are already above the WQG freshwater 99% species protection DGVs it should be made clear that the material can be used without a further assessment of risk. The decision tree should also consider the amount of soil material being reused, which may be too small to have any impact on the food chain as referred to in section 8.2.

If the soil leachate contains PFAS above the WQG freshwater 99% species protection DGVs a further risk assessment is required. How can we be expected to properly assess risk against the uncertainty of the DGVs and exposure pathways that we do not properly understand? From our experience the environmental regulator is making decisions based on overly conservative qualitative risk assessments. There needs to be a scientific approach and the PFAS NEMP should provide further guidance. The Australian and New Zealand Water Quality Guidelines state that the 99% species protection level applies as a default to slightly to moderately disturbed ecosystems. For highly disturbed ecosystems the 95% species protection level should apply as per the Victorian State Environment Protection Policy (Waters) No. S 499.

The draft PFAS NEMP 2.0 appears to be biased towards managing the risks associated with the use of biosolids contaminated with PFAS compared to the use of recycled water for irrigation or discharge to aquatic ecosystems. While the majority of PFAS partition to the biosolids they are generally applied only once to agricultural land and do not have a direct pathway to aquatic ecosystems whereas effluent is discharged directly and indefinitely to aquatic ecosystems.

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15. Wastewater treatment

15.1 PFAS Management Framework

The statement "Criteria for environmental contaminants, including PFAS, are established by the relevant wastewater utility in partnership with the environmental regulator..." does not reflect the current relationship. There is a consultation process before the draft PFAS NEMP 2.0 is finalised; however, there is no direct response from HEPA with regard to our concerns.

We understand the intent of the precautionary approach; however, PFAS is an issue because it is recalcitrant to all treatment processes and passes through to the biosolids and effluent/recycled water and these contaminated materials must be discharged to the environment. The only realistic way to manage PFAS is to prevent it from entering into the sewerage system but no wastewater utility can control the input of PFAS from domestic sources and there is very limited action that can be taken to manage input from trade waste source. The statement that "All relevant legal and regulatory requirements are met including compliance with the PFAS NEMP" must be amended to remove the requirement to comply with the PFAS NEMP. We have an obligation to manage environmental risks but we have had verbal instruction from our environmental regulator that there is no legal or regulatory requirement to comply with the PFAS NEMP. The PFAS NEMP rather provides a guideline for management.

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15. Wastewater treatment

15.2 Additional management tools

This section puts the onus on the wastewater utility to fund applied research to address any knowledge and technology gaps. The environmental regulators should be leading research activities in collaboration with the wastewater utilities to address these gaps to provide a more robust management plan rather than a precautionary management plan.

Appendix D. Example PFAS Management Framework for a Wastewater Utility

The key risk is the management of PFAS entering into the sewage network and the example management framework clearly addresses this (refer section 5.1); however, trade waste agreements in Victoria do not specify a limit for the discharge of PFAS and any proposal to amend the agreements requires ESC approval. This issue must be addressed in section 7.1 as there are currently no enforcement procedures with regard to PFAS discharged by our trade waste customers.

While the long term risk to human and environmental health are not definitive it is unreasonable to expect the wastewater utilities to invest in treatment technologies to destroy or permanently capture

PFAS from its reuse products. This would be unprecedented. The focus should be on managing the input of PFAS from domestic and trade waste sources and further research to better understand the risks to make informed management decisions. This should be addressed in section 9.

Section 9.2 should clarify that the 99% species protection level applies to slightly to moderately disturbed ecosystems. For highly disturbed ecosystems the next level of species protection should apply as per the Victorian State Environment Protection Policy (Waters) No. S 499, *i.e.*, the 95% species protection level.

Section 9.4 should recognise that the reduction of PFAS in biosolids applied to land is a long term strategy that will need to be done in collaboration with the environmental regulator in line with the example management plan for effluent discharged to aquatic ecosystems (refer section 9.2).

South East Water Corporation
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Draft PFAS NEMP Version 2 – Written Submission Cover Sheet

Name (optional):
Science and Innovation Team

If applicable – Organisation:
Hunter Water

Address (optional):
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Position (optional):

Email (optional):
zoe.rogers@hunterwater.com.au

Confidentiality

(i) Confidentiality requested? ~~Yes /~~ No

(ii) If so, does part of your submission include confidential or sensitive information? ~~Yes /~~ No

Have you provided confidential or sensitive information in a separate attachment *Yes / No*

Have you provided a redacted version *Yes / No*

Draft PFAS National Environmental Management Plan Version 2 sections

If you have specific comments or suggested text changes, please clearly identify the extract of the relevant part of the NEP on which you are providing feedback.

Overarching comments:

Purpose of NEMP

The purpose of the NEMP is stated on page 3 under **The Plan: Guiding environmental regulation of PFAS**. Primarily, the guidance is targeted at state environment regulators; and the text under this heading has not been added to or edited in v2.0. However, v.2.0 has been expanded to include guidance targeted at water utilities in response to the many uncertainties around risk assessment and management of PFAS in water and wastewater by utilities and regional councils.

There are statements throughout v2.0 which suggests that each water utility must or should comply with the NEMP as a standalone document (in addition to regulatory requirements within each jurisdiction). Specific examples are provided under section headings below. This is contrary to the guidance provided around PFAS management frameworks for wastewater and biosolids.

Risk Assessment approach

We generally support the underpinning guiding principles that emphasise effects-based risk assessment and adaptive management for PFAS that enables flexibility to respond to changing priorities and new information. Management for 'Net environmental benefit' is important; noting that utilities have finite resources that should be targeted for maximum gain for the environment and our communities. The high costs of removing PFAS from effluent could prevent other environmental mitigation work being done, unless dedicated resources are provided to utilities to achieve this. PFAS is just one class of numerous persistent contaminants of concern that pose management challenges for water utilities now and in the future.

Source Control

Preventing contamination of wastewater is much more cost effective than removing low concentrations of contaminants from effluent and biosolids. PFAS concentrations in trade waste can be highly variable, but trade waste volumes vary significantly. It is the total load of PFAS entering a wastewater treatment works (WWTW) from its sewerage catchment that determines the concentration in effluent and biosolids generated by the WWTW. As such, load-based licence conditions for PFAS (and other contaminants) can give utilities flexibility in managing PFAS risks. As PFAS is predominantly a legacy issue, this would require utilities to renegotiate existing TW agreements, which is more time consuming for utilities than issuing agreements for new connections.

Precursor compounds

Studies of PFAS in wastewater and PFAS biotransformation in wastewater treatment plants in recent years has shown that municipal wastewater contains highly variable loads of diverse precursors of the three regulated chemicals PFOS, PFHxS and PFOA. To adequately manage risks from tradewaste connections, it is very important that utilities monitor precursor compounds (i.e. the typical analytical suite of 28+ compounds available from most commercial labs).

Responsibility for contaminated wastewater and end products

Concrete sewer assets become contaminated with PFAS from contaminated wastewater, relative to the original concentrations. Thus, wastewater from an affected part of a sewer network will continue to deliver elevated PFAS to the WWTW long after the source/s have been disconnected or PFAS loads mitigated/diverted. The same is true where PFAS in contaminated groundwater infiltrates leaking gravity sewers. It is effectively impossible for utilities to recover any costs under these situations due to the ubiquity of PFAS in sewage and PFAS contamination of industrial sites and estates over many decades.

Without extensive replacement of large areas of contaminated sewer assets, utilities are unable to control ongoing PFAS contamination of WWTW outputs. Similarly, utilities have no means of controlling ongoing diffuse inputs of PFAS (or any other chemical) into municipal sewage. Thus the legal responsibilities and any ensuing costs of mitigation should not be borne by utilities alone.

It is unclear where legal responsibility lies for the contamination of effluent and biosolids reuse sites, both historical (prior PFAS being identified as a persistent contaminant) and ongoing, particularly under third party agreements for reuse.

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8. Environmental guideline values

8.1 Human health guidance values

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8. Environmental guideline values

8.2 Ecological guideline values

P24 notes that state regulators may elect to specify the level of environmental protection to be achieved across an entire jurisdiction (e.g. the 99% species protection). However, we argue this would cause misdirection of limited resources which would be better used to protect the most sensitive aquatic endpoints (including commercial and recreational fishing/shellfish harvesting). Instead, we stress the importance of working collaboratively with utilities, using existing and new data, to determine which level of protection is optimal, with the overall objective of 'net environmental benefit' using limited resources.

Site-specific guideline values (GVs) for all chemical and physical stressors in fresh and marine waters are lacking for the coastal margin of NSW, where most of the population resides (and utilities including Hunter Water). This is despite the wealth of data that has amassed in the grey literature across numerous agencies and utilities in NSW over decades. The NSW government has a responsibility to collate and synthesise these data into conceptual models for waterways by region, with major river systems as a priority. This would inform which PFOS and PFOA GV from the Australian and New Zealand Fresh and Marine Water Quality Guidelines (WQGs) is most appropriate to use for each receiving environment. The updated default GV for 99% species protection will not be published until after comments are made to the draft NEMP v2.0, and

possibly not until after v2.0 is finalised. The current GV is based on very limited data that is not reflective of aquatic receiving environments of individual utilities.

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10. On-site storage, stockpiles, and containment

10.1 Storage, stockpiles, and containment

'PFAS-containing solid waste' including biosolids is referred to as contaminated waste, along with high concentration PFAS sources such as AFFF, without acknowledging that most municipal biosolids have very low PFAS concentrations if there is no PFAS hotspot industry in the sewer catchment of the WWTW they were produced in. This labelling of biosolids as a contaminated waste product completely disregards the many demonstrated opportunities for beneficial reuse of this product. Resource recycling has long been promoted by Australian governments.

This section should include acknowledgement that state jurisdictions already regulate or are involved in the management of biosolids from WWTWs, and that utilities are already managing temporary storage stockpiles with containment principles as a high priority. Specific guidance on how to adapt existing management practices for biosolids stockpiles would be useful, as most utilities will not have the option of designing and constructing new storage facilities for biosolids.

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10. On-site storage, stockpiles, and containment

10.2 Design considerations See above – most utilities are already implementing these design principles under state regulation and best practice.

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10. On-site storage, stockpiles, and containment

10.3 Guidance note - On-site storage and containment

There is no guidance as to who is responsible for enforcing these protocols. Follow up to ensure compliance with consent conditions is often lacking from consent authorities, even for hazardous waste sites.

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12 Reuse of PFAS-contaminated materials

Again, the use of 'elevated' without any context or explanation is confusing. For utilities, the practical definition of 'elevated' would be elevated above typical background levels for biosolids, based on routine monitoring; or elevated above a published threshold (e.g. soil investigation levels).

12.1 Reuse without a risk assessment

The decision tree in Figure 2 is much too prescriptive, considering that local jurisdictions are the authority for biosolids reuse. Inclusion of the 99% species protection guideline value in the

decision tree in Figure 2 as a trigger for further risk assessment automatically mandates a risk assessment for every application site, every time, as this GV is below trace LOR. The revised GV for 99% species protection, yet to be released, is likely to be lower than typical ASLP results for biosolids with typical low background levels of PFAS compounds, because acid leachate test results in much higher PFAS extraction compared to normal soil water infiltration. This will prevent the beneficial reuse of biosolids as a soil fertiliser and therefore should be assessed in a regulatory impact assessment of the NEMP.

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15. Wastewater treatment

15.1 PFAS Management Framework

P61 regarding the three bullet points for key areas of an effective management framework:

Wastewater inputs – this is a critical part of the monitoring effort by utilities. Adequate sampling for characterisation (baseline concentrations) at suspected PFAS hotspot trade waste connections and raw influent at WWTWs may be adequate if there is consistently low PFAS concentrations (or scale back to seasonal for the longer term dataset). The frequency of routine monitoring of confirmed hotspot connections should be informed by the risk, i.e. the PFAS loads produced.

Wastewater processing – this is much less important for wastewater utilities using 'typical' conventional wastewater treatment technologies, given the high cost of monitoring. PFAS transformation pathways have been studied and described across a broad range of municipal wastewater treatment plants in various climates around Australia and overseas. Baseline sampling of WWTW influent and effluent should be adequate to assess general biotransformation patterns within a particular WWTW, provided typical operation is generally consistent.

Wastewater outputs – monitoring of effluent and biosolids should be informed by risk assessment informed by: the size of the sewer catchment, the proportion of residential vs tradewaste connections, types of industry, and the receiving environment and end users. A one size fits all approach is not appropriate for monitoring chemical contaminants.

> P61: "All relevant legal and regulatory requirements are met including compliance with the PFAS NEMP." This suggests compliance with the NEMP is a regulatory requirement; this is not the case.

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15. Wastewater treatment

15.2 Additional management tools

> These are taken as a list of recommendations of management tools which can be used at the discretion of each utility based on the level of risk, rather than a prescriptive list.

Appendix D. Example PFAS Management Framework for a Wastewater Utility

The example framework provides useful guidance for utilities but should not be seen to be prescriptive or opt-out.

5.2 Risk Assessment

Table 1: the risk type 'legal' should be added to the hazardous events in rows 1, 2 and 6 (and potentially all) due to the current uncertainty around utilities' responsibility for PFAS contamination of wastewater and associated infrastructure and receiving environments.

Table 1 repeatedly refers to 'elevated PFAS' without any explanation or definition of 'elevated' – i.e. compared to <LOR or compared to 'typical' wastewater PFAS levels (e.g. trace levels often present if trace lab methods are used).

Financial costs are included in Table 1, however there is scant mention of the financial burden on utilities throughout the NEMP. The scale of investigation, management and remediation actions both recommended and strongly implied throughout the NEMP (including the Example Framework) will require substantial investment by utilities which will be prohibitive for many unless the costs are passed on to the customers. A regulatory impact assessment of the NEMP should be carried out if its purpose is to be a management plan to be adopted by individual utilities.

6 Monitoring and analysis

As per the above, monitoring programs should be informed by risk assessment rather than undertaken on a one-size-fits-all approach.

6.1 Sampling

"Sites where beneficial reuse products have been used in the environment."

PFAS concentrations for effluent and biosolids from typical WWTWs (i.e. not heavily contaminated by PRAS hotspot/s) are very low. Therefore, soil and groundwater PFAS concentrations at most reuse sites will very likely be negligible unless other contamination has occurred. Therefore, initial sampling should be targeted at reuse sites where it is known that higher strength biosolids or effluents have been applied in the past and where the receiving environment is most sensitive. For instance, mine rehabilitation sites are not a high priority because they typically have a closed loop for surface water runoff and pumped groundwater (which is already contaminated from mining). Whereas, agricultural sites adjoining natural watercourses are higher priority.

Which party or agency has legal responsibility for undertaking investigations at reuse sites is a matter for each jurisdiction. It is not automatically the responsibility of the utlity; and this should be noted in the NEMP and example framework. Guidance from state jurisdictions is needed by utilities on this point.

7.1 Trade Waste controls

There should be discussion of the risks posed by tankers discharging to WWTWs, as utilities may be unaware of this risk. Monitoring and controlling tankered waste is more challenging for utilities than fixed TW connections.

7.2 Domestic controls

“In consultation with the Example Jurisdiction EPA, EW will actively consider the suitability of new technologies and any other opportunities that may arise to assist with controlling PFAS in domestic wastewater.” This is not relevant to low concentration, diffuse PFAS inputs from domestic and low-strength tradewaste connections. However, point source PFAS pre-treatment technologies deployed at hotspot tradewaste properties could be part of the management toolkit for some utilities. It is not the responsibility of the utility to undertake due diligence on new technologies or direct any TW customer to use a specific technology. PFAS limits on tradewaste agreements should be set with an understanding of what PFAS removal rates can be achieved by different technologies; and informed by what level of risk is posed by that customer (based on the factors described above including total PFAS load and receiving environment).

8. Processing Stage

“EW will continue to work with regulators and experts to review options to better manage PFAS contamination across the board at the processing stage. A key focus for this work will be identifying affordable, efficient and scalable infrastructure or other technologies to control PFAS before it reaches the environment.”

The NSW EPA traditionally has remained agnostic to particular technologies and focused on the treatment standards, leaving commercial decisions to licence holders. The above approach would be a departure from that stance; however it would be beneficial to utilities if regulators continue to educate themselves about PFAS treatment technologies. This may be more appropriate though partnerships with research bodies (e.g. universities, CRCs, WaterRA) than with individual utilities.

Consideration has not been given to the potential negative environmental impacts of PFAS removal technologies, including the production, transport and disposal/destruction of synthetic resin polymers; and high energy use for technologies involving ozone production and/or high temperature. Chemical air and water emissions as well as greenhouse gas emissions would become significant if all effluent is treated to <LOR for PFAS. Net environmental benefit must be factored into decision making.

9.2 Effluent discharged to aquatic ecosystems

P96: “Consistent with the PFAS NEMP, EW aims to reduce the concentration and load of PFAS in effluent as low as possible and, in the long term, below the limit of detection for perfluorooctane sulfonic acid (PFOS), perfluorooctanoic acid (PFOA) and perfluorohexane sulfonate (PFHxS) and any other PFAS identified as being of high concern.”

“In practice, EW aims to work towards the reduction of PFAS in effluent over the long term, in partnership with the Example Jurisdiction EPA, other stakeholders and the community, to achieve the water quality default guideline value at the 99% species protection level set under the Australian and New Zealand Water Quality Guidelines.”

These statements are at odds with the overarching approach of contextual and adaptive risk assessment and management of PFAS. The updated default GV for 99% species protection will not be published until after comments are made to the draft NEMP v2.0, and possibly not until after v2.0 is finalised. The current GV is based on very limited data that is not reflective of aquatic receiving environments of individual utilities. Even as aspirational goals the above limits are currently unrealistic and for many utilities unachievable, without fundamental changes to funding models.

Without investing in new WWTW technology, the removal of PFAS in effluent discharges to environment is not possible. As noted previously, PFAS removal technology is prohibitively expensive to roll out to all WWTWs and is not feasible for utilities without passing the costs on to customers or requiring much larger capital budgets from treasury.

9.3 Recycled water used in the built environment or in products, discharged to stormwater systems, applied to terrestrial ecosystems or injected into groundwater

This section refers to avoiding "contamination of sensitive environments or food webs" with PFAS from repeated application of recycled water, without defining 'sensitive'. It then goes on to describe management practices that in effect would assume every receiving environment within a utilities area of operations is 'sensitive', which is a one-size-fits-all approach that negates site-specific risk assessments. Furthermore, it disregards the fact that many utilities already provide a substantial proportion of treated effluent to third parties for irrigation on farms and recreation facilities, and have done so for decades in many cases. Monitoring of historical application sites should not automatically be the responsibility of the utility that supplied the recycled water.

Reuse of recycled water has been encouraged by state and federal jurisdictions for more than a decade, particularly in response to drought conditions. It is expected that water scarcity will continue, and likely worsen, as populations grow and climate change impacts take greater effect. There is a trade off between beneficial reuse during great demand for fit-for-purpose water, and risk mitigation for all trace contaminants in that water, not just PFAS. This is a broader conversation that needs to involve government agencies other than EPA.

"The beneficial reuse of recycled water in products, such as soil conditioners, is a matter for the Example Jurisdiction EPA." It is not clear what this sentence is referring to; it implies uses other than irrigation of recycled water.

There is no guidance for design of recycled water monitoring programs; whereas this information is provided for sewer network and sampling at WWTWs in Sections 6.2 and 7 of the Example Framework.

9.4 Biosolids applied to terrestrial ecosystems or in products

It would be useful if this included a case study using the decision tree in Figure 1, Section 12 of the NEMP, if this is the preferred approach. Further guidance on the "biosolids lifecycle risk assessment and an inventory of PFAS in biosolids" would be welcome, particularly as Figure 1 does not specifically refer to the entire lifecycle of biosolids. Risk assessments are not a priority for biosolids with low PFAS concentrations; and if Figure 1 is modified to remove reference to the 99% species protection GV, may not be required at all.

9.5 Biosolids disposed to landfill or other disposal

There is a real risk for utilities that landfill facilities will not accept biosolids. This is a major financial risk for utilities and should be included in a regulatory impact assessment.

Draft PFAS NEMP Version 2 – Written Submission Cover Sheet

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Confidentiality

(i) Confidentiality requested? ~~Yes /~~ No

(ii) If so, does part of your submission include confidential or sensitive information? ~~Yes /~~ No

Have you provided confidential or sensitive information in a separate attachment ~~*Yes /*~~ *No*

Have you provided a redacted version ~~*Yes /*~~ *No*

Draft PFAS National Environmental Management Plan Version 2 sections

If you have specific comments or suggested text changes, please clearly identify the extract of the relevant part of the NEP on which you are providing feedback.

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8. Environmental guideline values

8.1 Human health guidance values

There is still ambiguity in the guidelines for residential soils. For example, what is the level for home grown eggs? How is that controllable in the public realm for residential soils?

What about other soils like biosolids amended soils or composts or recycled water for food? It would be of value to provide guidance on appropriate management.

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8. Environmental guideline values

8.2 Ecological guideline values

NEMP2.0 recognises that there is an issue with the 99% species protection level being below the LOR for most testing (and that it is often below the background level in receiving waters), so the guideline suggests defaulting to 'non-detection' may be the alternative. This implies a nil discharge view. It is also our understanding that the science behind the 99% species protection level is questionable and is currently being revaluated. This needs to be made clear.

Also, the levels of detection changes with time as analytical techniques improve and much of the PFAS identified is from legacy use. Perhaps the focus should be on what levels are in the ecology and how to minimise this through pathway control and levels in products. If the analytical detection level is 0.001 µg/L and test results are below that, at what point does it trigger the need for testing aquatic biota?

Guidance is required at this level if we agree to protect 99% of species.

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10. On-site storage, stockpiles, and containment

10.1 Storage, stockpiles and containment

Storage, stockpiles and containment includes WWTP effluent and implies that wastewater is a contaminated product, which is not necessarily the case.

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10. On-site storage, stockpiles, and containment

10.2 Design considerations

10. On-site storage, stockpiles, and containment

10.3 Guidance note - On-site storage and containment

Who checks that industries that use PFAS are located below the 1:100 year AEP for flood? Is there a requirement for storage of PFAS source? Does transport of PFAS fall under waste tracking?

12 Reuse of PFAS-contaminated materials

12.1 Reuse without a risk assessment

What is the criteria that determines what is PFAS contaminated soil in the first place? Do all soils need this screening or is it only those from known “hotspot” locations?

15. Wastewater treatment

15.1 PFAS Management Framework

There appears to be an assumption that all wastewater is contaminated, primarily via trade waste inputs, and there should be no discharge of contaminated material to the environment. However not all wastewater contains PFAS above levels of detection.

The PFAS Management Framework needs to include the requirement for a risk assessment upfront. If a utility has done a comprehensive risk assessment and found the risk is low, supported by targeted PFAS testing, then is there still the need to develop a management plan for the system? It would be better to undertake a risk assessment in the first instance to see if there is a risk of the effluent being above the guideline level, then develop a targeted management framework to address these risks.

For large utilities, the cost to implement the described PFAS management plan across the whole network will be exorbitant and provide little gain for the expenditure. It needs to be targeted based on risk.

Smaller regional utilities may not have the funding available. The extent of monitoring needs to be based on the level of risk to the community and the environment.

Is the NCWG able to develop a risk based decision tree to guide action at the right level based on risk?

There is little guidance in the NEMP2.0 on trade waste acceptance standards. It would benefit from including system specific risk assessments to drive appropriate management of customer discharge, rather than generic, overly conservative, acceptance criteria. The initial NEMP indicated there would be work done to establish trade waste criteria and guidance on trade waste for water authorities. NEMP2.0 Table 8, page 78 indicates this would be complete in June 2018. What are the methods being used to derive appropriate trade waste acceptance criteria or specific criteria relevant to trade waste?

Trade waste also needs to consider risk. What is the risk we are managing through generic acceptance standards if wastewater influent shows acceptable levels of PFAS? The NEMP hints at this in the example management framework, indicating “Where potentially significant sources of PFAS are identified, EW will aim to work with affected customers to ensure trade waste discharge is consistent with the customer’s trade waste agreement and EW’s trade waste management policy.” Using this approach, utilities could possibly determine a ‘significant source’ based on the impact to the receiving catchment (ie high concentration, very low volume customers may not need source control).

There needs to be more discussion on the implications of source control for affected trade waste industries. What are the reasonable costs to place on a small business to treat at source? The industries discharging PFAS to sewer aren’t necessarily large-scale organisations. It would be good to see a worked example of

PFAS source control being implemented for a small business on a low budget. This would probably highlight the social and economic implications of applying extremely stringent source management criteria to small volume dischargers (where no impact is identified at receiving treatment plants).

If utilities do not accept trade waste inputs containing PFAS, how is industry supported to manage the problem and will the solution be regulated to prevent direct environmental discharges?

It would be helpful to confirm roles and responsibilities (eg the role of the EPA in managing PFAS use) and impacts on trade waste discharge. While source control will be the most cost-effective approach to managing trade waste discharge, no guidance is provided on the EPA's role in determining how PFAS use can be contained at source (eg closed loops).

The assumption is that Utilities would accept trade waste for treatment and pass on the cost to trade waste customers. In the case of PFAS, most wastewater treatment processes do little to mitigate any risk so we can't pass on a cost for something we can't treat. For PFAS the only option is to work with the trade waste customers to implement their own specialised treatment, refuse access to sewer services (but then EPA needs to regulate where the PFAS goes) or all parties work together to find a solution.

15. Wastewater treatment

15.2 Additional management tools

The need for these management tools should be considered based on risk. It is important to remember that PFAS is just one of many chemicals that water utilities need to be vigilant about.

Appendix D. Example PFAS Management Framework for a Wastewater Utility

5.1 Risk sources

This section is very important so that we don't lose sight of the origin of the problem. Wastewater treatment plants are not the source of the PFAS. If we can control/stop PFAS entering the network then there is no risk to the community or environment.

Whether PFAS sources are located in residential or industrial areas is less relevant considering that for wastewater spills or stormwater inflow, these occur to waterways that route flow to other areas.

5.2 Risk prevention

Minimising PFAS entering the system in the first place is the most prudent action financially, and for human and environmental health.

6.1 Sampling

The proposed sampling strategy doesn't consider the overall risk. If the level in the treated wastewater (and other products) is low and below guideline levels then there should not be a need to have a management plan for that system. This needs to be made clear up front.

A risk assessment needs to consider hotspots in the catchment and input from trade waste customers. Initial monitoring by Sydney Water has found that a domestic catchment has levels below the limit of reporting (influent and effluent).

It may be helpful to separate out research and development monitoring to answer a specific hypothesis rather than incorporate into broad scale programs where the interpretation will be difficult given the temporal and spatial variability. Monitoring effluent at "critical control points" for all wastewater treatment plants will give us a lot of data below analytical detection levels or near that level (the data we have currently indicates this for influent and effluent). If the question is about treatment process and what processes could do to change salts, then a separate research program should be designed to test for that specifically.

Monitoring sites where beneficial reuse products have been used in the environment is not practicable as reuse products are applied by contractors up to 300 km out of Sydney. PFAS monitoring requires careful sampling techniques and given the locations and transport distances, this is not practical. Rather to determine what levels are in soil, farm plot trials could be designed to determine risk for the highest risk pathways and cover a wide variety of plant crops. However again, this is a research question and not something that should be expected of utilities.

The overall cost to implement the monitoring program outlined in the framework as it currently stands will be exorbitant, without necessarily providing value to the community/tax payers.

In regards to TOPA analysis, it is our understanding that TOPA is now considered of minimal value except during remediation to define the capacity of the treatment system required.

In general, this Appendix highlights the apparent discordance for the water industry on the management of PFAS proposed in the draft NEMP 2.0. It doesn't appear to consider the overall risk and balance against cost in the way that utilities would consider it.

The use of environmental guideline values in Section 8 of the draft NEMP 2.0 strongly suggests that a risk-based approach is being advocated. This is reinforced in many places in the draft NEMP 2.0, including the description of the Precautionary Principle (Section 3, point 2a), which notes that the principle is risk-weighted.

However, there are statements in the draft NEMP 2.0 that suggest that the aim is nil discharge of PFAS to the environment, presumably in anticipation of Australia ratifying the Stockholm Convention covering PFAS (yet even then, the section on management of contaminated soils notes that the Stockholm Convention and the Basel Convention have an acceptable limit of 50 mg/kg). Section 3.1 discussing contaminated waste, states that 'Dilution is not acceptable for example in soil, compost or other products', which would seem to contradict a risk-based approach.

This is reinforced in the Framework for a Wastewater Utility (Appendix D, Section 9.2), which suggests advising stakeholders that the aim is to move to nil detectable discharge of PFAS to the environment based on the current uncertainty about the long-term impacts of these chemicals on human and environmental health (Section 9.2). This would seem to involve an unwarranted ongoing expenditure given that the levels of discharge now are likely to be small compared to the legacy contamination accumulated prior to restrictions on their use in the early 21st century.

PFAS can be detected where products containing PFAS were once used. It is detected in most human blood samples (most older Australians used Scotchgard™ for example). The Australian Red Cross acknowledges that there "are wide variations in PFOS and PFOA levels in donated blood among the general population" and "does not recommend donors undergo blood testing for the purpose of donating blood". Is it realistic to expect nil detections of PFOS or PFOA in biosolids and other products resulting in landfill disposal rather than beneficial use where levels are already low? Considering we can donate blood and consume food with low levels of PFOS, the management of risk appears disproportionate.

If the level in the treated wastewater (and other products) is low and below guideline levels then there is no need to have a detailed management plan, including regular monitoring across the system. This is how a utility would respond to a risk assessment that indicated low risk from a chemical. This needs to be made clear up front.

If new knowledge demonstrates that the risk assessment requires updating and perhaps that further monitoring is required, this can be done when that knowledge is available.

6.2 Catchment based monitoring

The suggested sampling of PFAS throughout the sewerage network should only be a requirement for a catchment where PFAS contamination above guideline levels has been identified.

The proposed sampling strategy appears to be more about information gathering. The NEMP2.0 isn't an appropriate place to include this. This kind of work is better suited to a University or research facility. The cost to the utility (and in turn the community) will be exorbitant and unnecessary if the risk had already been identified as low.

7.2 Domestic controls

The onus to control PFAS in domestic wastewater, including identifying new technologies, should not fall back on the utility. There needs to be greater government enforcement and control of household products that contain PFAS.

Trade waste acceptance criteria should be standardised and guidance provided in the NEMP. Water utilities can't manage PFAS in trade waste without clear direction on "problem definition".

8. Processing

The routine monitoring to identify emerging trends in PFAS levels within the processing stage of its operations is potentially an academic exercise for a chemical whose import and use has substantially declined in the past 20 years. Funding is best directed at controlling it at the source so that it doesn't enter the wastewater treatment plant in the first place.

This section also talks about identifying technologies to control PFAS before it enters the environment. Is this really the most effective use of our customers money? It would be more cost effective to identify the source of the PFAS and control it at the source, rather than when it has been diluted in large quantities of wastewater.

Incidents should not rely on "end-of-pipe" monitoring for contamination events but rather disclosure of incidents by the party responsible for the spill/discharge. Utilities have a requirement to report all wastewater incidents to the regulator. Chemical spills by other industries should also be regulated by the EPA and not the water industry. Incidents to stormwater or wastewater should be disclosed as neither is treated before environmental discharge.

9.2 Effluent discharged to aquatic ecosystems

This section states utilities are to aim towards the 99% species protection level (0.00023 µg/L or 0.23 ng/L), which basically means no discharge of PFAS. To put this into context, a typical adult has about 3.9 ng/mL in their blood and a child 2.9 ng/mL. So the level in the wastewater discharge needs to be over an order of magnitude lower than what is in our blood!

Again this section encourages remediation as opposed to source control. Remediation is appropriate for legacy contaminated sites, but is not a cost effective option when it can be controlled and treated at the source.

9.3 Recycled water

If PFAS is below the limit of detection in the treated wastewater and the recycled water, then there is no need to monitor PFAS in the soil, groundwater and downstream environments.

9.4 Biosolids

Very few utilities could afford nor gain acceptance to build landfills or incineration facilities that operate at temperatures above 1000 degrees to destroy PFAS.

Biosolids or other residuals generated from wastewater treatment should be assessed for risk. It is important to provide guidance.

In cases where the levels are problematic, it is important to contain solids to minimise entry to biological food chains.

Industry Feedback

***qldwater** consolidated feedback*

Submission on PFAS National Environmental Management Plan V2.0 Consultation Draft

May 2019

1. **Contents**

2. Background

The Queensland Water Directorate (***qldwater***) is the central advisory and advocacy body within Queensland's urban water industry representing the state's public water and sewerage service providers, from small local governments up to major utilities including Queensland Urban Utilities and Unitywater. ***qldwater*** works with its members to promote safe, secure and sustainable urban water services for Queensland communities.

This collated response was compiled in response to a request for feedback on the **PFAS National Environmental Management Plan V2.0 Consultation Draft.** This document summarises feedback from the urban water sector through discussions with members, emails and written feedback from Water and Sewerage Service Providers (WSSPs). WSSPs were also encouraged to respond directly.

3. General Feedback

Currently there are no mandatory restrictions on the use of PFAS in Australia. However, the National Industrial Chemicals Notification and Assessment Scheme (NICNAS) has issued recommendations to industry stakeholders for the phase out of PFAS, and for PFOS and PFOA firefighting products to be restricted to essential use only, and not used for fire training or testing purposes. Queensland and South Australia have also introduced bans on firefighting foams containing PFAS in their jurisdictions.

This means that in Queensland (with the exception of fire-fighting foams containing PFAS), parties responsible for creating and releasing PFAS are not being held accountable for releases to the environment. Instead communities are required to pay the cost of addressing the impact at points where the chemicals are concentrated (such as airports and sewage treatment plants).

The ***Draft NEMP V2.0*** appears to be reinforcing this departure from the polluter-pays principle by targeting the wastewater industry. Regulation of the use of contaminants through elimination could potentially see a rapid decline on environmental releases, but the focus of the document is to deal with the products at the end of their life and placing the responsibility on WSSPs. We understand that elimination is being looked at Nationally from a regulation perspective but to date, there are no adopted standards prohibiting these substances, other than in fire-fighting foams. The urban water sector recommends more emphasis be place on a hierarchy of controls including elimination of the products at their source.

Conventional water treatment and wastewater treatment plants are not able to destroy PFAS, thus there could be a significant cost impact for the industry to invest in new technologies to remove PFAS. The cost of PFAS destructive technologies is unknown at this stage (even though there are several trial technologies on the market for either absorbing or destroying PFAS). PFAS concentrations commonly increase during wastewater treatment due to precursor degradation, yet the risk profiles of many PFAS are still unknown. This makes a response that is proportionate to risk difficult to assess.

The ***Draft NEMP V2.0*** will set the expectations for regulators to impose more regular monitoring and testing of PFAS in drinking water, wastewater, biosolids and landfill leachate adding additional costs to communities. More work is required on identifying the geographic locations, PFAS producing industries and the PFAS compounds that pose the greatest risk to the environment so any testing requirements can be tempered, using a sensible approach to monitoring and testing rather than taking an expensive blanket approach. The Queensland urban water sector strongly supports the precautionary principle for protection of public and environmental health for contaminants such as PFAS but notes that social and traditional media attention can provoke unbalanced responses from politically motivated regulators. A national approach should moderate these conflicting drivers to provide more balanced guidance.

The Regulatory Impact Statement (RIS) in October 2017 on options for the regulation of perfluorooctane sulfonate-related chemicals (PFOS) prepared by the Australian Department of the Environment and Energy, showed the least cost option to reduce and minimise exposure to PFAS was ***$39 Million over 20 years***. This is likely an underestimate. Much of this cost was associated with licencing, wastewater treatment and landfill leachate (which in many cases is discharged to sewer), meaning that WSSPs could bear much of the additional cost burden. The ***Draft NEMP V2.0*** deems that the WSSPs are the polluters and leaves unclear who should

fund the $39 million over the next 20 years and whether Federal and State subsidies will be available to support WSSPs.

Attributing the costs and responsibilities for dealing with PFAS to the urban water sector creates a raft of additional problems. Once present in wastewater and biosolids PFAS is diluted volumetrically. The containment of large volumes of wastewater is impractical and the methods of disposal of liquids is not dealt with in the ***Draft NEMP V2.0***. It is also silent as to what methods can be utilised to "destroy" PFAS in leachate and contaminated stormwater, particularly when dealing with large volumes, though it does recognise emerging treatment technologies. Even monitoring the extent of potential contamination represents a large additional cost. For example, the introduction of the new Queensland waste levy taking effect on 1 July 2019 and the introduction of End of Waste Codes through environmental legislation means WSSPs must increase PFAS monitoring significantly, even if they currently only have low levels of PFAS present in wastewater and biosolids. This increases operational costs for WSSPs and resource impacts associated with risk assessments, reporting and testing and monitoring programs, identification of point sources and secondary sources, response and WH&S.

The ***Draft NEMP V2.0*** states that addressing each element of the framework, as per the example framework provided, will enable WSSPs to demonstrate compliance to regulators, stakeholders and the broader community. This will set the expectations for Regulators to impose the ***Draft NEMP V2.0*** framework on licence conditions and compliance and regulatory actions for wastewater treatment facilities, regardless of the likelihood of elevated levels of PFAS present, the associated risks or the cost impacts of the imposed conditions. This means that the costs of PFAS contamination are being passed on to rate payers with little transparency creating no link between the source of the pollution and the ultimate cost for addressing it. This will act against any activities aimed at reducing dangerous PFAS at their source. The example PFAS Management Framework provided in the appendix reinforces these additional costs and is largely inadequate in addressing this issue. The communication recommendations for communities are naïve and should be edited by communications/marketing experts to be useful for a utility preparing such a document for public consumption. In general, the proposed NEMP 2.0 changes are not acceptable to the Queensland urban water industry and a more risk-based approach is recommended.

4. Specific Comments

Reference	Issue	Comment
Section 8.1 P26	The guideline values for residential with garden/accessible soil have been updated from the values published in the PFAS NEMP 1.0 and are considered higher reliability than the values they replace.	This will impact mulch sold by composters using biosolids, although it is unclear on what the exact impact will be.
Section 10.1 P38	The management of PFAS-containing products and PFAS-contaminated materials often includes on-site storage, stockpiling, and containment.	Unclear how this will impact the End-of-Waste Code in Queensland which attempts to encourage beneficial reuse. Additional monitoring, testing and containment costs on site may be required prior to taking material off-site. Also monitoring for PFAS presents well known challenges around methods used, labs offering the service, cost and time delays. Continuous monitoring of wastewater streams to detect elevated levels is not plausible so any detection will probably be in the biosolids – well after the flows have gone through the plant.
Section 10.2 P38	On-site storage, stockpiles and containment – Design Considerations. WWTP may be	In most WWTP's bunded areas, spill areas and old sludge drying beds generally drain back to the head of the plant to be returned through the

	required to construct adequate holding facilities and infrastructure which do not leach or cause migration of contaminated materials into the environment or human health "that are "sufficiently graded, impervious base or hardstand and drained to retain and spills or leaks" and "leachate management systems should be incorporated into the design" and include a "bunded area for trucks".	treatment process. Although additional processing may see additional PFAS absorbed into the biosolids as it is stable, mobile and persistent in aqueous form it will also migrate through the treatment process to outfall. Therefore, WWTPs could be required to construct additional large closed/isolated/contained storage facilities adding a significant expense.
Section 10.2 P39	"detect, monitor, and collect any PFAS-contaminated liquid (leachate) generated during storage (the collected liquid should be extracted from the sumps for separate treatment or destruction)" and "ensure that the migration of leachate from sumps and other detention storages does not occur"	Additional testing and containment costs required for landfill operators and WWTP operators.
Section 10.2 P39	Infiltration, <u>though</u> some liners, such as clay and geosynthetic liners, is expected to occur at a significantly slower rate than for other media.	typo
Section 10.3.3 P41	PFAS-contaminated materials, particularly liquids, should be stored above ground in appropriate containment vessels such as covered intermediate bulk containers (IBCs) and isotainers in bunded areas.	The containment of large volumes of liquid (e.g. a large WWTP processes an average of around 44 ML/day on a dry day) is impractical and the methods of disposal of this liquid are not dealt with in the Draft NEMP V2.0. Consideration is required for the both the total volume and large number of sewage treatment plants nationally and the lack of a way to destroy PFAS at large scale at present. Even if it were possible to use (e.g.) granular activated carbon (GAC) to filter PFAS from water/wastewater the by-product will be GAC that has concentrated levels of PFAS which will then need to be dealt with in large volumes?
Section 10.3.4 P42	Containment	The size required for containment is unclear as the Draft NEMP V2.0 states the bunding/containment must be: "of a sufficient size to retain a major spill, including capacity for stormwater runoff" to ensure all PFAS-contaminated material is contained. This may be practically difficult to

		achieve. Associated costs are unclear with respect to community benefit/risk.
Section 10.3.4 P42	Leachate and contaminated stormwater should be captured, analysed for PFAS, and if necessary, treated, removed and destroyed. Leachate and	Typo (full stop needed)
Section 10.3.4 P42	Leachate and contaminated stormwater should be captured, analysed for PFAS, and if necessary, treated, removed and destroyed. Leachate and contaminated stormwater from a storage or containment facility cannot be released to stormwater drains, sewerage, groundwater recharge, or other waters, nor can they be incorporated into composts, soil conditioners or other materials for beneficial reuse	This will affect WWTP practices of reusing both biosolids and recycled water. There is a risk that the uptake of and establishment and expansion of beneficial reuse of biosolids and recycled water schemes will be jeopardised in the future. Particularly if contamination levels for PFAS are set at very low levels.
Section 10.3.12 P46	Leachate and contaminated stormwater must be captured, analysed for PFAS, and appropriately managed	Significant additional testing and containment costs required for landfill operators for materials containing PFAS for future recovery or destruction
Section 10.3.13 P47	Technical documentation, such as design specifications, construction drawings, design reports, site investigations, impact assessments, site-specific risk assessments, environmental management plans (EMPs), PFAS Management Plans (PMPs), verification documentation, and QA/QC documents should be developed and endorsed by relevant key stakeholders prior to construction commencing	Increased operational and management costs for landfill and WSSP operators
Section 12.1 P49	A principle that must inform consideration of unrestricted or blanket reuse values for soil is that the levels of PFAS must be sufficiently low that they will not pose an increased or unacceptable risk to any receptor or to the environmental values of waters.	If TOFA is used instead of TOPA (refer section 19.2), it restricts the soil application rate which means more land is required for the re-use of biosolids. (Assuming no existing residual PFAS in the soil). The USEPA Method (speciates) is preferred as being more relevant for wastewater treatment plants. It is also unclear on how to apply this to recycled water re-use.
Section 14.6 P58	Waste is not permitted to be subjected to disposal operations that may lead to recovery, recycling, reclamation, direct reuse or alternative uses of persistent organic pollutants	There is a concern for landfill limitations. Landfills already do not want to accept biosolids due to their consistency and difficulty to handle and manipulate. What are they to do with the liquids? Also, the Draft NEMP V2.0 puts additional limitations on landfills accepting PFAS contaminated waste.

Section 15.1 P61	The PFAS management framework should address the specific needs and circumstances of each wastewater utility, in consultation with relevant regulators	Does this assume that every utility needs to undertake this work, even if they do not have an existing PFAS issue? This is adding significant expense to utilities that do not currently have an issue. Would it not be better to undertake some environmental testing first and only make utilities that have an issue comply with the additional monitoring and reporting requirements
Section 15.1 P61	PFAS management framework	There is an attempt being made to capture PFAS at trade waste discharge point instead of elimination of the production, also imposing additional workload on WSSPs to identify, licence, and determine pre-treatment requirements for these premises.
Section 15.1 P61	PFAS management framework	Any framework should be regulated by the State, not Federally to ensure there is not a double-up of requirements for “comprehensive on-site environmental management plans with ongoing monitoring and management”, otherwise it will create duplication of workload and cost to WSSPs.
Section 15.1 P61	PFAS Management Framework	Perhaps instead of treating PFAS as a separate, stand-alone problem, the hazards should be included in the water utilities established risk management framework e.g. using the 12 elements in the Australian Sewage Quality Management Guidelines (June, 2012)
Section 15.2 P62	Relevant infrastructure interventions could include trade waste interceptors; repairs to leaky infrastructure to stop the unintended movement of PFAS into and out of wastewater infrastructure; and treatment equipment to reduce PFAS in effluent	Cost of infrastructure interventions is being passed on to WSSPs and ultimately communities, not the producers of the PFAS products, other than in the limited trade waste scenario. There is thus no polluter-pays signal to assist in reduction of PFAS at their source.
Section 15.2 P62	Additional Management Tools	This imposes additional requirements and impost on WWTPs, namely: - PFAS inventories for specific wastewater catchments or priority areas within catchments - stakeholder engagement plans for specific wastewater catchments or industries - remedial action plans, transition plans or continual improvement plans prioritising short, medium and long-term actions to address identified issues - risk assessments for specific discharges and products for beneficial reuse - applied research strategies to address knowledge and technology gaps - infrastructure management and development plans - communication strategies to publicise relevant information such as monitoring results and progress against the outcomes listed above

Section 15.3 P62	Case Study	It has been presumed that the WSSP is alerted to the incident of the accidental discharge of foam or they see foam/bubbles in the wastewater system. The suggested actions: “turning off pump stations, extraction of material from the affected sewers and pipework cleaned, diversion and collection of sewage” is impractical for a large urban wastewater treatment system and plant. Presence of PFAS in contaminated stormwater does not mean that it has gone through a wastewater treatment plant unless it is due to a wet weather event. Although there is guidance regarding disposal of affected Biosolids (7th dot point) to a landfill capable of receiving PFAS-contaminated materials, there is no direction as to what is to be done with the isolated, contained and contaminated water.
Section 16 Data sharing and reference to data sharing in Framework (Appendix D) P64	*If there is no reason that data cannot be made public, it will be shared.*	The sharing of data is encouraged between entities, however, release of that data to the public without careful wording around risks (or lack of risks) caused by the concentrations found should be avoided; i.e. where there is no ‘safe’ limit set in the NEMP.
Section 19.2 P71	TOPA provides information on whether precursors are present and informs risk management	Concerns have been raised about the application of TOFA as this restricts the soil application rate which means more land is required for the re-use of biosolids. (Assuming no existing residual PFAS in the soil). There are concerns that Environmental Regulator could apply NEMP V2.0 without full understanding of what the different test methods and results mean. TOPA can be used in conjunction with a US EPA method to understand the total presence of organic fluorine in a sample and this is considered to be a better method.
Appendix D P89	Environment at risk from elevated PFAS in discharged effluent or any other emissions from WWTP	It is unclear how environmental harm from PFAS will be measured and what constitutes making land unsuitable for any use due to PFAS contamination. How will it be determined what is harmful to ecological receptors and how will adverse safety or suitability for crops be measured?
Appendix D Table D.1 P91	The first hazard in the table talks about PFAS impacting staff health and safety due to elevated PFAS in the sewage network	As the PFAS is unlikely to come into contact with staff (and highly unlikely to be consumed), mention of this hazard to staff health is misleading and has the potential to cause unnecessary concern (and the psychological distress mentioned). Is there evidence of PFAS volatilisation and inhalation (at levels that would lead to health concerns in sewer workers)? Suggest that this hazard should be removed from the table unless supported with evidence.
Appendix D Table D.1 P91	The second last hazard in the table is about disposal of	It is unclear what sort of infrastructure would be impacted by PFAS that would mean extra costs for

	infrastructure and impacts of PFAS contamination	disposal? Would pumps, mixers, etc that have been exposed to sewage need to be disposed of differently? This point needs clarification.
Appendix D P91	*The resulting additional risks include potential impacts on the effectiveness of biological treatment processes*	Highly unlikely that PFAS compounds have any impact on biological treatment processes? Is there any evidence of this?
Appendix D P92	Catchment based monitoring an analysis	The expenses associated with this monitoring are very large. One medium service provider with 7 WWTP's noted that catchment and monitoring of the sewer network is also very onerous and estimated costs at hundreds of thousands of dollars to routinely monitor, review the data and draw conclusions.
Appendix D P94	*7.2 Domestic controls* *The role of domestic wastewater as a vector for PFAS, mainly from consumer products, is also recognised. However, in the short term, there is limited opportunity for EW or its domestic customers to identify or control PFAS in consumer products. The manufacturers and suppliers of consumer products, and the manufacturers and suppliers of the chemicals included in these products, bear the primary responsibility for taking action to reduce the levels of PFAS reaching domestic wastewater.* *In the meantime, EW will draw on data from its monitoring program to build a better understanding of the contribution of domestic wastewater to the burden of PFAS, including temporal and spatial variation, PFAS types and total PFAS load. This data will contribute to assessment of the risks arising from this source and the identification of possible management responses.*	This section in the example WWTP plan highlights the fact that costs of monitoring (and controlling PFAS) are being shifted to customers of the WWTP. What is the intended purpose of this text? What is the expected reaction of customers reading this part of the document?
Appendix D P95	*As limited information is currently available to inform action at the processing stage to address the chronic risks associated with the day to day flow of PFAS, a key focus for the first phase of this work is addressing the acute risks to wastewater processing that may arise from short-term pulses of elevated PFAS, such as major contamination events. This is discussed in more detail below*.	Sampling to detect 'short-term pulses' would be extremely expensive and not practical.
Appendix D P95	*If a major contamination event does occur, EW will consider the full range of response strategies in consultation with the Example Jurisdiction EPA. Possible strategies, depending on the severity of contamination, could include diversion of PFAS-contaminated wastewater from specific sites or sewer lines, altered processing arrangements within the affected WWTP to prevent or minimise PFAS impacts such as reduced treatment effectiveness, and diversion to environmentally sound disposal or destruction of PFAS-contaminated materials.*	Disposal and destruction currently costs about $1000/kL, this is not practical for a WWTP.

Appendix D P96	*Consistent with the PFAS NEMP, EW aims to reduce the concentration and load of PFAS in effluent as low as possible and, in the long term, below the limit of detection[1] for perfluorooctane sulfonic acid (PFOS), perfluorooctanoic acid (PFOA) and perfluorohexane sulfonate (PFHxS) and any other PFAS identified as being of high concern.*	This is an admirable aim, but it would take time and significant public funding to achieve particularly if major infrastructure investment is required. It will be difficult for large utilities to have such an aim when they have no control over the source of contamination. Small utilities and councils would be unable to aspire to such an aim.
Appendix D P97	*Adequate trials will be conducted before water recycling is rolled out at scale.*	How does this suggestion accord with substantial recycling agreements already in place across the country including many in Queensland?
PAGE 97	*Adequate trials will be conducted before water recycling is rolled out at scale. This will include testing of receiving soils, groundwater and downstream environments for PFAS contamination before the application of recycled water, testing of recycled water, and testing of receiving soils, groundwater and downstream environments after the application of recycled water across several years.*	A number of water utilities already have existing water recycling schemes. If this requirement is enforced, the costs of running these schemes would become unviable. PFAS testing is costly and environmental sampling of areas receiving recycled water is a huge burden.
PAGE 97	*It is also **highly likely** in most receiving environments that a proportion of sedimentary particles from the biosolids will be transported offsite and these are likely to carry adsorbed PFAS and other contaminants.*	With proper biosolids management techniques (as required by the guidelines) including incorporation into the soil, up-slope and down-slope buffers etc it seems unlikely that there will be biosolids transported offsite after application. Why would it be considered 'highly likely'?
Appendix D P97	Biosolids	The biosolids issue is particularly fraught at present in Queensland. The need to be careful about potential impacts from PFAS in biosolids has resulted in controls being put in place which could end up with most biosolids being directed to landfill. This would be an expensive and wasteful option as would incineration. It is not yet clear how this issue can be dealt with an appropriate risk-management approach. The NEMP provides little guidance on this issue at present.
Appendix D P99	Glossary	The glossary could do with a review by a professional editor. For example, terms like 'pathway' are defined but 'paleochannel' is not. 'Attenuation' is in there but 'advection' is not. The ultimate target audience should be given consideration in a document with wide-reaching implications and costs like this proposed NEMP.

[1] "*It is noted, however, that due to technical advances the limit of detection may be reduced so low that this is impracticable.*"

Draft PFAS NEMP Version 2 – Written Submission Cover Sheet

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Confidentiality

(i) Confidentiality requested? ~~Yes~~ / No

(ii) If so, does part of your submission include confidential or sensitive information? ~~Yes~~ / No

Have you provided confidential or sensitive information in a separate attachment ~~Yes~~ */ No*

Have you provided a redacted version ~~Yes~~ */ No*

Draft PFAS National Environmental Management Plan Version 2 sections

If you have specific comments or suggested text changes, please clearly identify the extract of the relevant part of the NEP on which you are providing feedback.

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8. Environmental guideline values

8.1 Human health guidance values

8.1.1 The guidance says if other exposure pathways are controlled, exceedance of the health values does not constitute a risk. However, there must still be a limit that would pose significant risk of health impacts, even if other pathways are controlled. At what daily intake or concentration would this be a risk? Suggest adding an upper limit guideline value for drinking water and recreational water as the primary exposure pathway.

Are the guideline values for PFAS (standard) or PFAS (TOPA)? This question can be applied to all guideline values described in the plan. This could have significant implications to assessing whether PFAS is indeed a problem or a utility and also the subsequent management actions and costs involved.

8.1.2 As for 8.1.1, limits required if those land uses are the primary exposure pathway (residential with garden/accessible soil, residential with minimal opportunities for soil access, public open space and industrial/commercial).

PFOS + PFHxS criterion is based upon assuming equal concentrations of each. How does this criterion change when this ratio is skewed towards either PFOS or PFHxS? If there is significant difference, suggest adding these limits in.

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8. Environmental guideline values

8.2 Ecological guideline values

Table 3 (Soil criteria for investigation – ecological guideline values) and Table 4 (Terrestrial biota guideline values) have different units. i.e. mg/kg vs. µg/kg. The limits could be easily misinterpreted when flicking between the tables (factor of 1,000 different). Suggest keeping units consistent between tables in the same sections and throughout the plan if possible.

8.2.3 99% species protection – high conservation value systems is below detection limits of commercially available analysis.

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10. On-site storage, stockpiles, and containment

10.1 Storage, stockpiles, and containment

This whole section on storage, stockpiles and containment is applicable to management of persistent organic pollutants in general. Would this information be better placed in an overarching systems approach and simply referred to in this management plan? This adds considerable bulk to the plan.

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10. On-site storage, stockpiles, and containment

10.2 Design considerations

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10. On-site storage, stockpiles, and containment

10.3 Guidance note - On-site storage and containment

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12 Reuse of PFAS-contaminated materials

12.1 Reuse without a risk assessment

What levels of PFAS in materials would be considered elevated? How can you use the decision tree if you're unsure whether PFAS levels are elevated or not? Guidance on what's considered elevated is definitely required.

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15. Wastewater treatment

15.1 PFAS Management Framework

Understanding baseline levels in sewage is a key requirement for smaller utilities that do not have the resources to do their own extensive PFAS baseline levels.

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15. Wastewater treatment

15.2 Additional management tools

All relevant tools but the resource requirements for smaller utilities will limit their implementation.

Appendix D. Example PFAS Management Framework for a Wastewater Utility

This section describes well the holistic management framework for PFAS however the time and resources required to build and implement the plan cannot be underestimated. QUU has implemented a PFAS management framework as a direct result of an emergency situation following loss of containment and several years of focussed effort, significant outlays of resources (FTEs) and monitoring costs (well into six figures). Most utilities, large or small, would have a hard time justifying the outlay in term of resources and costs in emergency situations, let alone situations where PFAS is not considered to be a risk or is not found at elevated levels.

PFAS analysis costs are extremely expensive and a sampling strategy that evaluates numerous locations from influent, process units and products (effluent, recycled water, biosolids) will be prohibitive. And these are the costs for one sewage treatment plant. QUU manage 27 treatment plants. One monitoring round of influent, effluent and biosolids costs in the order of $50,000.

Information on what background levels of PFAS could be expected by a utility before monitoring starts will be extremely beneficial in terms of understanding the actual PFAS risks involved and the management strategies and actions to be applied. This will also significantly reduce monitoring costs by minimising the need to do extensive sewer background level analysis if not required.

As per a preceding comment, the management framework described here could easily be applied to other persistent organic pollutants/emerging contaminants in a systems approach.
