Submission No 42

INQUIRY INTO INQUIRY INTO PFAS CONTAMINATION IN WATERWAYS AND DRINKING WATER SUPPLIES THROUGHOUT NEW SOUTH WALES

Organisation: Natural Turf Alliance

Date Received: 9 December 2024

NATURAL TURF ALLIANCE

Communities for Sustainable Greener Futures in our Public Spaces

NSW Parliament

Inquiry into PFAS contamination in waterways and drinking water supplies throughout NSW.

PFAS contamination derived from Synthetic Surfacing and Sports Fields

On behalf of

Natural Turf Alliance Incorporated

Acknowledgement of Country

The Natural Turf Alliance acknowledges the Traditional Owners and Custodians of the lands on which we live, work and play.

We respect and identify the significant role and understanding that First Nations people have to the land and their connection to Country and their role in caring for and maintaining Country over thousands of years.

May their strength and wisdom be with us today and we pay our respect to Elders past, present, emerging and future.

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1.0 | Executive Summary |

The Natural Turf Alliance (NTA) is aware of the emerging local and international concern around the potential impacts of per and polyfluoroalkyl substances (PFAS) derived from synthetic turf and artificial ground covering materials and their impacts to waterways, drinking water, groundwater supplies, aquatic ecosystems and the broader environment.

The NTA continually strives to ensure that Federal, State and Local governments as well as Sporting Associations, Sporting Users and Community Members are aware of the risks posed by synthetic turf relevant to PFAS contamination and is committed to keeping the community informed on any PFAS related issues and updates undertaken abroad.

> *The existence of PFAS, perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA) compounds within synthetic turf has been identified within the reporting of the NSW Chief Scientist and Engineer (NSWCSE), Independent review into the design, use and impacts of synthetic turf in public open spaces Final report, 13 October 2022.*

With the realisation that synthetic turf is constructed and contains chemicals within the PFAS family the NSWCSE requested for further information and advice from the NSW Technical and Advisory Group (NSW TAG) relevant to the links between PFAS exposure from synthetic turf fields and several health effects.

NSW TAG identified numerous concerns relevant to the presence of PFAS within synthetic turf and the inclusion of PFAS components within its construction. NSW TAG indicated that the **presence of PFAS in synthetic turf is potentially due to** the presence of PFAS chemicals within the feedstock used to make the synthetic turf or the material used in the recycling process for either the feedstock or the infill. NSW TAG also indicated that PFAS chemicals **may be present due to PFAS chemicals being added as an extrusion aid during the making of the pile blades and the carpet backing**.

NSW TAG noted that depending on the *source of the feedstock, the chemicals present, and their concentrations*, the existence of PFAS chemical components will be highly variable from each individual field and the subsequent impacts to waterways and drinking water supplies would be dependent upon the fields siting within its local and broader environment.

This variability, *of PFAS concentration*, has obvious implications on waterways, drinking water, groundwater supplies and aquatic ecosystems.

It would be apparent that the NSW Government has failed to undertake or initiate any of the recommendations outlined by the *NSW Technical and Advisory Group, as detailed within the reporting of the NSWCSE*, to address the emerging human health and environmental impacts derived from PFAS leaching and contamination from synthetic turf fields and artificial ground covering materials, since the release of the report in October 2022.

This failure by the NSW Government poses and generates significant human health and long term environmental implications to waterways and drinking water supplies throughout New South Wales.

2.0 | Formulation of the Natural Turf Alliance |

The Natural Turf Alliance (NTA) was formed due to the growing community concerns and evident body of work being compiled by the scientific community with regards to the human health, environmental degradation and risks to waterways and drinking supplies derived from the utilisation of synthetic ground covering surfaces such as synthetic turf and the long term impacts to human health and the environment being identified both locally and abroad.

Within Australia there exists very little understanding of the human health, environment and potential risks derived from the continued utilisation of synthetic ground covering materials within the built environment. Given the growing community concerns and the lack of information present within Australia the NTA came together as an alliance of over thirty community groups to raise awareness and seek Government actions to address the concerns being raised.

In so doing the NTA were fundamental in ensuring the NSW Government investigated the concerns of the time given the obvious lack of information in existence.

This lack of information and understanding is clearly identified within the reporting of the NSW Chief Scientist, *Independent review into the design, use and impacts of synthetic turf in public open spaces Final report*, 13 October 2022,[1] which the NTA advocated for and ensured was undertaken by the NSW Government given the concerns being identified.

The NSW Chief Scientist reporting is the only one of its kind within Australia and clearly identifies the significant risks and unknowns that surround the impacts to human health, the environment and future generations given the identification of PFAS contaminates; via leachates , pollutants and airborne particulate, released from synthetic turf fields.

Concerningly, it is evident that very little is understood as to the impacts and risks to the environment and human health derived from synthetic turf and the release of PFAS contaminates generated by these infrastructure elements.

The NTA strongly believes that there is the need to further investigate the risks of PFAS contaminates to waterways and drinking supplies due the the utilisation of synthetic turf and artificial ground covering materials that contain, composed of, utilise or constructed with PFAS chemicals.

It is becoming clear that there are substantial unknown risks to future generations and the potential for significant risks to human health, the environment, waterways and drinking supplies for future generations if synthetic ground covering materials continue to be utilised within the built environment given the significant PFAS contaminate loss they generate.

[1] https://www.chiefscientist.nsw.gov.au/__data/assets/pdf_file/0004/542263/CSE-Synthetic-Turf-Review-Final-Report.pdf

3.0 | Introduction | PFAS constituents utilised within synthetic turf |

This submission will detail the apparent inability of the NSW Government to address the impacts to waterways and drinking water supplies brought about by the existence of PFAS, PFOS and PFOA within the construction of synthetic turf fields and the subsequent release of PFAS chemicals within airborne nano and micro plastic particles and leachates impacting waterways and aquatic ecosystems.

Moreover, PFAS contaminated leachates are identified entering waterways, drinking water supplies and groundwater systems through existing infrastructure stormwater systems connected to synthetic turf fields. Stormwater systems then further direct PFAS contaminated waters into broader waterways and introduce PFAS contaminated leachate into estuaries, river systems and eventually our oceans.

3.1 | PFAS | Loss & Dispersion into Waterways and Drinking Supplies |

PFAS contaminated microplastics and macroplastics are released into aquatic ecosystems, through the disintegration and breakdown of the synthetic field surface brought about by general usage, wear and tear and UV destabilisation. This breakdown to the synthetic turf fibres, blades, carpeting, shockpad and drainage cell releases significant amounts of nano, micro and macro plastic pollution, *containing PFAS*, into surrounding waterways.[2]

Reporting by the University of Technology Sydney[3] indicates that the annual amount of PFAS contaminated particulate lost directly to the environment ranges from eight hundred kilograms (800 kg) up to three thousand two hundred kilograms (3200kg) for a single field.

Given that within NSW there are over two hundred (200) synthetic turf fields constructed this equates to between one hundred and sixty kilograms thousand (160,000kg) to six hundred and forty thousand kilograms (640,000kg) of PFAS contaminated plastics potentially entering NSW waterways and drinking supplies generating significant human health and environmental impacts.

This reporting is further substantiated by independent advisory bodies and agencies utilised by the NSW Government within reporting undertaken by the NSWCSE and the recommendations provided to the NSW Government within the final report of the NSWCSE, *Independent review into the design, use and impacts of synthetic turf in public open spaces Final report,* 13 October 2022, *in particular Appendix 13.*

3.2 | PFAS | Health Risks and Environmental Degradation

Numerous concerns are raised relevant to human health impacts and environmental degradation, due to impacts by PFAS contaminated particles loss and dispersed from synthetic turf fields with a clear indication of a lack of understanding and need for further work to be undertaken to fully understand the implications brought about by the existence of PFAS chemicals within synthetic turf.

[2] https://www.sciencedirect.com/science/article/pii/S0269749123010965
[3] https://naturalturfalliance.org/wp-content/uploads/2024/11/UTS_ISF_Syntheticsurfaces_materials_Finalreport-1.pdf

On review of the reporting provided within the NSWCSE report **it is evident that further research and investigative works are required to be undertaken by NSW Government agencies** working in this space and that regulatory oversight and routine testing is required to provide a greater understanding of the impacts to waterways and drinking water supplies from PFAS chemicals contained within synthetic turf and artificial ground covering materials.

4.0 | PFAS | Current Understandings | Local and Abroad

To assist this inquiry garner a better understanding of the issues raised, attached is the reporting provided to the NSWCSE by the *NSW Technical and Advisory Group* (NSW TAG) and NSW Environmental Protection Agency (NSW EPA) in response to the questions posed by the NSWCSE.

Appendix 13 of the NSWCSE report, has been reproduced within the following pages to allow for an understanding of the issues, concerns, relevant information, advice and recommendations provided to the NSWCSE in their investigations of concerns with PFAS contamination derived from synthetic turf.

Upon review of the documentation it would be evident that there are existing human health impacts and significant environmental concerns already known with PFAS contaminated leachates, plastic pollutants and airborne particulates and many unknowns.

Since the finalisation of the NSWCSE and its release in 2022, there have been major developments in the understanding of PFAS chemicals detrimental effects and significant advancements made relevant to implementing mitigation measures to reduce the amounts of PFAS contaminate permissible within drinking water supplies and waterways.

On 10 April, 2024, the US EPA announced the final *National Primary Drinking Water Regulation* (NPDWR) for six PFAS. The NPDWR establishes legally enforceable levels, called *Maximum Contaminant Levels* (MCLs), for six PFAS in drinking water:

PFOA,
PFOS,
PFHxS,
PFNA, and
HFPO-DA

as contaminants with individual MCLs, and PFAS mixtures containing at least two or more of PFHxS, PFNA, HFPO-DA, and PFBS using a Hazard Index MCL to account for the combined and co-occurring levels of these PFAS in drinking water. The US EPA also finalized health-based, non-enforceable Maximum Contaminant Level Goals (MCLGs) for these PFAS.

The US EPA expects that over many years the NPDWR will prevent PFAS exposure in drinking water for approximately 100 million people, prevent thousands of deaths, and reduce tens of thousands of serious PFAS-attributable illnesses.

The US EPA is also making unprecedented funding available to help ensure that all people have clean and safe water. In addition to the final rule, the US EPA announced $1 billion in newly available funds[4] through the Bipartisan Infrastructure Law to help states and territories implement PFAS testing and treatment at public water systems and to help owners of private wells address PFAS contamination.

5.0 | PFAS | NSW Government Inaction |

Such actions are required within NSW; given the toxicity, cumulative concerns, known and yet to be identified detrimental effects that exist with PFAS contamination to human health and the environment. The inability of the NSW Government to undertake similar measures places existing and future communities at risk.

These risks are only increased through the continued utilisation of synthetic surfacing materials, *such as synthetic turf known to be constructed with PFAS containing components*, which then break down and interact with human users and the broader community through dispersion, leachate and airborne particulate. These same PFAS contamination impacts occur within the environment influencing waterways, drinking water supplies, the local and greater environment.

Chemical analyses of crumb rubber and other artificial turf components have identified hundreds of chemicals, including known carcinogens, neurotoxicants, and endocrine disrupting chemicals.[5]

Recent studies of whole synthetic turf fields and their components have identified PFAS as an emerging class of contaminants to be considered alongside known rubber chemicals, emphasising that although crumb rubber is notoriously hazardous, other components of synthetic turf should be studied as well.[6]

PFAS contaminants can wash off synthetic turf fields into the environment, collect in players' clothes, or be accidentally ingested and inhaled during athletics or by babies and toddlers, resulting in additional sources of exposure. These actions also disperse PFAS contaminates more broadly and place them within the community.

It is clear that the NSW government MUST address this emerging area of concern, especially in light of the fact that there has been a proliferation of synthetic turf fields installed throughout NSW since 2014, from twenty four (24) to over two hundred (200) fields in 2024.

> **The continued utilisation and installation of synthetic turf fields substantially increases the risks of PFAS contamination to waterways and drinking water supplies with unknown impacts to the broader community. Action/s are required to address this and ensure the safety and long term health of existing and future communities is NOT compromised by continued inaction by the NSW Government in this space.**

[4] https://www.epa.gov/dwcapacity/emerging-contaminants-ec-small-or-disadvantaged-communities-grant-sdc#2024
[5] Massey R, Pollard L, Jacobs M, Onasch J, Harari H. 2020. Artificial Turf Infill: A Comparative Assessment of Chemical Contents. New Solut. 30(1):10–26
[6] https://www.diva-portal.org/smash/get/diva2:1544989/FULLTEXT01.pdf

6.0 | NSW Chief Scientist Report | PFAS | Appendix 13 |

NSW GOVERNMENT | Office of the Chief Scientist & Engineer

Mr David Gathercole
Chair, NSW PFAS Technical Advisory Group
NSW Environmental Protection Authority
Locked Bag 5022
PARRAMATTA NSW 2124
Email:

Dear Mr Gathercole

Re: Request for Advice on Per- and poly-fluoroalkyl substances (PFAS)
Review of the use of synthetic turf in public spaces

I write in relation to a review being undertaken by the NSW Chief Scientist & Engineer into the potential risks to the environment and human health from the use of synthetic turf in public spaces (the Review). The Terms of Reference can be found here.

We are seeking assistance from NSW Government agencies and entities that may have expertise, data and/or literature related to the use of synthetic turf relative to natural surfaces. This includes the potential impacts of chemicals which may be released from synthetic turf surfaces and in-fill materials, or which may be contained in any water run-off.

PFAS has been raised with the Review as a potential series of chemicals of concern – either contained in the materials themselves (see Attachment A) or as an aid in the extrusion process (see for example Gluge et al 2020).

Attachment A contains information identified by the Review and questions that we would appreciate advice from the Technical Advisory Group. If possible, I would be grateful for a response by Friday 12 August 2022.

Should you or other members of the TAG have any questions, please do not hesitate to contact me at or phone .

Yours sincerely

Dr Suzanne Pierce
Director Policy, Science & Research

20 July 2020

cc. Mr Edward Jansson, Senior Manager OCSE
Mr Kishen Lachireddy, Manager, Surveillance and Risk Unit, Health Protection NSW
Dr Pip Brock, A/Principal Project Officer, DPI
Ms Janina Beyer, A/Team Leader DPE Science
Dr Tina Jafari, lead hydrogeologist, DPE Water
Ms Alison Imlay, Manager Food Science, DPI Food Authority
Dr Matt Taylor, A/Director Fisheries Research, DPI Fisheries

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Attachment A
Request for advice to the NSW PFAS Technical Advisory Group (TAG)

Background: literature
The Review team as well as independent scientific experts commissioned by the Review have undertaken searches on the presence and concentrations of PFAS in synthetic surface sporting fields. The literature relevant to synthetic turf surfaces appears limited, having reviewed Scopus, ProQuest Science and Technology databases, Web of Science and Springer Materials. Relevant information identified (including grey literature) included:

- A Masters degree thesis (Stockholm University), which sampled 18 fields, finding PFAS in 76 percent of the backing samples (concentrations ranging from 0.04 to 0.89 µg/kg) and in 18 percent of infill samples (concentrations ranging from 0.03 to 0.21 µg/kg). One sample identified PFAS in the surface blades. Concentrations appear highest In Ethylene Propylene Diene rubber (EPDM) and Styrene Butadiene Rubber (SBR) fields. Note that in Australia, the majority of fields currently installed utilise SBR products from recycled tyres.
  Source: Naim, A (2020) An Investigation into PFAS in Artificial Turf around Stockholm, in Department of Environmental Science
- A review by TRC for the City of Portsmouth, which detected very low levels of a limited number of PFAS in the synthetic turf samples, concluding the levels detected did not represent a human health risk to those using the synthetic turf
  Source: TRC (2022) Technical memorandum: Evaluation of PFAS in Synthetic Turf (attached)
- Advice to the Martha's Vineyard Commission and Oak Bluffs Planning Board on testing for PFAS in synthetic turf fields from the Ecology Centre
  Source: Ecology Centre (2020) Memo on PFAS-free Synthetic Turf Standards and Testing
- An information sheet from the Toxics Use Reduction Institute (TURI) including reports of NGO tests on field samples.
  Source Massachusetts Toxics Use Reduction Institute (2020) Per- and Poly-fluoroalkyl Substances (PFAS) in Artificial Turf Carpet.

The Review also identified a position statement from the Mount Sinai Children's Environmental Health Centre (2017) Artificial Turf: A Health-Based Consumer Guide. The primary focus of the document is on the risks of rubber crumb, although it references chemicals of concern in the blades and leaching from the product. The Guide makes suggestions for safer play on artificial surfaces. Note that NSW Health has undertaken a literature review on the health impacts of synthetic turf that encompasses rubber crumb.

Request for advice
a. Is the information set out in points 1 -11 below accurate and/or have there been changes of note that the Review should be aware of, including research priorities and programs?
b. Is the TAG aware of other literature (not referenced above) or literature searches specific to the use of synthetic turf and impacts on human, environmental or ecological health that may be relevant to the Review Terms of Reference?
c. Could the TAG comment on the values found in the limited studies and samples referenced above relative to other values observed in priority PFAS-affected sites in Australia, potential routes of exposure and implications, if any, in light of current knowledge and evidence?
d. Is the TAG aware of any testing of synthetic turf materials in Australia?
e. Could the TAG comment on the use and value of fluorine testing for the presence of PFAS? The context for this question relates to material provided to the Review regarding the presence and markers for various chemicals of concern, including PFAS, particularly by members of the community, versus data on the effects at various concentrations and exposure pathways (per point 1 below).

f. Over the course of the project, the Review was advised, including by industry stakeholders, that unless tested themselves, the composition of imported products was unknown, and that there is a need for standards.
    i. The Review is considering recommendations to improve data collection, reporting and sharing. This includes for example, declaration and testing (validation) of the chemical composition of synthetic turf materials imported or manufactured. Could the TAG provide comment on the potential approach, including the parameters that might usefully be covered and/or any barriers to implementation of such an approach.
    ii. The Review is also considering establishment of a sample library to promote research and the ability to compare research outcomes of different products and surfaces (e.g. performance under different conditions). Could the TAG comment on what any parameters for such a library e.g. number and size of samples etc.

g. Does the TAG have any views on future data collections or research priorities relevant to the Review TOR 4 more generally?

Review observations and assumptions relevant to this request for advice

1. The Environmental Health Standing Committee (enHealth) is a standing committee of the Australian Health Protection Principal Committee (AHPPC). enHealth guidance on undertaking environmental (EHRA) and human health impact risk assessments include the following: consideration of sources of issues, data on the dose or concentration of a pollutant/hazard to have an effect, the source, timing frequency and consistency of exposure among different populations, and the potential for adverse health effects, including severity and reversibility of health effects.
2. Advice by enHealth on per- and poly-fluoroalkyl substances (2019) includes that
    - *In human studies, the Expert Health Panel for PFAS found that a number of health effects (such as slightly high blood cholesterol) have been associated with PFAS exposure but these health effects are generally small and have not been shown to be clinically significant. More research is required before definitive statements can be made on causality or risk but, currently, there is no evidence of a significant impact on human health.*
    - *Although there is still uncertainty around the potential for PFAS exposure to cause significant adverse human health effects, we do know that some long chain PFAS, such as PFOS and PFOA, can persist for a long time both in the environment and in humans. Therefore, it is prudent to reduce exposure to PFAS as far as is practicable. Action should be taken to address the source of the exposure and interrupt known human exposure pathways. Determination of human exposure pathways is best achieved through a full human health risk assessment that examines all potential routes of exposure.*
    - *enHealth considers ingestion of food and drinking water contaminated with PFAS to be the major human exposure pathways. Inhalation of dust contaminated with PFAS and dermal (skin) contact with PFAS are considered to be minor exposure pathways.*
3. Australian Government Department of Health (DOH) advice includes that:
    - *There is no current evidence that supports a substantial impact on an individual's health from PFAS exposure. A number of studies show a link between PFAS exposure and several health effects, however there is limited or no evidence of human disease accompanying these health effects.*
    - *People can be exposed to PFAS in their workplace if they are involved in the manufacture or use of PFAS. Outside of the workplace, exposure to PFAS can occur from food, water (ground and surface water) and various consumer products. Dermal (skin) contact with PFAS is not considered a significant exposure pathway.*
4. The Australian National University was commissioned by the DOH to undertake research into three communities affected by PFAS contamination as a result of firefighting activities in nearby Defence Force bases. The overall ANU study findings released in December 2021 include:

- *There was clear evidence of elevated blood serum concentrations of PFAS in residents and workers in the PFAS-affected communities and increased psychological distress in the three exposed communities.*
- *The evidence for other adverse health outcomes was generally limited. For most health outcomes studied, we did not find evidence that health was worse in PFAS-affected communities than non-affected communities. Rates of some adverse outcomes were higher among people in individual PFAS areas, but this does not necessarily mean that PFAS was the cause. Overall, our findings were consistent with previous studies that have not conclusively identified causative links between PFAS and adverse health outcomes. The association between higher PFAS levels and elevated cholesterol levels was consistent with the previous evidence.*

5. NSW Health advice includes that
   - *There is currently no consistent evidence that exposure to PFOS and PFOA causes adverse human health effects. However, based on the evidence from animal studies potential adverse health effects cannot be excluded*.
   - *In humans, there is no conclusive evidence that PFASs cause any specific illnesses, including cancer.*
6. The PFAS National Environmental Management Plan (NEMP) provides nationally agreed guidance on the management of PFAS contamination in the environment, including prevention of the spread of contamination. It supports collaborative action on PFAS by the Commonwealth, state and territory and local governments around Australia. The NEMP is an Appendix to the Intergovernmental Agreement on a National Framework Responding to PFAS Contamination established in 2020. The NEMP sets out agreed definitions, primary indicators of the presence of PFAS compounds, primary and secondary sources of contamination, analytical and risk assessment methods, monitoring and management approaches. NEMP does not address current use and management of PFAS-containing products and articles. A framework for future work is organised into six themes: PFAS chemicals including analytical methods, environmental data and monitoring, water, soil, resource recovery/waste management and site-specific application of NEMP guidance.
7. The second version of NEMP released in 2020 provides updated advice on environmental guideline values for human health investigation levels for soil, including for public open space (Table 2) and ecological values including exposure scenarios for soil (Table 3), biota (Table 4) and ecological water quality (Table 5).
8. Work undertaken by the UNSW Water Research Lab for the Review notes that the levels reported (Naim, 2020) are lower than median levels reported in a global survey of PFAS in soil (Brusseau et al (2020) PFAS concentrations in soils: Background levels versus contaminated sites. However, leachability remains unknown and transport in runoff also requires testing to understand possible threats to nearby ecosystems. This approach appears consistent with exposure pathways for ecological assessments set out in section 8.6 of the NEMP.
9. The NSW Environment Protection Authority leads the NSW Government PFAS Investigation Program. Current investigations are focused on sites where it is likely that large quantities of PFAS have been used.
10. At its meeting of 21 December 2021, the EU Committees for Risk Assessment and Socio-Economic Analysis supported Germany's proposal to restrict the use of undecafluorohexanoic acid (PFHxA) and related substances. This would prohibit manufacture, production or placement on the market.
11. In June 2021, a US Environmental Protection Agency rule change requires all manufacturers (including importers) of PFAS in any year since 2011 to report information related to chemical identity, categories of use, volumes manufactured and processed, by-products, environmental and health effects, worker exposure, and disposal.

DOC22/729022-1

Dr Suzanne Pierce
Director Policy, Science & Research
Office of the Chief Scientist and Engineer
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By email:

Dear Dr Pierce

NSW Technical Advisory Group
Synthetic turf in public spaces - risk of per- and poly-fluoroalkyl substances (PFAS)

I refer to the Office of the Chief Scientist and Engineer (OCSE) letter dated 20 July 2022 requesting advice from NSW Government agencies and entities on the potential risks to the environment and human health from the use of synthetic turf in public spaces.

Specifically, OCSE has requested advice from the NSW PFAS Technical Advisory Group (TAG) on potential impacts of per- and poly-fluoroalkyl substances (PFAS) from synthetic turf.

Your request has been reviewed by the members of the TAG including the Environment Protection Authority (EPA), Department of Planning and Environment – Science, Department of Primary Industries, Department of Planning and Environment – Water, and NSW Health.

The TAG has provided a response to each of your seven (7) questions and general comments in **Appendix 1**. Please note, this response is in addition to advice that was provided directly to your office from NSW Health and Department of Primary Industries – NSW Food Authority.

If you have any further questions about this issue, please contact Maria Moreno, A/Unit Head Operations Metro North, on or at

Yours sincerely

30 August 2022

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Appendix 1

NSW PFAS Technical Advisory Group advice to Office of the Chief Scientist and Engineer on PFAS exposure from synthetic turf in public spaces-August 2022

Please find a response to questions on notice below.

This response should be read along with the information provided in **Attachment A** of Office of the Chief Scientist and Engineer correspondence dated 20 July 2022.

a. Is the information set out in points 1-11 below accurate and/or have there been changes of note that the Review should be aware of, including research priorities and programs?

Point 1:
enHealth guidance on risk assessment provides a framework for assessing human health risks. We also note that there is a potential for contaminants to leach into stormwater and otherwise into the environment (i.e., implications for ecological and environmental risks), and therefore a reference to the Australian Water Quality framework for assessing contaminant risk to aquatic ecosystems is also recommended.

Point 2, 3 and 5:
As point 1 indicates, the process for undertaking a human health risk assessment is based on enHealth guidance. As such, the TAG suggests that the focus for any human health assessment of risk from PFAS needs to use the tolerable daily intake (TDI, FSANZ) - rather than the inclusion of point 2, 3 and 5 which are communication points from Health Organisations on the potential health effects of PFAS. The TDI is designed to be protective of these health effects, and thus we suggest this is referred to instead.

Point 4:
The PFAS Health Study (December 2021) investigated the health effects of PFAS of three Australian communities exposed to historical fire-fighting foam products used on Defence bases. It is unlikely that PFAS from the pile blades of synthetic turf would reach those contamination levels and therefore from a risk communication perspective, those studies need to be interpretated appropriately within the context the synthetic turf review.

If the purpose of this point is to link PFAS exposure with health risks, we refer to the process of a risk assessment using the TDI above.

Point 7:
The reference to human health and ecological guideline values for soil and biota guideline values are not relevant for the purpose of synthetic turf. The way these guidelines are determined do not apply in this instance, and it would be inappropriate to apply these guideline values to PFAS concentrations in synthetic turf (e.g., synthetic turf exposure is not the same as soil exposure, and wildlife criteria are for food that wildlife eat). The ecological water quality guidelines referred to in point 7 however would be useful if risk from PFAS leaching from synthetic turf and rubber infill or monitoring of stormwater/waterways downstream from synthetic fields was undertaken.

Point 8:
Comparison of PFAS in synthetic turf with soil is not appropriate, given that PFAS is not naturally occurring, and soil is not a 'product.' It could be more useful to compare PFAS levels in synthetic turf with other products that have deliberately had PFAS added for water resistance/surface protection etc. purposes (e.g., raincoats and other plastics) as a comparative level.

The comment on leachability is valid and applies to all potential contaminants that could leach from synthetic turf (noting we believe there are likely to be more relevant contaminants of concern other

than PFAS based on a hazard and concertation basis). This part of the comment could be separated from the soil comment and linked with water quality guideline values.

Point 9:

The TAG is not sure of the purpose of this statement.

It could be useful to recognise that synthetic turf sporting fields generally fall under council's jurisdiction. Further, it could be useful to investigate if PFAS has been on the radar for any councils with synthetic turf sporting fields. Especially given that some have stormwater monitoring projects that address potential contaminants of concerns from synthetic fields.

Point 10:

The TAG is not sure the relevance of singling PFHxA out from all the other PFAS, given that you may wish to identify first if PFHxA is even present in synthetic turf and plastics. Also, other PFAS have already been listed in the Stockholm convention and therefore should be phased out with time as well. This leads to 2 points:

- not all countries that manufacture PFAS and products that contain PFAS are registered to Stockholm or the European system. Therefore, this is unlikely to directly translate to PFAS presence synthetic turf globally; and
- this assumes that the presence of PFAS in synthetic turf and rubber infill is a deliberate addition into the articles. To get a feel of the likelihood of this, we recommend a scan of the literature on PFAS concentrations in articles that deliberately have PFAS added as a comparison to those levels identified in synthetic turf. It is also likely that PFAS in synthetic turf is due to the feedstock used to make the products, and/or the materials used in the recycling process. This also means that depending on the feed stock, there is likely to be high variability in potential contaminant concentrations.

Point 11:

As in comment on point 10, we are not sure how US EPA chemical regulation translates to PFAS in synthetic turf in Australia. The Australian government via AICIS and the IChEMS also have reporting requirements for importing chemicals into Australia. Would it be more useful to explore if and how these may have influences on contaminants of concern in products/synthetic turf? The statement listed further seems to be related to the importation of PFAS chemicals, rather than PFAS contained in articles/products. It should be established whether this is relevant in the context of synthetic turf used in Australia. Is the turf produced in Australia or is it produced overseas (and where) and then imported into Australia in its final form?

b. Is the TAG aware of other literature (not referenced above) or literature searches specific to the use of synthetic turf and impacts on human, environmental or ecological health that may be relevant to the Review Terms of Reference?

Specific to PFAS in synthetic turf, the TAG is aware the following paper, although note, we have not undertaken a review for papers specific to this request):

> Mélanie Z. Lauria, Ayman Naim, Merle Plassmann, Jenny Fäldt, Roxana Sühring, and Jonathan P. Benskin. Widespread Occurrence of Non-Extractable Fluorine in Artificial Turfs from Stockholm, Sweden. *Environmental Science & Technology Letters* 2022 9 (8), 666-672. DOI: 10.1021/acs.estlett.2c00260

The paper seems to be the publication connected to the Master's thesis that was referenced. Comparisons of the different analytical techniques employed are also in this paper.

c. Could the TAG comment on the values found in the limited studies and samples referenced above relative to other values observed in priority PFAS-affected sites in Australia, potential routes of exposure and implications, if any, in light of current knowledge and evidence?

Expected pathways are accidental ingestion and dermal contact, however, we are not aware of any PFAS exposure pathways being assessed for users of synthetic turf fields. Based on the current knowledge on concentrations of PFAS in synthetic turf and its contribution of exposure pathways, the resultant health impacts would be minimal.

Additional points of note:

- The study mentioned above listed concentrations of PFOS in the sporting field in the range of 84-118 pg/g (0.084 ug/kg - 0.118 µg/kg) and PFOA in the range of 46 – 96 pg/g (0.046 µg/kg – 0.096 µg/kg). This is lower than the typical laboratory reporting limits in many matrices.
- Comparing the concentration of PFOS/PFOA in the sporting field to the concentration of PFOS/PFOA in other plastics or food packaging materials may be a more useful approach in this instance. We suggest a review of such data is undertaken, but as an example, a study of PFAS in popcorn bags found concentrations of PFOS up to 7.7 µg/kg (Mortera and Tena 2013). The Australian packaging Covenant also tested Australian popcorn bags and found concentrations of total PFAS (sum of 28 targeted PFAS) up to 69 µg/kg.
- There are also measurements of total fluorine concentrations for some materials, but we note care must be taken when comparing such data because the lab methods used for total fluorine measurements may not be the same and as such may not be comparable.
- References:

APCO Report: PFAS+in+Fibre-Based+Packaging (packagingcovenant.org.au)
Moreta, C. and Tena, M.T., 2013. Fast determination of perfluoro compounds in packaging by focused ultrasound solid–liquid extraction and liquid chromatography coupled to quadrupole-time of flight mass spectrometry. *Journal of Chromatography A*, *1302*, pp.88-94.

d. Is the TAG aware of any testing of synthetic turf materials in Australia?

We are aware of some research on chemicals in or leaching from synthetic turf fields by Macquarie University, but we are not sure if PFAS is one of the chemicals of concern that are being investigated. The study is investigating the leachability of chemicals from synthetic turfs and their effects on ecosystems.

e. Could the TAG comment on the use and value of fluorine testing for the presence of PFAS? The context for this question relates to material provided to the Review regarding the presence and markers for various chemicals of concern, including PFAS, particularly by members of the community, versus data on the effects at various concentrations and exposure pathways (per point 1 below).

There are many different ways to test the presence of PFAS i.e., targeted measurement of specific PFAS, non-target analysis for unknown PFAS, total oxidisable precursor assay (a measure of the presence of PFAA-precursors), total organic fluorine testing, extractable organic fluorine testing. These are all likely to give very different results, an example of such a study can be seen in the paper listed above.

Understanding what the objective is for using fluorine testing, what types of fluorine are captured/not captured by specific methods (and if these are comparable) and if there are other fluorine compounds that may be present in synthetic turf other than PFAS that could influence results are important to consider.

Importantly, sound sampling strategy and appropriate study design (i.e., approaches to understand leaching potential to water and soil matrices in rainwater) are required to interpret chemical testing for PFAS meaningfully.

f. Over the course of the project, the Review was advised, including by industry stakeholders, that unless tested themselves, the composition of imported products was unknown, and that there is a need for standards.

i. The Review is considering recommendations to improve data collection, reporting and sharing. This includes for example, declaration and testing (validation) of the chemical composition of synthetic turf materials imported or manufactured. Could the TAG provide comment on the potential approach, including the parameters that might usefully be covered and/or any barriers to implementation of such an approach.

The presence of PFAS in synthetic turf maybe due to the chemical being added as an extrusion aid during the making of the pile blades, or due to contamination from other environmental sources. If the presence of PFAS in synthetic turf is very low, then routine testing for them is costly, in the context of other more prioritised chemicals such as PAHs and some heavy metals.

Additionally, it would be important to establish a list of chemicals of concern, and these will likely differ when considering human health and potential ecological/environmental risks. From this is can be systematically established if PFAS is of concern (this may already have been done by OCSE, but noting the approach we would take in general, as this information was not available to TAG).

The data collection, reporting and sharing on the chemical composition imported of manufactured, would this be voluntary with industry? Who would maintain this?

ii. The Review is also considering establishment of a sample library to promote research and the ability to compare research outcomes of different products and surfaces (e.g., performance under different conditions). Could the TAG comment on what any parameters for such library e.g., number and size of samples, etc.

If a library is established, we suggest considering different types of synthetic turf (i.e., virgin turf, newly laid and different states of weathered turf), age of the field, and environmental conditions. Where possible these samples should be collected together with stormwater to allow an investigation into chemical run-off from synthetic sporting fields.

g. Does the TAG have any views on future data collections or research priorities relevant to the Review TOR 4 more generally?

Based on above we highlight the importance of including the following in any assessments around synthetic turf:

- Environmental exposure (not only human health)
- microplastics
- identifying the key chemicals of concern

Additionally, it is recommended that testing for PFAS be considered in the context of testing for other more prevalent chemicals such as PAHs and some heavy metals.

General Comments

1 – Remaining questions relating to PFAS contamination from synthetic turf

It would seem as though there is not a currently strong understanding of the full chemical composition and stability of the chemicals in the synthetic turf matrix. There are several questions to be answered before the TAG can fully consider the issue, for instance;

- What exactly is in the turf (including raw materials) and are synthetic turfs all the same?
- Does it leach?
- How much does it leach?
- How is it transported through environmental media?
- What concentrations get into the waterways?
- Do animals take it up in any quantity?
- Does it affect fish health?
- Does contamination of fish present a significant exposure pathway for humans?

It is important to note that, in the context of aquatic fauna, the chemicals can accumulate and some of them may create risk if they reach the waterways in high enough concentrations. As to whether contaminants originating from turf is more or less significant in the context of the large stable of diffuse contaminant sources across our urban landscape, we can't say.

2 – Contaminant testing for synthetic fields

The TAG feel that there would be benefit in including PFAS in the suite of potential contaminants that are routinely investigated at synthetic field sites.

Additionally, the TAG feel that each site would been to be considered with regard to the contaminant and the surrounding environment. For instance, it would be important to identify sites where there is a risk to a particularly sensitive ecosystem or critical habitat, or where there might be cumulative contaminant pressures such as where the site is located on other known contaminated sites (i.e., sites within an existing PFAS contamination zone).

3 – Synthetic turf regulation in NSW

Synthetic turf and potential PFAS contamination of synthetic turf are not currently regulated by the EPA. Additionally, there are currently no limits on PFAS levels for synthetic turf or recovered wastes applied to land.

No data is held by the EPA regarding the potential contamination of synthetic turf, recovered wastes, and no literature reviews have been undertaken.

7.0 | Terms of Reference | Analysis relevant to Synthetic Turf |

Given the statements contained within the NSWCSE reporting and the advice and recommendations provided by both the NSW TAG and NSW EPA and the concerns they both raise with regards to PFAS contamination and leachates generated from synthetic turf fields impacting waterways and drinking water supplies throughout NSW, the following table has been compiled to address the Term of Reference for the inquiry.

TERMS OF REFERENCE	**ANALYSIS RELEVANT TO SYNTHETIC TURF**
(a) the adequacy and extent of monitoring and data collection on PFAS levels in waterways and drinking water sources	As stated within the reporting provided to the NSWCSE undertaken by NSW TAG and NSW EPA there is a complete lack of monitoring and data collection relevant to the PFAS levels in waterways and drinking water sources in proximity or downstream to synthetic turf fields or artificial ground covering materials. **Immediate action is required to address this and ensure that PFAS contamination via airborne particles, leachates, fibre loss and infill material dispersion is monitored and data collection of PFAS levels occurs.** Many synthetic turf fields are located in close proximity to aquatic ecosystems, waterways and drinking supplies with no monitoring. **Impacts from PFAS contaminated leachates generated from synthetic turf fields to water borne species, life forms, aquatic inhabitants and those who prey on these species has been identified with significant risks to further food chain contamination.** Failure to monitor and undertake data collection from PFAS leachates derived from synthetic turf fields has clear risks to drinking water sources and human health impacts given the cumulative risks associated with PFAS chemicals.. **Long term monitoring and data collection is required, as stated by NSW TAG, at synthetic turf sites throughout NSW.** NSW TAG state there is a need to undertake additional monitoring and assessment *Based on above we highlight the importance of including the following in any assessments around synthetic turf:* · *Environmental exposure (not only human health)* · *microplastics* · *identifying the key chemicals of concern* *Additionally, it is recommended that testing for PFAS be considered in the context of testing for other more prevalent chemicals such as PAHs and some heavy metals.* ***"The TAG feel that there would be benefit in including PFAS in the suite of potential contaminants that are routinely investigated at synthetic field sites. "*** *"Additionally, the TAG feel that each site would need to be considered with regard to the contaminant and the surrounding environment."*

	"For instance, it would be important to identify sites where there is a risk to a particularly sensitive ecosystem or critical habitat, or where there might be cumulative contaminant pressures such as where the site is located on other known contaminated sites (i.e., sites within an existing PFAS contamination zone). "
(b) the adequacy of the reporting and disclosure requirements to the public of monitoring and findings on PFAS contamination of water	**Current reporting and disclosure of PFAS monitoring and findings on PFAS contamination in water surrounding synthetic turf fields is TOTALLY INADEQUATE.** There exists no reporting and monitoring of PFAS contaminated leachates from synthetic turf fields throughout NSW. **The presence of PFAS contaminated water derived from synthetic turf is NOT clear and the understanding, reporting and disclosure requirements are NON EXISTENT to members of the public.** The public are not aware of the presence of PFAS within synthetic turf and the implications this has on human health and the environment. **Impacts to local and broader ecosystems from PFAS contaminated leachate are NOT CONSIDERED and thus NOT REPORTED within the planning, development, installation, ongoing use and end of life processing of synthetic turf fields.** The failure of industry to disclose and make readily available the chemical constituents and components of synthetic turf inhibit the efficiency and efficacy of reporting and monitoring of PFAS contamination to surrounding waters and drinking water supplies. **Routine and ongoing monitoring, reporting and testing of PFAS contaminate leachates and airborne particulate derived from synthetic surfacing should be mandatory and the requirement for the results to be disclosed to the public and documentation made readily available** PFAS reporting with regards to quality control within waterways, drinking water sources, aquatic ecosystems, river systems, estuaries, water catchment areas, groundwater systems and oceanic waterways is required such that exists with air quality controls throughout NSW. **At-risk communities in close proximity to synthetic turf fields should have readily available data provided to them regarding stormwater overflow, underground surcharge, riverine overflow and PFAS contaminated water movements with monitoring provided to adjoining properties owners.** Disclosure of reported PFAS contaminants from extreme rainfall events and stormwater overflow events surrounding synthetic turf fields is required to ensure public safety and the mitigation of cumulative human health impacts to soil for PFAS contaminate leachates and airborne particulate generated from synthetic turf fields. **The requirement for synthetic turf suppliers, industry agencies, consultants, advisors, facility owners and sporting user groups to undertake regular monitoring, data collection and reporting of PFAS contaminants to waterways must be established and for these results to be disclosed and made available.** Routine testing, monitoring and reporting of the contribution to PFAS contaminate derived from the components of synthetic turf fields must be mandatory over the lifecycle of the field. **Analysis, research and reporting must be undertaken relevant to PFAS**

	contaminated particulate, fibres and leachate dispersion locally and within downstream waterways systems. Given the presence of PFAS in synthetic turf there is a need for routine testing and a prioritisation of the cumulative testing that records and identifies a greater presence of PFAS contaminate within the local environment surrounding synthetic turf fields. **There is a requirement to establish a list of PFAS chemicals of concern, relevant to synthetic turf, that identify and consider both the human health and potential ecological/ environmental risks generated from PFAS leachates and particulates dispersed and lost into the environment..** There exists a need to systematically establish if PFAS derived from synthetic turf leachate and airborne particulate represents a concern over the lifetime of the field with adequate reporting provided to users, surrounding property owners and the broader community. **Data collection, reporting and sharing on the chemical composition of imported or locally manufactured synthetic turf is required to ensure that the cumulative risks of PFAS contamination to water and the surrounding environment is known and recorded**. Agencies manufacturing, supplying, installing, maintaining and involved in the end of life processing of synthetic turf MUST be required to report and disclose the results of the monitoring and reporting of PFAS contaminate generated over the lifetime of a synthetic turf field. **There exists a requirement for industry stewardship, whereby the human and environmental risks generated by the dispersion of PFAS contaminated leachate or airborne particulate is borne by the industry.** NSW TAG recommends considering different types of synthetic turf (i.e., virgin turf, newly laid and different states of weathered turf), age of the field, and environmental conditions when monitoring and reporting PFAS contamination. NSW TAG states that "*where possible these samples should be collected together with stormwater to allow an investigation into chemical run-off from synthetic sporting fields.*" **The reporting from these samples needs to be made readily available to the public.**
(c) the identification of communities at risk from PFAS contamination	**Within NSW Government agencies there exists NO identification of the risks to waterways, drinking water supplies, communities, ecologically sensitive areas and ecosystems to PFAS contaminants derived from synthetic turf fields.** The NSW Government has failed to identify communities, both human, environmental and ecological, that are at risk of PFAS contaminates derived from synthetic turf. **The cumulative nature of PFAS chemicals and the identification that the NSW Government has failed to identify and establish at risk communities of PFAS contaminated particulate, leachate and/or other substances is gravely concerning.** Adjoining residential properties, downstream participants and the broader community are at risk. of PFAS contaminate leachate and airborne particulate generated by synthetic turf. **The NSW Government is deeply lacking and failing to undertake the requested actions and recommendations of the NSW Technical and Advisory**

	Group (NSW TAG) in this space. The inability of the NSW Government to act and ensure that the concerns and recommendations of the NSW TAG are addressed is deeply concerning **enHealth guidance on risk assessment provides a framework for assessing human health risks relevant to PFAS contamination to waterways and drinking water, yet it would be apparent that such action has failed to be utilised by the NSW Government.** NSW TAG identified that relevant to synthetic turf fields "*there is a potential for contaminants to leach into stormwater and otherwise into the environment (i.e., implications for ecological and environmental risks), and therefore a reference to the Australian Water Quality framework for assessing contaminant risk to aquatic ecosystems is also recommended.* **Action by the NSW Government to undertake such assessments and utilise the Australian Water Quality framework for assessing risks to aquatic ecosystems has failed to be undertaken.** In June 2021, a US Environmental Protection Agency rule change required all manufacturers (including importers) of PFAS in any year since 2011 to report information related to chemical identity, categories of use, volumes manufactured and processed, byproducts, environmental and health effects, worker exposure, and disposal. Similar regulations MUST be enacted by the NSW Government
(d) the adequacy and effectiveness of government engagement with and support for communities disproportionately affected by PFAS contamination, including First Nations communities	**The NSW Government has failed to engage with and support communities affected by PFAS contamination derived from synthetic turf field installations.** The inability of the NSW Government to effectively consult and support communities impacted by airborne PFAS particulate and leachate contamination is clearly represented within the failures identified by NSW TAG and NSW EPA. **NSW TAG indicates that the process for undertaking a human health risk assessment is based on enHealth guidance. As such, the NSW TAG suggests that the focus for any human health assessment of risk from PFAS needs to use the tolerable daily intake (TDI, FSANZ)** The NSW Government has failed to initiate or undertake any human health risks relevant to PFAS contamination from synthetic turf utilising tolerable daily intake. (TDI) **Sporting users, community members and neighbouring residential properties at greater exposure risks due to the cumulative impacts of PFAS particulate and leachate given the greater exposure and livable hours have not been assessed.** NSW TAG states that "*TDI assessment of PFAS risks to human health is designed to be protective of these health effects, and thus we suggest this is referred to instead.*" The NSW Government has failed to undertake such measures.
(e) sources of exposure to PFAS, including through historic and current firefighting practices	**The combustion of synthetic turf containing PFAS chemicals presents a risk to firefighting practices, personnel and the broader community**. The combustion of synthetic turf releases toxic PFAS chemicals into the surrounding atmosphere with unknown impacts.

Historical firefighting experiences and utilisation of PFAS containing foams has been identified as a significant contributor to PFAS contaminated waterways and drinking water sources, reference Blue Mountains.

The combustion of synthetic turf and the resultant fumes, ash and toxic runoff within the water utilised to extinguish synthetic turf fires is greatly unknown.

The NSW Government has failed to identify and address the potential fire risks and sources of exposure to PFAS from the combustion of synthetic turf.

Given the significant contributions PFAS containing foams and flame retardants utilised historically to fight fires has had to NSW waterways and drinking supplies and their persistence within the environment and ecological systems, this is clearly an oversight by the NSW Government

Given the scale and amount of PFAS containing materials utilised within a single synthetic turf field, stated by industry representatives to be 225,000kg, the risks are significant.

There exists within the NSW Government a complete lack of understanding in the fire risks posed by flammable products containing PFAS chemicals such as synthetic turf; with its utilisation incorporated within community Neighbourhood Safer Places within bush fire prone areas.

There is a need to ensure remote bush fire-prone areas have an *Indoor Neighbourhood Safer Place*, so people can take shelter when open spaces are too dangerous due to fire conditions that clearly do not utilise PFAS containing chemicals.

Educational facilities, principally schools, are often nominated *Indoor Neighbourhood Safe Places*, yet playgrounds and surrounding outdoor spaces within schools regularly utilise synthetic turf within their infrastructure, with obvious implications .

According to the reporting undertaken by the NSWCSE, exposure to synthetic turf within bush fire prone areas presents the following challenges;

- synthetic turf products tested are classified as easily flammable.
- Materials used in other layers and infill vary significantly in flammability and toxicity
- Sand reduces heat release rates while SBR exhibits higher peak heat release rates and flammability.
- There are no relevant ignition or fire testing standards for outdoor applications of synthetic turf experiencing bushfire wind and temperature conditions.
- The chemical constituents of synthetic turf are unknown which greatly impacts the knowledge and understanding of the chemicals and their impacts to human health and the environment on combustion.

The release and exposure to PFAS chemicals within firefighting measures and the consequences of such to personnel and the environment are unknown by the NSW Government relevant to synthetic turf.

(f) the health, environmental, social, cultural and economic impacts of PFAS	**The health, environmental, social, cultural and economic impacts of PFAS utilised within the construction of synthetic turf fields installed through NSW is unknown.** The experts utilised within the reporting of the NSWCSE identified the following; *9.1 Chemical constituents of synthetic turf* *Many of the commissioned experts, from diverse research areas, identified a singular major knowledge gap - that chemical constituents of synthetic turf components, and their associated human and environmental health impacts are not fully known.* *There is a need for laboratory and on-site studies conducted under Australian climatic and environmental conditions, and human health assessments across age and demographic categories.* *The development of a chemicals and materials library for synthetic turf components could inform leachate toxicant and pollutant identification and identify the impacts of synthetic surfaces on ecological and human health. Including chemicals and additives used during production, and materials such as SBR rubber that have a high variability* In light of the aforementioned, the NSW Government has a clear need to investigate and determine the impacts from PFAS chemicals utilised within synthetic turf relevant to the health, environment, social, cultural and economic prosperity and longevity of existing and future generations. **The significant emerging human health risks identified relevant to exposure to PFAS containing chemicals is becoming more present.** The risks to human health are all too clear and the need to mitigate and reduce exposure to such chemicals is apparent. **The risks from PFAS chemicals to the environment and ecological systems are very apparent with severe consequences and long term detrimental impacts well known.** The apparent failure of the NSW Government to excel and advance action in this space is deeply concerning given the ramifications that delaying such actions present to the environment, society . **The continued utilisation of synthetic turf fails to mitigate and reduce exposure to PFAS chemicals within the environment with devastating consequences to flora and fauna, with particular reference to unique native species such a platypus.** The inability of the NSW Government to heed the obvious warnings and address the impacts derived from synthetic turf containing PFAS chemicals, further complicates and increases the risks posed by PFAS and the social, cultural and economic burdens to be experienced into the future. **The NSW Government is required to "*disallow*" the continued utilisation of synthetic turf so that it protects and ensures the long term sustainability and health of future generations.** The requirement for the NSW Government to enact the *precautionary principle* within this space is clearly evident, given the unknown long term impacts derived from PFAS containing synthetic turf.

(g) the impacts, monitoring and mitigation of contamination on livestock, domestic animals and wildlife, including water birds, fish and other aquatic life	**The NSW Government MUST ensure that the impacts from PFAS contamination from synthetic turf to waterways and drinking supplies for livestock, domestic animals and wildlife is removed.** The breakdown and release of PFAS contaminated leachates and airborne particulate from synthetic turf fields has significant risks to Australian flora, fauna, domestic animals and livestock. **The failure of the NSW government to establish and undertake monitoring of PFAS contamination derived from synthetic turf has clear ramifications.** The inability and apparent lack of interest of the NSW Government to attempt or undertake mitigation measures aimed at reducing PFAS contamination presents significant implications and risks to livestock, domestic animals and wildlife, including water birds, fish and other aquatic life **Action is required by the NSW Government to remedy and rectify the release of PFAS contaminate from synthetic turf such that the impacts are mitigated.** The removal of synthetic turf and artificial ground covering materials is clearly needed given the substantial release and dispersion of PFAS containing contaminate within airborne particulate and leachates derived from the synthetic materials utilised within their construction. The insight and findings of the NSWCSE indicate; > ***Restrictions on eight PAHs, limiting concentrations in crumb rubber used as infill material in on playgrounds or in sport applications have been recently applied in the EU.*** The same measures MUST be enacted within NSW. > ***Progressive restrictive measures to limit potentially harmful chemicals in synthetic turf components may reduce unforeseen consequences to health.*** The removal of PFAS chemicals within the components, manufacture and construction of synthetic turf MUST be undertaken and regulations established by the NSW Government to enforce such measures. > ***Measures to reduce chemical leachates and microplastic pollution serve to reduce potential cumulative harm to aquatic and soil life, the environment and ultimately human health.*** Such measures MUST be established by the NSW Government so as to reduce potential cumulative harms from PFAS contamination
(h) the structure, capacity, capability and resourcing of New South Wales Government agencies and water utilities to detect, monitor, report on, respond to and mitigate against PFAS contamination of water supplies, including the adequacy of infrastructure and resources	**Existing capabilities to detect, monitor, report on, respond to and mitigate against PFAS contamination of water ways relevant to synthetic turf fields is non-existent.** NSW Government agencies are lacking the structure, capacity, capability and resources required to detect PFAS contamination from synthetic turf fields. **Identification by NSW TAG that monitoring and testing of PFAS leachates and airborne particulate from synthetic turf fields is not currently being undertaken.** enHealth guidance on risk assessment provides a framework for assessing human health risks.

	NSW TAG note that there is a potential for contaminants to leach into stormwater and otherwise into the environment (i.e., implications for ecological and environmental risks), and therefore a reference to the Australian Water Quality framework for assessing contaminant risk to aquatic ecosystems is also recommended. NSW TAG identified there would be benefit in including PFAS in the suite of potential contaminants that are routinely investigated at synthetic field sites. The capacity and capability of NSW Government agencies to undertake this work does not exist. **NSW TAG feel that synthetic turf sites need to be considered with regard to the contaminant and the surrounding environment**. There exists a need to identify sites where there is a risk to a particularly sensitive ecosystem or critical habitat, or where there might be cumulative contaminant pressures such as where the site is located on other known contaminated sites (i.e., sites within an existing PFAS contamination zone). The ability for NSW Government agencies to undertake this work does not currently exist. **Synthetic turf and potential PFAS contamination of synthetic turf are not currently regulated by the NSW EPA**. Additionally, there are currently no limits on PFAS levels for synthetic turf or recovered wastes applied to land. **Indicated within the reporting of the NSW CSE, to date, no data is held by the NSW EPA regarding the potential contamination of synthetic turf, recovered wastes, and no literature reviews have been undertaken.** This critical work, regulation and data collection has NOT been established within NSW.
(i) the adequacy and effectiveness of New South Wales's legislative and regulatory framework in testing for, monitoring, mitigating and responding to PFAS contamination, including the adequacy of health-based guidance values, as compared to the standards and practices of other Australian and international jurisdictions	**Within NSW and nationally there are no regulatory frameworks for testing, monitoring, mitigating and responding to PFAS contaminate derived from synthetic turf.** NO health based guidance values exist to regulate the manufacture of synthetic turf. **The commissioned experts, from diverse research areas utilised within the reporting of the NSW CSE identified a singular major knowledge gap - that chemical constituents of synthetic turf components, and their associated human and environmental health impacts are not fully known. Thus, the adequacy and effectiveness of the regulatory framework is failing.** The NSW CSE identified that there is a need for laboratory and on-site studies conducted under Australian climatic and environmental conditions, and human health assessments across age and demographic categories. This work is not being undertaken by NSW Government agencies. **The recommendation by the NSW CSE that the NSW Government develop a chemicals and materials library for synthetic turf components that could inform leachate toxicant and pollutant identification and identify the impacts of synthetic surfaces on ecological and human health. This chemicals and materials library has NOT been formalised.** The regulatory framework established for products, being relevant Australian Standards, has NOT been established with synthetic turf which is NOT inline

	with international jurisdictions and practice. *Australian Drinking Water Guidelines* requires substantial rectification to align with International best practices The regulation of PFAS contaminates from synthetic turf and other major sources MUST be mitigated.
(j) public sector resourcing and coordination amongst relevant agencies in preventing controlling and managing the risks of PFAS to human health and the environment	**There exists no public sector resourcing or coordination amongst relevant agencies as this work is NOT being undertaken within NSW.** Synthetic turf and potential PFAS contamination of synthetic turf are not currently regulated by the NSW EPA. **Additionally, there are currently no limits on PFAS levels for synthetic turf or recovered wastes applied to land.** Indicated within the reporting of the NSW CSE, no data is held by the NSW EPA regarding the potential contamination of synthetic turf, recovered wastes, and no literature reviews have been undertaken. **This critical work, regulation, data collection and coordination of public sector agencies has NOT been established within NSW.** The prevention, control and management of the risks of PFAS to human health and the environment derived from synthetic turf is NOT being undertaken throughout NSW.
(k) international best practices for water treatment and filtration, and the environmentally sound management and safe disposal of PFAS	**Within NSW, international best practices for water treatment, filtrations and environmentall sound management and safe disposal of PFAS contaminated synthetic turf DOES NOT exist.** Mitigation measures required overseas are NOT established and utilised within NSW to reduce the harms caused by PFAS leachates, nano and micro plastic pollution and airborne particulate generated by synthetic turf. **Methodologies to reduce PFAS contaminate leaching and dispersing into local and broader environments from synthetic turf fields is NOT being established or advanced within NSW.** Reporting by the NSW CSE in 2022 relevant to the impacts of environmentally sound management and safe disposal of PFAS identified significant failures and areas of concern. **NSW Government agencies have failed to undertake or initiate or provide a response to the NSW CSE report for over 24 months.** US Environmental Protection Agency rule change, In June 2021, that required all manufacturers (including importers) of PFAS in any year since 2011 to report information related to chemical identity, categories of use, volumes manufactured and processed, byproducts, environmental and health effects, worker exposure, and disposal. Similar regulations has not been established here. **The recently enacted ban, within the EU, on PFAS contaminated SBR or ELT (crumb rubber) infill, has NOT been undertaken within NSW.** The reporting of the European Chemicals Agency (ECHA) and their identification of (very) high Poly Aromatic Hydrocarbon (PAHs) concentrations within infill materials utilised within synthetic fields and their recommendation

	for their removal has not been followed within NSW. **The failure to undertake such measures and establish bans on PFAS contaminate infill materials and attempts to mitigate the very high PAHs concentrations and consequent risks levels, as established within the EU has not been followed within NSW**. The inability of the NSW Government to heed and follow international best practices needs to be reviewed. There exists significant risks to existing and future generations. **Action to address PFAS contamination to waterways and drinking water supplies from PFAS leachates, nano and micro plastics pollution and PFAS contaminated airborne particulate MUST be undertaken by the NSW Government**
(l) the effectiveness of remediation works on specific sites and international best practices for remediation and management of contaminated sites	**The NSW Government has failed to identify specific sites where the detrimental effects of PFAS contamination from synthetic turf fields is occurring.** There exists no public sector agencies undertaking this vital work which means that remediation works are NOT being undertaken within NSW. **Synthetic turf and potential PFAS contamination of synthetic turf are not currently regulated by the NSW EPA and as such government agencies are failing to manage and establish international best practice for the remediation and mitigation of PFAS contamination at synthetic turf sites.** There are currently no limits on PFAS levels for synthetic turf or recovered wastes applied to land which is contrary to international best practice. . **Indicated within the reporting of the NSW CSE, no data is held by the NSW EPA regarding the potential contamination of synthetic turf, recovered wastes, and no literature reviews have been undertaken. International best practice requires such data to be collected.** Critical remediation work, regulation, data collection and co ordination of public sector agencies has NOT been established within NSW to investigate, establish and undertake remediation works at sites where synthetic turf fields are leaching PFAS contaminate.. **The prevention, control and management and remediation of the risks of PFAS to human health and the environment derived from synthetic turf is NOT being undertaken throughout NSW**. International best practices have NOT been established within NSW to address PFAS contamination and pollutants generated from synthetic turf fields.
(m) areas for reform, including legislative, regulatory, public health and other policy measures to prevent, control and manage the risks of PFAS in water supplies	**Synthetic turf and potential PFAS contamination of synthetic turf are not currently regulated by the NSW EPA and as such government agencies are failing to manage and establish international best practice for the remediation and mitigation of PFAS contamination at synthetic turf sites.** There exists no public sector agencies undertaking this vital work which means that remediation works are NOT being undertaken within NSW. **The NSW Government has failed to identify specific sites where the detrimental effects of PFAS contamination from synthetic turf fields is occurring.**

	International best practices have NOT been established within NSW to address PFAS contamination and pollutants generated from synthetic turf fields. There are currently no limits on PFAS levels for synthetic turf or recovered wastes applied to land which is contrary to international best practice. Indicated within the reporting of the NSW CSE, no data is held by the NSW EPA regarding the potential contamination of synthetic turf, recovered wastes, and no literature reviews have been undertaken. International best practice requires such data to be collected. **Critical remediation work, regulation, data collection and coordination of public sector agencies has NOT been established within NSW to investigate, establish and undertake remediation works at sites where synthetic turf fields are leaching PFAS contaminate.**. The prevention, control and management and remediation of the risks of PFAS to human health and the environment derived from synthetic turf is NOT being undertaken throughout NSW. ***Australian Drinking Water Guidelines*** **requires substantial rectification to align with International best practices** The regulation of PFAS contaminates from synthetic turf and other major sources MUST be mitigated.
(n) the impact of taking contaminated water sources offline on water security, including the effects of diverting water between communities; the social, economic and logistical implications of such diversions, and the challenges posed by PFAS contamination to water availability, drought management and emergency supply planning,	Unknown and not an area of expertise
(o) any other related matters.	Given the rapidly changing impacts and unknowns from PFAS contaminates, it would be relevant to raise the concerns contained within the rational of the *precautionary principle* and the need for NSW Government agencies to consider; *not only known risks, but also potential risks to the environment and human health may need to be addressed; when there is a rational basis for concern, when their nature or magnitude is uncertain, and when a causal link with a certain action or process is not fully established. … This notion of precaution is based upon the assumption that in certain cases, scientific certainty, to the extent that it is obtainable with regard to environmental issues, may be achieved too late to provide effective responses to environmental threats. (OECD 2002, p. 6)*[7]

[7] https://www.pc.gov.au/research/supporting/precaution/precaution.pdf

8.0 | Conclusion |

The NTA strongly believes that there is the need to further investigate the risks of PFAS contaminates to waterways and drinking supplies due the the utilisation of synthetic turf and artificial ground covering materials that contain, are composed of, utilise or constructed with PFAS chemicals.

> ***What is becoming clear is that there are substantial unknown and the potential for significant risks to human health and the environment for future generations if synthetic ground covering materials continue to be utilised within the built environment given the significant PFAS contaminate loss generated.***
>
> ***The current inaction by the NSW Government to address and act upon the recommendations provided to them within the reporting of the NSW Chief Scientist and Engineer only exacerbates these risks.***
>
> ***PFAS impacts to waterways and drinking water supplies, from synthetic surfacing and ground covering materials, will only increase given the continued utilisation of these products within the built environment.***
>
> ***Regulatory action and oversight by the NSW Government is required to ensure that the potential PFAS contamination from synthetic turf and ground covering materials is removed.***
>
> ***Regulatory action has and is being established internationally with significant steps being undertaken to ensure there exists regulatory protections from PFAS contamination derived from synthetic turf.***
>
> ***The introduction of and establishment of bans on synthetic turf and artificial ground covering materials has taken place abroad and similar actions are required in NSW to ensure the human heath, environmental and long term degenerative impacts from synthetic turf and PFAS are mitigated.***

The NTA greatly appreciates the opportunity to submit to this inquiry. Representatives of the NTA are happy to further engage with this inquiry and if so desired would make themselves available in person at relevant hearings. We look forward to hearing back from you with regards to appearing before this inquiry if so required.

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