Climate Action Merri-bek
P.O. Box 381
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9 December 2024

To: Christina Grayland, Merri-bek Council
Email: cgrayland@merri-bek.vic.gov.au

Re: McDonald Reserve Facility Design Plan

We are a grassroot Incorporated group of citizens in the municipality of Merri-bek in Melbourne's Northern suburbs active on climate advocacy since 2008. We bring our experience and knowledge of climate and environmental issues and the need for rapid decarbonisation to address the climate emergency, especially as it applies to our own municipality, but also generally for Australia as a whole.

We became aware of the climate and environmental issues with synthetic turf during the Merri-bek Council proposal to convert Hosken Reserve multi-use grass sports field to a synthetic sports field. Our submission on McDonald Reserve Facility Design Plan focuses on possible environmental and health issues.

We thank Merri-bek Council for this opportunity to put in a submission on the upgrade of McDonald Reserve.

John Englart
Convenor, Climate Action Merri-bek
for and on behalf of Climate Action Merri-bek

Submission on McDonald Reserve Upgrade

Executive Summary

We have an in principle concern at the installation of synthetic turf or plastics/rubber based softfall in the municipality.

This concern arises out of a number of issues

- The unknown chemicals used in synthetic turf and softfall.
- The possible presence of PFAS forever chemicals or other toxic chemicals that can impact human health and the environment
- Generation of both airborne and water based microplastics pollution as synthetic turf or soft fall wears.
- Urban heat microclimate implications from converting grass to synthetic turf.
- What is the vegetation plan for mitigating heat and biodiversity impacts?
- If synthetic surface is decided upon after the Sports Surfaces Policy is applied:
    - How will microplastics pollution be minimised and mitigated against?
    - What is the End of Life Plan and is it consistent with Council's Sustainability and Circular Economy Policies?

Synthetic surfaces are a non-essential plastics product derived from fossil fuels. We should, in principle, be reducing use of non-essential plastics to reduce the climate crisis, biodiversity crisis and the plastics pollution crisis.
See: Chen, Xuejing, Kristen McDonald, Madeline Rose, Pacific Environment, 23 May 2023, "Stemming the Plastic-Climate Crisis: Paris Alignment for Plastics Requires at least 75% Reduction,",
https://www.pacificenvironment.org/wp-content/uploads/2023/05/Stemming-the-Plastic-Climate-Crisis-1.pdf

This entails curbing non-essential plastics use such as synthetic surfaces. We note and applaud Council doing this in other areas, such as Council's Plastic Wise Policy.

I raised the issue of Microplastics pollution and PFAS contamination in my statement to Council meeting 14 September 2022 when the 2nd Hockey Field Feasibility Study was presented. See Blog article:
https://takvera.blogspot.com/2022/09/microplastics-pollution-threat-fails-to.html

The health and environmental impacts of Synthetic turf, PFAS and microplastics are active areas of research, with substantial knowledge gaps, and very far from being settled.

Design of McDonald Reserve sports facilities will be a significant test of Council's new Sports Surfaces policy in weighing up all the benefits and impacts, and applying the precautionary principle.

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Response to 2nd Hockey Field Feasibility Study

In my statement to Council meeting 14 September 2022 where the 2nd Hockey Field Feasibility Study was presented I raised deficiencies with this report.

The Feasibility Report had a number of errors which I tried to highlight in my statement, the major one being the complete absence of the microplastics pollution threat.

A Swiss/German study published October 2021 found that between 50 kilograms to over 1 metric ton per year was the average fibre loss from a synthetic pitch. (Bertling et al 2021) This is separate from infill loss assessed at 2.98 tonnes average per year from the same study (which would mainly apply to soccer artificial turf rather than hockey). The NSW Chief Scientist report on Synthetic Turf[1] found the amount of turf fibres lost from a synthetic turf field is likely to be in the 100s of kilograms per year, with the amount increasing for fields near the end of life or under poor maintenance.

There are several more errors in the Feasibility study I did not go into.

The health and environmental impacts that were mentioned in the study, were not adequately detailed or quantified which was in sharp comparison to data provided to justify the social benefits.

Here is an excerpt from my statement to Council meeting:

> 1. Great effort has gone into highlighting the social need and benefits of a new field hockey pitch in our municipality, and I acknowledge that.
>
> 2. While the environmental impacts and impacts to other sports and active recreation are mentioned, there is little detail given commensurate with the argument put forward for hockey.(1)
>
> 3. There is one environmental impact which is totally missing from this report: Microplastics Pollution. Is this an issue? Ask Port Phillip Bay Keeper Neil Blake OAM about synthetic fibres pollution with KP Hardiman Reserve (2) in Darebin, used for hockey. Or refer to Martin Sheppard of Smart Connection Consultancy who wrote the Sports Surface Needs Analysis for Council in 2018 who prepared an assessment in 2021(3) of ways to mitigate some of the damage of infill microplastic pollution.
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> 4. My last point I'd like to raise is siting. One of the sites, Parker Reserve in North Coburg, is partly built on a waste tip with evidence of some subsidence. This may require extra stabilisation work for the base of a hockey pitch to be built. Secondly, a synthetic hockey pitch being built next to Merri Creek would cause any microplastic

[1] NSW Office of the Chief Scientist, Synthetic Turf in Public Spaces, https://www.chiefscientist.nsw.gov.au/independent-reports/synthetic-turf-in-public-spaces
Full Report: https://www.chiefscientist.nsw.gov.au/__data/assets/pdf_file/0004/542263/CSE-Synthetic-Turf-Review-Final-Report.pdf

pollution finding its way into the creek environment affecting aquatic ecosystems(4) and the food web and contributing to plastics pollution in Port Phillip Bay.

This may include fluoropolymers (PFAS related chemicals)(5) used in manufacture of synthetic turf blades and matting(6). Fluoropolymers have chemical traits of biopersistence and bioaccumulation which are noted as of concern for both human and environmental health.

Notes:
(1) See my Literature Review: Synthetic Turf carbon footprint, environmental, health, microplastics and biodiversity impacts (April 2021) written in part to counterbalance the narrow social benefits that accrues to a relatively small but influential cohort in governance decision making on sports surfaces with the various environmental impacts.
https://takvera.blogspot.com/2021/04/literature-review-synthetic-turf-carbon.html

(2) Port Philip Baykeeper Neil Blake on KP Hardiman Reserve as reported in The Age in 2021
https://www.theage.com.au/national/victoria/we-re-running-out-of-space-turf-wars-heat-up-over-synthetic-grass-20210413-p57itd.html

(3) Martin Sheppard (March 2021), Minimising the Impacts of Microplastics on the Environment
https://www.linkedin.com/pulse/minimising-impacts-microplastics-environment-martin/

(4) Boyle, Kellie., and Örmeci, Banu., (Sep 2020), Microplastics and Nanoplastics in the Freshwater and Terrestrial Environment: A Review, Water 2020, 12, 2633; doi:10.3390/w12092633 https://www.mdpi.com/2073-4441/12/9/2633

(5) Lohmann, Rainer., Ian T. Cousins, Jamie C. DeWitt, Juliane Glüge, Gretta Goldenman, Dorte Herzke, Andrew B. Lindstrom, Mark F. Miller, Carla A. Ng, Sharyle Patton, Martin Scheringer, Xenia Trier, and Zhanyun Wang, (Oct 2020) Are Fluoropolymers Really of Low Concern for Human and Environmental Health and Separate from Other PFAS? Environmental Science & Technology 2020 54 (20), 12820-12828
DOI: 10.1021/acs.est.0c03244
https://pubs.acs.org/doi/10.1021/acs.est.0c03244

(6) Lauria, Mélanie Z., Ayman Naim, Merle Plassmann, Jenny Fäldt, Roxana Sühring, and Jonathan P. Benskin, (July 2022) 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 https://pubs.acs.org/doi/full/10.1021/acs.estlett.2c00260

The unknown chemicals used in synthetic turf and soft fall

The chemical content of synthetic turf is undisclosed and unregulated.

As well as the base plastic, additives such as flame retardants, plasticizers, anti-bacterials, and pigments can be added which can pose environmental and health issues. Some of these additives have been shown to be toxic.

Some additives in the manufacture of polyethylene plastics products and their toxic potential for health from Lopez et al (March 2023):
Abad López, Angela Patricia, Trilleras, Jorge, Arana, Victoria A. , Garcia-Alzate, Luz Stella, Grande-Tovar, Carlos David., (March 2023) **Atmospheric microplastics: exposure, toxicity, and detrimental health effects**, RSC Adv., 2023, 13, 7468-7489 doi.org/10.1039/D2RA07098G

Flame retardants: Polybrominated Diphenyl Ethers (PBDEs)
Health Impacts: Diabetes, neurobehavioral and developmental disorders, cancer, reproductive health effects, and impaired thyroid function

Pigments: Cadmium (Cd)
Health Impacts: Promotion of cell apoptosis and DNA methylation, oxidative stress, DNA damage, bone and lung damage, alterations in calcium metabolism, and kidney stone formation

Titanium (ti)
Health Impacts: Decreased cell viability and increased intracellular reactive oxygen species (ROS) cytotoxicity in human lung and colon epithelial cells

Plasticizers: Phthalates (DBP, DEHP)
Health Impacts: Endocrine disruption, associated with reproductive toxicity and carcinogenicity

Bisphenol A (BPA)
Health Impacts: Endocrine disruptors associated with obesity, fertility problems, cardiovascular disease, reproductive disorders, and breast and prostate cancer

Possible presence of PFAS forever chemicals

There has been very limited testing in Australia of the chemical content of synthetic turf, but we note testing in both the USA and Europe has found Fluoropolymers and PFAS present in turf fibers and matting and suggested this is a world-wide problem..

In the USA there are cases where synthetic fields have polluted the water table with PFAS that provides drinking water for the community.

There are over 14,000 PFAS chemicals, only a few of which are tested for, and many of which toxicity studies haven't been performed. PFAS is both bio-persistent and bio-accumulative.

Both microplastics and PFAS affect environmental ecosystems and human health, and when combined together, or with other toxic pollutants, **may have both an additive and synergistic impact.** This has important implications not only for animal species but for human health. It is not just the single health impact of either PFAS chemicals or microplastic particles on health but the way they work together that can multiply health impacts.

A study by Tayebeh Soltanighias et al in October 2024 highlighted the combined toxicity of perfluoroalkyl substances and microplastics in aquatic ecosystems. One of the potential sources for both microplastics and PFAS chemicals is synthetic turf.[2]

See our Submission to the Senate PFAS Inquiry

For Australian testing of PFAS in Synthetic Turf, the Natural Turf Alliance, based in Sydney, reported that:[3]

> "The National Measurements Institute of the Department of Industry, Science, and Resources recently completed testing on samples of artificial turf plastic fibre obtained from a synthetic field in Northern Sydney.
> The test reported 15 mg F/kg of organofluorine, a concentration within the range observed in other international studies."

The Natural Turf Alliance also suggests potential PFAS dermal exposure from artificial turf.

> A recent preliminary US study looked at levels on the skin of six-year-old soccer players and their coach. Three players and one coach used GhostWipes® to wipe their hands prior to and after soccer games on artificial turf and on natural grass fields in California in the summer of 2023. Results suggest an increase in PFOS levels from playing on artificial turf with a mean increase of PFOS (mean=0.6125 ng/wipe, $p<0.08$).[4]

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[2] Tayebeh Soltanighias, Abubakar Umar, Muhammad Abdullahi, Mohamed Abou-Elwafa Abdallah, Luisa Orsini, (19 October 2024), Combined toxicity of perfluoroalkyl substances and microplastics on the sentinel species Daphnia magna: Implications for freshwater ecosystems, Environmental Pollution, Volume 363, Part 1, 2024, 125133, ISSN 0269-7491, https://doi.org/10.1016/j.envpol.2024.125133

[3] Natural Turf Alliance, Health Risks of PFAS in Synthetic Turf – July 2024 https://mcusercontent.com/246a8c63a2c1af6ed1687fed8/files/4038be53-9d14-ac45-cfb2-63ce95af9c3f/Health_Risks_of_PFAS_in_Synthetic_Turf_2024_07_12.02.pdf

[4] Peer.org https://peer.org/wp-content/uploads/2024/03/3_6_2024-Dermal-absorptionPFAS-AT.pdf

I also draw your attention to Synthetic Turf in Public Spaces – Chemical composition of materials. This is the Summary Report prepared for the Office of NSW Chief Scientist & Engineer by the Institute for Sustainable Futures, August 2022.[5] It notes that more research and testing of synthetic turf materials is needed:

> "Further analysis of the material components in the synthetic turfs is needed not only from the players' safety perspectives but also from the environmental point of view. There is a disagreement in literature regarding the safety of some of the chemicals. (pg 32)"

Airborne and water based microplastics pollution

As synthetic surfaces wear they produce microplastics which are both airborne and water based..

Airborne microplastics

Finer particles become airborne and can travel over a wide area adding to urban pollution. I draw your attention to a literature review and a peer reviewed study on this threat:

> Breathing Plastic: The Health Impacts of Invisible Plastics in the Air (March 2023), https://www.ciel.org/reports/airborne-microplastics-briefing/
> "analyzes the implications of micro- and nanoplastics moving through the air and entering the human body via inhalation."

> Abad López, Angela Patricia, Trilleras, Jorge, Arana, Victoria A. , Garcia-Alzate, Luz Stella, Grande-Tovar, Carlos David., (March 2023) **Atmospheric microplastics: exposure, toxicity, and detrimental health effects**, RSC Adv., 2023, 13, 7468-7489 doi.org/10.1039/D2RA07098G
> https://pubs.rsc.org/en/content/articlehtml/2023/ra/d2ra07098g
> Comment: Review article of airborne microplastics, including exposure, toxicity and health effects. Outdoor sources for microplastics include: "abrasion of synthetic textiles, incomplete incineration of plastic waste, municipal solid waste, dust storms, abrasion from synthetic rubber tires, scaffolding mesh on construction sites, and synthetic turf for ground cover are recognized as potential sources of MPs suspended in outdoor air."

[5] Jazbec, M. and Florin, N. (2022) Synthetic Turf in Public Spaces – Chemical composition of materials. A summary report prepared for the Office of the NSW Chief Scientist & Engineer by Institute for Sustainable Futures, ResearchGate, https://www.researchgate.net/publication/380856085_SYNTHETIC_TURF_IN_PUBLIC_SPACES_CHEMICAL_COMPOSITION_OF_MATERIALS

Microplastics impact on aquatic ecosystems

Larger particles can be carried away on clothing, shoes, or be washed away into stormwater and into creek catchments affecting aquatic ecosystems.

Boyle et al (2020) provides a detailed outline to microplastic pollution impact in the freshwater and terrestrial environment

> Boyle, Kellie., and Örmeci, Banu., (Sep 2020), Microplastics and Nanoplastics in the Freshwater and Terrestrial Environment: A Review, Water 2020, 12, 2633; doi:10.3390/w12092633 https://www.mdpi.com/2073-4441/12/9/2633
>
> Quite a good broad ranging Literature review of microplastics and their various impacts, current regulatory environment. Impacts include on freshwater, terrestrial ecosystem health and raising questions about impact on human health..
>
> “Any biota that consumes microplastics can suffer from gastrointestinal tract issues and obstruction, potentially leading to false satiety, starvation and death [3]. However, this only considers the physical implications of the microplastic and does not take into account the chemical effects. Plasticides can easily migrate away from plastics and cause deleterious consequences to biota. Many of the additives are lipophilic and can penetrate cell membranes and interfere with biochemical reactions occurring in the cells, resulting in behavioural and reproductive issues….Once the microplastic is in the gastrointestinal tract it can leach plastic additives, as well as any toxin that it may have adsorbed when discharged to the environment (i.e., persistent organic pollutants (POPs)). Many of these additives and POPs are toxic to biota and can cause abnormalities [3], which in turn, could lead to potential death of the organism.”
>
> “Bioaccumulation effects due to microplastics entering food networks (i.e., accumulating in bottom feeders such as sedimentary organisms), and building from one level to the next is a possibility, but has also yet to be fully explored for freshwater and terrestrial life.”
>
> ‘Early findings suggest that there is a potential threat to human health, but more research needs to be conducted to shrink the knowledge gap…Most alarmingly, the blood-brain barrier was breached in Japanese rice fish, and such a breaching poses extreme health risks to all animals and humans.”

Urban heat microclimate implications

Converting a present grass sports field to a synthetic surface will increase local temperatures in and around McDonald Reserve. A park that once offered a slight Cool Park effect will now become a microclimate heat hotspot.

Given the trend with global warming and increasing global temperatures and local temperatures, a park development that worsens the local urban microclimate temperatures needs to be carefully assessed.

We discussed Urban heat microclimate impacts extensively in our 2021 Literature review. See:
https://takvera.blogspot.com/2021/04/literature-review-synthetic-turf-carbon.html#urbanheat

What is the vegetation plan mitigating biodiversity and urban heat impact

The present Design plan does not have any information on tree removal or new tree plantings.

Extra tree plantings for canopy shade will assist with mitigating the extra urban heat that synthetic surfaces will add.

The impact of additional hard inorganic surfaces needs to be factored in on local biodiversity. See our 2021 Literature Review where we discuss this impact:
https://takvera.blogspot.com/2021/04/literature-review-synthetic-turf-carbon.html#biodiversity

What is being proposed to mitigate biodiversity impacts, if any?

Mitigating Microplastics pollution

Should any synthetic surfaces be approved, there needs to be mitigation infrastructure installed to reduce microplastics from entering local soils, stormwater, and local waterways. This can substantially reduce pollution, but not stop it completely.

Unfortunately airborne microplastics are much more difficult to mitigate against. Because they are smaller, they are also more dangerous to ecosystems and human health.

Synthetic Hockey Field

The synthetic surfaces used for hockey have become more advanced. As they are a plastics based product they should be treated with caution as to their long term environmental and health impact.

I understand the demand for a second hockey field and also the fact the sport has essentially locked itself into using synthetic surfaces. This is very problematic considering the plastic

chemical makeup of synthetic turf which poses both long term health and environmental issues.

At the very minimum Council should stipulate that any surface approved for supply and installation is guaranteed and certified as PFAS free. If such a guarantee and certification cannot be given, a synthetic surface should not be pursued.

Tennis Courts

The present design plan for the tennis courts is for 4 additional en-tout-cas courts and two new sand filled synthetic courts.

Synthetic surface tennis courts are not an essential use of plastics, given a workable alternative surface exists. Given the chemical and microplastic pollution risks with synthetic turf, all the tennis courts should use en-tout-cas or hard surfaces.

Given the Council Sports surfaces policy, including the precautionary principle, the existence of a readily available alternative surface, the use of new synthetic tennis courts should not be justifiable.

Children's Playgrounds

Plastic surfaces, including use of soft fall, should be avoided in children's playground spaces. We draw your attention to the below study on microplastics in children's playgrounds

Tree plantings should be used as primary shade with shade sails only used as a temporary structure while trees are growing to supply shade. Shade sails are a likely source of airborne microplastics as they wear and degrade with age.

Three pieces of research of particular note to consider for any children's playground development in McDonald Reserve and across the municipality::

> Vera S. Koutnik, Jamie Leonard, Lea A. El Rassi, Michelle M. Choy, Jaslyn Brar, Joel B. Glasman, Win Cowger, Sanjay K. Mohanty, ***Children's playgrounds contain more microplastics than other areas in urban parks***, Science of The Total Environment,
> Volume 854, 2023, 158866, ISSN 0048-9697,
> https://doi.org/10.1016/j.scitotenv.2022.158866 .
> (https://www.sciencedirect.com/science/article/pii/S0048969722059654)
> Abstract: Children spend many hours in urban parks and playgrounds, where the tree canopy could filter microplastics released from the surrounding urban hotspots. However, the majority of children's playgrounds also contain plastic structures that could potentially release microplastics. To assess if the children's playgrounds pose a higher exposure risk than other places inside the park, we evaluate the extent of microplastic contamination in the sand, soil, and leaf samples from 19 playgrounds

inside urban parks in Los Angeles, CA, USA. The average microplastic concentration in sand samples collected inside the playground was 72 p g−1, and >50 % of identified plastics were either polyethylene or polypropylene. Microplastic concentrations inside the playgrounds were on average >5 times greater than concentrations outside the playgrounds in the park, indicating that children playing within the playground may be exposed to more microplastics than children playing outside the playground in the same park. By comparing the microplastic composition found inside and outside the playgrounds with the plastic composition of the plastic structures in the playground, we show that plastic structures and other products used inside the playgrounds could contribute to elevated microplastic concentration. The population density was slightly correlated with a microplastic concentration in the park soil but did not correlate with microplastic concentration inside the playgrounds. Therefore, playgrounds in urban parks may have microplastic exposure risks via inhalation or ingestion via hand-to-mouth transfer.

Pfautsch, Sebastian., Agnieszka Wujeska-Klause, Judi Walters, **(2022) Outdoor playgrounds and climate change: Importance of surface materials and shade to extend play time and prevent burn injuries,** Building and Environment, Volume 223, 2022, 109500, ISSN 0360-1323, https://doi.org/10.1016/j.buildenv.2022.109500. (https://www.sciencedirect.com/science/article/pii/S0360132322007314)
Comment: Primary focus is on impact of urban heat on playground surfaces, and potential for burn injuries. Synthetic turf and other rubber/plastic surfaces are considered as part of this framework. The research has implications for urban heat for synthetic turf pitches.

In terms of designing playgrounds for thermal comfort. This Standards Council of Canada commissioned report may provide some useful insights:

Kennedy, E., Olsen, H., and Vanos, J. (2020). **Thermally Comfortable Playgrounds: A review of literature and survey of experts (Technical Report).** National Program for Playground Safety, University of Northern Iowa, 37 pp. + Appendices.
https://scc-ccn.ca/resources/publications/thermally-comfortable-playgrounds

Synthetic Surface End of Life

Old synthetic turf should never be reused for other purposes, as this is when the material degradation is accelerating causing more microplastics pollution. See NSW Chief Scientist report for this recommendation.

Recycling synthetic turf with unknown chemical content risks furthering toxic contamination in the down-cycled products produced; or risks toxic leaching if disposed of in landfill; or causes PFAS in bottom ash and as airborne pollution if put through an industrial waste Incinerator.

For approval of installation of any synthetic turf surface there needs to be an End of Life Plan put forward consistent with Council's sustainability, circular economy and waste policies.