NSW GOVERNMENT | Chief Scientist & Engineer

Progress report

Independent review into the design, use and impacts of synthetic turf in public open spaces

8 February 2022

Errata

- Cover page – revised ‘8 February 2021’ to ‘8 February 2022’

NSW GOVERNMENT | Chief Scientist & Engineer

Dr Caroline Butler-Bowdon
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Dear Dr Butler-Bowdon

Progress report - review into the design, use and impacts of synthetic turf in public spaces

In November 2021 the (then) Minister for Planning and Public Spaces the Hon. Rob Stokes MP requested that the NSW Chief Scientist & Engineer conduct an independent expert review into the use of synthetic turf in public open spaces in NSW.

I submit this progress report in accordance with the Terms of Reference on behalf of the Review team in the Office of the NSW Chief Scientist & Engineer (OCSE). The final Review report will include substantive detail on different surface types and associated issues. The purpose of this report is to provide you with a high-level summary of activities undertaken to date and planned next steps.

This Review builds on the 2021 study commissioned by the (now) Department of Planning and Environment (the Department) and undertaken by Ethos Urban – the Synthetic Turf Study in Public Open Space (the Study).

As agreed with the Department in December 2021, given the initial piece of work - in the form of the Study - the OCSE Review will not undertake general consultations. The extent of public interest is understood. However, the 2021 Study process included consultation with stakeholders and communities. Further, the Study report sets out the array of potential risks and benefits from the use of synthetic turf in public open spaces, providing a strong platform for the scientific focus of this Review. That said, a dedicated email address has been established by OCSE to enable stakeholders to provide the Review with additional scientific and technical information. Considerable technical material has been provided already to OCSE from the general public. Ideally, such information will encompass new matters not canvassed in the Study.

Having reviewed the Study report and undertaken an initial literature search, the Review team has been meeting with scientific and technical experts. The focus of these meetings is firstly, to obtain a more granular understanding of existing information and data, as well as knowledge gaps. Secondly, to develop the most suitable approaches to systematically test observations and issues and attempt to fill these gaps where possible.

The first phase of work (December-January) focused on gathering information, categorising thematic areas of interest, prioritising issues the Review should consider and identifying data requirements and sources. Supporting the needs of the group within the Department tasked with developing the guidance is a central consideration.

As you are aware, understanding the relative benefits and risks is complex, not least because of the variability of material inputs in both the design and management of all surface types. The Review is also conscious that many public spaces and sports fields are built on repurposed sites previously used for industrial purposes, waste disposal and landfill. This may have a bearing on both selection of surface types as well as our understanding of potential impacts. Initial discussions have also highlighted the importance of understanding the behaviour and impacts of different surface types under Australian conditions.

The Review team is issuing formal as well as informal requests for information. This will continue over the course of the project as additional questions arise and new issues emerge.

An expert roundtable series will be used to systematically work through identified themes and refine details. This includes leveraging research planned or underway already that the Review could draw on as well as sequencing data inputs, activities and capabilities required for any Review-commissioned work. This second phase of Review work began in late January with a Roundtable focusing on thermal considerations and rainfall runoff.

As possible, the Review is drawing on existing processes to obtain inputs. This includes advisory groups established to support the guidance being developed by the Department. This approach is useful in communicating the technical focus of the OCSE Review as well as coordinating information requests from our two agencies. Additionally, the Review is calling on the knowledge and expertise from other NSW Government agencies and councils as well as experts from the NSW research sector. Technical information will also be sought from industry as needed.

The Review plans to undertake a limited number of site visits, likely commencing in March. Locations (to be finalised) will be selected to best meet the scientific needs of the Review, with a view to obtaining a mix of geographic locations, climatic conditions and factors such as diversity of surface types, proximity to natural and urban features and access. The Review team will work with relevant councils to arrange visits. Site visits will also present an opportunity to obtain additional information from council staff and local communities relevant to the Review Terms of Reference.

Recommendations are not made in this report, with issues and themes subject to more detailed analysis in coming months.

I would like to take this opportunity to thank the individuals and agencies who have made contributions in the first phase of the Review.

Yours sincerely

Dr Christopher Armstrong
Deputy Chief Scientist and Engineer

8 February 2022

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1. Introduction

The use of synthetic turf in public open spaces has attracted increasing public attention, both nationally and internationally. There is an array of technical and non-technical factors that influence site and material selection for surfaces. These in turn have a bearing on potential risks and benefits for human, environmental and ecological health at individual, community and systems levels.

In 2021, the (then) NSW Department of Planning, Industry and Environment (the Department) commissioned a study into the use of synthetic turf in NSW community sports fields (the Study).[1,2]

The Study identified a range of factors that have increased interest in and use of synthetic and hybrid surfaces and both potential benefits and risks in the use of synthetic turf relative to grass. The Study also outlined opportunities to address areas of expressed public concern. These will not be reproduced in full here, but identified approaches include use of mixed and hybrid surfaces, improved design and maintenance of surfaces, improved site management practices and use of emerging materials. It recommended consideration be given to the potential benefits of hybrid turf and later generations of synthetic turf, and that further research be undertaken. Recommended areas of research focus included heat effects, human health impacts and use in bushfire prone areas.

In November 2021, the (then) Minister for Planning and Public Spaces the Hon. Rob Stokes MP requested that the NSW Chief Scientist & Engineer conduct an independent expert review into the use of synthetic turf in public open spaces in NSW. Terms of Reference were finalised in December 2022 and are included at Appendix 1. For simplicity, this piece of work is referred to as the Review.

In parallel, the Department of Planning and Environment is leading the development of guidance on the use of synthetic surfaces in public open space and has established advisory structures to support this process. The Review will contribute to the development of the guidance while focusing on scientific and technical factors in its work.

The Study, technical information provided to the Review by community groups, current guidance work as well as information available from other jurisdictions have provided a starting point for the Review in terms of factors that are driving uptake of synthetic and hybrid materials and capturing key issues of public concern.

Accepting other issues will emerge, in the time available the Review will focus its efforts on bringing a scientific and technical lens to these issues. This includes capturing and utilising data from multiple sources, identifying significant gaps and designing studies that would help to systematically test the evidence for observed impacts and expressed concerns about risks to the environment and human health.

It will not be possible for this Review to address all issues in detail. However, per Term of Reference 4, the Review will provide a forward data and research agenda on how these could be addressed over the medium and longer term.

[1] Now the NSW Department of Planning and Environment
[2] Ethos Urban (2021) Synthetic Turf Study in Public Open Space

2. Initial activities

Following finalisation of the Terms of Reference, initial Review activities included:

- reviewing the Study findings, recommendations and information sources. The consultants who undertook the Study provided the Review with a list of search terms used for the Study literature review and where possible, reports it drew on
- undertaking an initial literature review to identify additional sources of information through published academic papers, work commissioned by NSW Government agencies and studies and guidance commissioned or developed by other Australian jurisdictions. The academic literature search encompassed potential health and environmental impacts of synthetic turf surfaces
- consultation with NSW agencies and an initial cohort of research experts to thematically group issues, identify data holdings and obtain feedback on scientific knowledge gaps
- working through sets of papers and reports, in particular technical and scientific material, provided to the Review by researchers and interested community groups
- a request to NSW university Deputy Vice-Chancellors (Research) to help identify content experts that might support the Review; potential capabilities of interest including environmental chemistry, hydrology, water flow modelling, air monitoring, soil science, exercise science, human health and ecological sciences
- seeking expert feedback on where effort should be prioritised and why from a scientific and technical perspective, and specific questions that should be posed
- establishment of a dedicated email address and webpage for interested stakeholders to provide additional scientific and technical information relevant to the Review. Additional information, including academic studies has been provided through this mechanism, with material provided being considered within relevant topic themes.

This initial set of activities was designed to help identify:

- the existence of data collections or sources of systematic data about playing field surfaces that would assist the Review, and whether these would be accessible to the Review. Data of interest includes but is not confined to the composition, characteristics, installation and design of materials currently in use, sites and patterns of use in NSW, the sustainability profile and maintenance requirements of both synthetic and grass turf and factors influencing design and development of new generations of surface types. Understanding availability of this early on helped determine subsequent activities e.g. whether surveys or other requests for information would be needed
- information and data that would be needed to inform human health and environmental risk assessments (e.g. data relevant to exposure pathways, hazards)
- content experts and capabilities to assist the Review on specific topics (including analytical and modelling capabilities, instrumentation etc)
- work already being undertaken or planned that is relevant to the Review
- the type and mix of work that may be needed to address specific questions (e.g. desktop research, data synthesis and analysis, surveys, lab or in-field experiments)
- the potential for any commissioned activities (e.g. sampling) to serve multiple purposes (i.e. contribute to different human health or environmental questions)
- challenges and issues with existing materials and emerging technologies that may help address these. This includes advances in fields such as materials science,

chemistry and biology that may provide alternate surface materials or inputs, and the stage of any research.

High level observations made, or which emerged from initial discussions include:

- the need for data and empirical evidence relevant to New South Wales and Australian (environmental) conditions. Experts pointed to most studies being undertaken overseas, and while providing insights, studies were needed that reflected Australian environmental conditions. This includes both weather extremes and more typical weather conditions (such as intense heat, humidity, wind, rainfall events) as well as changing climatic conditions. An example of importance is intensity of heat effects (e.g. bleaching) on different surface types, and consequent reflectivity
- the importance of robust studies and study design able to systematically test assumptions and observations and can control for multiple factors and variables. Observational one-off examples have been useful in highlighting potential issues and impacts but required are experimental processes that can control and account for multiple variables and be replicated
- systematically assessing temperatures above surfaces (microclimate) as well as at-surface temperatures. While at-surface temperatures have received significant attention, experts pointed to the need to assess radiant heat effects on individuals and account for diverse factors e.g. field orientation, climatic conditions, demographics (e.g. different ages and height), duration and intensity on the field etc.
- considering potential benefits as well as risks of synthetic and hybrid surfaces, and the circumstances for use
- considering the extent to which previous site use might contribute to human and/or environmental risks, and the effectiveness of turfs in addressing this
- the value of laying out a longer term (multi-year) and multi-disciplinary research agenda that captures, over time, changing seasonal cycles and that can be contributed to by expertise from multiple fields over time.

Following this initial phase of work the Review team has begun making more targeted requests for data and information. This includes a request to an initial cohort of urban and regional Councils for information about fields established or planned. The Review is also seeking advice about how it may obtain a more complete picture of sites across NSW.

The Review has also developed a set of thematic topics that will be explored through a series of Roundtables with content experts. These sessions are intended to inform activities to be undertaken or set in train by the Review in the coming months as well as identifying longer term strategies best suited to fill knowledge gaps.

2.1 Roundtable 1

An initial Roundtable held on 27 January 2022 focused on two priority themes - thermal considerations of different surfaces and water run-off. A list of invited participants is at Appendix 2. Each session was structured to:

- refine and prioritise critical issues, including identification of additional matters for consideration
- obtain advice on possible data capture, sampling or research approaches to best address issues
- identify factors or variables that should be taken into consideration in study design

- understand the research strengths and interests of attendees, and others with expertise that might be approached and/or were undertaking work on each issue.

Session one discussion focused on potential heat impacts on individuals, and our understanding of the mechanisms of action by which surfaces affect ambient and mean body temperatures, the extent of 'heat island' effects on the broader community and environment and potential cooling strategies.

Discussion prompts for session two (water run off) included rates of surface water run-off and absorption; capturing the profile and performance of surfaces in terms of the amount of pollutant or particulate run-off, whether surfaces are intended to or act as 'caps' on remediated sites; implications of run-off from a sustainability perspective (e.g. impact on maintenance and replacement schedules) and potential human health impacts.

The Roundtable discussion was wide-ranging and included the following topics:

- potential to establish a bank of surface material samples to facilitate standardised studies, including all components (blade, crumb, infill, grid structure and composition, glues etc)
- extent to which provenance of materials can be traced and is tested for trace metals and elements
- understanding better the interplay between wind velocity, humidity, temperature and radiation under different surface and climatic conditions, and in turn, how these affect the immediate area (microclimate) and bodily mechanisms (e.g. sweat response)
- behaviour of surfaces at lower temperatures and impacts on individuals
- factors used by designers to control heat radiation (e.g. fibre type, fibre length, leaf shape, pigmentation)
- composition of soils under different surface types and impacts of different surface characteristics including absorptive capacity, soil quality, biota etc
- measurement challenges associated with microplastics including size distribution, irregular shape, hydraulics etc., impact on mobilisation and spread and collecting samples onsite
- transport and fate of run-off including impacts on nearby habitat; availability of indicative species to test impacts e.g. toxicity
- surface versus groundwater issues including 'capping' and infiltration under different scenarios
- impacts (e.g. microplastic dispersion) from 'walk-off' as well as water-run-off (e.g. adherence of particulates to shoes, clothes; efficacy of containment features etc)
- lifecycle assessments including carbon footprint on production, use of fertilisers on natural turf, ageing of materials in Australian conditions, end of life management approaches
- heat island effects, cooling strategies and cumulative impacts of conversion of multiple fields
- community impacts (social, mental health etc).

Feedback from Roundtable 1 is being analysed to help determine more targeted literature searches that may be undertaken as well as the type, ordering and design of research studies canvassed at the meeting. Design elements will be subject to further discussion and refinement with experts.

It is anticipated that subsequent Roundtables over the course of the Review will follow a similar pattern. Topics for the next tranche of discussions will include exposure to aerosol contaminants, bushfire risk and surface lifecycle assessment. The longer list of topics will be revised and added to as work progresses.

The Roundtables will also help inform a longer term research and data agenda (Review Term of Reference 4).

3. Next steps

In the coming months the Review will continue with information gathering, data analysis, engagement of subject experts including through Roundtable discussions and commissioning of studies.

A Final Report will be delivered in mid-2022.

The Review is planning a limited number of site visits, likely commencing in March. Locations are not yet finalised. Sites will be selected with a view to how they might contribute to the Terms of Reference, including obtaining a mix of geographic locations and conditions, diversity of surface types, proximity to natural and urban features and access.

The Review team will work with relevant councils and agencies to arrange site visits. Site visits will also present an opportunity to obtain additional information from council staff and local communities relevant to the Review Terms of Reference.

Appendix 1 - Terms of Reference

The Chief Scientist & Engineer will conduct an independent review and provide expert advice on potential risks to the environment and human health from the use of synthetic turf in public open space in NSW and alternative approaches and technologies.

In undertaking the review, the Chief Scientist & Engineer through the Waratah Network and noting areas of expressed public concern will:

1. Identify, describe and provide advice on:
    a. key scientific and technical issues associated with the use of synthetic turf compared with grass surfaces in public spaces
    b. available data, including:
        - data on the installation of synthetic turf in public spaces in NSW, including location, scale, type, composition, age and installation methods
        - performance data, including intended purpose (activities), rates of use, maintenance requirements, lifespan and replacement schedules
        - experiential data from the use of synthetic turf in NSW and other Australian and select international jurisdictions, including data on environmental and human health impacts
        - comparative data on synthetic and grass surfaces in NSW, including current and projected scale of installation; examples of mixed installation of grass and synthetic surfaces; any trends of note
    c. knowledge gaps, including initiatives in other jurisdictions to address these
    d. applicability to NSW of scientific studies and experiential data from other Australian and international jurisdictions.
2. Provide advice on:
    a. potential air and water pollution impacts associated with use of different materials in construction and installation of synthetic turf (e.g. synthetic fibres, cork infill, rubber crumb infill)
    b. potential health impacts of synthetic turf in public open spaces and sports fields including:
        - on immediate users, including the rate of use of open spaces; exposure to chemicals, heat impacts and the rate and type of injuries
        - on proximate residential areas, including but not confined to potential impacts on temperature
        - relevance of geographic and/or spatial factors, including differences relating to urban and regional locations, areas under development etc
    c. potential environmental and ecological impacts of synthetic turf compared to natural turf including but not limited to water runoff and local impacts, urban heat island effect, use in bushfire-prone areas, changes to fauna habitat and wildlife corridors and light pollution.
    d. technical and scientific considerations associated with the use of synthetic turf.
3. Provide advice on:

a. emerging science and new materials that could be used in conjunction with or as an alternate to existing natural and synthetic surfaces (including identifying new components and potential prototypes, and advances in materials and biological sciences)

b. best management practices in the design, installation, maintenance disposal and recycling of synthetic turf

c. scientific and technical factors for consideration by local government and other organisations when considering natural and synthetic surfaces.

4. Develop a research program including:

   a. a description of in-field, laboratory and other studies that will help address key knowledge gaps in the short, medium and longer term and priorities for future data collections

   b. commissioning tests of existing materials under different conditions such as heat, humidity, increased water flow and UV exposure to understand impacts, including substances released into the natural environment.

5. As needed, the Chief Scientist & Engineer may:

   a. seek advice from relevant Government agencies and other organisations

   b. consult with key stakeholders on technical and scientific matters

   c. draw on additional sources of advice and expertise or engage experts as needed

   d. commission or recommend studies.

6. The Chief Scientist and Engineer will:

   a. provide an initial report by 7 February 2022

   b. provide a final report by mid-2022.

Support

Secretariat support will be provided by the Office of the Chief Scientist & Engineer. The Department of Planning and Environment will also provide support.

The agency contact is Dr Caroline Butler-Bowdon, Executive Director Public Spaces, Place, Design and Public Spaces.

Appendix 2 – Research Roundtable 1

Invited Participants

Government	Research	Apologies
Dr Chris Armstrong (OCSE)	Prof Ollie Jay (USYD)	Dr Deborah Hailstones (DPI)
Dr Pip Brock (DPI)	Dr Francois Flocard (UNSW)	Prof Ian Paulsen (MQ)
Dr Julie Cattle (EPA)	Dr Emma George (WSU)	Dr Jeff Powell (WSU)
Dr Leesa Keogh (OCSE)	Assoc Prof Will Glamore	Mr Jeff Standen (Health)
Ms Grace Lee (Health)	Mr Gurpreet Singh (SCU)	
Mr Kishen Lachireddy (Health)	Dr Negin Nazarian (UNSW)	
Mr Adam Littman (DPE)	Dr Riccardo Paolini (UNSW)	
Mr Richard Loudon (DPE)	Prof Sebastian Pfautsch (WSU)	
Ms Fiona MacColl (OOS)	Assoc Prof Neil Perry (WSU)	
Dr Suzanne Pierce (Chair)	Dr Jason Reynolds (WSU)	
Ms Cheryl Robertson (DPE)	Prof Sathaa Arumugam Sathasivan (WSU)	
Ms Julia Smith (OCSE)	Dr Chris Stevens (SCU)	
	Dr Scott Wilson (MQ)	