

Artificial Turf Resources

- May 26, 2022 Letter to Parks and Sustainability Commissions: https://drive.google.com/file/d/1DL3ZmRzXq6_FvGwJCqiDdn6uUDmuoOsd/view?usp=sharing
- Letter from the Glendale Environmental Coalition for previous Parks Commission meeting: <https://glendaleca.primegov.com/Portal/viewer?id=2940&type=2>
- Compilation of Turf issues: <https://www.safehealthyplayingfields.org/>
- New Jersey Work Environment Council Fact Sheet: Be Aware of Artificial Turf Hazards <https://njwec.org/PDFs/fact-artificialterf.pdf>

Injuries

- Synthetic Turf Injuries: <https://docs.google.com/document/d/11B7TKTm4yfaRmOKIR-Z-zwH08GfrETa8URG7-b1yCrk/edit>
- Documents with links to articles on Heat Injuries and Death on Turf <https://docs.google.com/document/d/14TuEbMhFSfu9qfBb7X-IJOW3cj-YgTvC07z7lg40yO4/edit>
- Types of knee injuries: <https://ryortho.com/breaking/ncaa-artificial-turf-can-increase-knee-injury-risk/>
- Turf injuries: <https://www.center4research.org/injuries-related-to-artificial-turf/>
- Turf injuries: <https://sportsfieldmanagementonline.com/2020/01/03/natural-grass-and-synthetic-turf-injury-research/11008/>
- Turf injuries: <https://journals.sagepub.com/doi/10.1177/0363546519833925>
- Why artificial turf may truly be bad for kids: <https://theconversation.com/why-artificial-turf-may-truly-be-bad-for-kids-72044>
- Injuries: <https://cronkitenews.azpbs.org/2020/07/03/athletes-injuries-artificial-turf/>
- National Library Of Medicine on Turf injuries: <https://pubmed.ncbi.nlm.nih.gov/30452873/>
- Liver disease from PFAS: <https://www.consumerreports.org/liver-disease/report-links-pfas-exposure-to-liver-damage-a2222667414/>
- More Liver Damage: <https://keck.usc.edu/synthetic-forever-chemicals-known-as-pfas-linked-to-liver-damage/>
- Synthetic Turf Hazards: <https://www.nontoxiccommunities.com/synthetic-turf.html>

Recycling

- Turf Recycling: <https://peer.org/false-artificial-turf-recycling-claims-ripped/>
- The Daily Pile-up of Artificial Turf: <https://www.theatlantic.com/science/archive/2019/12/artificial-turf-fields-are-piling-no-recycling-fix/603874/>

Cooling & Maintenance

- Water Requirements for Cooling Artificial Turf:

- https://drive.google.com/file/d/1_8-HwZjhrN78RelU9roKYArcN5ZsAcxP/view
- <https://www.parksandrecbusiness.com/articles/2016/10/part-2-watering-synthetic-turf>
- Shawgrass Maintenance webpage:
<https://www.shawgrass.com/resources/maintenance-guidelines/>
- Turf watering requirements:
https://docs.google.com/document/d/10C27ylq3c3oywdSWtXzGn8rj_wXI3-fA3Wnut_1gpqA/edit
- Failing Turf Fields in S Cal:
<https://www.dailybulletin.com/2018/06/19/artificial-turf-fields-are-failing-across-southern-california-costing-millions-heres-why/>

Infill

- Article on Plant Based Infill:
https://docs.google.com/file/d/1MScmC4TVuWXtGLnJvy1R_xBOV2SMT3ue/edit?filetype=msword

PFAS and Other Contaminants.

- PFAS in building materials: <https://greensciencepolicy.org/docs/pfas-building-materials-2021.pdf>
- PFAS:
<https://www.ewg.org/news-insights/news/new-studies-show-pfas-artificial-grass-blades-and-backing>
- Airborne Particles:
https://www.researchgate.net/publication/345093395_A_pendulum_rig_study_on_airborne_transmission_and_migration_of_particles_from_artificial_football_turf
- Lead in turf particles (an issue with older fields):
https://www.cdc.gov/nceh/lead/prevention/sources/soil.htm?CDC_AA_refVal=https%3A%2F%2Fwww.cdc.gov%2Fnceh%2Flead%2Fprevention%2Fartificialturf.htm
- The Princeton Environmental Commission's Artificial Turf - Not A Sound Financial, Environmental, or Just Investment:
https://www.princetonnj.gov/DocumentCenter/View/9205/Princeton-Environmental-Commission-Artificial-Turf-Report-Dec-2021-PDF-?fbclid=IwAR203Pxxn_Fr3HaQPHYXi12IjstvBlw2gfkIOBDlvPBaWFKH-8N7Mq1bQvo
- Wave of Deceptive Marketing PFAS Claims Raises “Personal and Advertising Injury” Coverage Issues: <https://www.jdsupra.com/legalnews/wave-of-deceptive-marketing-pfas-claims-3397327/>
- EPA Roadmap to reduce PFAS:
https://www.epa.gov/system/files/documents/2021-10/pfas-roadmap_final-508.pdf
- Environment and Human Health, Inc. Summary and links to turf scientific articles
<https://njwec.org/PDFs/fact-artificialterf.pdf>
- Calculations for the petroleum content of proposed and existing fields:
<https://docs.google.com/document/d/14xBYeh49znxRvPmQGxgZ8wH0wUTmo3-L12RESJaeks/edit?usp=sharing>

Heat Island Effects

- Heat island effects:
<https://www.nrpa.org/parks-recreation-magazine/2019/may/synthetic-sports-fields-and-the-heat-island-effect/>
- Synthetic Turf Heat Studies:
<https://aces.nmsu.edu/programs/turf/documents/brigham-young-study.pdf>
- Redlining and Exposure to Urban Heat Islands interactive map:
<https://www.arcgis.com/apps/dashboards/73e329457b6644e7a6ff13ecce43c8d8>
- CalEnviroScreen 4.0 interactive map:
<https://experience.arcgis.com/experience/11d2f52282a54ceebcac7428e6184203/>
- The degree of flammability for an artificial grass surface system:
https://www.e3s-conferences.org/articles/e3sconf/pdf/2018/20/e3sconf_infraeko2018_00038.pdf

Environmental Justice Issues at the Glendale Locations

- Site-by-site Analysis of Pollution and Heat Conditions:
<https://docs.google.com/document/d/1ca3zJERlAwURQkOsA2V0GMZyDLfYfjKAOeB1FodWRhE/edit?usp=sharing>
- Greening Schoolyards Advocacy Toolkit:
<https://www.childrenandnature.org/resources/green-schoolyards-advocacy-toolkit/>
- Why Green Schoolyards: <https://www.greenschoolyards.org/introarticles>
- Why Green a Schoolyard: <https://www.angelenosforgreenschools.com/why-a-green-schoolyard>

Sierra Club Positions

- San Diego Chapter of Sierra Club Position Statement:
https://drive.google.com/file/d/1ds0qZVk1oJ_twAePawslpLFuB7uCau-b/view?usp=drivesdk
- Long Island Sierra Club Group Statement: <https://www.lisierraclub.org/synthetic-turf>
- Loma Prieta Sierra Club Statement:
https://docs.google.com/document/d/1Bga-mqY8KScqHRFJodkJfvTt4DcEUaABEPBUFd_DLnE/edit
- Massachusetts Sierra Club Statement:
<https://www.greensherborn.com/news/massachusetts-sierra-club-addresses-sherborns-artificial-turf-proposal>
- Maryland Sierra Club Statement:
<https://www.greensherborn.com/news/massachusetts-sierra-club-addresses-sherborns-artificial-turf-proposal>

Alternatives to Artificial Turf

- Native sods <https://www.deltabluegrass.com/sod-products/california-native-sod/>
- Sod Blends and Varieties: <https://www.deltabluegrass.com/sports-turf/sod-blends-varieties/>
- EPIC System <https://drive.google.com/file/d/1MYPL9SCBuGv58H7zoUUhU4xAaYtCBVpW/view>
- Maximizing the Durability of Athletic Fields:
https://www.cityofportsmouth.com/sites/default/files/2020-03/AG-726_Maximizing_the_Durability_of_Athletic_Fields.pdf
- Non-toxic Communities article on Organic Athletic Fields with links:
<https://www.nontoxiccommunities.com/organic-athletic-fields.html>

- National Turfgrass Evaluation Program: <https://www.nontoxiccommunities.com/organic-athletic-fields.html>
- Natural Grass Advisory Group: <https://www.deltabluegrass.com/sports-turf/sod-blends-varieties/>
- For LA County, The Safe Clean Water Program can help with stormwater capture: <https://safecleanwaterla.org/about/vision-mission-goals/>
- Stormwater Comparisons: <http://www.pugetsoundstormwater.com/2021/04/new-study-shows-artificial-turf.html>

Comment Letters and News Articles

- Letter from Clean Water Action: <https://drive.google.com/file/d/1Gbll0nekHKJqmHnUCpLWA6S2y3LT6o3j/view?usp=drivesdk>
- Comments from a Soccer Player: <https://mastersoccermind.com/the-reason-why-all-soccer-players-prefer-grass-over-turf/>
- Vista Letter: <https://docs.google.com/file/d/1uoXUrUxUorJywXORqsdAmIZighVZ6nJv/edit?filetype=msword>
- GEC Rebuttal to Parks Department report: <https://gec.eco/wp-content/uploads/2021/04/Athletic-Field-Surface-GEC-Followup-Input-RE-Staff-Report.pdf>
- Debunking Myths Around Artificial Turf: <https://gvt.net/blog/debunking-myths-around-artificial-turf/>

General Notes

Some of the following notes refer to rubber tire infill. While not in the current proposal, this infill exists at the sports complex in Glendale. There are abundant links for more information.

Climate/Pollution impacts

Polyethylene is the most highly produced plastic globally and the most frequently discarded material. [Methane and ethylene](#) are emitted at 2x and 76x more readily from polyethylene, respectively, in air than when in water. [Methane](#) traps 90% more heat than carbon dioxide.

Synthetic turf is made from polyethylene, with additional toxic and carcinogenic chemicals. Each regulation sized plastic soccer field (approximately 80k square feet), constitutes 500k pounds of plastic waste: [40k pounds of blades and backing, over 400k pounds of infill](#) (2-9 pounds per square foot); A regulation sized field [requires 40,000 crumbed used tires](#). Each year, [1.5 to 5 metric tons](#) (pg 24) of microplastic [infill](#) migrate off field (requiring replacement to maintain safety), and [551-661 pounds](#) of PFAS laden degrading microplastic blades, per field- lost to air, water and soil. Used tire crumb migration off of playing fields have been found in waterways around the world ([Hong Kong](#), [Scotland](#), [Ireland](#), [Australia](#), [Norway](#)). The industry is installing 3-4 new plastic fields daily across the country. Based on information from [Waste Management](#), each 80,000 square foot plastic turf field (20 tons of plastic waste) represents 13,700 gallons of petroleum based oil, exclusive of any rubber infill. At 3 to 4 installations per day, that would be 41,100 to 54,800 gallons worth of petrochemical based synthetic turf rolled out daily in the US. Each synthetic regulation sized, field is the equivalent [of 3.2 million plastic bags or 46 million straws](#): 9.6 to 12.8 million plastic bags or 138 to 184 million plastic straw equivalents

every 3-4 days. Used tire crumb infill adds more petrochemical waste. Each car tire requires 7 [gallons of oil to manufacture](#) while truck tires require 22 gallons.

The California Office of Environmental Health Hazard Assessment (OEHHA) study on synthetic turf is not complete. A [2019](#) draft report confirms 126 chemicals in used tire crumb infill; [Yale researchers](#) (2019) identified 306 chemicals in crumb: 52 known carcinogens; another 6 suspected or presumed carcinogenic by both the US EPA and the European Chemicals Agency (ECHA); additional 197 considered carcinogenic a priori. Researchers in the Netherlands (2021) revealed they identified an [additional 46 carcinogenic chemicals](#). The US EPA Federal Research Action Plan (FRAP) on Recycled Tire Crumb Used on Playing Fields and Playgrounds (FRAP 1), found 355 chemicals. Korean researchers (2020) found children who play on crumb rubber are [10 times more likely to develop cancer](#) than those who play on soil.

Tire crumb is estimated to be 28-30% of the microplastic pollution in our oceans and 50% of the microplastic pollution in urban areas. In December 2019, [researchers](#) discovered the antiozonant N-1,3-dimethylbutyl-N-phenyl-p-phenylenediamine ([6PPD](#)) in tires converts to 6PPD-quinone which has resulted in a 40-90% decline in the coho salmon population. Tire crumb in [playing fields and playgrounds](#) are contributing factors.

Plant-based turf infills can contain pesticides. One has been found to contain per and polyfluoroalkyl substances ([PFAS](#)). They have been implicated in increased toxic algae blooms.

At the end of their useful life (8 year average), 400,000 pounds of infill (used tire crumb in ~97% of existing fields) and 40,000 pounds of plastic carpet remain. For the current 30,000 playing fields in the US, that's **12 trillion pounds** of infill and **1.2 billion pounds** of plastic carpet that continues to pollute for the approximately 450 years it takes to decompose.

Environmentally Hazardous Substances:

Synthetic turf blades, backing, shock pads and even wood infill have shown a 100% positive test rate for total fluorine, the gold standard for testing products for the presence of [PFAS](#), a family of 12,039 “forever” chemicals (US EPA). These chemicals leach into soil, waterways and oceans. They cross human placentas, enter human breast milk, bioaccumulate in humans, wild and aquatic life. PFAS in Synthetic Turf is in the California Department of Toxic Substance Control ([DTSC](#)) current work plan (pg. 14).

Environmental Justice(EJ)/Social Justice (SJ)

Few communities can afford the average \$1.2 million for a single synthetic turf field installation. They are often partially funded by [State Parks and Recreation](#) and [Federal Grants](#), which are often awarded to EJ/SJ communities preferentially. EJ/SJ frequently lack cooling [green space](#) and are further subjected to heat islands created by impermeable, over heated surfaces such as [synthetic turf](#). Exposure to the toxic chemicals in plastic play surfaces presents [elevated health risks](#) in communities where access to care is difficult. The added costs of maintenance, safety testing, annual replacement of lost infill and ultimately replacement and landfilling add to the burden. [Illegal dumping](#) and increased expense to the community can all have irreversible [consequences](#).

At a cost of up to 4.3 times more than natural grass [over the 8 years](#) of a typical warranty, synthetic turf is a very poor financial investment.

Harm to human health:

[PFAS](#) can cause reproductive (including a [47% decrease in fertility](#)), developmental, liver, kidney, and immunological effects and tumors in laboratory animals. Human epidemiology studies show an increase in serum cholesterol levels, effects on infant birth weights, the immune system, cancer, and thyroid hormone disruption. Because they are bioaccumulative, PFAS exposure can impact multiple [generations](#).

[Plastics](#) contain endocrine disrupting chemicals, such as PFAS, and chemicals used as plasticizers, flame retardants, colorants, UV stabilizers, biocides, heat stabilizers, antioxidants, lubricants, and foaming agents, catalysts, [Phthalates](#) and more. Such chemicals can cause neurological and behavioral disorders, obesity, metabolic dysfunction, [reproductive disorders](#) and cancer. [Tire products](#) (i.e. crumb, mulch) are [plastics](#). Even at low doses, chemicals can act [synergistically](#) to cause disease and cancer.

Exposure to Methicillin-resistant Staphylococcus aureus ([MRSA](#)) and [other bacteria](#) is a potentially life-threatening consequence of dermal abrasions, known as [turf burns](#), due to friction on synthetic turf. [Inhalation](#) and [ingestion](#) are additional exposure pathways. [Lower body injuries](#) are significantly higher on synthetic turf, as are [concussions](#) and [heat stroke](#).

Harm to wild and aquatic life; loss of biodiversity

Synthetic turf and microplastics have caused a decrease in [bird](#) populations, accumulation of microplastics on [bees](#), negatively impacts [ocean habitats](#), and kills [soil](#) biome. Some PFAS have also been linked to phytotoxicity, aquatic toxicity, and terrestrial ecotoxicity.