

Assessing Toxic Chemicals in Stormwater Runoff from Artificial Turf Fields and in Artificial Turf Components



IC2 Product Testing Working Group

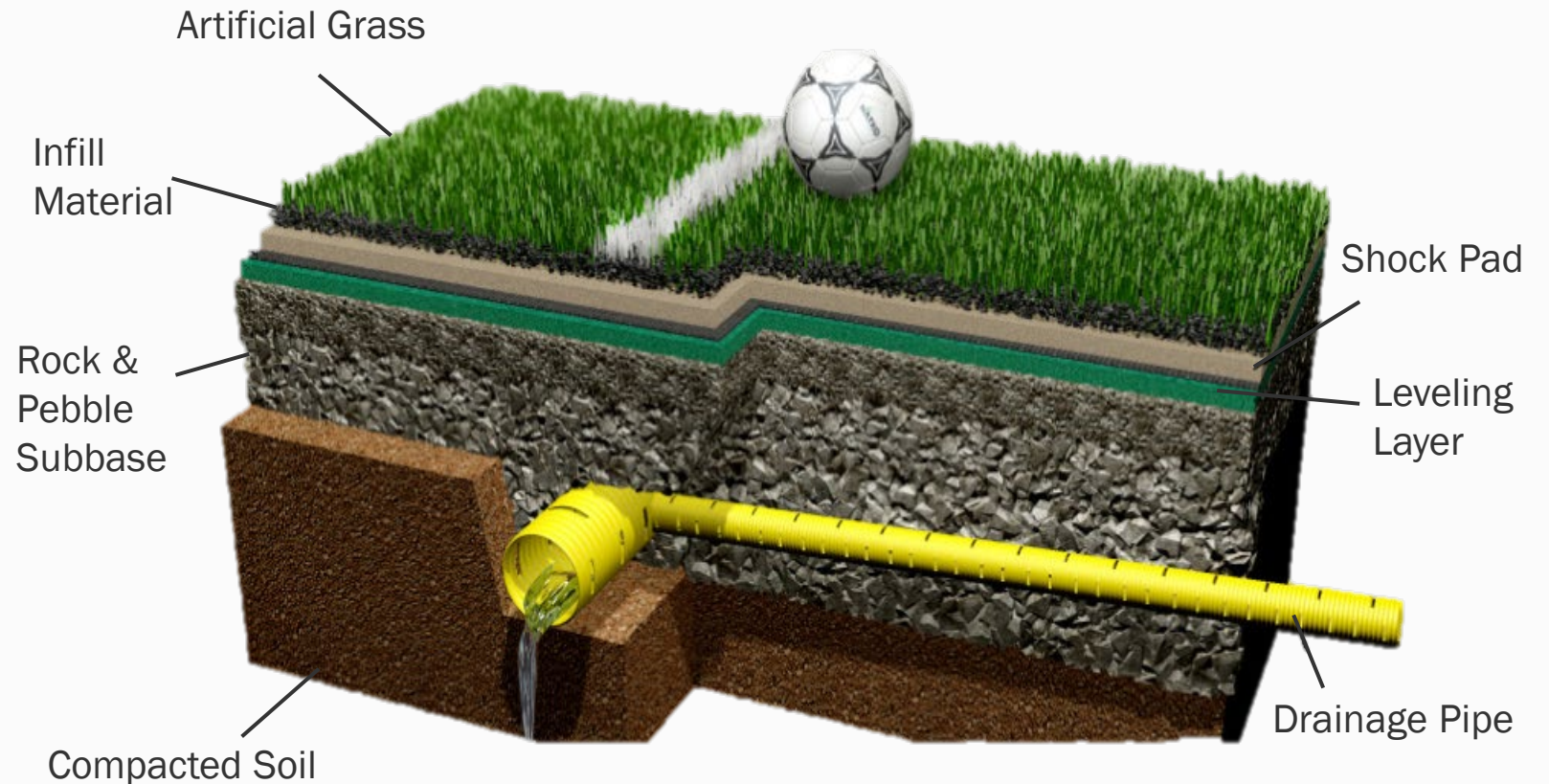
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Artificial Turf Installation - Brief Introduction

- Installed on top of compacted soil and rocks
- Multiple layers of product components
- Centralized perforated drainage pipes direct runoff



Study Purpose

- Assess whether toxic chemicals are present in runoff from and components of artificial turf installations
- Component samples were collected from installations that participated in the stormwater runoff study
- To support data-driven decisions by Ecology's **Product Replacement Program**
 - Reimbursement funding
 - Disposal services
 - Opportunities for businesses to transition to less toxic options



Chemicals of Interest

Metals (6 elements)

Arsenic

Cadmium

Copper

Lead

Nickel

Zinc

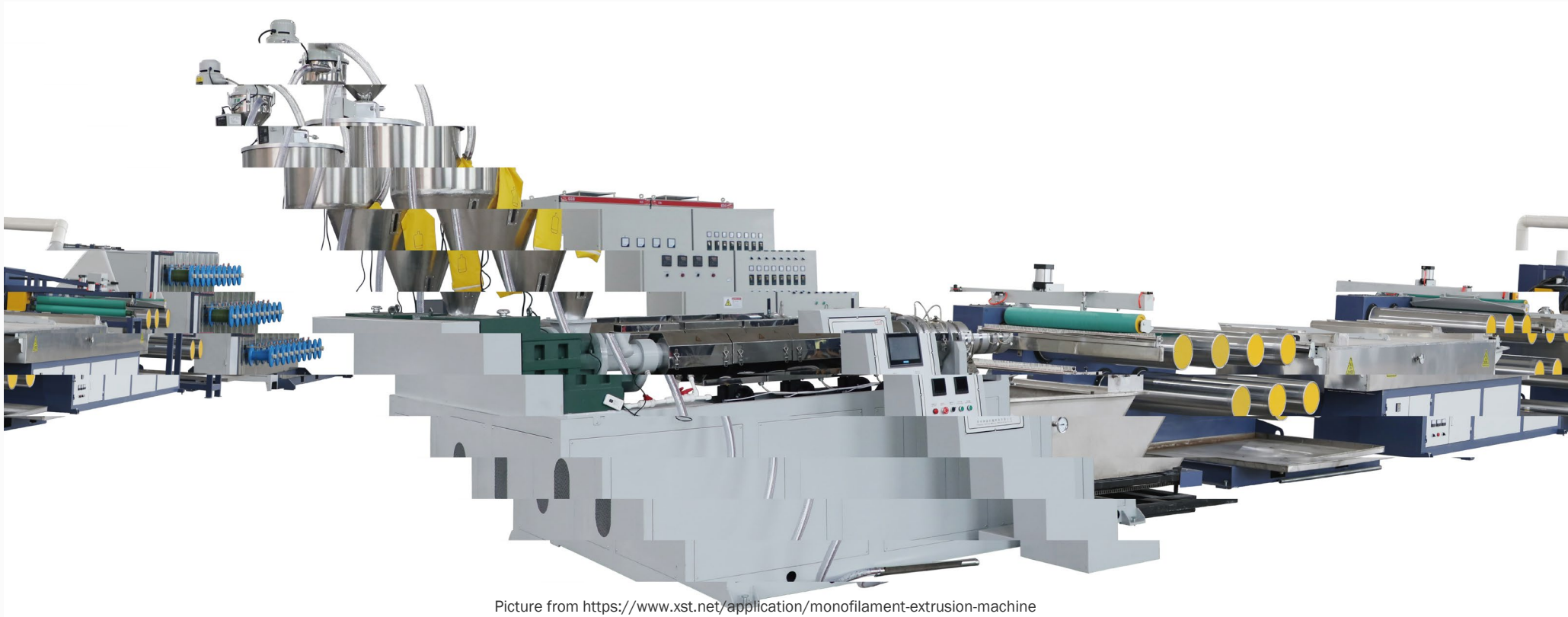
PFAS (40 compounds by 1633)

PFBA	6:2FTS
PFPeA	8:2FTS
PFHxA	PFOSA
PFHpA	NMeFOSA
PFOA	NEtFOSA
PFNA	NMeFOSAA
PFDA	NEtFOSAA
PFUnA	NMeFOSE
PFDoA	NEtFOSE
PFTTrDA	HFPO-DA/GenX
PFTeDA	ADONA
PFBS	PFMPA
PFPeS	PFMBA
PFHxS	NFDHA
PFHpS	9CI-PF3ONS
PFOS	11CI-PF3OUdS
PFNS	PFEESA
PFDS	3:3FTCA
PFDoS	5:3FTCA
4:2FTS	7:3FTCA

6PPDQ

Potential Sources of PFAS

- Artificial grass blades → monofilament and slit-film
- Antistatic agents → PVDF and PTFE
- Turf backing material?
- Infill coating?



Picture from <https://www.xst.net/application/monofilament-extrusion-machine>

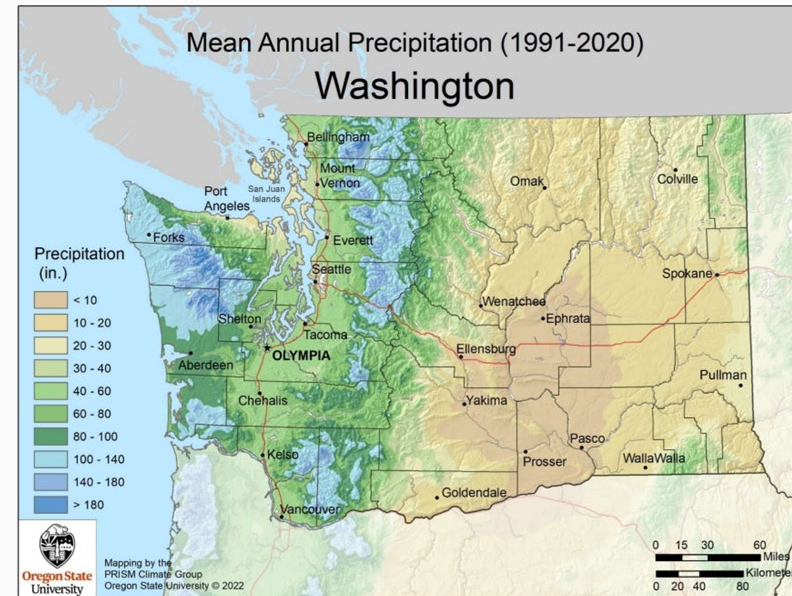
Potential Sources of 6PPDQ

- Crumb rubber infill
- Rubber shock pads
- Rubber products → 6PPD as an antiozonant/antioxidant
 - Transforms into 6PPDQ once released from product



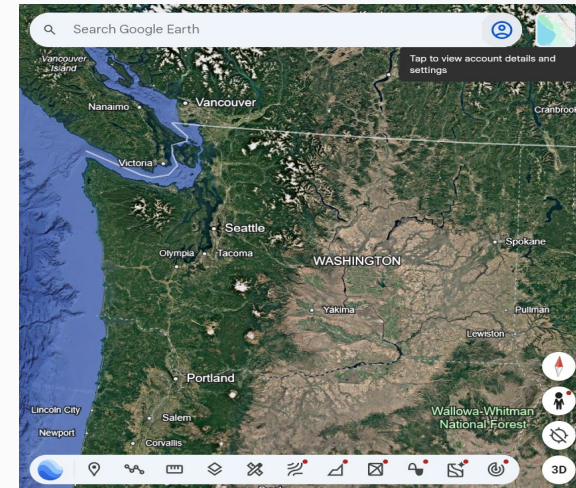
Study Area

- Study included artificial turf installations made of different materials, of variable ages and use-types.
 - Included athletic fields and playgrounds at community parks and schools.
- Study to assess runoff from up to 30 artificial turf installations across Washington
- Planned to sample from at least 3 installations in each region of Washington



Study Recruitment

1. Make a list of artificial turf fields and playgrounds in Washington.
 - Unofficially polled colleagues from Ecology offices across the state
 - Online reconnaissance
 - WA Recreation and Conservation Office grants for artificial turf fields
 - Athletic fields by counties and major cities in Washington
 - Sports offered by school districts
 - Intramural sports for students
 - Viewed artificial turf installations on Google Earth
2. Identify owners of artificial turf fields and playgrounds by contacting:
 - City, County, and Tribal parks departments
 - School districts and Universities
 - Private owned athletic organizations



Study Recruitment

3. Inform owners about the study purpose and timeline.
 - Developed a Study Q&A
 - Clearly explain how the data will and **will not** be used

Q: If you find 6PPDQ, PFAS, or heavy metals, will I be responsible for cleanup or will it affect my stormwater permit?

A: This research study is separate from the sampling done for stormwater permits, and the samples collected for this study do not apply to stormwater permit requirements. Although this study isn't related to permit requirements, cities, municipalities, and businesses are still responsible for reducing toxic chemicals in stormwater, following [Washington's stormwater regulations and guidance](#).¹ If you have questions about your municipal stormwater permit requirements, please reach out to your [regional municipal stormwater permit contact](#).



Washington Department of Ecology

Artificial Turf Runoff Study Q&A

Background

Washington Department of Ecology is initiating a study to assess chemical runoff from turf fields, particularly during rain events. The study will help us determine whether a product replacement program is needed.

Questions and Answers

Q: How will the findings be used?

A: The study's findings will help us understand whether toxic chemicals are washing off artificial turf installations and entering the environment. Depending on what we find, we may develop a product replacement program to financially assist with replacing artificial turf installations with safer alternatives. Our goal is to support businesses while reducing environmental pollution.

Q: If I participate, will my field be named in a study report?

A: Participant information will not be mentioned by name or city in the study report. Sample sites will be described by geographic region of Washington. Field owners will receive a copy of their field's results by request. Sample results are subject to public disclosure.

Q: How will samples be collected?

A: Field scientists will collect rainwater runoff at the nearest drainage outfall to the artificial turf installation. Water is hand-collected into bottles that are submitted to a laboratory for testing. Sampling will not interrupt use of the field or impact turf material. Our sampling only takes a few minutes.

Study Recruitment

4. Ask owners if they want to participate in the study and are willing to sign a Participation Agreement.



STUDY PARTICIPATION AGREEMENT

This Participation Agreement ("Agreement") is entered into by and between the Washington Department of Ecology ("Ecology") and the participant specified below ("Facility").

Ecology's Product Replacement and Environmental Assessment Programs have established a study, at no cost to participating facilities, to assess whether toxic chemicals are washing off artificial turf installations and entering the environment through stormwater runoff.

The Facility desires to participate in the study and agrees to comply with the requirements set forth by Ecology in this Agreement.

In consideration of the mutual agreements contained herein, the Parties agree as follows:

1. Study Description

Ecology's Obligations:

- a) Ecology will collect and test stormwater runoff from artificial turf installations. Collection intervals will vary at each facility and will be determined by Ecology.

Facility's Obligations:

- a) Facility agrees to cooperate with Ecology and provide access to its premises as necessary to facilitate stormwater sampling and as described in this Agreement.

Participant Recruitment Sneak Peek

Participants Include*

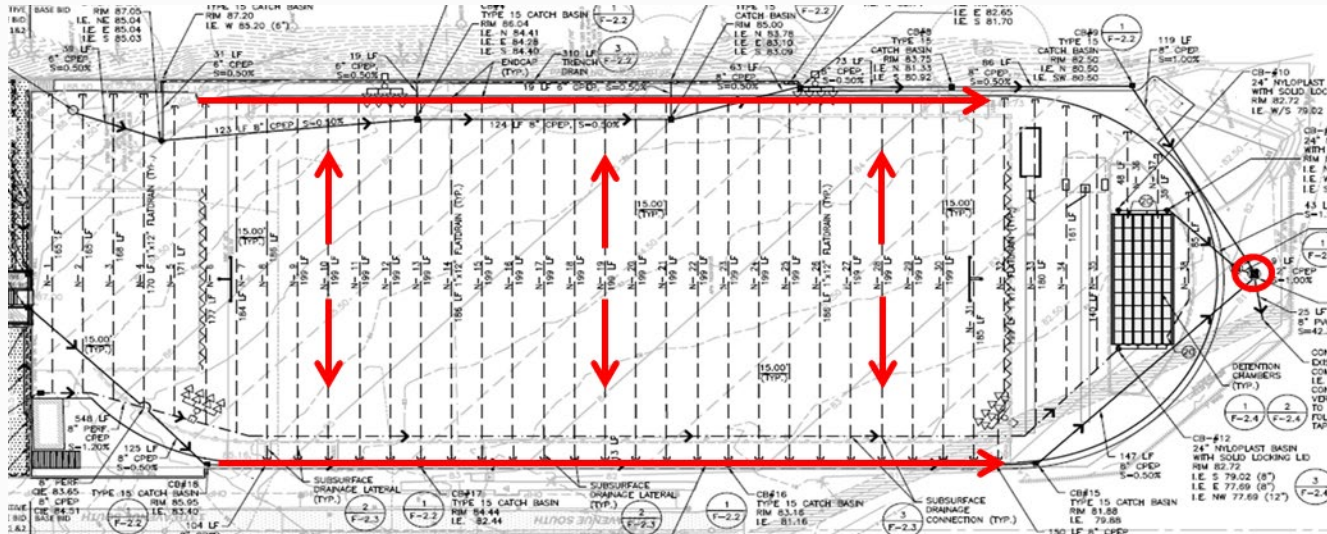
- County Parks Departments
- City Parks Departments
- Tribes
- Public School Districts
- Universities
- Private owned athletic fields

Installation Types Include*

- Sport turf & crumb rubber infill
- Sport turf & cork infill
- Sport turf & olive pit infill
- Playground turf & crumb rubber infill
- Playground turf & sand infill

*Participants and installation types may change

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- Drainage directs runoff off playing surface
- Runoff flows to stormwater system or directly into the ground

IN A PERFECT WORLD!

Even the Best Laid Plans...

- Worked with field owners to obtain site drainage plans.
- Met with field representatives at each site to find the outfall location.
- Over time, we had to remove 14 sites from the study (out of 30)
 - Accessibility of discrete runoff to sample:
 - Unaccessible outfall location
 - Field infiltrates into ground
 - Stormwater treatment system in place
 - Unknown runoff contributions
- Study proceeded with 16 sites with known outfall locations.

Runoff Sampling

- Sampling window for runoff was April to December 2025
- Drought impacted our ability to sample throughout 2025
- We extended sampling window into Spring 2026

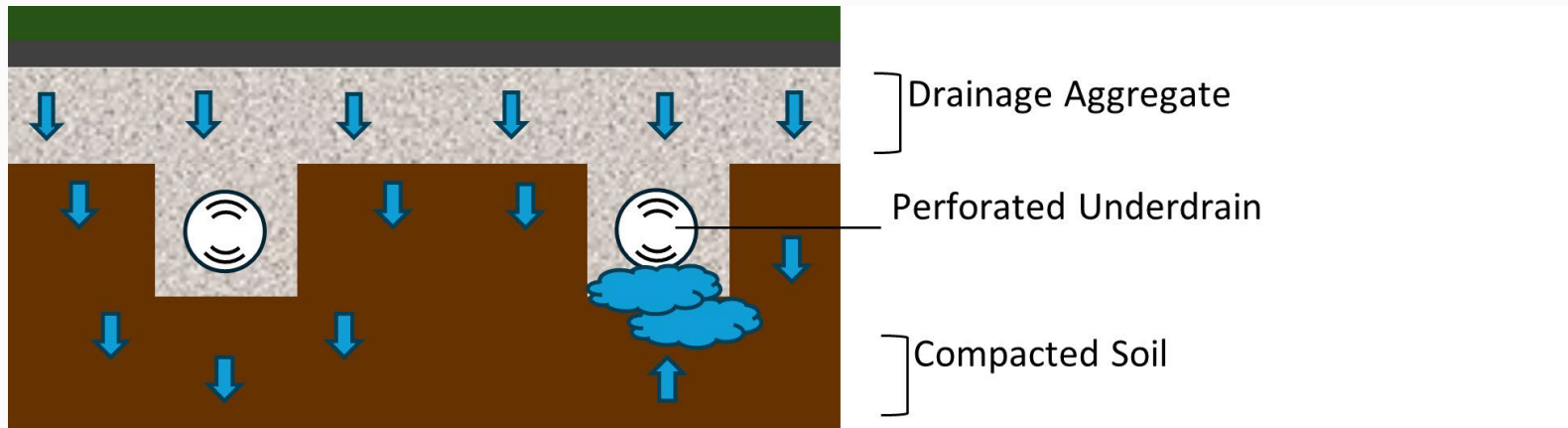
Unable to sample at 33 field visits (successful at 8 fields)

- Runoff not flowing enough to sample:
 - First criteria was 0.15" predicted rain → No flow at most sites
 - Need to change storm event criteria
 - At least 0.2" predicted rain → Still no flow at many sites



Runoff Flow Dynamics

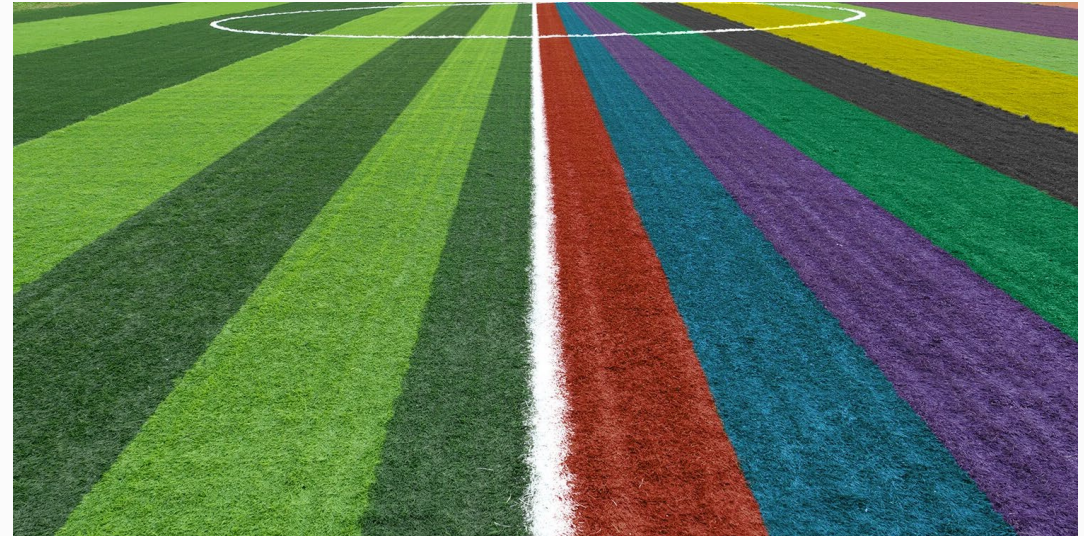
- Perforated underdrain pipes direct runoff to outfall, but only once the surrounding ground is saturated.
- Study area was drier than usual so saturation point is difficult to predict.



Simplified figure adapted from Hudepohl et al. 2016

Artificial Turf Components

- Turf blades → Multiple colors
- Infill → Multiple types
- Turf backing material & shock-absorbing pad → May not be accessible

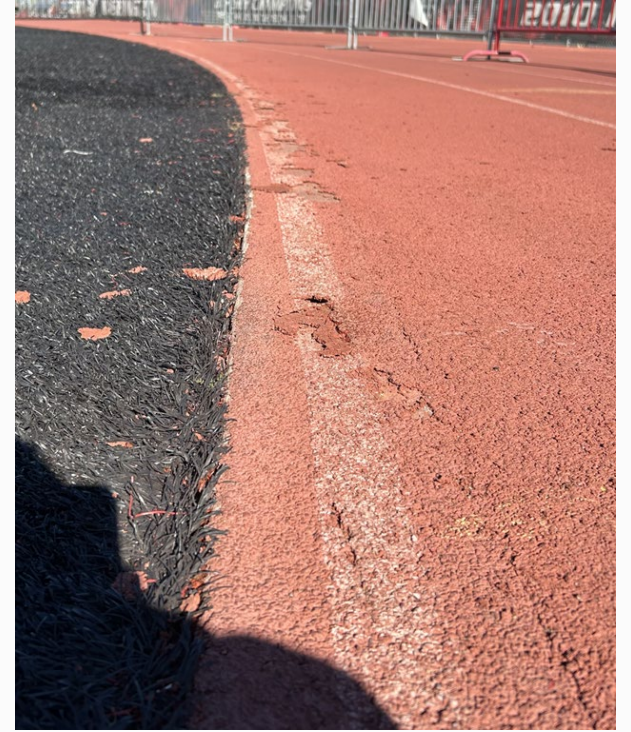


Picture from <https://www.newgroundtechnology.com/colorprint>



Picture from <https://progreen.com/different-types-of-infill-for-artificial-turf/>

Sneak Peek – Component Samples



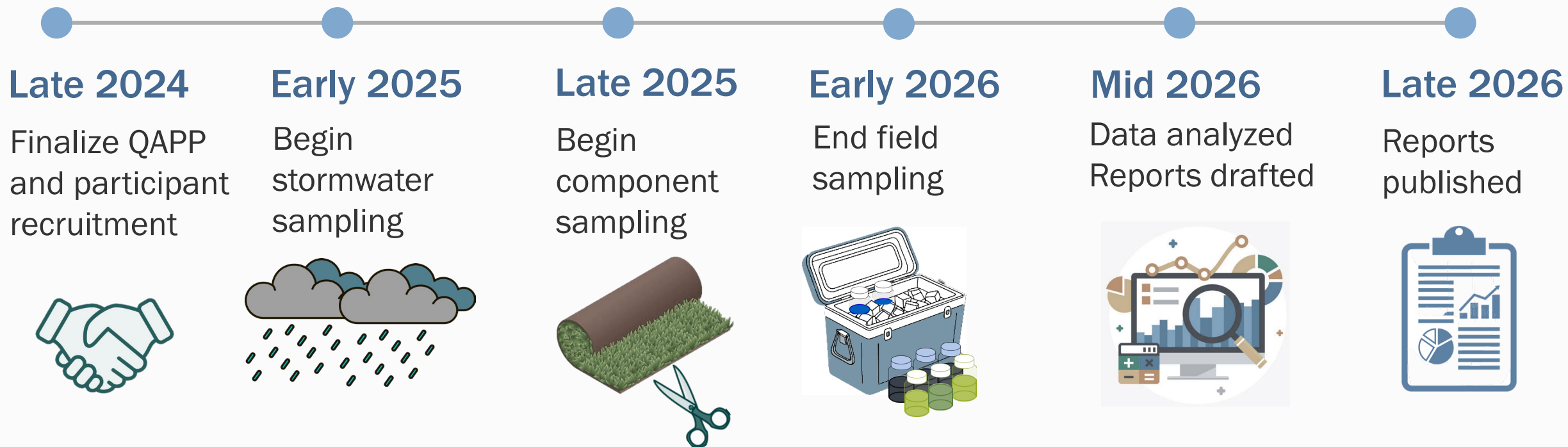
Sampling Progress

- Runoff samples collected at 8 sites
- 1 site was sampled twice
- Total runoff samples = 9

Component	Samples
Turf Blades	34
Turf Backing	5
Infill	21
Running Track	4
Total	64



Project Schedule



Sample Preparation Issues

Cryomill Size Reduction

- Processed at contract lab
- All turf blade & backing samples were “clumpy blobs” (N=39)
- Samples for 6PPDQ & target PFAS analyses only
- Potentially impacted extraction of analytes due to clumped surface area

Digestion for Metals Analysis

- Microwave-assisted acid digestion by EPA 3052 without HF
- 30 out of 64 samples did not completely digest or dissolve into solution
- Potential bias for metals analytes



Questions?

Contact Info

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Product Replacement Program -

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Artificial Turf Components

- Field sampling guided by
 - EPA ORD SOP (2018) - Tire Crumb Characterization Study: Field Collection and Laboratory Standard Operating Procedures
 - CalEPA's OEHHA SOP (2025) - SOPs for Sample Collection, Preparation, and Analysis Synthetic Turf Study

