



Microplastics and the water environment



Plastic enters the wastewater stream down sinks, pipes, manholes and sewers and into MWRD intercepting sewers and water reclamation plants, where it is physically separated through the treatment process, fed by conveyor belt and removed into screen dumpsters. Smaller particles known as microplastics, however, can evade this process, slip through screening and threaten the quality of local waterways and aquatic life.

Microplastics are an emerging environmental pollutant. Their persistent nature and potential release of chemicals and additives used in synthesis may have an impact on organisms. Microplastics are pesky plastic particles under 5 mm in size that enter the environment through human use and negatively affect water quality and can harm both human and aquatic life. As the agency tasked with treating wastewater for Chicago and 128 suburban communities, managing stormwater for Cook County and protecting the region's waterways and the source of its drinking water, the Metropolitan Water Reclamation District of Greater Chicago (MWRD) strives to mitigate plastic pollution

in the water environment and protect public health.

Microplastics can come from plastic bottles, tires, paint, cosmetics and clothes and take the form of fibers, beads, foam and other fragments. Microplastics can be ingested through contaminated food and water can cause DNA damage, cellular damage and inflammation. Primary microplastics include small pieces of specially manufactured plastics used in personal care products, such as hand and facial cleansers, shower gels, toothpaste and industrial scrubbers. Secondary microplastics include small pieces of plastic derived from the deterioration (biological activity, mechanical abrasion, and UV

Microplastics are detected in:

- Air
- Beer
- Seafood
- Honey
- Salt
- Tap water

There are not many studies on human health implications, but they could lead to:

- Immune Response
- Respiratory Problems
- Chemical Leaching
- Accumulation

radiation) of larger plastic waste, referred to as macro-plastics.

During the manufacturing process of plastics, many concerning organic constituents are added to enhance these plastic products. Further study is required to understand the impacts from leaching out of these compounds as well as the adsorption of toxic organic pollutants and pathogenic microbial assemblages on the surface of microplastics and their eventual fate and transport in terrestrial and aquatic environments.

Microplastics can pass directly into wastewater streams and are too small to be retained by the standard filters used at water reclamation plants (WRPs). As a result, plastics end up in solids or enter waterways after treatment. Fish and other aquatic life cannot tell the difference between plastic and food, so they feed on microfibrils and microbeads that disrupt nutrient uptake and clog their intestines. There are considerable challenges and costs to remove microplastics at the MWRD's seven WRPs, especially considering the more than 400 million gallons of wastewater the MWRD cleans each year for 5.16 million residents.

Estimates of macro-plastics in wastewater treatment and disposal cost in 2021

	Stickney WRP (Cicero)		Calumet WRP (Chicago)		O'Brien WRP (Skokie)	
	Volume (CY)	Disposal Cost	Volume (CY)	Disposal Cost	Volume (CY)	Disposal Cost
Annual Total Trash Disposed	16,200	\$562,500	4,700	\$96,000	3,752	\$184,700
Proportion as Macro-plastics (range)	15-30%	\$84,400-\$169,800	15-30%	\$14,400-\$28,800	10-20%	\$18,500-\$37,000

New treatment technologies and pretreatment initiatives have led to cleaner water and a decrease in heavy metals and the recovery of water, nutrients, solids, energy and other resources to be beneficially reused. Physical screening and filtering processes have also allowed the MWRD to recover thousands of cubic yards of plastic each year. But plastics can appear in wastewater streams as well as in litter and other debris that harms local waterways. In 2021, the MWRD recovered 1,682

cubic yards (CY) of river and canal debris, including 182 CY of debris collected by skimmer boat crews.

In 2014, Illinois became the first state to ban the manufacture and sale of products containing microbeads, removing these products from shelves in 2018. This was followed by the Microbead-Free Waters Act of 2015 banning nationwide use of microbeads in personal care products. Since then, many other countries have also taken action to ban microbeads.

But more help is needed. The MWRD urges governmental support, policy and intervention to eliminate or phase out the manufacturing of microplastics in other products and replace with sustainable alternatives. Everyone can play a role protecting the water environment by minimizing their use of plastics and personal care products using microplastics, disposing and recycling plastics properly and preventing them from contaminating local waterways.



MWRD staff remove plastic trash and other debris from the main stem of the Chicago River. The fleet of skimmer boats operate along the Chicago area waterways from mid-April to mid-October, and after significant storms year round, unless weather conditions prohibit safe operations. A basket kept at water level collects debris as the boat trolls over it. A larger MWRD debris boat operates year-round with a crane to lift heavier materials.

Top items removed from area waterways:

- Trees
- Cans
- Plastic
- Styrofoam
- Glass bottles
- Paper
- Rubber materials
- Food

Overall, the usage of plastics has brought inevitable harmful impacts to the environment and health. Continued production, use and lack of proper recycling of plastics waste still pose many fundamental problems that need greater attention soon. The development of biodegradable and other sustainable alternatives to plastics is still in its infancy, nonethe-

less, there have been renewed efforts and investments in this research area and alternatives are beginning to be available at the commercial scale.

The MWRD supports research on the ecological effects of microplastics and a greater understanding of the potential harm to human health, aquatic life and surrounding ecosystems.