

PROGRESSIVE
COMPANIES



STORMWATER RUNOFF AND LAKES

Keeping Our Lakes Clean and Healthy
in a Changing Regional Climate





HYDROLOGIC CYCLE

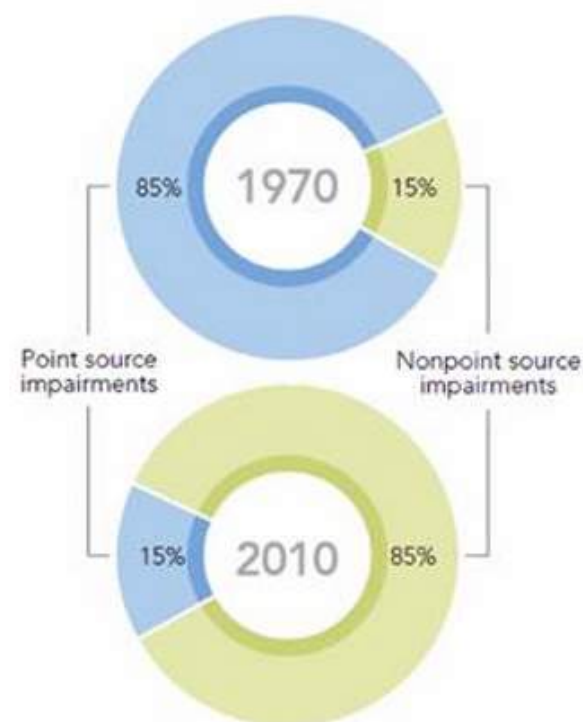


National Issue

“Stormwater is the only growing source of water pollution in many watersheds throughout North America. Urbanization and climate change exacerbate stormwater pollution, and, today, more than half the world’s population lives in cities.”

“To put this issue in the context of environmental effect, in 1970, 85% of water quality impairments were associated with point-source pollution. The remaining 15% came from nonpoint sources such as agricultural and urban stormwater. Today, after significant advancements in wastewater treatment, these values have flipped — 85% of impairments now stem from nonpoint and urban stormwater discharges.”

Rainfall to Results: The Future of Stormwater
Water Environment Federation, 2015



Extreme Precipitation Events



Heavy precipitation events are becoming more frequent and intense

1958-2021

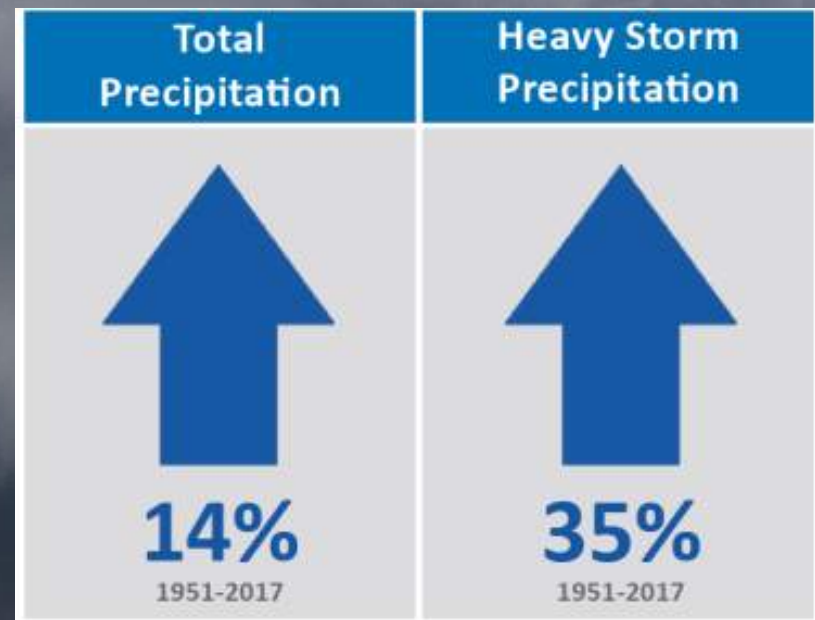
change (percent)

0 10 20 30 40

NOAA Climate.gov
Adapted from NCA5

Total Precipitation	Heavy Storm Precipitation
 14% 1951-2017	 35% 1951-2017

Michigan Data Courtesy of GLISA 2019

[illegible]

Michigan Data Courtesy of GLISA 2019

Changes in the Heaviest 1% of Daily Precipitation Events from 1951-1980 to 1981-2010 in the Great Lakes Region

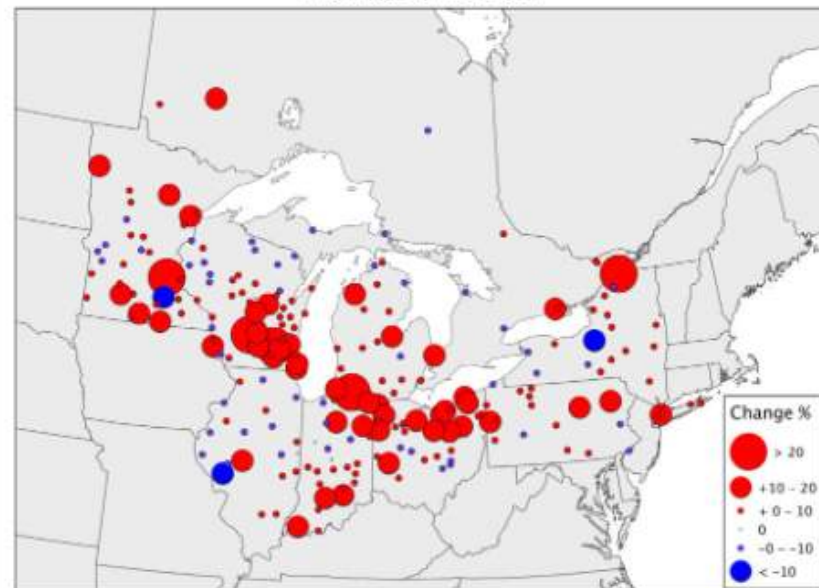
Change in Intensity of
1% Heaviest Storm (%) 5.1

Change in Number of
1% Heaviest Storm Days (%) 23.6

Change in Amount Falling in
1% Heaviest Storms (%) 24.5

Regional analysis of extreme precipitation. Values are based on observations from 230 U.S. and Canadian GHCN stations across the Great Lakes region.

Observed Changes (%) in the Intensity of the 1% Heaviest Precipitation Days (1951-1980 vs. 1981-2010)



Change in intensity of the heaviest 1% of daily precipitation events for GLISA quality-controlled GHCN-Daily stations in the Great Lakes region.

Impacts from Storm Sewers and Open Drains



- Lawn/Driveway Runoff
 - Fertilizers
 - Pet and Avian Waste
 - Pesticides
 - Household Chemicals
 - Salt
- Streets
 - Sediment
 - Oils and Greases
 - Cleaners/Detergents
 - Increased Water Temperature
 - Salt
- Outfalls
 - Soil Erosion Sediment
 - All the Above

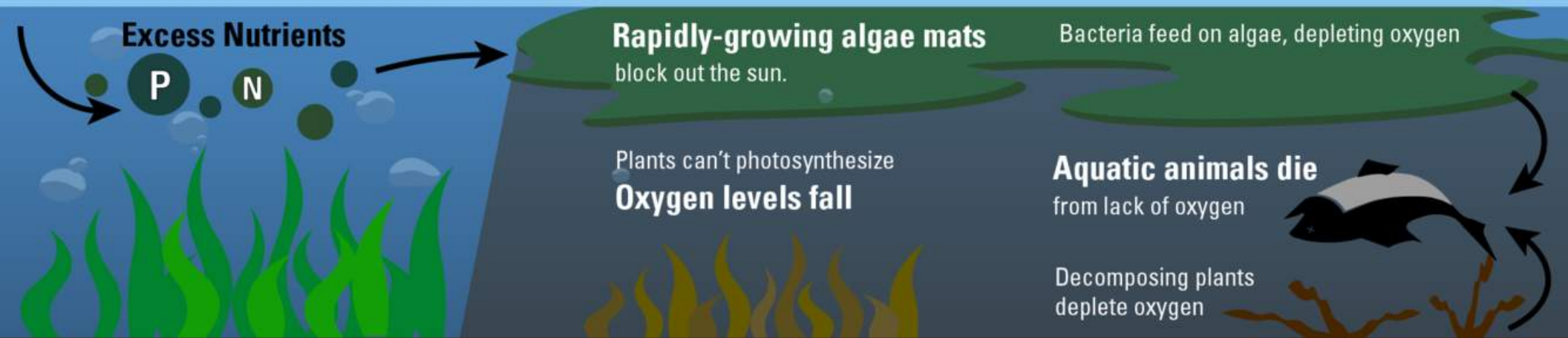
An aerial photograph showing a massive, swirling green algal bloom in a body of water. The bloom has a complex, fractal-like pattern with many smaller swirls and eddies. The color is a vibrant, slightly yellowish-green. The surrounding water is a darker, more uniform green. The text "HARMFUL ALGAL BLOOMS" is overlaid in white, bold, sans-serif capital letters on the left side of the image.

HARMFUL ALGAL BLOOMS

Fertilizers and Nutrients

- Plant and Algal Growth
- Blocks Sunlight
- Decreases Oxygen

Nutrient Pollution





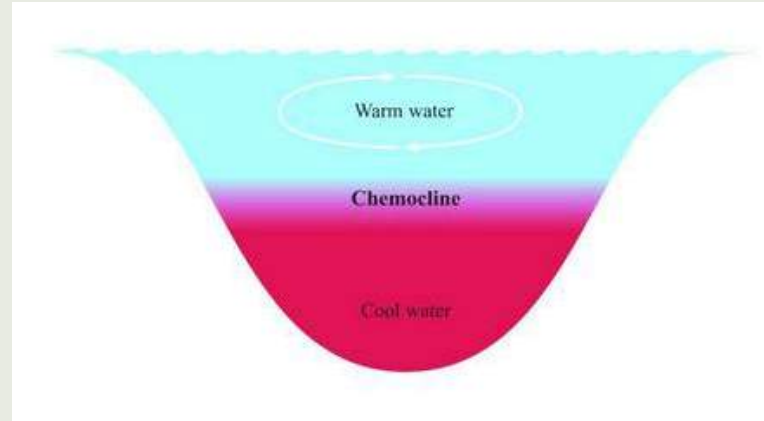
Pet and Avian Waste

- *E. coli*
- Nutrients

Household Chemicals

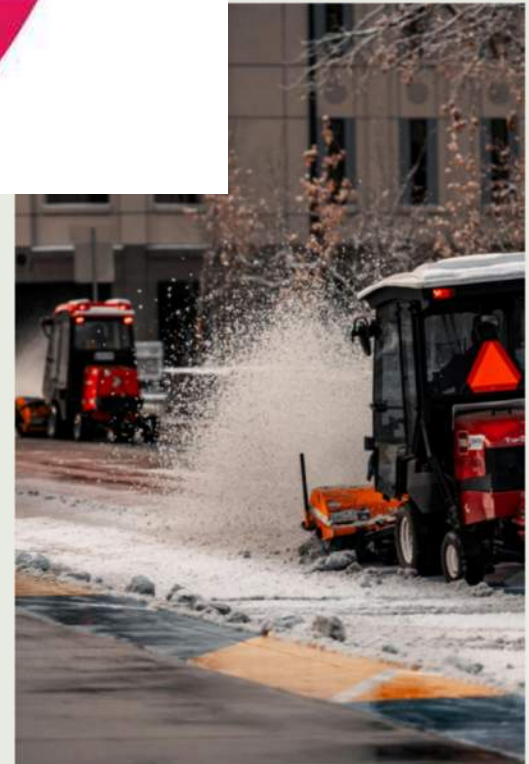
- *E. coli*
- Cleaners/Detergents
- Pesticides
- Oil and Grease





Chlorides

- Habitat/Biodiversity Decreases
- Water Temperature
- Very Transmissible/Soluble
- Increases Available Phosphorus
- Decreased Oxygen





Sediment

- Habitat
- Blocks Sunlight
- *E. coli*
- Build up

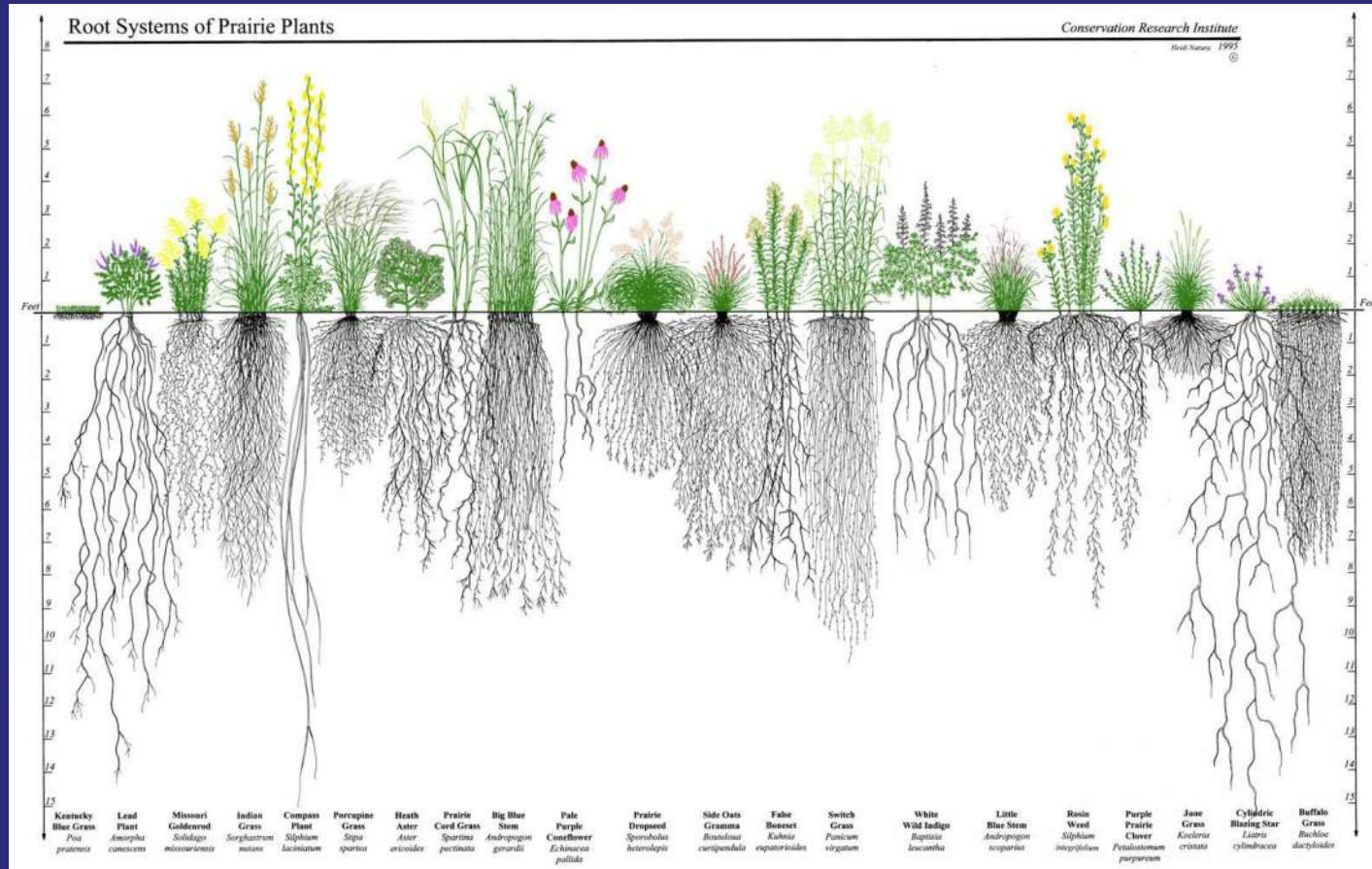
Increased Water Temperature

- Plant and Algal Growth
- Loss of Habitat/Loss of Native Species





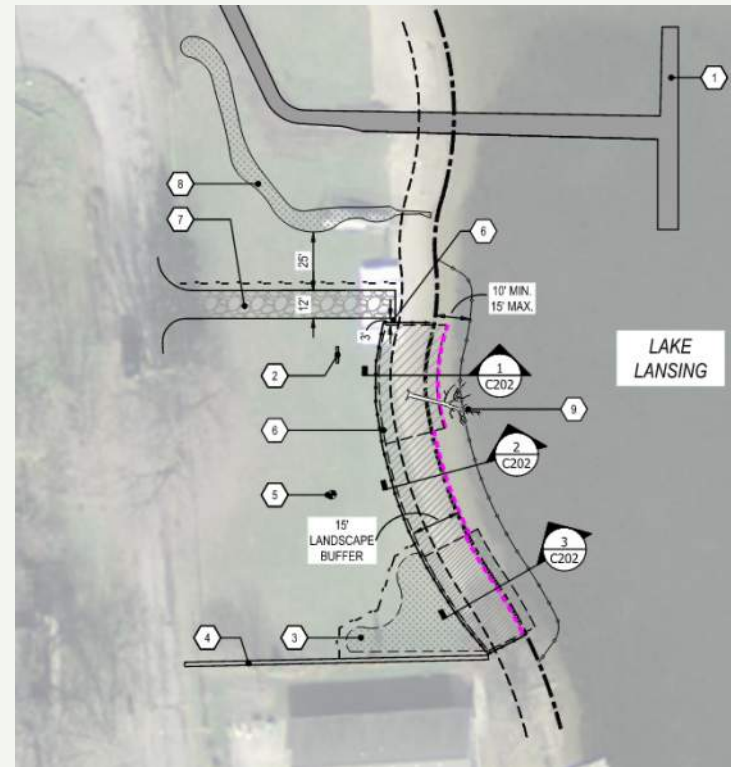
NATURE-BASED SOLUTIONS

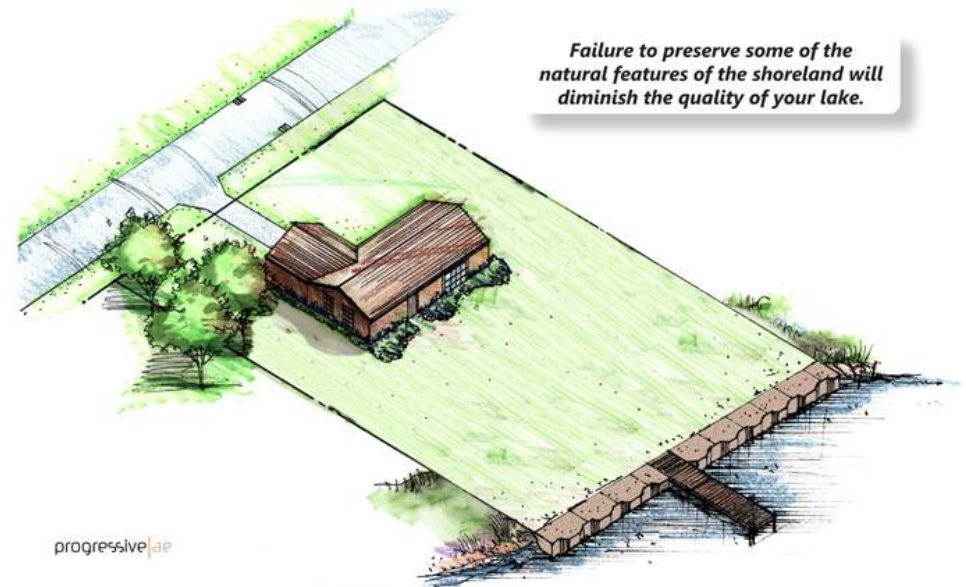
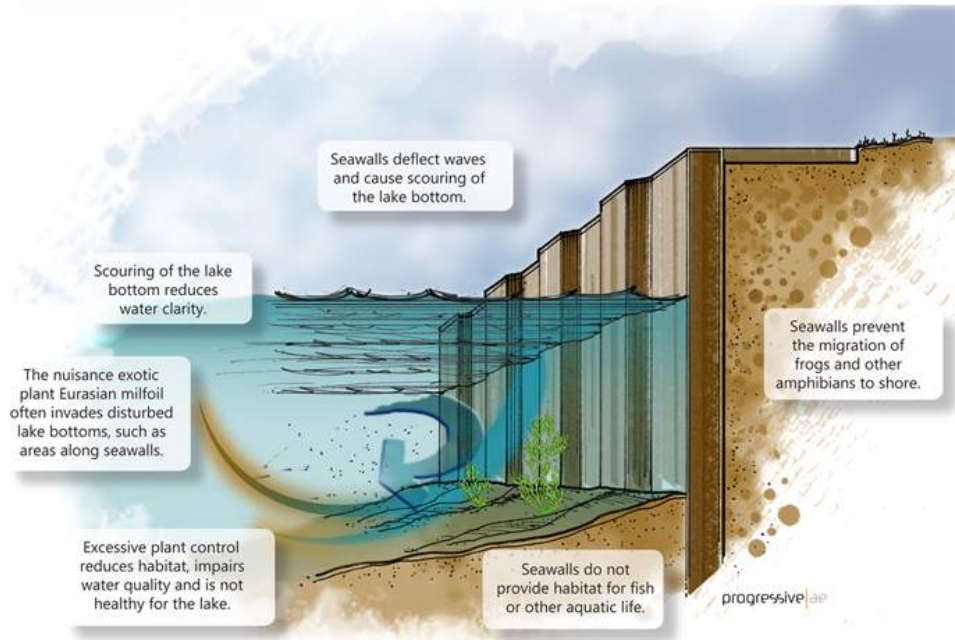


Rain Gardens and Bioswales



Natural Shorelines and Filter Strips





Hardened Shorelines

Your shoreland can be maintained to provide beach and boat access for you while maintaining habitat for fish and wildlife.

Don't dump into storm drains; pollutants may be piped directly to the lake.

Most lakeside soils have more than enough phosphorus to grow lawns, trees, and shrubs. Adding phosphorus fertilizer is usually not necessary, and can cause excessive growth of aquatic plants.

Maintain a greenbelt of trees, shrubs, and ground cover—it's habitat for fish and wildlife, and helps protect water quality too.

Minimize lawn area to reduce the need for fertilizer.

You can maintain a small beach and dock area—it's "habitat" for you!

Establish a greenbelt to filter runoff and discourage nuisance geese.

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Aquatic plants are part of a healthy lake. They produce oxygen, provide food and habitat for fish, and help to stabilize shoreline and bottom sediments.

Insects and other invertebrates live on or near aquatic plants, and become food for fish, birds, amphibians and other wildlife.

Plants and algae are the base of the food chain. Lakes with a healthy fishery have a moderate density of aquatic plants.

Aquatic plants provide habitat for fish and other aquatic life.

Aquatic plants help to hold sediments in place and improve water clarity.

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Trees and shrubs prevent erosion and provide habitat.

Roots and stones absorb wave energy and reduce scouring of the lake bottom.

Predator-fish such as pike hide among plants, rocks, and tree roots to sneak up on their prey. Prey-fish such as minnows and small sunfish use aquatic plants to hide from predators.

Natural Shorelines

Daylighting Outfalls and Buffer Strips



Permeable Pavement



Leaching Catch Basins

Mechanical Filters

- Floatables
- Solids
- Hydrocarbons



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The background features a complex, abstract geometric pattern. It consists of various shapes including squares, triangles, and rounded rectangles, some of which are filled with a light green color while others are white. The shapes are arranged in a way that creates a sense of depth and movement, with some elements overlapping others. The overall effect is a modern, minimalist design.

THANK YOU

We welcome your feedback,
insights and inquiries.



weareprogressive.com