

FRESHWATER 101 TEXT

This is a fun and interactive presentation that includes 2 activities to help engage students and track their knowledge. Ask the audience questions. The cadence should be fun, grateful (we're so lucky to live near all this freshwater) and hopeful (look how we've cleaned up our waters in the past). Please encourage our youth to participate in the future of solving the world's water challenges. Each bolded headline is a new slide. Questions are highlighted in yellow and answers are in red.

Tools: Projector, presentation and maps - US and Milwaukee Waters

WHAT'S THE MOST IMPORTANT SUBSTANCE?

WATER! Awesome water! Now, we're going to take a journey to learn amazing things about Water locally and worldwide.

EARTH What is all the blue on our planet Earth?

That's water. That's why they call it the **Big Blue Planet**. How much water is there on earth? ~ 70%

WATER IS SPECIAL It's a life-giving substance to humans, plants and animals. Water in landscapes creates beautiful scenery.

WE ARE WATER How much water is there in our bodies? **About 70% too**. Much of our blood, muscles and brain contain water. Don't forget to drink water. If you feel tired or crabby you may just need water. Blood and other body fluids turn thick like sludge when you don't have enough water, so it's hard for your body to function.

THEY'RE MOSTLY WATER TOO! Animals, birds, reptiles, fish and plants are made up of mostly water too.

WE'RE SO LUCKY - WATERS OF MILWAUKEE & WI

MILWAUKEE'S WATERS Milwaukee has a Great Lake, 3 rivers and many streams. **Can you name Milwaukee's 3 rivers?**

RIVERS: Milwaukee, Menomonee and the Kinnickinnic. Each river has a watershed – an area that drains into the river. On this map each river's watershed is a different color. **Who know which Great Lake do we live on? Lake Michigan.** All 3 of these rivers are in the Lake Michigan watershed. The dark brown line shows the continental divide - water that falls inside the brown line goes to Lake MI and water that falls outside of the brown line goes all the way to the Mississippi River.

GREAT LAKES Here is a picture of our 5 Great Lakes. We live on Lake Michigan right here – point to Milwaukee. These lakes are all connected and flow out to the St. Lawrence Seaway and the Atlantic Ocean. These surface waters are 25% of all the freshwater in the world – right in our backyard! **Can you name all the lakes?** An easy way to remember them is the word HOMES.

WISCONSIN'S WATERS We live in a state with an abundance of water. We're water-rich! The Mississippi River, the 4th longest river in the world, runs along our western border. There are over 12,000 rivers and streams in Wisconsin that flow over 50,000 miles. We have 2 Great Lakes (Lake Superior and Michigan) and over 15,000 inland lakes - more than MN's "Land of 10,000 lakes".

WHY ARE WE SO LUCKY? The Great Lakes region is water-rich, however, we are mostly surrounded by a world in a water crisis in populated areas – more on that later...

WATERSHEDS [If available, stop and do a 10-minute demo with an Enviroscope Model and Milwaukee Waters map, otherwise skip this slide]

Let's learn about what a watershed really is and see how water flows in our neighborhoods.

MILWAUKEE WATERS HISTORY

NATIVE AMERICANS Native Americans have lived in this area for thousands of years. They used their canoes on the waterways which were like highways to move into and around Milwaukee before it was even a city, just an area of wetlands and forests. Before Milwaukee was settled, the Menomonee River ran through a big valley of wetlands, the Menomonee Valley, where the Brewers now play baseball. The valley was like a grocery store for Native Americans (according to John Gurda), with wild rice, fish, water fowl and plants and herbs. Different tribes camped on the bluffs where the new UEC Center, Potawatomi Casino, Miller Brewing and Wauwatosa are now located.

EUROPEANS In the early 1800's people from Europe such as Germany, Poland, Ireland, and more countries began to settle in this beautiful and water-rich area. They brought many skills from their homelands, like beer and sausage making, and building and constructing cities. During the late 1800's the Menomonee Valley and the wetlands were filled with soil and businesses and manufacturing moved into this area.

150 YEARS Over the next 150 years the population grew from hundreds to hundreds of thousands. Pollution from raw sewage from homes and toxic chemicals from companies were dumped into the waterways, especially in the Menomonee Valley. People treated these waterways like garbage dumps and threw away cars, tires, refrigerators and all sorts of junk. Slowly the waterways began to improve. In the early 1920's we began to treat the raw sewage and in 1970's the Clean Water Act stopped companies from dumping their toxic waste into the waterways. Together many groups and agencies have made progress improving water quality over the last

30 years in the Milwaukee area.

TODAY: Our rivers and Lake Michigan are finally in better shape. The Menomonee Valley has also been cleaned up of toxic soil and sediment and now new businesses have moved in. The waters are cleaner, floating garbage is reduced, the diversity of fish and wildlife is growing, and beavers have even been seen on the Milwaukee River. It's once again safe to canoe and kayak on the rivers and in 2018 there was even a swimming race - the 1st in over 60 years! The future goal is to have fishable, swimmable and drinkable water for all.

WATER'S USES

TRANSPORTATION let's talk about how we use water in this area. As we mentioned, rivers and lakes were highways for Native Americans and early shipping like this 1860's schooner. This is the *Denis Sullivan* that was built in 2000 as a replica of an 1800's schooner and is located at Discovery World on the lakefront. In the late 1800's if you looked out on Lake Michigan you would have seen hundreds of schooners. These ships moved products, coal and grain even as far as Russia. In those days ships didn't have high tech navigational systems, so you'll find many sunken schooners at the bottom of Lake Michigan along the coast. Today Great Lakes shipping, with large barges, is an industry worth \$60 billion in the U.S. and Canada and provides nearly 400,000 jobs!

GREAT LAKES & ST. LAWRENCE MAP [Show the students the path from Duluth, MN to the Atlantic Ocean.]

MANUFACTURING Do you know what made Milwaukee famous? **Beer, brats and bikes.** We're famous worldwide for manufacturing today and in the past. Manufacturing needs lots of water that we're **lucky** to have. We were known for making saddles and leather goods, beer, meat products and sausages, engines, tractors, mining equipment, trains,

and machining. Water is the foundation of Milwaukee's economy.

IMPORTANT WATER USE Water is also important to put out fires and for growing food.

AGRICULTURE 70% of the world's freshwater is used for growing food, otherwise known as agriculture.

UNIQUE & AWESOME WATER

WOW WATER Water is the most amazing substance on Earth and there's no other compound like it. It's the only substance that naturally occurs in 3 states: solid (like ice and ice floats), gas (clouds) and liquid.

WATER IS POWERFUL Look at the damage of floods in the news - damaging property, killing people and costing lots of money. A tidal wave in 2004 killed almost 250,000 – that's similar to 1 in 4 people in the Milwaukee area. Tidal waves, or tsunamis, usually happen in the Pacific Ocean from earthquakes. Water also shaped the Grand Canyon.

NIAGRA FALLS Water also generates power – hydroelectricity. The Falls generate enough power for over 4 million homes in New York and Ontario, Canada. Niagara Falls connects two Great Lakes: Lake Erie and Lake Ontario – just a 10 hr. drive from here. The water is also so powerful it cuts down into the rock and has moved the falls back 6 miles in the last 10,000 years – that's EROSION.

WATER CRYSTALS Frozen water is a solid crystal. These are pictures of frozen water crystals. Dr. Emoto studied frozen water and through his research believes that water has memory and is affected by its surroundings. He exposed water to different situations, positive and negative, froze the water and then observed the crystals. These pictures show that water responds to negative and positive input. Listening to the Beatles also created a beautiful crystal. WOW amazing!

WORLDS WATER INVENTORY

HOW MUCH WATER IS THERE? How much of the Earth is water? Like us, Earth contains about 70% water. Let's look at how much, what kind and where water is located.

WATER - 2 TYPES There are two types of water. Can you name the 2 types of water? Salt water, the water in our oceans and freshwater, the water from our faucets, and in lakes, rivers, groundwater and in ice.

Our Big Blue Planet Earth is mostly saltwater - 97%. The remaining water is freshwater in glaciers, groundwater and rivers and lakes.

LESS THAN 1% The most important fact to know is... less than 1% of all the water in the world is available FRESHWATER for over 7 billion people, and animals to use and to drink. That's not very much. Let's find out where it is.

#1 & 2 1. Glaciers are made from accumulated snow. Almost 69% of freshwater in the world is in glacial ice. We really can't get access to the ice in glaciers, can we? 2. Almost 31% of freshwater in the world is in the ground in large cavities called aquifers. We get our water in Milwaukee from Lake Michigan, but if you live outside of Milwaukee, chances are you're getting your water from groundwater.

#3 & 4 Only 0.3% of freshwater is in lakes and rivers. What lakes are these? These are the Great Lakes. Did you know the Great Lakes contain 20% of the world's surface freshwater and 85% of the freshwater in the U.S.?

Most towns and cities get their water from lakes and rivers if they don't receive it from the ground. The problem is that there are too many people that live in areas with too little water, so lakes and rivers are running low. Climate change, including higher temperatures and droughts, also reduces water in waterways.

AIR There is also a very small amount of water in the air as humidity and fog.

WATER CYCLE Water is in constant motion around the planet and changes states along the way from liquid to gas to solid. The sun drives the water cycle. The sun heats the earth's water which causes water to evaporate and rise as gas (evaporation). Water droplets cool, condense and form clouds. Then water falls as rain, sleet or snow. It's so amazing that there is the **same amount of water on earth now** as when the dinosaurs roamed the earth. [Take a drink of water]. I could even be drinking dinosaur pee!

WATER'S FLOW & STORMWATER

WHERE DOES WATER GO? Where does water from INSIDE our schools, homes and businesses go that goes down drains and in toilets? Where does the water go OUTSIDE when it rains or snow melts?

MMSD (Milwaukee Metropolitan Sewerage District)

The water from INSIDE goes to be cleaned at the MMSD treatment plant. Wastewater or fluid from our homes and businesses travel through pipes underground to the treatment plant by the Summerfest grounds.

DEEP TUNNEL In the 1980's the MMSD built a huge underground tunnel system to hold excess wastewater. The tunnel holds up to 521 M gallons of water that is waiting to be cleaned. [Read slide.]

MMSD The MMSD has a multiple step process for cleaning wastewater. This treatment plant is located by Summerfest. However, not everything is able to be cleaned out like caffeine, micro-plastics, some chemicals and pills (hormones, anti-depressants) we take and expel. Scientists are now studying how fish are affected.

WHERE DOES RAIN/SNOW GO? A big rain washes off everything on the land as it races to a storm drain or low area or right into a river or lake. This is stormwater. Stormwater carries away dirt, garbage, dog poo (bacteria & nutrients), cigarette butts and chemicals in our yard and on the streets.

WHERE DOES RAIN/SNOW GO? Stormwater often goes right into a storm drain that either flows into a combined sewer that flows to the treatment plant or directly into our waterways.

WHAT'S THE #1 SOURCE OF POLLUTION TO OUR WATERWAYS? **Stormwater!** We have caused this problem so we can fix it. Keeping the land clean of debris, dog poo and chemicals keeps the waters clean.

MILWAUKEE'S WATERS As mentioned, all these rivers come together by Summerfest and flow out into Lake Michigan. However, when it rains these rivers carry debris off the land....

3 RIVERS FLOW ...and flow together and carry sediment and stormwater that flows out into the lake. See this large plume? **What did we mention is found in STORMWATER?** **Garbage, dog waste and chemicals.** After a large rain the beaches are often closed because the water is contaminated. We need to wait until the dirty near shore water mixes with the rest of the lake water. This poor boater doesn't know what they're sailing in.

WHY CARE ABOUT WATER?

WHY CARE #1: OUR DRINKING WATER Lake Michigan is the source of our drinking water. All 3 rivers and stormwater flows into the lake.

MILWAUKEE WATER WORKS Milwaukee has some of the best drinking water in the U.S. Again, we're so **lucky!** They pull water from about 7 miles out to ensure we have safe, clean water and then they treat the water with O3 (ozone). However, there is a reason we invested in this expensive system that kills organisms in the water. In 1993 Milwaukee experienced the worst water quality catastrophe in U.S. history. A teeny, tiny bug called cryptosporidium, got in the water and caused over 400,000 residents to get very sick and 69 people died. That was almost ½ of all the people in Milwaukee getting sick. So basically, ½ of all of you here would have been sick.

There's always a silver lining to a bad situation – now we have even better drinking water.

WHY CARE #2 THERE'S TOXIC WATER NEAR US

Waukesha, a town just 20 minutes away from Milwaukee, discovered that its groundwater was contaminated with **Radium**, a radioactive isotope that occurs in the bedrock surrounding the aquifer. Waukesha's solution is to pipe Lake Michigan water from Milwaukee (about 15 miles of pipe), use it, clean it and then return the water to Lake Michigan using pipes and then discharging to a river that flows into the lake. There are many very unhappy people about Waukesha's very expensive and potentially habitat-damaging plan. Many believe Waukesha should just clean their groundwater and conserve water, so they use less.

WHY CARE #3: TOXIC ALGAE The lagoon between the Art Museum and McKinley Marina, Lake Winnebago and hundreds of other waterways nationwide experience toxic algae blooms in the warm summer months, especially after big rains. In 2016 Lake Erie had so much green algae that the City of Toledo had to shut down their drinking water plant for 3 days! Dogs can die from swimming and drinking this green water and it can also make humans sick.

WHY CARE #4: WATER RESTRICTIONS There are many cities in the U.S. and worldwide that don't have enough water for their residents and businesses. Therefore, they need to restrict the amount of water people use, like using water to water lawns or gardens or washing cars. Sometimes they will even give tickets to people they catch watering! Many towns grow too large for the water that is available. There have also been many droughts in some of these areas over the last 20 years.

WHY CARE #5: WHAT HAPPENED TO THE ARAL SEA?

The 4th largest lake in the world almost completely disappeared in 2014. The Aral Sea is a freshwater lake that is larger than Lake Michigan. This body of water, located south of Russia disappeared over a 20-year

period. Why? They dammed 2 rivers flowing into the lake to remove water to grow fields of wheat and cotton. This was originally a dry, desert-like area.

THE ARAL SEA TODAY It's a desert! The exposed lake bed had industrial toxic waste that is now blowing around in this very windy area. There was also toxic debris from munitions testing.

WHY CARE #6: THERE'S A WORLD WATER CRISIS!

Most people in the world do not live in a water-rich area like Wisconsin. Just look at these numbers.... The quality and quantity of water affects the health of billions of people.

SOLUTIONS

BE A WATER GUARDIAN Now you know how special and limited water is, and how **lucky** we are to live in this water-rich area. We invite you to become a **Water Guardian**. Take steps to improve water quality and protect our waterways – especially from diversion.

KEEP THE LAND CLEAN So, if we keep the land clean, it keeps the rivers clean that flow into Lake Michigan. Never dump in sewers. Pick-up litter and dog poo.

PICK-UP DOG POO Yuck, right?! Well sorry, but it's the responsibility of being a dog owner. If you pooped on the sidewalk your parents or guardian would have to pick it up; no difference with a dog. Check out these facts [review slide list].

AT HOME SOLUTIONS You can get a copy of the *Simple Solutions Resource Guide* that has a fold-out poster of over 50 easy solutions you can do at home to help protect our waters.

GREEN INFRASTRUCTURE GI are things you build to manage water where it falls so it reduces stormwater runoff and flooding which helps improve water quality. [Review list.]

SOLUTIONS: WE NEED YOU! We need more brilliant minds to solve the world's water issues. You don't need to be an A-student, of course that helps, but great ideas come from all types of people.

WE'RE SO LUCKY!

GLOBAL WATER CENTER Milwaukee is home to the new Center with businesses and researchers that are finding solutions to the world's water crisis. This is the largest cluster of water businesses in the U.S.

SCHOOL OF FRESHWATER SCIENCES Milwaukee is also home to the UWM SFS, the only freshwater university and research center like it in the world!

WE'RE SO LUCKY Be proud Milwaukee! Keep it clean and protect our waters. Tell others too!