Slide 2: Your Name

- Introduce yourself
- Mention you are in the water or wastewater field, or whatever field you are in
- If you are an active NEWEA member or would like to start the presentation in this fashion, begin with the "What is NEWEA?" activity using the NEWEA letter package and tips.

Slide 3: Water Cycle

- Introduce Water Cycle picture
- We use water from the environment, then we clean it and return it back to the environment. Water is the ultimate in recycling! That is why it is so important to keep our water clean.
- The water you used this morning to brush your teeth could have been a dinosaur's bath water- that is how long our water has been around. Some day your great grand children will be drinking the same water you used today.

Slide 4: Down the Drain

- Ask "Who used water today?" (Almost every hand will go up)
- Ask the kids for ideas on how they use water in the house.
- As they answer, go room by room and repeat the ways the students use water.
- Start with the kitchen; we use water to wash dishes, either in the sink or a dish washer, we use the garbage disposal, we rinse off fruits and vegetables, we dump out liquids and ice cubes still in a cup, etc.
- It's not just water going down the drain, it is water plus…bits of food, soap, etc.
- Next, talk about doing laundry; point to the washing machine, ask students if they have ever had anything in their pockets when it went into the washing machine, but it was gone when it came out.
- Save the bathroom for last…talk about brushing teeth, taking baths and showers, and finally the toilet.
- Pull out the toy toilet and give it a flush!
- Raise your hands if you flushed a toilet already today.
- Remind students that we all flush toilets every day; we have to because, as humans, we have to go the bathroom, we have to brush our teeth, we have to take baths and showers—these things keep us healthy.
- Explain that when we use water this way and it goes down the drain, we call that **wastewater**.

Slide 5: Oceans and Rivers

- Where does the wastewater go? (Some students may begin by saying the "ocean" or "rivers." Tell them they are right, but it doesn't go straight from the house to the ocean.
- Ask how the wastewater gets from the house to the ocean or rivers.
- Through a sewer. (While some treatment plants discharge to groundwater, this concept is a little advanced but may be appropriate to mention if it is applicable to your town.)

Slide 6: Sewers

- A sewer is a pipe underground that wastewater or sewage travels through.
- Students may start by saying sewers are where wastewater goes. Tell them they are right but explain that wastewater doesn't stay in the sewers, it travels through the sewers.

- Where does it go from there?

Slide 7: Septic Tanks

- Not all buildings are connected to a sewer; others are connected to a **septic system**.
- Ask students who has a septic system in their yard.
- Explain that a septic system is a tank that collects wastewater, and where solids settle to the bottom and need to be pumped out by a truck.
- Point out the picture of the system vent (the 'candy cane') – many kids will recognize that they have one of those in their yard.

Slide 8: Treatment Plant

- If you do not have a septic system in your yard, then the wastewater will go through a sewer.
- Wastewater doesn't travel directly from homes to the ocean or rivers; something happens to it in between…it gets cleaned at a wastewater treatment plant.
- A wastewater treatment plant is different from a water treatment plant. A water treatment plant cleans the water before we use it, and a wastewater treatment plant cleans the water after we use it, before it goes back into the environment.
- Discuss the typical wastewater treatment processes (Slides 9 through 16).

Slide 9: Bar Screens

- Bar screens are a physical treatment process.
- Wastewater is allowed to flow through the screens, but large objects are stopped.
- What types of objects might be stopped in a bar screen? (Let the students answer; use the list below if they don't come up with answers or to supplement their answers.)
    - Rocks
    - Sticks
    - Soda cans
    - Disposable diapers
    - Kids' toys
    - Anything else large that has made its way through the sewer system
- Older bar screens were typically cleaned manually. Many modern bar screens are cleaned automatically using moving rakes or other motorized equipment.
- The material removed from bar screens is called screenings.

Slide 10: Grit Removal

- The flow of wastewater is slowed down as it enters the next stage of the
- treatment process, called grit removal.
- **Grit** is solid material that is small enough to have made it through the bar screens, but heavy enough to settle out when the flow of wastewater is slowed down.
- Grit removal is also a physical treatment process, because it relies on heavy material settling to the bottom.
- What might settle out in a grit chamber?
    - Small rocks and pebbles
    - Dead fish
    - Insects
    - Food particles
- Point out the picture of grit.

- Grit that settles out to the bottom is usually collected and pumped or moved by conveyor belts to where it can be removed from the wastewater treatment facility.
- Together, grit and screenings are usually hauled away from the treatment plant to a landfill

Slide 11: Primary Settling Tanks

- The next phase of the wastewater treatment process is called primary treatment.
- Once again, this step relies on a physical process to further clean the water. Primary settling tanks, also called primary clarifiers, are large round or rectangular tanks where the water is slowed down even more, so that more material can settle to the bottom.
- The material that settles to the bottom during primary treatment is called primary sludge.
- Since the grit chambers were removing very heavy material, the flow did not need to be as slow as it needs to be in the primary clarifiers, which means the primary clarifiers are much larger tanks than the grit chambers.
- The material removed in primary treatment is usually heavy organic solids, human waste, ground up food from garbage disposals, and toilet paper. In addition to settling, some materials float to the top of the tanks. These floatable materials are called **scum**. Floatation is also a physical removal process. Scum includes fats, oils, grease, and small bits of plastic that have made it through the bar screens.

Slide 12: Aeration Tanks

- Next, the water flows into the secondary treatment system. Secondary treatment is the first process in the wastewater treatment plant that is not a physical process.
- Secondary treatment is a biological process.
- The first part of the secondary treatment system usually consists of large rectangular tanks where air is added to provide oxygen to promote the growth of beneficial or “good” bacteria. These tanks are called aeration tanks.
- The bacteria in these tanks use the organic matter in the wastewater as food. They multiply and consume the organic wastes.
- By providing oxygen only in some of the tanks in a secondary treatment system, you can promote the growth of particular bacteria that like certain nutrients that you’d like to remove. For instance, nitrogen and phosphorus can be removed by having tanks with and without oxygen in the proper order to encourage the bacteria that remove these nutrients to grow.
- Bad bacteria are still present in the wastewater during this stage of the treatment process as well. These are the bacteria that came into the treatment plant with the human wastes, and they will be removed later in the plant.

Slide 13: Secondary Clarification

- The second half of the secondary treatment process is secondary clarification.
- Secondary clarifiers are basically just like primary clarifiers. They provide a place where the flow is very slow, and heavier matter has the opportunity to settle out.
- The solids that settle to the bottom in the secondary clarifiers are called secondary sludge. Secondary sludge consists mainly of the dead bacteria and other microorganisms, clumped together with other organic matter.

- Secondary sludge is removed from the bottom of the secondary clarifiers. It does not tend to be as thick as primary sludge (it has a higher percentage of water in it).
- Clean water in these tanks flows over weirs that surround the outer edges of the tanks.
- In the circular tank shown in the picture, the weirs are the v-shaped ring that goes around the whole tank near the edge.

Slide 14: Tertiary Treatment

- The water leaving secondary treatment is very clean in terms of removal of organic matter. However, laws exist today that often require removal of more than just the solids and organic matter. Therefore another step is often required.
- This is called **tertiary treatment**.
- Many treatment plants use tertiary treatment to remove excess nutrients, like nitrogen and phosphorus, before the clean water flows back to the environment.
- These excess nutrients, if not removed, can cause algal blooms in rivers and oceans where the treated water is discharged. Algal blooms are bad because they can reduce the oxygen available for fish in the water, causing the fish to die.
- They can also keep people from being able to enjoy the water for swimming and boating.
- Tertiary treatment is usually either a chemical process, where chemicals are added to encourage the settling of certain substances, or a physical process, such as filtration through materials with very small pore sizes.
- These treatment processes are sometimes similar to those used to treat water that you drink. Therefore, water coming out of tertiary treatment processes can be of similar quality to drinking water.

Slide 15: Disinfection

- Disinfection is where the bad bacteria are eliminated.
- They are usually either killed or inactivated in one of two ways.
- Sometimes, chemicals such as chlorine are added to the water to destroy the disease-causing bacteria and viruses. This is similar to what is done in swimming pools to keep the water clean.
- The second method is using ultraviolet light.
- Ultraviolet (or UV) light, when emitted into the water as it goes by, can also destroy or inactivate bacteria or viruses.
- Why is it important to eliminate these organisms before the water goes back into the environment?
    - Because you might be swimming in that water
    - Because you might be drinking that water at some point in the future
    - Because it prevents the spread of disease
- After disinfection, the clean water is finally ready to go back into the environment. This water, after all of these treatment steps, is called effluent.

Slide 16: Solids Handling

- There are many different options of what to do with the primary and secondary sludge and scum that were removed during the treatment process.
- Some treatment plants use equipment to thicken the sludge onsite and remove as much water as possible. This is called sludge thickening and dewatering.
- Some facilities use anaerobic digesters to thicken the sludge.

- If you have ever flown into Logan Airport in Boston, you may have seen the egg-shaped digesters on Deer Island, where wastewater is treated from the City of Boston and many of the surrounding towns
- One advantage of these digesters is that the sludge digestion process can also be used to create energy to help provide power for the treatment plant.
- Other facilities use trucks to haul their sludge offsite to other facilities that either burn the sludge (called incineration) or put it in landfills.
- Sludge that has the water and any harmful substances such as metals removed can be processed into fertilizer. Fertilizer made from sludge around New England can be purchased to put on your lawn or garden.

Slide 17: Influent/Effluent

- When the water comes into the treatment plant it's dirty (remind them it's our dishwater, shower water, toilet water), but the job of the wastewater treatment plant is to clean the water before putting back in the environment.
- **Sludge** is the material removed from the wastewater, and that it can be turned into fertilizer or used to make fuel.
- Ask: **Why do you think it is important that water be cleaned before going into the environment? What are some uses of oceans and river waters?**

Slide 18: Oceans and Rivers

- What are some uses of oceans and river waters?

Slide 19: Water Cycle

- CLOSING: Use the water cycle picture and explain that it is important to protect water because all the water that is on earth is all the water we will ever have. We need to protect it and keep it clean.

Slide 20: Questions

- What does the "N" in NEWEA stand for?
- What is one way that you use water?
- What might be in wastewater other than water?
- Where does the water go after it goes down the drain?
- What is the pipe called that the wastewater travels through?
- Where does the cleaned wastewater go?
- Why is it important that water is clean before it is returned to the environment?