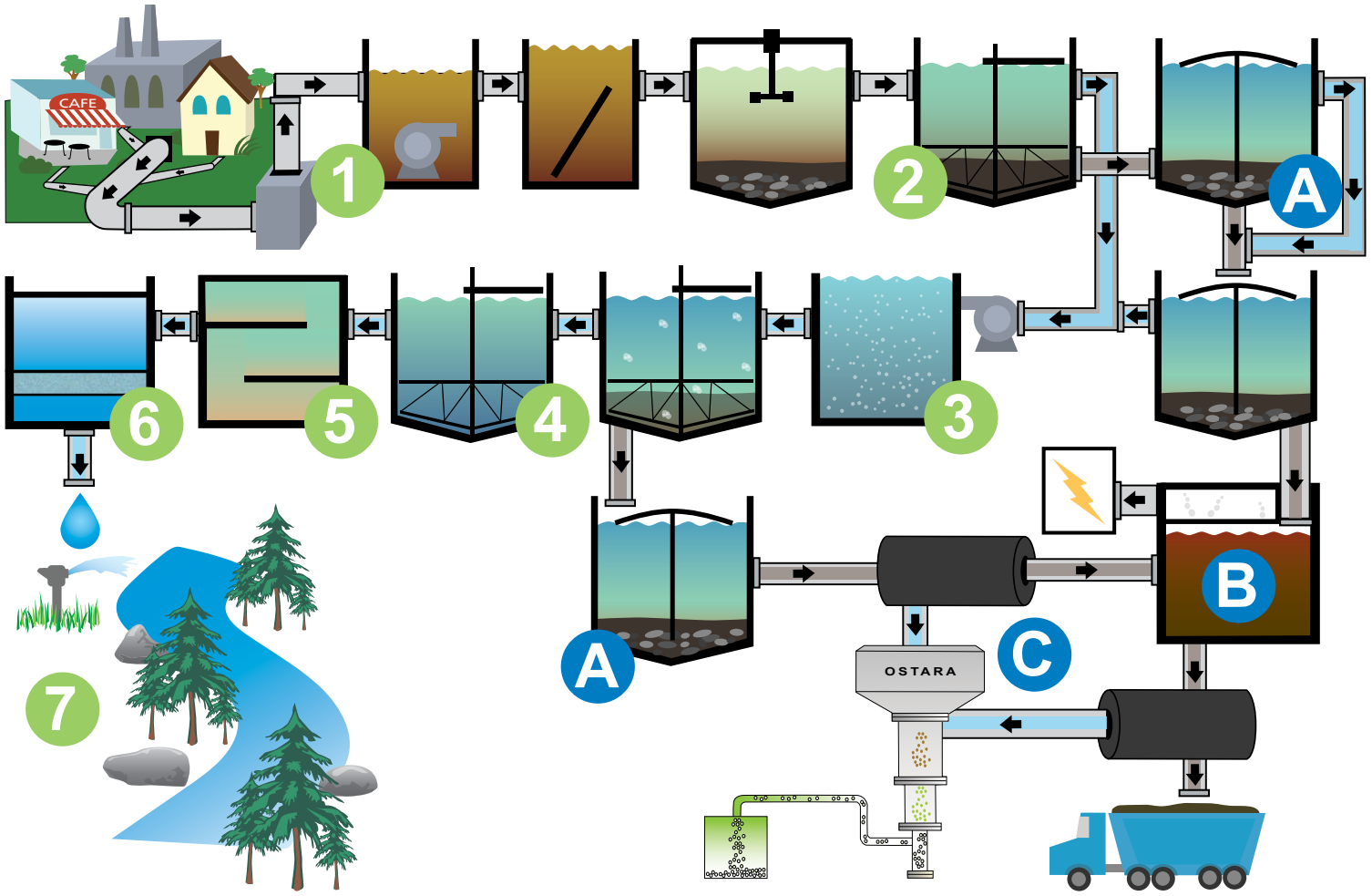
DURHAM WATER RESOURCE RECOVERY — PROCESS



Liquids Recovery

At the Durham Water Resource Recovery Facility, used water flows through the plant through a series of processes: preliminary, primary, secondary, tertiary, disinfection and effluent discharge.

1 Preliminary Process

Flow from homes and industry eventually comes to the Durham Influent Pump Station. The flow is measured and then pumped to the Headworks Building. Headworks prepares the incoming flow for downstream treatment by screening out larger debris and garbage and allowing heavy materials to drop out prior to Primary Treatment.

2 Primary Treatment

Flow from Headworks is sent to up to four separate primary clarifiers. Primary clarifiers are large tanks that allow the flow to slow down. This lets particles settle to the bottom of the tank while fats, oils, and grease float to the surface. A skimming arm skims the water surface to remove buildup while sludge pumps remove sludge from the bottom of the clarifiers. The solids removed from these tanks are sent to solids handling for further treatment.

3 Secondary Treatment

There are many types of secondary treatment. The Durham facility employs activated sludge with an enhanced biological nutrient removal configuration. This means an environment is created in aeration basins that allows the natural bacteria in wastewater to grow and thrive. The bacteria incorporates contaminants and phosphorus in the

Solids Recovery

The first half of the job at a water resource recovery facility is to remove foreign constituents from the liquid flow stream. Those foreign constituents, or solids, are resources that can be reclaimed. The solids treatment process consists of thickening, digestion, dewatering, and phosphorus recovery.

A Thickening

The main purpose of thickening is to concentrate the solids by removing a large volume of water. We are able do this by gravity thickening the primary sludge. The UFAT® process was created at Durham to capture the volatile fatty acids in the primary sludge and returns those acids to the aeration basin to aid in nutrient removal.

The secondary sludge goes through a process invented by CWS called

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water. The bacteria can also convert the nitrogen in the water into nitrogen gas. As the flow leaves the aeration basin, secondary clarifiers slow the water down similar to primary clarifiers. As the bacteria sink to the bottom, sludge pumps return the bacteria to the front to meet the incoming flow and remove further contaminants. A portion of the bacteria are removed (wasted), along with contaminants and nutrients in the bacteria, and sent to solids handling to maintain a stable aeration basin population.

4 Tertiary Treatment – Chemical Clarification

At Durham, tertiary treatment is accomplished by chemical clarification. Alum is added to the secondary effluent to allow smaller particles to clump together and form a "floc" of particles. These larger clumps are easier to settle in the chemical clarifiers, where they are removed and sent to solids handling.

5 Tertiary Treatment - Filtration

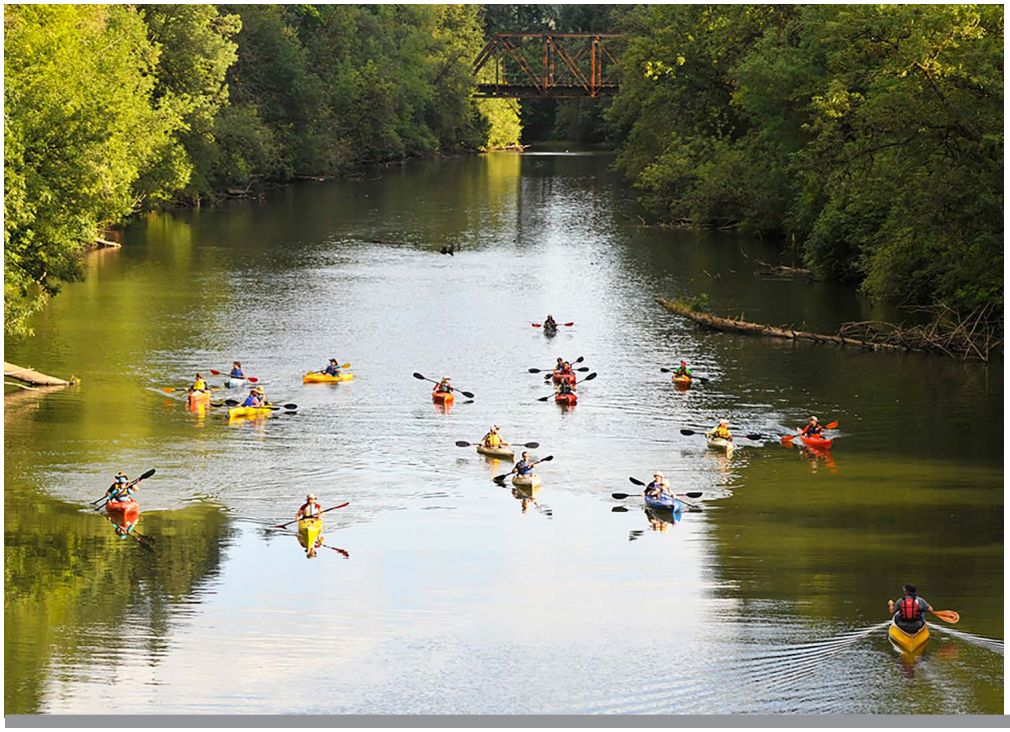
The filters contain a mixture of sand and anthracite media to capture fine particles that were unable to settle out in the primary and secondary treatment processes. This is the same process that occurs at drinking water plants for purifying the water and is a final step to reduce phosphorus concentrations to extremely low levels.

6 Disinfection

Disinfection inactivates harmful microorganisms and Durham accomplishes this with chlorine. The flow is dosed with sodium hypochlorite, a more concentrated form of bleach, and held in serpentine tanks called chlorine contact basins to allow sufficient contact time to disinfect the flow. As the flow leaves the chlorine contact basins, it passes through filters.

7 Effluent Discharge

As the flow prepares to leave the plant, sodium bisulfite is added to neutralize any remaining chlorine in the water. The resulting water is such high quality, it actually improves the health of the river and is close to drinking water quality. In the summer, a portion of the water is not returned to the river, but is instead used onsite or pumped offsite as Class A recycled water for irrigation. The recycled water is not dechlorinated so that the chlorine can prevent a recurrence of contamination.



WASSTRIP®. It goes through a process of gravity thickening in an environment without oxygen, which causes the bacteria to release stored phosphorus. Then, the secondary sludge is further thickened using a centrifuge. The liquid from the centrifuge is high in phosphorus, so it is sent to phosphorus recovery to reclaim the phosphorus. Sludge from the primary and secondary processes is mixed together and sent to the anaerobic digesters.

B Digestion

Anaerobic digesters function much like a human stomach. They consume what they're fed and turn that "food" into water and biogas, which is high in methane. The biogas is captured and fed to engine generators, which produce electricity used to help run the plant. They also provide heat to keep the digesters at a healthy temperature and space heating for much of the Durham campus. During the digestion process the solids are stabilized to meet Class B biosolids criteria. Any solids left are sent to dewatering.

C Dewatering and Phosphorus Recovery

Water in the sludge from the anaerobic digesters is removed using high-speed dewatering centrifuges. This liquid has a high content of phosphorus and ammonia, so it's sent the phosphorus recovery center to make a high quality fertilizer.