

EXP. NUMBER	EXPERIMENT/SUBJECT Ellis Creek Field Trip	DATE 1/29/14	Very well Done.	
NAME [REDACTED]	LAB PARTNER _____	LOCKER/DESK NO. [REDACTED]	COURSE & SECTION NO. 8 8	

I. Ellis Creek Field Trip

Analysis Questions:

① We went to the Ellis Creek Water Recycling Facility on January 29th 2014. Our guide was operator Ereg Harris. We went to learn about both primary and secondary sewage treatment. We were able to walk through the grounds of the treatment plant.

Observations

- Nearly all PC automated
- Headworks
 - ↳ Removes as many things as we can (highest evolution)
 - ↳ Removes synthetic products
- Post-Headworks
 - ↳ Paddle wheels to impart oxygen (allows water to absorb oxygen) rags/grit
- Centrifical force to remove
- 2 streams
 - ↳ Water and solids all H₂O goes to old facility on Hopper St. before Ellis Creek Facility
- Speed of mixed liquor separation
 - ↳ Faster = happy bugs
 - ↳ Slower = not so happy
- Bacteria treats H₂O
- UV light for disinfection
- Bleach to kill pathogens

② APES Vocab. Relation

Sludge: Mixed liquor (mostly bacteria), liquid should be clear on top

Water Pollution: Dewatering = 17% waste, New method = water goes to pond for nature to "do its job", use concentrated bacteria to treat H₂O

Pathogens: Bacteria lives on bark; pull out odorous compounds ← biofilter, bleach

Wastewater: Goes through mechanical screens to remove pathogens and grit

Fecal coliform bacteria: Digester at 100° (similar to body temp.) solid breakdown: anaerobic bacteria to break down solids, so they're inert

Oxygen-demanding waste: A certain amount of aerobic bacteria is needed to dissolve in water (BOD)

Biochemical oxygen demand: Ellis plant removes the BOD contaminant levels:

State says MCL = water cannot cause any detriment to the receiving stream, State also needs to know gallon count:

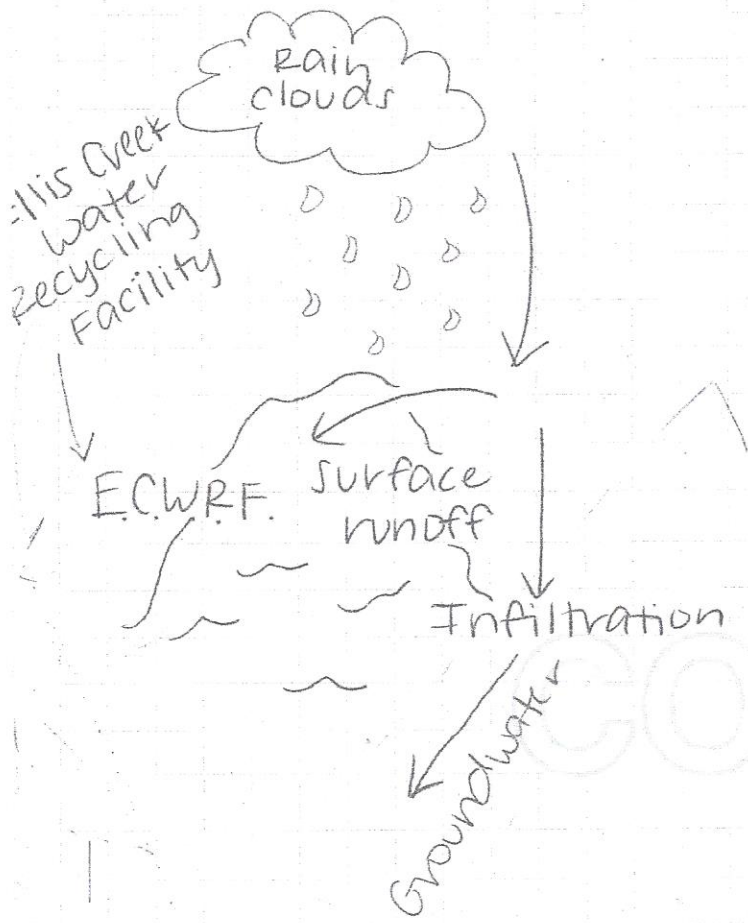
- ↳ 5 million a day (Summer)
- ↳ 36 million a day (Winter)

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③ Address to Hydrologic cycle :

The Ellis Creek facility relates to the hydrologic cycle because the treatment plant itself is a runoff collector.

After rain or precipitation, the surface runoff travels to the treatment facility for filtering and further treatment.



④ Water quality technology :

The technology at Ellis Creek has raised some environmental issues.

The technology takes place of some creatures' habitats and puts them in harm's way.

They involve the use of seepage tanks and like most treatment plants, involve a primary, secondary, and tertiary treatment.

The final disinfection of pathogens involves inorganic additions which can lead to algal blooms and other aquatic issues.

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	none			

Pt 1. Background

We visited the Ellis Creek Water Recycling Facility in Petaluma, and we got to tour their process. First we saw their control room, then the actual recycling facilities (outside), and then their lab where they test the water.

was a misty
Wednesday, January
29th

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Outside, we saw:

Headworks, the oxidation ditches, the secondary clarifiers, the oxidation pond, the wetlands (from afar), the outside of the digester, and we heard about the disinfecting process.

In general it was quite smelly and loud.

At headworks, large screens remove waste, and then a vortex uses centrifugal force to remove grit and seeds. It's oxidized, then goes through a secondary filter that helps remove water soluble compounds. Some goes to the oxidation ponds and wetlands, and other goes through another filter, then to disinfection. The first amount is put back into the Petaluma River, and the second amount is used for irrigation. Solids are broken down, dried, and sent to landfills. The water treatment facility processes billions of gallons per year, and 90% of the work is done automatically (electronically).

Pt 2. Chapter 14 Connections

water pollution - Petaluma water is polluted by solid waste such as rags and towels, and by chemicals, oil, and seeds

sludge - the leftovers from headworks create a "sludge" that is processed then sent to the landfill

wastewater - the gray water is reused in local agriculture, and some is used in Windsor

Maximum Containment Levels - MCLs are tested in the lab. They hope there is "good bacteria" in the "liquor" they test with as they hope it will help it settle faster.

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P13 Hydrologic cycle

The water treatment facility can be seen as an extra step of the water cycle, between surface runoff, and entering the rivers and oceans. The water treatment facility catches some runoff as well as the water we used (pulled up from groundwater or lakes), and cleans it before it is returned to rivers/lakes — in this case, the Petaluma River. We also create a mini cycle within the water cycle if the water is reused for human purposes, such as cleaning or agricultural use.

P11 Technology of H₂O Quality

As touched on above, the water treatment plant follows many of the steps of the sewage treatment plant in our book. Water goes through primary treatment (headworks), secondary treatment, and then exposure to UV rays (tertiary treatment). Thickened sludge is taken to a landfill, but not incinerated or used for ~~the~~ fertilizer. When the Ellis Creek plant has too much water, overflow isn't dumped but is rather transferred to the nearby, former water treatment plant. The former plant only does primary treatment. Some environmental issues include the impact on local endangered species, including the salt marsh ^{or harvest} mouse. The plant was specifically designed with species like this in mind, and now many of these mice happily call the 30 acres of polishing wetlands home. Much of this water is dumped in the river, but the plant follows "extensive laboratory testing and monitoring" regulations to make sure there is no harm to wildlife there.

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Last Wednesday, we went to Ellis Creek Treatment Facility. We went to observe how a water treatment plant works. The first thing I noticed was that it smelt and sounded like a beach, along with the seagull noises. There are three treatments and a Solid treatment. The first stop was the headworks where they separate the synthetic products like baby wipes and dental floss. They also have oxidation ditches to add air and oxygen. In the tertiary treatment, they use pumps ~~to~~ and they utilize UV energy to destroy DNA of a cell, in order to stop it from reproducing. In the solids portion anaerobic bacteria breaks ~~up~~ down solids, which are composted in 100°F (similar to our bodies). In total, they treat about 5 million gallons on a summer day and around 36 million gallons of water on a winter day, due to rain.

The water pollution is nonpoint sources because it comes from different parts of Petaluma. In the primary treatment, they end up with sludge, which contains a lot of water. So, once they treat it, they dewater it to only 17% of water. Also in the headworks, they remove BOD load from the waste water. The level of BOD can be determined by indicator species like ~~bacteria~~ bacteria. ^{like fecal coliform} This is important because oxygen-demanding waste can lead to ~~control~~ algal blooms then cultural eutrophication. In addition, our guide explained that they are required to meet the maximum contaminant level issued by the EPA and Californian government. The MCL includes different pollutants, such as PCBs and PBDEs.

In the hydrological cycle water undergoes 5 steps: condensation, precipitation, infiltration, runoff, evapotranspiration. Water vapor condenses to form clouds, which result in precipitation when the conditions are suitable. Precipitation falls to the surface and infiltrates the soil or overflow to the oceans runoff. This cycle cleans water, but since we can't replicate we use water treatment plants, such as Ellis Creek. Usually water is pumped from a body of water, where the water undergoes series of

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processes, in order to clean the water. Basically, water treatment plants are one more step to the hydrologic cycle because the water treated is released to another body of water, thus being part of nature's hydrologic cycle of recycling water.

Ellis Creek follows three treatments. In primary treatment they remove the grit and solid waste. Headworks has bar screens filters the big material, like towels and floss. The Vortex Grid removes the small stuff by spinning and separating material by weight. In the oxidation ditches, air is added for better aerobic digestion. In secondary treatment is the use of gravity to separate the sludge from the clear stuff. In oxidation ponds, algae and bacteria decompose the remaining waste. Also chlorine is added to kill microorganisms. In the tertiary treatment where sand medium filters out the small particles. They also use UV electromagnetic energy to penetrate cells and destroy their DNA, in order to stop reproduction. The sludge can be sent to a landfill, incinerated, or spread on farmlands; at Ellis Creek they usually send it to a landfill.

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Field Trip Write Up: Ellis Creek Water Recycling Facility

① On Wednesday, January 29 we went on a field trip to the Ellis Creek Water Recycling facility. I don't know what our guide's name was, but he said he was involved in both the mechanical and biological aspects of the facility. We went on this field trip because right now in class we ~~are~~ also currently on water pollution, and one of the sections was on water treatment. So we took the field trip to get first-hand experience and a better understanding of the topic, both why we need it and how it is done. Our tour began in the ~~facility's~~ facility's lobby, where our guide gave us some background information on what we were going to see. We then proceeded to the control room. There, the guide told us about how the plant is run and what it takes to run it. From there we took a little walk to where the water actually gets treated. We passed the screw press, Headworks, Methane Digester, and various oxidation ditches. It was cool to be that close to the technology we had spent time covering in class. And lastly we made our way to the lab, where our guide briefly discussed the biological side of what we had seen.

② This field trip ~~is~~ is highly related to Ch 14 of our textbook, including a number of vocab words on our sheet. The first two are water pollution and wastewater, which go hand in hand. Wastewater is often polluted in some way, and it is up to facilities

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like Ellis Creek to make the water clean enough to return it to nature with no harm. Another Ch 14 topic that would be an alternative to a water treatment facility is a septic system. These are used in rural areas that aren't connected to city water systems, and they use septic tanks and leach fields to perform the same tasks as water treatment facilities, except for a few of the facilities more high tech features. Another vocab word relative to the field trip is sludge. It is the solid waste material taken from the wastewater during treatment. ~~Another~~ Oxygen demanding waste was another topic addressed by our guide. Because of its biochemical oxygen demand, untreated water would be hazardous to return to natural water systems. It could use up the oxygen in that body of water and create a dead spot. To avoid this, the ~~water~~ water is put into oxygenation ditches, where water wheels turn the water to incorporate more oxygen into it. And the last vocab word our guide talked about, while we were in the lab, were indicator species. These, fecal coliform bacteria for example, are used to see which things are in the water without directly testing for them.

③ The Water Treatment Facility is greatly related to the Hydrologic Cycle. It plays a role in the runoff and infiltration stages of the cycle, acting as a gate ~~which the water~~ so the contaminated water cannot progress ~~to~~ to these stages. It must first be treated, then it can run into rivers and streams or infiltrate back into aquifers.

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(7) Because it was built very recently, the Ellis Creek Water Treatment Facility has a lot of the latest technology to combat water pollution issues. The Headworks removes all rags, grit, and gravel from the wastewater. The screw press takes as much water as possible out of the sludge to increase the amount of clean water returned to nature as well as decrease the volume of waste that has to be disposed of. The oxygenation aitches combat the problem of oxygen demanding wastes causing dead spots by using wheels to churn the water, incorporating more oxygen to it and meeting the wastes BOD. And lastly the facility employs UV light to kill pathogens in one of the final steps. One major problem remains untreated, however. And that is the presence of pharmaceuticals in the water. So far, there is no way to remove them, so they keep accumulating in the water. Finding a way to remove these from the water will be a major water treatment issue in the coming years.

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EXP. NUMBER	EXPERIMENT/SUBJECT	DATE	24
	Water treatment	1/31/14	
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1. Where: Ellis Creek Water Recycling Facility

When: January 29, 2014

Why: to learn about and observe the process of treating $\frac{8}{8}$ sewage water

Who: Our guide was one of the operators of the facility

What: We observed the process of treating waste water. We saw where the headworks take place, such as removing the inorganic solids, and we also saw where the primary and secondary treatment is done. Finally, we visited the lab where they test the quality of the water.

2. This field trip related to numerous subjects from chapter 14. Our guide said that the facility receives wastewater 24 hrs a day, with 5 mil gallons a day during the summer and 36 mil a day in winter. They have systems in place to divert the water when the maximum containment level is reached. He also discussed anaerobic and aerobic processes that are used to break down waste. Oxygen-demanding waste is broken down by plants to lower the biochemical oxygen demand of the water. The anaerobic process takes place first to break down solids, and the aerobic process occurs after. Huge paddles are used to oxygenate the water called mixed liquor that is loaded with bacteria. Sludge is a byproduct of the process, and it is used as fertilizer for local farms or sent to a landfill.

3. Water recycling relates to the hydrologic cycle because it puts clean, healthy water back into the system. Recycled water will be evaporated and condensed, and eventually precipitated back down, so it is beneficial to the system that the water is clean.

4. Water recycling facilities are great because they treat and clean the water. They relate to the technology of water quality because they employ all of the same processes. One problem is the nitrogen and phosphorus they input into water that fertilize and cause algal blooms, but treatment facilities are working on tertiary processes to prevent this.

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5. I can understand most of the processes better. The guide did not go as in depth. I can more easily identify the differences between primary and secondary treatment.
6. I don't fully understand the difference between headworks and primary treatment. I think they might be the same.

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