Unit 3: Water Conservation

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Unit Summary

Water is our nation, state, and community's most precious and finite resource. A safe and reliable water supply fosters our high quality of life by protecting public health, accommodating firefighting needs, bolstering economic prosperity, and much more. In spite of that, few know the source of this vital liquid that flows readily from our faucets, showerheads, and sprinklers nor that it is in constant jeopardy, as a diminishing precipitation supply in our state persists. Given this, the water unit seeks to build a deeper understanding of the sources of our water supply and create a clear and constructive pathway for students support their school's efforts to conserve and make efficient use of Earth's most precious resource. Your mission will be to help students identify opportunities for water conservation on campus and support their work to spread the message about the importance of water to teachers and peers. Here is a summary of how you'll help your school achieve its water conversation goals including the activities, campaign opportunities, and skills bolstered by this unit.

Actions *Here are some actions students will take to complete the green@school checklist and reduce their school's environmental impact.*	1. **Research**— look up unknown words and concepts first! 2. Become **campus water detectives**—check out bathrooms, kitchen, cafeteria, and even campus landscaping. Interview relevant school and district staff to identify where water is used on campus and discover where it's wasted. 3. Design **signage** to encourage water conservation in bathrooms/kitchens. 4. Install water-saving devices and recommend policy and technologies.
Campaign Opportunities *There are several opportunities for student teams to raise awareness and educate their teachers and peers about the impacts of saving water!*	1. Build a **Water Awareness Campaign** to educate teachers and peers on your school's water conservation and efficiency practices. 2. Make or experiment with a **watershed model** and share your understanding of watersheds with your peers and/or teachers. 3. Design a **water use experiment** to analyze how signage, water saving devices, or other variables impact water use on campus. 4. **Tour** your local watershed or visit your local water district to find out more about water sources, use, and conservation in your community.
Skills *Each team will build & apply different skills to accomplish their green@school goals. Here are some specific skill sets students may exercise across this program.*	1. **Get your math on**—calculate the flow rates of faucets and toilets on campus and find out how much you could save. 2. **Be a marketing agent**—design signage for bathrooms and restrooms that will effectively encourage conservation. 3. **Become a local advocate** – raise awareness on your campus and recommend water-saving changes to your school and the District. 4. **Find your inner detective**—interview staff overseeing landscaping and other water use on campus. Identify where water-savings opportunities.
Contacts *To evaluate campus energy use, students will have to build new outreach skills. Here the people you may want to help them contact.*	Purchasing Manager, Your school district Grounds-Custodial Manager, Your school district Energy Manager, Your school district Water Conservation Specialist at your local water district **Who else? Write any others contacts you can think of:**

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Certification Checklist

As described in the green@school Handbook, each Unit corresponds with a targeted resource conservation goal and a specific section of the California Green Business Program's checklist, designed so that students will use this tool (the checklist) to assess their current campus environmental actions and identify opportunities for improvement (learn more at http://www.greenbusinessca.org/). This will occur following their deep dive into the subject through the lessons and activities shared in this chapter that seek to build their baseline knowledge on the subject before they are asked to become subject matter experts assessing their school's operations and practices. The checklist is included at the beginning of each unit so you can see what you're building towards, but again, know that its expected use will follow the activities and lessons shared below. Further, completing the actions in this checklist will enable your school to receive statewide recognition for your environmental leadership (bonus!). To assess the water conservation practices on your campus, walk through this list with your students, administrators, or other resource-relevant school site staff.

green@school Certification Checklist						
#	Measure/Action/Practice	Does your school meet this measure?			Controlled by school staff administrator (SA), school district (D) or Students (ST)	Investigation Notes and Status
		YES	NO	DON'T KNOW		
Water Conservation						
Reduce Your Water Bill						
Required						
1	Install toilets with 1.6gpf (gallons per flush) or less					

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green@school Certification Checklist

#	Measure/Action/Practice	Does your school meet this measure?			Controlled by school staff administrator (SA), school district (D) or Students (ST)	Investigation Notes and Status
		YES	NO	DON'T KNOW		
Water Conservation						
2	Check for and repair all leaks, including in toilets					
3	Assign a person to monitor water bills for sudden rises in use, and to track use over time. Call your water company should sudden rises occur					
4	Test irrigation sprinklers quarterly to ensure proper operation and coverage and repair all broken or defective sprinkler heads/nozzles, lines and valves					
5	Post signs in restrooms and kitchen to encourage water conservation and to report leaks					
6	Use only dry methods to clean outdoor hard surfaces and post instructions for staff					
7	Save water by programming the irrigation system to use shorter, repeated cycles of watering (3 start times of 3 minutes each instead of one start time of 10 minutes)					

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green@school Certification Checklist

#	Measure/Action/Practice	Does your school meet this measure?			Controlled by school staff administrator (SA), school district (D) or Students (ST)	Investigation Notes and Status
		YES	NO	DON'T KNOW		
Water Conservation						
8	Adjust the irrigation schedule monthly during irrigation season, or as needed					
9	Adjust sprinklers for proper coverage, optimized spacing, and eliminated runoff					
10	Water during early morning, pre-dawn hours					
Complete at Least 5:						
1	Schedule your water company to make a presentation to staff to encourage water conservation at home					
2	Indoors, use dry floor cleaning methods, followed by damp mopping, rather than spraying or hosing with water					
3	Change window cleaning schedule from periodic to as required					
4	Provide additional urinals in men's restroom and reduce number of toilets					

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green@school Certification Checklist

#	Measure/Action/Practice	Does your school meet this measure?			Controlled by school staff administrator (SA), school district (D) or Students (ST)	Investigation Notes and Status
		YES	NO	DON'T KNOW		
Water Conservation						
5	Install low-flow aerators and showerheads (your water company may offer these for free); As low as 0.5gpm and no greater than 2.5gpm for lavatory sinks; 2.0gpm or less for kitchen sinks; 2.0gpm or less for showerheads					
6	Adjust boiler and cooling tower blowdown rate to maintain TDS (total dissolved solids) at levels recommended by manufacturers specifications					
7	Replace water-cooled equipment, such as air conditioning units, with air-cooled					
8	Work with your water company to develop a site-specific water budget. Track your water use to ensure efficient watering					
9	Group plants with similar water requirements together (hydrozone) on the same irrigation line					
10	Plant drought tolerant plants that will not need pruning at maturity					

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green@school Certification Checklist

#	Measure/Action/Practice	Does your school meet this measure? YES	NO	DON'T KNOW	Controlled by school staff administrator (SA), school district (D) or Students (ST)	Investigation Notes and Status
Water Conservation						
11	Irrigate with reclaimed water, graywater or rainwater					
12	Install self-adjusting weather-based irrigation controller to tailor schedule to local weather, plant type					
13	Install rain shut-off devices or moisture sensors that turn off the irrigation during rain					
14	Use drip irrigation					
15	Apply mulch or compost in non-turf areas to improve the water holding capacity of the soil					
16	Replace water intensive turf with woodchips, plant based mulch, loose stones or permeable pavers					
17	Install water pressure-reducing valves to <50psi					

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Student Learning Outcomes

In this unit, students will become proficient in the vocabulary and concepts describing water efficiency and conservation and grow connected to their avenues for implementation at school and at home. The following outcomes will be achieved through this unit's activities, demonstrations, analysis, and investigation. After completing this unit, students will be able to:

1. Articulate at least three ways their school's infrastructure and practices drive its water use.
2. Measure water use from faucets and fixtures and identify three water-efficient technologies to reduce water use on campus.
3. State the difference between water efficiency and water conservation.
4. Communicate and pledge three ways to conserve water and/or use it more efficiently at home and at school.
5. Name three career choices that relate to water efficiency and/or conservation.

Lesson Plan

2013 and 2014 were the driest years on record and 2015 is anticipated to mirror these precipitation patterns. In fact, local reservoirs have dropped to 49 percent of their 20-year average, according to the Santa Clara Valley Water District (2014). Yet, as anyone who lived through the 1970s can attest, this isn't the first time our state has faced a water shortage. However, if you ask your students if they have experienced any hardship because of the current drought, they will probably say "no." Survey your class to learn what they're doing at home to save water. You may get simple answers like "turn the faucet off when I brush my teeth" or "take shorter showers", but these solutions don't apply to conserving water on their school campus. This unit focuses on what students can do to conserve water at school and expands these efforts to those more impactful in their homes and teaches them about efficient technologies to reduce water use, framed by the lessons below. Keep in mind that this unit is more analytical so students will need to keep their pencils and observation skills sharp.

LESSON 1: WATER 101: THE WONDROUS WATER CYCLE

LESSON 2: WATER 102: WATER GOES ROUND AND ROUND

LESSON 3: DESIGN IT BRIGHT: WATER EFFICIENCY AND CONSERVATION OPPORTUNITIES

LESSON 4: GROWING GREENER: WATER INVENTORY

LESSON 5: GETTING GREEN DONE: INFLUENCE PEERS, STAFF, FAMILY AND COMMUNITY

A note to instructors: the plug-and-play activities shared throughout all green@school units are framed for your students, with the hope that you can simply offer/print these activities for their direct use. No extra prep time required!

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Lesson 1: Water 101: The Wondrous Water Cycle

This unit starts with the basics - where *does* water come from? To help students understand how water gets to their tap, we'll review the basic components of the water cycle.

➢ Research Activity | *The Where of Water*

The EPA's Water Cycle Interactive Tool: (http://www.epa.gov/safewater/kids/flash/flash_watercycle.html) offers a great way to engage them in the various attributes and connections occurring in this complex and critical system. After introducing the theme – provide them with the link to EPA's tool. After they have spent a little time working with the tool, walk them through the following exercise. Presented below are the components of a worksheet to present or show on screen to engage them in the topic further. Students can work independently or in pairs, and report out to the class after working on the answers for the teacher defined time.

The Wondrous Water Cycle

Where does our water come from? Explore the EPA's Water Cycle Interactive Tool: (http://www.epa.gov/safewater/kids/flash/flash_watercycle.html) and share your learnings with classmates through this exercise.

Provide YOUR definition of the water cycle below. *Don't know how to get started, think about it this way: What does it do? What's involved? What actually happens in this miraculous cycle?*

_____
_____
_____
_____

What components of the water cycle were already familiar? Where have you heard these terms before?

_____
_____
_____
_____

What are some new terms you learned while exploring the cycle? *Use the graphic below as your "cheat sheet".*

_____
_____
_____

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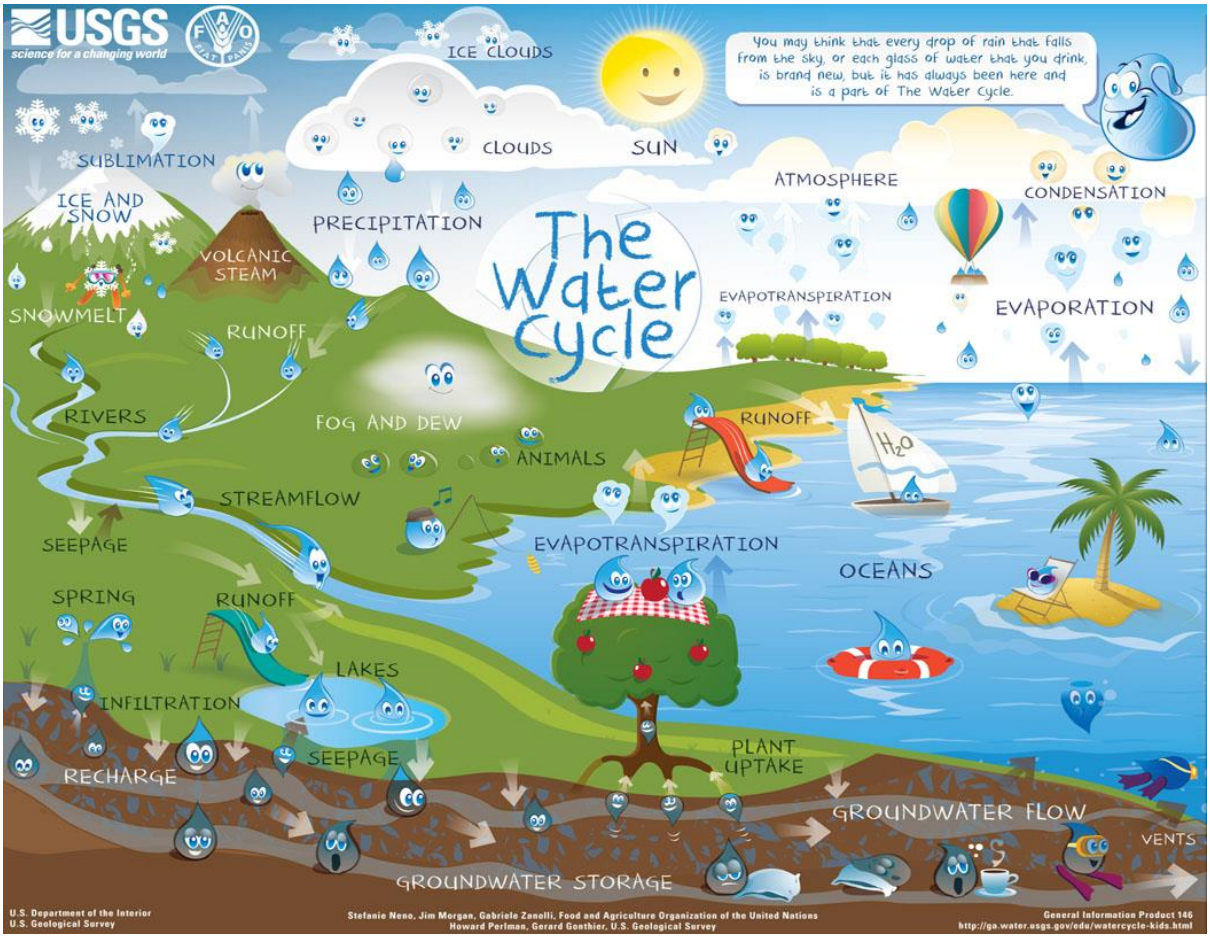

Now that you've looked at the natural water cycle, how do you think the urban water cycle differs?

_____

_____

_____

_____

What components of either water cycle do you interact with on a daily basis?

_____

_____

_____

_____

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➢ Research Activity | *Hi, I'm Wally Your Watershed*

Thanks to the last activity, students now understand the water cycle and have deeper insight into how water is exchanged between land, water bodies, and the atmosphere. But how does this water actually make its journey into the city, student's homes and your school? To discover this, you'll coach students through this online investigation, using the following worksheet, which again can be presented as a presentation or printed as a worksheet.

Hi, I'm Wally Your Watershed, Nice to Meet You!

Okay, so you're watershed's name probably isn't Wally, or Winifred, or Waldo, but it is an important system to introduce yourself to. In this exercise, we'll build upon our knowledge of the water cycle and visit the Santa Clara Valley Water District Website (http://www.valleywatercompplan.org/cities/view/356) to discover the source of our water locally. Where does it come from and how does it get to my tap or my school's drinking fountain? You'll answer these questions outlined as below**.** You'll need to pick the City you live in (i.e. City of Cupertino) or another to respond.

What watershed does Cupertino lie primarily within?

_____
_____
_____
_____

What other watersheds is Cupertino partially located in?

_____
_____
_____
_____

Who are the major water suppliers for Cupertino? And, by the way, what's a supplier?

- Supplier 1:
  _____
- Supplier 2:
  _____

Water Supplier Definition:_____

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➢ Action Activity | *FIELD TRIP! Discover Your Local Watershed*

In the last two exercises, students explored the water cycle and learned the source of their personal water supply, but these concepts can be abstract. The best way to infuse these learnings is to get outside and see their watershed firsthand! In Cupertino, students can see, touch, feel, and even smell their local water supply at McClellan Ranch Preserve, an 18-acre open space preserve home to the Stevens Creek, livestock barn, blacksmith shop, Cupertino's sole community garden, and a coming-soon Environmental Education Center (http://www.cupertino.org/index.aspx?page=1006). Contact your green@school coordinator to help you schedule a field trip so students can connect with their watershed and learn more about the Stevens Creek Corridor, Restoration, and Trails Projects (http://www.cupertino.org/index.aspx?page=314). Use the questions below to help inform their experience, relevant for instructors outside of Cupertino as well!

Field TRIP! Discovering MY Watershed

Date of Field Trip:_____

Location: _____

Background Research:

1. Where am I going? _____
2. Why am I going here? _____
3. What do I expect to learn? _____

Field Trip Exploration:

1. What surprised me about this site?

_____
_____
_____
_____
_____

2. What did I already know about this site?

_____
_____
_____
_____

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3. What new terms did I learn?

4. How will my learnings change my actions at home?

5. How will my learnings change my actions at school?

6. What's one fact I will share with my parents?

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Lesson 2: Water 102: Water Goes Round and Round

Now that you understand the water cycle and have discovered your local watershed, we'll now begin our research to grow water wise by discussing the current drought, learning about careers in the water field, and understanding what water policies and resources exist at the local and state level.

➢ Online Activity | *Wacky Water Wisdom*

This online activity seeks to expand student knowledge about the power of water by sharing fun and incredulous water facts. Students will find the activity different and playful, and you'll be amaze by its ability to fill their heads with interesting facts that can be used in later campaigns and when chatting with friends about water conservation and efficiency. Again, this is designed as a worksheet or presentation that can be printed or shared as a projected presentation. Students can work independently or in pairs and report back as a class or pair-share.

Build your Whacky Water Wisdom

Think you know everything there is to know about water after exploring the water cycle and learning about your local water supply? Think again! Dive into the following article and answer the following questions to get whacky about water and grow water wise!

Treehugger Facts About Water: http://www.treehugger.com/clean-technology/how-many-gallons-of-water-does-it-take-to-make.html

1. What are a few of the facts that aren't new to you? How'd you know them already?

_____
_____
_____
_____
_____

2. What are a few facts that are new to you? What did you find particularly interesting?

_____
_____
_____
_____
_____

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3. How will these learnings change your actions at home?

_____
_____
_____
_____
_____

4. Teacher time: Find another water fact-based article online to share, list what else you learned below. You'll be the teacher, instructing classmates on your learnings.

_____
_____
_____
_____
_____

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➢ Discussion Activity | *In the News: What's This Drought All About?*

In this lesson, students will discuss how water policy has influenced K-12 schools in California, after reading recent selected news articles. Water has been a discussion topic in environmental circles for the past few years, until recently water has made headlines Due to our state's drought. Below are selections of articles that describe the status of water and outline regulations that attempt to resolve our impending crisis. Again, share this as a worksheet or presentation to help them gain a deeper understanding of the significance of our drought to their school and personal lives.

What's this drought all about?

Water isn't a topic typically covered by the news, until there's a shortage – known as a drought. Is our state experiencing a drought? If so, what are our policymakers doing to resolve this to ensure this finite resource, which sustains ALL life, can once again prevail and ensure your and your ancestor's future success? Review the articles below and answer the questions to learn "what's this drought all about?" Cupertino also has a drought fact sheet that may help answer some questions (http://www.cupertino.org/Modules/ShowDocument.aspx?documentid=8044).

Articles:

1. "California Approves Forceful Steps Amid Drought", The New York Times (July 15, 2014), http://www.nytimes.com/2014/07/16/us/forceful-steps-amid-a-severe-drought.html?_r=0

2. Bernstein, Sharon, (January 2013), "California governor signs bills to tackle state's water crisis"[Online]. Available: http://www.reuters.com/article/2013/10/08/us-usa-california-water-idUSBRE99716K20131008

3. Thomas, Ted; Scott, Elizabeth; Carlson Doug (January 2014), "First Snow Survey of 2014 Shows Dry Conditions" [Online]. Available: http://www.water.ca.gov/news/newsreleases/2014/010314.pdf

After reading the above articles, answer the following questions:

1. Why are we in a drought?

_____
_____
_____
_____
_____

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2. What is California doing to mitigate (i.e. resolve or change) the situation?

_____
_____
_____
_____
_____

3. What can you and your peers do to help?

_____
_____
_____
_____
_____

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➢ Professional Development Activity | *Guest Speaker: Wet Your Appetite for a Career Related to Water!*

Expose students to green careers in water-related fields by bringing in a guest speaker, such as the Santa Clara Valley Water District representative, the district's landscape architect, or a local water utility representative to speak with the students. Ask your green@school coordinator for suggestions and help securing guest speakers (*email: sustainability@cupertino.org*). Hearing from an expert in water conservation is not only a great way to find out how students can reduce their own impacts (certain to be information covered by the speaker), but is also a good opportunity to learn about careers in this environmental field. Before hearing from the guest speaker, have students do their own research to learn more about the speaker and their organization. In the table below, ask students to fill in their findings about the guest speaker. Be sure to have them write down 3 questions to ask after their presentation!

Student Professional Development → Water Speaker

Name/Title:	
Organization:	
Job Description:	
Email:	
Important websites:	
Question 1:	
Question 2:	
Question 3:	
Notes:	

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➢ Research Activity | *Let's Get Political*

What does water policy look like in California, and how can students get involved? Empower students as local research and policy experts by giving them time to research and discuss relevant state and local water policies and programs. Another reason students should be proud to live in the golden state – California leads the country in water efficiency and conservation policy! Now it's time to have students put on their detective hats and conduct research on some of the most important California water policies, and a recent policy adopted in their community that literally effects their own backyards, using the worksheet provided below.

Getting Water Wise – Policies that Reduce Water Waste

If water resources are limited, how do we ensure their availability for future generations? One tool is public policymaking, defined in this resource as the following (learn more at: http://www.cliffsnotes.com/more-subjects/american-government/public-policy/the-policymaking-process):

> "Public policy refers to the actions taken by government — its decisions that are intended to solve problems and improve the quality of life for its citizens. At the federal level, public policies are enacted to regulate industry and business, to protect citizens at home and abroad, to aid state and city governments and people such as the poor through funding programs, and to encourage social goals."

What policies help protect and conserve water in our state? Read on to explore a few national, state and local policies that help save water in our community. Dive deeper by opening this links at least 2 of the following policies and 3 of the programs listed below and discuss the following questions with the class:

1. Which of these policies is new to you? What are its intended goals?

_____
_____
_____
_____
_____

2. How does each policy impact you and your family?

_____
_____
_____
_____

3. Do you think each policy has been/ will be successful? Why or why not?

_____
_____
_____
_____

POLICIES

United States and California water policies are established to ensure that:

- Residents have enough safe drinking water and enough water to live
- The water delivered is regulated and void of toxins/contaminants
- Runoff from agriculture and farms do not enter or pollute our watershed
- Waterways have enough water to support ecosystems

There are many policies in place and many that are underway to provide these basic needs to society and the planet. The following are just a sampling of those policies. Many more can be found at the National Resources Defense Council (http://www.nrdc.org/water/), State of California Water Resources Board (http://www.swrcb.ca.gov/), and The US Environmental Protection Agency (http://water.epa.gov/).

- The Clean Water Act (CWA) (http://www.epa.gov/lawsregs/laws/cwa.html) is the cornerstone of surface water quality protection in the United States. (The Act does not deal directly with groundwater nor with water quantity issues.) The statute employs a variety of regulatory and non-regulatory tools to reduce direct pollutant discharges into waterways, finance municipal wastewater treatment facilities, and manage polluted runoff. These tools are employed to achieve the broader goal of restoring and maintaining the chemical, physical, and biological integrity of the nation's waters so that they can support "the protection and propagation of fish, shellfish, and wildlife and recreation in and on the water."
- The Safe Drinking Water Act (SDWA) (http://water.epa.gov/lawsregs/rulesregs/sdwa/index.cfm) is the main federal law that ensures the quality of Americans' drinking water. Under SDWA, EPA sets standards for drinking water quality and oversees the states, localities, and water suppliers who implement those standards.

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- The Nonpoint Source Pollution (NPS) Control Program (http://www.waterboards.ca.gov/water_issues/programs/nps/plans_policies.shtml) ensures that polluted runoff doesn't reach our rivers, streams, lakes, beaches, bays, and our groundwater.

RESOURCES

These resources will be useful for you as you embark on your water investigations later in this unit. Read a little about at least 3 of these organizations and/or programs by opening their websites, and revisiting them as needed as you advance to the green@school checklist!

- California Water Resources Board (http://www.water.ca.gov/): California Department of Water Resources is responsible for managing and protecting California's water. DWR works with other agencies to benefit the state's people, and to protect, restore and enhance the natural and human environments.
- Santa Clara Valley Water District (http://www.valleywater.org/) manages an integrated water resources system that includes the supply of clean, safe water, flood protection and stewardship (i.e. conservation programs0 of streams on behalf of Santa Clara County's 1.8 million residents. The district manages 10 dams and surface water reservoirs, three water treatment plants, an advanced recycled water purification center, a state-of-the-art water quality laboratory, nearly 400 acres of groundwater recharge ponds and more than 275 miles of streams.
- San Jose Water Company (http://www.sjwater.com/) San Jose Water Company is one of two water utilities providing service in Cupertino. This business provides rebates, account details, latest regulations related to your home or business.
- California Water Service Company (https://www.calwater.com/) – this is the other water utility in Cupertino, providing nearly all the same services as San Jose Water. Not sure which utility provides service to your home or school? Use this Water District Tool to find out (http://gis.valleywater.org/WaterRetailer/).
- EPA's Watersense (http://www.epa.gov/watersense/): This is a US EPA website that offers resources, education, laws and regulations related to water in the United States. Students should be familiar with the site to get up to date information on statistics, and changes in laws.
- Green@Home Cupertino (http://www.acterra.org/programs/greenathome/cupertino.html): The City of Cupertino partners with the Palo Alto based non-profit Acterra to offer the Green@Home program. Sign up for a FREE home assessment, to learn more about your water use.
- Energy Upgrade California (https://energyupgradeca.org/county/santa_clara/overview): Sign up for the Energy Upgrade California Home Upgrade program to make home improvements that can save water and energy and make your home more comfortable.

Lesson 3: Design it Bright: Water Efficiency and Conservation Opportunities

Now that students have background in the sources, uses, and challenges with water in our state and localities, we'll share opportunities to conserve, or use less, water in their, and their school's daily activities. These activities serve as a simple introduction into the ways students can take action to cut water use. There are a myriad of resources available online to expand their action plans. Start with your local city's water conservation webpage (i.e. www.cupertino.org/savewater), visit this great campaign to learn how to save water at home (http://www.saveourh2o.org/content/home), and/or checkout this school-focused conservation resource (http://www.waterconservationschool.com/fiftyways.htm).

➢ Online Activity | *Do You Sing in the Shower?*

We'll start simple: have your students considered the length of their showers? Depending on age the showerhead, they may not know that they can use up to 5 gallons of water a minute. If they take up to a 20-minute shower, like most teenagers, they could consume up to 100 gallons of water! That's equivalent to 100 gallons of milk – or nearly 2 years' worth of milk for the typical household! Have them Take this shower test to see how many gallons of water they can save by simply shortening their shower time. (http://www.epa.gov/watersense/docs/ws_shower_better_learning_resource_508.pdf)

➢ Discussion Activity | *Fact or Fiction: Test Your Water Expertise!*

Empowered with the whacky water facts gained in the lesson above, play fact or fiction (True or False also works) with the statements below to help stress the importance of conservation to student's peers, teachers, and family.

1. The average American family of four uses about 400 gallons of water (imagine a swimming pool) per day. [1]
2. We are currently in a drought but it doesn't affect us because we can still water our lawns, wash our cars, and run our decorative water fountains.
3. All of the water that will ever exist on Earth is what we have right now.[2]
4. In 2013, California had driest year since records began in 1849, with 90% of the state in a drought since May.[3]

[1]Environmental Protection Agency, accessed 11/18/14 at http://www.epa.gov/WaterSense/pubs/indoor.html
[2]Green Star Schools, accessed on 11/29/14 at http://www.greenstarschools.info/pdf/Water_Interactive_Pathway_v6.7.pdf
[3]USA Today, a Gannett Company, accessed on 12/02/14 at http://www.usatoday.com/story/weather/2013/12/26/california-drought-water-shortage-wildfires/4192275/

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5. Making one single sheet of paper uses 13oz. of water– more than a typical soda can.[4]
6. All people on earth have access to clean water.
7. A shower uses 7+ gallons of water/minute. A washing machine uses 55+ gallons/load. [5]
8. Most Californians use about 60% of their water outdoors on landscaping.[6]
9. An American taking a five-minute shower uses more water than the average person in a developing country slum uses for an entire day.[7]

Instructor Key: *1. True; 2.False; 3. True 4. True. 5. True; 6. False, 780 million people lack access 7. True 8.*

➢ Discussion Activity | *Review These Facts to Test what Students Learned*

1. Which of these facts seemed the most outrageous and why?

   _____
   _____
   _____

2. Which of these facts would you like to see change in the next 10 years?

   _____
   _____
   _____

3. How can YOU and/or green@school help achieve that goal?

   _____
   _____
   _____

[4] Cleveland State University, accessed on 11/15/14 at http://urban.csuohio.edu/~sanda/syl/envpol/materials/GREEN%20FACTS.pdf
[5] The Franklin Institute, accessed on 11/27/14 at http://learn.fi.edu/guide/schutte/howmuch.html
[6] Save our Water, accessed on 11/19/14 at http://saveourh2o.org/content/quick-facts-about-water-use-california-and-why-you-should-conserve
[7] United Nations Development Programme (UNDP). (2006). Human Development Report 2006, Beyond Scarcity: Power, poverty and the global water crisis

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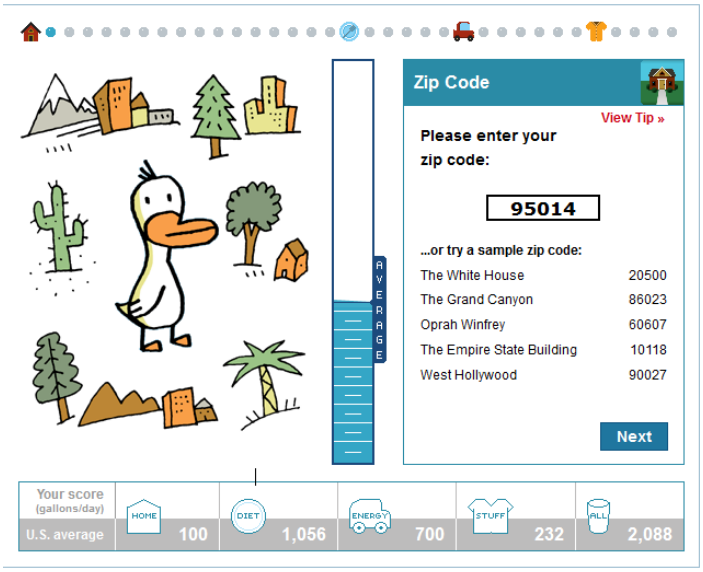
➢ Online Activity | *Water Footprint*

How much of this precious resource do we use in our homes? Share National Geographic's Water Footprint Calculator with students so that they may calculate their water footprint (http://environment.nationalgeographic.com/environment/freshwater/change-the-course/water-footprint-calculator/) Knowing how much water they use can help target where to save water and money for their family (and make the case that this extra $ *could* increase their allowance)! Coach them through this exercise with the following questions:

- What's a footprint?
- Why do we use this term?
- What other footprints do we evaluate in the environmental field?
- What's my biggest source of water use?
- How can I address this consumption (i.e. use)?



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Lesson 4: Growing Greener: Water Inventory

We've spent some time exploring the ways students can save water at home, now we'll apply this knowledge to understand what we can do to conserve water at school. Water is purchased for the school, at a growing expense, and used around campus for various purposes. The activities shared below help students understand how water arrives on campus, how it's used, and what opportunities or technologies exist to cut water use and safeguard this limited resource.

➢ Online Activity | *From Source to Tap and Back*

Instructors can share the tools available on the Environmental Protection Agency's Drinking Water Website, unraveling the mystery of how water actually arrives at our tap (http://water.epa.gov/learn/kids/drinkingwater/gamesandactivies.cfm). The interactive website will give students a glimpse into the complexity of our drinking water infrastructure and the importance of protecting this system.

- Virtual Tour of a Drinking Water Treatment Plant - A flash-based step-by-step how water is treated and delivered to your home or business as water that is safe to drink (http://water.epa.gov/drink/tour/index.cfm).
- Water Treatment Cycle - An illustration of the water treatment process (http://water.epa.gov/learn/kids/drinkingwater/watertreatmentprocess.cfm).
- Drinking Water Bloopers - Embarrassing moments in the life of a water drinker (http://water.epa.gov/learn/kids/drinkingwater/bloopers.cfm).

It's also important to introduce them to the perceptively uncouth subject of effluent and wastewater, since it is part of our water system ☺ Here are a few resources to pull from when discussing this topic, sure to raise some eyebrows but critical for the bathroom audit upon which you are about to embark ☺

The following is an excerpt of the PBS from Source to Tap and Back Lesson Plan: (http://www.pbs.org/newshour/extra/lessons_plans/understanding-your-water-from-source-to-tap-and-back-again/)

Wastewater is used water–it is often called sewage. Wastewater is water that has been used in homes or by industries and businesses and disposed of via sewers that cannot be reused or discharged back into nature unless it is treated by a licensed wastewater facility. Wastewater can include substances (called **suspended solids**) such as human waste, food scraps, oils, soaps, and chemicals. In homes, wastewater is what goes "down the drain" from sinks, showers, bathtubs, toilets, washing machines, and dishwashers. Businesses and industries release large amounts of wastewater from their machinery, cooling processes, and other uses that also must be cleaned before being released back into surface water. After a rainstorm, the water

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(called **storm runoff** or **storm water**) that washes off roads, parking lots, driveways, and rooftops is considered wastewater because it can contain harmful substances that harm local surface waters.

The goal of wastewater treatment is to remove the suspended solids from wastewater so that it can be returned back to the environment safely. If these solids remain in the water, as they break down, they use up the oxygen in the water that supports the plants and animals living in the water.

Most wastewater treatment usually uses two to three steps:

- Primary treatment removes 40-50 percent of the solids. **Sanitary sewers** carry wastewater from homes and businesses to the treatment plant. Bar screens let water pass through, but not trash or other large objects. The trash is collected and properly disposed of. A grit chamber, a large tank that slows down the flow of the water, allows sand, grit, and other heavy solids to settle at the bottom of the tank for removal.
- Secondary treatment removes approximately 90 percent of the **pollutants**. A secondary sedimentation tank allows the **microorganisms** and solid wastes to form clumps and settle at the bottom. The water is then aerated.
- Tertiary treatment completes the process. It can involve more filtration and nutrient removal. The wastewater is then treated with a disinfectant, such as chlorine, before it is discharged from the treatment plant. The disinfectant kills disease-causing organisms in the water. After treatment, the water can be safely returned to nearby waterways.

On the next page, you will find a diagram to share to help conceptualize these concepts.

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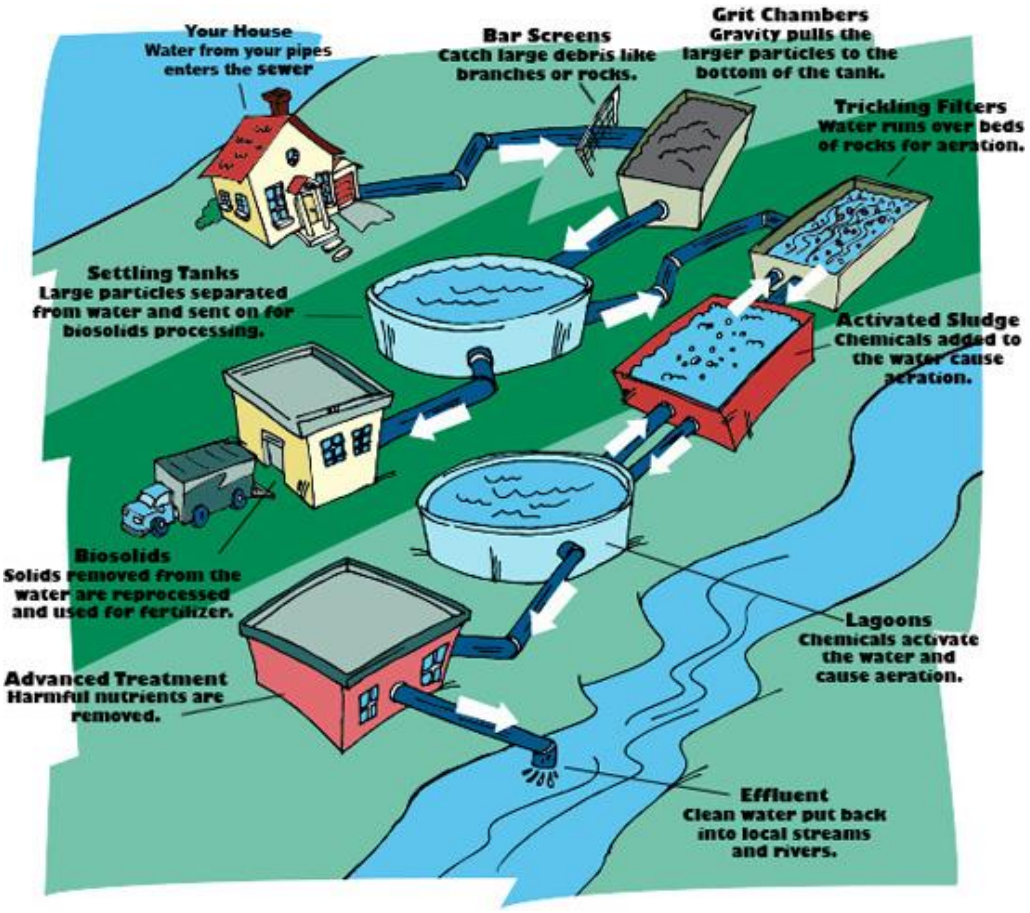

Image Source: (http://greenplanetethics.com/wordpress/wp-content/uploads/2012/04/water-treatment-process-4-25-12.jpg)

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➢ Action Activity | *Water Audit: Hidden Water Use*

So, once water is treated, where does it go? How is it used? The average Californian uses 196 gallons per day. [8] We only drink 1% of all the water we use. Other ways in which we use all this water includes flushing the toilet, washing clothes, showering and bathing, sinks in the bathroom and kitchen, leaks (about 10%), baths, dishwashers, flushing urinals, drinking water, and the production of materials.

Students will apply the lessons above to investigate elements of their school's purchases that influence water use, such as office supplies, food items, bottled drinks, and other items. This "embedded water," or the water used to produce products and food, can account to about 70% of our personal water footprint! After that, they'll conduct an investigation to learn water's direct use across their campus.

First, have students review the following articles to inform their response to the questions below:

- Water Wise – Embedded Water – (http://www.waterwise.org.uk/pages/embedded-water.html)
- National Geographic - The Hidden Water we Use – (http://environment.nationalgeographic.com/environment/freshwater/embedded-water/)

Next, have them respond to the following:

- What fact surprised you in these articles?
- Of all the materials you consume each day, what requires the most water to produce?
- Of the materials used at your school, what requires the most water to produce?

A note to instructors: students may need to interview staff in your main office or at the District to uncover the answers and learn more about their campus' purchasing practices. Encourage them to do so, and help them prepare questions in advance, or emails to schedule some time to find out more by interviewing these adults.

Now it's time for the student's to assess direct water use on campus within bathrooms (i.e. sinks, toilets and urinals) and classrooms and common spaces (i.e. sinks and drinking fountains). While conducting this audit students will be introduced to water efficiency and the importance of conserving natural resources by conducting a series of experiments, noting

[8] Save our Water, accessed on 12/04/14 at http://mavensnotebook.com/wp-content/uploads/2014/02/20-percent-water-use-reduction-infographic-5.jpg

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observations, and doing some simple math. Using the tools and tables provided students will determine the water use in your classroom, bathrooms, sinks, drinking fountains, staff rooms, and other areas where water is used. (*Note: This audit will not focus on irrigation. Landscape and field water use will be covered in another section*).

Activity Time: The duration of this activity can range from a few hours to several weeks, depending on your class/club's time availability. [9]

A. Faucets

This is a two-part observation. You'll check for leaks and also learn about flow rate by:

1. Observing every faucet in the school. Check to see if it is leaking. If so, how significant is the leak? Is it a small drip (once every 10 seconds), large drip (constantly dripping), or a stream of water? Use the table provided to record leaks. If there are no leaks, record that too. Be sure to observe all the school's faucets (washrooms, custodian's sink).
2. Using the flow bag (mentioned in our "Materials needed" table at the end of this unit), fill the bag with water from each faucet for 5 seconds. The line on the bag will show you how many gallons per minute flow from that faucet (called the flow rate).

Faucet	**Location** (Boys 1, girls 1, staff, custodial, classroom sink #, etc.)	**Type of Faucet** (Single Push, Push for flow, lift handle, pull on, automatic)	**Leaking? Observation** (none, slow drip, fast drip, stream)	**Flow Rate** in gallons per minute (GPM)
Girls Bathroom 1				
1				
2				
3				
4				
5				
6				
7				
8				
9				

[9] Regional Municipality of Peel, CA, accessed on 11/28/14 at https://www.peelregion.ca/pw/waterstory/pdf/water-audit.pdf

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Girls Bathroom 2				
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
10				

Faucet	**Location** (Boys 1, girls 1, staff, custodial, classroom sink #, etc.)	**Type of Faucet** (Single Push, Push for flow, lift handle, pull on, automatic)	**Leaking? Observation** (none, slow drip, fast drip, stream)	**Flow Rate** in gallons per minute (GPM)
Boys Bathroom 1				
1				
2				
3				
4				
5				
6				
7				
8				

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9				
10				

Boys Bathroom 2				
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

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Faucet	**Location** (Boys 1, girls 1, staff, custodial, classroom sink #, etc.)	**Type of Faucet** (Single Push, Push for flow, lift handle, pull on, automatic)	**Leaking? Observation** (none, slow drip, fast drip, stream)	**Flow Rate** in gallons per minute (GPM)
Staff Room/Office/Custodial				
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
Classrooms				
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

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B. Toilets

Toilets can be observed for leaks and the flow rate. The flow rate is usually written on the toilet or urinal (or can be researched online if you know the model of the toilet – also often listed on the equipment itself).Students will observe every toilet and urinal in the school. Check to see if it is leaking. If so, how significant is the leak? Is it a small drip (once every 10 seconds), large drip (constantly dripping), or is there a puddle of water around or under the toilet or urinal? Use the table provided to record leaks. If there are no leaks, record that too. Be sure to observe all the school's urinals (washrooms for students, staff, office etc.)

Use this guide to help determine the significance of the leak, if there are any:

Urinal Flush Volume

- Older than 20 years – 19 litres per flush
- 10 to 20 years (but built before 1996) -12 Litres per flush
- Less than 10 years (built after 1996) – 3.8 litres

Toilet Flush Volume

- Older than 20 years - 13 Litre
- Less than 10 years (built after 1996) 6 Litres

Toilets	**Location** (Boys 1, girls 1, Boys 2, Girls 2 staff, custodial, office etc.)	**Type** (Manual or Automatic)	**Leaking? Observation** (none, slow drip, fast drip, stream)	**Flush Volume** Liters/Gallons per flush (GPF)
Girls Bathroom 1				
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

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Girls Bathroom 2				
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
Boys Bathroom 1				
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

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Boys Bathroom 2				
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
Staff Room/Office/Custodial				
1				
2				
3				
4				
5				

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Urinals	**Location** (Boys 1, Boys 2, staff, custodial, office etc.)	**Type** (single flush or automatic)	**Leaking? Observation** (none, slow drip, fast drip, stream)	**Flush Volume** Liters/Gallons per flush (GPF)
Boys Bathroom 1				
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
Boys Bathroom 2				
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

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Staff Room/Office/Custodial				
1				
2				
3				
4				
5				

C. Water Fountains

Now's let's review water use in our fountains. How many are there? Do they run constantly or only when people drink? How long does it take you to get a drink? Do you fill water bottles from it? Observe the fountain at recess will tell you how long each student drinks from the fountain. How much water is used for drinking compared to flushing and washing? Observe your partner and record the time it takes to take a drink from the fountain.

Water Fountains (# of spouts)	**Leaking? Observation (**none, slow drip, fast drip, stream**)**	**Time it takes to take a drink** (t)	**Flow Rate** (gallons per minute)
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Lesson 5: Getting Green Done: Influence Peers, Staff, Friends, Family, Community

Empowered with their own action plans to transform water use in their home and school, students can also encourage others to save water. To inform their outreach, students can spend time investigating behaviors (i.e. consumption) that drive individual water use, beyond those already shared above. By using simple observation, interview and survey techniques, which you can lead them through, informed by this NY Department of Education Tool (http://schools.nyc.gov/documents/teachandlearn/project_basedFinal.pdf), students can analyze and recommend water conversation practices to their peers and family that can have lasting results for our environment.

One way to drive large-scale (vs. individual) change is to develop a campaign. A "public **information" campaign** seeks to change the knowledge, attitudes or behaviors of a **defined** target audience. There are a myriad of resource online to help students build their campaign, but here is a sampling of ideas to launch their research and implementation on campus:

1. **Rethink your Drink:** Encourage Peers to drink water instead of sugary alternatives for health benefits and to reduce the embedded water use in these beverages (*consult the Health and Wellness unit to learn more*)
2. **Report a Leak –** Develop water conservation signage to hang near sinks, toilets, and drinking fountains with contact information for your custodian/janitorial staff to ensure leaks are fixed as quickly as they're spotted (*be sure to check with staff before placing their email address of phone number on the sign ☺)*
3. **Go Native -** Promote the benefits of native, drought tolerant garden by teaming with students and teachers to plant (or revive!) one at your school (*consult the Health and Wellness unit to learn more)*
4. **Adopt a school –** Find a nonprofit organization working to expand fresh drinking water infrastructure in a developing country. Many are focused on building wells in towns near schools to ensure students have access to this life-sustaining resource and can continue to attend school vs. embark on long journeys to attain fresh drinking water for their families.
5. **Water Wise Videos:** Encourage students to create a video campaign persuading students and teachers to save water at school, based upon their investigation, or at home, based upon their learnings about our individual consumption patterns.
6. **Pledge Campaigns:** Work with students run lunch-time pledge campaigns for water efficiency and conservation – shorter showers, irrigate on a schedule, fix leaks, turn off the tap when not in use, use aerators, etc. They can set up a table in the cafeteria to educate their peers about our consumption habits and have a sign-up sheet for specific pledges. They should also have a hand-out for students to track their achievement of each pledge,

which they can share with the organizing team to access great prizes (students can fundraise, bake, or make donation requests at local businesses – building their social and entrepreneurial skills).

7. **Build an Educational Campaign –** Support students to design and launch **a** campaign educating the rest of the school about water issues in school, the city, county, state, country, and world. Students can build informational materials including posters, newsletters, talking points for morning announcements, articles for school mailings, and presentations for the PTA.

To bring real water conservation change to their schools, students can research the cost, implementation effort and efficacy of any of the following practices, shared in their checklist and/or come up with some of their own:

- Install faucet aerators to reduce flow to .5gpm.
- Install one or more water bottle filling stations on campus to encourage students to drink fresh local water vs. bottled water or sugary sweetened beverages.
- Remove lawns and replacing them with native drought tolerant plants.
- Change the irrigation schedule for the fields to support more efficient watering.
- Install weather and soil moisture based irrigation sensors

A note to instructors: Templates for memo creation, surveys, grant applications, presentations, and pledge forms can be provided by the City of Cupertino staff upon request.

How will students get their messages across? Work with them to write memos to the district and administration for any of the above measures they want the district or school to implement.

Are your students still unsure what message to share with the school, or are you looking to expand their learning through the use of multimedia tools? Grow student water expertise by watching these videos as inspiration for them to design their own video or campaign around campus.

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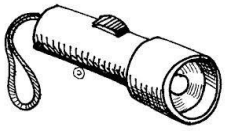
The California Water Story (https://www.youtube.com/watch?v=OzIe7tS1SgQ): A 16 minute video talking about water, where it came from, history of how people used the water,
Water vs. Farmers (http://www.theguardian.com/money/2014/mar/18/californias-drought-hurting-farmers-helping-environmentalists) another perspective of how the drought affects people.
Silicon Valley Advanced Water Purification Center: Visit with Secretary John Laird, (http://www.valleywater.org/Videos.aspx)
Change the Course: Help Save the Colorado River (http://www.youtube.com/watch?v=Vbi6hQXvbHI)
Water.org has a number of videos to connect the water crisis occurring in other parts of the world. Most people in the developing world do not have access to safe drinking water or sanitation, which contaminates their water supply. Learn more about just how lucky we are in the United States by previewing the following videos:

- Water Day 2014 (http://www.youtube.com/watch?v=jQzilJh4jrw)
- Matt Damon Explains Water.org (http://www.youtube.com/watch?v=KdwinEmUqF0)

Materials Needed

To complete some of the activities within the Unit 3 lesson plan, you will need some special tools and materials.

Tool	Picture	Description	Where you can get it
Water Flow Bags		Determine the flow rate of your school faucets. Faucets that flow at .5 gallons per minute (GPM) or higher are inefficient and can be easily modified with a faucet aerator. Adding a low-flow faucet aerator can drastically reduce your school's water usage and expenditures. Instructions on how to use the flow bag are printed on the bag.	Check one out from the Cupertino library as part of the DIY kit. Library: 10800 Torre Ave Cupertino, 95014 http://www.sccl.org/ Or from your green@school coordinator: City Hall: 10300 Torre Ave Cupertino, 95014 (408)777-3362 sustainability@cupertino.org
Flash Light		The flashlight is used to see the gallons per flush on the toilet in a school bathroom. The writing is often small and hard to see. Sometimes the faucets also have writing on them that indicate the flow in gallons per minute.	You can use your phone flashlight app or borrow one from a teacher or custodian.
Smart Phone Camera		Take pictures of any leaky areas, or rusted plumbing parts.	A regular camera will work as well. But uploading them to a central location is important.
Calculator		Any type of simple calculator will do!	Students or teachers should have some. Phone calculators will work as well.