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AMERICAN WATER



Water on the Home Front

Investments in Conservation

- **Grade Level:** 6-12
- **Objective:** Students will learn how an in-home water audit can help to identify the best ways to save water and money.
- **Subjects:** Mathematics, Environmental Science, Consumer Science, Economics

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INTRODUCTION

Initiatives to reduce freshwater use, establish conservation programs and develop technologies that accomplish these goals are being pursued by industry, agriculture and governmental entities. Ultimately, however, it is the choice of the consumer to embrace a conservation mindset and employ the available programs and devices to achieve sustainable water use and minimize the pressure on this valuable resource that is so essential to life.

Some options for reducing water use are obvious. Behavioral modifications, such as shutting off the water while brushing teeth, taking shorter showers and irrigating crops and gardens based only on need require no monetary investment.

Changes that do require a financial commitment are often modest, such as installing aerators on faucets, modified shower heads and water saving devices in the toilet tank. Significant investments may be required, however, to maximize conservation efforts. Washing machines and dishwashers that reduce water use can cost several hundred dollars more than their conventional counterparts. On a larger scale, some businesses, golf courses and apartment buildings have installed grey water systems, which allow them to recycle the water used for non-drinking purposes. This involves modifying their internal plumbing so that the water used from dishwashers, sinks and washing machines is stored so that it can be reused for non-potable purposes, such as flushing toilets or irrigation. Examples of where American Water has installed grey water systems include the Solaire apartment complex in New York City, the New England Patriots Gillette Stadium located in Foxborough, Massachusetts, and many golf courses.

A variety of modifications can reduce your water usage (and your water bill), but for some, that is not enough of an incentive. Instead, local regulations and, for some, resource use ethics are the driving factors. It is everyone's responsibility to act responsibly and preserve our most precious resource: water.

DID YOU KNOW?

If all U.S. households installed water-efficient appliances, the country would save more than 3 trillion gallons of water and more than \$18 billion dollars per year!

MATERIALS NEEDED

- Piece of paper
- Pen or pencil
- Calculator
- Enclosed data sheets



EXERCISE

The Smith Family has just moved into a new home. Located on a beautiful two-acre property, the 100-year-old farmhouse is flanked by a barn and guest cottage. The Smiths are planning to restore the house and convert it into a Green Bed and Breakfast business. The family will establish and advertise a business that supports local organic farmers, works towards zero waste by maximizing composting and recycling, uses active and passive solar energy, landscapes with native plants and embraces the latest in water-saving technologies and approaches.

The financial investment in the property has left the family in need of more capital to realize their environmentally-responsible design. A low-interest loan from a non-profit water conservation organization is being reviewed and considered, but it requires that the Smiths install all water conservation devices immediately. The other option is to rent out the guest cottage on a short-term lease and use the income to purchase and make improvements over the course of several months. In order to obtain a state green business certification the family must demonstrate at least a 40 percent reduction in water use for the property. An audit of water use and inventory of water using appliances, plumbing fixtures and prop-

erty descriptions is provided. The family now needs to weigh their options carefully to determine which approach is the best for their home and business.

TASKS

Using the provided list of existing fixtures, appliances, plumbing and property description; the water-saving data on efficient options and behavioral modifications; and the cost of purchasing and installing these green measures, determine the following:

1. How much water is used by the family of five in the house with current fixtures, appliances and plumbing?
2. How much money is needed up front to attain a 40 percent reduction in water use and the green business certification? NOTE: the 40 percent reduction can come from any conservation methods of choice, but the calculations must be demonstrated.
3. How much money is needed up front to maximize the water-saving effort and employ all possible measures at once?
4. Given a monthly rent of \$750 from the rental property, prioritize the order in which you would implement the green measures, i.e., which one would you install first, second and so on. Consider both water savings and financial cost.



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EXISTING FIXTURES, PLUMBING, APPLIANCES AND LANDSCAPE

| | Sinks | Toilets | Showers | Washing Machine | Dishwasher |
|---------------------------|---|---------|---------|-----------------|------------|
| Main Home | 7 | 4 | 4 | 1 | 1 |
| Guest Cottage | 3 | 2 | 1 | 1 | |
| Barn | 2 | | | | |
| Property/Sprinkler System | <ul style="list-style-type: none"> The property has 2,000 m² of ornamental non-native flower gardens irrigated by seven sprinkler heads and 300 meters of pipe. | | | | |
| TOTALS | | | | | |

WATER AUDIT DATA - CURRENT WATER USE

The below calculations are for each member of the Smith Family (5 members). Values for water use are per appliance or device per person per day unless otherwise noted.

| | How Often Used | Gallons Used | Total Daily Use Per Person |
|---|-------------------------------|------------------------|----------------------------|
| Sink Use | 5 minutes per day | 1.2 gallons per minute | |
| Toilet Use | 5 flushes per day | 3.5 gallons per flush | |
| Shower Use | 10 minutes per shower per day | 3.8 gallons per minute | |
| Laundry | .4 loads per day | 38.5 gallons per load | |
| Dishwasher | .2 loads per day | 9.3 gallons per load | |
| Sprinkler System (used an average of 100 days per year) | 30 minutes per day | 2 gallons per minute | |

HIGH EFFICIENCY TECHNOLOGIES AND PROPERTY MODIFICATIONS – COST AND WATER SAVINGS

| | Water Savings | Cost to install | Quantities Needed | Total Cost |
|----------------------------------|---------------------------------|---|-------------------|------------|
| High-Efficiency Toilet | 1.6 gallons per flush | \$240 each | | |
| Toilet Tank Displacement | 2.1 gallons per flush | \$3 each | | |
| High-Efficiency Shower Heads | 2.2 gallons per minute | \$30 each | | |
| Faucet Aerators | 1 gallon per minute | \$4 each | | |
| High-Efficiency Washing Machines | 24.3 gallons per load | \$590 each | | |
| High-Efficiency Dishwasher | 6 gallons per load | \$450 each | | |
| Drip Irrigation Hoses | 55 gallon capacity | \$110 each | | |
| Rain Barrel/Rain Gutter Adapter | 2.2 gallons per minute | \$240 each | | |
| Native Plantings | Reduces irrigation needs by 60% | Seed (\$1 per m ²); mature plantings (\$20 per m ²) | | |
| Grey Water System * | 100 gallons per day | \$6,000 | | |

*prevents water from discharging into sewer system. The water saved through this system can only be used for irrigation or groundwater recharge

QUESTIONS

1. Consider behavioral changes in terms of water savings. What aspects of water use outlined in this exercise would be main targets for conservation? Explain.
2. For the above task, why have you ranked the water conservations measures as established? Develop your response.
3. The grey water system is the second most expensive option (mature native plantings for the entire property is first). Given the limitations for water savings and considering the other measures to be taken, do you believe it is appropriate for this property? Explain.
4. What are the pros and cons of purchasing seed vs. mature plantings for the native gardens?
5. The Bed and Breakfast business will advertise “green” practices. How might the Smith family work to ensure that guests of their Inn embrace the same conservation ethic?
6. Do you feel a special certification should be available to businesses that go green? Why or why not?

EXTENSIONS – AT HOME

1. Complete a water conservation audit for your own property and home. Where could you make improvements? Prepare a budget for your family and make a difference where you can.
2. Research local businesses. Are there any that have embraced green technologies and are they using this as part of their advertisement? Stop in and ask the manager/owner why they have embraced environmentally-friendly practices and inquire if it has helped their bottom line.

NOTES

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DEFINITIONS

- **Drip Irrigation:** An irrigation method that saves water and fertilizer by allowing water to drip slowly to the roots of plants, either onto the soil surface or directly onto the root zone, through a network of valves, pipes, tubing and emitters.
- **Faucet Aerators:** Attached to the tip of an indoor water faucet, aerators supply adequate flow while reducing water use by mixing air into the water stream.
- **Grey Water System:** A plumbing system that diverts the water used from sinks, dishwashers and washing machines into a tank that can then be used for non-potable purposes, including flushing toilets, irrigation or groundwater recharge. Water containing human waste and potential pathogens is kept separate.
- **High Efficiency:** The provision of energy that meets the needs of the present without compromising the ability of future generations to meet their needs.
- **Native Plants:** A term used to describe plants endemic (indigenous) or naturalized to a given area in geologic time. These plant species will often grow without significant amendments to the soil and without the need for extensive irrigation.
- **Rain Barrel:** Vessel used to collect and store rain water runoff, from rain gutters for example, for use in irrigation and ground water recharge.
- **Sustainable Resource Use:** A pattern of resource use that aims to meet human needs while preserving the environment, and done so in a way that these needs can be met in the present, and also for generations to come.

REFERENCES

- Visit www.h2ouse.net for water saving tips, technologies and ideas.
- For additional lesson plans, visit www.amwater.com.

COMMENTS

We want to know what you think. Feedback and/or suggestions for improving this lesson plan can be e-mailed to joi.corrado@amwater.com.

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In a world where everything we touch frequently changes, water is our constant. We've never stopped needing it to drink, to cook, to clean, to live. We'll always need it for sanitation, for fire protection, for watering our lawns and washing our cars.

It's easy to take water for granted. And because so many do, we don't.

We are scientists, environmentalists, innovators, and protectors. We are also residents and employees in the communities we serve. We understand how important, how precious, and how critical water is to daily life.

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A special thanks to Ron Smith for developing the core content of this lesson plan. Ron Smith, a science educator from NJ, has been teaching biology, environmental science and interdisciplinary studies in the classroom, lab and field for 18 years. It was important for us that our lesson plans be crafted by an educator for educators. We appreciate his hard work.

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