



# Union Sanitary District

Serving the wastewater management and water pollution prevention needs of the cities of Fremont, Newark, and Union City.

## GRADES 4-6 LESSON PLANS

## HOW TO USE THESE LESSON PLANS

### Inside this issue:

Union Sanitary District Outreach	2
Vocabulary	2
Water: A Precious Resource	3
Experimenting with Liquids	4
Extending our Visit	6
Cleaning Wastewater	7
How to Help	8

The Union Sanitary District is providing these lesson plans so you can better prepare your students for our visit and to extend the lesson after we leave.

All students and their parents in Fremont, Union City and Newark use our services every day, but are unaware of our role in keeping the creeks, flood control channels and waters of the bay clean.

We suggest that you go over the water cycle before

we come into the classroom. This is outlined on page 3, *Water - A Precious Resource*. You may also like to review the vocabulary listed on page 2 with your students, as these words will be used in our presentation. The video that is being sent to you prior to our visit illustrates the importance of not pouring oil, herbicides, or pesticides down the storm drain.

You may want to follow our visit with a hands-on

lab that is included on page 4. Students learn about properties of liquids.

In addition, you may also want to extend the lesson as outlined on page 6. Use the black and white side of the placemat that is being left with each child.

Please help us spread the message of keeping our environment clean and remember that we are counting on you to help reduce pollution in the San Francisco Bay.

## Who is Union Sanitary District?

The Union Sanitary District is an independent special district which provides wastewater collection,

treatment and disposal services to the residents and businesses of the cities of Fremont, Newark and Union City, in Southern Alameda County, California.

Independent special districts are voted into existence by the citizens they serve, and are sanctioned under California law to perform specific local government functions within certain boundaries. The District was formed in 1918 and reorganized under the Sanitary District Act of 1923. It derives its authority in the California Health & Safety Code (Sections 6400-6830).

The District is governed by an elected Board of Directors which is accountable to the public. The Directors are members of the community they represent. The District recovers the cost of their service delivery through rates imposed on users of the service. The District is independently audited and subject to state and public scrutiny. Other special districts in Alameda County provide services such as water supply, fire service, mosquito abatement, recreation, parks and hospital services.



Union Sanitary District's "Odor Scrubber," which reduces smells.

## Union Sanitary District's Outreach

Union Sanitary District's Elementary School Outreach program is committed to educating young students on the importance of keeping pollutants out of the sanitary sewer system and storm drain system lines. This will be accomplished by teaching them the importance of one aspect of preventing pollution known as **urban runoff**. Pollutants are carried by runoff from streets, roadways, commercial and industrial sites. Another source of urban runoff is our homes, by way of cars, household products, and garden chemicals that enter storm drains through rainwater and garden runoff water. Through this educational outreach effort, USD expects to reduce the amount of pol-

lutants entering local creeks and ultimately the San Francisco Bay. Also, by reducing the volume of pollutants entering the Alvarado Treatment Plant, we will reduce the amount of pollutants that end up in landfills and the Hayward Marsh which flows into the San Francisco Bay.

Pictured above are USD environmental inspectors, one of whom may visit your classroom. From left to



right: Wade Jackson, Barbara Silva, Shannan Szychowski and Tim Berger.

## VOCABULARY

**BIOSOLIDS** - the residual solid material resulting from wastewater treatment

**DISCHARGE** - to release from confinement

**DISINFECT** - to destroy harmful bacteria

**EFFLUENT** - waste water from treatment plants or manufacturing facilities discharged into the environment

**HERBICIDE** - an agent used to destroy or inhibit plant growth

**PESTICIDE** - a chemical used to kill insects or pests

**POLLUTANT** - to cause harm to a specific organism

**PREVENT** - to stop from happening

**REDUCE** - to make less

**SANITARY SEWER SYSTEM** - an underground system of pipes which carries wastewater from homes and businesses to the treatment plant

**SLUDGE** - the solid material that sinks to the bottom of water and waste water treatment tanks before treatment of the water; untreated waste solids

**STORM DRAIN SYSTEM** - an underground system of pipes which carries rain water to the creeks, streams, flood control channels and bays

**WASTEWATER** - water that has been used by humans to clean, wash, or flush

**WASTEWATER TREATMENT PLANT** - the facility where wastewater gets cleaned so that it can be released back into the natural water cycle

**WATERSHED** - a region, drainage basin, or area bounded peripherally by a divide and draining ultimately to a particular watercourse or body of water

## Water—A Precious Resource

Water is our most common natural resource. It is essential to the biology and chemistry of all living things, it plays a major role in shaping the earth and is an active agent in many physical reactions. It is important to most life to keep it clean.

There is plenty of water on Earth, but 97% of this water is saline (contains dissolved salts). Only 3% is fresh and about two thirds of that amount is locked up in polar ice caps and glaciers; about one third (1%) can be found as ground water, lakes, and in the atmosphere.

Water exists in three states of matter: solid (ice), liquid (water), and gas (vapor) at normal conditions. Water is a colorless, odorless, tasteless liquid with a melting point of zero degrees centigrade and a boiling point of 100 degrees centigrade.

Water is cleaned as it passes through nature's water cycle. When

water evaporates to the gaseous phase, it leaves the dissolved impurities behind. Water can also be cleaned through other natural ways. Overtime, civilization have developed ways in which they can also clean water by taking advantage of part of the natural water cycle.

Discuss with students the major points of the water or hydrologic cycle by going over the information below.

Nature cleans water, but it is a long process. Nature is also random. A city needs clean water, but it sometimes does not rain when you need it. As humans live in urban areas, they need to control the flow of water. They generate wastewater, but they cannot just release all that untreated water into a stream, river, or bay. Wastewater must be cleaned before it

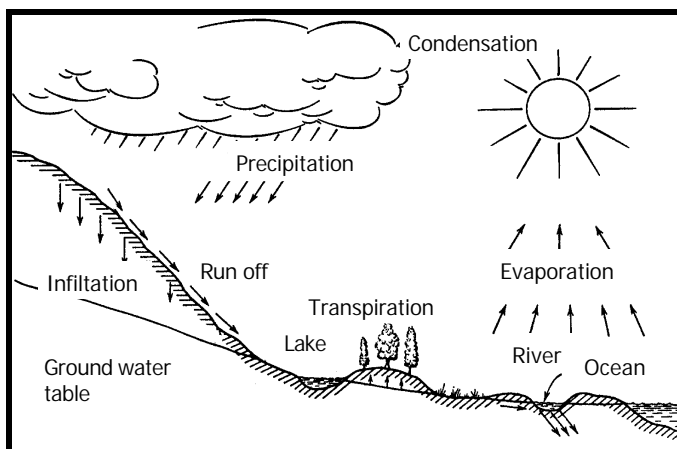
is released.

Different cities clean their wastewater in various ways. For example Union Sanitary District treats the wastewater before it is released into the bay. They have had to construct large treatment systems to deal with the 40 millions gallons of wastewater that is produced each day.

Everyone should realize clean water is important to all living organisms.



## Water Cycle



This "cycling" of water is continuous. Water is perhaps the ultimate example of recycling.

1. Water **precipitates** from clouds as rain, snow, sleet, or hail to the Earth's surface.
2. Depending on a number of factors such as soil type, slope, moisture conditions, and intensity of precipitation will either **infiltrate** into the ground or **runoff** into rivers and streams. Virtually no water infiltrates through paved roads and parking lots, so almost all of it becomes **urban runoff**.
3. Runoff from rivers, and streams is **stored** in large bodies of water such as lakes, estuaries, and the San Francisco Bay.
4. Water is returned to the atmosphere **evaporation** from the surface of land or water bodies, or through plants by a process called **transpiration**.
5. Clouds are formed by **condensation** of water vapor that evaporated from the land or oceans.

# Experimenting with Liquids - Learning to Clean Water

## OBJECTIVES

1. Comparing different densities of liquids.
2. Experimenting with different ways to clean an oil spill.

## INTERDISCIPLINARY SKILLS

Science  
Environmental awareness

## ESTIMATED TIME

1 hour

## MATERIALS:

Plastic vials marked in fourths  
Ice water with yellow coloring  
Hot water with blue coloring,  
Salt water with red coloring  
Oil, sticks  
Cotton swabs or cotton  
Crepe paper or other soft grade of paper  
Food tray (Styrofoam or plastic)  
Worksheet



## BACKGROUND

Water is so common to students that they can't see its special properties, but water (without any additives) has characteristics that make it unique. It has a high boiling point, low freezing point, is tasteless, and odorless.

The density of a substance is the mass of that substance

compared to the volume that the substance occupies.

Density will vary depending upon the temperature. The density of water as a liquid is higher than that of water vapor. Substances can sometimes be identified by its density. In this lab experiment we want the students to compare the densities of certain liquids by comparing their density with the density of water.

After the students complete the density portion of the lab, they can consider the effects of oil pollution on water. Oil will float and cause problems for organisms that live on the surface. The students task will be to use their knowledge of density to try and clean the oil spill.



## PROCEDURE

This activity demonstrates the different densities of different liquids and how this information can be applied when cleaning an oil spill.

Write the chemical formula of water on the board ( $H_2O$ ) and explain the elements that make up water, namely, hydrogen and oxygen. Discuss with students that hydrogen and oxygen are naturally found as gas. Make sure they know and

understand the role of water in the water cycle.

The students should have a tub of water and they should pour oil on it representing an oil spill. Give them 3 substances: soap in a small vial, craft sticks, and an adsorptive substance like cotton swabs or crepe paper. Ask the students to design a way to capture the oil and clean up the spill.

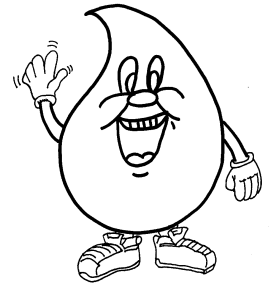
Discuss the effects of contamination and oil pollution on

the environment, wildlife, and humans. Too much oil can destroy the habitat of many animals. Oil cover birds which prevent them from flying. Oil can kill the small organisms on the surface of the water that are needed for larger organism for food.

Clean up of oil spills incorporates the use of density. You can actually contain a spill in oceans and then "scraped" from the surface of the water. Spills in rivers or coastal areas are more difficult to contain.

**PROBLEM:** How can you remove oil from a spill that has occurred in water?

**PREDICTION** \_\_\_\_\_  
\_\_\_\_\_



**EXPERIMENT 1.**

**MATERIALS:** plastic vials marked in fourths, ice water with yellow coloring, hot water with blue coloring, salt water with red coloring, oil

**PROCEDURE:**

1. Make a prediction of how you think the materials will layer. Draw a picture of your prediction in the space below.
2. Add each material to your vial in the order you predicted.
3. Add them slowly, one at a time. Tilt the vial as you pour.
4. Did it work? If not, try it again.
5. Make a drawing of the results and label the different layers, use colored pencils or crayons.

PREDICTION

ACTUAL

**EXPERIMENT 2.**

**MATERIALS AND PROCEDURE:** Using a small dish of water, pour 1 tablespoon of oil onto it and try to figure out the best way to clean the oil spill. You have three items with which to clean it: soap, stick (non-absorptive), and paper, cotton swabs or some other absorptive material.

**CONCLUSION:** Which item cleaned the spill? (or could you clean it?)

\_\_\_\_\_

Describe how you were able to remove the oil.

\_\_\_\_\_  
\_\_\_\_\_

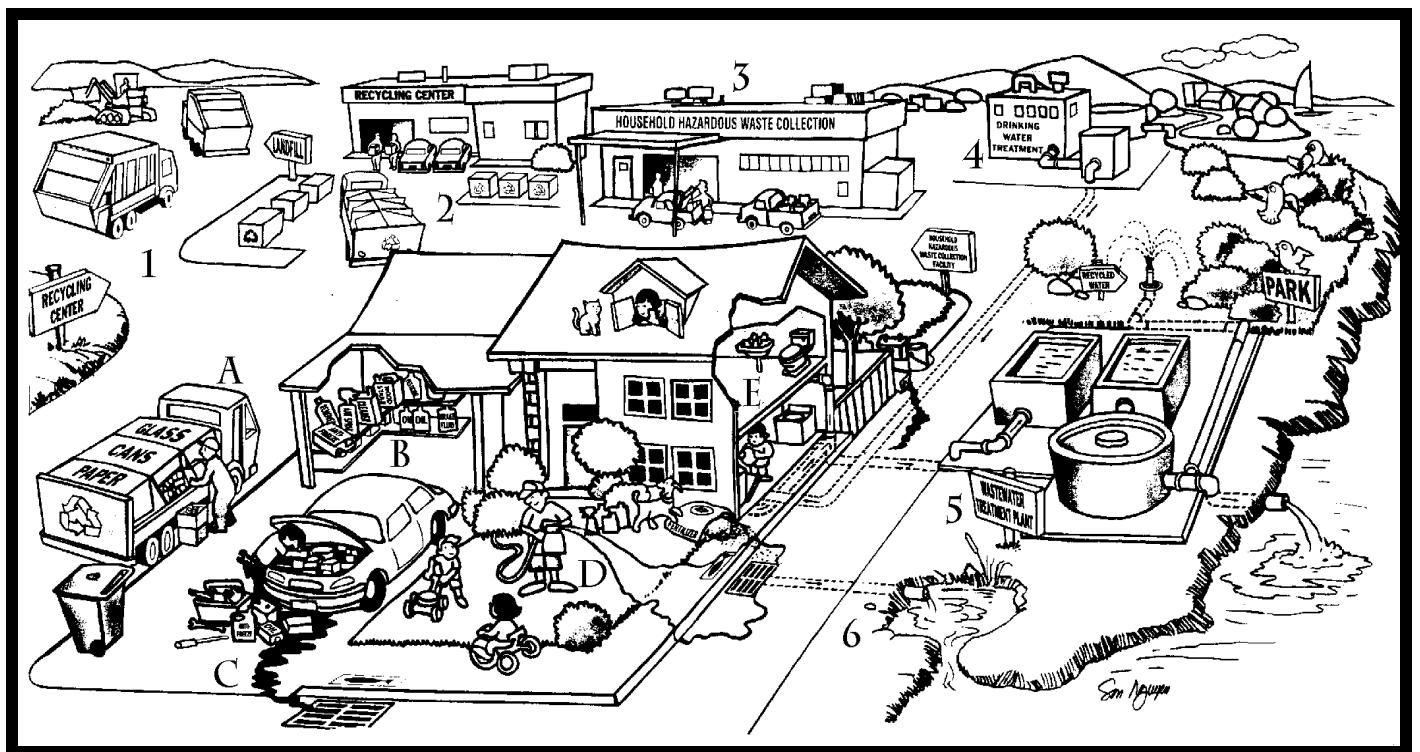
# EXTENDING THE LESSON

Your students will each be given a placemat that can help you extend this lesson.

- A. Steel cans, glass jars, and various paper products can be recycled. On garbage day you can put them out near the street in the bins provided by your waste management service and they will recycle them for you. This is a way to decrease the amount of garbage going into a landfill and it also reduces the need for mining or harvesting of precious natural resources. Please recycle!
- B. Household chemicals, cleaning products, and art projects can be harmful to you and your family. You can dispose of empty containers at your local hazardous waste collection service. The filled containers should be used according to manufacturers directions. The storage of these products should be in an area where runoff from sinks and or hoses will not effect the product. Also these materials need to be stored away from small children.
- C. Oil and antifreeze that leak out of cars is washed into storm drains when it rains. Check your cars for drips and leaks. If you find any, ask whomever is responsible for the car to have the leaks fixed soon!
- D. Fertilizers contain large amounts of nutrients such as nitrogen and phosphorous that can wash into lakes and streams, and may cause algal blooms. These blooms use up the oxygen in the water that fish and other organisms need to breathe. When it rains, excess amounts of fertilizers can run off into storm drains, roadside ditches, and nearby waterways.
- E. In your home only a few diluted chemicals can go down the drain. Most chemicals are harmful to humans and can not be removed at the wastewater treatment plant. This is why you should never pour motor oil, antifreeze, pesticide, and other household products down the sink.

## LOCAL INFORMATION

1. Your garbage needs to go somewhere, otherwise we would be living in one big mess. Ask students who picks up their trash.
2. A place for your used cans and glass bottles is local recycling companies or 20/20 recycling centers at local shopping centers.
3. Household hazardous waste is collected at 7010 Auto Mall Parkway, or call (510) 624-5900. Up to 5 gallons of used motor oil can be dropped off at your local gas or service station.
4. The drinking water that serves most of Fremont, Newark and Union City is from the Alameda County Water District.
5. The wastewater is treated by USD's Alvarado Treatment Plant. The treated wastewater is discharged into deeper waters of the S.F. Bay.
6. Water that goes down our storm drains goes directly to nearest creek and then into the S.F. Bay







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## How Can You Help?

### Storm Drain System

1. Do not use the storm drains to dispose of liquid substances.
2. Wash your cars at a car wash.
3. Bring used oil herbicides and pesticides to a local drop off point.
4. Use less toxic products on your lawn and gardens.
5. Pour dirty mop water into the sink or toilet.
6. Clean the driveway with a broom instead of a hose.
7. Stencil the storm drain around your school, with, "No Dumping, Drains to Bay."

### Sanitary Sewer System

1. Do not use the toilet as a wastebasket.
2. Do not dispose of pesticides and/or herbicides in the sinks or toilet.
3. Follow the directions on container labels for safe disposal of household cleaning products and paints and medications.

## Where Does It Go?

Ask your students question 1-9 listed below. Put their answers into two columns on the board labeled (1) Sanitary Sewer, (2) Storm Drain.

### In which pipeline system does the water go when .....

1. you brush your teeth? (*Sanitary Sewer*)
2. your parents wash your clothes? (*Sanitary Sewer*)
3. you wash the car in your driveway? (*Storm Drain*)
4. you wash the car at the carwash? (*Sanitary Sewer*)
5. you flush the toilet? (*Sanitary Sewer*)
6. your parents fertilize the lawn? (*Storm Drain*)
7. you paint and wash your brushes in the sink, (*Sanitary Sewer*); outside (*Storm Drain*)
8. you wash your pet inside? (*Sanitary Sewer*)  
outside? (*Storm Drain*)
9. you hose off your driveway? (*Storm Drain*)

Review with students the reasons not to put certain things down the sewer lines and the storm drains. Also review the purpose of these two systems in our daily lives.



Overview of Alvarado Wastewater Treatment Plant (top) ; Hayward Marsh (bottom)

