BACK BAY SCIENCE CENTER

Watershed & Urban Run-off Module

Activity I – Household Products Testing

CALIFORNIA STATE CONTENT STANDARDS

Grades 6 – 8

6th Gr. Science:
Ecology - 5b, e

7th Gr Science:
Physical Principles in Living Systems - 6d
Investigation and Experimentation - 7a

8th Gr Science:
Reactions – 5a
History/Social Sciences: 8.3.6; 8.12.5

Grades 9 – 12

Science:
Biology/Life Sciences –
Ecology 6a, b, c, d

Earth Science –
California Geology – 9a, c
Biogeochemical Cycles – 7a, b

AP Science - Science Practices SP 1.2
Life Science LS 3.1

History/Social Science –
11th Gr 11.11.5
12th Gr 12.3.2

EEI P and C: Ic; IIa; IVb, c
Ocean Literacy Principles: 1g; 3; 5f; 6e;
Climate Literacy Principles: 2c, d; 4g; 6c, d; 7d

BACKGROUND INFORMATION

A watershed is a region defined by the path of water flow. All the water falling on or flowing within a specific watershed will flow to a river that identifies the watershed. The boundaries are determined by the higher elevations, and the topography as the land slopes down towards the sea. Typically, watersheds are separated by peaks of ridges - rain falling on one side of a ridge flows down the hills in one path, while rain falling nearby will flow down the hills in another path – forming two separate watersheds.

The Newport Bay Watershed is traversed by the San Diego Creek. It is bounded by the foothills of the Santa Ana Mountains to the east (Loma Ridge), and the San Joaquin Hills to the west and southwest. Nine cities and several unincorporated areas are located partly or fully within the watershed: Costa Mesa, Irvine, Lake Forest, Laguna Hills, Laguna Woods, Newport Beach, Orange, Santa Ana,

and Tustin. The watershed is highly urbanized, with housing, commercial and business developments, as well as some agriculture (row crops - strawberries, avocados, lemons and commercial nurseries).

Looking at the big picture, topography determines not only the course of the water, but also impacts what is carried with it on its journey downstream. Steep cliffs along any portion of the path will allow a faster flow of water that has the momentum to move larger rocks, sediments, toxins or other objects great distances. Gentle sloping topography results in a slower flow of freshwater. If steep cliffs exist where fresh and salt water meet, there will be an increased movement of large objects. Heavy watering of non-native or ornamental plants by humans in the summer in addition to rainy months can impact fresh-salt dynamic flow seasonally. If the gentle slope occurs where freshwater meets salt water, or if there is a long fetch as in Upper Newport Bay, there is increased possibility for the incoming salt water to move farther upstream and deposit what it is carrying. If the topography is such that the water meanders back and forth, there will be more opportunities for upstream sediments and other materials to be deposited upstream, before reaching the mouth of the estuary. If the water takes a long and straight course, there is a greater possibility for materials to flow and be deposited further 'downstream', as well as incoming salt water and anything it's carrying to move further 'upstream', with greater mixing of fresh and salt further 'upstream'. Finally, if

there is a deep channel, there is a greater possibility of distinct 'zones' within the water column: salt on bottom (denser), fresh on top, and brackish (mix of two) in middle. This also creates micro-habitats for animals which are adapted to live in different levels of salinity to inhabit the same channel.

As the water flows, dependent on topography and seasonal variations, its force allows deposition and retrieval of a wide variety of materials along its banks. If flowing past a refinery, it can pick up chemicals specific to its site. If it passes a tire plant, it can pick up chemicals specific to this site. Because of their site-specificity, their pollution is known as point source pollution. On its way to the sea, the river can also flow past agricultural fields, picking up animal waste, insecticides and fertilizers. As it passes residential or commercial areas, it can also pick up cleansers from car washing, oil from parked cars, animal wastes, herbicides and fertilizers. Because these pollutants are not site-specific, they are known as non-point source pollution.

The pollutants that are added to the river upstream wind their way through the watershed, and can be deposited anywhere along its banks. Slowly moving waters offer a greater opportunity for deposition. These pollutants are joined by whatever is washed down neighborhood curbs into the storm drains, known as urban run-off. Ornamental and non-native plants require chemical amendments to the

soil, which are washed down the curbs during rains or watering. Batteries and electronics that are left outside leach dangerous chemicals. Although coming from far-away, and indirect, this mix of chemicals and litter has a profound impact on the plant and animal species living downstream. Localized direct human impact within the Nature Preserve is added by the litter, pet waste and off-trail disturbance of nesting-sites within the habitat.

The accumulation of visible "litter" can be dramatic to many. The incredibly slow decomposition rate of plastic bags and bottle caps or fishing lines is hard to comprehend. The damage they can do to wildlife that mistake it for food or become entangled is horrible, and preventable. It is the invisible pollutants, however, that are the most dangerous. The phosphates in most household cleansers cause eutrophication, which is the rapid increase in algae, or algal blooms, resulting from the increased presence of nutrients in the water. When the long ropes of algae die off and decompose, oxygen is pulled out of the water by the increased bacteria population. This lack of oxygen in the water kills the animals in the water. The nitrogen from fertilizers also creates imbalance, as does raw sewage and oil. The chemicals found in even treated water are a challenge, and are monitored at several stations along our watershed.

Estuaries have the remarkable capacity for filtering pollutants out of waters. The marsh grasses and peat can filter herbicides and heavy metals out of the water. This is a tremendous service to the planet. The concern is what is the carrying capacity – how much overload is so much that the estuary cannot recover. In our desire to be close to our shores, we have developed estuaries and their surroundings into homes, shopping centers and business complexes. California has lost over 90% of its coastal wetlands, and the increased toxicity of our urban run-off is something we must monitor and try to mitigate. There is much that we can do as individuals and together to preserve and safeguard our remaining wetlands for the beauty, diversity, natural respite and service they provide.

RESOURCES:

http:/era.noaa.gov/information – Estuary Restoration
http://ga.water.usgs.gov/edu/earthwherewater.html -Earth's water distribution
http://environment.nationalgeographic.com/environment/freshwater Audubon's freshwater initiative, with links to usage calculator, information,quizzes,games
http://www.ocwatersheds.com - information on local issues and monitoring
http://newportbay.org/watershed/what-is-a-tmdl/
http://www.coastal.ca.gov/publiced/UNBweb/owow.html

EXTENSIONS:

1. Map the watershed in your local area.
2. Monitor, record and discuss human activities in your neighborhood that impact the watershed.
3. Brainstorm alternative ways to protect the watershed.
4. Write an article for the school newspaper, publishing results of your monitoring and alternative suggestions.
5. Write local businesses, chambers of commerce, city council about results of your monitoring and alternative suggestions.

TEACHER GUIDE – Watershed & Urban Run-off Module

ACTIVITY I: Household Products Testing

OBJECTIVES:

Students will be able to –.

1. Explain what a watershed is in general.
2. Identify the watershed for Newport Bay specifically.
3. Detail Ways in which activities along the watershed impact the Bay
4. Conduct pH test on common household products that enter the Bay.
5. Identify the Life-Friendly Zone for pH.
6. List actions they can take to mitigate pollution.

KEY TERMS:

Algal Bloom Brackish Carrying Capacity Channel Decomposition Rate Direct Human Impact downstream Estuary Eutrophication Fetch Food-web Freshwater Indirect Human Impact micro-habitat Native nesting site niche Non-Native Non-Point Source Pollution Ornamental Point Source Pollution Sediment Topography upstream Urban Run-Off Water Column Watershed

MATERIALS:

Observation Worksheets and Analysis Questions
Pencils
Non-latex gloves
Tap Water
pH Papers
Laminated pH Gauges
Test Samples of: Dawn, Joy, Ajax, generic dish soap
Simple Green, Fantastic, Windex
Cigarette butt water, fertilizer water, weed killer water
Cola, lemon-lime soda, lemonade
15 small beakers, baby-food jars to hold test samples
grease pencil to label sample jars
Sealed samples of sea shells: 1 in air, no water, showing overall size and shape
1 in plain ocean water
1 after 1 day in pH 7, or lower for effect

1 after 1 week in pH 7, or lower for effect
1 after 1 month in pH 7, or lower for effect