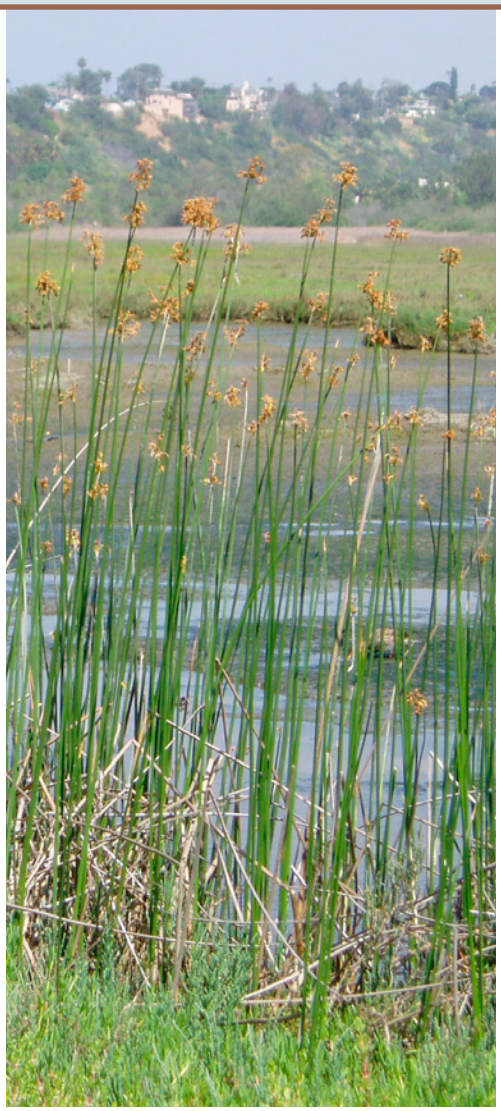
San Elijo Lagoon CONSERVANCY

Connecting communities. Protecting nature.

Watershed Biodiversity

Teacher's Guide • Grades 6–8 • Supplemental Curriculum & Field Experience

Photo courtesy The Escondido Creek Conservancy



TEACHER OVERVIEW

The overall goal of this program and teacher's guide is to connect middle-school students with their local watershed and get them involved in conservation actions to protect it.

Objectives

Students will:

- Understand they live in a watershed, what it is, how it works, and its relevance to their lives
- Connect to and appreciate their watershed
- Explore and experience the biodiversity of a watershed through observations
- Assess the health of the watershed and understand watershed ecosystem services
- Commit to watershed conservation and encourage others to do the same.

California Performance Expectations & Dimensions

Note: This program can assist with meeting the following Performance Expectations and Dimensions from California's Next Generation Science Standards (NGSS) for grades 6 through 8. The Dimensions focus on ecosystems and human activity. For connections to Common Core State Standards, see Appendix 2.

Students who demonstrate understanding can:

MS-ESS3-3 Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment. (Grade 6)

MS-LS2-2 Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems. (Grade 7)

MS-ESS3-4 Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems. (Grade 8)

Science & Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
• Constructing Explanations & Designing Solutions • Engaging in Argument from Evidence	• ESS3.C: Human Impacts on Earth Systems • LS2.A: Interdependent Relationships in Ecosystems • LS2.C: Ecosystem Dynamics, Functioning, and Resilience • LS4.D: Biodiversity and Humans	• Patterns • Cause and Effect • Science Addresses Questions About the Natural and Material World

Vocabulary

aquifer	an underground layer of rock or soil that contains water from which groundwater can be extracted
biodiversity	the number and variety of organisms (plants, animals, and others) found within a specified geographic region
chaparral	a habitat with dense, small evergreen shrubs that grow where summers are hot and dry and winters are cool and moist
coastal sage scrub	a habitat on drier coastal slopes that consists of drought-resistant, deciduous shrubs and other plants
culvert	a drainage or channel, such as a flood control channel, that crosses under a road or railway
deciduous	plants that lose their leaves during certain seasons; in California, usually the dry summer-fall season
ecosystem	all the living and nonliving things that interact in an area; within each ecosystem is one or more habitats (think of an ecosystem as a town or city and habitats as the neighborhoods)
ecosystem services	the benefits that ecosystems provide humans, from fresh air, clean water, and food to breaking down waste and building soils to beauty, recreation, comfort, and inspiration
endangered	at risk or in danger of becoming extinct
endemic	native to and confined to a certain place or region
environment	all the living and nonliving things that surround and affect an organism
erosion	the process by which water, wind, or other means wears away land
estuary	a partially enclosed body of water along the coast where fresh water from rivers and creeks meets and mixes with salt water from the ocean
groundwater	water that is in underground streams or aquifers
habitat	a specific type of environment where particular animal and/or plant species live; a home
halophyte	a plant adapted to living in a salty environment
invertebrate	an animal without a backbone or vertebral column
macroinvertebrate	an invertebrate that's large enough to see without the use of a microscope
mudflat	an area of mud and other fine sediment that's part of a coastal wetland, which is often exposed during low tides and covered during high tides
nutrient	an inorganic substance that living things need to live and grow
organism	a living thing, such as an animal, plant, alga, bacterium, or fungus

Pacific Flyway	a north-south route between Alaska and Patagonia that's used by migrating birds
parameter	a measurable characteristic or feature, such as temperature or pH
pesticide	a substance used to kill harmful or undesirable plants or animals
pH	a measure of acidity (acid) or alkalinity (base) of water or other solution indicating hydrogen ion concentration on a scale of 0 (acidic) to 14 (basic), with 7 being neutral; pH is an abbreviation for "power of Hydrogen"
pollution	a substance (pollutant), often produced by humans, that causes harm to a natural environment; pollution sources are either easy to pinpoint (*point source pollution*) or difficult to pinpoint (*non-point source pollution*)
riparian	a type of wetland near or along the banks of a river, stream or lake; a streamside or riverside habitat
runoff water	water that doesn't soak into the soil, and instead runs off the land into storm drains, creeks, rivers, etc.
salt marsh	a type of coastal wetland flooded and drained regularly by saltwater tides
sediment	sand, particles of rock, bits of soil, and remains of once-living organisms that can move with a fluid and are eventually deposited
succulent	thick and juicy; plants with thick, fleshy, water-storing leaves or stems
threatened	at risk of becoming endangered, leading to extinction
tides	the periodic rise and fall of sea level or ocean's surface under the gravitational pull of the moon (predominantly) and the sun
turbidity	cloudiness of water or other liquid caused by an abundance of fine particles or tiny organisms
watershed	an area of land that drains the rain falling onto it (or water flowing through it) into a common body of water, such as a creek or stream, which flows into a larger body of water, such as a river or lake, which eventually flows into an estuary and out to the ocean
wetland	an area that is covered by water during all or some part of the year

Introduction

The Escondido Creek Watershed

When it rains, the falling water runs downhill off the land into nearby creeks, rivers, and lakes. If you were to follow a raindrop from the mountains to the ocean, you would be following the raindrop through a watershed. A **watershed** is the area of land and water bodies that collect rainwater. A watershed includes the mountains, valleys, and flatlands, as well as water flowing above ground and underground (**groundwater**) in creeks, rivers, and **aquifers**. Most watersheds eventually end at the coast, often at an **estuary** open to the ocean. Flowing water connects all of the communities in a watershed, and what happens upstream affects those living downstream.

Did you know that you live in a watershed? We all do. Do you know which one you live in? If you live between Escondido and Cardiff, you probably live in the Escondido Creek watershed. This watershed starts in Bear Valley above Lake Wohlford and stretches 26 miles through the City of Escondido, past Elfin Forest to Cardiff, and through the San Elijo Lagoon to the Pacific Ocean. Additional communities it touches are Encinitas, Rancho Santa Fe, San Marcos, Solana Beach, and lands of The San Pasqual Band of Kumeyaay Indians. The Escondido Creek watershed covers approximately 54,112 acres in northern San Diego County.

This teacher's guide focuses on the Escondido Creek watershed, however the environmental and water-quality issues found there are pertinent to most coastal California watersheds. (*Note: There are 11 major watersheds in San Diego County, and Escondido Creek is part of the larger Carlsbad Hydrologic Unit. If you and your students don't live in the Escondido Creek watershed, visit the link above to find your watershed.*)

During our field program, we will observe, compare, and contrast the urban Escondido Creek **environment** with four natural **habitats**, and see how the differences affect water flow, wildlife **biodiversity**, and water quality. There are many habitats in this watershed and we will focus on **chaparral**, **coastal sage scrub**, **riparian**, and **salt marsh** habitats.

Note: See the map on page 11 for the location of these habitats within the watershed.

Chaparral Habitat

Chaparral is California's most common plant community, found in every county in the state. It is characterized by mild, wet winters and hot, dry summers (called a Mediterranean climate and found in only a few places on Earth). The average annual rainfall can vary between 9 and 30 inches, usually increasing with elevation. Most plants are dense, woody, evergreen shrubs with thick, leathery leaves to hold in moisture. Plants in this community are also adapted to dry-season fires, and the ability to regenerate from a stump after fire is a characteristic of chaparral plants. A noteworthy endangered species that makes this habitat its home is the **endangered** quino checkerspot butterfly.

Coastal Sage Scrub Habitat

Coastal sage scrub is another dry habitat of rocky slopes and flatlands, receiving an average of about 10 to 20 inches of rainfall per year. Most plants are drought-resistant, **deciduous** shrubs. They tend to be shorter (about 3 feet) and less dense than those of the chaparral. Sage scrub plants are also typically softer in texture. A noteworthy species that makes this habitat its home is the **threatened** California gnatcatcher.

Riparian Habitat

Along the banks of the Escondido Creek and other small creeks throughout the watershed is the riparian habitat (a streamside freshwater wetland). The fairly consistent water source (above and below ground) supports a dense thicket of **vegetation** that's typically taller and lusher than those in the drier chaparral or coastal sage scrub. Flowing streams (sometimes seasonal) and drainages create washes that support trees and smaller herb-like plants. Cool, shaded, and wet riparian habitat attracts many species. Noteworthy endangered species that make this habitat their home are the least bell's vireo, southwestern willow flycatcher, and arroyo southwestern toad.

Salt Marsh Habitat

A salt marsh is a low-lying coastal area periodically flooded by salt water from ocean tides. At low tide mudflats are exposed on the upper edges of the salt marsh. Salt water, along with consistently mild temperatures, sustains low-growing, **succulent**, salt-tolerant plants (called **halophytes**). The dominant plant here is pickleweed. Within the salt marsh are tidal creeks and mudflats that are submerged and exposed twice a day as the **tide** rises and falls. Noteworthy endangered species that make the salt marsh their home are the Belding's savannah sparrow and Ridgway's rail.

Note: During the field trip we will be exploring and making observations at three locations throughout the watershed: Concrete Creek, Elfin Forest, and San Elijo Lagoon.

Concrete Creek

Water is important for every community, supporting a variety of habitats and the plants, animals, and people that live there. People usually build communities with easy access to much-needed water. Unfortunately, we don't often build wisely, and being too close to too much water can be dangerous. The City of Escondido is built around the upper end of the Escondido Creek, which sometimes flows a little and sometimes flows a lot depending on the rains. To control heavy flows and prevent floods, the creek was engineered to travel straight through the center of Escondido. We will observe part of the seven-mile concrete "creek" and **culvert**, a channel built in the 1960s to protect homes and businesses from damaging floods. (*Note: This channel is separate from the pipes of the municipal sewer system.*)

Elfin Forest

About midway along the Escondido Creek watershed is the Elfin Forest Recreational Reserve. This 784-acre reserve serves many functions, including storing a local water supply, fully protecting habitats for many species, and providing beauty and recreation in nature for people living in urban environments. Native plant communities here vary with rainfall and the presence or absence of water. The Escondido Creek meanders through Elfin Forest, where we'll observe chaparral, coastal sage scrub, and riparian habitats.

San Elijo Lagoon

The waters of Escondido Creek reach the coast at Cardiff and flow into the San Elijo Lagoon, a very important natural environment in the Escondido Creek watershed. The San Elijo Lagoon Ecological Reserve (Reserve) covers nearly 1,000 acres that include wetland and upland habitats. The wetlands are some of San Diego's most diverse and of the few remaining along the CA coast. Here, fresh water meets seawater in a body of water called an estuary. An estuary is partially enclosed and receives fresh water from rainfall and **runoff** and salt water from tidal flow. This mingling of waters, along with the **organisms** living here, produces an area high in **nutrients**. Estuaries are one of the most productive **ecosystems** in the world with a multitude of habitats and a great variety of species.

The Reserve is home to more than 735 species of mammals, birds, reptiles, amphibians, fishes, spiders, insects, plants, algae, and other organisms that live here year-round or visit seasonally. It's a resting spot for migrating birds traveling the **Pacific Flyway** and a nursery area for a variety of young birds, fishes, and **invertebrates**. There are seven distinct habitats in and around the Reserve. They vary based on the availability of water and how fresh or salty it is. As with Elfin Forest, there's chaparral, coastal sage scrub, and riparian habitats. We'll be focusing on salt marshes, the area of the Reserve that's most affected by ocean tides.

Ecosystem Services

People have benefitted from California's watersheds for many thousands of years. These benefits, called **ecosystem services**, support our basic needs for water, food, shelter, and so much more. Watershed ecosystem services include:

- Biodiversity and productivity
- Nurseries for commercially important marine organisms
- Clean air and water
- Flood and erosion control
- Fertile soil
- Beauty and inspiration for hiking, birdwatching, photography, art, and music.

Watersheds are biologically diverse. Biodiversity is the number and variety of species living within a geographic area. Biodiversity helps ensure ecosystem health in response to environmental changes. California, and San Diego County, are some of the most biodiverse places in the United States. California has more species, more **endemic** species (species found only in California), and more rare and endangered species than any other state in the U.S. Our coastal wetlands, including salt marshes, are some of the most productive and biologically rich ecosystems in the world, rivaling rain forests. These areas serve as nurseries for many marine animals, including commercially important fishes and invertebrates.

As watershed plants absorb nutrients during photosynthesis, they also absorb air pollution, cleaning the air and renewing it by giving off oxygen for us to breathe. Plants in the watershed also help clean the water. Riparian forests and salt marshes slow water flow, and slow-flowing water drops **sediment**, clearing the water. Plants and other organisms take up pollutants and decompose many toxic substances in the water and sediment, resulting in cleaner water. By slowing the water, wetlands throughout the watershed also help control flooding, limit land **erosion**, and enrich the soil.

Nature is nurturing and inspirational. Many scientists, naturalists, writers, artists, musicians, architects, and designers have been inspired by nature. Some notable people from the past are: Ansel Adams (photographer), John James Audubon (birder & artist), Katharine Lee Bates (songwriter), Rachel Carson (scientist & writer), George de Mestral (engineer & designer), John Muir (naturalist & author), John McLaren (horticulturalist & park superintendent), and Georgia O'Keeffe (painter). Local architect James T. Hubbel designed the nature center at Elfin Forest. Do you know of anyone else whose inspiration comes from natural places?

Unfortunately, human population growth and development throughout San Diego County has led to significant habitat loss and a reduction in watershed ecosystem services. As water flows through our neighborhoods, it picks up **pollution** from yards (fertilizers and **pesticides**), streets (oil and grease), and walkways (trash and pet poop), and carries the pollutants throughout the watershed. Today's polluted water no longer encounters the cleaning services that wetlands used to provide. Over the past 200 years, nearly 85% of Southern California's watershed wetlands have been destroyed. With fewer wetlands, the job for those that remain is bigger and more challenging. Too much pollution and trash can overwhelm wetlands' cleansing abilities and destroy their usefulness. This disrupts the lives of the plants and animals living there, and ultimately affects the health of habitats throughout the watershed.

In the end, all the pollution from Escondido to Cardiff flows to the San Elijo Lagoon and into the ocean. When you think about the people and human-made environments along this watershed, you can see how everyone's daily choices impact watershed habitats and water quality from the mountains to the ocean.

Water Quality & You

Ecosystem health is crucial to ecosystem services. Scientists and technicians use different tests to measure a watershed's health, just like doctors use different tests to measure your health. Two examples of ways to determine the health of a watershed are to monitor the **water quality** and assess the biodiversity.

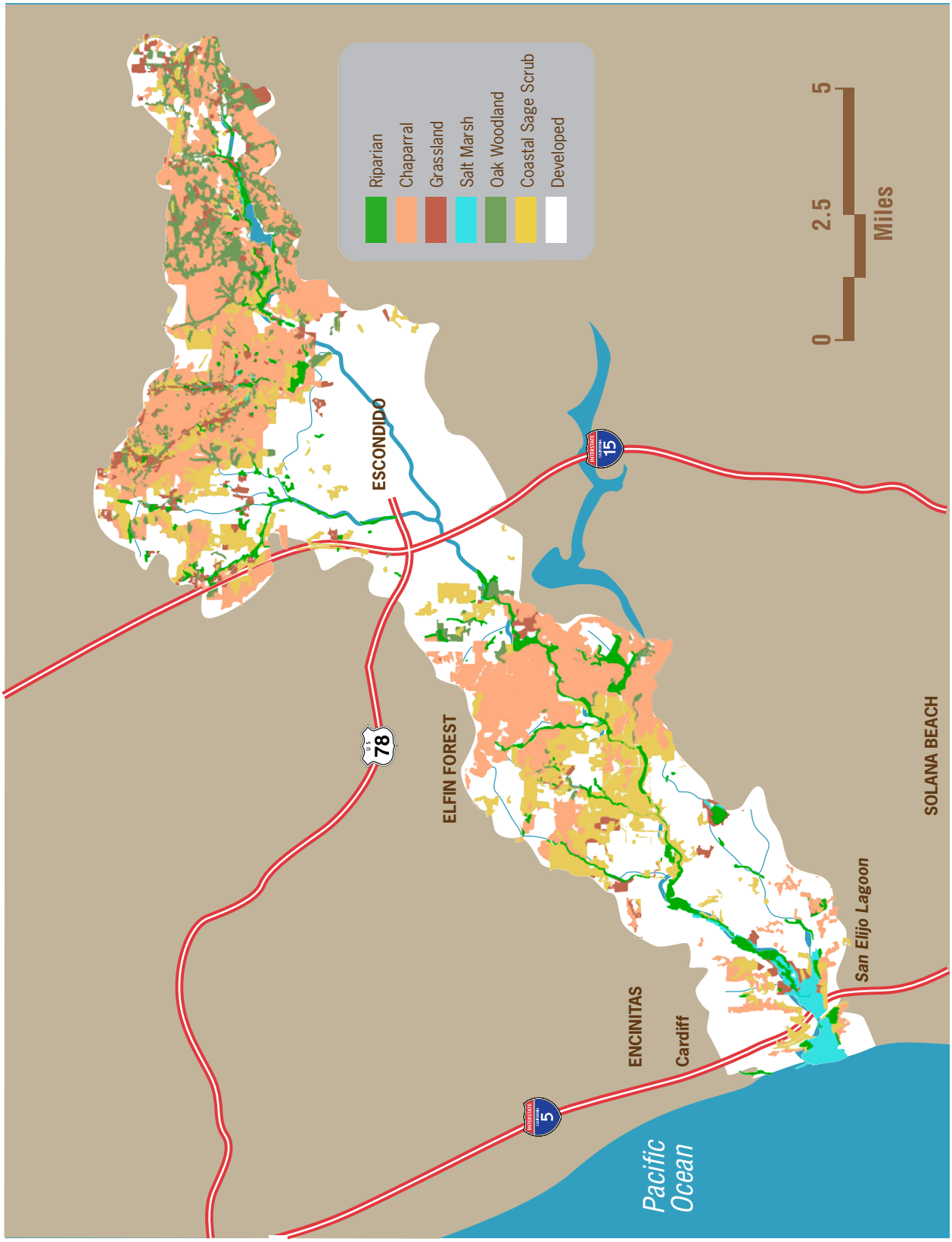
To determine water quality, the characteristics (**parameters**) that scientists test are physical, biological, and chemical. Examples of physical parameters include temperature, **turbidity** (water cloudiness), and trash. Examples of biological parameters may include catching and counting **macroinvertebrates**, such as insect larvae. An example of a chemical test is measuring **pH**.

During this watershed program, you will observe and record pollutants, turbidity, and pH in a freshwater riparian stream and a salt marsh to determine water quality. In addition, you will assess macroinvertebrates in the freshwater stream as another indicator of water quality.

Since everyone lives in a watershed, everyone affects the quality of the water. We all have a responsibility to protect our limited freshwater resources and the ecosystem services they provide. And by caring for and protecting our watershed, we're helping care for the ocean as well. It's critical that we keep the water in our watersheds flowing clean and healthy.

Photo courtesy Olivenhain Municipal Water District

Escondido Creek Watershed and Major Habitats



References and Suggested Readings

For more information about California watersheds and habitats, and for students' research work, look for these references at a local library or online.

General References

Calflora: Information on wild California plant species, searchable by county, plant community (habitat), common name or scientific name, resulting in maps, photos, and some basic information: www.calflora.org/

California Education and the Environment Initiative (EEI) K-12 curriculum: http://californiaeei.org

deNevers, G., Edelman, D.S. & Merenlender, A. (2013). *The California Naturalist Handbook*. Berkeley: University of California Press.

San Diego County Plant Atlas, San Diego Natural History Museum (includes a Google Earth Plug In): http://sdplantatlas.org. Also interactive plant search map: http://sdplantatlas.org/SDMapBoxQuery_VE.aspx

Schoenherr, A.A. (1992). *The Natural History of California*. Berkeley: University of California Press.

Watershed References

California Chaparral Institute. Information on native shrubland communities (habitats) of California, including chaparral and sage scrub: www.californiachaparral.org

Elfin Forest Recreational Reserve: http://escondidocreek.org/elfin-forest-recreational-reserve/

The Escondido Creek Conservancy: http://escondidocreek.org

The Escondido Creek Watershed: http://www.sanelijo.org/escondido-creek.html

Project Clean Water. San Diego County Watersheds map. See Carlsbad Hydrologic Unit for Escondido Creek: http://www.projectcleanwater.org

San Diego Coastkeeper. San Diego Watersheds. Interactive map of water quality along watersheds, including Escondido Creek: http://www.sdcoastkeeper.org/learn/swimmable/san-diego-water-quality.html

San Elijo Lagoon Conservancy: www.sanelijo.org

Zedler, J. B. (2015). *Salt Marsh Secrets: Who uncovered them and how?* Imperial Beach, CA: Tijuana River National Estuarine Research Reserve. Available for download at: http://trnerr.org/saltmarshsecrets/

Water Quality Monitoring References

U.S. Environmental Projection Agency (EPA). *How's My Waterway?* (searchable by location): http://watersgeo.epa.gov/mywaterway/

World Water Monitoring Challenge. *Water quality indicators: Biological, chemical and physical parameters.* Adapted from *Healthy Water, Healthy People: Water Quality Educators Guide* (www.projectwet.org). Available at: http://www.monitorwater.org/uploadedFiles/Content/Resources/Water_Quality_Indicators_Final(1).pdf

ACTIVITIES

We developed the activities in this packet to support your field trip and your students' conservation action projects.

Pre-Visit

Exploring Your Watershed

Activities 1A, 1B, and 1C are designed as pre-visit activities. We recommend you use these activities to get your students familiar with the Escondido Creek watershed environment, environmental issues, and vocabulary, as well as the worksheets for the field program.

Activity 1A: Getting to Know the Escondido Creek Watershed

Activity 1B: What Belongs & What Doesn't?

Activity 1C: Field Observations & Predictions
We recommend students arrive the day of the field program familiar with the worksheets and with copies in their science notebooks.

Post-Visit

Protecting Your Watershed

Activities 2A and 2B are designed as a post-visit activities that will help your students review what they learned in the field and get them engaged in the conservation of their watershed.

Activity 2A: Reflections

Activity 2B: Taking Action

GETTING TO KNOW THE ESCONDIDO CREEK WATERSHED

Teacher's Aid

Activity Introduction

This first pre-visit activity is a virtual exploration of the Escondido Creek watershed. Activity 1A front-loads students with watershed excitement, relevance, and vocabulary.

Time & Materials

- This is a class activity and it should take you and your students one class period to complete (depending on your technology and familiarity with it).
- You'll need a computer with access to Google Maps and a screen or whiteboard (Promethean or other) for projecting the map onto. You may also make one or more large copies of the watershed map on page 11.
- Students will need a place in their science notebooks for taking notes and possibly drawing a watershed map.

Instructions to Teacher

Explore the Escondido Creek watershed from your classroom using Google Maps. *(Note: Google Earth, MapQuest or a large paper map can be used as an alternative. However, these instructions are for Google Maps. Other apps/sites will have different features and use different terms. We recommend you select the view and images that would be best for your students and become familiar with the map and how it works prior to the first class period.)*

Open Google Maps and select the Terrain view (you can also use Satellite view if you want more detail). Type into the Search box (upper left corner) the following locations, or click on the map to select each.

- Your school's address
- Lake Wohlford
- 1876 Harmony Grove Road, Escondido, CA (this is the location of the creek culvert)
- Elfin Forest Recreational Reserve, 8833 Harmony Grove Road, Escondido, CA
- San Elijo Lagoon Nature Center, 2710 Manchester Avenue, Cardiff, CA

Save each location (you have to sign into Google to do so). Once you have the map locations, explore. Zoom in and out, use Street view (and the 360 rotation icon) and Photos (lower right corner) to virtually visit each site. (*Note: Consider pointing out landmarks such as schools, grocery stores, restaurants, and parks to give students a better sense of place.*)

If you enter your destinations in the order above, and click on Directions and then on Walking mode, Google Maps will trace a route through the Escondido Creek watershed from Lake Wohlford, past Elfin Forest to the San Elijo Lagoon. The map's route doesn't exactly follow the creek, but from Elfin Forest to the coast students should be able to spot the creek on the map.

In their science notebooks, have students draw or note the locations they'll visit during the field program and the mileage between each. They can also note places they virtually pass along the way (to look for while riding on the bus).

Instructions to Students *(given verbally)*

Introduction

We'll be doing several activities over the next few days [weeks] to get you ready for our field trip through the Escondido Creek watershed. Right now we're going to start by taking a virtual field trip using my [or our] computer[s]. This trip will be an exploration of our local watershed.

Instructions

Does anyone know what a watershed is?

[Take answers and encourage responses.]

A watershed is an area of land that drains the rain that falls onto it (and water flowing through it) into a common body of water, such as a creek or stream, which eventually flows all the way to the ocean. The watershed we're going to be visiting is the Escondido Creek watershed. We'll be going on a real trip through this watershed on [date], but first to get familiar with it we're going to visit it virtually today.

We'll be using Google Maps *[or whatever program you are using]* for this trip. I'm going to project this and you can follow along on the maps [or computers] in front of you.

[Enter the first location on Google Maps. You can start or end with your school street address, or insert it wherever it will help students orient to where they are and going in the watershed.]

The Escondido Creek watershed begins along the ridges above Bear Valley near Lake Wohlford. Has anyone ever been to Lake Wohlford?

[Type into the Search bar (upper left-hand corner) Lake Wohlford, and click on the location. Use the Street view and/or Photos to show students what the place looks like.]

On a new page of your science notebook/journal, write the name of this place, and note your answers to these questions:

- How would you describe this place?
- Is it urban, natural, or a mix of both?
- Where is the water in this part of the watershed?
- What else do you see here?

[Have students note their responses in their science notebooks, and if you show them familiar local landmarks, have them note those as well.]

*[Continue to visit each location listed in the **Instructions to Teacher** and ask the same questions as above to spend some time talking/writing about each place to familiarize students with the location. Have students continue to make notes on each location in their science notebooks.]*

Now that you're familiar with each location, I'm going to show you how we're going to visit the Escondido Creek watershed during our field trip by following the creek, from a culvert in Escondido to Elfin Forest to the San Elijo Lagoon on the coast.

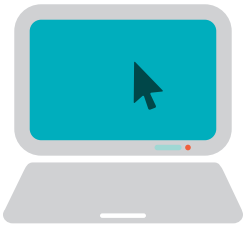
[Plot the route from your school to the culvert on Harmony Grove Road to Elfin Forest to the San Elijo Lagoon.]

In your notebooks, note the mileage from each location to the next, then add those and note the total mileage.

[Based on the virtual exploration of the watershed, you might have students draw their own map of the watershed from Lake Wohlford to San Elijo Lagoon, including images, labeled descriptions, and mileages.]

Wrap Up

Now that you have an idea of what and where the Escondido Creek watershed is, next you'll be researching habitats and the plants and animals living in each place.



WHAT BELONGS & WHAT DOESN'T?

Teacher's Aid

Activity Introduction

This second pre-trip activity has students researching the plants and animals of the watershed and environmental problems that organisms face living in such a highly human-impacted place. This will prepare them for the field program where they will explore four watershed habitats and engage in a variety of water-quality tests. This activity will also get students thinking about human impacts and a conservation action project they will do as their final activity.

Time & Materials

- This activity should take about 2 or 3 class periods to complete.
- Students will work in small groups conducting research and presenting their results.
- Students will need the Student Worksheet on page 20 and species list from Appendix 1.
- Student groups may need copies of background materials in this packet and access to the library or online resources (see Introduction on pages 6–10 and References and Suggested Readings on page 12).
- For the wrap-up nametag activity, students will need nametags and materials to draw and write on them.

Instructions to Teacher

Divide your class into eight teams and give each team a research assignment based on the matrix below, the questions on the Student Worksheet (page 20) and species list in Appendix 1. To help students with their research, see References and Suggested Readings on page 12.

After each team has researched answers to the worksheet questions, have them share their findings with the rest of the class. (To make the information cohesive, have Team A go before Team B for each habitat.) Each presentation should be 3 to 5 minutes long using low- or high-tech options such as poster, PowerPoint, Keynote, Prezi, iMovie, Adobe Voice, PowToon, or Educreations. We suggest students develop a storyline for their presentations. For example, present as if they were walking someone through a habitat explaining what they see, including the human impacts, and how they would ask the person to protect the watershed.

Research Questions	Chaparral	Coastal Sage Scrub	Riparian	Salt Marsh
Team A Questions 1–3	Team A1	Team A2	Team A3	Team A4
Team B Questions 4–6	Team B1	Team B2	Team B3	Team B4

To help students reflect during the field program on their background research, have each create a nametag to wear during the field program. Each nametag should include the student's name and a drawing of a plant or animal with its common and scientific name from the habitat they researched. (You may want to assign species so that most of the organisms researched are represented on the field program.) You could ask students to draw their pictures on one side of the nametag, and list three interesting facts on the back, such as the habitat, an adaptation for that habitat, and a human impact on that habitat. (See San Elijo Lagoon website for a nametag template.)

Instructions to Students *(given verbally)*

Introduction

During our field trip to the Escondido Creek watershed, we're gong to explore four watershed habitats. Does anyone know what a habitat is?

[Take answers and encourage responses.]

A habitat is a home — a place where particular plant and animal species live. Not every animal or plant lives everywhere — you wouldn't find a dolphins living in the desert or a cactus living in the ocean. Animals and plants are adapted to specific habitats.

To prepare for the field trip you will be researching the habitats of animals such as the mountain lion, western fence lizard, Anna's hummingbird, and striped shore crab. You'll also be learning about plants such as the scrub oak, coyote brush, mulefat, and pickleweed.

Instructions

I'm going to divide you into eight research teams. We will be exploring four habitats and so there will be two teams researching different questions for each of the habitats. The habitats are: chaparral, coastal sage scrub, riparian, and salt marsh. Here are your assignments:

[Divide your class into eight teams as per the matrix on the previous page and assign each team a habitat and set of the questions from the Student Worksheet on the next page. Also share with them the species list for that habitat from Appendix 1.]

To do your research, use *[describe resources available to them]*.

When you have completed your research, you will be presenting what you learned to the rest of the class [or grade level]. Your presentations should answer the research questions that your team has been assigned.

[Describe or provide written expectations for students' presentations, such as format, use of technology, storyline, length, due date, etc.]

Wrap Up

As each group presents their research, I will summarize findings in a table drawn on the board and I want you to do the same using this table.
[Give students the worksheet on page 20.]
When we're done, you can include the table in your science notebooks.

Now that you know about some of the Escondido Creek watershed habitats and what lives there, I want you to create a nametag to wear during the field trip. On one side of your nametag, draw a plant or an animal from the habitat your researched. Then, add your name and the organism's common and scientific name. On the back of your nametag, write three interesting facts about that organism, such as its habitat, an adaptation for that habitat, and a human impact on that habitat.
[Distribute nametag templates.]

Activity 1B: Student Worksheet

Instructions:

Research your assigned habitat by answering the questions you were given (see below). Then, prepare a two- to five-minute presentation for your class describing what you learned from your research. To help you plan your presentation, fill in this worksheet.

Team Members: _____

Watershed Habitat: _____
(chaparral, coastal sage scrub, riparian, salt marsh)

Presentation Delivery Method/Media: _____

Presentation Storyline (*if any*): _____

Presentation Date: _____

Research Questions

Team A

1. Define your habitat (what are its characteristics), and where is it found throughout the Escondido Creek watershed (or the watershed you live in).

2. What are the most common plants in your habitat?

   a) Describe some of the adaptations that allow them to survive in this habitat.

   b) Are there any endangered plant species that live in your habitat?

3. What are some of the animals that live in your habitat?

   a) Describe some of the adaptations that allow them to survive in this habitat.

   b) Are there any endangered animal species that live in your habitat?

Team B

4. What is the water source for the organisms that live in your habitat?

   a) Is there visible evidence of a lot or a little water? Where does most of the water come from?

   b) What factors affect the availability and quality of water?

5. What are some of the impacts humans have on your habitat and the organisms living there?

6. What are ways to reduce or eliminate human impacts on your habitat?

Acitivty 1B: Presentation Summary Worksheet

Instructions: During the presentations, use this worksheet to take notes about the habitats.

Questions Answered	Chaparral	Coastal Sage Scrub	Riparian	Salt Marsh
1. Habitat Characteristics				
Location in the Escondido Creek watershed				
2. Common plants & adaptations				
Endangered plant or animal species				
3. Common animals & adaptations				
Endangered plant or animal species				
4. Water source, availability, and quality				
5. Human impacts				
6. How to reduce human impacts				

FIELD OBSERVATIONS & PREDICTIONS

Teacher's Aid

Activity Introduction

During the field program your students will make observations, conduct water-quality tests, and predict what they might find as they travel from one site to the next. The observations and tests will provide them with indicators of human impacts and the quality of the watershed habitats. Becoming familiar with this activity and the student worksheets will help prepare them. During the field program, students will be given some quiet time to record and draw their observations and note their predictions on the worksheets.

Time & Materials

- This is a class activity that should take about 20 to 30 minutes to complete.
- You and your students will need the Student Worksheets on pages 23 & 24 for review (not to be completed during this activity).

Instructions to Teacher

To prepare your students for their field program, review the Student Worksheets (pages 23 & 24) with your class. Have your students tape/glue the worksheets into their science notebooks so they have them during the field program. Explain how important it is for scientists to be observant and to carefully document their observations.

Instructions to Students *(given verbally)*

Introduction

During our field trip on [date], we will be making observations, conducting water-quality tests and predicting what we might find as we travel from one location to the next. We will be working like field scientists, who use these same techniques. Our observations and water-quality tests will provide us with indicators of human impacts on the quality of watershed habitats. It's important to be observant and to carefully note all of your observations and test results. Accuracy is key to collecting quality scientific data.

You will be using a worksheet during the field trip to record the data you collect at each location, and I want to make sure you understand what you'll be recording before the field experience. You'll learn more about each of the water-quality tests during the field program. *[Project for students a copy of the worksheets from the following pages, and discuss with them. Before the field trip, distribute a copy of the worksheets to each student and have them glue/tape the worksheets into their science notebooks.]*

Acitivty 1C: Student Worksheet

Instructions: Write about what you observed and the test results at each location.

OBSERVATIONS	Bridge/Concrete Creek Culvert	Elfin Forest	San Elijo Lagoon
Plants Types of plants, and describe bark, leaves, feel, any flowers, scents	• • •	• • •	• • •
Wildlife Types of mammals, birds, reptiles, insects, other animals	• • •	• • •	• • •
Human Impacts: Habitat Quality: Trash, sounds, erosion, buildings, roads, trails, other	• • •	• • •	• • •
Human Impacts: Water Quality Indicators	Water visible? Yes No Source & Flow:_____ Water type? Fresh Salt	Water visible? Yes No Source & Flow:_____ Water type? Fresh Salt Temperature:_____ pH:_____ Turbidity:_____	Water visible? Yes No Source & Flow:_____ Water type? Fresh Salt Temperature:_____ pH:_____ Turbidity:_____
Prediction: What do you think you'll see at the next site? More of the same or something different?			

Acitivty 1C: Student Worksheet 2

Instructions: Draw a picture of what you observed at each location.

Bridge/Concrete Creek Culvert

Elfin Forest

San Elijo Lagoon

REFLECTIONS

Teacher's Aid

Activity Introduction

This first post-visit activity is designed to help your students reflect and review what they observed and learned while in the field.

Time & Materials

- This activity should take about 30 to 60 minutes to complete.
- Students can work in small groups or individually.
- Students will need a blank page or two in their science notebooks.

Instructions to Teacher

Have students answer the following questions in their science notebooks (referring back to their field observations):

- How and why were the three places you visited in the Escondido Creek watershed different?
- What was most surprising and disturbing to you about the human impacts on each of these three places?
- What do you think about this watershed and the ecosystem services it provides people?

Instructions to Students *(given verbally)*

Introduction

I would like you to reflect on your field experience through the Escondido Creek watershed. You can refer to your observations worksheets if that will help you.

Instructions

[You can project these questions, or write them on the board for students to copy and refer to.]

In your science notebooks, answer each of the following questions:

- How and why were the three places you visited in the Escondido Creek watershed different?
- What was most surprising and disturbing to you about the human impacts on each of these three places?
- What do you think about this watershed and the ecosystem services it provides people?

Wrap Up

[If you have time, have some of your students share their answers to each of the questions, or discuss their answers with one another in small groups.]

TAKING ACTION

Teacher's Aid

Activity Introduction

This final post-visit activity is designed to help get your students engaged in the conservation of their watershed through personal behavior changes and a group conservation project.

Time & Materials

- Students will work in small groups developing an action plan, implementing it, and presenting it.
- This activity should about 2 or 3 class periods. Depending on the action project(s) students choose to work on, implementation of most action plans will take time outside of class.
- Students will need school and possibly community support to implement their action plan(s).

Instructions to Teacher

On a simple chart drawn on a whiteboard, have students write or place dots under the conservation actions that they currently do, such as recycle, don't litter, pick up trash (individually or a group cleanup), try to use less water or energy, bike or walk to school, etc. Then discuss the human impacts they saw during the field trip through the watershed. Have them identify which of their current conservation actions are most helpful to the watershed and the organisms living there. Have students discuss other conservation actions that they individually and as a group could take to make sure their watershed is healthy and the water clean.

Based on the discussions, have each student choose an action that he/she could do more of or better, or a new action that would help the watershed. Have each student commit to do more for at least a week or two (or until the end of the month or until another memorable date).

Then have the class determine how they, as a group, could get more people involved in helping the watershed. Have them decide with whom they could work and how they would work with that group or those people. Will they work with those on campus, at home, in the neighborhood, elsewhere in the watershed? Will they ask for help from environmental organizations, city officials, park agencies, local newspaper, community groups, or businesses? Will they start their own project or join another one, such as a citizen science project, local cleanup, or habitat restoration? Who will they communicate with (and how) regarding the project and its results? Have the class (or small groups within the class) develop a project that would get more people involved in helping to protect the watershed.

There are many actions that students could take. We would encourage them to do something more than they, the school, or community are currently doing to help the environment. Listed below are some suggestions from other teachers.

- Create signs or infographics to post around campus to initiate a campaign on how to properly Reuse, Reduce, and Recycle, or inform other students about conservation efforts on campus, such as the school garden.
- Educate the community through school newsletters, morning announcements, PTA meetings, editorials, etc., about the importance of conserving water, recycling, planting natives, and/or keeping storm drains clean from harmful pollution.
- Pick up litter for two weeks in one area.
- Make a conservation video or slideshow about what you can do to protect the Escondido Creek watershed, and share it with an audience, such as peers, an elementary school or class, or a community group.
- Plant native plants in planter boxes or a garden at the school.
- Organize or get involved in a creek or beach cleanup.
- Get their family to visit and volunteer with a local environmental, conservation, or community group that cares about the environment and watershed.
- Conduct a trash audit: Collecting all the trash they and their family or friends produce in a single day. Then, sort and count the trash to see what's there. Compare each other's trash. Are there ways to reduce the amount of trash you produce in one day?
- Record the length of their showers, how many times they flush the toilet in a day, and other waters uses? Calculate how much water they and their family use in one day. Are there ways to reduce the amount of water used?

Upon completing their projects, have students document projects and develop a display or a presentation (poster or other media) for the school, parents, or community groups on what they did and how they cleaned and/or protected their watershed.

Instructions to Students *(given verbally)*

Introduction

As you observed during our field trip, how people live each day has an impact on the watershed, and this affects the quality of the habitats and the ecosystem services that the watershed provides. Do you think the watershed needs our help? [*Discuss with students.*]

We all want to have a positive impact on where we live, and we can do that by living each day keeping the place where we live — the watershed — in mind. So this final activity is about taking action to keep the watershed clean and to protect it.

I want to start by having us list all the things we already do to help the watershed. Who has something for our list?

[Take a positive action. Write or project that on one side of the board.]

How many of you do this regularly, such as every week or every day?

[Tally the answers. Then ask for more conservation actions and tally how many students do each of the actions you add. The list might include recycle, don't litter, pick up trash, join a group cleanup, try to use less water or less energy, bike or walk to school, etc. Keep adding to the list until students can't think of anything more that they already do.]

Now think about an action that you could do that you're not doing right now that would help clean or protect the watershed. Can anyone think of something more that we could do but aren't doing now?

[Take a new positive action and write or project that on the other side of the board. Then ask for another conservation action. Build the list and have students discuss the additional items and maybe why they don't do them or how they could add them to the list of action they do.]

It looks like there are more things that all of us could do. In your science notebooks, write down one more thing that you could do to help clean or protect the watershed, and for a week *[or other designated time]* I want you commit to do that one thing more, and keep track of how well you do during that time.

[At the end of the week, discuss how well students were able to keep their commitments, along with what helped them and what got in their way. Ask students to commit to continue the actions.]

Looking at both of our lists on the board, let's talk about how we can get other people involved in keeping the watershed clean and protecting it. *[Have students discuss their ideas.]*

Instructions

Your next assignment is to develop a project that gets others involved in cleaning or protecting the watershed. I want you to work in small groups *[you can assign groups if you prefer]*. Some things to think about as you plan this project are:

- Will this be a project for the school campus, at home, in your neighborhood, or elsewhere in the watershed?
- Will you start your own project or join another one, such as a citizen science project, a local cleanup or a habitat restoration project?
- Who will you involve in this project? Will you need help from your family, teachers or administrators here at school, local environmental organizations, city officials, park agencies, local newspaper, community groups, or businesses?
- Who will you communicate with (and how) regarding your project and its results?

[Provide students with the Student Worksheet on page 30 to help them plan their projects.]

After you've developed your project plan (and gotten my approval), then you will do your project between [dates]. Upon completing your project, you will document and present what you've done to the class [or others at school or larger community] on how they can protect the watershed.

[Describe or provide written expectations for students' project presentations, such as format, use of technology, length, due date, etc.]

Activity 2B: Student Worksheet

Instructions:

Develop a watershed conservation action plan by answering the questions below. Then prepare a two- to five-minute presentation for your class, school, or community describing your plan and how they can get involved in protecting your local watershed.

1. Conservation Action Project (What To Do? When? Where? How? With Whom?)

_____

_____

_____

2. Why did you choose this project?

_____

_____

_____

3. List 2 or 3 people, local agencies/organizations, or websites that you can use for research.

_____

_____

_____

4. How will your conservation action help the community and watershed?

_____

_____

_____

5. How could you get other people interested in helping and involved?

_____

_____

_____

APPENDIX | 1 Common Plants and Animals of the Escondido Creek Watershed

Note: Many species live in more than one habitat. Some are limited to a very specific habitat.
To help students with their research, see References and Suggested Readings on page 12.

Chaparral	
Manzanita	*Arctostaphylos glauca*
Ceanothus	*Ceanothus tomentosus* and *Ceanothus verrucosus*
Chamise	*Adenostoma fasciculatum*
Scrub Oak	*Quercus berberidifolia* and *Quercus dumosa*
Quino Checkerspot Butterfly	*Euphydryas editha quino*
Coast Horned Lizard	*Phrynosoma coronatum*
Southern Pacific Rattlesnake	*Crotalus oreganus helleri*
Wrentit	*Chamaea fasciata*
Mountain Lion	*Puma concolor*
Woodrat	*Neotoma fuscipes*
Coastal Sage Scrub	
Black Sage	*Salvia mellifera*
Coastal Sagebrush	*Artemesia californica*
Coyote Brush	*Baccharis pilularis*
Lemonadeberry	*Rhus integrifolia*
Bumblebee	*Bombus* sp.
Western Fence Lizard	*Sceloporus occidentalis*
California Gnatcatcher*	*Polioptila californica*
California Towhee	*Pipilo crissalis*
Coyote	*Canis latrans*
Desert Cottontail	*Sylvilagus audubonii*
Riparian	
Cottonwood	*Populus fremontii*
Mulefat	*Baccharis* sp.
Sycamore	*Platanus racemosa*
Willows	*Salix* spp.
Southern Mule Deer	*Odocoileus hemionus fuliginatus*
Raccoon	*Procyon lotor*
Anna's Hummingbird	*Calypte anna*
Western Tiger Swallowtail	*Papilio rutulus*
Pacific Tree Frog	*Hyla regilla*
Least Bell's Vireo*	*Vireo bellii* ssp. *pusillus*
Salt Marsh	
Pickleweed	*Salicornia pacifica*
Salt Grass	*Distichlis spicata*
Cordgrass	*Spartina foliosa*
California Horn Snail	*Cerithidea californica*
Striped Shore Crab	*Pachygrapsus crassipes*
Mullet	*Mugil cephalus*
Belding's Savannah Sparrow*	*Passerculus sandwichensis beldingi*
Osprey	*Pandion haliaetus*
Ridgway's Rail*	*Rallus obsoletus levipes* (formerly Light-footed Clapper Rail)
Snowy Egret	*Egretta thula*

** after a name indicates a threatened or an endangered species*

CONNECTIONS

Sixth Grade ELA/Literacy

RST.6-8.1	Cite specific textual evidence to support analysis of science and technical texts.
WHST.6-8.7	Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.
WHST.6-8.8	Gather relevant information from multiple print and digital sources; assess the credibility of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and providing basic bibliographic information for sources.
SL.8.5	Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.

Seventh Grade ELA/Literacy

RST.6-8.1	Cite specific textual evidence to support analysis of science and technical texts.
WHST.6-8.9	Draw evidence from literary or informational texts to support analysis, reflection, and research.
SL.8.1	Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on topics, texts, and issues, building on others' ideas and expressing their own clearly.
SL.8.4	Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation.
SL.8.5	Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.

Eighth Grade ELA/Literacy

RST.6-8.1	Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.
WHST.6-8.9	Draw evidence from informational texts to support analysis, reflection, and research.
SL.8.1	Engage effectively in a range of collaborative discussions (one-on-one, in groups, teacher-led) with diverse partners on grade level topics, texts, and issues, building on others' ideas and expressing their own clearly.
SL.8.4	Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation.
SL.8.5	Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.

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Bring your class on a field trip to the lagoon.
To learn about the different programs offered or to schedule a walk...

- visit sanelijo.org/education
- email education@sanelijo.org
- call (760) 436-3944