BACKGROUND INFORMATION

This section presents some basic water resources information and local examples which may be useful in teaching the learning activities. Additional information is presented at the beginning of each activity.

Words shown in **bold** text throughout this guide appear in the Glossary, Appendix B.

WATERSHEDS

In any **watershed**, gravity carries water from the highest point to the lowest, forming **creeks and rivers**. In a natural environment, rain water flowing overland, called **runoff**, is slowed down by trees and vegetation. When the water moves more slowly, more of it soaks into the soil where it is taken up by plant roots or **percolates** farther down into the **groundwater aquifer**. The movement of water through a watershed is part of the natural **water cycle**.

People influence and interrupt the natural water cycle. In an **urban** watershed like our community, miles of hard surfaces, such as streets, highways, parking lots, sidewalks, and rooftops, prevent rain water from soaking into the ground. These **impervious** surfaces increase the flow of runoff, causing **erosion**, scouring **contaminants** into the water, and changing stream flows.

LOCAL WATER RESOURCES

The **Fresno Metropolitan Flood Control District** serves an urban and rural watershed, some of which drains to the **San Joaquin River** (Figure TG-2). The San Joaquin River, fed by snow melt and **reservoirs**, flows year round. Its high-quality waters support a wide variety of **aquatic** and **riparian** plants and animals. Other creeks and **streams** flow through the watershed seasonally. Seasonal creeks and streams, common in our area, are called **ephemeral** streams. They support riparian and seasonal aquatic habitats. These surface water resources also support recreation. Some of the streams have been **channelized** and incorporated into the irrigation **canal** system.

All of these **surface water** resources percolate through the soil to groundwater. The groundwater aquifer generally lies at depths ranging from 50 to 150 feet below our community. The quality of our groundwater supply is very good. Most of our water is delivered from groundwater wells to our homes with minimal treatment.

THE STORM DRAIN SYSTEM

In the winter of 1955-56, record floods caused millions of dollars in damage to residences and businesses in Fresno and Clovis. In response, voters created the Fresno Metropolitan Flood Control District to provide effective solutions to flooding and drainage problems.

Today, the District's local storm drain system consists of more than 375 miles of underground **pipelines** and some 134 **ponding basins**. The storm drain system prevents flooding by draining runoff from streets and **gutters** down **storm drain inlets**, through pipelines to ponding basins, canals, creeks, and the San Joaquin River (Figure TG-3).

Most of the District's storm drains carry runoff to ponding basins, where the water percolates into the groundwater aquifer. The percolated water replaces
the water pumped out of the aquifer for drinking water and industrial and agricultural uses. Research has shown that contaminants of greatest concern in storm water stay in the **sediments** on the basins' surface. They do not move through the soil and therefore are not a risk to groundwater quality. Sediments in the basins are routinely monitored and removed to prevent contaminants from accumulating to levels of concern.

Unlike the drains inside our homes - drains and pipelines from sinks, tubs, washers, and toilets - storm drains do not flow to the **wastewater** treatment plant.

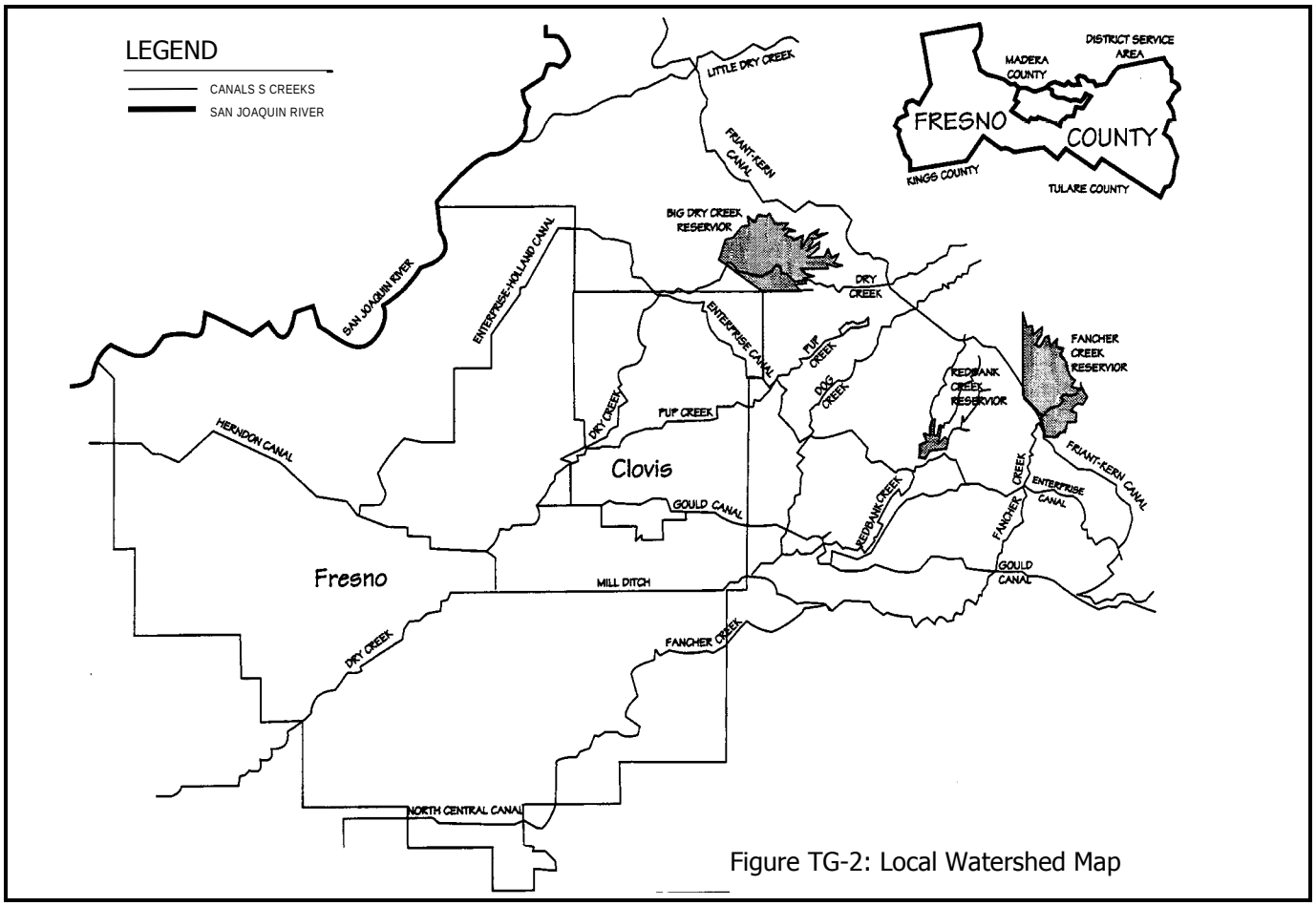


Figure TG-2: Local Watershed Map

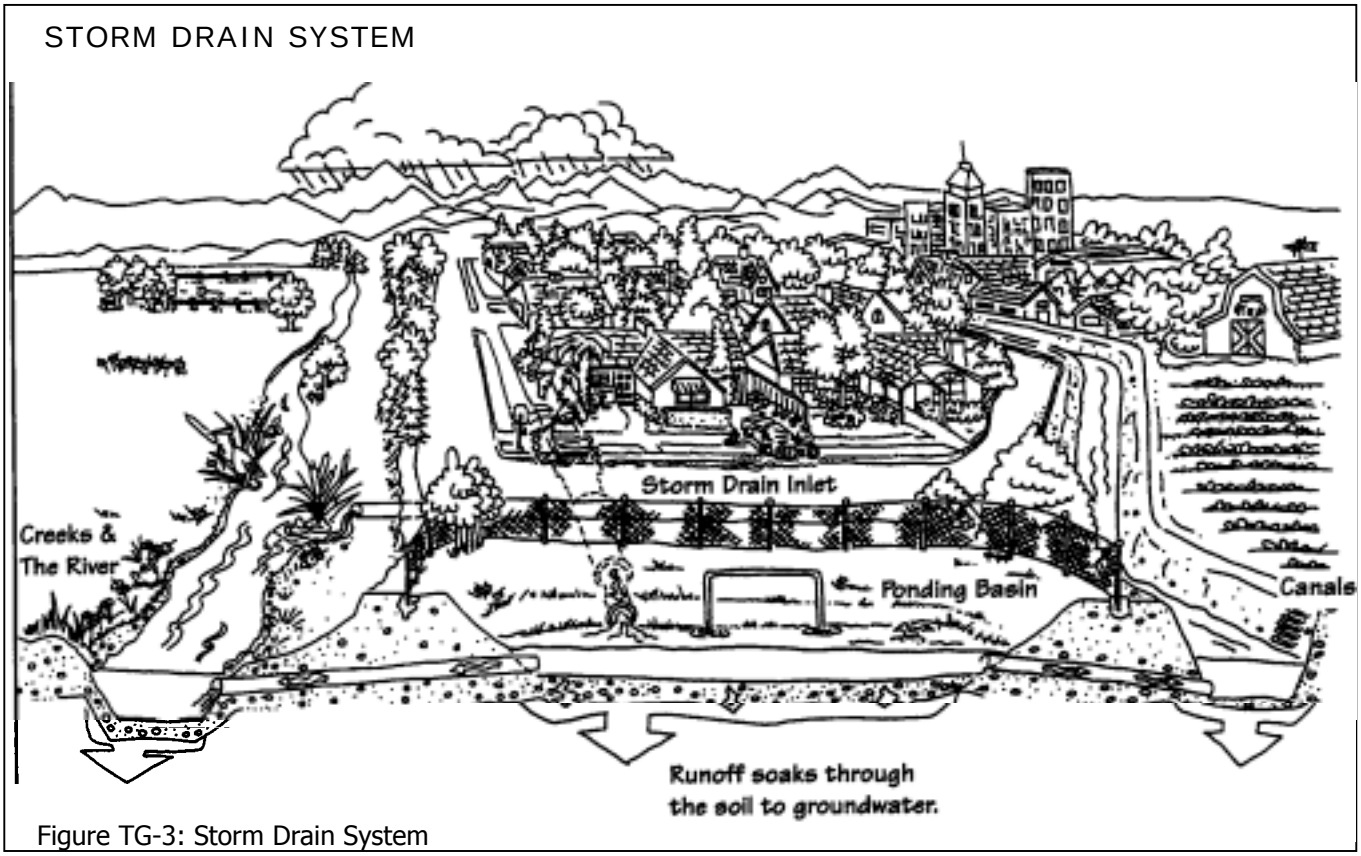


Figure TG-3: Storm Drain System

STORM WATER POLLUTANTS, SOURCES, & ENVIRONMENTAL IMPACTS

There are many ways our daily activities can contribute to storm water pollution. Table TG-1 presents a list of **pollutants** commonly found in urban storm water runoff, the sources of these pollutants, and the impacts the pollution can have on the environment.

Table TG-1. COMMON STORM WATER POLLUTANTS, S0URCES AND IMPACTS

Pollutants	Sources	Impacts
Sediments	Erosion, construction sites, earth moving activities	• bury organisms living on the bottom of waterbodies and cover the spawning beds of fish • reduce the penetration of sunlight (cause **turbidity**) slowing **photosynthesis** in plants, thereby reducing the amount of oxygen in the water and the availability of food for other aquatic organisms
Nutrients	Decaying yard debris, fertilizers, food wastes, human and animal wastes	• cause excessive algae and weed growth; subsequent decay produces odor, taste, and aesthetic problems and reduces oxygen otherwise available for microorganisms and fish
Motor Oil & Petroleum Products	Leaking vehicles, gas stations, repair shops	• oil coats birds' feathers and the fur of riparian mammals causing loss of body heat and poisoning • toxins are lethal or damaging to various organisms, thus affecting the **ecosystem's** balance • oil interferes with the function of gills and blocks oxygen absorption into water • long-term exposures to various toxins have adverse human health effects
Pesticides	Runoff from gardens, and agricultural lands	• toxins are lethal or damaging to algae, **zooplankton**, fish, and other organisms, thus affecting the eco system's balance • long-term exposures to various toxins have adverse human health effects • some pesticides have been known to **bioaccumulate** in the **food chain**, threatening predators
Heavy Metals	Car batteries, brake pads, and exhaust; paint pigments	• metals in water can be very toxic to fish and other wildlife • some metals can bioaccumulate in the food chain, threatening predators • accumulations in stream and lake sediments are lethal or damaging to organisms living on the bottom of the waterbodies
Bacteria/ Pathogens	Human and animal wastes, overflows from sanitary sewers	• cause recreational waters to become unsafe to swim in • cause shellfish beds to become unsafe food sources • create a risk of human illness from drinking contaminated water
Garbage & Debris	Illegal dumping, dead animals, leaky dumpsters, construction, debris, litter	• trash blocking storm drains causes flooding • reduce the recreational value of waterbodies • can harm wildlife, e.g., litter can cause strangulation or entanglement, ingested litter can cause intestinal blockage when wastes decay they deplete the oxygen supply otherwise available for aquatic organisms
Chlorine	Draining swimming pools	• toxic to aquatic organisms, including fish

A LOCAL ECOSYSTEM AND FOOD CHAIN

The contaminants found in storm water runoff can be harmful to wildlife and people (as presented in Table 1). Higher concentrations of toxic materials can kill fish; lower concentrations are often lethal to the aquatic organisms fish eat. Some toxic pollutants are persistent and accumulate in the environment. Some bioaccumulate in the food chain as one organism eats others which have been contaminated. A simplified summary of the local aquatic and riparian ecosystem and food chain follows.

At the base of the food chain (Figure TG-4) are the **producers**. Producers are organisms that carry out photosynthesis to create the organic building blocks of all life. Algae, mosses, and the higher plants are examples of producers, which can range in size from single-celled blue-green algae to an enormous valley oak. Examples of Producers that can be easily observed along the San Joaquin River and at District ponding basins include single- or multi-cell algae found in ponds or slow-moving waters, and other types of plants such as moss, ferns, grasses, shrubs, and trees.

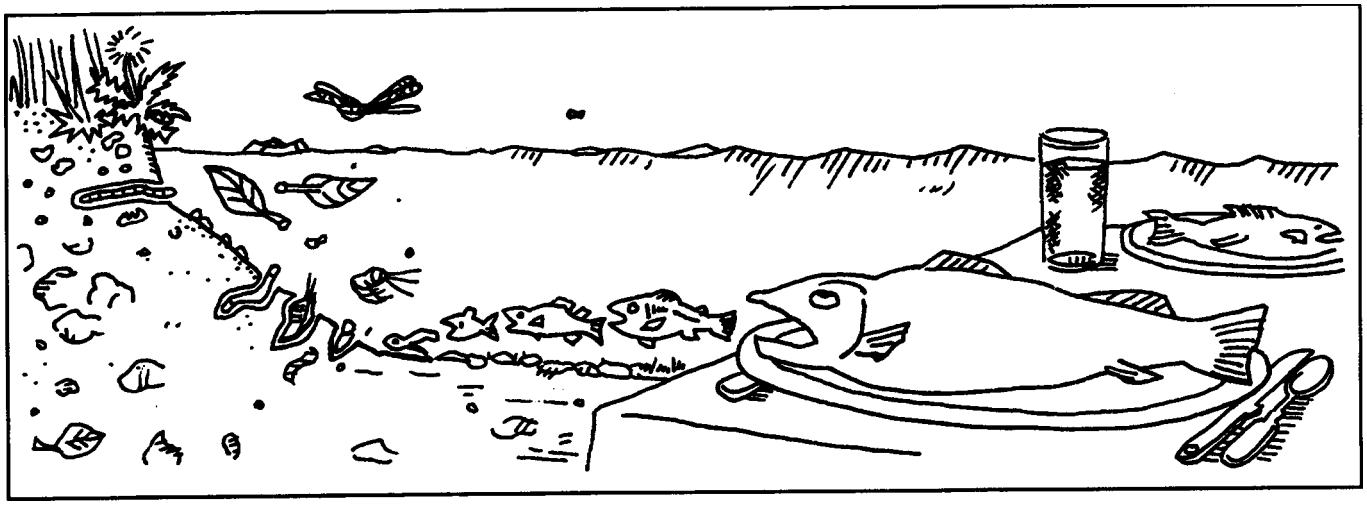


Figure TG-4: Food Chain

The banks of the San Joaquin River and other local waterways are protected by a variety of riparian plants and trees which help stabilize the stream banks and provide habitat for dozens of species of birds and other wildlife. Typical members of the riparian woodland are cottonwood, black willow, valley oak, sycamore, Oregon ash, blackberry, and buttonbush.

Primary consumers are the next level of the food chain. This group includes all plant eaters, or **herbivores**, from microscopic organisms that feed on single-celled algae to large mammals such as deer that feed on grasses and shrubs. In aquatic ecosystems, the primary consumers are usually microscopic floating animals called zooplankton which can be easily observed under a microscope. Examples of zooplankton include protozoans such as paramecium, amoeba, and woodruffia. Another primary consumer living in ponds, streams, and rivers is the water boatman, an insect that "rows" underwater.

Primary consumers in the local **terrestrial** ecosystem include insects such as grasshoppers, katydids, and termites; birds such as California Quail, Mourning Doves, and Cedar Waxwings; and rodents such as ground squirrels, California voles (meadow mice), deer mice, dusky-footed woodrats, pocket gophers, and beavers. California mule deer, a large primary consumer, may be found in local riparian corridors.

Secondary consumers are made up of **omnivores** (plant and meat eaters) and **carnivores** (meat eaters). Careful observers can find aquatic predatory insects in ponds and streams, such as water striders, water scorpions, and the nymphs of dragonflies and damselflies.

The San Joaquin River is home to many species of fish which eat insects, plankton, plant materials, and smaller fish. These include largemouth bass, bluegill, mosquito fish, redear sunfish, channel catfish, and threespine stickleback. Crayfish are also common. Reptiles, such as gopher snakes, and

amphibians, such as salamanders, also inhabit the area. Tadpoles, frogs, and toads are often found in and around local streams and District ponding basins.

Omnivorous and carnivorous mammals living along the San Joaquin River include moles, shrews, bats, opossums, badgers, skunks, weasels, bobcats, mountain lions, foxes, and coyotes. Predatory birds, such as Red-Tailed Hawks and American Kestrels, can often be seen.

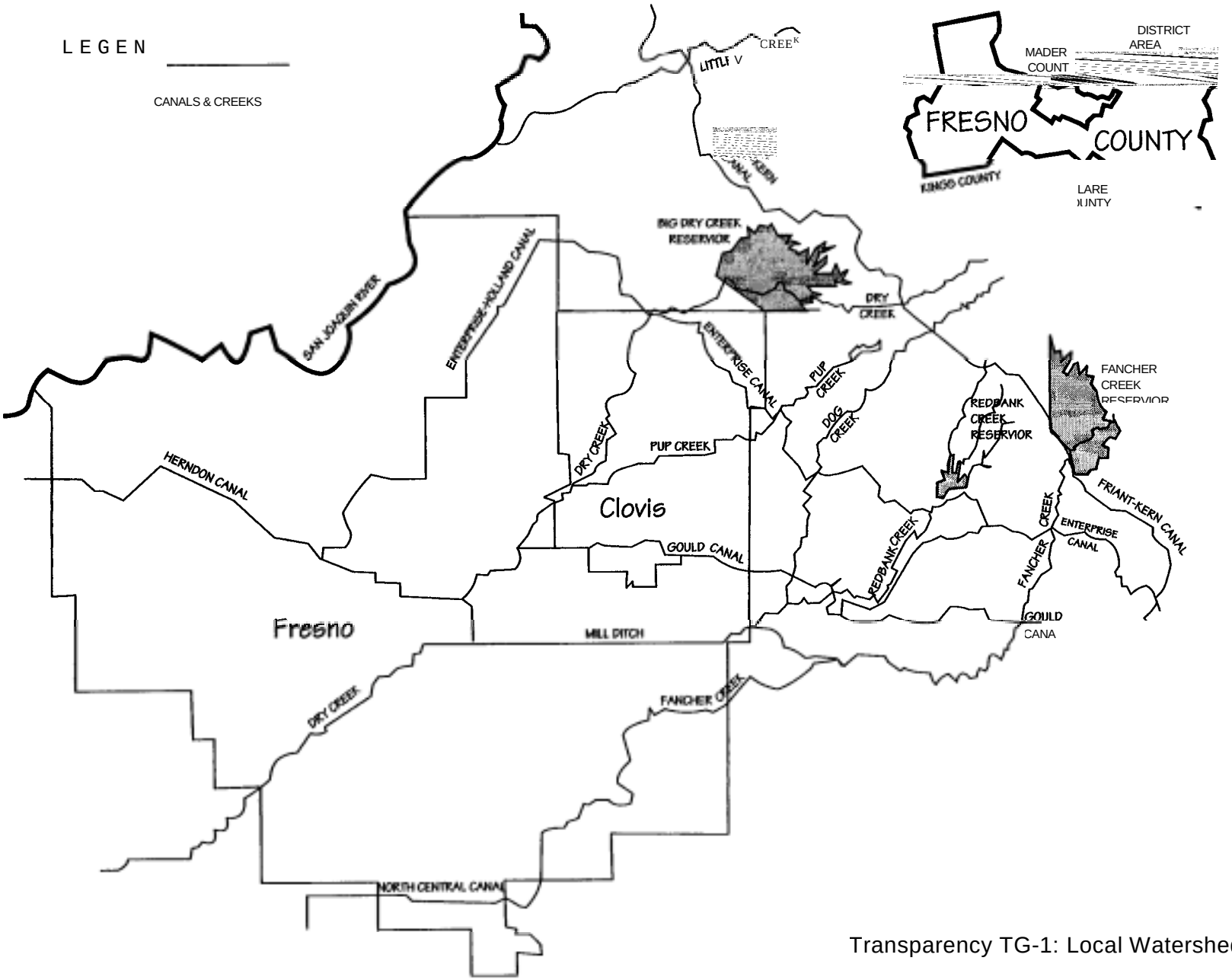
Unfortunately, a number of fish and wildlife species known to occur along the San Joaquin River are currently considered rare, threatened, or endangered, including:

- Kern Brook Lamprey
- California Tiger Salamander
- Southwestern Red-Legged Frog
- San Joaquin Pocket Mouse
- Bald Eagle
- Swainson's Hawk
- Burrowing Owl
- Western Yellow-Billed Cuckoo
- Peregrine Falcon

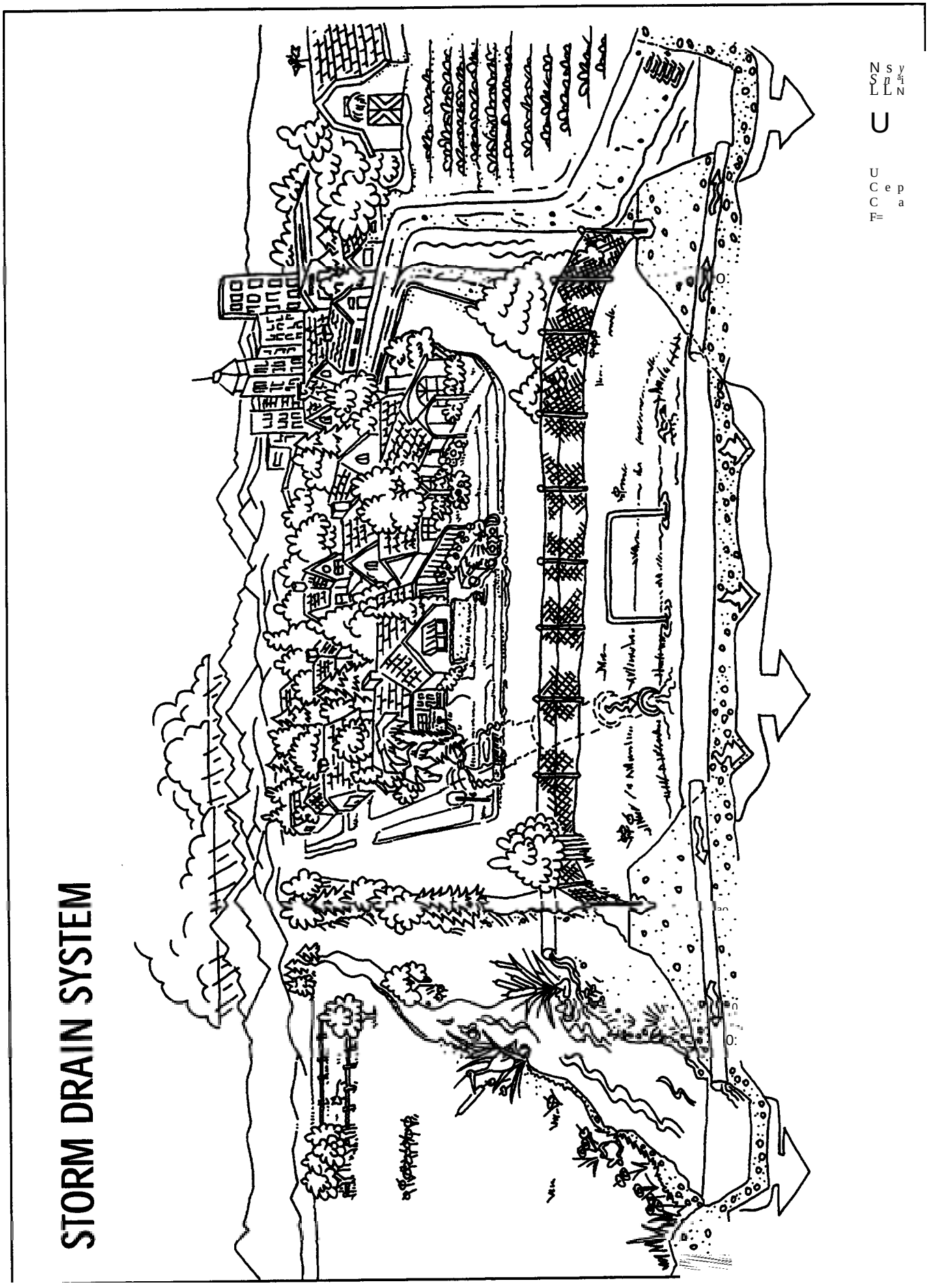
These species and other members of the river community need to be protected from harm as much as is possible.

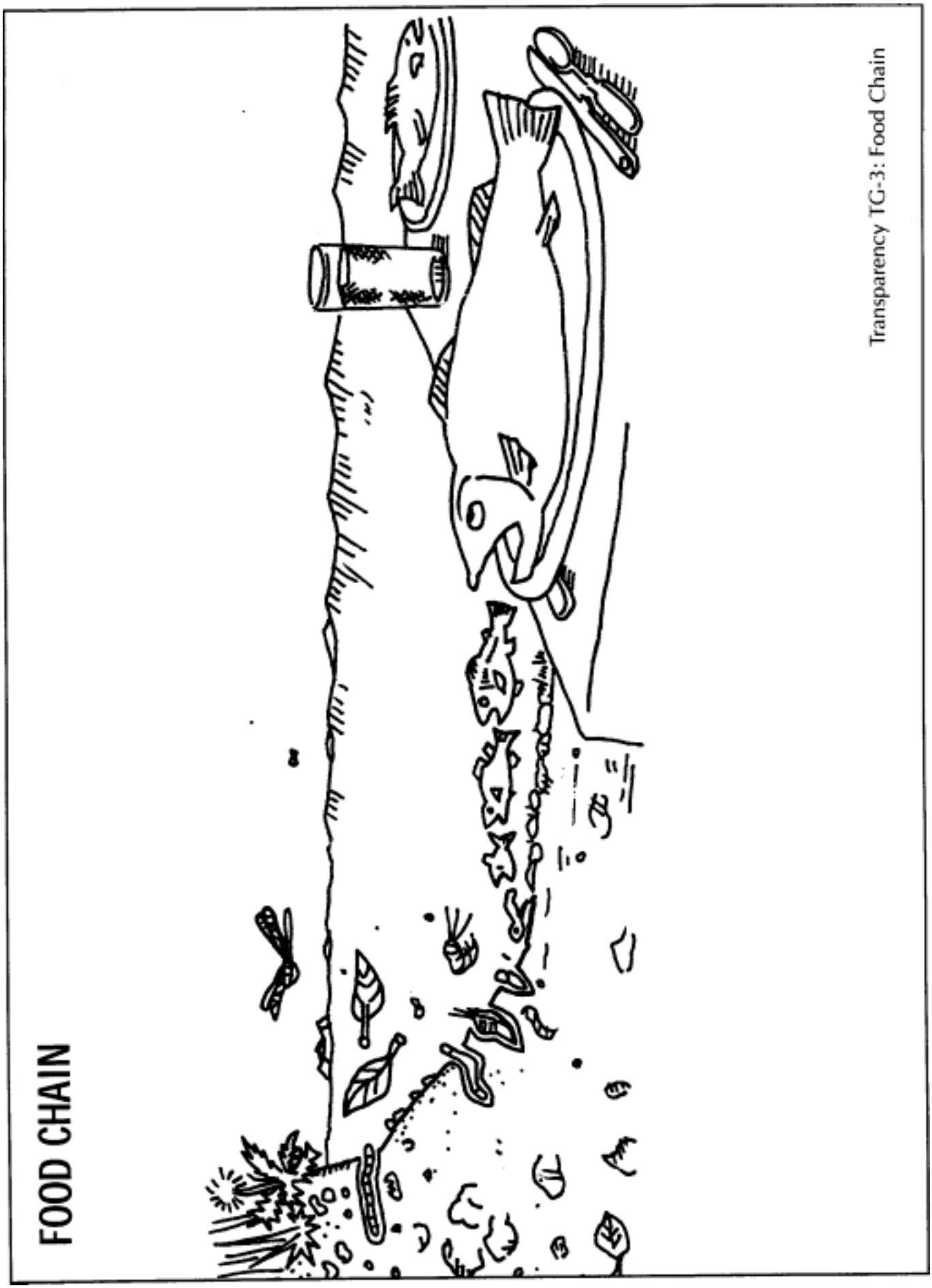
Decomposers - bacteria and fungi - are abundant in local aquatic ecosystems, causing the decay that makes nutrients and minerals available to producers.

Food chains cross-link and intertwine to form complex **food webs**. Further, a food chain may be represented as a **food pyramid**. As energy is transferred up a food chain, much of it is lost as heat; therefore, a much larger amount of potential food energy must be generated by the producers at the bottom of the pyramid, than will eventually be available to be consumed by predators at the top of the pyramid.



Transparency TG-1: Local Watershed Map


STORM DRAIN SYSTEM


FOOD CHAIN
Transparency TG-3: Food Chain