



California Project WET Gazette

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The Once and Future Issue

A New Year is upon us, but the water news may seem like we've returned to the past. Touted in post election media as the 'once and future' Governor, Jerry Brown has returned to the executive helm of California. As Governor thirty years ago, Governor Brown worked to complete the State Water Project his father began to build in the 1950's. But the system had and still has- one troublesome chokepoint: the Sacramento-San Joaquin Delta. Thirty years ago, Governor Brown suffered a major political defeat in the battle to pass a plan to shuttle fresh water from the Sacramento River around the Delta to the pumps of the State Water Project and Federal Central Valley Project on the southern edge of the Delta. Governor Brown returns to office endorsing a similar plan to build a peripheral canal or tunnel recommended by outgoing Governor Schwarzenegger's Bay Delta Conservation Plan (<http://baydeltaconservationplan.com>), which also received a mid-December endorsement from the Obama administration. Needless to say, the current plan has plenty of critics, but resolving the issues surrounding the Delta is vital to the future of California and provides a rich opportunity for educators to embed student understanding of standards and concepts within this major environmental issue- and Project WET activities can help.

Fed by runoff from the northern Sierra Nevada Mountains and the southern Cascades, the Sacramento River flows south to meet the northbound San Joaquin River just south of the city of Sacramento where the Sacramento-San Joaquin Delta is formed. Here the Sacramento and San Joaquin rivers mingle with smaller tributaries and tidal flows to form a 700-mile maze of sloughs and waterways surrounding more than 60 leveed tracts and islands. The rivers' combined fresh water flows roll through the Carquinez Strait, a narrow break in the Coast Range, and into San Francisco Bay's northern arm, forming the San Francisco Bay/Sacramento-San Joaquin Delta Estuary, commonly referred to as the Bay-Delta. It is an *'Incredible Journey'* (p: 161) and the simple inclusion of writing prompts to the Project WET activity of the same name has been a popular way to introduce students to the geography and natural resources of the watershed.

The Bay-Delta forms the largest estuary on the West Coast with more than 738,000 acres. An estuary is a coastal area where fresh water from rivers mixes with ocean water and where salinity (saltiness) is between the extremes of seawater and fresh water. The tributaries, sloughs and islands support more than 750 animal and plant species, including an estimated 80 percent of the state's commercial fishery species living in or migrating through the Delta. Populations of several native fish – including the Delta smelt- have declined because of a combination of entrainment in pumping facilities, poor water quality, limited food supply, lack of habitat and nonnative species that compete for food. The Bay Delta Conservation Plan hopes to restore up to 80,000 acres of tidal marsh, seasonally inundated floodplain and riparian habitat distributed throughout the Delta. Instead of a species-by-species approach, a natural community and habitat conservation plan will provide a more comprehensive approach for protecting environmental resources by addressing impacts to endangered and listed species. *'Salt Marsh*

Players' (p: 99) is a popular activity to reinforce student understanding of habitats, adaptations and the interrelationships of organisms in the environment. The activity can easily be extended to include the Delta issues listed above and have students think about what impact it may have on their salt marsh community- and how this applies to the Delta or other natural communities. *'Capture, Store and Release'* (p: 133) would also be another great activity to help students understand the role of wetland and riparian habitats in an ecosystem like the Delta, as well as *'Humpty Dumpty'* (p: 316) to help students begin to understand the challenges involved in ecosystem restoration projects.

The Sacramento- San Joaquin watershed drains nearly 50 percent of the state's runoff through the Delta. Five highways pass through the Delta, as do three railroads, two deep-water shipping channels, hundreds of natural gas lines and five high-voltage transmission lines. More than half-a-million people call the Delta home, living in 14 cities and towns in five counties. Many other live on the fringe in areas such as Stockton and West Sacramento. The Delta is the embodiment of the Project WET activity *'Sum of the Parts'* (p: 267), an excellent activity that introduces students to *point source* and *non-point source* pollutants and common *best management practices* that are used to reduce or eliminate the flow of pollutants into our waterways. Used in conjunction with a map of their community within the watershed and the activities *'Just Passing Through'* (p: 166), *A-maze-ing Water* (p: 219) and/or *'Rainy-Day Hike'* (p: 186) and students can not only see how communities within the Delta or hundreds of miles upstream can all contribute to the combined flow of pollutants impacting the Delta, but it also provides opportunities for Service Learning projects to locally mitigate the flow.

The Delta is also the hub of California's water distribution system and the largest single drinking water source in the nation, providing drinking water for more than 25 million Californians and irrigating over 7 million acres of farmland that produces up to 45% of the fruits and vegetables grown in the United States through the State Water Project and federal Central Valley Project- and herein lies the crux of the problem. Too much water pulled from the Delta in times of low flow increases the risk of upsetting the balance of freshwater that keeps the saline waters of San Francisco Bay from intruding into the heart of the Delta. Not enough water pumped to meet the need of users increases the use of groundwater as well as the risk of aquifer depletion and subsidence in the San Joaquin Valley- with the latter potentially disrupting water delivery to millions of Californians due to a sinking California Aqueduct. Meanwhile, the ever-present risks associated with earthquake and flooding hover over the region's fragile levee system – putting the hub of the state's water supply distribution at risk of complete shutdown. The Project WET activities *Choices & Preferences* (p: 367) and *'Water Works'* (p: 274) used in conjunction can demonstrate the choices involved in water management- and the difficulty in balancing those choices without a collapse of the interconnected web of water users. *'Get the Groundwater Picture'* (p: 136) does a great job helping students understand the structure of an aquifer as well as the issues surrounding groundwater use and subsidence.

The Bay Delta Conservation Plan is designed to be a comprehensive ecosystem approach that provides the best opportunities to recover fisheries and ensure reliable water supplies. Its aims to separate the water delivery system from Delta freshwater flows, restore thousands of acres of habitat, restore river flows to more natural patterns and address the many other stressors impacting fish populations, such as invasive species, pesticides and ammonia discharges. Critics of the plan include advocates for other water conveyance measures to a greater emphasis on water conservation practices. Our water news blog [Aquaformia](#) is an excellent resource to review the multiple *'Perspectives'* (p: 397) regarding the Delta and fold them into the Project WET activity of the same name. The Project WET guide is loaded with water conservation activities, but I'd recommend *'The Long Haul'* (p: 260), *'Easy Street'* (p: 382) and/or *'Water Concentration'* (p: 407) to look at the interrelationship between the convenience and our water use behaviors. *'Money Down the Drain'* (p: 328) also provides some stunning results for students and educators alike and leads to a great discussion of the relationship between the cost of water and water use behaviors- contact your local water provider to find out the going rate for water supplied to your school.

The New Year will be an interesting time in the realm of water resources as well as politics in general. I've tried to load the *'Websites of Interest'* section of this Gazette with links that I hope will

provide you with good sources of background information on our major California water infrastructure projects, multiple perspectives on Delta issues and the larger web of California water issues. Many of the links also provide additional material that can be integrated into your favorite Project WET activities to help students better understand Delta issues. A large portion of the text of this article is from our Water Education Foundation *'The Layperson's Guide to the Delta'*, which is part of a series of Layperson's Guides that explore pertinent water issues. Please see the *'Topics'* and *'Subject Area'* appendices of your Project WET guide for additional activities that address Delta issues or feel free to contact me for suggestions at: projectwet@watereducation.org.

WEBSITES OF INTEREST

California's Water Crisis

<http://aquaformia.com/californias-water-crisis>

This 2007 article by the Aquaformia 'Aqua Blog Maven' provides background information on California water issues, including the factors putting stress on California's water resources and options for meeting the challenges ahead. You can also find current articles and viewpoints on Delta issues by scrolling down to the news article archive folders or clicking: <http://aquaformia.com/archives/category/delta-issues>

California's Water: An LAO Primer

http://www.lao.ca.gov/2008/rsrc/water_primer/water_primer_102208.pdf

California's water delivery system is facing a series of challenges due in part to a combination of increasingly variable weather conditions, legal requirements, and system operation and conveyance constraints. These challenges affect water availability, reliability, and delivery. This report of the Legislative Analyst's Office (LAO) provides, through a "quick reference" document relying heavily on charts to present information, a snapshot of water in California.

Water Plan For The 21st Century

<http://www.jerrybrown.org/water-plan-21st-century>

California's water is threatened as never before. Climate change, invasive species, toxic chemicals, dumping and just plain inefficiency threaten California's water supplies. Ensuring safe and sufficient water supplies for the 21st century requires significant investments in our water infrastructure and natural ecosystems. The goal must be to maintain and enhance water supplies for all Californians and take action to restore the Bay-Delta and meet California's true water needs.

California Water Impact Network

<http://www.c-win.org/protecting-delta.html>

C-WIN is a non-profit, tax exempt California Corporation that advocates for environmentally sensitive and equitable use of California's water, including in-stream uses. The San Francisco Bay/Sacramento-San Joaquin River Delta endures many threats to economic sectors relying on its water, fish and wildlife. Despite these continuing threats, there are also solutions to the Delta's problems. C-WIN here provides links to descriptions of the threats posed and solutions for the Delta.

The State Water Contractors

<http://www.swc.org/isswp.aspx>

The State Water Contractors purchase water from the California State Water Project. It is a multi-faceted system that includes reservoirs, lakes, storage tanks, canals, tunnels, pipelines and pumping and power plants that capture, store, and convey water to 27 public agencies. Almost any issue that affects the State Water Project's operations directly affects members of the State Water Contractors and the 25 million residents, businesses and farms that they serve.

The Central Valley Project

http://www.usbr.gov/projects/Project.jsp?proj_Name=Central+Valley+Project

The Central Valley Project was built primarily to protect the Central Valley from crippling water shortages and menacing floods, but the CVP also improves Sacramento River navigation, serves farms, homes, and industry in California's Central Valley as well as major urban centers in the San Francisco

Bay Area; it is also the primary source of water for much of California's wetlands. This website includes photos and information on CVP structures and links to the history of the project.

The Mid-Pacific Region

<http://www.usbr.gov/mp/aboutus.html>

The Bureau of Reclamation, Mid-Pacific Region was created by the Secretary of the Interior in 1942 and is best known for the massive Central Valley Project (CVP) built to tame the flood waters and irrigate the semi-arid acreage of California's vast Central Valley, the CVP grew over the last 50 years to become one of the largest water storage and transport systems in the world.

California State Water Project Overview

<http://www.water.ca.gov/swp>

Have you ever wondered where the water you drink and use comes from? To reach many of us, water must travel long distances through complex delivery systems such as the California State Water Project. Planned, designed, constructed and now operated and maintained by the California Department of Water Resources, this unique facility provides water supplies for 25 million Californians and 750,000 acres of irrigated farmland. The SWP is the nation's largest state-built water and power development and conveyance system.

State Water Project Slideshow

<http://aquaforia.com/state-water-project-slideshow>

This full-color slideshow highlights the historical value of the SWP to the daily lives of Californians and provides great material for use with '*Incredible Journey*' (p: 161), '*Choices & Preferences*' (p: 367) or '*Wet Work Shuffle*' (p: 360). The slideshow is packed full of historical photographs and images of the facilities that comprise the entire system. Web links are included throughout each section to help readers explore each subject further. Copies of the slideshow are available on CD through the Water Education Foundation in PDF format for \$25 each. Please contact the Foundation at (916) 444-6240 to order a copy.

U.S. Army Corps of Engineers

<http://www.spk.usace.army.mil/projects/civil/Delta/Index.html>

The Sacramento-San Joaquin Delta has a vital and highly complex role in the California ecosystem. The U.S. Army Corps of Engineers shares responsibility in this complex issue with a host of local, state and other Federal stakeholders. The Delta Initiatives Matrix is a tool developed by the Corps to assist in tracking the multiple ongoing planning efforts in the Delta. The matrix lists projects and studies that could have a direct or indirect influence to Corps initiatives, as well as pertinent references and resources. This product is a living document that is frequently updated to reflect new and changing information.

Bay Model History

http://www.spn.usace.army.mil/bmvc/bmjourney/the_model/history.html

The U.S. Army Corps of Engineers constructed the San Francisco Bay Model in 1957 to understand how the water flows in the Bay. The hydraulic model, the largest of its kind, was used as a scientific research tool from 1958-2000 to evaluate circulation and flow characteristics of the water within the estuary system associated with the geometry or shape of the Bay and related waterways. The research department of the Bay Model was closed in 2000, but the model continues to operate as a public education center.

Delta Subsidence in California

<http://pubs.usgs.gov/fs/2000/fs00500/pdf/fs00500.pdf>

The Sacramento-San Joaquin River Delta of California once was a great tidal freshwater marsh blanketed by peat and peaty alluvium. Although the Delta is now an exceptionally rich agricultural area, its unique value is as a source of freshwater for the rest of the State. This US Geological Survey Fact Sheet contains superb information on the historical and present structure of the Delta and integrates well with the Project WET activities '*Just Passing Through*' (p: 166) and '*Capture, Store and Release*' (p: 133).

California's Central Valley Groundwater Study

<http://pubs.usgs.gov/fs/2009/3057>

The U.S. Geological Survey (USGS) has released results from a study on the largest water reservoir in the State of California, the Central Valley groundwater system. Since about 1960, groundwater has been

depleted by almost 60 million acre-feet, which is, on average, enough to supply every resident of California with water for 8 years. Tools and information can be used to help manage the Central Valley aquifer system, an important State and national resource. This US Geological Survey Fact Sheet works well with the Project WET activity '*Get the Groundwater Picture*' (p: 136).

USGS Science Supports Decision Making

<http://pubs.usgs.gov/fs/2010/3032/>

U.S. Geological Survey (USGS) scientists are in the forefront of the effort to understand what causes changes in the hydrology, the ecology and the water quality of the Sacramento-San Joaquin River Delta and the San Francisco Bay estuary. Their scientific findings play a crucial role in how agencies manage the Bay-Delta on a daily basis.

Water Facts & Fun

<http://www.water.ca.gov/education/wffcatalog.cfm>

Lots of free materials for California educators, including '*The California Water Works*' that has a colorful comic book character, Professor Goodwater, leading students through the water cycle, showing them how water is delivered through California's built and natural water systems to the end users. Guidelines for water conservation are provided as well.

Flood of 1955 Interviews

<http://www.sutterbutteflood.org/podcasts.html>

The destructive power of water is on full display during flood events and one of the worst in recent history was the Christmas Eve flood of 1955. The Sutter Butte Flood Control Agency provides free podcasts of the radio series 'What About the Flood?' - a 1956 radio series in which survivors shared their harrowing accounts of the night Sutter County flooded after a levee broke apart in Yuba City. The 8 interviews of this 38 part series are available at the website above. The Project WET activities '*Dust Bowls and Failed Levees*' (p: 303) or '*Nature Rules*' (p: 262) for ready-made for integrating the podcasts.

If you would like more information on Project WET please contact Brian Brown, California Project WET Coordinator at: projectwet@watereducation.org or (916) 444-6240.

Check our website www.watereducation.org and/or contact us for updates.