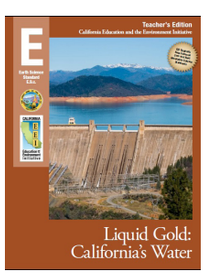
California Education and the Environment Initiative

The EEI Curriculum cohesively integrates science and engineering practices (SEPs), content (disciplinary core ideas/DCIs), and crosscutting concepts (CCs) within its lesson procedures. This preliminary analysis intentionally teases apart the individual SEPs, DCIs, and CCs as a means of correlating the EEI unit with specific performance expectations; however, the EEI lessons weave these components back together.

High School Earth Science

E.9.c – Liquid Gold: California's Water

"Liquid Gold: California's Water" examines one of the major global challenges that humanity faces, the need for supplies of clean water. The unit explores how engineering and water management practices are being used to address California's growing need for water and considers the resulting changes in the physical environment. These changes can ultimately affect ecosystems, their populations, and overall biodiversity. By exploring issues related to water, this unit shows how the sustainability of human societies and the biodiversity that supports them require responsible management of natural resources. This provides a context within which students can consider the contributions that scientists and engineers can make by developing technologies that preclude or limit ecosystem degradation.



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Next Generation Science Standards* Correlation with the California Education and the Environment Initiative (EEI) Curriculum

The EEI Curriculum is a great choice for transitioning to NGSS and contributes toward achievement of the performance expectations for the standards reflected in the Summary Chart below: HS-ESS3 Earth and Human Activity; HS-LS2 Ecosystems: Interactions, Energy, and Dynamics; HS-LS4 Biological Evolution: Unity and Diversity; and HS-ETS1 Engineering Design. Each EEI unit highlights a small number of performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts. Therefore, the EEI units contribute to students' overall achievement of the performance expectations by the end of a school year, where they will have had multiple opportunities to engage in all appropriate science and engineering practices, disciplinary core ideas, and crosscutting concepts. While EEI was designed to teach the 1998 California science standards to mastery, it reflects the real world interconnections in science and already incorporates many of the paradigm shifts reflected in the NGSS. To learn more about how EEI supports NGSS, visit http://californiaeei.org/NGSSGuides/.

Correlation Chart Key

SEP (Science and Engineering Practices)
DCI (Disciplinary Core Ideas)
CC (Crosscutting Concepts)

	Next Generation Science Standards											
	HS-ESS3			HS-LS2			HS-LS4			HS-ETS1		
California Connection				✓	✓		✓		✓	✓	✓	✓
Lesson 1 – Identify elements of California's water management and use issues by analyzing a case study.	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓
Lesson 2 – Analyze California's hydrologic regions and identify the state's surface and groundwater sources.	✓	✓	✓	✓		✓	✓		✓	✓	✓	✓
Lesson 3 – Trace how water in California is moved from its origin to areas where it is used via local and state water projects.	✓	✓	✓	✓		✓	✓		✓	✓	✓	✓
Lesson 4 – Discuss case studies about the effect of water transfers on ecosystems and describe factors in water allocation decisions.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Lesson 5 – Evaluate the contributions of the scientific community to the management of water in California.	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
Traditional Unit Assessment	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Alternative Unit Assessment	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	SEP	DCI	CC	SEP	DCI	CC	SEP	DCI	CC	SEP	DCI	CC

DRAFT

EEI Unit E.9.c. Liquid Gold

Disciplinary Core Ideas Supported by this EEI Unit

HS-ESS3 Earth and Human Activity
HS-LS2 Ecosystems: Interactions, Energy, and Dynamics
HS-LS4 Biological Evolution: Unity and Diversity
HS-ETS1 Engineering Design

Performance Expectations	Suggestions for Using the EEI Unit to Support NGSS
HS-ESS3-1: Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.	Use the unit to help students discover how the availability of fresh water has caused humans to build aqueducts, dams, levees, and canals to move water from areas with a high concentration to areas with little naturally occurring water in order to meet human needs.
HS-ESS3-3: Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.	Use the unit to help prepare students to create a computational simulation by having them obtain, study, and interpret data connecting the effects of salinity (geosphere) and species loss (biosphere) to human activity.
HS-LS2-6: Evaluate the claims, evidence and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.	Use the unit to give students multiple opportunities to examine and discuss the history of water use in California, solutions that have been implemented to meet those human needs, and the impacts those decisions have had on organisms and ecosystems.
HS-LS4-5: Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.	Use the unit to help students investigate how environmental changes caused by distributing water to areas of human need have had an adverse effect on species (salmon and smelt) in California's Sacramento-San Joaquin Delta.
HS-ETS1-1: Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.	Use the unit to help students recognize that the availability of fresh water in various areas of California has caused humans to build aqueducts, dams, levees, and canals to move water from areas with a high concentration to areas with little naturally occurring water in order to meet human needs.
HS-ETS1-3: Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.	Use the unit to have students consider the positive and negative effects of past, current, and potential future solutions to having an adequate and sustainable supply of fresh water in California.

Science and Engineering Practices (SEPs)	Suggestions for Using EEI to Support SEPs	Disciplinary Core Ideas (DCIs)	Suggestions for Using EEI to Support DCIs	Crosscutting Concepts (CCs)	Suggestions for Using EEI to Support CCs
Using mathematics and computational thinking (HS-ESS3-3)	Use the unit to have students review mathematical information depicting California's water supply and water use (Lesson 2). Have students interpret a water chart showing California's "water budget" and predict how water needs can be met in the year 2030 (Lesson 5).	**ESS3.A: Natural Resources:** Resource availability has guided the development of human society. (HS-ESS-3-1)	Use the unit to help students recognize that the availability of freshwater in California has had a significant impact on the development of our society (Lessons 1, 2, and 3).	**Cause and effect (HS-LS4-5, HS-ESS3-1)**	Use the unit to help students investigate the effect uneven distribution of water in California has had on large engineering projects, such as the design and construction of dams, levees, and aqueducts (Lessons 1, 2, and 3). Have students identify the effects that the water distribution system in California has had on agriculture and species survival (Lesson 4).

Science and Engineering Practices (SEPs)	Suggestions for Using EEI to Support SEPs	Disciplinary Core Ideas (DCIs)	Suggestions for Using EEI to Support DCIs	Crosscutting Concepts (CCs)	Suggestions for Using EEI to Support CCs
Constructing explanations and designing solutions (HS-ESS3-1, HS-ETS1-3) **Engaging in argument from evidence (HS-LS2-6, HS-LS4-5)**	Use the unit to help students recognize that over the past 100 years humans have had to transfer water great distances to meet demand, often through government projects (Lessons 1, 2, and 3). Have students examine California's distinct water regions and how the movement of water from region to region requires a complex system that incorporates the engineering and construction of dams, levees, and aqueducts (Lessons 1, 2, and 3). Use the unit to have students analyze evidence that historical episodes in California have, over time, resulted in the water management system now used in California (Lesson 1). Have students use data and models to help them establish that California's water distribution system is based on the water cycle, the influence of land and ocean on weather patterns, and discover that those factors distribute precipitation unevenly throughout the state (Lesson 2). Give students examples of the California water projects that were created out of a need to move and store water great distances to meet human demand (Lesson 3). Provide students with information connecting the water management system in California to its adverse effects on soil salinity levels and the Delta Smelt population (Lesson 4). Ask students to analyze available information and make judgments, based on evidence, on current	**ESS3.C: Human Impacts on Earth Systems:** The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources. (HS-ESS3-3) **LS2.C: Ecosystem Dynamics, Functioning, and Resilience:** A complex set of interactions within an ecosystem can keep its numbers and types of organisms relatively constant over long periods of time under stable conditions. If a modest biological or physical disturbance to an ecosystem occurs, it may return to its more or less original status, as opposed to becoming a very different ecosystem. Extreme fluctuations in conditions or the size of any population, however, can challenge the functioning of ecosystems in terms of resources and habitat availability. (HS-LS2-6) **LS4.C: Adaptation:** Changes in the physical environment, whether naturally occurring or human induced, have tus contributed to the expansion of some species, the emergence of new distinct species as populations diverge under different conditions, and the decline – and sometimes the extinction – of some species. (HS-LS4-5)	Use the unit to have students study how human society affects Earth's systems, and the technologies and social regulations that affect those impacts (Lessons 1, 3, and 4). Use the unit to have students analyze how human distribution of water disturbs the health and population of the Delta Smelt and can lead to unhealthy levels of certain elements in soil and in groundwater (Lesson 4). Use the unit to have students evaluate how changes in freshwater availability have contributed to changes in biodiversity within a natural system, including a severe decline in some species populations (Lesson 4).	**Stability and Change (HS-LS2-6, HS-ESS3-3)** **Influence of engineering, technology, and science on society and the natural world (HS-ETS1-3, HS-ESS3-3)**	Use the unit to have students study how changes in the stability of arid agricultural regions changes over time, and discover that the stability of populations native species of plants and animals change as humans interact with their environment (Lesson 4). Use the unit to help students recognize how humans use science, engineering, and technology to help manage the water needs of both humans and the environment (Lessons 2, 3, 4 and 5).

Science and Engineering Practices (SEPs)	Suggestions for Using EEI to Support (SEPs)	Disciplinary Core Ideas (DCIs)	Suggestions for Using EEI to Support DCIs	Crosscutting Concepts (CCs)	Suggestions for Using EEI to Support CCs
	and future decisions California has to make in order to balance human water needs and its impact on the environment (Lesson 5).	Species become extinct because they can no longer survive ad reproduce in their altered environment. If members cannot adjust to change that is too fast or drastic, the opportunity for the species' evolution is lost. (HS-LS4-5)			
		ETS1.A: Defining and Delimiting Engineering Problems: Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them. (HS-ETS1-1)	Use the unit to allow students to obtain, define, and evaluate requirements set by society related to moving and obtaining fresh water to meet human needs (Lessons 1 and 3).		
		Humanity faces major global challenges today, such as the need for supplies of clean water and food or for energy sources that minimize pollution, which can be addressed through engineering. These global challenges also may have manifestations in local communities. (HS-ETS1-1)			
		ETS1.B: Developing Possible Solutions: When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. (HS-ETS1-3)	Use this unit to have students consider constraints of engineered water transfer solutions, such as cost, safety, local considerations, and the potential effects on natural systems (Lessons 4 and 5).		