Watershed Explorers Program

2019-2020 Program Summary

Solano RCD is grateful to the program funders:

Solano County Water Agency
Solano County and All City Jurisdictions
Beverage Container Recycling City/County Payment Program
CalRecycle Used Oil Recycling Program
Vallejo Water Conservation Program
Vallejo Flood and Wastewater District
Fairfield-Suisun Sewer District
Potrero Hills Landfill

Fall field trip component funded by the Habitat Conservation Fund administered through Greater Vallejo Recreation District

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PROGRAM OVERVIEW

The Watershed Explorers Program engages third grade students in exploring their local watershed through in-class lessons provided by their classroom teacher, a water lesson facilitated by the Solano RCD through the School Water Education Program, and a field trip to a local park or open space. Concepts are linked to the *Next Generation Science Standards for California Schools.* In both lessons and on the field trip, students are prompted to use exploration routines to develop a mindset of curiosity, support development of scientific language and use of tools, and to directly engage with their peers to build their social and communication skills.

In March 2020, in-person lessons and field trips were cancelled as schools closed in response to COVID-19. Solano RCD created a Watershed Explorers Program distant learning online page with digital activities, videos and additional resources for topic extensions.

GOALS AND OBJECTIVES

The primary program goal of the Watershed Explorers Program is to help students develop an awareness of the outdoor, natural world. Specifically, students obtain, evaluate, and communicate information about how drought and runoff pollution influences living things in a watershed and leave the program able to:

- Describe the path water takes from source to sink;
- Understand the role drought plays and practice ways to conserve water;
- Recognize how stormwater influences our watersheds and the impacts of motor oil and trash;
- Understand how to mitigate the impacts of their own and their family's behaviors on the local watershed by becoming stewards of our county waterways, including how to implement the "Triple R" (reduce, reuse, recycle) messaging.

AUDIENCE

2020 Scheduled Participants

- Benicia – 4 schools comprising 13 classes of 321 students – no spring field trip
- Vallejo – 5 schools comprising 14 classes of 329 students – no spring field trip
- Fairfield – 3 schools comprising 13 classes of 315 students and 76 adults
- Suisun – 2 school comprising 9 classes of 200 students and 39 adults
- Vacaville – 4 schools comprising 10 classes of 252 students – no spring field trip
- Dixon – 3 schools comprising 10 classes of 253 students and 26 adults
- Rio Vista – 1 school comprising 3 classes of 72 students a – no spring field trip
- Travis AFB – 1 school comprising 3 classes of 84 students and 13 adults
- Unincorporated - 1 school comprising 3 classes of 75 students and 10 adults

Registered for the program were 24 schools, 78 classes with 1,901 students. 41% of all Solano County 3rd grade classes enrolled in the program. Due to COVID-19, 11 field trips with 852 students and 164 chaperones from 35 classes actually participated.

School Name	Classes	Students	Field Trip Site	Spring Trip Date
Dixon				
Anderson Elementary	3	75	Pond C	Tues. January 28th*
Dixon Montessori	4	103	Pond C	Thu. February 6th* Fri. February 7th*
Gretchen Higgins	3	75	Valley Glen Pond A	Thu. April 16th
Fairfield/Unincorporated				
KI Jones	6	126	Rockville Hills	Mon. March 2nd* Tues. March 3rd*
Laurel Creek	3	81	Rockville Hills	Thu. March 5th*
Nelda Mundy Elementary	4	108	Rockville Hills	Tues. March 10th*
Tolenas	3	75	Rockville Hills	Thu. February 20th*
Suisun				
Crescent Elementary	4	100	Rockville Hills	Thu. February 27th*
Suisun Elementary	5	100	Rockville Hills	Fri. March 6th*
Travis				
Scandia Elementary	3	84	Rockville Hills	Mon. March 9th*
Rio Vista				
D.H. White Elementary	3	72	Sandy Beach	Mon. March 30th
Vacaville				
Edwin Markham Elementary	3	72	Lagoon Valley	Fri. April 3rd
Hemlock Elementary	3	74	Lagoon Valley	Thu. March 26th
Kairos Public School Academy	2	50	Lagoon Valley	Thu. April 2nd
Orchard Elementary	2	56	Lagoon Valley	Tues. March 31st
Benicia				
Joe Henderson Elementary	4	96	Glen Cove/Benicia SRA	Tue. April 21st
Mary Farmar Elementary	3	78	Glen Cove/Benicia SRA	Wed. April 22nd
Matthew Turner Elementary	3	72	Glen Cove/Benicia SRA	Thu. April 30th
Robert Semple Elementary	3	75	Glen Cove/Benicia SRA	Thu. April 23rd
Vallejo				
Cooper Elementary	3	66	Glen Cove/Benicia SRA	Tue. May 5th
Highland Elementary	3	75	Glen Cove/Benicia SRA	Fri. May 1st
Patterson Elementary	2	50	Glen Cove/Benicia SRA	Fri. May 8th
Pennycook Elementary	4	90	Glen Cove/Benicia SRA	Mon. April 27th
Wardlaw Elementary	2	48	Glen Cove/Benicia SRA	Fri. April 24th
Planned Classes:	**78**		**Planned Students:**	**1901**
Actual Participating Classes:	**35**		**Actual Participating Students:**	**852**

Table 1. Program participation by school. Actual field trips that occurred are indicated with an asterisk.

Fall Phenology Component
804 students from 33 classes of the Watershed Explorers Program participated in the fall phenology field trip. Participating students came from across all seven cities in the County, each visiting their respective city's park or open space. These students had the opportunity to compare and contrast environmental variances within the parks from fall to spring as well as document the different phenophases, or stages they observed. The student-collected data is submitted to the USA National Phenology Network (USPN) where it is utilized to better understand how plants, animals, and ecosystems respond to changes in the climate locally, regionally, and nationally.

METHODOLOGY

Teacher-Led Activities

Participants receive a Watershed Explorers Student Journal, which contains activities to complete prior to the RCD-facilitated lesson and field trip. Classroom teachers receive preparatory information in a Watershed Explorers Teachers Guide and are able to use this resource to lead students through completing the following activities.

What Is A Watershed Explorer? Students hypothesize what a watershed explorer looks like and what they might do. They consider what they may bring in their backpack and what they may look for. Students use words and drawings to express their ideas. At the end of the program, students repeat this activity with the hope that they draw themselves and understand that anyone can become a watershed explorer.

What Is Phenology? This activity introduces the concept of phenology by having students make inferences about a deciduous tree that is changing throughout the seasons. Teachers introduce observation tools that are used throughout the program, including *I notice, I wonder, It reminds me of.* These tools are adapted from the Lawrence Hall of Science BEETLES Program.

Fun with Phenology. Students connect their personal experiences to phenological events by playing a bingo-inspired game. Students share, discuss, and record various natural events that happen during specific seasons. The goal of this activity is to have students apply their own experience to the concept of phenology to understand why it is important for scientists to track phenological events.

How Are You Connected To Water? This activity summarizes the water cycle by having students imagine that they are a drop of water traveling from the clouds, into creeks, rivers, and oceans. Drought, storm drains and stormwater pollution are key components of this activity. Students are asked to use words and drawings to show the path that their unique water droplet takes after it hits the ground.

How Much Water Do You Use? Students log their daily water use in gallons, and look for ways that they can conserve water wherever they are. The term drought is introduced and explained to further help students understand why it's important to be water conscientious in California.

How Do Watersheds Work? Students model and observe how a watershed works by using a crumpled piece of paper as their landscape and a spray bottle to represent rain.

What's In My Watershed? Students explore their campus and look for evidence that their school is part of a watershed. Teachers help students connect stormwater pollution and drought impacts on their local watershed.

School Water Education Program – Water Lesson

With support from the Solano RCD's School Water Education Program, a Solano RCD educator provides a 50-minute presentation for each enrolled class featuring where students' drinking water comes from, where stormwater goes, and ways they can conserve water. Students use maps provided by the Solano County Water Agency to discover how Solano County drinking water travels to their home and how they can conserve that water. Students see the movement of water pollution while using a hands-on, three-dimensional non-point source watershed model (EnviroScape). As part of this activity, students learn the key differences between sewer and stormwater pathways.

Field Trip Components

When students arrive on the field trip, they are outfitted with the equipment they'll need to investigate the landscape and divided into small groups. Guided by program educators, students use their journals and participate in these hands-on activities.

Storm Drain Model

Description: Students observe a storm drain model demonstration by creating an "oil spill" and then following the path of the contaminated water. Students discuss the significance of properly disposing used oil, and watch their program leader dump "oil" in a recycling container. ***Desired Outcome:*** Students bring their student journal home and share with their parents where they can discard used motor oil.

Watershed Drawing

Description: Students model the movement of pollution (e.g., oil and litter) through a watershed; from streets, to storm drains, out to creeks, and oceans. The students verbally explain their drawings to the group. ***Desired Outcome:*** Students tie key watershed and stormwater pollution concepts together to deepen their knowledge.

Reduce, Reuse & Recycle (RRR)

Description: Educators talk to students about RRR concepts, using student lunches as tangible examples of reusable items and the importance of recycling. Each student journal includes a color-it-yourself CRV page comic featuring Petrolia the Used Oil Avenger - *Petrolia and the Case of the CRV Refund* to reiterate that many cans and bottles can be exchanged for cash. Classes are invited to participate in the WE! Recycle Challenge by collecting recyclables in their class for a month and turning them in at a CRV Recycling Center. ***Desired Outcome:*** Students understand the significance of the RRR message and begin discarding trash responsibly while also engaging in the California Beverage Container recycling program.

Plant and Animal Phenology

Description: As a group and individually, students observe a plant or animal to help them deepen their observation skills and put what they observe into context with the current season. Students make predictions about how the characteristics of the plant (e.g., number of flower buds) or animal (e.g., nesting behavior) will change over time, and how drought may affect these organisms and their watershed. Students are encouraged to come back with their families to check if their predictions are accurate. ***Desired Outcome:*** Students are able to identify phenological characteristics of plant and animal behaviors, and are able to predict how the impact of drought may affect their watershed.

Discovery Swap

Description: In this two-part activity, students practice making and recording observations through nature journaling, use field guides to identify organisms, and present findings to their peers. At the beginning of the activity, students pair up and collect macroinvertebrates in a local creek, pond, or lake with a net and tray. Students brainstorm how various pollutants and drought can harm macroinvertebrates and other life in the ecosystem they are studying.

Desired Outcome: Students will directly connect drought and stormwater pollution to the vitality of macroinvertebrates, and all life that relies on them, in their local waterways.

Phenology Observation Quest

Description: Students work in pairs to locate and identify seasonally driven phenomena (e.g., opening leaf buds, pollinator activity, dropping leaves). Once the Observation Quest is complete, the group discusses how understanding phenology is important to organism's dependency on water availability, and how we should all conserve water to support plants and animals during times of drought. ***Desired Outcome:*** Students will directly connect water consumption to preservation of life across all ecosystems.

Distance Learning Resources

In early April 2020, Solano RCD began creating distance learning materials featuring five key components of the Watershed Explorers program: the watershed concept, stormwater pollution, water from source to sink, phenology, and watershed stewardship. Each topic included two or more short videos featuring program staff, several printable pages from the program's Student Journal, and links to additional resources to allow for further exploration. The materials were made available on the Solano RCD website, solanorcd.org, under Distance Learning. The resources were shared directly with teachers and school principals and formatted to be readily incorporated into the teacher's digital classroom.

What is a Watershed?

Description: Students watch four videos of staff describing watersheds using homemade models and/or sharing watershed phenomena they found around their home. Participants complete three activities from the Student Journal, either by printing out the pages or transcribing their work into a notebook. Students also have the option of creating their own watershed models and investigating miniature watersheds around their home. ***Desired Outcome:*** Students understand what a watershed is and can identify their local Solano County watershed.

Storm Drains and Storm Water Pollution

Description: Students watch two videos featuring program staff as they track stormwater flowing into their local storm drains and describe stormwater pollution. Afterwards, participants are encouraged to conduct investigations for how development can impact the flow of stormwater and what may contribute to stormwater pollution. ***Desired Outcome:*** Students tie key watershed and stormwater pollution concepts together to deepen their knowledge and protect stormwater quality.

Solano County Water from Source to Sink

Description: Students watch one of two videos in which program staff use Google Earth and other imagery to describe the sources of tap water for the different cities of Solano. ***Desired Outcome:*** Students can list and describe the source(s) of their tap water and describe why it is important to save water, especially during droughts and for the future since it is uncertain when the next drought will come.

Phenology

Description: Students learn about phenology through four videos, each video teaching a new skill to help students become better scientific observers and to consider the impacts drought and climate change has on ecosystems. ***Desired Outcome:*** Students use observation tools and nature journaling to document their observations and scientific questions to better understand their local watershed.

Watershed Stewardship

Description: Equipped with a list of achievable stewardship actions, students are inspired to become Watershed Protectors. They watch five videos on the following topics: RRR message, CRV (California Redemption Value) program, recycling used oil, stopping water waste in the garden, and saving water in the home. Participants are given activity pages and resources on used oil recycling as well as the CRV program. They are invited to create a list of how they will accomplish protecting their watershed. ***Desired Outcome:*** Students feel knowledgeable and empowered to take the actions necessary to protect their watershed and can support their families in doing the same.

Watershed Wednesday

Every Wednesday in May, SRCD educators led a live, virtual classroom from 10am-11am via Zoom Webinar. Students, parents, and teachers from Solano County were invited to attend. Each Wednesday covered a different watershed topic.

Making a Watershed – May 6, 2020

Description: Students learned about watersheds by building a watershed model with paper, markers, and a spray bottle. ***Desired Outcome:*** Students understand the term watershed, can name their local watershed, and list ways that they can be a watershed protector.

Solano County Water Report – May 13, 2020

Description: Students received a report from a program educator who dressed up like a reporter and provided an update on California's current water conditions. Students then played the reporter and reported on how they conserve water in their home. ***Desired Outcome:*** Students learn about their local water resources and the importance of water conservation in California.

Making Observations – May 20, 2020

Description: Students are introduced to topics of drought and phenology by making and recording observations of natural phenomenon happening right outside of student's homes. ***Desired Outcome:*** Students sharpen their observations skills and gain insight into how plants and animal react to the changing seasons.

Aquatic Mini-Beasts – May 27, 2020

Description: Students are introduced to the wild array of macroinvertebrates living in Solano County creeks and use their observation skills to record information on the critters they observe. ***Desired Outcome:*** Students understand how abundance and diversity of macroinvertebrates Solano County's local creeks can reveal the quality of our creek water. Students learn how the actions they take around the homes or schools can impact the life living in our waterways.

Teacher Feedback for Watershed Wednesdays

"I really enjoyed your presentation. I especially like when you polled the audience with questions. I was too shy to speak up, so the poll made me feel like I was still participating. I also enjoyed the Nature Guide activity (I am going to bring it up in my Zoom meeting today) and would recommend having another "hands on project" kids love making things! I am going to tell my students to watch next week! Thank you!" –Bessie Bazos, Robert Semple Elementary, Benicia

PROGRAM EVALUATION

We assess gains in student knowledge about concepts taught in the Watershed Explorers program with a two-part assessment quiz. The first quiz is administered before students participate in the program, this is intended to make a baseline assessment of their prior knowledge. Participants take the second, identical quiz after participating in the in-class curriculum and fieldtrip, to identify changes in knowledge as students leave the program. The 4-question pre and post assessments are designed to measure understanding of the watershed concept, phenology, and water conservation.

Watersheds are a historically difficult concept for students of all ages. We are experimenting with ways to match our question format to students' literacy and ability to respond in writing. We have shortened our quiz instrument to its current format, in addition to introducing the idea of visually providing answers instead of requesting them verbally. Field trip participants vary wildly in reading and comprehension skills, which exacerbates the difficulty of written response-driven assessment. As is always the case, at least half of all samples analyzed required a very fluid understanding of spelling and phonetics to decode, with some responses virtually indecipherable.

Evaluation Questions include:

1. Draw and/or write what you think of when you hear the word "watershed"?
   Desired elements: Hills/mountains, cityscape, storm drains, water flowing into waterways/watershed.
2. List ways nature changes as the seasons change.
   Desired Response: Leaves fall, flowers bloom, the rainy season comes, rain falls, etc.
3. List ways you can protect water.
   Desired Response: Keep storm drains/storm water clear of pollution, RRR, recycle used oil, clean up after your pet, teach your friends and family about storm water pollution, etc.
4. What should we do if we don't get much rain?
   Desired Response: Conserve water by turning the water off when brushing teeth or washing hands, taking shorter showers, water plants in the AM and PM, etc.

<u>Fall Phenology Field Trips</u>

Fall 2019 was the third year of a Habitat Conservation Fund grant-funded five-year program to pilot a fall WE field trip focused on phenology, with a strong citizen science emphasis. 804 students participated in eleven 4-hour field trips, representing 33 classes containing an average of 24 students each.

622 students completed the pre-assessment, which asked them to spend 5 minutes using words and/or drawings to answer the questions. Students struggled with all of these questions, with only 28% able to provide correct or partially correct answers to most questions. Students did best at answering the question about changes in nature, with 45% able to provide correct or partially correct answers. 37% were able to provide correct or partially correct answers about ways to protect water. 16% gave correct or partially correct answers to the question about what to do when it didn't rain very much, and no one was able to describe a watershed in images or in words.

560 students completed the post assessment, which asked the same questions. 52% of respondents were able to answer all questions correctly or partially correctly, an improvement of 28% overall, with improvements on individual questions ranging from 9% to 82%. The greatest improvement was to the "ways to protect water" question, to which 82% of students provided correct or partially correct answers, an increase of 44%. Students also showed marked improvement in their understanding of what happens in a drought, with 60% providing a correct or partially correct answer. As in the pre-assessment, the "what do you think of when you hear 'watershed'" question proved to be the most challenging, with only 9% of students providing correct/partially correct answers. Fall field trip material

focuses mostly on the aspect of phenology, thus the results are consistent with intended program messaging.

Winter-Spring Field Trips

Increased funding allocation started this year with the expectation that Solano RCD would increase the number of classes it took on field trips in their home watershed. The COVID-19 pandemic interrupted those plans, as well as the ability of the students and teachers who did participate to access the full experience.

The Governors Shelter in Place Order, implemented in late March, reduced the number of schools participating in our spring program from 24 to nine. Of those nine, only three schools (Dixon Montessori, Nelda Mundy, and Suisun Elementary) also participated in the fall program, rendering comparisons between the groups who participated in both field trips with the group who participated in only the spring field trip of little statistical use.

449 students completed the spring pre-assessment quiz. 49% of these students were able to provide correct or partially correct answer to all questions, with 51% providing no answer or incorrect answers. As in the fall program, the “draw or describe a watershed” question was by far the most difficult for participants, but 20% of respondents were able to complete this task correctly or partially correctly. In the fall, no student could do this in the pre-assessment. 36% (16% in fall cohort) of students gave correct or partially correct answers to the water conservation question, 67% (37% in fall cohort) provided correct or partially correct answers to the water protection question, and 76% (55% in fall cohort) were able to correctly or partially correctly list phenological changes across seasons. Students demonstrated better understanding of all concepts, presumably because of the teaching and learning they were exposed to in the interim.

435 students completed the post assessment instrument, with an average of 76% correctly or partially correctly answers given for all questions, an improvement of 26 percentage points from the pre-assessment. Greatest improvement was in the watershed concept question: 66% of students provided correct or partially correct answers on the post assessment, an improvement of 46%. Improvement was lowest for the phenology question, with students moving from 76% correct or partially correct to 86% percent correct or partially or correct, suggesting solid understanding of the concept to begin with, which was improved by more exposure. Students had the most trouble with the water conservation question, with 64% providing correct or partially correct answers, a gain of 28 over the course of the program. Overall student performance moved from an F to a C+, a solid gain in understanding.

PHOTO DOCUMENTATION

Highland students from Vallejo journaling after a hike from Glen Cove to Benicia State Recreation Area.

D.H. White students work on their watershed drawing at Sandy Beach Park in Rio Vista.

Students from Dixon Montessori making and recording observations at Pond C in Dixon.

Vacaville students learn that drought can influence their local waterways at Lagoon Valley Park.

Students give a thumbs up after doing Discovery Swap at Rockville Hills Regional Park.