Innovative, Long-term Outreach Program for Upper Elementary Students
Integrating Water Resources Topics with High Tech Pen Pal Partnerships and Measurable Outcomes

2016 Report

Presented by
Ciudad Soil & Water Conservation District

June 2016
EXECUTIVE SUMMARY

RiverXchange is an innovative, long-term outreach program that integrates water resource topics with computer technology, student writing, and a hands-on curriculum to meet specific, measurable outcomes. Since 2007, the program has enabled upper elementary classes from New Mexico to become “high tech pen pals” with a class outside the state to share what they learn about the geography, culture, and ecology of their local river and watershed. Including these partner classes, we have served over 14,000 students! Each student spends about 25 hours engaged with the program over the course of the school year.

The curriculum incorporates hands-on activities, multiple classroom presentations by local water resources professionals, and a field trip to the local river or an important watershed feature. The field trip includes water quality monitoring and/or a service learning project. Students write about the various curriculum topics and the field trip via a private wiki website that can be viewed by their partner class. The computer technology and writing components provide a unique way to reinforce what was learned, increase student motivation to learn, and enable organizers to collect valuable metrics. RiverXchange is a great way to teach 21st Century Skills such as Collaboration, Communication, Creativity, and Critical Thinking.

This year, funding enabled 45 NM classes (1,150 students and 45 teachers) to participate. The majority of participating schools were Title I schools. Each NM class was partnered with one or more classes outside the state for a total of nearly 2,900 participants. All program costs and coordination are provided free of charge to NM teachers. Training, technical support, and curriculum materials are provided free of charge to partner teachers. The program required $71,823.41 in cash and received total match valued at $157,637.00 in the form of in-kind contributions including workshop space and computer lab use, classroom resources, presenters' time in the classroom, field trip docents, donated trees and shrubs as well as the teachers' and students' time.

All major “Next Steps” recommended in the RiverXchange 2015 Report were completed, including improvements to the program such as requiring teachers to communicate by phone to form a stronger relationship, and creating a more user-friendly online forum for teachers. Our pre- and post-survey showed a significant increase in water conservation behaviors. Students demonstrated significant knowledge of water resources issues on three online assessments. We saw many wonderful student video and PowerPoint projects as well as great writing that demonstrated critical thinking skills and understanding of the connections between issues.

Teachers faced a major challenge this year with the implementation of the new computer-based PARCC test, which made it more difficult to access computer labs. Feedback indicated that teachers found the program helpful in teaching Common Core standards as well as 21st Century Skills. Those who did participate in the program were especially committed, and many plan to return next year.
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PROGRAM DESCRIPTION

Mission
The mission of RiverXchange is to deepen students’ and teachers’ understanding and appreciation for their local river ecosystem, motivate participants to protect local water resources by conserving water and keeping their source water clean, and to provide a high quality, high impact outreach opportunity for funders and in-kind contributors.

The Big Water Questions
The curriculum frames program outcomes as “guiding questions” known as Big Water Questions. A long-term goal of RiverXchange is that students understand these questions and can formulate logical, fact-based answers by the time they finish elementary school. We believe that students who can synthesize water facts to understand larger water issues will have the proper critical thinking skills and foundation for further discussion in middle and high school so that they will become informed citizens and voters on water issues.

Understanding a Watershed
- Is every place in the world part of a watershed?
- Where does your community’s stormwater go?
- How can surface water become polluted?
- How does the water cycle relate to weather?
- How are groundwater and surface water connected?
- How can groundwater become polluted?
- What actions can all of us take to keep water clean?

Water in Our Society
- In what ways does our society use water?
- Where does your community’s drinking water come from?
- Does everyone have the right to use as much water as they want?
- Where does your community’s wastewater go?
- What actions can all of us take to conserve water?

River Ecosystem
- How does water affect living things in an ecosystem?
- What role do forests play in a watershed?
- What role do wetlands play in a watershed?
- What are some of the ways scientists can determine the health of a river, lake, bay or ocean?
- What actions can all of us take to improve the health of our ecosystem?

Background
As producers of children’s water festivals and other grade K-12 water resources outreach in NM since 2007, we observed early on that NM elementary teachers rarely incorporated water concepts in the classroom beyond what is required by the state (e.g., water cycle), and that most elementary teachers
considered “water” strictly as a science topic. While teachers personally acknowledged the importance of conserving water and keeping source water clean, we continued to find that upper elementary students had little or no understanding of major water resources topics unless the teacher specifically integrates a wide range of water topics into the curriculum.

We created RiverXchange to provide a free program that is fun, interesting, and easy to integrate into the normal curriculum. Our hope was to motivate participants to explore water resources topics in depth. The program is carried out over eight months so that students spend more time developing a sense of pride and personal connection to their own river ecosystem, as well as a personal connection to a distant river ecosystem and the students who live near it.

RiverXchange began in 2007 as a pilot project of Experiential EE, LLC (under a services agreement with the New Mexico Water Conservation Alliance) and the National Great Rivers Research and Education Center, featuring partnerships between two fourth grade classes in Albuquerque, NM, and two fifth grade classes in Godfrey, IL. A curriculum was developed, a field trip to the river was coordinated, and partner classes “met” three times during the year via video teleconferencing to present what they had learned. The upper elementary level was chosen because of our successful festival work with this age group.

After the pilot project, we transitioned to a web-based technology called a wiki. This enabled us to overcome limitations such as the high cost, availability and time zone logistical issues associated with video teleconferencing – and easily involve more classes. The curriculum was updated to incorporate the writing component and we introduced classroom guest speakers to reduce teacher workload and bring up-to-date technical information into the classroom.

In 2012, ownership of RiverXchange transferred to Amy White of Orilla Consulting, LLC, who managed the program through July 2015. In August 2015, RiverXchange became part of the Ciudad Soil & Water Conservation District. Since 2007, we have served nearly 17,000 students!

This year, the program featured the following components:

- Standards-based curriculum including hands-on science and social studies lessons, as well as writing assignments.
- Coordination of class partnerships
- KidBlog online posting and communication
- Teacher training on curriculum implementation and use of KidBlog
- Ongoing technical and motivational support
- Online class postings
- End of year teacher survey
- Pre and post student surveys (NM only)
- Payment for teacher workshop substitute teachers (NM only)
- Coordination of at least four guest speakers into the classroom (NM only)
- Coordination of a field trip to the local river or important watershed feature (NM only)
- Field trip bus transportation payment (NM only)
- Field trip leadership and activity planning (NM only)
Program Management and Financial Support

The program timeframe was July 1, 2015 through June 30, 2016. All components including fundraising, design, planning, implementation and analysis were carried out by employees of Ciudad Soil & Water Conservation District, including:

Amelia White (through December 2015)
Bonnie Schmader
Melissa McLamb
Jennifer Moss

Sponsors

● Southern Sandoval County Arroyo and Flood Control Authority (15 classes)
● Mid Rio Grande Stormwater Quality Team (30 classes)
● US EPA: Urban Waters Small Grant, in partnership with Ciudad Soil and Water Conservation District
● National Fish & Wildlife Federation
● US EPA Region 6 Small Grant, in partnership with New Mexico Water Conservation Alliance (teacher workshop for all classes)

Sponsors provided $71,823.41 in cash. Program expenses included:

● Substitute teachers for NM teacher workshops
● Field trip bus transportation for NM classes
● Field trip portable toilet rentals for NM classes
● USGS water education posters for each teacher
● Coordination services (planning, implementing and assessing all program components)

New Mexico In-Kind Partners

● Albuquerque Bernalillo County Water Utility Authority
● Bernalillo County Cooperative Extension, 4-H
● CDM Smith, Inc.
● City of Albuquerque – Open Space Division and Municipal Development
● City of Rio Rancho – Environmental Programs Office
● Daniel B. Stephens and Associates
● New Mexico DEpartment of Transportation
● Rocky Mountain Youth Corps
● Sandia Laboratories
● Sandoval County Cooperative Extension
● Smith Engineering
● Southern Sandoval County Arroyo and Flood Control Authority
● University of New Mexico

In-kind contributions totaled $157,637.00. For NM classes, in-kind contributions included classroom guest speakers, field trip docents, planting materials, workshop space and computer lab use, and classroom resources. This year, we were informed that teachers' and students' time attending the presentations and
field trips could be counted as match. For partner classes, in-kind contributions included classroom guest speakers, field trip docents and field trip bus transportation. Sponsors and in-kind partners were recognized on our website and in presentations.

**Participant Selection**
All 45 participating NM classes were fifth grade classes. The majority of participating schools were Title I schools. There were approximately 1,150 students and 45 teachers, distributed as follows:

<table>
<thead>
<tr>
<th>Bernalillo County</th>
<th>Sandoval County</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arroyo Del Oso Elementary School (3 classes) Title I</td>
<td>Cochiti Elementary and Middle School (2 classes) Title I</td>
</tr>
<tr>
<td>Bandelier Elementary (1 class)</td>
<td>Colinas del Norte Elementary (3 classes) Title I</td>
</tr>
<tr>
<td>Cochiti Elementary (2 classes) Title I</td>
<td>Maggie Cordova (2 classes)</td>
</tr>
<tr>
<td>Edward Gonzales Elementary (6 classes) Title I</td>
<td>Martin Luther King, Jr. Elementary (5 classes) Title I</td>
</tr>
<tr>
<td>Georgia O'Keeffe Elementary (2 classes)</td>
<td>Placitas Elementary (1 class)</td>
</tr>
<tr>
<td>Lew Wallace Elementary (1 class) Title I</td>
<td>Rio Rancho Elementary School (5 classes) Title I</td>
</tr>
<tr>
<td>Los Ranchos Elementary (2 classes) Title I</td>
<td></td>
</tr>
<tr>
<td>Monte Vista Elementary (3 classes)</td>
<td></td>
</tr>
<tr>
<td>Mountain View Elementary (2 classes) Title I</td>
<td></td>
</tr>
<tr>
<td>Osuna Elementary (3 classes)</td>
<td></td>
</tr>
<tr>
<td>Zia Elementary (2 classes)</td>
<td></td>
</tr>
<tr>
<td><strong>750 students, 30 teachers</strong></td>
<td><strong>400 students, 15 teachers</strong></td>
</tr>
</tbody>
</table>

Partner classes were located in 21 U.S. States, as well as in Cambodia, Ecuador, Israel, Nepal and Rwanda. There were about 1,756 students and 45 teachers (some teachers had more than one class participating). We have found that partner teachers are highly motivated and come to the program with a willingness to participate even though our NM-based funding cannot be used to help coordinate their classroom guest speakers, arrange a field trip, or pay for any direct costs.

**Teacher Professional Development Workshop**
Although preparation began many months earlier, RiverXchange officially kicked off in September with a full-day teacher workshop for NM teachers and online training sessions for partner teachers. Teachers learned how to implement the activities in the curriculum and how to operate and manage their class blog (KidBlog). Volunteer presenters were on hand at the NM workshops to schedule classroom presentations. Guest speakers Rick Billings from the ABCWUA and Kathleen Verhage from the City of Albuquerque
spoke to the teachers about challenges to riparian ecosystems due to watershed pollution and contamination issues. They also discussed the importance of endangered species and habitat restoration.

**KidBlog Technology**
One of the most important, yet challenging, aspects of program implementation continued to be the training of teachers on how to use computer/internet technology for the online pen pal communication component. This year we used KidBlog instead of the Wiki platform and found it to be simpler for the teachers to use. However, there were still glitches and similar challenges to blogging for teachers. We plan to use KidBlog again for 2016-2017. We will be better prepared for training and troubleshooting next year.

**Online Partner Training**
Teachers were able to access an online video training regarding how to set-up and use their Kidblog throughout the year. We used a free video service called Vimeo. This was an efficient and effective way to have teachers access the same quality of training on their own time. Many teachers contacted us if they had difficulties and we also checked in with many of them mid Fall to answer any questions and troubleshoot any issues.

**Curriculum**
A key component of RiverXchange is the hands-on curriculum, which is carried out from September through May for NM teachers. It was developed to help students reach for deeper meaning through hands-on learning and reinforce what they have learned through the process of writing to their pen pals. Organizers strive to incorporate emerging water resources issues into the curriculum, increase networking opportunities for teachers, reduce teacher workload and align the curriculum with public school curriculum priorities including Common Core Standards. Each student spends about 25 hours engaged with the program over the course of the school year!

Each class learns about its own local water resources issues through hands-on activities, classroom guest speakers and a field trip. Students write about what they are learning via a private educational website that can be viewed by their partner class(es). The computer technology and writing components provide a unique opportunity to reinforce what was learned, increase student motivation to learn and collect valuable metrics about student performance.

Through RiverXchange, students take pride in sharing their knowledge of the local ecosystem and learning from their peers about another river ecosystem. Comparing the two geographical areas gives students a broader understanding of the importance of a river ecosystem to human and other life. Students gain the unique opportunity to share personal experiences and ask questions about a distant place. Teachers feel this kind of personal connection is a big deal for kids – many of whom have never traveled beyond their city limits.

All activities are correlated to NM state standards and benchmarks for Science and Social Studies. All activities (because they require that students communicate information on the KidBlog) address Common Core Language Arts standards for writing. Some activities also address Common Core Mathematics standards. For a summary of the RiverXchange Curriculum, see Appendix 1.
Guest Speakers
We coordinated four guest speakers to visit each NM classroom. In all cases, guest speakers were water resources professionals from local agencies. Guest speakers introduced technical information that was often completely new to a teacher. Topics included:

- watershed/nonpoint source pollution
- drinking water
- wastewater
- water and agriculture

Partner teachers were strongly encouraged to invite guest speakers into the classroom to help carry out the curriculum. Since program funding is NM-based, we were not able to assist partner teachers with coordinating guest speakers into the classroom; however, we provided partner teachers with names of regional U.S. agencies and offered a resource guide that be able to assist. This year, many partner teachers had presentations from stormwater and wastewater educators as well as watershed specialists and county conservationists.

Field Trips
The program requires that all classes attend at least one field trip to their local river or important watershed feature, which should incorporate a service learning component, if possible. We coordinated all NM field trips. Throughout the winter and spring, students helped plant more than 700 trees and shrubs and restore more than 10 acres of riparian habitat along the Rio Grande in Albuquerque. Some of the fall and spring field trips included a water quality monitoring component.

New Mexico Field Trip Locations

Shining River Open Space

Managed by City of Albuquerque Open Space, this property is located in on the east side of the Rio Grande, immediately south of Paseo del Norte. This area was part of the ABCWUA Paseo del Norte drinking water mitigation project, which included planting native vegetation along a silvery minnow channel. While students planted native trees, they observed porcupines, bald eagles, coyotes and other bosque animals.

Tingley Wetland

This 18 acre tract, adjacent to the Bosque in downtown Albuquerque, is owned by the City of Albuquerque and features a restored constructed pond and peripheral wetlands include native and non-native aquatic habitat. Students took a hike into the Bosque, planted native shrubs near the wetland, tested water quality, and observed macroinvertebrates.

Teachers were encouraged to invite additional water-related guest speakers into the classroom and/or go on additional field trips. Several teachers organized additional field trips to Albuquerque’s Southside Water Reclamation Plant, Cooperative Extension’s “Kids, Kows, and More” event, or a Bosque Ecosystem Monitoring Program site, to expand upon what their students learned through RiverXchange.
Partner Field Trip Locations
Since program funding is NM-based, we were not able to assist partner teachers with coordinating a field trip; however, we did provide partner teachers with names of agencies located in most parts of the U.S. that may be able to assist. We know that many of them did water quality testing. Many also went on field trips, to relevant places including water treatment plants, local reservoirs, dams and river/watershed museums.

EVALUATION

Teacher Surveys
Using FluidSurveys, we asked for feedback from NM and partner teachers to help us identify areas in which we could improve the program to make it easier and more useful for them. The response rate for NM teachers was about 45%. The response rate for partner teachers was about 25%, though they had much less notice to submit their responses. We received valuable information from all teachers throughout the school year. Here are the main points:

- Most teachers chose to participate in the program to learn about local water resources issues, connect with a classroom in a thematic learning environment and enhance their writing skills with meaningful content for their students. Many teachers reported that they were pleased with their experience and met their learning objectives as participants.

- It was difficult for teachers to maintain communication with their partners, even though we encouraged them to get in touch by phone or Skype within the first two weeks of school. Many resorted to e-mail introductions due to time differences and for ease.

- More partner teachers posted and responded on the blogs than NM teachers.

- Most teachers liked the Kidblog format this year and many found it easier to use than the wiki. Many teachers who experienced difficulty with the blog reported that this could have been resolved at the beginning of the year with more tech support from RiverXchange organizers.

- Scheduling computer time continued to be especially difficult with many NM teachers reporting that they had extremely limited access to computers due to limited technology access in the classroom and computer-based tests taking up the computer labs for the majority of the year.

- Teachers who used the curriculum found it very effective and useful for learning about their local watershed and teaching about critical water resources issues, including conservation.

- As in previous years, we see the more engaged teachers are in the partnership aspect of the program the greater their learning outcomes are for their classrooms. Many teachers expressed a strong interest in returning to the program next year and offered useful ideas for improvement regarding the partnership aspect and implementation of the curriculum.
Almost all of NM teachers found RiverXchange helpful in teaching Common Core Standards.

*How useful is RiverXchange in helping your students achieve Common Core English/Language Arts Standards in the following areas?*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Very helpful</th>
<th>Somewhat helpful</th>
<th>Not that helpful</th>
<th>I really haven't explored this much yet</th>
<th>Total:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Producing coherent writing through planning, revision and regular practice</td>
<td>13</td>
<td>7</td>
<td>0</td>
<td>0</td>
<td>20</td>
</tr>
<tr>
<td>Researching different aspects of a topic from several sources</td>
<td>15</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>20</td>
</tr>
<tr>
<td>Narrative writing to describe experiences</td>
<td>12</td>
<td>7</td>
<td>0</td>
<td>1</td>
<td>20</td>
</tr>
<tr>
<td>Informative/explanatory writing to explain a topic</td>
<td>16</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>20</td>
</tr>
<tr>
<td>Writing opinion pieces and supporting a point of view with evidence</td>
<td>15</td>
<td>5</td>
<td>1</td>
<td>0</td>
<td>20</td>
</tr>
<tr>
<td>Reading informational texts</td>
<td>13</td>
<td>7</td>
<td>0</td>
<td>0</td>
<td>20</td>
</tr>
</tbody>
</table>

Many teachers felt there was value in having an authentic audience for students to write to concerning water related issues and reported that their students enjoyed learning about the other school in another state or country. Here are some of their comments:

From NM teachers:

“*My students were exposed to places and things that they had not seen before. It also really sparked their interest in science.*”

“*Exposure to the issues of water in NM. My students had a partner class in another country, so that really helped them understand the scope of the world beyond NM.*”

“*It also really helped them learn how to use and comment on a website. And, of course, it greatly increased their awareness of water related issues*”

“*My students have a true understanding of how important water is to our life and all things that are alive. They also see how they can impact our river with their actions.*”

From partner teachers:

“*Students are provided a "real" audience in which to share their learning. That is the main reason I have continued to participate.*”

“*I was able to work on collaborative structures with my children, increase their knowledge of geography and show them several new careers.*”
“To collaborate with others outside of our classroom and improve writing and computer skills.”

As always, New Mexico teachers were thrilled with the guest speakers and field trips.

“We planted trees in the bosque. This was a great trip and families enjoyed their involvement.”

“My students loved planting the trees. Many of them commented on how they had never been to the Bosque before....”

RiverXchange also helped overwhelmingly in teaching students 21st Century Skills.

How useful is RiverXchange in helping your students develop the following 21st Century Skills?

<table>
<thead>
<tr>
<th>Variable</th>
<th>Very helpful</th>
<th>Somewhat helpful</th>
<th>Not that helpful</th>
<th>I really haven’t explored this much yet</th>
<th>Total:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Critical Thinking/Problem Solving</td>
<td>12</td>
<td>8</td>
<td>0</td>
<td>0</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>60.0%</td>
<td>40.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td></td>
</tr>
<tr>
<td>Teamwork</td>
<td>18</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>90.0%</td>
<td>10.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td></td>
</tr>
<tr>
<td>Adaptability to new learning/working structures</td>
<td>15</td>
<td>4</td>
<td>0</td>
<td>1</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>75.0%</td>
<td>20.0%</td>
<td>0.0%</td>
<td>5.0%</td>
<td></td>
</tr>
<tr>
<td>Communication Skills</td>
<td>13</td>
<td>7</td>
<td>0</td>
<td>0</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>65.0%</td>
<td>35.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td></td>
</tr>
<tr>
<td>Taking initiative</td>
<td>10</td>
<td>10</td>
<td>0</td>
<td>0</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>50.0%</td>
<td>50.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td></td>
</tr>
<tr>
<td>Accessing and analyzing information</td>
<td>13</td>
<td>7</td>
<td>0</td>
<td>0</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>65.0%</td>
<td>35.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td></td>
</tr>
<tr>
<td>Curiosity/Imagination</td>
<td>18</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>90.0%</td>
<td>10.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td></td>
</tr>
</tbody>
</table>

Student Surveys

A key component of RiverXchange is its specific, measurable goals relating to student performance. We collected quantitative data on student performance by way of a pre and post survey and qualitative data by reading what students submitted on KidBlog. We also surveyed students about their actions before and after participating in RiverXchange.

Pre/Post Behavior Survey

We asked students about their actions regarding water use before and after the program; improvements were observed in several areas, most notably picking up dog poop and not pouring fats, oils or grease down the drain!
<table>
<thead>
<tr>
<th>Activity</th>
<th>Always (or Very Often)</th>
<th>Sometimes</th>
<th>Never (or Not Very Often)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turn off the faucet while brushing your teeth</td>
<td>25.4%</td>
<td>68.9%</td>
<td>5.8%</td>
</tr>
<tr>
<td>Spend less than 10 minutes in the shower</td>
<td>31.7%</td>
<td>51.0%</td>
<td>17.3%</td>
</tr>
<tr>
<td>Pick up your dog's poop, if you have a dog - otherwise leave blank</td>
<td>20.8%</td>
<td>54.1%</td>
<td>25.9%</td>
</tr>
<tr>
<td>Drop your trash on the ground</td>
<td>17.5%</td>
<td>78.0%</td>
<td>3.9%</td>
</tr>
<tr>
<td>Water your outdoor plants during the coolest part of the day, if you have any outdoor plants - otherwise leave blank</td>
<td>34.7%</td>
<td>40.8%</td>
<td>24.4%</td>
</tr>
<tr>
<td>Wash chemicals or oil off your driveway into a storm drain</td>
<td>25.5%</td>
<td>65.0%</td>
<td>9.6%</td>
</tr>
<tr>
<td>Sweep grass clippings and leaves into a storm drain</td>
<td>18.0%</td>
<td>72.6%</td>
<td>9.4%</td>
</tr>
<tr>
<td>Wait until you have a full load to run the washing machine</td>
<td>29.2%</td>
<td>59.9%</td>
<td>11.0%</td>
</tr>
<tr>
<td>Apply more fertilizer and/or pesticide than the label says to use</td>
<td>29.8%</td>
<td>58.3%</td>
<td>11.9%</td>
</tr>
<tr>
<td>When you want to wash your car, take it to a carwash</td>
<td>35.9%</td>
<td>46.4%</td>
<td>17.7%</td>
</tr>
<tr>
<td>Pour fats, oils or grease down the drain</td>
<td>24.1%</td>
<td>65.5%</td>
<td>10.4%</td>
</tr>
<tr>
<td>Use your toilet as a trash can (for example, flush it just to get rid of tissues, Q-tips or other trash)</td>
<td>12.8%</td>
<td>82.4%</td>
<td>4.8%</td>
</tr>
<tr>
<td>Visit your local river</td>
<td>29.8%</td>
<td>55.2%</td>
<td>15.0%</td>
</tr>
</tbody>
</table>
How often do you or your family do the following things? (POST)

- Turn off the faucet while brushing your teeth: 73.2%
- Spend less than 10 minutes in the shower: 68.7%
- Pick up your dog’s poop, if you have a dog - otherwise leave blank: 62.3%
- Drop your trash on the ground: 79.9%
- Water your outdoor plants during the coolest part of the day, if you have any outdoor plants - otherwise leave blank: 43.1%
- Wash chemicals or oil off your driveway into a storm drain: 77.6%
- Sweep grass clippings and leaves into a storm drain: 81.8%
- Wait until you have a full load to run the washing machine: 64.9%
- Apply more fertilizer and/or pesticide than the label says to use: 73.5%
- When you want to wash your car, take it to a carwash: 41.5%
- Pour fats, oils or grease down the drain: 79.9%
- Use your toilet as a trash can (for example, flush it just to get rid of tissues, Q-tips or other trash): 84.8%
- Visit your local river: 57.1%
Student Writing
The writing component is one of the most valuable aspects of the program, yet it continues to be our biggest challenge. We are continually striving to improve participation in this area because it helps teachers integrate writing in the content areas and reinforces student understanding of key water resources concepts. Teachers continued to face major challenges this year in getting efficient internet access in the classroom and/or access to computer labs, which are tied up for much of the year for NM teachers with the PARCC and other computer-based tests.

Many teachers joined the program this year planning to use RiverXchange as a major component of their writing program to meet Common Core Language Arts standards, which require teachers to focus more on writing within content areas. Each year, we strongly encourage teachers to have students write and edit paragraphs before going to the computer lab because this promotes higher-quality thinking and writing. When students do go through this process, it shows. We also encouraged teachers to use various forms of communication in addition to writing, such as videos, PowerPoint presentations, or audio files.

This year, we switched to a new online learning platform, KidBlog, which seemed less conducive to small group projects than previous formats though more intuitive for teachers and students to use. KidBlog allowed all participating classes to see all the other classes’ blogs. We saw many great classroom video and PowerPoint projects. We also saw a lot of well constructed individual writing. Much of the writing shows critical thinking, as well as a broad understanding of how our ecosystem, stormwater, drinking water, wastewater and agriculture are connected.

Teachers and students expressed frustration if the pen pals did not write back quickly or at all. We explain to teachers that the writing component is valuable for students even if pen pals don’t post because students in the same class could read and comment on each other’s writing. Still, our biggest challenge is to increase the number of successful partnerships, in which both partners are actively engaged.

This year, we had more partner teachers register with us than ever before. The interest was exciting at first but proved to create more difficulty in ensuring successful partnerships for NM classes as many were partnered with more than one class to accommodate the excess of registrants and added to the sense of workload for teachers.

It was much easier to assess and manage student writing with KidBlog than on the previous wiki format. Rather than nearly 2,400 student pages to track throughout the school year, we had about 115 class blogs to track.

We noticed more postings from partner classes than NM classes. Many partner teachers register for the program having already prioritized the need to organize classroom time to blog throughout the school year, so as to ensure they have a successful experience as participants. In contrast, many NM teachers register for the program to receive the beneficial learning experiences of the presentations and field trip; the blogging and partnership aspect is not as strong of an incentive for their participation as it is the main incentive for the partner teachers.

We know from discussions with teachers over the years that the absence of student writing does not mean they did not do the activities, or that no learning took place. Many teachers were dealing with issues
unrelated to the program, such as new curriculum in other areas, school reorganization, construction which prevented access to the computer lab for a portion of the year, or personal life changes that conflicted with engaging more with the program. We did our best to foster successful online partnerships. Even though some blogs had minimal to no activity, NM students still benefited from the guest speakers and the field trip.

Samples of Student Writing (spelling and punctuation are original)

River Geography
“Hello my name is Paco, and I live in New Mexico. We have been doing our river-x project. A watershed is when land feeds water into a body of water such as rivers, lakes, seas, and oceans. The name of our river is the Rio Grande. The journey our river takes is it starts in the Rocky Mountains and ends in the Gulf of Mexico, and travels over 2000 miles. The Rio Grand goes through Texas, Colorado, and New Mexico. Our river is muddy in some places, big in some places, and small in some places. We get 5-10 inches of rain every year, but we have got a lot of rain this year. The end of summer and the beginning of fall is our monsoon season. Sincerely, Paco”

Watershed Model
“On October 14, our class had Catherine Conran came to our class to talk about where our storm water goes, and how it can be polluted. We learned that the storm water here doesn't go to a water treatment plant. Instead it goes either straight to the Rio Grnde River or it is infiltrated into our aquifer. Another thing we learned is that there are a lot of pollutants that can contaminate our water. Dog poop is a big problem here because people don't pick up after their dogs, and because it is so dry here it just becomes hard and floats into the river. The best part of the presentation was when we got to use different "pollutants" to really mess up the model of the city that Ms. Conran brought with her. Some of the students sprinkled or dumped different pollutants like: oil, trash, fertilizer, pesticide, etc. Then a rainstorm came and we saw how those pollutants ran down into the river and eventually the aquifer. Gross!”

Infiltration and Runoff
“Hi my name is Abi and I’m in a cloud with my friends Haley and Bailey. So I’m here to tell you about my journey through the “water cycle”. Never mind can’t talk falling out of the cloud now! This is what they call precipitation, when you fall out of the sky. Now I am underground refilling the aquifer. Here we go again wait… where is Haley? She must have gone another way, well we still have ba... never mind just me. Now I’m in some ocean some people call this a collection. It is where all the water comes then there is evaporation when the sun soaks up all the water and forms it into a gas. I am now into a cloud again ‘oh’ look there is Haley now we are together again but where is bailey? Oh here she comes! This one is called condensation it is where little rain drops like me go to clouds and produce precipitation again. How it happens is simple you were a gas then form into a liquid again. So I forgot to tell you that a runoff is where you basically run off the mountain but don’t try this at home please. Then you flow underground, geez this is going by fast but anyway finally we have transpiration that is when water comes out of the leaves of plants and goes into the air. In fact I think Haley and bailey went that way. Sorry can’t talk falling again………. Ok so now I’m on top of the mountain. Nope never mind down the hill so that was the runoff and next is infiltration again where you go underground. Haley is already in the ocean and bailey who knows where she is. She is evaporating now. Bye Haley! Now I’m going to evaporate talk to you in the
clouds again. ... Oh hi bailey have you seen Haley? ‘‘no sorry”. Ok that’s fine. So now I’m in the clouds so that was basically my life I do that all the time it is fun!! Talk to you later!!!!”

Water and Agriculture

“Nicole and Steve were talking about the commercial uses of the river. They talked about the 4 H program, the 4 h’s stand for head, hands, heart, and health. They talked about different ways that people water different type of crops. The first way they talked about was flooding, flooding is where you just flood your crop with water at lot of times you might see people flooding Chile crops that use a lot of water. Another way that Nicole and Steve talked about is the sprinkler that is when water gets mist at the plants to grow a lot of times sprinklers are set up to spray for the time as needed. The last way to water crops is the drip system that is where a tube runs along a tree with a hole to allow the water to come out but not a lot of water comes out because plants that use a drip system most likely those plants don't use a lot of water. I would have to say that the drip system uses a lot less water than the flood.”

Drinking Water

“a few days ago someone from the water utility authority came and told our class about how much water gets wasted when you have a leaky faucet. if you have a leaky faucet that drips 8.5 ml a minute, you waste 1,157.1 gallons a year!”

“How many gallons are used each year? Well there is about 10,275,93 gallons of water that is used, i think that is a crazy amount of water that is used a year. That is what we learned last week in my class because a person from W,U,A. Everyone knows that you take 2 minutes brush your teeth right, you can save water by turning the water off that way water is not just going down the drain because that would make more water be wasted and we don't want water to be wasted. Another way that we don't waste water is by turn your shower water off if your not in the water yet and after done taking a shower just turn the water off and don't get out with it on that is still wasting water just more water. You know what the biggest thing that is being wasted is our totients. That is weird to think about that the totients in your house is being used the most out of all the thing that we used the number 1 thing that is used is our totients.”

Wastewater

“Surface water gets polluted by us throwing trash the It goes to the river when it rains. When farmers use chemicals to kill insects off plants that goes to the ocean and kills the fish . When you throw old medicine on the toilet then you flush it goes into the water we drink. This doesn't help our watershed or the environment.”

(from CAMBODIA)

“Hello! My name is Sreyneang. You can called SO. I love to play sport and listen to music and audio. Also I like to make a quote when I doing something. Have you seen my watershed or learned anythings. Here is the cool think about us, we are living on one of the river name Basic that has divided from Mekong river (a big flow river). Also there is current problem like trash, sewage, industrial pollution, over fishing and the building of dam. In the future, I will try to solve this issue. Who want to work with me?”

(from New Mexico)

“We have the same problems. I also want to help rivers some day! To be able to help all the animals that need the water and be able to save all these fish and let them survive. Our river was pretty much destroyed
by humans! At first our river was called the Rio Bravo, which means brave river; (Rio means river and Bravo means brave) it was full of life and there was a big amazing curving river! Until humans came and made it Rio Manso, and made it strait, killed animals and destroyed almost all the nature. Now we are trying to make it a better place, but humans are still destroying it with pollutants. Did you know we actually find bath tubs in our river! Comment back soon.”

Forests and Wetlands
“Dear friend,

My name is Ari. I learned about EROSION! If your wondering what that is, I can tell you. Erosion is when there’s a rock or land and it might snow at night and, melt in the day and then and then the rock breaks down. That happens because when the snow melts it turns to water and dissolves the rock down to be thinner and look different the next day. A good and easy way to stop/slow down erosion is by vegetation! Vegetation is when planting trees, bushes, vines and lots of other plants. The plants help slow down erosion it. would be pretty cool to watch happen step by step (it would be pretty cool and tiring). This is what I learned about erosion. -Ari”

Field Trips
“I loved the tree planting field trip! It was a very good learning experience. My favorite fact was that the trees “sleep” during winter and they can’t feel anything. My favorite part of planting a tree was twisting the auger to make a hole. An auger is a long metal pole with a handle on top. At the bottom there is a metal cylinder that has blades and it digs dirt out of the ground. We had to dig until we could see water at the bottom of the hole. Then, we put the tree in the hole and used a shovel to fill the hole with dirt. When we were done our tree was a little crooked, but we named him C. Branchy. Come visit him at the Bosque! The experience of planting trees was super cool and amazing. If you ever have the chance to do it, check it out.”

“The first thing I learned is you have to dig until you reach the water table. My hole got to about 8 feet. We had to dig until the soil was dripping wet in order to plant the tree. The second thing I learned is some trees can feed insects. They also provide birds’ nests and shelter for animals. Some trees provide food like berries. Trees that are planted by the river prevent erosion. The roots of the tree prevent it.”

RECOGNITION
We acknowledged the exceptional commitment made by presenters and field trip providers by sending thank you cards with quotes from student KidBlog writing about the activities they provided. We also acknowledged sponsors and in-kind contributors on our website.

NEXT STEPS

● We have applied for funding from several sources for 2016-2017, including:
  ○ Southern Sandoval County Arroyo and Flood Control Authority
  ○ Mid Rio Grande Stormwater Quality Team
  ○ City Of Albuquerque
• **Teacher Workshop:**
  - Eliminate original teacher workshop and offer a recognition event, with an engaging and relevant speaker, for participating teachers in early to mid Spring. New Mexico classes will learn to operate the blog via online training video and phone conversation(s) with RiverXchange organizers.

• **Partnerships:**
  - Conduct more thorough interviews with interested teachers outside of NM to enhance understanding of the commitment to participate and promote better engagement throughout the year.
  - Partner teachers more systematically for mentoring and/or technologies available to them.
  - Require teachers to communicate with their partner twice a semester.
  - Offer a reward incentive for partner classes to demonstrate outstanding engagement in the program (responsiveness on the blog).
  - Partner New Mexico classes together and coordinate joint field trips if possible.
  - Offer an additional field trip or other reward incentive for outstanding participation from NM classes.

• **Curriculum:**
  - Revise the curriculum to simplify and emphasize fun, engaging activities for classrooms.
  - Review possibilities of organizing Kidblog to be more easyful for teachers who rather make whole class or group postings and add to blog training for next school year.
  - Create a general blog next year to highlight interesting blog submissions for all participants to view and comment on.
  - Provide access to informational texts on same topic, appropriate for varying reading levels.
  - Continue to encourage audio, video, or other presentation formats as an option along with writing assignments.
  - Encourage classes to create a culminating project towards the end of the year to be presented to a larger audience.

• **Assessment:**
  - Distribute the Pre and Post Survey in a more timely manner so we receive as many responses as possible. Share results with teachers.

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**APPENDIX 1: CURRICULUM**

*Welcome to RiverXchange... learning and sharing across borders!*
RiverXchange is about communication and developing 21st Century Skills while learning about our watersheds!
Each class will be partnered with one or more classes in a different state. **The big idea is to communicate with your partners at least twice each semester by posting projects on your shared wiki website and responding to what your partners have posted.**

A firm "handshake" will get your partnership off to a great start! As soon as you get your partnership assignments, you MUST contact each other by phone, Skype, or FaceTime, to establish a working relationship. Most importantly, you will **set two dates each semester for sharing your projects, and let your partner know what you plan to do.** Then, post these dates on the Teacher Collaboration page of your wiki, which can be seen only by wiki administrators.

The curriculum in the following pages is what New Mexico teachers will be doing throughout the year, and is a rich resource for teachers in other states. However, many partner teachers will be doing other excellent river and watershed-related projects and will post about these on the wiki instead. Our goal is that students be able to understand and discuss all of the Big Water Questions by the end of the year.

**The Big Water Questions**

**Understanding a Watershed**
1. What is a watershed?
2. Where does your community’s stormwater go?
3. How can surface water become polluted?
4. How does the water cycle relate to weather?
5. What role do forests play in a watershed?
6. What role do wetlands play in a watershed?
7. What actions can all of us take to keep water clean?

**Water in Our Society**
1. In what ways does our society use water?
2. From what source does your community get its drinking water?
3. Does everyone have the right to use as much water as they want?
4. What actions can all of us take to conserve water?
5. How are groundwater and surface water connected?
6. How can groundwater become polluted?
7. Where does your community’s wastewater go?
8. What is the difference between wastewater, stormwater, and drinking water?

**River Ecosystem**
1. How does water affect living things in an ecosystem?
2. What are some of the ways scientists can determine the health of a river, lake, bay or ocean?
3. What are some of the ways humans have changed rivers or other aquatic ecosystems?
4. What actions can all of us take to improve the health of our ecosystem?
Student Assignments:

All of the lessons in our curriculum include a “Student Assignment” which can be expressed through writing, photos, video, audio, powerpoint, or other projects. The only requirement is that you post two projects each semester, and respond to what your partners have posted. This new format supports the essence of our program - meaningful sharing between classes.

Suggestions include:

- Create a public service announcement
- Create a newscast with various reporters discussing different areas
- Create a short documentary
- Create an animation (using a tool such as kid pix)
- Create a powerpoint presentation
- Write a poem
- Write a book report for one of the suggested books
- Create a poster and post a photo of it on the wiki

We know that with all the other pressures in schools today, it may be difficult to find time to share on the wiki. Here are some suggestions we have gathered over many years of working with teachers on this great program.

Strategies for making the most of limited computer time:

1. Take videos on your smartphone, then post them yourself to group pages
2. Take pictures of posters or hand written assignments, then post to group pages.
3. Do a whole class project/posting using the Promethean or Smart Board. For instance, write down all the things that can pollute our river, group them by source/non-source, identify which ones the kids can help prevent, save and post the final diagram in each of the groups on the wiki.
4. Read postings from partners using Promethean or Smart Board, as a “Friday fun day” activity on the weeks they have posted. This could be done as a reading aloud/public speaking exercise.
5. Identify and train one student from each group to be the “tech leader.” Have just these students use the limited classroom computers to post the group projects.
6. Encourage posting from home as homework. Just be sure to monitor what was posted the next day. Even if not all students have computers at home, some will. Consider dividing students up so that at least one person in each group has computer access at home, and they could become the “tech leader.”

Strategies for planning and integrating with other curriculum:

- When looking at your plans for the year, for all subjects, keep RiverXchange in mind. Remember, if you want to post “out of order” that is fine!
- Modify the style of writing to match what you are planning to cover at that point in the year.
- Posting shortly after a guest speaker comes to your class is recommended, so you could also consider rearranging your language arts curriculum (and scheduling your computer lab time) to coordinate with times when presenters are scheduled.
- Whatever subject you enjoy the most, see how you can use RiverXchange to enhance it.
New Mexico Curriculum Overview

Remember, partners in other states may be doing their own curriculum, but we hope you will be able to have good discussion on several of these topics over the course of the year. You may also want to combine some of the lessons so that students do a project that incorporates elements of multiple topics from the curriculum. For example, you could have students write about their river’s geography while also talking about its watershed and ways to keep pollution out of it.

Unit 1: Understanding a Watershed
   1. River Geography
   2. Watershed Model
   3. Infiltration and Runoff
   4. Forests and Wetlands

Unit 2: Water in Our Society
   5. Commercial Uses of Our Rivers
   6. Drinking Water
   7. Groundwater
   8. Wastewater

Unit 3: River Ecosystems
   9. Field Trip (with pre and post activities)

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Unit 1: Understanding a Watershed (September-December)

Project 1: River Geography

Student Assignment
Write a friendly letter to your partners (on your group page) or create another type of project, explaining:

a) what a watershed is  
b) the name of your river - this is also the name of your watershed!  
c) the journey of your river from its headwaters to the ocean  
d) what the river is like in your area - big/small, clear/muddy, fast/slow?  
e) how much precipitation your area receives each year, and what season gets the most precipitation

Informational Texts

- *Follow the Water from Brook to Ocean*, by Arthur Dorros or *Paddle-to-the-Sea*, by Holling C. Holling
- “Rains make a dent in drought ranking” article.  

Classroom Activity – Flexible! Just do as much as you want, and feel free to substitute other activities.

1. Read the book, *Follow the Water from Brook to Ocean*, by Arthur Dorros (about the Colorado River) OR *Paddle-to-the-Sea*, by Holling C. Holling (most U.S. School or public libraries have one or the other, or they can be purchased online). Explain how water flows from smaller bodies of water into a larger body. Introduce the concept of a watershed as the land area that drains into a body of water, and explain that this is where surface water comes from.
2. Show students the *U.S. Watersheds Map* (see link below), pointing out your watershed and your partners' watershed. Talk about the significance of the Continental Divide in North America, and show them where it is in New Mexico. Ask students “Is every place in the world part of a watershed?” Even if there are no hills or mountains, and there is no visible surface water, every place IS in a watershed because precipitation that falls on that land area eventually drains somewhere.
3. Have students identify your river or stream on a large classroom map, and show them where your school is located in relation to your river (north, south, east, west). Figure out where your river or stream starts (headwaters), what tributaries flow into it, and what ocean it flows into at its delta (many students may not know that the Gulf of Mexico is part of the Atlantic Ocean).
4. Point out what towns (if any) are upstream from you and discuss how they could affect your water (quantity and quality) either positively or negatively. Discuss what towns are downstream (if any) and how your town could affect their water, either positively or negatively. Trace your river's path to the ocean, recording each body of water it passes through.
5. Locate your school and your partners' school on the *Precipitation Map* (see link below). How many inches of precipitation does your area receive? Compare with your partner’s ecosystem.
6. Discuss seasons, timing of your area’s precipitation, the altitude of your area and how these affect weather. Explain how precipitation and snowpack affect the river.
7. Show students the *Major Cities and Rivers Map* (see link below), and ask them why they think so many big cities are located near major bodies of water.
8. Optional: If you have time, students (or groups of students) could research major flora and fauna in different regions along the length of your river or tributaries and create a picture postcard from that place. Or, they could write a story about a journey down the river.
9. Optional: New Mexico classes -- for more information about the Rio Grande watershed in New Mexico, show students the Everything is Connected in a Watershed poster (in teacher packet), then visit the All About Watersheds website (see link below) to explore the interactive version.

Vocabulary

- **Watershed:** The land area from which snowmelt and rain drain into a river, lake or other body of water. Also known as a drainage basin or catchment.
- **Surface water:** Water collected on the ground or in a waterbody such as a stream, river, lake, wetland or ocean.
- **Continental Divide:** A drainage divide on a continent (in the U.S., the Rocky Mountains) such that the drainage basin on one side of the divide feeds into one ocean or sea, and the basin on the other side either feeds into a different ocean or sea.
- **Headwaters:** The source of a river (where it starts).
- **Tributary:** A creek, stream, or river which feeds a larger stream or river or a lake.
- **Delta:** The mouth of a river (so named because it is triangle-shaped like the Greek capital letter Delta).
- **Desert:** A region that receives less than 10” of precipitation per year.
- **Precipitation:** All the water that falls from the sky, in solid or liquid form, such as rain, snow or hail.
- **Snowpack:** The amount of snow that accumulates annually in a mountainous area.
- **Floodplain:** Land that may be submerged by flood waters, or a plain built up by materials deposited by a river.

Materials

- **U.S. Watersheds map:** [http://maps.howstuffworks.com/united-states-watersheds-map.htm](http://maps.howstuffworks.com/united-states-watersheds-map.htm)
- **Precipitation Map:** [http://www.wrcc.dri.edu/pcpn/us_precip.gif](http://www.wrcc.dri.edu/pcpn/us_precip.gif)
- **Major Cities and Rivers Map:** [http://cgee.hamline.edu/rivers/Resources/watershedmaps/quiz3.htm](http://cgee.hamline.edu/rivers/Resources/watershedmaps/quiz3.htm)
- **Optional:** Everything is Connected in a Watershed poster and All About Watersheds website link: [http://allaboutwatersheds.org/poster/poster_view](http://allaboutwatersheds.org/poster/poster_view)

Project 2: Watershed Model

For NM classes, this is presented by a guest speaker. For partner classes, we encourage you to see if you can find someone from a local agency who has an watershed model, such as the Enviroscape.

Student Assignment

Write a persuasive paragraph, or create another type of project, about why it is important to keep stormwater clean and what we should do.

Informational Texts

- "Dead Zone" article. [http://www.sciencenewsforkids.org/2012/03/suffocating-waters/](http://www.sciencenewsforkids.org/2012/03/suffocating-waters/)
Classroom Activity – Flexible! Just do as much as you want, and feel free to substitute other activities.

1. Watch The Human Solution to Water Pollution video (see link below).
2. Schedule a guest speaker to bring a model of a watershed, OR make your own using the activity on the back of the USGS poster – Watersheds: Where We Live (the poster may be shown on a SmartBoard – see link below, and a printable copy of the activity is on your wiki).
3. Discuss how the gutters in our streets lead to storm drains, which often lead directly to the nearest body of water. Discuss the difference between stormwater and wastewater (from household drains and toilets). Find out how your community handles stormwater – is it combined with a municipal wastewater (sewage) system?
4. Read news articles (see links below) about garbage in rivers and dead zones caused by nutrients in agricultural runoff. Review the Top Ten Ways to Protect Our Precious Water handout (in teacher packet), and brainstorm other ways to reduce nonpoint-source pollution.
5. Optional: For a great math-based extension activity, try Don’t Trash Our Rio (in teacher packet) where students learn how much trash is pulled from Albuquerque’s storm drain system yearly, and calculate how many trash bags or classrooms it would fill. Even though it is based on an Albuquerque news article, this activity is applicable to any area that has a storm drain system.
7. Optional: New Mexico classes, watch Segment 3 of the Mid Rio Grande Stormwater Quality Team’s educational video (link below) to learn about Albuquerque’s and Rio Rancho’s stormwater system.
8. Optional: Partner classes, Google “stormwater” in your area and see what information is there. Water districts, the Departments of Heath and Environment etc. have many educational resources.

Materials

- The Human Solution to Water Pollution video: [http://sscafca.org/teacher-resources/](http://sscafca.org/teacher-resources/)
- Top Ten Ways to Protect Our Precious Water handout (in teacher packet and on wiki Curriculum page)
- Watershed model such as Enviroscape, OR USGS poster – Watersheds: Where We Live (the poster is available at [http://water.usgs.gov/outreach/Posters/watersheds/grade.html](http://water.usgs.gov/outreach/Posters/watersheds/grade.html) and a printable copy of the activity is on your wiki) and supplies:
  - Butcher paper (or newspaper) and plastic wrap
  - Several large baking pans or plastic containers (clear ones can be reused for Project 4: Groundwater)
  - Waterproof marker
  - Spray bottles filled with water
  - Small plastic houses, cows and cars (or little pieces of modeling clay to represent these)
  - Cocoa powder and colored drink powders
- Optional: Don’t Trash Our Rio activity (in teacher packet)
- Optional: The Majestic Plastic Bag video: [http://www.youtube.com/watch?v=GLgh9h2ePYw](http://www.youtube.com/watch?v=GLgh9h2ePYw)

Vocabulary
● **Watershed:** The land area from which snowmelt and rain drain into a river, lake or other body of water. Also known as a drainage basin or catchment.

● **Point-source pollution:** Water pollution coming from a single point, such as a sewage-outflow pipe or a factory.

● **Nonpoint-source pollution:** Water pollution coming from a wide land area, not from one specific location. Occurs when rainwater, snowmelt, or irrigation runs off plowed fields, city streets, or suburban backyards, picking up soil particles and pollutants, such as nutrients, pesticides, and other chemicals.

● **Storm drain:** A drain, often under sidewalks, designed to collect excess rain and ground water from impermeable surfaces such as streets, parking lots, sidewalks, and roofs. Also known as a storm sewer.

● **First flush:** The first surface runoff of a rainstorm. This is when we see the highest levels of pollution in water entering the storm drains.

● **Stormwater:** Runoff from a storm which either flows directly into a water body or is channeled into storm drains, which eventually discharge to surface waters.

● **Wastewater:** All the water that goes down a drain into a municipal sewer system or septic system. Also known as sewage.

**Project 3: Infiltration and Runoff**

**Student Assignment**

Where does rainwater go when it falls on your school grounds? Write a RACE paragraph, or create another type of project, using evidence from your mini-field trip around the school.

**Informational Texts**

● **USA Today** article. *La Niña Brings Flood Risks, Drought to the West* (a printable copy is on your wiki).


**Classroom Activity – Flexible! Just do as much as you want, and feel free to substitute other activities.**

1. Listen to the *Water Cycle Song* (see link below). You may want to print out the lyrics for students (a printable copy is on your wiki). Review the six major components of the water cycle: precipitation, runoff, infiltration, evaporation, transpiration, and condensation.

2. Discuss how the sun’s energy starts the whole process, and how the water cycle relates to weather, recalling the amount and timing of your area's precipitation.

3. Point out that when precipitation hits the ground, it can either run off, sink in (infiltration, also known as percolation) or evaporate back into the air. Explain how all plants move water from the ground to the air through the process of transpiration.

4. Read the *USA Today* article (see link below) and discuss how La Niña and El Niño bring dry weather or wet weather to your area. Discuss what happens in different areas of the school when you have too much rain – are there areas that flood?
5. Using *Investigating the School Grounds* (a printable copy is on your wiki) as a guide, take students on a “mini field trip” to investigate where rainwater goes on your school grounds to observe changes in land contours, and the location of downspouts and catchment areas. Discuss where runoff appears to be occurring, what affects infiltration, and the difference between **permeable** and **impermeable surfaces**.

6. Discuss how storm drains carry pollution from impermeable surfaces into the nearest body of water, whereas the process of infiltration into permeable surfaces helps filter out pollution.

7. Discuss how runoff can cause flash floods. In Albuquerque, concrete-lined arroyos are very dangerous because runoff comes from a larger area and the water moves very fast – people have drowned. In Rio Rancho, the arroyos in their natural state are generally safe unless rain clouds are visible.

8. **Optional:** For a math-based extension, test infiltration on various surfaces, using *Does it Soak Right In?* (a printable copy is on your wiki) as a guide. Graph the data as a class to build data analysis skills.

**Materials**

- *Investigating the School Grounds* activity (a printable copy is on your wiki)
- *Water Cycle Song* lyrics (a printable copy is on your wiki)
- **Optional:** *Does It Soak Right In?* activity (a printable copy is on your wiki)
  - A soup can for each group, all the same size, with both ends cut off
  - Stopwatches
  - Rulers
  - Measuring cups

**Vocabulary**

- **Precipitation:** All the water that falls from the sky, in solid or liquid form, such as rain, snow or hail.
- **Runoff:** The rain or snow that does NOT sink into the ground, that runs off the land into a river, lake or other body of water (often carrying dirt and pollution with it).
- **Infiltration:** The process of water sinking down into the ground to refill the aquifer. Also called percolation.
- **Evaporation:** The process by which water changes from liquid to vapor (water in a puddle, river, lake, ocean, or other body of water evaporates into the air).
- **Transpiration:** The process by which water comes out of the leaves of plants, primarily through openings in the leaves, and goes into the air.
- **Condensation:** The process by which water changes from vapor to liquid (water in clouds condenses to form rain).
- **Impermeable surface:** A material that water can NOT soak into (or infiltrate); also called an impervious surface.
- **Permeable surface:** A material that water can soak (or infiltrate) into; also called a pervious surface.
- **Flash flood:** A rapid flooding (less than six hours) of low-lying areas (such as washes, rivers, dry lakes, basins), caused by heavy rain, snow or sudden icemelt in surrounding areas.
- **Arroyo:** A Spanish word for a drainage ditch, gully or ravine which was carved by water drainage.
Project 4: Forests and Wetlands

Student Assignment
Write a persuasive paragraph, or create another type of project, about why wetlands and forests are important in our watersheds.

Informational Texts
- ABQ Journal article. River Diversions Halted Due to Burn Scar Runoff (a printable copy is on your wiki).

Classroom Activity – Flexible! Just do as much as you want, and feel free to substitute other activities.
- Watch The Adventures of Junior Raindrop video (see link below) to learn about how vegetation helps prevent erosion.
- Read the ABQ Journal article (a printable copy is on your wiki) about erosion from wildfires polluting the Rio Grande.
- Do the Wetland Model activity from the back of the USGS poster – Wetlands: Water, Wildlife, Plants (the poster may be shown on a SmartBoard – see link below, and a printable copy of the activity is on your wiki) to examine the effects of a wetland in reducing erosion and controlling flooding.
  - To model forests in the watershed, stick cotton balls in the clay and repeat the experiment again to see that the muddy water gets even cleaner as it travels through the “forest.”
- Even in desert areas like New Mexico, there are wetlands, and riparian areas. Many are constructed (man-made) specifically for cleaning stormwater. Discuss how these areas also support a diverse community of living things, and how many people used to think wetlands were not important. In fact, they would fill them in with soil and build right on top of them!
- Find books from your library on different kinds of wetlands, and discuss the differences in wildlife and plant communities they support – OR watch the NatureWorks video (see link below).
- Optional: Do the Water Treatment Plants activity (see link below) to see how celery sticks, like wetland plants, can help filter water by absorbing pollution. This activity is very quick to set up, then just wait one day to see what happens.
- Optional: New Mexico classes, watch Segment 2 of the Mid Rio Grande Stormwater Quality Team’s educational video (link below) to learn how stormwater from our roadways is handled, and how a constructed wetland helps clean stormwater.

Materials
- USGS poster – Wetlands: Water, Wildlife, Plants. The poster is available at [http://water.usgs.gov/outreach/Posters/wetlands/middle.html](http://water.usgs.gov/outreach/Posters/wetlands/middle.html), and a printable copy of the activity is on your wiki.
- Supplies:
  - Small rectangular plastic storage containers, or baking pans or paint trays
  - Modeling clay
  - Small pieces of carpet
Cotton balls

- Optional: Water Treatment Plants activity (a printable copy is on your wiki)
  1. Celery sticks
  2. Cups of colored water

**Vocabulary**

- **Erosion**: The process in which a material (such as a river bank) is worn away by water or air, often due to the presence of abrasive particles in the stream.
- **Wetland**: An area such as a marsh or swamp that is covered with shallow water or where the soil is naturally soaked with water.
- **Riparian area**: The area around the banks of a natural body of fresh water, where the vegetation and landscape is directly influenced by that water.

**Unit 2: Water in Our Society (January-May)**

**Project 5: Commercial Uses of Our Waterways**
For NM classes, this is presented by a guest speaker from the county's Cooperative Extension. For partner classes, we encourage you to see if you can find someone from a local agency or business who can present on this topic.

**Student Assignments**
Write an informational paragraph or a friendly letter to your partners, or create another type of project, explaining:
  a) How was the river (or other waterway) important when people first settled in your community?
  b) How has your waterway been used by people for commerce (to make money) in your community's history?
  c) Do some people still rely on the waterway for their jobs, such as farming, fishing, shipping, or recreation?
  d) What technologies have people developed to solve water problems in your area (like drilling wells, building dams, locks, and fish ladders, different kinds of irrigation, or technologies to conserve water or prevent pollution?)

**Informational Texts**

**Classroom Activity – Flexible! Just do as much as you want, and feel free to substitute other activities.**
- Research the major commercial use(s) of your river/waterway (such as agricultural irrigation, shipping/transportation, electricity, fisheries and/or recreation) and invite a guest speaker to present, or find an activity that relates. In New Mexico, the only major commercial use of the Rio Grande is agriculture – 80% of the water goes to irrigation!
Discuss how these commercial uses influenced the location/history of your community, and how these users can also help a community conserve water and keep water clean (such as conserving water when irrigating, controlling erosion, keeping boat engines in good repair).

Discuss how people have developed technological solutions to solve water problems. For example, many ancient settlements in the West were abandoned because of lack of water, but irrigation technology has made it easier to survive. Dams have made it easier to control the flow of rivers, reservoirs store water, and fish ladders are built so that dams don't prevent their migration. High-efficiency toilets and other appliances help conserve water.

In NM, discuss the acequia system which was put in place by the Pueblo people and early Spanish settlers. Watch one of the YouTube videos, or read an article about water rights (see links below).

Show students the USGS poster - Navigation: Traveling the Water Highways (see link below, and a printable copy of the activity is on your wiki). Discuss how some communities use their river for transportation, while New Mexico rivers are used mainly for agricultural irrigation. New Mexico students may not be familiar with dams, locks and boats traveling on the river. If your river is used for transportation, you may want to do the River Profile activity on the back of the poster.

Optional: Water Ripples games (see link below). Review ways our society uses water, particularly in agriculture.

Optional: Water Rights. Using the Pass the Jug activity guide (see link below), act out the two different methods of assigning water rights to all the water users. Discuss the difference between the Riparian Rights and Prior Appropriation doctrines. Research the history of water rights in your community and compare the differences in water rights issues with your partners' area. Prior Appropriation is used in the western states, which receive far less precipitation. Revisit the Precipitation Map and discuss why this makes a difference. Read about farmers being allowed to sell their water rights to allow more water for the ecosystem.

Materials
1. USGS poster - Navigation: Traveling the Water Highways. The poster is available at http://water.usgs.gov/outreach/Posters/navigation/grade.html, and a printable copy of the activity is on your wiki.
3. Optional: Water Rights
   o Pass the Jug activity: http://www.earthsciweek.org/forteachers/passthejug_cont.htm
   o Precipitation Map: http://www.wrcc.dri.edu/pepn/us_precip.gif
   o Ancient Irrigation video: http://www.youtube.com/watch?v=RUv2Tz1ayTc
   o Ditch Cleaning at Arroyo Hondo video: http://www.youtube.com/watch?v=Yyqxdb5EObU

Vocabulary
- Irrigation: Watering crops. When natural precipitation is not enough for crops, farmers use flood irrigation (common in New Mexico), drip irrigation and/or overhead sprinklers.
- Acequia: An irrigation ditch used to distribute water from rivers to farms. Most are simple ditches with dirt banks, but they can be lined with concrete. An important form of irrigation in the development of agriculture in the American Southwest.
- Erosion: The process in which a material (such as a river bank) is worn away by water or air, often due to the presence of abrasive particles in the stream.
● **Dam:** A barrier built across a river to hold water back; sometimes used to generate electricity.
● **Lock:** A chamber with gates that close off for raising and lowering boats on a river or canal.

**Project 6: Drinking Water**

For NM classes, this is presented by a guest speaker from the water utility. For partner classes, we encourage you to see if your local utility can send someone to present.

**Student Assignments**

*Write a persuasive paragraph (or create another type of project) explaining why it is important to conserve water, and what we should do.*

**Informational Texts**

- *Jacksonville Journal Courier* article. *City Cracking Down on Water Use* (a printable copy is on your wiki).
- *ABQ Journal* articles (several on drought and drinking water; printable copies on your wiki).

**Classroom Activity – Flexible! Just do as much as you want, and feel free to substitute other activities.**

1. Discuss the *Indoor Water Use* graph (see link below), emphasizing that all of these activities use clean drinking water. Explain that in homes and other buildings there is one set of pipes that bring clean drinking water into the home and a different set of pipes that takes the dirty water away. Be sure to mention that in many parts of the country (like in NM) people use almost as much for watering plants outdoors as all their indoor water use combined. Discuss how xeriscape and watering during the coolest part of the day can help.

2. Schedule a guest speaker to present on where your drinking water comes from, how it is treated to make it safe for drinking, and/or ways to conserve water. OR research where your drinking water comes from, and do The Value of Water activity from the back of the USGS poster - *Water: The Resource That Gets Used & Used & Used For Everything* (see link below, and a printable copy of the activity is on your wiki). Students will examine their water use by using play money to record their daily usage, then brainstorm how to conserve. For a math-based extension activity, you can graph the data as a class to build data analysis skills.

3. Discuss how flooding or drought can affect your community's drinking water. Look for articles in your local paper, or read one of the suggested articles (printable copies are on your wiki). The *Jacksonville Journal Courier* article talks about flooding in Illinois, while one *ABQ Journal* article talks about the emergency water restrictions in Las Vegas, NM. Other *ABQ Journal* articles discuss Albuquerque and Santa Fe drinking water projects and the current drought.

4. **Optional: Water Footprint.** Calculate your impact using an online tool (see link below).
5. **Optional: Water Use in Other Countries.** To learn more about water use in other countries, invite a guest speaker from Water for People (see link below) and/or watch the *Water for Life* video, and/or
read the book *A Long Walk to Water*, by Linda Sue Park. Compare average indoor water use in the U.S. to that in other nations.

6. **Optional: The Water-Energy Connection.** Show students the *Power Couple* video and/or water-energy posters to learn about the connection between electricity and water use, then do the activity (see links below.).

**Materials**

- *Indoor Water Use Graph* [http://www.epa.gov/WaterSense/pubs/indoor.html]
- **Optional: Water Footprint Calculator**
- **Optional: Water Use in Other Countries**
  - Speaker: [http://www.waterforpeople.org/assets/pdfs/committees/water-for-people-committee.pdf](http://www.waterforpeople.org/assets/pdfs/committees/water-for-people-committee.pdf)
- **Optional: The Water-Energy Connection**

**Vocabulary**

- **Drinking water:** Water that has been purified to standards set for human consumption.
- **Xeriscape:** The use of low water use plants in landscape (*not* “zeroscape”). *Xeros* is Greek for “dry.”
- **Conserve:** To use something wisely; not wasting.
- **La Niña:** An irregularly occurring movement of deep cold water to the ocean surface along the western coast of South America that brings less precipitation to the southern U.S. and more to the northern U.S.
- **El Niño:** An irregularly occurring flow of unusually warm surface water along the western coast of South America that brings more precipitation to the southern U.S. and less to the northern U.S.

**Project 7: Groundwater**

**Student Assignment**

How are groundwater and surface water connected? Write a *RACE* paragraph, or create another type of project, using what you learned from the aquifer model.

**Informational Texts**

- *ABQ Journal* article. *State: Kirtland Jet Fuel Leak Massive* (printable copy is on your wiki)
- *ABQ Journal* article. *KAFB Ramps Up Fuel Spill Cleanup* (printable copy is on your wiki)
Classroom Activity – Flexible! Just do as much as you want, and feel free to substitute other activities.

- Watch *The Story of Groundwater* video (see link below) to learn the difference between groundwater and surface water.
- Show students the *Major U.S. Aquifers* map (see link below) and locate your aquifer.
- Do the activity *Recharge-Discharge* from the back of the USGS poster – *Groundwater: The Hidden Resource* (the poster may be shown on a SmartBoard – see link below, and a printable copy of the activity is on your wiki). Students build a simple aquifer model to learn about the water table, how a well works, and how groundwater and surface water are connected. Discuss how if we pump too much of surface water it can deplete groundwater, and vice versa. Also, if one person pumps too much groundwater from their well, it can affect their neighbors' wells.
- Leaking underground tanks (such as septic tanks or gas tanks beneath gas stations) are a major source of groundwater pollution. This can be demonstrated using small plastic cups with holes poked in the bottom. Sink a cup into the gravel of the model and fill it with colored water to see how pollution spreads through groundwater. Note that contaminated groundwater can pollute surface water and vice versa.
- Read articles from the Albuquerque Journal about a jet fuel leak from Kirtland Air Force Base (printable copies are available on your wiki) or find articles about similar issues in your area. Discuss what types of pollution can get into groundwater and what can't. Solids such as trash and dog poop on the earth’s surface cannot travel down to the aquifer. Dissolved chemicals, heavy metals, and very large amounts of farm animal waste can, however.
- Read articles about groundwater from the Groundwater Foundation. Review the *Top Ten Ways to Protect Our Precious Water* handout (in teacher packet). Brainstorm other ways to prevent groundwater pollution.

Materials

- *Top Ten Ways to Protect Our Precious Water* handout (in teacher packet)
- USGS poster – *Groundwater: The Hidden Resource*. The poster is available at [http://water.usgs.gov/outreach/Posters/groundwater/grade.html](http://water.usgs.gov/outreach/Posters/groundwater/grade.html), and a printable copy of the activity is on your wiki.
- Supplies:
  1. Several clear baking pans or plastic containers
  2. Gravel to fill containers 2/3 full
  3. Several pump tops from soft-soap or hand-lotion containers
  4. Paper cups with holes punched in the bottom to sprinkle water
  5. Colored drink powder
Vocabulary

- **Aquifer**: A wet underground layer of water-bearing rock or materials (gravel, sand, silt or clay) from which groundwater can be extracted using a well.
- **Groundwater**: Water located beneath the earth’s surface in cracks between soil particles and fractures in rock formations. A large and usable quantity of groundwater is called an aquifer.
- **Surface water**: Water collected on the ground or in a waterbody such as a stream, river, lake, wetland or ocean.
- **Water table**: The top surface of an aquifer (how far you have to dig down to find water).
- **Well**: A man-made hole with a pipe that goes down to the water table. A pump helps bring the groundwater up.

**Project 8: Wastewater**
For NM classes, this is presented by a guest speaker from the water utility. For partner classes, we encourage you to see if your local utility can send someone to present.

**Student Assignment**
Write a narrative or creative paragraph, or create another type of project, explaining the journey of your community’s wastewater.

**Informational Texts**
- ABQ Journal article. *Aging Pipes Mean Higher Water Bills* (printable copy on your wiki).
- Combined sewer overflows article (Includes a fantastic video! Scroll way down to see "A Drop's Life").

**Classroom Activity** – Flexible! Just do as much as you want, and feel free to substitute other activities.
- Invite a guest speaker to learn about where your community's wastewater goes, OR (if your community has a municipal sewer system) do the activity *Where Does Your Used Water Go?* on the back of the USGS poster - *How Do We Treat Our Wastewater?* (see link below; printable copy is on your wiki).
- Show students the *Septic System* poster (a printable copy is on your wiki) and explain the difference between a sewer system and a septic system – they both treat wastewater essentially the same way, but a septic tank is right by the house and uses a drainfield in rural areas. If desired, watch the *Dirty Jobs* video (see link below). If your community has mostly septic systems, discuss how important it is to have the tanks pumped out regularly to avoid groundwater pollution.
- Discuss what kinds of things NOT to put down the drain or toilet – for example, fats, oils, and grease can solidify in pipes and cause a backup. Read the articles about Albuquerque’s crumbling sewer infrastructure (a printable copy is on your wiki), read the article about combined sewer overflows by a geology professor from Kent State (see link below), or find local news articles about issues in your area.
Discuss how treated wastewater is recycled in many communities (such as watering golf courses), and how a community's treated wastewater will be used by downstream communities.

Review the differences between stormwater, drinking water, and wastewater, emphasizing how different sets of pipes are involved, and that the “quality” of the water being transported is very different.

Materials
1. USGS poster - How Do We Treat Our Wastewater? The poster is available at http://water.usgs.gov/outreach/Posters/wastewater/grade.html, and a printable copy of the activity is on your wiki.
2. Supplies:
   1. 14 feet of yarn, string or rope
   2. Shredded paper or packing peanuts and a cardboard box
3. Septic System poster (a printable copy is on your wiki).
4. Combined Sewer Overflow video: A Drop’s Life. Applies to certain cities only, mostly in the eastern US, find out if your city has this type of system. https://www.youtube.com/watch?v=5Ug1hravb9Q
5. Dirty Jobs: Septic Tank Technician video (Caution – this video has one bad word at 1:16) http://home.howstuffworks.com/home-improvement/plumbing/sewer2.htm

Vocabulary
1. Wastewater: All the water that goes down a drain into a municipal sewer system or septic system. Also known as sewage.
2. Sewer system: A system of underground pipes used to transport human waste. In some communities, the sewer system is combined with the storm system (known as a combined sewer).
3. Septic system: A small-scale sewage treatment system common in areas with no connection to a municipal wastewater system. A septic tank is a key component of a septic system.
4. Stormwater: Runoff from a storm which either flows directly into a water body or is channeled into storm drains, which eventually discharge to surface waters.
5. Drinking water: Water that has been purified to standards set for human consumption.

Unit 3: River Ecosystem Field Trip (any time during the year)

Project 9: Field Trip

Student Assignment
Write a narrative paragraph or a friendly letter to your partners, or create another type of project, about your field trip experience:
   a) If you tested the water, explain why we collect water quality data and what it means.
   b) If you planted trees or did another service learning project, explain how your project will help the river ecosystem.

Informational Texts
1. A Waterproof Case (in teacher packet)
2. The Water Down Under booklet (in teacher packet)
Pre-Field Trip Activities

1. Define an ecosystem (the physical environment together with all the species that live there). Discuss how living things depend on the nonliving things, such as water, air, soil/rocks, and the sun.

2. Read The Water Down Under booklet to learn more about macroinvertebrates and water quality. OR watch Macroinvertebrate Lunch and have students complete the student guide (see link below) to learn about the role of aquatic macroinvertebrates in the food web and what they can tell us about the health of our ecosystem. Many animals depend on them for food. Some aquatic macroinvertebrates are sensitive to pollution, so one way scientists can tell how healthy a river ecosystem is by looking at which types of macroinvertebrates are living in the water. Many of them spend only part of their lives in the water, so if the water is polluted, it has far-reaching effects on the ecosystem. Discuss producers, consumers and decomposers, and where aquatic macroinvertebrates fit (some are consumers, some are decomposers).

3. Talk about the field trip and location, and what students can expect.

4. Optional: Frogline News. Watch a newscast by frogs (see link below) to revisit how pollution gets into surface water. Discuss the significance of the frog (i.e., the frog is a biological indicator species because it is very sensitive to water pollution). Remind students of the watershed model and how they can prevent nonpoint-source pollution.

5. Optional: Acid Rain. Watch the video How Acid Rain Works (see link below).

Field Trip

1. For New Mexico Classes: Field trips may include a service learning project, such as tree planting or an agricultural activity. Otherwise, they will incorporate hands-on lessons about riparian areas, wetlands, macroinvertebrates and water quality, and students will use a field journal. On the field trip, students will gather data about pH, temperature, turbidity and dissolved oxygen.

2. For Partner Classes: We strongly encourage you to take any water-related field trip available in your area, and we can help if you have trouble finding one. Please let us know if you’d like a water quality monitoring kit!

3. Water quality data will be sent to the World Water Monitoring Challenge program and will appear on their website. If you receive a water quality testing kit from us, please submit your data to the Partner Teacher Coordinator immediately after your field trip.

Post-Field Trip Activity

1. Review how land use affects water quality and what the water quality data tells us about the ecosystem.
   - Increased river temperature can be caused by many things including low river flow, large areas of impermeable surfaces, lack of vegetation, and stormwater that is warm from flowing over roads.
   - High temperature and/or fertilizers (including pet waste) can cause algae bloom, which can reduce dissolved oxygen.
   - Erosion or algae bloom can cause turbidity, leading to higher temperature.
• Acid rain, mine drainage or algae bloom can cause low pH (normally pH is determined by the types of rocks or trees present in the watershed).
• Compare the class data to other World Water Monitoring Day sites on the 2013 map on their website (see link below).
• Read news articles about issues in your local ecosystem. A few articles for NM are provided (printable copies are on your wiki).

Optional: River Food Web. Make a food web for your local ecosystem, identifying producers, consumers and decomposers, native species and invasive species, as well as local endangered species. Discuss how wildlife are “water users” too. Like humans, wildlife needs clean water to live, so as a community we must consider their needs when making choices about water. NM Classes: use Bosque plant and animal cards to do The Web activity (a printable copy is on your wiki), discussing how all living things depend on each other. For Partner Classes: The Web activity can be applied to any ecosystem and is a simple, yet fun way to get kids thinking “on their feet”.

Materials

Pre-Field Trip Activities:
• Macroinvertebrate Lunch activity
  o Video, student sheet, answer sheet: http://www.watersheds.org/earth/macro_resources.htm
Frogline News video: http://www.youtube.com/watch?feature=player_embedded&v=HhlPtNX5XTM

Field Trip:
Macroinvertebrate Data Sheets (if desired, printable copies are on your wiki).

Post-Field Trip Activities:
World Water Monitoring Challenge website http://worldwatermonitoringchallenge.com/
Optional: The Web food web activity (a printable copy is on your wiki).

Vocabulary

Ecosystem: All the living and nonliving things that interact in a particular place.
Bosque: A Spanish word for woodlands, it refers to the riparian areas of stream and river banks in the southwestern U.S.

pH: A measure of the acidity or alkalinity of water (or a solution) on a scale that ranges from 0 (extremely acidic) to 14 (extremely alkaline). Pure water has a pH of 7 (neutral).
Turbidity: A measure of water clarity based on the amount of particles suspended in it.
Dissolved oxygen: The concentration of oxygen dissolved in water, expressed in milligrams per liter or as a percent saturation.
Riparian area: The area around the banks of a natural body of fresh water, where the vegetation and landscape is directly influenced by that water.
Aquatic macroinvertebrates: Animals that have no backbone, are visible with the naked eye, and spend all or part of their life in water. This diverse group of animals includes worms, mollusks, arachnids, crustaceans and insects.

Food web: A representation of the predator-prey relationships between species within an ecosystem.
Producers: Organisms, generally plants, that make their own food (using only the sun's energy, water, and inorganic compounds), and are the foundation of the food chain.
**Consumers:** Organisms that obtain nutrients by eating other organisms (such as plants or other animals).

**Decomposers:** Organisms (such as bacteria, fungi, other plants and animals) that break down the remains of dead organisms, releasing the substances that can be used by other members of the ecosystem.

**Native species:** A species that naturally occurs in a particular ecosystem.

**Invasive species:** A plant or animal introduced from a different area that competes with native species that is taking over an area.

**Endangered species:** A plant or animal species existing in such small numbers that it is in danger of becoming extinct (dying out completely).