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

2012 Report

June 14, 2012

Presented by Experiential EE, LLC

Company Proprietary
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EXECUTIVE SUMMARY

RiverXchange is an innovative, long-term youth outreach program that integrates water resources topics with computer technology, student writing, and a hands-on curriculum to meet specific, measurable outcomes. Since 2007, the program has enabled 147 upper elementary classes from New Mexico (NM) to become “high tech pen pals” with a class outside the state to learn about the geography, culture and ecology of their local river and watershed – and share what was learned.

The curriculum incorporates hands-on activities, classroom presentations by local water resources professionals, and a field trip to the local river or important watershed feature. The field trip includes water quality monitoring and/or a service learning project. Students write about what they are learning via a private wiki website that can be viewed by their partner class. Each student is assigned a pen pal, who is able to read and comment on what was written. Program outcomes are measured via three online student surveys and an analysis of student wiki writing. The computer technology and writing components provide unique ways to reinforce what was learned, increase student motivation to learn, and enable organizers to collect valuable metrics. All program costs and coordination are provided free of charge to NM teachers. Training, technical support and some curriculum materials are provided free of charge to partner teachers.

This year, funding enabled 66 NM classes to participate. Each NM class was partnered with a class outside the state for a total of over 3,000 participants (1,625 students and 70 teachers in NM). The program required $92,310 in cash and received in-kind contributions valued at $93,595. All major “Next Steps” recommended in the RiverXchange 2011 Report were met. Notable changes/additions to this year’s program include:

- Grew program from 45 to 66 partnerships; included classes from three NM counties, 17 U.S. States, two Canadian provinces, and Romania.
- Revised curriculum to incorporate new Big Water Questions, new lesson plan format including resources, vocabulary and assessment questions for each activity.
- Created all wikis and student pages before program launch to reduce technical difficulty for teachers. Curriculum page on all wikis included links to resources.
- Expanded field trip locations and incorporated water quality monitoring component in partnership with World Water Monitoring Challenge.
- Established a November 1 wiki writing deadline to ensure all classes got off to a strong start.
- Implemented a wiki writing incentive program for classes in Albuquerque and Rio Rancho which improved quantity and quality of writing as well as assessment response rate.

Performance on the three online assessments showed that NM students achieved Proficiency or higher on many water resources issues relating to the curriculum, and a record 56% of NM classes met our goal of writing on five or more water resources topics -- more than double last year's percentage.

Finally, teachers said that all components of the program were important/valuable to their own and their students' learning experience, especially the interaction with water resources professionals through classroom presentations and the pen pal component.
PROGRAM DESCRIPTION

Purpose of Program
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 source water clean, and provide a high quality, high impact outreach opportunity for funders and in-kind contributors. The program targets fifth grade students.

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 resources 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 2006, we observed early on that NM elementary teachers rarely incorporate water concepts in the classroom beyond what is required by the state (e.g., water cycle), and that most elementary teachers consider “water” strictly as a science topic. While teachers personally acknowledge the importance of conserving water and keeping source water clean, we routinely find that upper elementary students have 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, provides many opportunities for critical thinking, and is easy to integrate into the normal curriculum. Our hope is that participants will want 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 (with the New Mexico Water Conservation Alliance as the fiscal agent) 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 work load and bring up-to-date technical information into the classroom.

Program Management and Financial Support
The program timeframe was July 1, 2011 through June 30, 2012. All components including fundraising, design, planning, implementation and analysis were carried out by Experiential EE, LLC, an Albuquerque-based consulting firm owned by Katie Babuska. In addition to Ms. Babuska, all work was carried out by the following team of independent contractors:
   Amelia White, Program Manager
   Bonnie Schmader, Field Trip Coordinator
   Pamela Dupzyk, Field Trip Coordinator
   Michelle Watson, NM Coordinator
   Jill Turner, Partner Teacher Coordinator

Once again, the New Mexico Water Conservation Alliance (NMWCA) served as a fiscal agent for two grants. NMWCA is a nonprofit 501(c)(3) corporation comprised of municipal and industrial water conservation professionals dedicated to water conservation education and networking.
Sponsors

- Southern Sandoval County Arroyo and Flood Control Authority
- U.S. Bureau of Reclamation
- Mid Rio Grande Stormwater Quality Team
- Santa Fe County
- City of Santa Fe
- Rocky Mountain Section/AWWA/RMWEA

Sponsors provided $92,310 in cash. Program expenses included:

- Computer software (e.g., wikis, online teacher training)
- Substitute teachers for NM teacher workshops
- Teacher workshop training materials and supplies
- Teacher classroom materials, including USGS water education posters
- Postage, photocopying
- Field trip bus transportation for NM classes
- Field trip supplies and portable toilet rentals for NM classes
- Awards for wiki writing incentive program (i.e., field trip bus transportation, gift cards)
- Coordination services (e.g., planning, implementing and assessing all program components)

In-kind Partners – Classroom Guest Speakers (NM)

- Albuquerque Bernalillo County Water Utility Authority
- Bernalillo County Cooperative Extension, 4-H
- Bernalillo County Public Works
- City of Albuquerque, Stormwater Division
- City of Rio Rancho
- City of Santa Fe
- NM Environment Department
- Sandoval County Cooperative Extension, 4-H
- Santa Fe County Cooperative Extension, 4-H
- Southern Sandoval County Arroyo and Flood Control Authority

In-kind Partners – Field Trip Docents (NM)

- Alcalde Sustainable Agriculture Science Center (NM State University)
- Bernalillo County Cooperative Extension, 4-H
- Bernalillo County Open Space
- City of Albuquerque Open Space
- City of Santa Fe
- Ciudad Soil and Water Conservation District
- La Plazita Institute
- Rio Arriba County Cooperative Extension, 4-H
- Sandoval County Cooperative Extension, 4-H
- Santa Fe County Open Space and Trails Program
- Santa Fe County Cooperative Extension, 4-H
- Small Farm Task Force (NMSU Cooperative Extension)
- Water for People (with representatives from Daniel B. Stephens, CDM Smith, Weston Solutions, Ciudad Soil and Water Conservation District, NM Environment Department)
In-kind contributions totaled $93,595. For NM classes, in-kind contributions totaled $72,310 and included classroom guest speakers, field trip docents, workshop space and computer lab use, student assessment software, wiki technology and classroom resources. For partner classes, in-kind contributions totaled $21,285 and included classroom guest speakers, field trip docents and field trip bus transportation. *NOTE: only about half of partner teachers reported this information; the actual amount is probably larger.* Sponsors and in-kind partners were recognized on our website and in presentations.

Participant Selection
Of the 66 participating NM classes, 65 were fifth grade and one was fourth grade (this teacher was participating before the program transitioned to fifth grade exclusively). There were 1,625 students and 70 teachers distributed as follows:

**Albuquerque – 25 classes**
- 576 students
- 27 teachers

**Rio Rancho – 22 classes**
- 581 students
- 24 teachers

**Santa Fe County – 19 classes**
- 468 students
- 19 teachers

Of the partner classes (all located outside NM), about half were fourth grade and half fifth grade. We marketed the program to both grade levels in order to secure more partners. 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, coordinate the field trip or pay for any direct costs. Partner classes were located in 17 U.S. states, two Canadian provinces, and Romania.

Participating New Mexico Schools

<table>
<thead>
<tr>
<th>Albuquerque</th>
<th>Rio Rancho</th>
<th>Santa Fe County</th>
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<tbody>
<tr>
<td>Annunciation Catholic School</td>
<td>Maggie Cordova Elementary</td>
<td>Amy Biehl Community School</td>
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<tr>
<td>Apache Elementary</td>
<td>Martin Luther King, Jr. Elementary</td>
<td>Carlos Gilbert Elementary</td>
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<td>Chelwood Elementary</td>
<td>Puesta del Sol Elementary</td>
<td>Pojoaque Intermediate School</td>
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<tr>
<td>Cochiti Elementary</td>
<td>Rio Rancho Elementary</td>
<td>Rio Grande School</td>
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<tr>
<td>Collet Park Elementary</td>
<td>Sandia Vista Elementary</td>
<td>Santo Nino Catholic School</td>
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<tr>
<td>Georgia O'Keeffe Elementary</td>
<td>Stapleton Elementary</td>
<td>South Mountain Elementary</td>
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<td>John Baker Elementary</td>
<td>Vista Grande Elementary</td>
<td>Turquoise Trail Charter School</td>
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<td>Lew Wallace Elementary</td>
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<td>Wood Gormley Charter School</td>
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<td>Navajo Elementary</td>
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<td>North Star Elementary</td>
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<td>Osuna Elementary</td>
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<td>Whittier Elementary</td>
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Curriculum
A key component of RiverXchange is the hands-on curriculum, which is to be carried out from approximately September 15 to May 15. 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 pal. 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.

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 wiki website that can be viewed by their partner class. Each student is assigned a pen pal, who is able to read and comment on what was written. The computer technology and writing components provide unique opportunities 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 have an exciting 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 local area.

All activities are correlated to NM state standards and benchmarks for Science, Social Studies and/or Mathematics. Also, all activities -- because they require that students post written information on the wiki -- address Language Arts standards for writing. For a summary of the RiverXchange Curriculum, see Appendix 1.

Guest Speakers
We coordinated four guest speakers into 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

Teachers were not limited to the guest speakers or field trips we coordinated for them; all were encouraged to invite additional water-related guest speakers into the classroom and/or go on additional field trips. Many teachers also invited guest speakers including the NM State Land Office and NM Office of the State Engineer. Several teachers organized their own 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 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 agencies located in most parts of the U.S. that may be able to assist.

**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, which occurred in the fall and spring months. New this year, all field trips included a water quality monitoring component, in partnership with World Water Monitoring Challenge and the Rocky Mountain Section of the American Water Works Association. World Water Monitoring Challenge made an in-kind contribution of water quality test kits for partner teachers; a financial contribution by the Rocky Mountain Section of the American Water Works Association enabled us to purchase kits for use on NM field trips and mail kits to all partner teachers. All data collected by RiverXchange classes were submitted to the World Water Monitoring Challenge website so that they can be shared with others around the world.

**Albuquerque Field Trip Locations**

**Sanchez Farm**

This 14-acre tract of land located in Albuquerque’s South Valley, is owned by Bernalillo County Open Space and serves as a drainage retention basin for stormwater runoff. The property features a wetland, irrigation ditch, and working farm that is run by La Plazita Institute. Students helped with planting, tested water quality, learned how farms are flood irrigated using the local acequia, and how wetlands clean stormwater.

**Tingley Beach 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.

**La Orilla Bosque / Open Space Visitor Center**

Managed by City of Albuquerque Open Space, this property is located in northwest Albuquerque, adjacent to the Bosque and Rio Grande. Students took a nature hike, saw how irrigation water and stormwater travel through the area, planted native shrubs near the wetland, and learned about the ancient people who lived on the property.

**Alameda Wetland/Bachechi Open Space**

The Bachechi property, owned by Bernalillo County Open Space, is 27 acres of fertile valley farmland, located just south and east of the adjacent 8-acre Alameda Open Space that is owned and operated by the City of Albuquerque Open Space Division. It is adjacent to the Rio Grande bosque and Rio Grande Valley State Park. Students took a nature hike, saw how irrigation water travels through the area, planted native shrubs near the wetland (City property only), tested water quality, and observed macroinvertebrates.
La Cieneguilla
The Santa Fe County Open Space at La Cieneguilla is an undeveloped site with safe access to the Santa Fe river and wetlands nearby. Water in the river at that point comes entirely from the outlet of the wastewater treatment plant. Students took a nature hike, tested water quality, and observed macroinvertebrates.

Alcalde Sustainable Agriculture Science Center
This 61 acre site, located on the east bank of the Rio Grande between Taos and Santa Fe, is owned by New Mexico State University. The center conducts research on sustainable agriculture to benefit the small family farms of north central NM. Students became “scientists for the day” to learn about acequias, agriculture, and irrigation techniques.

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.

Teacher Professional Development Workshop
Although work began many months earlier, RiverXchange officially kicked off in September with a full-day teacher workshop for NM teachers and a 90-minute online training session for partner teachers. Five in-person workshops and ten online training sessions were held to train all 132 teachers. The workshops and trainings focused on how to implement the activities in the curriculum, and how to operate and manage a class wiki. NM teachers learned how to implement several of the hands-on activities, and they were introduced to guest speakers who were on hand to schedule classroom presentations.

As a condition of participation, all teachers signed a Letter of Understanding and Agreement. They were asked to review what the program is about, agree to carry out all major components of the program, and protect student privacy. Teachers also received an information packet containing a copy of this letter, the curriculum, and other program information and materials, including a set of nine USGS water education posters. In addition, partner teachers received a classroom water quality testing kit.

Wiki Technology
One of the most important yet challenging aspects of program implementation continued to be the training of teachers on how to use the wiki, so that they feel confident and remember what to do back in the classroom. A wiki enables one or more users to edit any page or to create new pages within the wiki web site. It is similar to a blog, with each student using their own page as a blog. We chose PBWorks as our web-based communication network. This year, we created the wikis as well as the student accounts prior to the workshop, in order to streamline the training for teachers.
Online Partner Training
Teachers were able to view an online slideshow explaining basic wiki procedures, then log in at an appointed time to participate in a live discussion and demonstration of the basic wiki procedures. We used WebEx, a virtual meeting platform that allows participants to see the presenter’s computer screen as they demonstrate procedures, and communicate with the presenter to ask questions. Time zone differences and teachers’ schedules necessitated that we hold ten online trainings lasting about 90 minutes each.

EVALUATION

Teacher Surveys
Using Survey Monkey, we administered two online teacher surveys – one for NM and one for partners -- to help us identify areas in which we could improve the program to make it easier and more useful for teachers. The response rate was about 50% on both the NM teacher survey and the partner teacher survey.

Response Similarities
- In general, teachers said that all components of the program were important/valuable to their students' learning experience.
- In general, most responded that interaction with water resources professionals was very helpful to them as teachers and very important/valuable to their students' learning experience.
- The most common difficulties reported were limited computer time and instructional time.
- Some teachers (both NM and partner) said the pen pal component was difficult or disappointing because their partner did not communicate with them very often.
- Many teachers (both NM and partner) reported that their students' limited writing and typing skills made it difficult to fulfill the amount of writing we requested of them.

Response Differences
- NM teachers overwhelmingly responded that the guest speakers and field trip were very important/valuable to their students' learning experience.
- Many partner teachers said they had difficulty scheduling guest speakers and field trips. This is because we were not able to help them with this task due to funding restrictions.
- More NM teachers than partner teachers reported difficulty scheduling computer time as a major obstacle.
- Some partner teachers said they felt they needed more technology training, probably because we were only able to offer initial online training.

Strategies for Improvement
As in years past, the wiki communication was the most difficult -- yet very rewarding -- component of the program for both teachers and coordinators. This year, we asked teachers how often they think is reasonable for students to write on the wikis, as a goal vs. reality. More NM teachers had the goal of writing as often as once a week, whereas a slightly larger number of partner teachers thought it would be more realistic to write just three times a year. We think the difference is due to our coordination of guest speakers into NM classes, which provides more opportunities with exciting new information to share with pen pals.
We also asked teachers what they thought about the following alternative pen pal options:

1. Wiki writing with one-to-one student partners, just three times a year
2. RiverXchange forum with many classes posting whole-class pieces
3. Paper (letter writing) pen pals with no wikis
4. Wikis but no pen pals
5. No wikis and no pen pals
6. Other

Keeping one-to-one partnerships but writing fewer times was the most popular choice among both groups. Teachers overwhelmingly commented that they liked the pen pal component, and many stated that they thought reducing the number of times students must write would make it less motivating. Here are a few teacher comments that will inspire us to keep working to improve the pen pal component:

- The use of the wikis to me is the crucial part of this program for students. It is what motivates them. I hope you don't go back to paper and pencil – these kids are living in the technology era and that is a step backward. If I chose a change then one to one three times a year, however we have 4 quarters. I would say twice a quarter for a total of 8 times.
- The wiki gets the students excited and they look forward to writing to their pals. This has only been our second year I would like to see if we can continue to work the same way to try and make it work. I believe we need to have communication more often than 3 times a year. Whole class pieces will not mean the same for the students. Maybe we could do a paper letter at least twice a year along with the wiki.
- I really like the way it is this year. I like the personal connections with each student talking to another specific student, and I like the wikispace as a communication tool. The way it is set up now allows me to integrate science, language arts, and technology standards into one lesson, and I feel like it really develops skills in all areas.
- I like the current format with partner wiki and students one-to-one writing. Having that added push to get onto the wiki more frequently allows for the children to maintain interest in it. I do not think they would get as much from it if it was only three times/yr.
- Students today do not usually do letter writing with skype and texting; I think they need to. They currently letter write in Language Arts so would be able to use this skill for this project.
- My students LOVE writing to their pen pals.

We asked teachers to share strategies that have helped them integrate RiverXchange into their normal classroom routine. Here are a few of their comments:

- Trying to integrate the lessons into language arts time with the writing assignments.
- My students who became experts were able to help other students who were struggling with computer issues.
- I've partnered with the science teacher. We haven't worked out our problems yet, but we keep talking about, "next year, we can do it this way..." I'm excited for another shot at it.
- Once the students became more familiar with posting on the wiki I was able to have them go and do it as they had free time.
- As with all schools money is tight for field trips. It took my grade level a while to problem solve as to where we could go that would be free.
I stopped taking the time to edit their typing. As long as their rough draft was edited I just hoped they typed it correctly:

I give time as a class to write in journals, then we type on class computers as we can.

Do the program as a whole-grade level definitely helps!

Making sure the kids have plenty of time for typing, and having the kids write rough drafts of their wiki posts before they sit at a computer.

Communicating with other teachers and setting a schedule and sticking to it. Your emails encouraging the taking of certain quizzes, helped too.

Having an additional day a week for computer lab has helped. The writing posting to the computer and journal ties in with our standards and curriculum.

We rotate computers during our intervention block, but only 4 students can get on per day.

Teachers also had some other great suggestions for improving the program:

As far as I know, the training of the partner teachers is quite limited and dependent on the partner teachers motivation to view a presentation and communicate with the NM teacher. I think it would be very useful if we could do something more interactive with the partner teachers. I really think the partner teachers and the NM teachers need to have a stronger connection to make the wiki work.

Maybe a longer workshop for teachers before school starts.

Perhaps, we could engage in a project to create or research more reading texts for the program. The video texts are incredible, funny, poignant, and well-researched and developed. Some more written text would be helpful.

If we could meet as a large group again in the middle of the school year to check up and share ideas, it might help inspire and encourage – to keep us on track.

One NM teacher mentioned she would like to teach RiverXchange as a unit at one point in the school year, rather than spread out the communication throughout the school year. We understand the motivation behind this idea, but have concerns that it may weaken the impact of the program and foster less communication between partners.

Overall, teachers had many positive things to say about the program:

Keep up the good work. Keep the funding coming. This is an infinitely important program for the future of our NM Society.

My first year and I have found all the coordinators very helpful and available when I needed answers. Thank you.

Coordinators were great and were on top of me to get my postings done & communicate with pen pals.

The checklist email was a good reminder. Sending those out periodically would be helpful. Really, it is just difficult to carve out time, but I feel like each year we get a little better.

I'm a nervous Nelly when it comes to getting everything to go, so I like how you help with the list and a phone call to get my rear in gear. Don't change that!

The guest speakers and the field trip presented material in a way that I could not without RiverXchange resources. The hands-on field experience was invaluable. Having people come into the classroom made a huge impact.
Guest speakers bring the lesson to life, as do field trips. The kids have talked all year long about both.

This is a very well-developed program. It has been amazingly beneficial to my students.

Thought it was great, hope to participate again next year.

**Student Surveys**

A unique and key component of RiverXchange is its specific, measurable goals relating to student performance. We collected student performance data on each curriculum unit via three online student surveys, and by reading what students wrote on their wiki student page. **Performance on the three online assessments showed that NM students achieved Proficiency or higher on many water resources questions relating to the curriculum.** “Proficiency” is defined as all students in a subgroup correctly answering the question at least 70% of the time.

**Online Unit Surveys**

This year, we updated the three online student assessments to reflect our new Big Water Questions, and we made all questions multiple-choice (eliminating open-ended responses).

**Response Rates**

As in previous years, a higher percentage of NM students versus partner students completed the student assessments. Teachers reported that as the year progressed, scheduling complications (e.g., testing, end-of-year activities), access to computers, and lack of instructional time were on-going barriers that prevented them from completing all components of the curriculum.

Overall student response rates were higher this year. We attribute this primarily to increased communication with teachers. In addition, a new incentive program, funded by Mid Rio Grande Stormwater Quality Team for classes located in their service area (Albuquerque and Rio Rancho), produced a significant improvement in response rates over last year for Units 1 and 2. Incentives included bus transportation funding for a field trip to a selected local water-related site, or a gift card to a science supply company. The incentives were awarded to four classes each in Units 1 and 2 that produced the best wiki writing and had also taken the student assessment for that unit.

<table>
<thead>
<tr>
<th>Unit 1</th>
<th>2011-2012</th>
<th>2010-2011</th>
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<tr>
<td>70% overall response rate</td>
<td>31% overall response rate</td>
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<tr>
<td>81% New Mexico</td>
<td>40% New Mexico</td>
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<tr>
<td>90% Albuquerque</td>
<td>38% Albuquerque</td>
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<tr>
<td>77% Rio Rancho</td>
<td>45% Rio Rancho</td>
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<td>41% Santa Fe County</td>
<td>39% Santa Fe County</td>
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<td>57% Partner</td>
<td>21% Partner</td>
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<tr>
<th>Unit 2</th>
<th>2011-2012</th>
<th>2010-2011</th>
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<tbody>
<tr>
<td>46% overall response rate</td>
<td>20% overall response rate</td>
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</tr>
<tr>
<td>67% New Mexico</td>
<td>30% New Mexico</td>
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<tr>
<td>72% Albuquerque</td>
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Unit 3  

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<th>Unit 3</th>
<th>2011-2012</th>
<th>2010-2011</th>
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<td>25% overall response rate</td>
<td>13% overall response rate</td>
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<tr>
<td>34% New Mexico</td>
<td>20% New Mexico</td>
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<tr>
<td>31% Albuquerque</td>
<td>20% Albuquerque</td>
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<td>31% Rio Rancho</td>
<td>13% Rio Rancho</td>
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<td>34% Santa Fe County</td>
<td>30% Santa Fe County</td>
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<td>15% Partner</td>
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**Performance Summary**

Performance on the three online assessments showed that NM students achieved **Proficiency** or higher on many questions. Because our funding is NM-based, our analysis focused solely on NM student survey performance. “Proficiency” is defined as all students in the subgroup correctly answering the question at least 70% of the time. Proficiency levels are as follows:

- **Beginning Step** – score of < 60%
- **Nearing Proficiency** – score of 60-69%
- **Proficiency** – score of 70-79%
- **Advanced** – score of ≥ 80%

Performance on all answer options are shown, rather than a simple percent correct and incorrect. We feel this approach provides organizers, teachers, guest speakers and field trip docents with a more complete understanding of what students are thinking, where confusion exists, and how adults can help students become proficient in all areas. In some cases, the answer options will be re-worked in 2012-2013 to improve clarity/reduce student confusion.

**NOTE:** For each unit question, the correct answer(s) is/are highlighted in yellow.

**2011-2012 Student Assessment Results -- UNIT 1**

- Presenter-led activity. Almost all NM students took the Unit 1 assessment, not just the most motivated classes (i.e., we have 4-5x more data this year compared to 2010-2011). In three out of five communities, at least 70% of students chose the correct answer.
- Many fifth graders may be hearing this concept for the first time. More work needs to be done to dispel misconceptions.
- Presenter-led activity. In four out of five communities, at least 70% of students chose the correct answer. This question requires some deep thinking for students unless the presenter or teacher directly addressed this concept.

- Teacher-led activity. In all communities, at least 70% of students chose the correct answer. A large percentage of Santa Fe Area students said “New Mexico” because they are thinking of the Santa Fe River.
Teacher-led activity. In two out of five communities, at least 70% of students chose the correct answer. An additional 4% wrote in “Other: Gulf of Mexico.” Some students may be confused because they don’t know whether the Gulf of Mexico is part of the Atlantic Ocean or Pacific Ocean.

Presenter-led activity. In one out of five communities, 70% of students chose the correct answer. Students still aren’t clear about the difference between stormwater, wastewater, drinking water. Many teachers aren’t clear, either (observed from classroom presentations).
Presenter-led activity. Students definitely understand the dog poop and trash message, and that pollution comes from all of us. It is interesting that Pojoaque and Santa Fe Area students did not connect how forest fires and soil erosion affect river pollution.

Teacher-led activity. In Albuquerque and Rio Rancho, less than 10 inches is the correct answer; in the other three communities, 11-30 inches is the correct answer.
Teacher-led activity. In all communities, at least 70% of students know that precipitation, condensation and evaporation are part of the water cycle. Fewer students are familiar with runoff, infiltration and transpiration. Fifth graders may be hearing these vocabulary words for the first time, or may not have been taught that these components are part of the water cycle.

Teacher-led activity. In spite of this being a New Mexico fifth grade science benchmark, a number of students still don’t know the correct answer.
Teacher-led activity. In all communities, at least 70% of students chose the correct answer. However, compare this to the performance on Q8 & Q9. Students are not clear on vocabulary and are not making connections for deeper meaning (i.e., whether the water cycle can stop). Fifth graders may be hearing these fundamental concepts for the first time.

Teacher-led activity. This is an advanced concept for most fifth graders. Students seem to think many things can travel between groundwater and surface water, but they aren’t clear that pumping one affects the other.
Teacher-led activity. In all communities, at least 70% of students know that chemicals and oil can pollute groundwater. Many students also chose an underground tank leak. In general, students seem to know what CAN pollute groundwater, but they don’t know what CANNOT travel into groundwater (i.e., large things like trash).

Presenter-led activity. In all communities, at least 70% of students correctly chose dog poop, trash and oil; over 50% correctly selected car wash. Next year, we will use the word “should” instead of “can.”
2011-2012 Student Assessment Results -- UNIT 2

- Presenter-led activity. In all communities, at least 70% of students chose almost all the correct answers. Students may not have chosen leaks because that kind of water is not “used” for anything.

- Teacher-led activity. In all communities, at least 70% of students chose the obvious correct answers.
• Presenter-led activity. In all communities, at least 70% of students chose Aquifer. In Albuquerque and the Santa Fe Area, at least 70% of students chose River, which is accurate. The remaining communities do NOT get water from a river, but there is still a significant percentage of students who chose this answer (fewer in Rio Rancho). More work is needed on this misconception.

• Presenter-led activity. Many students, especially in the Santa Fe Area, understand the personal responsibility for their water use.
Teacher-led activity. In most communities, at least 70% of students chose the correct answer. In Rio Rancho, students may not connect drought with groundwater, which is their source of drinking water.

Teacher-led activity. This is not as applicable in New Mexico as it is for partner classes, but many New Mexico students still chose the correct answer.
- Teacher-led activity. Most students are confused about this, which indicates teachers may have skipped this topic.

- Presenter-led activity. Many Albuquerque, Santa Fe Area and Edgewood students chose the correct answer; however, presenters likely discussed the wastewater treatment process but did not use the words "sewer" and "septic."
• Presenter-led activity. Presenters likely did not address the distinction between sewer and septic.

• Presenter-led activity. Presenters may not have addressed the distinction between sewer and septic. Compare results to Unit 2/Q9. In most communities, at least 70% of students answered correctly. In Pojoaque, very few students' homes are connected to a sewer system.
Teacher- and presenter-led activity. In all communities, at least 70% of students knew that communities are usually settled near water. The other choices may not be obvious to students unless they were addressed specifically.

Presenter-led activity. Students are certainly aware of agriculture as a commercial use of the Rio Grande, but apparently not clear that it is the major use of our river.
Presenter-led activity. In all communities, at least 70% of students know major ways to conserve water, but more work is needed on outdoor water use. The water-electricity connection is definitely not obvious to students unless it has been specifically addressed.

2011-2012 Student Assessment Results -- UNIT 3

Teacher-led activity or covered on field trip. In Rio Rancho and Santa Fe Area, at least 70% of students classes chose the correct answer. In Pojoaque, the field trip did not include this component.
Teacher-led activity or covered on field trip. In all communities, at least 70% of students chose the correct answer.

Teacher-led activity or covered on field trip. In Albuquerque and Rio Rancho, at least 70% of students chose the correct answer, perhaps because most of these classes visited an actual wetland on their field trip.
- Teacher-led activity or covered on field trip. In all communities, at least 70% of students said that wetlands support a diverse community of plants and animals. As seen in Unit 1, students may not clearly understand the difference between stormwater and wastewater.

- Teacher-led activity. Compare performance to Unit 1/Q6. Improved performance may be due to discussion occurring later in the year (spring). In Albuquerque and Rio Rancho, at least 70% of students said that forests support a diverse community of plants and animals.
Teacher-led activity or covered on the field trip. Most students understand that healthy aquatic ecosystems are diverse, include macroinvertebrates, and can be monitored by measuring pH, turbidity, and dissolved oxygen.

Teacher-led activity or covered on field trip. In all communities, at least 70% of students chose correctly on nearly all the answers except fungi. Students may not know much about fungi in general.
Teacher-led activity or covered on field trip. In all communities, at least 70% of students know that all living things need a certain amount and quality of water. More emphasis is needed on the fact that many animals depend on aquatic macroinvertebrates, and that humans can learn to conserve, whereas animals cannot.
• Teacher-led or covered on the field trip. In Rio Rancho and Albuquerque, at least 70% of students chose all of the correct answers. Most students are getting the message on all of these choices. The Pojoaque field trip did not include a service learning component, whereas most Albuquerque and Rio Rancho field trips did. The Santa Fe field trip included macroinvertebrate monitoring, but not service learning.

Student Writing

The writing component is one of the most valuable features of the program, and the most time consuming for organizers in terms of motivating teachers. From the start, our goal has been to find ways to improve the amount and quality of student writing, as this program feature helps teachers integrate writing in content areas (a hot topic in education) and reinforces student understanding of key water resources concepts.

As noted in the Teacher Surveys section, computer time was often the most significant barrier teachers faced in carrying out the program. Many teachers were also dealing with issues unrelated to the program, such as new curriculum in other areas, school reorganization, or construction which prevented access to the computer lab for a portion of the year.

With over 3,000 student pages to track throughout the school year, managing and analyzing this unique assessment component required regular and ongoing wiki review. We analyzed student writing by tracking the number of different curriculum topics written on by each class.
The curriculum outlines 11 topics to be covered by the teacher, guest speaker and/or field trip docent. The teacher is to cover any topic not presented by a guest speaker or field trip docent. Our November 1 deadline for wiki writing resulted in 100% of NM and partner classes writing at least once by that date. In addition, our goal was that all NM classes to write on at least five topics, because we coordinated four classroom guest speakers plus the field trip. Ultimately, 56% of NM teachers achieved this goal -- more than double the percentage in 2010-2011.

The majority of writing took place during Unit 1 and Unit 2 (October through March). This correlated to the major timeframe when guest speakers visited the classrooms. In addition, many classes wrote about their field trip if it was taken in the spring. The new wiki writing incentive program, funded by the Mid Rio Grande Stormwater Quality Team, resulted in a significant improvement over previous years in both quantity and quality of student writing in Units 1 and 2 for classes located in their service area (Albuquerque and Rio Rancho). Next year, we plan to expand the incentive program to all areas. Criteria for the wiki writing incentive program included:

**Unit 1**
- thorough explanation of watershed geography
- persuasive writing about why it’s important to keep stormwater clean, and/or
- connecting the topics to personal action

**Unit 2**
- explanation of where our drinking water comes from and where our wastewater goes
- persuasive writing about why it is important to conserve water and what we can do
- explanation of how our river has affected agriculture, and how agriculture has affected our river ecosystem, in our community's history
Samples of Student Writing (Unedited)

Watershed Model

"You guys wouldn't believe what we learned today in class. We had a guess speaker come into our class room. He talked about how people like you and me pollute the Rio Grande everyday by getting the dry ground above the river dirty. Then rain comes and washes all of litter down the hill into the river. So it's important that people that don't pick up after their pets. They don't realize that those germs get in their drinking water. Another bad thing that people do is use chemicals to kill bugs that eat their plants. Then the rain washes those things down into the water also. A way we could prevent this pollution from our rivers is by picking up after our dogs after our walks. We could follow the directions and use the right amount as said for fertilizer. People can pick up trash and put things under there cars to catching oil leaks. By doing these simple things we could make our watersheds cleaner than ever!!"

"Today I am going to tell you why you should keep your storm water clean. One reason you shouldn't litter storm water because all the pollution goes into your local river. Pollution in the river can make wild animals very sick. A second reason you shouldn't pollute the storm water is because the water your drinking could be the polluted storm water that went in to the river. A third reason you shouldn't pollute storm water is it's not good for water,plants,and trees to to have chemicals on them, in them, or around them,this could cause harm. One last reason you shouldn't pollute storm water is because the pollution can really stink,(litterally), so don't pollute keep a clear enviornment!!"

Drinking Water

"We did an experiment in class. We were trying to figure out how much water is wasted every year by leaky faucets in our homes. First, we had to find out how much water is wasted and multiply it to come up with what the yearly total was. We used multiplication to do this. My group came up with 13,331 gallons in a year. That is a lot of water. I have told my mom and dad to get their leaky faucet fixed and they are working on it because we have wasted a lot of water in the two years it has been leaking.”

"Drinking water comes from an aquiifer and occurs naturally. It also comes from the Rio Grande. Here in Rio Rancho we get our water from the aquifer only. when it rains it infiltrates into the ground and "recharges" the aquifer. The problkem is we use the water faster than it can recharge. In Albuquerque they get their water from the aquifer and from the Rio Grande. To be able to drink from the Rio Grande the water must go through a special process. They mix positive chaerges and negative charges in the water. The bacteria in the water sinks down with the charges.They do this until there is less than 10% of bacteria, then it is ready to drink.”

Wastewater

“On Friday, people from the water treatment center came to our school. They showed us how they clean the water. It was cool because we made clean water into dirty water by putting cereal, oil, vinegar, and dirt. Then, we poured the water over a screen and a glass jar. That represented how to stop all of the big pieces of garbage from going into the water treatment. After that, we tested to see if it was an acid or a base. Next we put charcoal over a filter and plastic bowl. Then, we poured the water over the charcoal slowly through because we did not want the sediment permeating the filter. This represented the microorganisms used to eat the waste. Then, we added baking soda to the water. That represented the chlorine killing all of the germs that was still in the water. They also used UV lights to kill the rest of the germs in the water. Finally, it was clean so the wild life in the Rio Grande can use it.”
“Hi, Joaunin again we are writing to tell you about what we learned. We had two guess visitors who came into our class. There names were Raul and Kevin they taught us about Septic Systems and the Sewer System. A Septic tank is part of the Septic system. It's when you flush the potty it goes into a tank. There's three parts, the top part is called scum it floats. The seconc part is water. Finaly the thrid part is called sludge is sinks to the bottom.”

Water and Agriculture

“Hello, it's me again. Sorry, I haven't written to you, yet. I got strep throat! Mr. John and Elliot came to our class and talked about 3 different ways to water your crops: sprinkler, drip, and flood. Sprinkler works best for the big circle fields you see at farms. Drip works best for vineyards to grow grapes, and flood works best for big wheat fields. They also talked about something called the Dust-Bowl. That is where a state is very dry and has no rain, but it does have high winds and spreads big clouds of dust everywhere. Would not want to be in the middle of that! The states that had the Dust-Bowl were Texas (You!), New Mexico (Us!), Nebraska, Kansas, and Oklahoma. Dust-Bowls were so strong they could wipe-out a house in minutes! I would not want to be in the middle of that! We also talked about which type of water would work best to grow lima beans. We took 3 tubs and filled them with soil and leveled them out with little toy tractors. Then we planted lima beans on top of the soil. If the beans move around the soil, then the crop is dead. The flood didn't work because it flooded the soil. Drip sort of worked because it was drip dropping everywhere, and the sprinkler worked the best (to me,) because it sprinkled on the beans and the soil. What have you learned? Please write back! Xea”

“Dear Wiki Partner, How are you? We had presenters and they taught us about farmers watering their crops and irrigation. There are 3 methods. I am going to tell you whats good and bad about them. #1,flood. Some farmers flood their crops. Whats good about the flood method is that the crops get more water. The bad thing about this method is that it wastes alooooot of water. #2, spray. Some farmers have this really big thing that sprays water on the crops and it goes alllll the way around the crop circles.(crop circles are really big circles made of crops).The bad thing about this method is the wind blows all the water from the crops away so it basically is wasteing water too. The good thing about it is that the water goes all the way around the crops.#3,drip the drip method is that its these tubes with teeny tiny holes in them. the good thing about the drip method is it does not waste as much water. The bad thing about it is that it is most likley to leeke. I hope you liked what i typed. Bye! your wiki partner, Destiny”

Field Trips

“Dear partner, Me and my class went on a field trip and it was great the best one ever! We went to the Open space visitor center there we got to learn about wetlands, how to plant trees and we tested wetland water. I think my favorite part was when we got to take a hike though the bosque. And we learnt a lot like did you know the sandhill crane stays in the Rio grande bosque area from november to march. And did you know that cottenwood trees are native they have been here for about one million years. Also Great blue herons eat fish! this field trip was great well bye.”

“As I was saying in my last letter my class and I just went on a field trip to the Alameda Wetlands. We learned how important it really is to many animals and to ourselves. We tested water samples,searched for insect larva, planted trees like Wolfberries, hiked, and more! My favorite part was when we planted trees. I think it is a great feeling knowing you're helping your community. We all had a great time. I hope you learn all about it!”
“On our field trip to the Bosque we tested the water for pH, Oxygen, and Turbidity. We learned that the more oxygen, the better. We also learned that you want the pH levels to be near the middle. Turbidity is the amount of clear water. On our trip, we also took samples of water. We found organisms and animals. We found a minnow and a damselfly-nib. They are great indicators that the water is still healthy.”

It was common for students to “jazz up” their writing with special font colors and styles. More technologically confident teachers taught their students how to upload graphs and photos. Some teachers required students to edit their writing before posting but most teachers allowed students to write and comment in a free form, conversational way. Next year, we will strongly encourage teachers to have students write paragraphs before going to the computer lab, because this promotes more high-quality thinking and writing.

As in past years, teachers reported that the more often students communicated on the wiki, the more fun they had with the pen pal component. Teachers and students expressed frustration if pen pals did not write back quickly or at the same pace. From the beginning, we explained to teachers that the writing component was valuable for students even if pen pals didn’t post often or at all, because students in the same class are able to read and comment on each other’s writing.

We know from discussions with teachers that the absence of student writing does not mean that no learning took place or that no activities occurred. On the contrary, teachers said that they really enjoyed participating in RiverXchange and felt that their students learned a lot, but admitted that computer time and instruction time were in short supply. Almost all NM teachers asked to participate in 2012-2013.

RECOGNITION

We acknowledged the exceptional commitment made by RiverXchange teachers by sending a Certificate of Appreciation to each teacher. In addition, we sent thank you cards to presenters and field trip docents, with quotes from student wiki writing about the activities they provided. We acknowledged sponsors and in-kind contributors on our website.

NEXT STEPS

1. Ownership of the program will transition from Experiential EE, LLC (Katie Babuska), to Orilla Consulting, LLC (Amy White) on July 1, 2012.
2. Funding has been secured for 2012-2013 which will enable at least 40 NM classes to participate. Classes will be located in Albuquerque, Rio Rancho and Edgewood. Additional locations may include Bernalillo, Placitas, Corrales, and Santa Fe. Sponsors include:
   Southern Sandoval County Arroyo and Flood Control Authority (20 classes)
   Mid Rio Grande Stormwater Quality Team (18 classes)
   Edgewood Soil and Water Conservation District (2 classes)
   Rocky Mountain Section/AWWA/RMWEA
3. Motivation:
   • We will expand the incentive program to all areas, as it clearly provided motivation to improve response rates on assessments as well as quantity and quality of wiki writing.
   • As we did last year, teachers will be required to sign a Teacher Agreement to participate, which outlines the duties to be carried out by them, and what they can expect from program coordinators.
4. Teacher Workshop:
   - A technical guest speaker will give teachers more detailed information about the water resources situation in our area.
   - We will schedule guest speakers at the workshop via signup sheets.
   - Detailed field trip information and expectations will be given to teachers.
   - A wiki will be created for each partnership prior to the teacher workshop, including student accounts and pre-formatted student pages, to further reduce the technological burden on teachers. Pen pals are partnered in a systematic way (i.e., Student 1 from Class A will be pen pals with Student 1 from class B).
   - Partner new teachers with returning teachers for mentoring.

5. Guest Speakers:
   - We will coordinate guest speakers on the four core topics: watershed/nonpoint source pollution, drinking water, wastewater, and agriculture.
   - We will schedule guest speakers at the workshop via signup sheets.
   - Before and after each guest speaker and field trip, we will remind teachers about writing prompts.
   - We will provide teachers with contact information of additional guest speakers so that teachers can directly coordinate additional presentations, if desired.
   - Guest speakers will receive a copy of related assessment questions/answers ahead of time.
   - Orilla Consulting contractors will make classroom presentations on core topics, if needed.

6. Field Trips:
   - Orilla Consulting contractors will plan and attend all field trips.
   - RiverXchange FAQs will be developed for field trip docents.
   - Field trip docents will receive a copy of related assessment questions/answers ahead of time.

7. Curriculum:
   - We will revise the curriculum to include suggestions from teachers.
   - We will revise student assessment questions, question formats, and answer options to improve clarity and ease of analysis.
APPENDIX 1: CURRICULUM INTRO & CALENDAR

Background
RiverXchange combines a year-long water resources curriculum with “high-tech pen pal” partnerships through social networking technology. The program helps fifth grade students learn about major water resources issues using their local river as a focal point, and then demonstrate understanding by applying that knowledge in a fun, interactive way. It also helps teachers expand their technical knowledge base and environmental network, and learn how to integrate water resources topics in multiple subject areas.

The curriculum integrates science, social studies and math lessons with essential writing skills to cover three units -- Understanding a Watershed, Water in Our Society, and River Ecosystem. Student outcomes are framed as The Big Water Questions and form the basis of the writing assignments and online assessments. Where possible, we have incorporated public-domain activities and resources. We strongly recommend that all teachers invite guest speakers into the classroom to conduct as many of the hands-on activities as possible. That way, teachers have more time to help students carry out the writing assignments. At least one field trip to the local river, tributary or important watershed feature is required. This year, we are able to cover the cost of a classroom water quality test kit for use on the field trip.

Participant Outcomes
- Participants will learn about major water resources issues, the need to protect our water resources, and what all of us can do to conserve water and keep source water clean.
- Participants will learn about The Big Water Questions.
- Teachers will learn about water-related classroom resources that can help them achieve their teaching goals.
- Teachers will learn how to integrate computers/technology in an innovative way.
- Students will achieve Proficiency on all three online unit assessments.
- Students will post on at least five water resources topics during the school year

Expectations
Organizers will provide (free of charge) all of the following:
- Partnership matching.
- Training on how to use the wiki technology.
- USGS water resources education posters (set of nine).
- The use of a “classroom” water quality test kit to be used on the field trip.
- Technical and moral support throughout the school year.
- For New Mexico teachers, we will also cover the cost of coordinating four classroom guest speakers, field trip coordination, field trip bus transportation, and the cost of a substitute teacher so teachers can attend the workshop.

In return, teachers must ensure all of the following:
- Students take the online assessment at the end of each unit.
- Students post on at least one topic no later than November 1.
- Students post on at least five topics during the school year.
- Students comment on their pen pal’s writing.
- Partner class water quality testing results are submitted to the RiverXchange team immediately after the field trip is taken.
Program Funding
Feedback gained from online student assessments and student wiki writing enables us to carry out measurable outcomes. Providing this “proof of student learning” is a key feature that distinguishes RiverXchange from other water resources outreach programs and helps us ensure continued funding. For this reason, all classes must make their first posting no later than November 1 or they will not be allowed to continue participation. We don’t want this to happen after all the great training and effort!

Big Water Questions (Student Outcomes)

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?
**2011-2012 Calendar**

This is a general timeline. Partner teachers may substitute similar hands-on activities and alter the timing of the activities; however, our goal is for all classes to cover similar topics at approximately the same time of year so that students can relate to the topics written about by their pen pal. *All students should post on at least five topics.* A “topic” is a major theme, as described below. It is not the same as commenting on the pen pal’s writing or general writing/chit chat between students. The field trip can occur at any time during the school year; however, note that there are suggested pre- and post-field trip activities.

**RED = Student Assessment Questions, which also relate to the Big Water Questions.**

**September**
- Teacher Workshops (New Mexico teachers)
- Online Trainings (Partner teachers)
- Scheduling of guest speaker presentations and field trips

**October**

*Unit 1: Understanding a Watershed*

**Topic 1: Our Rivers** - Study maps of your river and discuss the major features of your local watershed. Locate your school and your partners’ school on the precipitation map. Post photos of your local area on the class wiki, and have students write a friendly letter about your watershed and its climate on their wiki pages.

*Is every place in the world part of a watershed?*
- What is a watershed?
- Where does your river start?
- Into what ocean does your river eventually flow?
- How much precipitation does your community receive each year?

**Topic 2: Watershed Model** – Invite a guest speaker to present, or make your own model of a watershed. Learn about nonpoint source pollution, the difference between stormwater and wastewater, and what kinds of things pollute surface water. Watch *Science or Fiction*. Students write a persuasive paragraph/essay on their wiki pages about why it is important to keep stormwater clean and what we can do.

*Where does your community's stormwater go?*

*How can surface water (like a river, lake, bay or ocean) become polluted?*

*What actions can all of us take to keep water clean?*

*Optional:* Do the math-based activity *Don’t Trash Our Rio* to learn about a real-life trash and storm drain problem, then calculate how many trash bags and classrooms it would take to store all that trash.

**November**

- **NOTE:** *All students must post on at least one topic by November 1!*
- **If you take a field trip in the fall, please see the field trip page for pre- and post-activities.**

**Topic 3: Infiltration and Runoff** – Listen to the *Water Cycle Song* and discuss how the water cycle relates to weather. Take a mini field trip on the school grounds to observe where runoff goes and where infiltration happens. Students write a *RACE paragraph/essay* answering the question, “Where does water go when it falls on our school grounds?” and citing evidence such as puddles or erosion observed.
How does the water cycle relate to weather?
- What are the major components of the water cycle?
- In the water cycle, what happens to precipitation that hits the ground?

Optional: Test to find out where infiltration occurs rapidly and slowly throughout the campus.

**Topic 4: Groundwater** – Watch *The Story of Groundwater*. Build a simple aquifer model to learn about how groundwater and surface water are connected, and how pollution can get into groundwater. Students write a creative or narrative paragraph/essay describing the journey of a raindrop into the aquifer.

- How are groundwater and surface water connected?
- How can groundwater (aquifer) become polluted?
- What actions can all of us take to keep water clean?

**Unit 1 Review** – Do vocabulary crossword included in teacher packet.
Take Unit 1 online student assessment.

**December**

**Unit 2: Water in our Society**

**Topic 5: Drinking Water** – Find out where your drinking water comes from. Discuss how weather patterns bring drought or flooding to your area, and how it affects your drinking water. Invite a guest speaker, or do the activity *The Value of Water*. Students write a persuasive paragraph/essay explaining why it is important to conserve water, and what we can do.

- 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?
- What actions can all of us take to conserve water?
- How does the water cycle relate to weather?

Optional: Learn what a water footprint is, then do the water footprint calculator.

Optional: Learn how water and energy are connected, and the resources used to produce a bottle of water.

- In what ways does our society use water?
- How are water and electricity connected?
- What resources does it take to produce a bottle of water?
- What actions can all of us take to conserve water?

**January**

**Topic 6: Water Rights** – Brainstorm a list of all the water users in our society, then act out the ways of assigning water rights. Revisit the precipitation map to see why different water rights doctrines are used in different areas. Students write a persuasive paragraph/essay explaining how they would modify the water rights rules in your area to make sure they are fair to all water users.

- In what ways does our society use water?
- Does everyone have the right to use as much water as they want?

- How are water rights assigned in your area?

**Topic 7: Wastewater** - Invite a guest speaker or do an activity to learn where your wastewater (sewage) goes. Learn the difference between a sewer system and a septic system. Review the differences between stormwater, drinking water and wastewater -- emphasizing how different sets of pipes are involved, and the quality of the water being transported is very different. Students write an informational or creative paragraph/essay explaining the journey of our wastewater.
Where does your community’s wastewater go?
- What is a sewer system?
- What is a septic system?

February

**Topic 8: Commercial Uses of Our Waterways** – Research the major commercial use(s) of your river (such as agriculture, transportation, fisheries and/or recreation) and do an activity, or invite a guest speaker to present. Discuss how these uses influenced the location/history of your community, and how these users can conserve water and keep water clean. Students write an informational or persuasive paragraph/essay explaining how the river has influenced your community's history and what commercial users can do to protect it.

**In what ways does our society use water?**
- How has water influenced human settlements and culture?
- What are the major commercial uses(s) of your river?

**What actions can all of us take to keep water clean?**

**What actions can all of us take to conserve water?**

Optional: Play one or more of the Water Ripples games which will help you review the ways our society uses water, particularly in agriculture.

Optional: To learn more about water use in other countries, invite a guest speaker from Water for People, 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 countries.

**In what ways does our society use water?**
- How does water use in the U.S. differ from water use in other countries?
- How can the lack of clean drinking water affect children in other parts of the world?

**Unit 2 Review** – Do the vocabulary crossword puzzle included in the teacher packet.

**Take Unit 2 online student assessment.**

March

**Unit 3: River Ecosystems**

**Topic 9: River Food Web** – Invite a guest speaker or watch Macroinvertebrate Lunch to learn about the role of aquatic macroinvertebrates in the food web and what they can tell us about the health of our ecosystem. Discuss producers, consumers and decomposers, and where macroinvertebrates fit. Watch Frogline News to revisit how pollution gets into surface water. Students write an informational paragraph/essay about one macroinvertebrate species and its role in the ecosystem.

**How does water affect living things in an ecosystem?**
- What role do aquatic macroinvertebrates play in the food web?
- Why do scientists study aquatic macroinvertebrates?

Optional: Make a food web for your local ecosystem, identifying native and invasive species, as well as local endangered species.

- What are some producers that are native to your river’s ecosystem?
- What are some consumers that are native to your river’s ecosystem?
- What is one invasive species in your river’s ecosystem?
- What is one endangered species in your river’s ecosystem?
April

**Topic 10: Forests and Wetlands** – Watch *The Adventures of Junior Raindrop*. Examine models of how wetlands and other vegetation in our watersheds can help clean water, reduce erosion, reduce flooding, and support a diverse community of living things. Students write a *persuasive paragraph/essay* about why wetlands are important in our watersheds.

*What role do forests play in a watershed?*
*What role do wetlands play in a watershed?*
*What is a wetland?*

May

Catch up or do optional activities if desired.

**Unit 3 Review** – Do the Unit 3 vocabulary crossword (included in teacher packet).
**Take Unit 3 online student assessment.**

**Teacher Feedback Survey** - we value your input!

**Topic 11: Field Trip** (field trips may occur at any time of year)

**Pre-field Trip Activity** - Read *A Waterproof Case* to learn about why we do different kinds of water testing. Test classroom tap water for temperature and pH; record to compare with the data students will collect at the river. Talk with students about the field trip and location, and what to expect.

**Optional:** Read *The Water Down Under.*

**Field Trip** – Field trips in New Mexico will incorporate hands-on lessons about wetlands, aquatic macroinvertebrates and water quality, and students will use a field journal. Water quality testing data will be submitted to the World Water Monitoring Challenge program. In some cases, an additional service learning project will be included (e.g., tree planting or agriculture activity).

**Post-field Trip Activity** – Review how land use affects water quality and what the water quality data tells us about the ecosystem. Compare your data to other World Water Monitoring Challenge sites. Students write a *narrative paragraph/essay* about their experience at the river, why we collect this data and what it means.

*What are some of the ways scientists can determine the health of a river?*
*How does water affect living things in an ecosystem?*
*Who or what are the other water users (besides humans) in an ecosystem?*
*What actions can all of us to take to improve the health of our ecosystem?*